

## Estimating Cost of Conflict and Increasing Food Security In Southern Sudan

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## **Abstract**

In order to meet humanitarian assistance programs, donor organizations like WFP need to procure food either locally or import it. Internal conflict may pose significant barriers to local and regional procurement programs like P4P. We develop a methodology to estimate the cost of conflict using a microeconomic setting. We examine the use of forward contracts to procure locally and derive a) what price should be paid to the suppliers, b) how should contracts be designed so that agents relinquish conflict and sign P4P contracts.

## **Introduction**

*“Sudan remains one of the World Food Programme’s (WFP) most complex operations, and large-scale humanitarian assistance in conflict-affected areas will continue to be needed in 2011. While some progress has been made in the overall security and stability situation since the signing of the Comprehensive Peace Agreement (CPA) in 2005, the widespread destruction and population displacement caused by decades of war, further exacerbated by recent poor harvests, high food prices and ongoing conflict, leave much of Sudan engulfed in a humanitarian crisis” – World Food Program*

According to an estimate by FAO/WFP, 890,000 people are currently severely food insecure and 2.4 million people are moderately food insecure in Sudan (United Nations Mission). Southern Sudan faces threats to food security due to a) historical and ongoing conflict, b) extremely low level of basic infrastructure, c) internally displaced populations and d) extreme environmental conditions (WFP country profile: Sudan). The 2005 Comprehensive Peace Agreement that ended the 21-year north-south civil war in Sudan is going to put further pressure on the existing limited resources. Under these circumstances, humanitarian organizations like WFP intend to support with programs to assist returnees to reintegrate into their communities, build their livelihoods and achieve food security.

WFP support plans include food for education (school feeding and take-home rations), food for work and food for recovery programs, work with communities to carry out much-needed infrastructure projects such as feeder roads, dams, schools, health clinics, wells and water collection ponds, training programs and support vocational training for adults. In order to successfully implement these support programs, WFP needs to procure a significant quantity of staple crop. Typically, food may be procured either locally or it could be imported from other countries that have surplus. Commodities

for food aid may be procured from different sources. US food aid depends on commodity procurement in the US and a powerful political coalition of US farm groups, shippers and relief agencies supports in-kind food aid donation (Haggblade and Tschirley, 2007).

Alternatively, local procurement of food aid in Africa has attracted growing interest due to several reasons. Local and regional procurement (henceforth, LRP) is gaining importance primarily because it can be less costly and aid can be delivered much faster.

In fact, WFP's Financial Rule states that:

*“When conditions are equal, preference will be given to purchasing from developing countries”*(World Food Program, 2010).

In 2009, under LRP initiative, WFP bought almost US\$1 billion worth of food commodities, 82 percent of which was purchased from developing countries. Total purchases in 2010 were 3.2 million metric tons, costing US\$1.25 billion (World Food Program, 2010). WFP's experience suggests that LRP may lead to significant savings in terms of both commodity costs and delivery times. For instance, on average, maize procured in Africa costs 30% to 50% less than white maize imported from the US and arrives 1 to 2 months faster than imports from the US (Haggblade and Tschirley, 2007).

The procurement rule of WFP is guided by the “Principle of cost efficiency and minimum cost”, whereby, food is procured locally if local prices are less than Import Parity Price (henceforth, IPP) (Purchase For Progress, 2010). When LRP meets the cost efficiency principle, it makes economic sense to procure food locally. On the other hand, if it is more costly to procure locally then donor organizations like WFP face a moral

dilemma: should they meet the planned development objectives by importing from abroad at an IPP lower than regional price? Or, should they continue procuring locally even at a price higher than IPP? If the latter route is followed, it is hard to justify in economic terms if one is looking only at price differentials. Although local procurement may involve higher costs in the short run, one might argue that the long term benefits of doing so could be substantial. This is particularly true for a region like Sudan, where long term building of markets is a prerequisite for farmers. Stable demand for crops from an entrusted organization like WFP could provide incentives for the agents to come back to farming. When they know that there is going to be a secure market outlet for their produce, it can potentially provide significant motivation for them to revert back to agricultural production.

