Regional Grain Stock Program

Consumption variability is a major concern in several countries. For countries in which domestic production is the primary source of food supplies, buffer stocks are often used to smooth year-to-year food supply variability. It has been hypothesized that if the SADC countries work together on a regional stocking program, they may be able to reduce their own national supply variability. In this section, a regional stocking simulation model is developed to analyze this policy alternative. Countries might be able to exploit the fact that SADC's regional production tends to be less variable than national-level production.

The central idea behind all stocking models is that grain supplies should be stored when grain production is unusually high and pulled out of storage when production is unusually low. The goal is to develop a model in which quantities are stabilized at the country level by storing and releasing stocks at a regional level.

A special feature of this study is that actual historical supply outcomes are contrasted with models of simulated supply outcomes for the same period. These results are meant to be suggestive only. Implementing some of the policies analyzed here may have very well changed the historical behavior of the economic actors in these countries.

In this study, the assumption is made that a regional authority would decide what levels of stocks to store and release. This authority would use the following regional model to determine the appropriate stock levels.

Stage 1:

- Determine regional stocking capacity;
- Calculate the historical trends in production, net imports, and supply in each country;
- Set a uniform policy target for supply (production plus net imports) levels;
- Set rules determining each country's net imports to keep these levels relatively constant;

Stage 2 (for each country and time period):

- Take historical production volumes and calculate model net imports;
- Calculate supply, and determine desired stock changes;
- Determine if sum of desired country stocks exceeds regional capacity, adjust if necessary.

An important assumption is that stocks will be stored in and transported to and from South Africa. This assumption exploits a unique feature of the region: that South Africa has excess capacity of modern storage facilities, which were built up in the apartheid era due to fears of trade embargoes (Lipton, 1986). The South Africa storage assumption essentially means that there is no storage capacity constraint for the regional model. An assumption is also made that stocks cannot fall too low below an arbitrary threshold of 5 percent of the trend regional supply.

The base case of the stocking model sets the supply policy target at 95-105 percent of trend supply levels, consistent with earlier models. When model supplies in each country exceed 105 percent of the supply trend, the grain is stored; when model supplies fall below 95 percent of the trend, grain is removed from storage. As a basis of determining the supply target bounds, the supply trend over time was statistically estimated for each country using "fit-the-best" criterion of different functional forms (linear, quadratic, logarithmic, log-log, and exponential). The net import response functions were estimated for each country individually according to two components: a structural grain deficit reflecting the difference between trend consumption and production. and a transitory component that was statistically modeled to reflect historical import behavior in response to production deviations.[8]

As an example of the stocking model, consider how the program would have worked for a small country like Swaziland in two different years (fig. 3). In 1983, total grain production was severely below the trend at 33,000 metric tons (MT). The model's policy rules call for net imports of 60,000 MT. The total supply for the year would be 93,000 MT, well below the minimum supply target of 149,000 MT (95 percent of trend supply levels). In order to bring the supply level up to this threshold, 56,000 MT would need to be drawn down from the regional stock reserve. The following year, there was a bumper crop of 154,000 MT. The model's

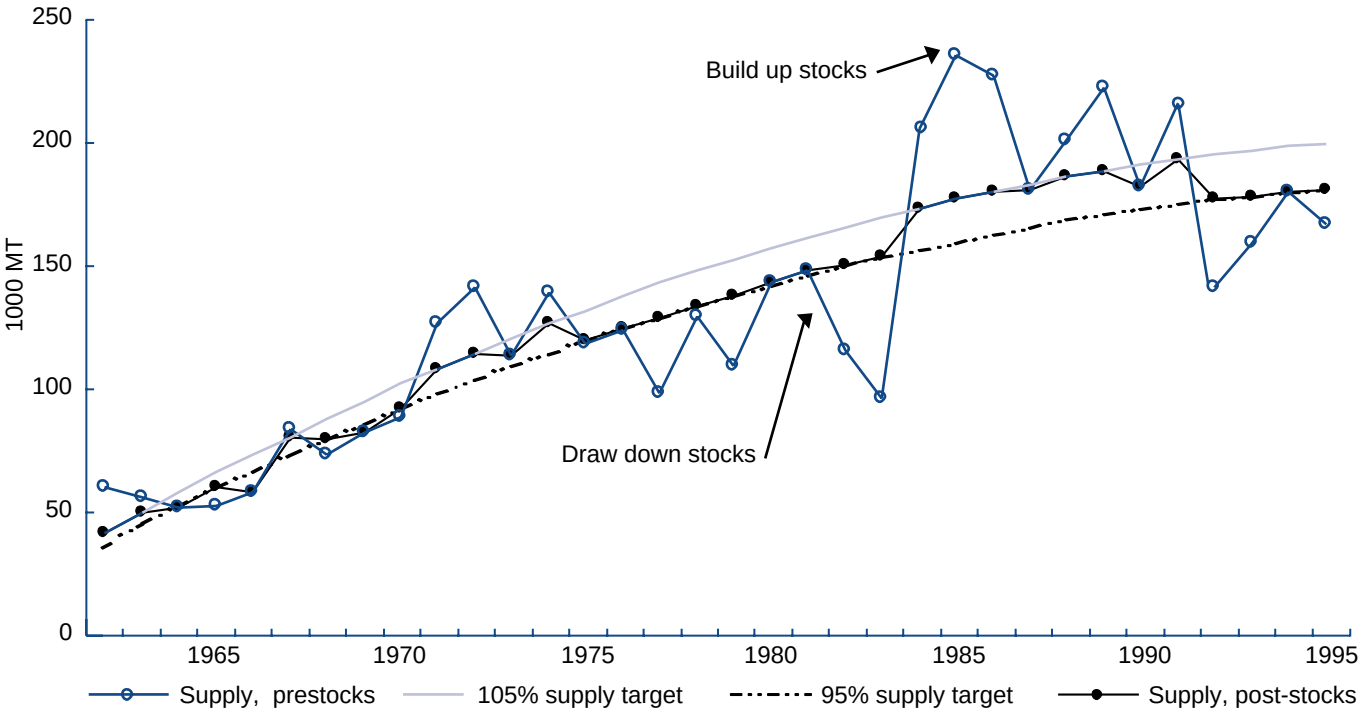
[8] Sensitivity analyses were performed but are not presented in this report due to the primary interest in base case comparability. The stocking model is more sensitive to changes in stock capacity constraints than different supply targets.

