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A.I.D. Famine Early Warning System

PRICE DATA in a FAMINE EARLY WARNING SYSTEM

FEWS Working Paper 2.7

by
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September 1992

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I. THE FEWS PROJECT

The Famine Early Warning System (FEWS) Project, in its second phase from 1989 through 1992, directly utilizes data from the various early warning systems (SAP) and market information systems (SIM) in the countries where the Project operates. These countries include Mauritania, Mali, Burkina Faso, Niger and Chad in the Sahel, Sudan, Ethiopia and Kenya in East Africa and, since May 1992, Malawi, Mozambique, Zambia and Zimbabwe in Southern Africa. FEWS established interaction with these groups as part of the Project's mandate to further collaborative links with other international and national actors interested in the use of food security related data to influence decision making.

The FEWS Project was not designed to collect primary data, but rather relies on already available data. A major premise of FEWS has always been that the Project's limited resources, spread over a large number of African countries, should focus on the assemblage, management, analysis, and presentation of data in complement with already existing data collection systems. Management and integration of data from several countries would also allow identification of regional patterns across the countries in which FEWS operates, presently totalling eleven.

FEWS utilizes existing data collection systems at the national, regional and international levels. FEWS supports the idea that these data must be fully exploited for their content prior to designing and implementing new data collection schemes. Thus, FEWS is a consumer of the information systems existing in Africa who, in return, provides added value to these data through database construction, expanded analysis, in-country training, collaboration with host country counterparts, innovative presentation formats and a regional perspective.

II. FEWS INTEREST IN PRICE DATA

Improved understanding of the role of the market in determining food security is the major interest for FEWS in SAP and SIM price data. Food security encompasses information from various disciplines which can be generally classified into three general domains covering food availability, food access and food

utilization.[1] The FEWS mandate to monitor these three aspects of food security necessitates the use of multiple indicators to follow this complex issue. FEWS utilizes a "convergence of evidence" approach across and within these three sectors to assure that reinforcing, and not conflicting, signals are being obtained from different types of food security information.

Initial efforts at monitoring markets for food security information focused on cereal prices because research in the Sahel had demonstrated that the value of cereal purchases was a major item in total market expenditures by households. FEWS uses SIM and SAP cereal price data (both cereal and livestock prices from SAP) to follow the

- impact of fluctuations in annual production on market expectations,
- determine seasonal price behavior for identifying deviations from normal,
- capture changes in the terms of trade for specific socioeconomic groups,
- identify regional patterns of market price behavior, and
- present the market price impact of sequential years of poor production.

Price information is also used in other, non-early warning, contexts such as distinguishing surplus and deficit producing zones, identifying market flow between zones and monitoring the impact of food aid on market prices.

The systematic use of price data as part of regular food security monitoring efforts is a recent addition to FEWS reporting. Standardized presentation products for price data across countries were first employed by the Project in the FEWS "Harvest Assessment of Cereal Production" of January 1991. Price data are presented in graphical formats to help educate the public on price behavior of cereal markets via historical, seasonal and cross-country comparisons.

FEWS price techniques are considered experimental and future refinements are expected. Although price presentation products have proven successful with field analysts, they have had limited impact on groups that promote the more narrow definition of food security that limits monitoring to biophysical indicators of food availability (supply). The FEWS theoretical framework for food security monitoring requires information concerning food access

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[1]. see Downing, Thomas E. "Assessing Socioeconomic Vulnerability to Famine: Frameworks, Concepts and Applications," FEWS Working Paper 2.1, January 1991.
and
May, Charles Alan, "Vulnerability and Food Security in the FEWS Project: Guidelines for Implementation," FEWS Working Paper 2.2, April 1990.

(demand) and food utilization, in addition to food availability.

Analysis and reporting of cereal price information is the first indicator from the demand side of food security used in regular monitoring by the FEWS Project. Present efforts to develop additional price data analysis and presentation products focus on the timely production of materials and improved analytical use of existing data. An additional benefit from these price data efforts has been the creation of a regionally compatible database structure for all FEWS monitored countries.

III. PRICE DATA SOURCES, MANAGEMENT AND TRANSFER

FEWS draws data from a variety of sources that include national, regional and international institutions. The management of these data are accomplished through commercially available software (dBASE, LOTUS, HarvardGraphics, AtlasGraphics, etc.). Specialized software programs have also been developed to meet the specific food security monitoring needs of the Project. Programs have been developed for working with satellite imagery, rainfall, prices, agricultural statistics and population. An often overlooked, but extremely important, function of any information system is the dissemination and transfer of data in a timely fashion for use by decision makers. In 1992, FEWS began using telecommunication links to expedite the transfer of data and messages between and among FEWS offices in both Africa and Washington.

