Risk Management Tools for Malawi Food Security
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Introduction
Malawi’s maize marketing policy is dominated by concerns about ensuring national food security. This policy is conditioned by three major factors. First, maize dominates the food economy. This grain crop accounts for over 90 percent of national cereals area, provides 85% of grain calories and between 52 and 65 percent of food calories overall (FAO, 1990, 2002). Second, when a shortfall occurs maize prices on local markets rise sharply since the private sector in Malawi is often unable to raise financing for import operations in the face of competing government interventions. During the 2005 drought, domestic maize prices doubled in much of the country, and tripled in areas experiencing the worst deficits. As a result, many poorer households could no longer afford to buy maize. Finally, the costs of resolving production shortfalls with maize imports are high. Transport and handling costs alone can easily double the costs of maize imports to this land-locked country, particularly when imports are required within a short window of time.

These concerns are heightened by the limited growth of maize production and productivity during the past few decades. Per capita maize production levels have declined leading the country to become a consistent maize importer. At the same time, many neighboring countries have started importing maize, raising competition for regional stocks. This competition is most severe when the region experiences drought. Rainfall variability also appears to be increasing. Malawi has experienced severe national drought in four of the past 15 years and climate change models suggest this may be a more frequent phenomenon.

In this context, the country has begun pursuing a strategy of maize self-sufficiency. Production support, in the form of subsidized fertilizer and seed has been provided to a growing proportion of smallholder farmers. During the 2006/07 season, approximately 80 percent of these farmers received coupons subsidizing the costs of inputs. In combination with favorable rainfall seasons, these efforts have contributed to the achievement of record maize production levels and large maize surpluses. Investments in the parastatal Agricultural Marketing and Development Corporation (ADMARC) have sought to reduce price variability on local maize markets with pan-territorial buying and selling prices, and the maintenance of over 300 buying and selling depots around the country.

These investments are backed by 180,000 mt of storage space for a strategic grain reserve which is in the process of being expanded with an additional 60,000 mt of storage space. The country maintains approximately 70,000 mt of strategic grain stocks, but seeks to expand this in view of the high costs of deficits. Maize export controls limit sales opportunities and require farmers and traders to hold surplus maize stocks. Currently, the country allows maize exports
on a strictly controlled basis. Private companies have been offered export licenses for 80,000 mt and the National Food Reserve Agency (NFRA) is coordinating exports of maize to meet government to government contracts with Zimbabwe and Swaziland.

Malawi is currently benefiting from the high prices received from its maize sales to Zimbabwe. However, this may be only a temporary gain. In most years countries like Zimbabwe or Swaziland would readily import maize from South Africa, both because of more favorable product prices and lower transport costs. This year Zambia, which has a strategic advantage in supplying maize to Zimbabwe, may soon be lifting its export restrictions. In Tanzania, the Democratic Republic of Congo, and Mozambique improvements in production and marketing infrastructure offer prospects for expanding output and trade for those countries within the region.

This discussion note outlines a framework for using market-based risk management tools to improve Malawi’s efforts to assure itself adequate maize supplies in the context of evolving regional grain markets. The strategy aims to strengthen the capacity of government to manage national maize supplies, while at the same time encouraging complementary investments by private traders to increase trade and hold stocks. The objective of these efforts is to stabilize maize supplies and reduce seasonal and spatial variability in national prices.

**Market Uncertainty and Risk**

Risk is pervasive in Malawi’s maize markets and much of it can be linked to the possibility of maize shortfalls resulting from drought. Production losses translate into higher food prices and uncertainty about access to maize when it is most needed.

In the past, government interventions designed to reduce these risks may, in practice, have amplified them. Historically in times of surplus, government has used ADMARC to purchase maize at designated pan-territorial floor prices in an attempt to maintain adequate price incentives to the producer. In times of shortage, ADMARC has been mandated to sell maize at pan-territorial ceiling prices in an attempt to limit increases in maize prices. Strategic grain reserves are similarly meant to assure maize supplies in the event of low production.

However, uncertainty about the level and timing of these interventions has undermined commercial trading activity that would have smoothed supply and price volatility. The government itself controls at least three-quarters of the national maize storage situated off the farm. The total volume of maize held by the country’s licensed private traders is difficult to quantify but probably amounts to less than five percent of national maize consumption. Banks are reluctant to lend to private traders because of uncertainty about government interventions in the domestic market. Traders are reluctant to buy and hold maize inventories
because of uncertainty about being able to cover costs through sales later in the season.

As a result, Malawi continues to experience unusually high levels of price variability. In practice, Government interventions are simply not large or fast enough to cope with local changes in maize supply and demand. Private sector activities ought to provide the first and primary point of market mediation – moving maize from surplus to deficit areas in response to price signals. But private sector traders are unable to make investments to support these activities when there is uncertainty about government intervention. The continuing limits of private sector investment magnify calls for government interventions in the name of market failure, yet these interventions further constrict private sector trade. This results in a vicious cycle of supply imbalance, a problem which is most severe when the country experiences shortfalls resulting from drought.