### **Purchase For Progress**

Purchase for Progress (henceforth, P4P) is an integral part of WFP's local and regional procurement program. P4P enables WFP to experiment with new mechanisms to purchase food *locally*. Through this program, WFP has realized cost savings of US\$22.6 million with respect to import parity price (IPP) (World Food Program, 2011). The objective is to leverage WFP's demand for food commodities to develop market opportunities for smallholder, low-income farmers. The underlying idea behind P4P initiative is as follows: a secure market would encourage smallholder farmers to increase and improve the quality of production resulting in higher incomes (WFP: Purchase for Progress). In order to implement P4P, different approaches are being piloted and tested, depending on the local conditions in each country.

In case of Southern Sudan, the goal of P4P is to strengthen the (re)emergence of farmers' organizations after the prolonged civil war. The idea is that once the farmer organization (FO's) are able to access a stable market, they will motivate agricultural production of their members, thereby revitalizing local markets and contributing to the region's economic integration and stabilization (Purchase for Progress: Southern Sudan). Committed demand from WFP is assumed to encourage production and it is envisioned that over time, they should be able to participate in competitive tendering on commercial markets (Purchase for Progress: Southern Sudan).

In 2010, P4P has started working with farmers' organizations in central and western Equatoria (known as the Greenbelt), in the semi-tropical zone of the southwestern part of the country. Through P4P, WFP intends to buy sorghum and maize from the participating households. Contracts have been signed with 4100 farmers to procure 1500 metric tones of food over 2 years (Purchase for Progress: Southern Sudan). The primary goal is to provide new and stable market opportunities to the targeted population. This project gives an incentive to farmers as well as other stakeholders to increase production by offering a market outlet.

### **Problem with LRP/P4P**

Local and regional procurement of food aid commodities is not a panacea. WFP has, in fact, encountered problems in identifying reliable suppliers of food aid commodities; limited infrastructure causing delay in delivery, etc (WFP, 2007). Also, as mentioned earlier, the basic premise of LRP is that food would be sourced locally when it is cheaper

than sending in-kind food aid from outside countries. The cost efficiency principle may not be met in a country like Sudan, where prices are likely to be higher than IPP.

There are other significant barriers to viability of LRP. Conflict is one such important obstacle. In this paper we examine the problems with implementation of P4P program in Sudan. While organizations like WFP are willing to invest in development programs like P4P, they are also constrained by uncertainties emanating from country specific idiosyncrasies. In particular, at the planning stage, there is too much uncertainty regarding the price that must be paid to the farmers to produce the food crop, the cost of production in the region, the infrastructural problems and so on. One way to manage this uncertainty is to resort to contract mechanisms, whereby certain amount of crop is purchased at a guaranteed price.

Unfortunately, limited productivity and high production and marketing costs render local commodities uncompetitive in Southern Sudan compared to imported staples (Purchase for Progress: Southern Sudan). Low productivity in Southern Sudan may be attributed to supply side impediments like absence of transport infrastructure, or access to proper inputs. Most of the smallholders do not have access to markets. Lack of proper extension services, quality seeds, agrochemicals and knowledge of best agronomic practices also lead to low productivity in this region. Prices in domestic market are also high also because historically it has remained a conflict prone region. The prolonged civil war has damaged market networks, logistics infrastructure and trade in general (The HGB Foundation). Following the referendum in January 2011, while Southern Sudan is now moving towards independence, almost two decades of conflict have adversely affected the infrastructure and economic foundations of the country. Production of food

has been hampered by fighting and displacement, as well as by unpredictable rainfall in recent years (World Food Program Country Profile: Sudan). In fact, the Emergency Food Security Assessment Report (2010) reveals that in South Kordofan, the probabilities of high food prices shock and conflict are both high (characterized by maximum of 5). Not only are these shocks recurrent, they are expected to occur throughout the year, with a high scale of severity (Emergency Food Security Assessment Report, 2010).

The above discussion on the economic situation of Sudan highlights the severity of the problem of conflict, the interplay between conflict and high food prices and the resultant problem faced by organizations like WFP while designing assistance programs. With this background, we formulate our research questions as follows.