A. DATA SOURCES

FEWS obtains secondary price data, mostly on cereals and livestock, from SIM (OPAM/Mali, OFNACER/Burkina, OPVN/Niger, BSA/Chad), SAP (Mali, Burkina, Chad), government statistical agencies (DNSI/Mali, INSD/Burkina, DSCN/Niger, CSA/Ethiopia) and livestock services (OMBEVI in Mali, MAE/PSA in Burkina). The SAP systems in Mali and Chad are administered by the AEDES group, while the SAP in Burkina is directed by SCF/UK in collaboration with OXFAM/UK. Both SAP systems use the "sentinel site" approach to early warning that requires an *a priori* determination of which regions of a country are most vulnerable to food insecurity.

B. DATA MANAGEMENT

The FEWS Project uses data as reported by each of the data collection systems mentioned above. FEWS obtains data from the SIM systems in electronic format, while those from SAP are generally entered by hand. Once entered into the FEWS produced price management software program (PRIX), these data are examined as both nominal and real prices. Both nominal and real prices

are often smoothed using a three-period moving average before presenting the final product as a time series graph. A three-period moving average removes excessive "noise" in the data, without significantly interfering with the "signal" measured. This is particularly true with monthly data, the period most frequently used by FEWS in reporting prices.

FEWS uses its own database format for storing price data to assure regional compatibility and comparisons. Data received in digital formats from other information systems must often be converted to insure this compatibility. While data are often converted to different formats through tedious manipulation of spreadsheet and database management programs, regularly collected data that are recorded in a structured database format can be converted through computer subroutines. Computer programs have been written to convert data from existing systems to FEWS format. Felix Lee of FEWS/Chad has written programs to electronically convert data from host institutions to FEWS format in Ethiopia, Chad, Niger, and Mali. A conversion routine from SIM to FEWS format for Burkina was written by Kalifa Traoré of OFNACER/SIM, an excellent example of direct SIM to FEWS collaboration.

C. DATA TRANSFER

Although price data are immediately useful to FEWS Field Representatives (FFR) in each country monitored, they are also transferred to Washington for regional integration, monitoring, analysis, presentations, and archiving. The present lag-time between data collection and arrival in Washington varies from two to four weeks, depending upon the country.

Data transfer is achieved through high speed modem communications over commercial phone lines. FEWS contacts its field staff in Africa twice a week using this telecommunications link for sending messages and computer files. With the FEWS Washington office acting as a hub, files can be shared between African countries. FEWS is presently testing a bulletin board system that would allow telecommunications access by other callers with a computer and modem.

A recent example is instructive of how this process works. Data from a market information system in Malawi were transferred to Washington in Lotus spreadsheet files via telecommunication links. The data arrived on Friday, were converted to a DBASE format compatible with FEWS price management and graphing software (PRIX), and sent back to Southern Africa (with PRIX) the following Monday for use by the field. The value added to these data from this process allowed greater access to the data by both national and international users in support of increased analytical and presentation purposes.