On national and international maize markets supply and price risks are increasingly resolved through a risk management strategy based on hedging. Hedging involves contractual agreements to buy or sell maize in the future at a particular price, thus reducing supply and price uncertainty. At the time of planting, for example, farmers may agree to sell their crop at a price that covers the costs of production. In developed markets this can be done either through a forward contract (to deliver the physical product), through a futures contract (which locks in the sales price on a financial basis), or through a put option (which locks in a minimum price floor). Maize processors or traders also find supply and price uncertainty problematic and use similar instruments to assure access to adequate supplies at a known price. For this purpose, they can use forward purchase contracts, futures contracts, or a call option (which locks in a maximum price ceiling). Commodity exchanges, such as the South African Futures Exchange (SAFEX) or the Chicago Board of Trade (CBOT) link buyers and sellers of these contracts. The impact of such markets on maize prices is evident in Figure 1 which highlights the continuing variability of Malawi’s maize prices compared with the reduced fluctuations of maize prices on the South African and Chicago exchanges.
Countries concerned about maize stocks can hedge maize supply and prices when it is possible to make use of nearby commodity exchanges. In 2005, Malawi successfully purchased a call option on the South African Futures Exchange in order to lock in a maize price and supply commitment to resolve the domestic supply shortfall caused by drought. As a result, Malawi was able to import during the lean season at prices $50-90/mt lower than existing market prices. This also helped ensure Malawi had access to at least a portion of the maize it needed on a timely basis, during a period when pipeline constraints were creating problems for humanitarian imports. Malawi is similarly considering purchase of a put option on the South African Futures Exchange in order to cope with the country’s current maize surplus. This would lock in a minimum price at which the country could sell its maize stocks if they are not needed in country at a later date.

Importantly, the consistent application of these tools over time can stimulate broader investment in national maize markets. The "contingent" aspect of option contracts helps the Government provide a clear signal to the private sector about the conditions under which it is prepared to intervene. For example, during a time of shortage, Government can use a call option to trigger contingent imports if and when prices get to an unaffordable level. These contracts thus create transparency about government intentions, which may help encourage private sector investment in stock-holding and trading activities.
In addition to hedging supply and price risks, two complementary strategies could also help Malawi better cope with the risks of maize shortfalls associated with drought. Weather insurance, a strategy recently applied in Ethiopia, can provide additional financing for the government to purchase maize in the event of severe and catastrophic drought. Although weather insurance is a relatively new market, the experience in Ethiopia has attracted growing interest and providers are interested in seeing if it can be replicated elsewhere. A third market tool, warehouse receipt-based financing may also help Malawi expand private maize storage and trading activities. Warehouse receipt based financing relies on collateralized stocks held in approved warehouses under agreed specifications. Introducing this mechanism may contribute to strengthening capacity of the private sector to hold maize stocks, reducing post-harvest losses, and improving the transparency of market operations.

A Risk Management Framework

The coordinated application of these three risk management strategies - price hedging, weather insurance and warehouse receipts - has the potential to reduce the variability of Malawi’s maize supply and prices while increasing the capacity and willingness of the private sector to expand activity in the market. These strategies would also strengthen Malawi’s ability to participate in regional maize trade, an environment that is expected to become increasingly competitive in the future.

The risk management framework presented here was requested by the Government of Malawi as a guide to demonstrate how market-based tools might be integrated into food security and maize market development policy on longer term basis. The framework is a draft, which has been developed in cooperation with the Government of Malawi and donors, specifically the World Bank, DFID, the European Comission, and USAID. Each of these stakeholders has expressed a strong interest in supporting a 4-year initiative that will involve continued testing of these tools.

Since concern over the risk of drought underlies many of these issues, a description of the coordinated risk management framework starts with an explanation of weather insurance.

Risk Management Tool 1 - Weather Insurance
Weather insurance involves the use of an index-based weather derivative contract to transfer the risk of severe national drought to the international markets. On a macro level, the aim of such a contract would be to secure timely and reliable funds for the Government if a contractually specified severe and catastrophic shortfall in precipitation occurs during the agricultural season, as measured by weather stations throughout the country. Early access to contingency funds would give the Government more flexibility in its drought
planning, and enhance the ability to launch an efficient and cost-effective drought response.

From an operational point of view, implementation of a weather insurance contract requires two main components. First, the risk markets that would underwrite drought insurance require a reliable rainfall index based crop production model. The index proposed for Malawi – the Malawi Maize Production Index (MMPI) – has been constructed using rainfall data from 21 weather stations throughout the country, and is based on the Malawi Meteorological Office’s national maize production forecasting model. This is a modified version of the FAO’s Water Requirement Satisfaction Index adapted for Malawian conditions. The model uses daily rainfall as an input to predict maize yields, and therefore production, throughout the country. The inter-annual variations in the current MMPI have a correlation coefficient of 74% with inter-annual variations in historical national maize yields for 1984-2006, and 85% with inter-annual variations the Malawi Meteorological Office’s national maize production forecasting model for 2000-2006.

Second, the weather contract requires an accurate feed of daily rainfall data to an independent operator of the MMPI – otherwise known as a data cleaner. This agency checks the integrity of the rainfall data and ultimately confirms the status of any payout.

Figure 2 shows the timeline and period of risk covered by this instrument. The insurance derivative itself would be purchased around August. The results of the season would be well known by April leading to a payout, in the event of severe drought, in May. The payout received in May could be used to finance the purchase of maize or other responses in the months that follow.