### **Problem statement**

It is difficult to estimate the cost of conflict and hence it remains a challenging research topic for agricultural economists, public and donor organizations like WFP.

Microeconomic case studies are likely to be more useful than the oft used macroeconomic studies due to the following reasons. Existing works typically tend to express the economic consequences of conflict in terms of effect on GDP in a conflict affected country. While macroeconomic studies do provide valuable insights on the aggregate effect of conflicts in a country, these studies tend to mask the effects on particular segments of the society. In particular, a macroeconomic study cannot provide an answer to practical questions like: what is the monetary cost of reducing conflict in a particular region and what would be the cost of bringing the conflicting agents back to a peacetime equilibrium. Our goal is to provide a methodology to estimate the cost of



conflict using a microeconomic setting. This approach would be particularly useful for organizations willing to invest in a country and asking the question: “How much extra money do we need to pay in order to reduce conflict in this region.” Macroeconomic studies, by design, cannot answer this practical question.

## **Literature Review**

Existing literature tend to express the economic consequences of conflict as a proportion of GDP (for example, Collier (1994), Staines (2004), Ra and Singh (2005)).

There have been some recent studies on the effectiveness of local and regional procurement programs (for instance, Clay and Riley (2005), Mwanaumo et al. (2005), Haagblade (2006)). While Clay and Riley (2005) describe the cost-effectiveness of LRP, they do not address the risks associated with LRP. Some researchers admonish that LRP may have adverse impact on prices in local markets. LRP can potentially increase the demand for food and drive up food prices for consumers. In fact, there have been instances in Uganda and Ethiopia where LRP led to price hikes. The report by Mwanaumo et al. (2005) explicitly notes that any food aid operation entails risks. In-kind food aid may reduce production and trade incentives in receiving countries. It could also induce dependency on outside countries, which could have negative long term implications.

Mwanaumo et al. (2005) mention about risks that (a) LRP may push local prices above import parity prices and/or historical prices (b) suppliers may default on tenders, and (c) locally or regionally procured food may fail to meet minimum safety standards. WFP tries to manage contract default and food safety risks through pre-qualification of

traders and by using contract conditions that penalize traders for default (Mwanaumo et al. (2005).

Chalmers (2006) found that targeted programs of conflict prevention are significantly cheaper than cure. Thus it may be easier and more cost-effective to prevent conflicts before the outbreak of violence. As he rightly points out, conflict prevention involves upfront spending commitments by different organizations. Therefore, it would be highly useful to estimate the cost of reducing conflict. Our study provides a method to estimate the cost of preventing conflict and hence contributes to this line of research.

There could be challenges with LRP/P4P at the implementation stage. One such problem is to design the commodity prices that must be paid to the smallholders in case of forward contracts, where WFP commits to procure a certain amount of commodities at planting time. The challenge of *forward contracting* is to ensure a fair price without distorting or disrupting markets. Other implementation challenges involve risk mitigation mechanisms to prevent contract defaults and ensure that quality standards are met. Our paper seeks to address some of these problems encountered with implementation of P4P under forward contracting. In particular we examine a) how much price should be paid to the suppliers, b) how should contracts be designed so that defaults by agents are avoided. By answering these two questions we also develop a method to estimate cost of reducing conflict.

### **Model Development**

WFP/P4P's goal is to maximize the net benefit from procurement through LRP/P4P

by minimizing the contribution cost towards the program. P4P is an integral part of WFP's local and regional procurement program (WFP:Purchase for Progress). Under the P4P program, WFP is testing several novel ways to buy staple crop locally and promote marketing opportunities for low-income smallholder farmers. Food may be purchased using any of the following methods. The first alternative is a competitive process, whereby suppliers compete to sell WFP a commodity.

The second approach is direct contracting, under which, at the time of harvest, WFP negotiates a contract to buy a commodity directly from farmers' organization. The price is pegged to the prevailing wholesale market price for high quality crops. With direct contracting, a competitive tender with a minimum of three bidders is not required. By virtue of warehouse receipt systems, smallholder farmers deposit crops that meet pre-determined quality criteria in a certified warehouse. In return, they are issued a receipt for about 60 percent of the market value of the commodities. The receipt can be exchanged for cash at a local financial institution. The final balance is paid once the commodities are sold.