IV. SAMPLE ANALYTICAL PRODUCTS

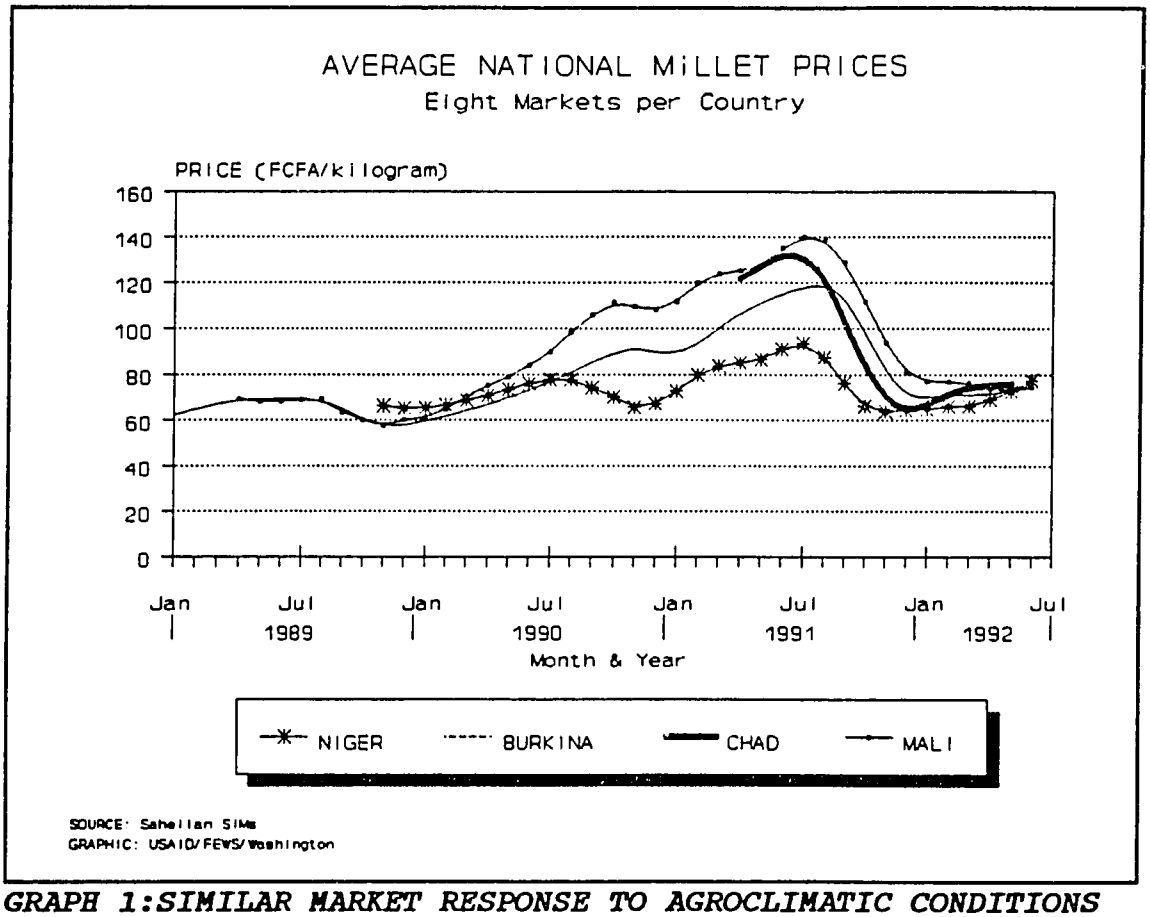
Initial efforts to integrate price data into FEWS Project early warning and monitoring activities focused on retail consumer cereal prices, which is a reflection of research on Sahelian consumption patterns. Evidence suggests that household expenditures on cereals can range from 50 to 75 percent of total market purchases. With cereals such a major component of total household expenditures, price changes can be expected to have serious consequences for household well-being.

The following sections present examples of FEWS presentation products including multiple year (inter-year), seasonal (intra-year), and terms of trade graphs. All examples use real data from either SIM or SAP sources in the Sahel. These examples focus on cereals, combined with livestock prices in the terms of trade graph, thereby reflecting the original focus of FEWS price data efforts. Completion of an integrated regional consumer price series for the FEWS monitored countries during 1992 has allowed FEWS to expand coverage to producer prices, wholesale prices and prices for other commodities, notably livestock, non-cereal foodstuffs, cash crops and labor.

A. GRAPH 1 - SIMILAR MARKET RESPONSE TO AGROCLIMATIC CONDITIONS

Current and historical information from several African countries has led FEWS to hypothesize climatic conditions as the major determinant of cereal price behavior. The interannual graph demonstrates the impact of current (annual climatic variation) and chronic (existing agroclimatic zone) agroclimatic conditions across several Sahelian countries.

The similarity of market response in Mali, Burkina, Niger and Chad over the last few years is striking. The analogous trends across countries is attributed to similar agroclimatic conditions