**Figure 2. Timeline for Weather Insurance Component**

<table>
<thead>
<tr>
<th>Risk coverage – 18 months:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug ’07--------------Oct-April---------May------------------June/August---------Dec/Jan ‘09</td>
</tr>
<tr>
<td>Purchase</td>
</tr>
<tr>
<td>of insurance</td>
</tr>
</tbody>
</table>

The second tool for coping with the risk of a food shortage is a contingent import agreement, or call option, an instrument already well known in Malawi following its successful application during the food crisis of 2005/6. A contingent import is based on a call option, which gives the buyer the right, but not the obligation, to buy maize for delivery later in the season. A call option is a contractually-specified agreement to purchase maize if needed at a pre-agreed maximum (ceiling) price at a pre-agreed time in the future. The call option provides protection against increases in market price levels and flexibility about supply when the country is uncertain about maize volumes in the market.
In Malawi, in years when the country is concerned about the risk of a food shortage, the logical time to purchase a call option would be June/July, to cover the following 6-8 months of uncertainty leading up to the lean season (Figure 3). In November, if it appears that additional maize is not going to be needed in the country, the call option is not exercised and in effect the contract is cancelled. However, in November if it appears that additional maize is going to be needed in the country, the call option can be exercised, and the Government can import through the pre-agreed arrangement.

**Figure 3. Timeline for Contingent Import Component**

Risk coverage – 7 months:

<table>
<thead>
<tr>
<th>June ‘07</th>
<th>July/Oct</th>
<th>Nov</th>
<th>Dec/Jan ‘08</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchase</td>
<td>Encourage</td>
<td>A1) If prices are high</td>
<td>Imports through</td>
</tr>
<tr>
<td>Call option for Commercial Imports</td>
<td>exercise option</td>
<td>option</td>
<td></td>
</tr>
<tr>
<td>Commercial Imports</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2) If prices remain low, do not exercise option</td>
<td>No imports through option</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The contingent import agreement may best be viewed as an insurance policy to cover the risk that private traders and/or humanitarian maize supplies are unable to fill a national maize supply gap. In Malawi concerns about maize shortage typically fall into two main categories: commercial market issues and humanitarian needs.

**Commercial Market Issues.** During a food shortage local maize prices tend to rise. This is particularly true in cases when private traders are unable to respond to the shortage with sufficient volume of imports.

In Malawi, private maize traders have been unable to undertake maize imports because of uncertainty about competition in the form of subsidized sales from ADMARC. Traders similarly worry about whether the government itself will flood the market with maize imports, possibly backed by food aid shipments from donors. In 2005/6, for example, commercial imports remained limited despite the substantial maize shortage in Malawi and ready availability of maize on regional markets. Greater transparency in government and donor decision making is therefore needed to encourage private sector activity.

A call option for commercial imports can help resolve this issue by signaling to the private sector the conditions - price level and volumes - under which government will be importing. For example, the government can announce to the public that it has lined up contingent imports which will be brought into the country if prices reach a stated maximum level. This would be a pre-agreed level at which supplementary government funded imports would be required. In this way, the private sector has an opportunity to respond first. It also has a clear view of the conditions under which the Government will intervene, and then only if necessary, to ensure that the market has enough maize at an affordable price.
Humanitarian Response. During a food shortage, Government and donors will also be concerned about arranging supplies to meet the needs of the most vulnerable populations. The scale of the humanitarian intervention may also be determined by watching how prices increase in the local market. Particular attention may be directed to areas of the country known to have the largest deficits and most vulnerable populations. The first orientation of humanitarian assistance may be to provide needy households with cash with which to purchase maize from the local market. If prices rise above threshold levels, humanitarian reserves may be allocated to certain markets. If prices remain high, due to shortages of both private and humanitarian maize, the call option could then be exercised as a back-up measure.

Managing Maize Surpluses in view of concern about the next shortage

The next set of risk management tools relate to the management of maize surpluses and the balancing problem that exists between wanting to ensure a market for surplus production and concern about the risk of a shortfall during the following season. In Malawi, high transport costs and a corresponding large difference between import and export parity prices justify saving at least a portion of surplus maize stocks in country in order to avoid the costs of export and later re-import. This is the justification underlying past suggestions that the country maintain a 60,000 mt strategic maize stock. However, the maintenance of these stocks is expensive. While Malawi has a reasonably good record at limiting losses in central storage, the financial costs of maintaining these stocks are substantial.

One difficulty with the strategy of maintaining high levels of stock in country is limited high quality warehouse space, which can result in increased storage costs and the problem of maize being allocated to poorer quality facilities with attendant increases in post harvest losses. If warehouses are full as the country heads into a new harvest, these problems can be particularly severe since there is no space for the new harvest crop. Under these conditions, there is a significant risk of decreasing prices, which in turn creates disincentives for producers to plant the following year.

The maintenance of large maize stocks also reinforces uncertainty about prices and maize supply conditions. The incentive for traders to hold stocks, or import maize, are limited if they believe government may start releasing its stocks on the market, particularly if there is a possibility that maize may be offered at subsidized prices (any prices that do not fully cover maize, storage and financing costs).

Two risk management options are available for coping with these problems. The first is a contingent export agreement, which is appropriate for stocks owned by the public sector. The second is, a "repo", or repurchase agreement, which is a trade finance agreement combined with a call option agreement. The repo
agreement can be based on stocks held by the private sector, but with first rights of re-purchase offered to the government. Both of these strategies establish a minimum price for maize exports and assure the availability of maize if drought occurs during the next cropping season.