policy rules would call for net imports of 46,000 MT.[9] The total supply of 200,000 MT would exceed the maximum supply target of 168,000 MT (105 percent of trend), so that 32,000 MT would go to the regional storage reserve. This example shows how stocks can be used to stabilize supplies—in this case between the range of 95 and 105 percent of the trend supply levels.

[9] Swaziland historically has imported grain, even in bumper crop years. For 1984, trend- or exogenous-level imports would have been 52,000 tons. Transitory differences in import levels were estimated according to a statistical regression (in levels) of import deviations on production deviations; in this case, the beta coefficient was estimated to be -0.159. The transitory component brings total import levels down to 46,000 tons in 1984 due to the surplus (positive) production deviation. Actual imports used in the historical regression were 32,000 tons in 1984.

The stocking program would require fairly frequent interventions in nearly all countries (table 3). In all cases, after the model's stocking actions are taken, the per capita grain supplies are stabilized and are generally smoother. In several of the smaller producing countries, the interventions would be relatively small in terms of volume. However, for the larger producers (Tanzania, Zimbabwe, South Africa), the volume interventions are much larger. In this base model, assuming a starting stock value of 15 percent (1.575 million tons in 1964), stocks average about 10 percent of the region's trend supply and use and range from about 5 percent to about 22 percent over the time period.

Figure 3
Example of Swaziland's model stocking activity



Source: Authors' calculations based on stocking model and U.S. Dept. of Agriculture, Production, Supply, and Distribution database, 1998.

Table 3—Summary of selected country hypothetical stock changes, base case, 1965-95

Year	Angola	Malawi	Mozambique	South Africa	Tanzania	Zambia	Zimbabwe	Region*
				1,000 metric tons				
1965	0	0	0	0	-189	-36	-20	-259
1966	-28	30	0	-351	428	0	0	78
1967	-59	205	0	923	-59	0	172	1,217
1968	-34	243	0	-342	0	17	-81	-203
1969	-48	52	0	-476	-76	19	171	-357
1970	50	98	0	-568	0	0	0	-443
1971	0	-49	0	0	0	0	264	256
1972	-27	0	6	174	158	0	544	848
1973	-2	54	33	-1,420	60	-27	-171	-1,569
1974	40	-139	22	494	-355	85	136	367
1975	56	0	0	0	0	-116	-15	-85
1976	72	57	0	-241	21	0	-107	-156
1977	145	-109	0	0	-9	9	-247	-200
1978	43	0	0	0	-134	15	-80	-177
1979	0	0	0	0	0	0	0	0
1980	38	-12	0	0	45	-56	0	30
1981	47	-92	0	1,052	0	0	397	1,404
1982	-15	-66	-11	0	-73	141	0	-69
1983	-13	-11	0	-900	-56	0	-346	-1,405
1984	0	0	0	0	0	0	0	0
1985	-56	-58	0	0	0	0	398	293
1986	-90	-81	0	0	0	-66	249	-3
1987	-24	-25	0	-34	0	33	-74	-130
1988	-120	0	0	0	-81	157	102	161
1989	-67	85	0	1,318	492	16	0	1,893
1990	-109	0	0	0	0	-59	417	263
1991	0	233	0	0	0	0	151	401
1992	109	-446	-6	-1,161	0	-387	-488	-2,535
1993	25	637	0	0	0	390	316	1,346
1994	0	-2	0	17	-2	0	7	22
1995	83	161	0	-1,332	333	-190	-497	-1,513

*Includes countries not shown.

Source: Authors' calculations based on stocking model and U.S. Dept. of Agriculture, Production, Supply, and Distribution database, 1998.