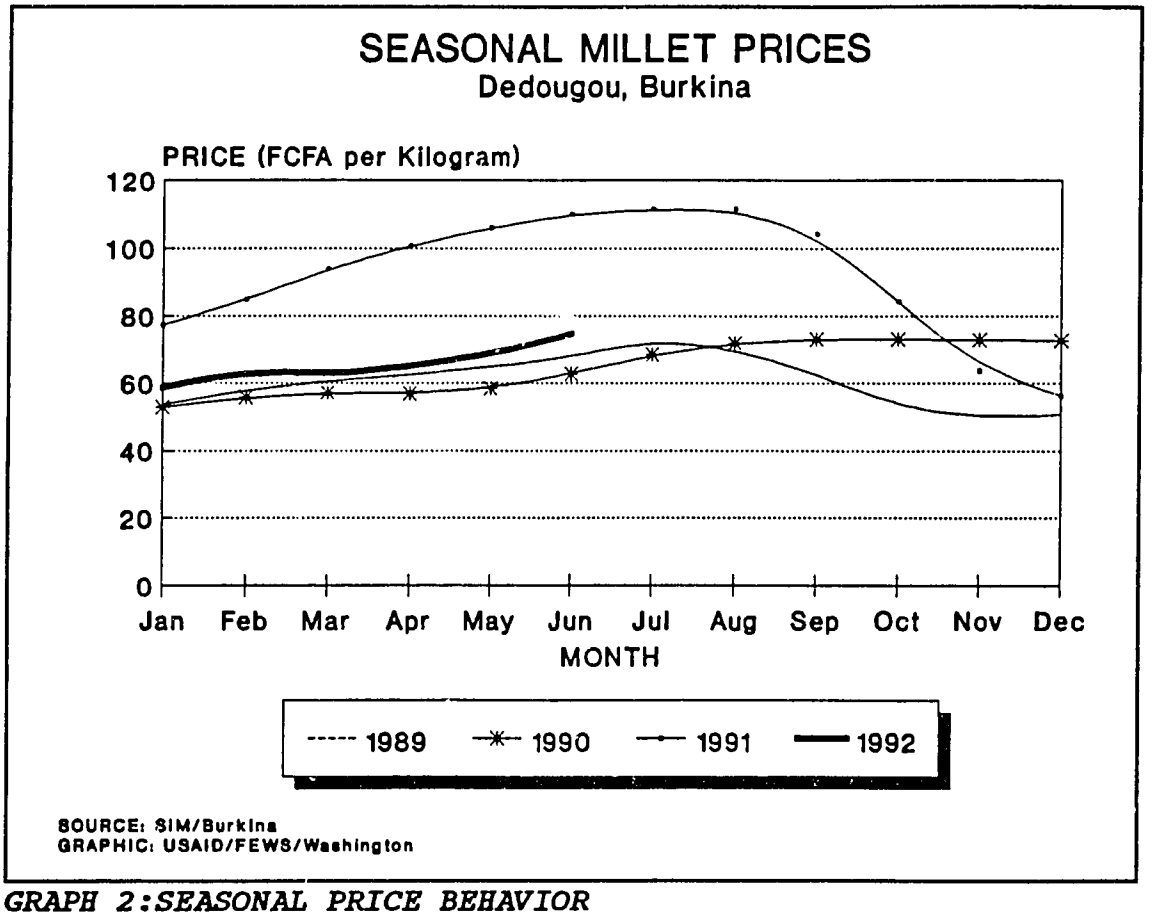
GRAPH 1:SIMILAR MARKET RESPONSE TO AGROCLIMATIC CONDITIONS

across the Sahel and directly impacts market price behavior. Price levels may vary, but the trend and seasonal patterns exhibited across the Sahel are similar throughout the region.

The harvest period decline in late 1990 was less than expected and reflected lack of market confidence in Sahelian production prospects for 1990/91. SIM data from Niger, Burkina and Mali exhibited a slight decline in expectation of the harvest outcome, but quickly resumed their upward price trend. In contrast, the impact of an excellent harvest, as occurred in the Sahel in 1991, is evident in the steep and extended decline in prices from their pre-harvest, seasonal highs of July 1991.

B. GRAPH 2 - SEASONAL PRICE BEHAVIOR

Annual agroclimatic impact on market price behavior can also be demonstrated with the seasonal, or intra-year, graph. The intra-year graph demonstrates the normal seasonal pattern for cereal prices in the Sahel. Prices normally peak during July-August with future direction and trend determined by annual agricultural production prospects. In years of good to excellent agroclimatic conditions, market expectations about the harvest are reflected in declining prices after July. This was the case in Dédougou, and throughout the Sahel, in 1989 and 1991. However, poor agroclimatic years result in increasing prices throughout the harvest period (August-November) as in 1990.