**Risk Management Tool 3 – Contingent Export Agreement (Put Option)**

A contingent export agreement is the exact opposite of a contingent import agreement. It is a contractually-specified agreement to sell maize, if needed, at a pre-agreed minimum (floor) price at a pre-agreed time in the future. This agreement is based on a put option, which gives the buyer the right, but not the obligation, to sell maize for delivery later in the season. The put option provides protection against market prices falling, and provides flexibility which is critical when the country is uncertain about maize supply in the market. If the maize stocks are needed in country, the put option is not exercised, export sales do not take place and the maize stays in the country. If stocks are not needed in country, the put option would be exercised and export shipments would take place at the pre-agreed price floor, or at the market price if it is trading at prices higher than the price floor.

A contingent export agreement protects the value of government held stock until it is either exported or allocated to domestic markets. The contingent export sale is based on a minimum price that, at the least, allows for price or cost-recovery of the initial investment in procurement of maize stocks. This approach is designed to reduce the risk of financial losses associated with a decline in prices, as would be likely to occur if the next harvest was positive. Such a loss in the value of maize stocks can quickly undermine budgets and may jeopardize access to future commercial finance.

The timing of commitments underlying the contingent export agreement would be similar to that used for a contingent import agreement. The put option could be purchased during the intake period of the previous crop, to be exercised as soon as the likely level of the next harvest is approximately known.

**Figure 4. Timeline for Contingent Export Component**

Risk coverage – 9 months:

<table>
<thead>
<tr>
<th>June-August ’07</th>
<th>Jan/Feb ’08</th>
<th>Feb-April ’08</th>
</tr>
</thead>
<tbody>
<tr>
<td>A) Purchase</td>
<td>A1) If preliminary crop estimates are high and stocks are not needed in country, exercise option</td>
<td>Exports through put option</td>
</tr>
<tr>
<td>put option for national stocks</td>
<td>A2) If preliminary crop estimates are low and stocks are needed in country, do not exercise option</td>
<td>No exports through put option</td>
</tr>
</tbody>
</table>
**Risk Management Tool 4 – Repo Agreement (Trade Finance + Call Option)**

Under a Repo (or “Repurchase” arrangement), a private sector bank or local trader would purchase the government’s surplus maize stocks with an agreement to maintain them in the country and sell back to government at a pre-agreed price, if needed. This is advantageous for the cash flow of the government’s budget.

In this case, the first component of the agreement relates to financing made available to support collateral management of stocks held in country, and the second component is a call option. As described above, the call option gives the government the right, but not the obligation, to purchase maize at a pre-agreed maximum price at a pre-agreed time in the future. If stocks are needed in country, the call option is exercised, and Government takes up the right to re-purchase the locally held stocks. If stocks are not needed in the country, the call option is not exercised, and the bank or trader arranges an export sale and shipments out of the country. Because the bank or trader will be exporting the maize if Government does not exercise its right of re-purchase, an export license is required when the original contract is signed.

Banks and traders will be interested in financing stocks held in country in locations where warehouses are in good condition, and can be operated under commercially based collateral management agreements. Banks and traders will finance the stocks and take responsibility for the collateral management function. All other functions – procurement, handling, and storage – remain with the government. This arrangement provides government with an assurance of the quantity and quality of stocks held in the country, and the flexibility to re-purchase those stocks if needed for local consumption the following year.

The timing of commitments underlying the “repo” agreement is virtually identical to the timing for the contingent export agreement, or put option (Figure 5). The “repo” could be purchased during the intake period of the previous crop, and exercised as soon as the likely level of the next harvest is approximately known. Once again, any exports would need to take place well before the beginning of the harvest in the importing countries.

**Figure 5. Timeline for Repo (Repurchase) Agreement – Trade Finance + Call Option**

<table>
<thead>
<tr>
<th>Risk coverage – 9 months:</th>
<th>June-Aug '07</th>
<th>Jan/Feb '08</th>
<th>Feb-April '08</th>
</tr>
</thead>
<tbody>
<tr>
<td>A) Purchase Repo for national stocks</td>
<td>A1) If crop estimates are low and stocks are needed in country, exercise call option</td>
<td>Stocks are Re-purchased / No exports</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A2) If crop estimates are high and stocks are not needed in country, do not exercise option</td>
<td>Stocks are not Re-purchased / Exports allowed</td>
<td></td>
</tr>
</tbody>
</table>
The determination for which instrument (3 or 4) is appropriate is based on a decision about ownership of the stocks. In cases where stocks are held publicly, and Government funds are being used to finance procurement and storage operations, a contingent export agreement is most appropriate because it protects the financial investment in those operations by providing a contingent sale that covers costs. In cases where stocks are held by the private sector (traders or banks), a trade finance + call option agreement is most appropriate because it protects the Government’s right to repurchase those stocks, and prevents them from leaving the country if needed the following year.

Both approaches give government the opportunity to make an initial stockholding decision, while monitoring production and likely supply conditions during the next production season. In cases of a large surplus, this should provide a comfort level to support decisions about exports. Each instrument thus offers a means to support or strengthen producer prices in a market characterized by higher levels of purchasing. And each of these strategies reduces the risks of financial losses associated with volatile maize prices.