The third approach is forward contracting, under which WFP agrees to purchase a specified quantity and quality of commodity from the farmers' organization at some time in the future at a minimum guaranteed price. In case of forward contracts, the suppliers receive a specified agreed price or according to a specified pricing formula (WFP: Purchase for Progress). Forward contracts are also being used to build up local food processing capacity. For instance, fortified blended flours, biscuits and vegetable oils are being produced using forward contracts. This is achieved by linking smallholder farmers

directly to processing facilities so that they can supply the staple commodities required as raw materials. For the purpose of this paper, we explore the forward contracts.

The sequence of actions between the players is as follows:

1. WFP offers a contract to a Farmer Organization (FO) to deliver a specified quantity and quality of a commodity at some time in the future at a minimum guaranteed price.
2. Contracts are signed between P4P and the FO.
3. After signing the contract, a certain segment of the agents decide not to switch to farming. They continue engaging in conflict. The remaining segment of the agents switch from conflict to farming to participate in the P4P program.
4. If an agent decides to switch from conflict to farming, s/he incurs a switching cost, exerts effort and invest in relationship specific assets to produce the crop for WFP.
5. After the yield is realized, the principal buys the crop from the FO at the guaranteed contract price.

Suppose the economy comprises of  $n$  agents, possibly engaged in some form of conflict. The P4P program aims to reduce conflict and ensure food security in the region. This can be accomplished in various ways. One way is to bring the conflicting agents into mainstream activities like agricultural production. The underlying idea is to create a stable and sufficient *demand* for the crop produced by the agents such that they would find it optimal to return to the mainstream activities and relinquish conflict.

In order to provide a demand for the produce, P4P writes contracts to the agents such that  $q$  units of output will be purchased from them at a guaranteed price of  $p$  dollars per unit of production. Let the marginal cost of production to be  $c$  dollars. Thus the profit of a typical agent signing the contract is given by

$$\pi = (p - c)q \quad (1)$$

The Participation Constraint or Individual Rationality Constraint (IRC) for each agent is

$$\pi \geq s + u \quad (2)$$

Inequality (2) tells us how much price should be paid to a typical agent so that s/he relinquishes conflict and accepts the P4P contract. If the agent accepts and signs the P4P contract, the benefit would be the profits earned through selling crops. The cost of signing the contract involves two distinct components. Let  $s$  represent the cost incurred by an agent in order to switch from conflict to farming. The other component of cost,  $u$ , may be interpreted as the cost of leaving the group of people who are currently engaged in conflict. It may be the case that conflicting agents have close bonding effects and therefore leaving the “peer group” to join the P4P program would be costly for the agent. The peer group may exert a severe penalty on the agent who intends to leave the group and join the P4P program. This penalty can significantly deter the agents from signing the contract, thereby leading to a failure of the envisaged program. Thus the participation constraint implies that P4P program must ensure that the benefit from switching to farming activities must exceed the cost of switching plus the utility from alternative “employment”, which, in this case is conflict.

We assume that the switching cost  $s$  varies randomly across the agents and is uniformly distributed over  $[0, s_{\max}]$ . This captures the intrinsic heterogeneity among the

agents in terms of their ability to switch from conflict to the alternative employment, viz. farming. Agents with switching cost  $s \in [0, s^*]$  would switch to farming. Equivalently, the agents whose switching costs are too high i.e.  $s \in (s^*, s_{\max}]$  would not switch. From (2) we compute the threshold required for an agent to switch

$$s^* = \pi - u \quad (3)$$

We derive the probability that an agent will give up conflict and sign the P4P contract as follows

$$\text{Prob}(\text{agent will switch}) = \text{Prob}(s \leq s^*) = \int_0^{s^*} f(s) ds = \frac{s^*}{s_{\max}} \quad (4)$$