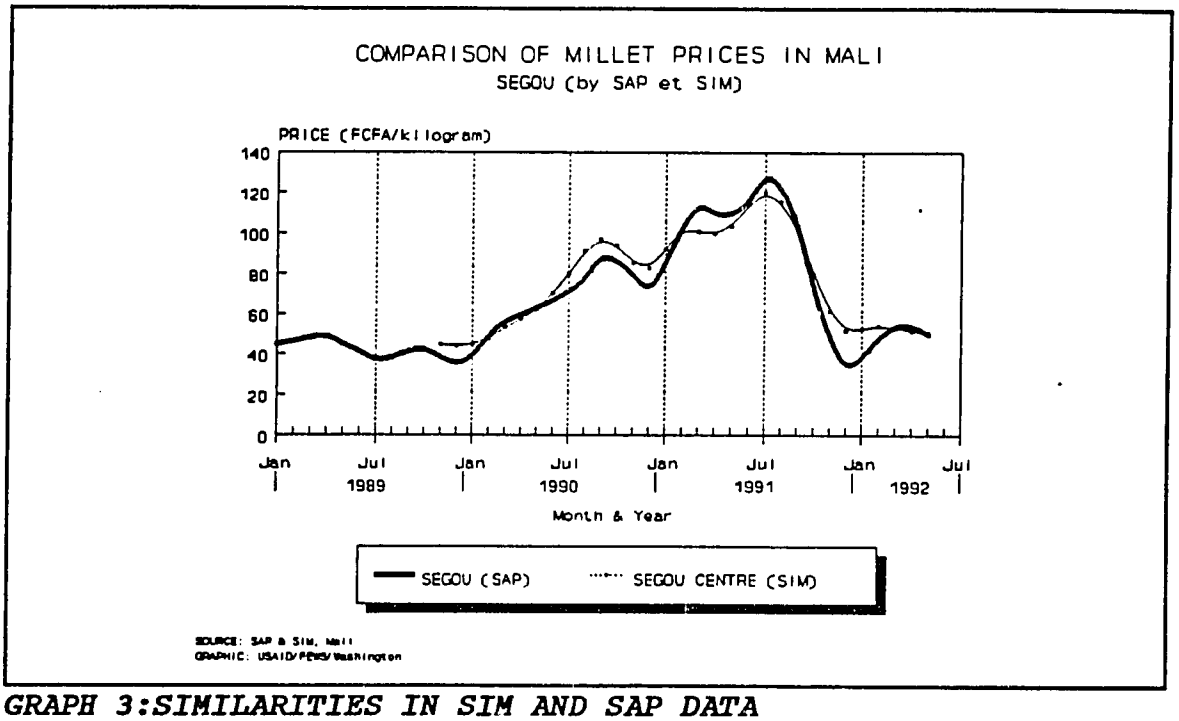
GRAPH 2:SEASONAL PRICE BEHAVIOR

The seasonal graph outlines the use of price information in early warning. When used in combination with prevailing agroclimatic information (rainfall, agricultural production estimates, satellite imagery) the market's expectations of the upcoming harvest will be reflected in the price behavior in the post-June period. This market information can be used to confirm, or refute, information from other sources using the principle of "convergence of evidence." This was the case with Mali price data when FEWS questioned production estimates based upon market response in its January 1991 "Harvest Assessment."

C. GRAPH 3 - SIMILAR LEVEL AND TRENDS IN SIM AND SAP DATA

Price data are frequently used in an early warning context to confirm, or contradict, biophysical data regarding the outcome of the current agricultural season. However, historical price data can also convey the impact of successive years of poor production through an increasing trend in cereal prices over months and years.

An example of price data used to capture the longer-term impact of a chronic decline in agroclimatic conditions is the increase in prices over the January 1990 to July 1991 period in the Sahel



GRAPH 3:SIMILARITIES IN SIM AND SAP DATA

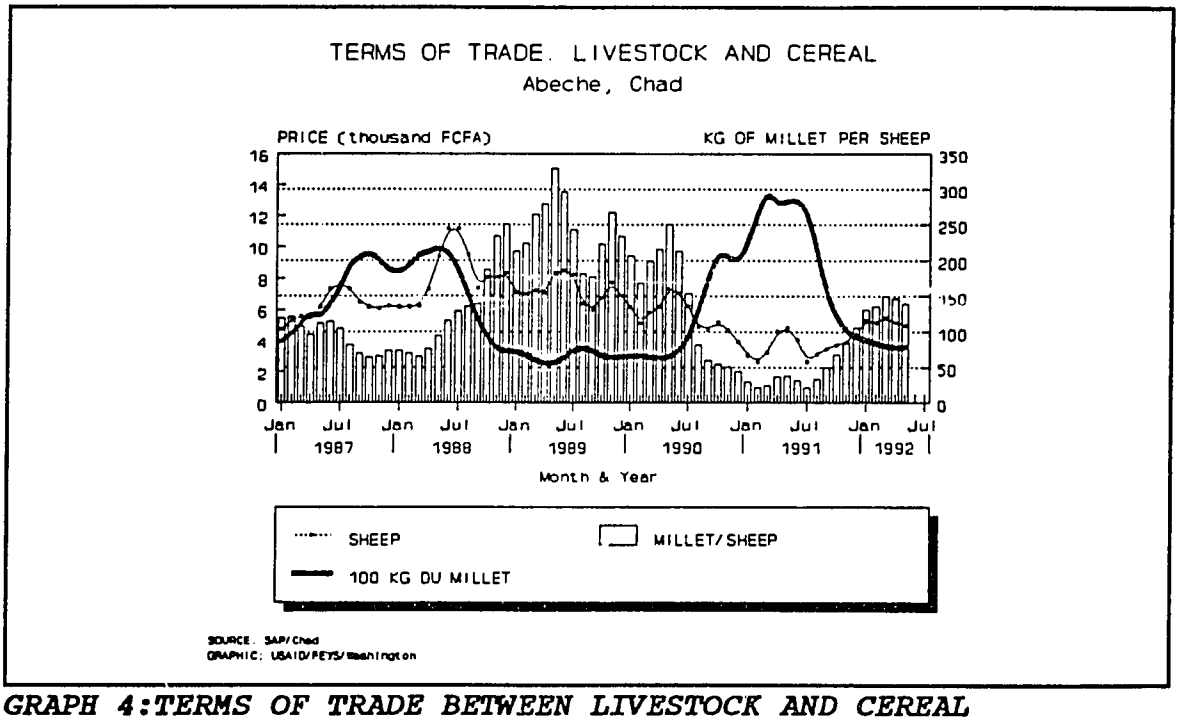
(see present example for Segou). The steadily increasing monthly price trend over this period can impart to decision makers the continuing and regular impact of successive years of poor production in a way that yearly production figures may not.