**Risk Management Tool 5. Warehouse Receipt System**

In most countries of the world, private traders hold the largest share of national maize stocks. Price signals are used to measure the relations between maize supply and demand, and thus monitor the level of maize stocks. In Malawi, however, maize markets remain thin. The quantities traded and stored are small relative to the aggregate level of national maize consumption. And incentives to hold maize are diminished by uncertainty about the government’s own price and stockholding strategies.

The risk management tools described above help assure access to a sub-set of stocks at predictable prices. However, the costs of these initiatives can be reduced if private traders hold a higher percentage of national stocks.

The establishment of a warehouse receipt system offers a useful complement to the risk management strategies described above. Warehouse receipts can increase the availability of funding for maize stockholding, improve the quality of stockholding and improve the transparency of national markets. All of which should help increase private incentives to hold stocks and in effect, share the risk of holding stocks.

Under the warehouse receipt system, banks provide contractually based financing to traders in exchange for the collateral of maize stocks held in well-managed and well-monitored warehouses. This financing allows the trader to purchase and hold additional stocks, or otherwise expand trading operations. The key requirement is that the maize stock holds a well defined value with a
level of assurance acceptable to the bank. This value is outlined in the receipt instrument itself, a document that provides verifiable descriptions of the:

- quantity, quality and grade of commodity;
- specific location where commodity is stored;
- value of the commodity;
- proof of existence of the commodity;
- proof of on-going management of the commodity; and
- security issues associated with the commodity.

In some cases, the receipt instrument might also be a trade-able document confirming the ownership and quality of warehoused maize stocks. As the system develops, trading based on warehouse receipts could reduce price risks and lower transaction costs.

By clarifying information about the availability of maize in the country, the warehouse receipt also improves transparency of the market and strengthens the government’s capacity to plan its food security programmes. This may also help reduce local price volatility. Because maize intake and storage systems must meet an agreed set of minimum standards to justify issuance of a receipt instrument, the system should also improve incentives to expand storage facilities and invest in improving the quality. Correspondingly, the warehouse receipt system may contribute to a significant reduction in the post-harvest maize losses. Over time, the size and quality of national maize stocks will increase while the cost of holding these stocks declines. In effect, as in most countries around the world, the private sector would take increased responsibility for handling the country’s strategic maize stocks.

It is important to note that the success of this initiative depends on the consistency with which the other market-based risk management tools are adopted. If uncertainty remains about the government’s own stockholding and market interventions and if trade controls remain in place, local traders and banks will have little incentive to store and finance large levels of maize stocks.

**Summary of Risk Management Work in Malawi**

In Malawi, technical work on market-based risk management instruments has been ongoing since 2005. First, an index-based crop production model – the Malawi Maize Production Index (MMPI) – which is based on a modified version of the FAO’s Water Requirement Satisfaction Index was constructed in collaboration with the Malawi Meteorological Office and reviewed by Government and local stakeholders. A contingent import (call option) contract was structured and successfully implemented during the 2005/6 food crisis. A contingent export

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1 This work has been supported by the World Bank’s Agriculture and Rural Development Department and a Multi-Donor Trust Fund for Commodity Risk Management. Donors to this trust fund include the Swiss Secretariat for Economic Affairs and the Netherlands Ministry of Foreign Affairs.
(put option) contracts and Repo agreement were structured and evaluated by the Government in both May of 2006 and May/June of 2007. The Government has expressed support for implementation of the Repo agreement this year and expects to be able to conclude a transaction in August. Technical work has also been done to identify the pre-requisites needed for development of warehouse-receipt based financing. The Government has recently reached agreement to facilitate the establishment of a pilot warehouse receipt scheme for the country under the leadership of the Grain Traders and Processors Association (GTPA).

This risk management framework proposed here was developed in response to a request from the Government for guidance on a more integrated approach to using these instruments. Since both Government and donors plan to continue investments in these tools, they have also requested assistance in developing a budget for a 3-5 year multi-donor risk management initiative for the country.

The next section of this note provides more detail about analytical work done in Malawi, specifically with respect to historical costs associated with using weather insurance and contingent import contracts. It also includes a budget proposal, based on input from donors, for a 4 year multi-donor program to support continued work on these tools.

**Application of Weather Insurance & Contingent Imports in 2005/6**

In order to envision how an integrated risk management framework might work in practice, one can consider an example of their application in 2004-05. If the government invested in weather insurance, a contract would logically have been purchased around July/August 2004, just prior to the start of the rainy season. Using the MMPI model, with a maximum payout of $10 million, a trigger level of 1.8 million metric tons, and an estimated premium of 8.6%, the premium cost would have been $859,868. Between February and May, the government was evaluating production and market information, and anticipating a significant shortage. Discussions coordinated with the Malawi Vulnerability Assessment Committee were used to initiate planning of a response.

The MPPI model underlying the weather insurance would have predicted the possibility of a payout in February. This likelihood would have been assured by April and factored into the national food security response.