Equivalently, we can compute the probability that an agent will continue with conflict as

$$\text{Prob}(\text{agent will not switch}) = \text{Prob}(s \geq s^*) = 1 - \text{Prob}(s \leq s^*) = 1 - \frac{s^*}{s_{\max}} \quad (5)$$

Thus the expected number of agents who would switch to farming under P4P program is

$$n \times \text{Prob}(\text{agent will switch}) = n \cdot \frac{s^*}{s_{\max}} \quad (6)$$

The expected number of agents who would not switch to farming and continue with conflict is

$$n \times \text{Prob}(\text{agent will not switch}) = n \cdot \left( 1 - \frac{s^*}{s_{\max}} \right) \quad (7)$$

### **Definition: Counterfactual Supply**

We define the *counterfactual* supply of crop under P4P program as the quantity that *could have been* produced locally if there were reduced conflict. The peacetime or counterfactual supply may be derived as

$$Q^{counterfactual} = n \cdot \frac{s^*}{s_{max}} \cdot q \quad (8)$$

The principal (in this case, the WFP) wants to procure  $Q^{counterfactual}$  through the P4P contract mechanism. From each of the participating agents, the principal would collect contracted quantity  $q$  and pay the contract price  $p$ . Let the value of each unit of procured crop be  $v$  ( $>p$ ). Typically, WFP purchases quantities of staple crops to distribute through food assistance programs. Let us assume that the parameter  $v$  represents the value of crop used in the humanitarian programs. Thus the objective function of the principal is

$$(v - p) \times Q^{counterfactual} = (v - p) \cdot n \cdot \frac{s^*}{s_{mac}} \cdot q \quad (9)$$

This is the net benefit of crops procured from the agents who sign the contract and participate in the P4P program.

Maximizing the above expression subject to the IRC of the agents (2) yields the optimal contract price:

$$p^* = \frac{v + c}{2} + \frac{u}{2q} \quad (10)$$

Comparative static results with respect to the exogenous parameters yield valuable insights for the principal.

$$\frac{\partial p^*}{\partial v} > 0, \frac{\partial p^*}{\partial c} > 0, \frac{\partial p^*}{\partial u} > 0, \frac{\partial p^*}{\partial q} < 0 \quad (11)$$

If the value of the procured crop increases then the principal would want to pay a higher equilibrium price to the farmers. This could be the case, for example, if the desired form of assistance is a school lunch program. It is often argued by the farmers that their cost of production is too high, which is expected in a region with a history of conflict.

If the cost of production increases, so will the equilibrium contract price. Otherwise, the agents would not find it optimal to switch to farming if they are not paid sufficiently to cover for their costs. If the benefit from engaging in conflict is high, then in order to induce the agents to give up conflict, the principal would have to pay a higher price to reduce conflict. Finally, if the principal is willing to purchase higher quantity of crops, then the equilibrium contract price would be set at a lower level. The farmers would be able to sell higher crop and the income from selling that crop should be sufficient to meet their participation constraint specified in (2).

In this highly stylized set up, the local procurement cost under P4P scheme, to be borne by the principal is

$$p^* \times Q^{counterfactual} = p^* \cdot n \cdot F(s^*) \cdot q \quad (12)$$

As an alternative to local procurement, the same amount of crop could have been imported at the Import Parity Price, or IPP ( $p^W$ ). In that case, the cost of procurement through imports would be

$$p^W \times Q^{counterfactual} = p^W \cdot n \cdot F(s^*) \cdot q \quad (13)$$

Thus the difference in procurement costs under the two alternatives is

$$\Delta = (p^* - p^W) \cdot n \cdot F(s^*) \cdot q \quad (14)$$

If the equilibrium contract price  $p^*$  exceeds the Import Parity Price  $P^W$  then the difference would be positive. Evidently, the principal must incur an extra bill of  $(p^* - p^W)$  per unit of crop procured from the farmers. Thus the farmers must be paid prices high enough so that farming becomes attractive compared to alternative activities like engaging in conflict.  $\Delta$  may consequently be regarded as a “cost of conflict”. It captures the extra



monetary cost that the principal must be willing to pay in order to implement P4P program in a conflict region.