This example from SIM and SAP data for Mali also demonstrates FEWS experience with data from these two sources. The data are very similar in both level and trend, with deviations between the two most likely attributable to methodological differences. However, the deviations are not dramatic, from an early warning perspective, and FEWS regards both sources as useful for early warning purposes. For example, the small deviations in these data from Ségou could be due to the weekly versus monthly collection period between SIM and SAP, respectively. By reporting on a monthly basis, SAP data are necessarily a reflection of averaging over weekly observations, while SIM data are collected weekly and averaged using a three-period moving average.

D. GRAPH 4 - TERMS OF TRADE BETWEEN CEREAL AND LIVESTOCK

Relative prices are created through comparisons against a reference period price, or through the creation of price ratios between different goods. FEWS frequently uses the ratio of cereal to livestock price, although wage rates (the "price" of labor) are used where available. This ratio is used to monitor the terms of trade, or relative purchasing power, between a hundred kilogram sack of cereal and an animal brought to market (or a month's wage).

Monitoring changes in relative price behavior offers significant insights into the differential impact of food insecurity across groups within society (pastoralists versus wage



GRAPH 4:TERMS OF TRADE BETWEEN LIVESTOCK AND CEREAL

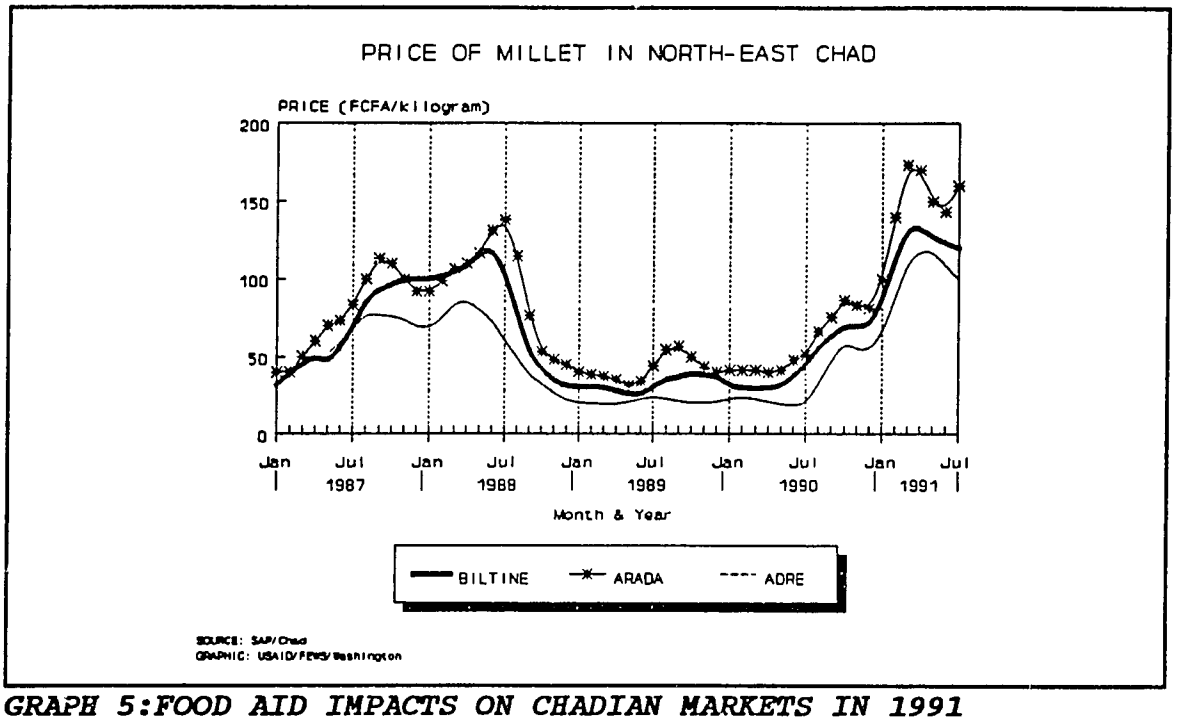
laborers, for example). This information can be used to target intervention strategies to the specific needs of particular groups of people. However, the cost of this additional information is increased data requirements, due to the need for coincident price series in time and space across multiple goods.