In May, the weather insurance contract would have paid out, in this case a sum of $1.4 million. The government could then choose to apply this funding to purchase a call option in June/July. The cost of protecting supplies at the then current market level of $187/mt would have been $31 / mt. The $1.4 million of insurance payout would purchase only 45,161 mt of maize. An additional 1.7 million option premium, or $3.1 million in total would allow the purchase of 100,000 mt of maize.²

² Alternatively, the insurance premium could be used for other drought planning and response activities. The funding for the price hedging may come from a separate investment account.
In an ideal scenario increased clarity about the government’s intentions would have encouraged Malawi’s private sector import, i.e. through August-October, and commercial imports would have helped to reduce local prices. Without more detailed analysis it is not possible to estimate the impact that commercial imports during this time period would have had on local prices. If the private sector failed to resolve the country’s maize deficit, the call option would have been exercised. In practice, since median prices in Malawi had moved significantly higher by the time the option was exercised in November 2005, to $271 / mt, we estimate the option contract provided a savings to the Government of $84/ mt, or $8.4 million on 100,000 mt.

A summary of the timing of these decisions and actions is shown in Figure 6.

Figure 6. Timeline for 2005/6 Example

More detail on the timing of decisions and actions for these instruments, in both shortage and surplus years, can be found in Appendixes A and B – Risk Management Framework: Shortage and Surplus Scenarios. The decision trees shown in the appendices are critical for guiding implementation of the risk management framework since throughout the year there will be particular periods of time when decisions are needed. As a general rule, this can be summarized as follows:

- Feb-May - Planning period
- June-August – Contracting period; requires decisions about investment to pay premiums for purchase of insurance and contingent contracts
- November-January – Activation period for price hedging contracts; requires decisions about whether or not to exercise contracts already in place

In the 2005/6 example, we assume that the payout from the weather insurance is used to either cover the costs of or leverage additional volumes of call option purchases. Table 1 below summarizes the financial impact of such a strategy.

<table>
<thead>
<tr>
<th>Timing</th>
<th>Steps</th>
<th>Financial Impact In USD</th>
<th>Cumulative Impact in USD</th>
</tr>
</thead>
<tbody>
<tr>
<td>July/Aug 04</td>
<td>Invest in purchase of weather insurance contract. Assume trigger level of 1,800,000 mt of production with estimated premium of 8.6%</td>
<td>Cost of $860,000</td>
<td>($860,000)</td>
</tr>
<tr>
<td>Nov-April 04/05</td>
<td>Severe drought</td>
<td>Payout of $1,450,00</td>
<td>$590,000</td>
</tr>
<tr>
<td>May 05</td>
<td>Weather insurance pays out</td>
<td>Payout of $3,100,000</td>
<td>($2,510,000)</td>
</tr>
<tr>
<td>July 05</td>
<td>Invest in purchase of 100,000 mt call option,– using weather insurance payout and additional funding</td>
<td>Cost of $8,400,000 for 100,000 mt</td>
<td>($5,890,000) for 100,000 mt</td>
</tr>
<tr>
<td>Dec-Jan 05/06</td>
<td>Import through call option – Achieve savings of $84/mt</td>
<td>Payout (savings) on call option of $8,400,000 for 100,000 mt</td>
<td>$5,890,000 for 100,000 mt</td>
</tr>
</tbody>
</table>
The technical work involved in structuring prototype contracts for Malawi has also included analysis of historical costs/payouts of these two instruments.

For the weather insurance, since this type of contract has only recently been tested in the market (for Ethiopia in 2005), it is difficult to estimate premium costs. The cost of purchasing a weather insurance contract will vary according to the selection of: a) the maximum payout in $ terms, b) the payout rate, or value assigned to each unit of the index in $/mt, c) the level of production set as the trigger level for the contract in mt, and d) the premium rate. Although the premium rate is difficult to estimate without actual presentation of a contract to the market, as a general rule of thumb it is expected to range between 8-13% of the value insured. In order to give an indication of costs and payout rates over time, we selected four different scenarios for prototype weather contracts.

1) Trigger level of 1,700,000 metric tons with estimated premium of 6.7%
2) Trigger level of 1,800,000 metric tons with estimated premium of 8.6%
3) Trigger level of 1,900,000 metric tons with estimated premium of 10.8%
4) Trigger level of 2,000,000 metric tons with estimated premium of 13.5%

A summary of costs and payouts over a period of 45 years follows in Table 2.

Table 2. Estimated payouts to weather insurance between 1962 and 2006

<table>
<thead>
<tr>
<th>Scenarios: Trigger level</th>
<th>Avg. annual Premium</th>
<th>Total Premium Costs (for 45 years)</th>
<th>Incident of payout (in 45 years)</th>
<th>Total Payout (for 45 years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,700,000 metric tons</td>
<td>$673,168</td>
<td>$30,292,554</td>
<td>5</td>
<td>$12,687,632</td>
</tr>
<tr>
<td>1,800,000 metric tons</td>
<td>$859,868</td>
<td>$38,694,052</td>
<td>7</td>
<td>$18,334,306</td>
</tr>
<tr>
<td>1,900,000 metric tons</td>
<td>$1,078,474</td>
<td>$48,531,319</td>
<td>8</td>
<td>$25,525,016</td>
</tr>
<tr>
<td>2,000,000 metric tons</td>
<td>$1,352,747</td>
<td>$60,873,612</td>
<td>13</td>
<td>$35,409,202</td>
</tr>
</tbody>
</table>