We note that the equilibrium income of each of the participating farmers is

$$\pi^* = (p^* - c) \cdot q = \left( \frac{v - c}{2} + \frac{u}{2q} \right) \cdot q \quad (15)$$

Consequently, the threshold switching cost is computed as

$$s^* = (p^* - c) \cdot q - u = \left( \frac{v - c}{2} \right) \cdot q - \frac{u}{2} \quad (16)$$

Since by assumption,  $s \sim U[0, s_{\max}]$ , the parameters must satisfy the following inequality:

$$v - \frac{2s_{\max} + u}{q} \leq c \leq v - \frac{u}{q} \quad (17)$$

Equivalently, it can be rearranged as

$$(v - c) \cdot q - 2s_{\max} \leq u \leq (v - c) \cdot q \quad (18)$$

Inequality (17) implies that for the implementation of the P4P program, the production cost of the agents must be bounded. In other words, for the P4P program to be successful, the cost of production must not be too high. This result leads us to supply side policy implications. While WFP provides a sufficient *demand* for the crop and is willing to pay a guaranteed price to the farmers, there should be supply side interventions as well.

Typically costs of production are too high in regions with a history of conflict.

Appropriate measures, like subsidies, building infrastructure should be taken in order to reduce cost of production.

Inequality (18) implies that the outside option of the agent must also be bounded.

If not, the envisaged P4P program might fail to induce large number of agents to switch to farming. Thus, if the agents obtain too high benefit from engaging in conflict, it is

likely that the IRC (2) would be violated, consequently they would refrain from joining the P4P program.

## **Discussion**

As we have described the situation in Sudan in the introduction of this paper, at the planning stage there can be too much uncertainty while implementing a program like P4P. The method outlined in this paper can however be used to estimate the cost of implementing the program, especially in conflict prone areas. The principal/ donor organization need to obtain the pieces of information on  $n$  (targeted population),  $c$  ( cost of production),  $p^W$  ( Import Parity Price) ,  $p^*$  (optimal contract price) in order to get an estimate of cost of conflict.

## **Conclusion and Future Research Directions**

Assessing the relative effectiveness of the three alternative mechanisms (viz. forward contracts, direct contracts and competitive tender) is natural extension of our work. Also, we have assumed in our model that the cost of production is same for all the agents. In reality, this may or may not be true. Future research may be directed to examine the effect of agents with different efficiency levels.

Also, a significant problem with P4P program is default of farmers on the contracts. Weak legal systems could limit WFP's ability to enforce contracts and impose penalties. Often it has been found that after signing the contract, the farmers are unable to meet contractual terms regarding quantity and/or quality. Thus the vendor may deliver only a part of the contracted amount to WFP (partial default) or not deliver at all (total

default). Even though agents are paid only according to what is actually delivered, contract defaults are a concern for WFP (2011). In the case of default, WFP has to replace the defaulted quantity with alternative commodities to avoid pipeline breaks for the beneficiaries of food assistance programs. Thus contract defaults can lead to higher transaction costs. In fact, out of the 150,000 metric tons of food contracted since September 2008, about 14% was defaulted and the 28% was delivered with delay (Purchase for Progress Update February 2011). The February 2011 update suggests that reasons for defaults tend to be similar across countries. Defaults can be generally attributed either to WFP's own internal business processes that need to be smallholder friendly, or to the P4P vendors' own weaknesses (weak bulking/aggregation capacity; financial weakness; lack of key post-harvest handling infrastructure and storage; weak governance structures or trust issues). It was found that the two factors often reinforce each other. There could be several reasons behind default. Two of them are price fluctuations over the contract lifetime and quality shortfall issues. In fact, a significant problem that has been a concern for donor organizations is side-selling. Under this circumstance, after signing the contract, some of the agents may decide to sell the produce to local traders instead of WFP. This may happen, and has often been the case, when local prices exceed the agreed contract price. Some farmers may decide to default on the contract and sell their crop to the local organization at a higher price. This moral hazard problem can dampen the investment initiative of donor organizations and may be a serious impediment to the success of P4P program. The effect of asymmetric information due to moral hazard is an interesting case and remains a future research area.

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