SAP data provide coincident price series for cereals (millet) and livestock (goat or sheep) for monitoring changes in pastoralist purchasing power. FEWS presents the price for one hundred kilograms of cereal, the animal price and the price ratio to identify the source of relative price changes. For example, the long-term declining trend in sheep prices (1989 to present) has resulted in significantly lower pastoralist purchasing power. Recent recovery in purchasing power is attributed more to declining cereal prices than a sustained recovery in the market for sheep.

E. GRAPH 5 - FOOD AID IMPACTS ON CHADIAN MARKETS IN 1991

A frequent response to early warning indications of food insecurity is food aid distributions. Food aid distributions can be effective when they are targeted to particular groups in specific areas at-risk of food insecurity. However, food aid is also thought to have negative impacts on cereal markets by depressing prices for locally produced cereals. Others have held that food aid distributions have little or no impact on local cereal markets. Price data provide quantitative insights into this debate over the full impacts of food aid.

In the first half of 1991, after successive years of mediocre agricultural production, people in northeastern Chad were at



GRAPH 5:FOOD AID IMPACTS ON CHADIAN MARKETS IN 1991

increasing risk of food insecurity. Rapidly increasing cereal prices signalled increased food insecurity throughout the region from mid-1990 through early-1991 in towns (Graph 4) and rural areas (Graph 5). Additional qualitative reports from SAP and a field visit to the region in February 1991 confirmed the problem. National food security stocks were released for distribution, to be replenished by donor contributions.

The impact of these limited distributions was a short-term downturn in prices in April through June, followed by resumption of previous price trends and levels. The excellent 1991/92 harvest had a much larger impact on the cereal market than the highly targeted distributions in northeastern Chad. This is fully reflected in the Abéché data (Graph 4) where the food aid driven decline in prices (April-May 1991) is very small compared to the impact of the subsequent national harvest.

V. REFLECTIONS AND CLOSING REMARKS

Both SAP and SIM require fast turnaround time on their data because early warning practitioners and market participants need information on a timely basis in order to make decisions. Delays in collection, analysis and reporting price information limit most of the systems in the Sahel to a one-month lag in reporting data. The most useful addition to existing price information systems (both SIM and SAP) would be improving the timely availability of price data. Nonetheless, any changes must be compatible with existing efforts to assure a continual time series of price data for the major commodities in each of the countries covered by SAP and SIM.

SAP and SIM have specific limitations that arise from their initial designs. From its inception, the SAP data have been spatially delimited in market coverage to certain portions of a country. The SIM systems have taken a more national perspective, as opposed to the "sentinel site" approach favored by SAP. Of course, financial and mandate limitations have also limited the spatial scope of Sahelian SAPs, but a theoretical perspective on the causes of food insecurity influences the choice of a delimited geographic area for monitoring.

A. FREQUENCY OF DATA COLLECTION

A clear distinction can be drawn between SAP and SIM price data information systems in the frequency of data collection and reporting. SAP reports monthly prices, while SIMs generally report weekly data. Of course, the weekly SIM data may be aggregated to the monthly level.

The exception to weekly SIM reporting is Niger where OPVN/SIM reports biweekly data (i.e., every other week). This different data collection period raises certain problems. Some of these concerns are the additional complications in making cross-country comparisons, limitations for SIM/Niger in having 26 observations per year compared to 52 in neighboring SIMs, delays in reporting data because two weeks pass before data are obtained and risks of missing particular "calendar" events (e.g., Tabaski, Ramadan, etc.) or other short-term market phenomena. These concerns are also relevant in the case of the monthly data reported by SAPs in the Sahel.

SAP and SIM are presently reporting information with about the same length of delay between collection and dissemination. Both systems report information with about a one month delay, although there are more timely examples in certain SIM systems (e.g., Burkina). SAP systems, with their emphasis on monthly prices, cannot presently report more timely information.

The two systems also differ in the length of their historical time series of price data. The SAP data presently offer a longer historical series for comparison purposes with data generally beginning in 1987. SIM systems generally began in 1989, although

some began earlier (Mali & Niger) and some later (Chad in April 1991).

As early warning systems, SAPs should consider reporting weekly data. A month or more wait for price reports could retard any advance information provided by the market. Other structural problems limiting the timeliness of price data to a one-month delay can also be overcome. A reduced lag time in reporting in all price information systems could be achieved by improved communications systems, increased training and sensitization on the part of information system staff on the necessity of timely reporting, and changing the SAP system collection to weekly reporting rather than monthly.

B. INCREASED SPATIAL COVERAGE

In "sentinel site" systems the *a priori* designation of which regions are most at-risk can bias the view of what causes food insecurity, who is affected and where it occurs. If food insecurity is viewed as simply a result of a risky climatic environment, then the focus of a "sentinel site" approach would delimit the areas covered to those areas with highest climatic variability. However, research from the Sahel in the late 1980's points to problems with narrowly defining food security in only a climatic sense.[2] The evolving famine in Somalia today indicates that in addition to drought, social and economic events can seriously disrupt food supplies and greatly influence access to food.