*Appendix C – Weather Insurance Scenarios – Costs and Payouts* - contains a graphical representation of this information.
For the contingent import (call option) instrument, it is easier to estimate premium costs since they are available through the SAFEX market which for the purposes of this analysis is assumed to be the source for imports to Malawi in shortage years since 1996. The cost of purchasing a contingent import or export contract is based on a commodity options pricing model and will vary according to a) the length of time between purchase of the contract and required delivery date, b) the difference between the current market price and the price level protected, and c) the level of volatility in the market. As with the weather insurance, a general rule for estimating the cost of option contracts to protect current market prices six months forward is 8-13%. Since option contracts are priced in $/mt, the biggest variable for overall cost will be the selection of the volume. In order to give an indication of costs and payout rates over time, we selected three different scenarios for volumes, and present the costs of locking in at-the-money (current) market price levels in mid-June, for options with expiry dates mid-November which would entail delivery in Dec/Jan. This analysis is based on the use of over-the-counter option contracts, which use SAFEX as a base and include delivery to Malawi. The scenarios include:
1) Volume of 100,000 metric tons
2) Volume of 200,000 metric tons
3) Volume of 300,000 metric tons
A summary of costs and payouts over a period of 10 years follows in Table 3.

Table 3. Estimated payouts to call option 1996-2006.

<table>
<thead>
<tr>
<th>Scenarios:</th>
<th>Avg. annual Premium</th>
<th>Total Premium Costs (for 10 years)</th>
<th>Incident of payout (in 10 years)</th>
<th>Total Payout (for 10 years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume of 100,000 mt</td>
<td>$27 / mt or $2,700,000</td>
<td>$29,807,465</td>
<td>7</td>
<td>$25,300,000</td>
</tr>
<tr>
<td>Volume of 200,000 mt</td>
<td>$27 / mt or $5,400,000</td>
<td>$59,614,931</td>
<td>7</td>
<td>$50,600,000</td>
</tr>
<tr>
<td>Volume of 250,000 mt</td>
<td>$27 /mt or $6,750,000</td>
<td>$74,518,664</td>
<td>7</td>
<td>$63,250,000</td>
</tr>
</tbody>
</table>

Appendix D – Contingent Import Contract Scenarios – Costs & Payouts contains a graphical representation of this information.

**A Note of Caution**
For both the weather insurance and contingent import contracting there are a number of important caveats.

First, insurance mechanisms are not designed to be money-making activities. The purpose of insurance is to protect against the unknown. When evaluating
investment in insurance, buyers should consider not the potential for payout, but
the benefits to investing in insurance which include improved security, translating
into enhanced capacity to budget and plan. In Malawi, ex post responses to food
market instability have typically absorbed a tremendous amount of time and
resources. As an alternative, these are ex ante approaches that provide the
government with tools to develop a contingency plan, using financial contracts
that either trigger automatically in the event of severe and catastrophic drought,
or can be triggered at the government’s discretion if price and supply problems
are unmanageable.

Second, as with all insurance, the best outcome is that it is not needed. In the
case of weather insurance, no payouts would indicate that the country is not
facing severe and catastrophic drought. In the case of the contingent imports, no
payouts would indicate that the supply situation is stabilized through commercial
trade and maize prices remain affordable.

Third, note that the weather insurance contract is designed to cover the risk of
severe drought, as measured by select weather stations. In some years, drought
may affect smaller parts of the country, but not be broad enough to trigger the
weather insurance payout. This is the inherent “basis risk” issue, which can be
improved over time as investment in weather station infrastructure allows for
more specificity in design of the contracts. Also, depending on the rainfall
season, payouts can range between $0 and the full sum insured. A moderate
drought would offer a lower payout than a catastrophic drought. Anyone paying
the premium should not expect that the weather insurance payout will be for the
full sum insured on a regular basis.

Fourth, since payouts from the weather insurance are uncertain, financing will not
be available every year to offset the cost of purchasing call options. As a result,
decisions about whether or not to invest in one or both instruments, should be
made independently. That is, if there is a weather insurance payout, the call
option may be funded. But if there is little or no payout, there may still be
justification for investing in a call option to facilitate a response to localized
problems.

Finally, as with all market-based instruments, application of the tools is
somewhat opportunistic. For the contingent contracting, it does not make sense
to create multi-year policies based on fixed hedging volumes. Market situations
will vary from year to year and hedging strategies will need to be customized
accordingly. The work in Malawi has shown that standard exchange-traded
contracts do not meet the Government’s needs. As a result, over-the-counter
(customized) contracts which include delivery to and from Malawi are more
appropriate. The objective of the framework proposed here is to lay out the basic
types of contracts which make sense for Malawi in either shortage or surplus
situations.
One Step Among Many

The investments described here will not replace the need for good production policy, nor for continuing investment in developing national markets. Important complements include additional investments in rural roads, particularly in areas cut off from national markets when the rainy season begins. Substantial investments remain necessary to improve the quality of maize storage. National maize price monitoring systems need to be improved to assure the quality and consistency of data available for decision making. Continuing training will strengthen the capacity of national analysts to interpret this information. On-going efforts are needed to improve the accuracy of national crop estimates, and develop better estimates of maize stocks available in the market. Investments are needed to improve information about regional markets necessary to inform decisions about how best to take advantage of opportunities for trade.

Parallel investments are also needed from the private sector. The country’s markets remain thinly traded with thousands of small-scale traders holding limited stocks, often under poor conditions. These are the entrepreneurs currently taking most risks in the market.

This year, Malawi is fortunate to be able to export maize profitability due to an unusual configuration of high international prices and low production levels in southern Africa – and particularly in South Africa. But this is an unusual year. More often, due to the correlation of weather patterns in southern Africa, Malawi will be looking to export in seasons when many neighboring countries have experienced favorable harvests. And the country may be pursuing maize imports when drought has affected the larger southern Africa region. It remains possible, even this year, that the entry of Zambia onto regional markets may threaten Malawi’s exports to Zimbabwe.

The fact remains that trading in both national and regional markets involves risk and the country best able to manage these risks will be that with the most productive agricultural economy, well-positioned to respond quickly to changing conditions.

The main objective of the risk management strategy described here is to help Malawi reduce the massive economic dislocation and welfare loss resulting from severe drought. These strategies should assure that consumers, including many farm households, obtain access to reasonably priced maize if and when this is needed – and most particularly when the rains broadly fail. These strategies (summarized in Appendix E) represent direct investments improving the country’s ability to manage food security risks and improving the efficiency and depth of national maize markets.

Though the strategy highlights public sector interventions, the success of its implementation depends on the continuing strengthening of private sector maize
markets. As the volume of maize traded in these markets expands and competition increases, marketing and inventory risks are more broadly shared, reducing the need for public interventions. More importantly, marketing costs and the volatility in the market should decline.
Budget Proposal

The risk management framework presented here is a multi-donor initiative, which has been developed in cooperation with the Government of Malawi and donors, specifically the World Bank, DFID, the European Commission, and USAID. Each of these stakeholders has expressed a strong interest in supporting a 4-year program of continued investments in risk management tools to strengthen food security.

An indicative budget for a 4-year initiative follows. The first category of investment required is fixed costs, which are necessary to support the implementation of the weather insurance and warehouse receipt strategies. In order to proceed with a pilot of the macro weather insurance instrument, a minimum set of investments is required to improve the accuracy of the Malawi rainfall data, and assure a daily feed to the data cleaner, with a backup feed to the World Meteorological Organization’s Global Telecommunications System (GTS). Current estimates indicate that approximately US$173,000 is needed for the communications links, and to upgrade or automate 4 weather stations. Over time, larger investments may allow the establishment of region specific insurance sub-components. A more comprehensive upgrade of the system may require an investment of closer to US$ 1 million subject to availability of new rainfall monitoring equipment that is being developed for African environments. Additional detail on these costs can be found in Appendix E – Upgrading the Malawi Meteorological Department’s Weather Communication & Infrastructure for National Drought Risk Management.

It is worth noting that even if the Government decides not to invest in the purchase of a weather insurance contract, the upgrading of meteorological facilities, and tracking of rainfall against a well-defined maize production model could substantially enhance Malawi’s existing early warning system. The predictive value of this model is good enough to allow a severe shortfall in harvests to be estimated as early as February. This would allow the country to begin setting aside resources for maize imports and organizing plans for such purchases.

A fixed cost investment is also necessary to support upgrading a select number of warehouses which will be used for the initial warehouse receipt initiatives. To start this process, an initial investment of US$60,000 is required to produce an inventory of warehousing operations in Malawi and document further actions necessary for the establishment of an efficient warehouse receipt system. After this task is completed, it is estimated that an investment of US$200,000 would be needed to refurbish facilities in 8 pilot locations. These costs would cover security systems, purchase of commodity handling equipment (tarpaulins, chemicals etc), and grading and communications equipment needed to ensure that the warehouses selected for the initial program are operating according to commercial standards. Assuming the pilot project was scaled up by 8 additional
locations each year, since costs for each location are expected to be $25,000, the annual investment needed would be $200,000. If the warehouse receipt system is successful, it is anticipated that over time the private sector would have incentives to make these investments and the government investment could be scaled down or eliminated.

Going forward, variable costs to support risk management strategies will primarily cover payment of premiums for weather insurance and contingent import/export contracts. For both products as indicated above, the range of costs is generally expected to be within 8-13% of the value of the sum insured. Costs will vary according to the parameters selected for each contract. As the historical analysis of costs described above shows, premiums for a weather insurance contract with a trigger level of 1,800,000 metric tons and a max payout of $10 million are estimated to be between $800,000 - $1,000,000 per year. Since the weather insurance contract has not yet been piloted, and there are a number of operational issues that need to be tested in taking such a contract to the market, it is recommended that the initial pilot transaction have a smaller premium, of $200-300,000. Premiums for contingent import contracts to protect at-the-money (current) market price levels six months forward for 200,000 mt are estimated to be between $4,000,000-6,000,000 per year.Premiums for contingent export agreements and “repo” agreements will be at similar levels.

The final budget category is costs related to back-stop technical support to facilitate continued structuring, testing, analysis, and monitoring of risk management approaches, and training and capacity building on these issues. This is an extremely critical component since building local capacity is necessary to ensure long-term sustainability of these approaches.

An initial budget for the investment needed to support integration of risk management tools into Malawi’s food security policy over the next four years is presented on the following page. This suggests the need for an investment of approximately US$4.73 million in year one and US$11.8 million in the three following years.