SAP systems should consider wider spatial coverage rather than the *a priori* determined geographical regions considered to be at high risk of food insecurity based on agroclimatic criteria. Regions and populations experiencing food insecurity, outside of areas considered agroclimatic risks, can be missed in the SAP system. The problems in southern Chad in 1992, an area not covered by SAP/Chad, are a good example.

There is some overlap in market coverage in the SAP and SIM systems with both groups monitoring the same market. Duplication in market coverage has allowed comparison of the two systems (see Graph 3). This overlap is useful in identifying outlier data points and points to the inherent reliability in the two systems. Data for the same market, commodity and time period from different institutions have proven useful in identifying suspect

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[2]. See Reardon, Thomas, Peter Matlon and Christopher Delgado "Coping with Household-level Food Insecurity in Drought-affected Areas of Burkina Faso," World Development, Vol. 16, No. 9, 1988: pages 1065-1074.
and
Staatz, John M., Victoire C. D'Agostino and Shelly Sundberg "Measuring Food Security in Africa: Conceptual, Empirical and Policy Issues," Journal of the American Agricultural Economics, Vol. 72, 1990: pages 1311-1317.

data points in Ethiopia and Mali. In both instances the problem was found to be data entry, rather than reporting. This result points to the need for error checking routines in any software designed for information system environments.

C. INCREASED COMMODITY COVERAGE

A major difference between SAP and SIM data collection efforts is the degree of specificity, or disaggregation, in their commodity determinations. The degree of data specificity required by an information system is a function of the intended use of the data and influences expenditure of money and effort on data collection. If data collected are intended to address standard information needs, then the level of data disaggregation required is straightforward. However, if data are intended to address more specific questions (e.g., margins, commodity substitution in consumption, price policy impacts on production, etc.), then more detailed data are required. For example, "sheep" is fine for SAP, but a livestock market information system would require greater specificity to account for differences in the sex, age, variety, condition or intended use of the animal. Similar specificity holds for the cereal sector where prices can differ for producers, consumers, exporters and handlers.

The distinction between SAP and SIM commodity coverage is one of specificity in commodity coverage (SIM) versus extent of commodity coverage (SAP). Commodity specificity was not originally considered relevant for early warning systems incorporating price information. However, expanding historical price datasets are increasingly used for sophisticated analysis, policy prescriptions and targeting issues that require more specific information. Limited resources and the differential impact of food insecurity within societies prompted SAP systems to originally emphasize broad commodity coverage over in-depth coverage.

Broader commodity coverage (e.g., cereals and livestock) has allowed the analysis of changes in relative prices. Terms of trade analysis to measure purchasing power of particular socioeconomic groups requires coincident price series that are available in the SAP data. Unfortunately, cross-country comparisons between SAP systems are not directly comparable because SAP/Mali uses goats as the monitored livestock, while SAP/Chad uses sheep.

SIM systems have limited their commodity coverage to cereals, with the exception being the SIM in Chad. This focus on cereal commodities limits the long-term usefulness of SIM data in monitoring other sectors of the national and regional economies through market behavior. Without information on prices of other goods and services, relative price changes can not be monitored using SIM data. Real price analysis with SIM data requires price and/or income information from other sources.

The need for expanded commodity coverage to monitor other components of the national economy had a significant impact on the institutional placement of the SIM in Chad. The SIM in Chad was placed in the *Bureau de la Statistique Agricole* (BSA), rather than the *Office Nationale des Céréales* (ONC). All other SIMs in the Sahel are institutionally located within former grain marketing parastatals, which accounts for their focus on cereal price monitoring. The SIM in Chad is unique in its wider commodity mandate, partly reflecting the later start of SIM/Chad (April 1991) than other Sahelian SIMs. The Chadian National SIM Seminar (February 1991) benefitted from insights that arose from the Bamako Seminar (May 1990) regarding commodity coverage.[3]

As both SAP and SIM systems evolve there will be increasing demands on them for more information. This increased demand for price data and analysis will require expanded compatible information across space, time and commodities. Neither SAP nor SIM alone are presently configured to meet the increased informational demand relevant to the multiple goals of early warning, food security monitoring, identification of vulnerable groups, targeting of intervention strategies, development planning and policy.

As in the case of livestock prices and SAP data collection, changes in relative prices can provide information on changing access to food for different socioeconomic groups. This increases the amount of work required, but the return is greater specificity of the impact of price changes on food insecurity. In order to determine household market access to foodstuffs (assuming availability), information is required on the productive activities that household use and what goods and services they trade against cereals. Throughout the Sahel, livestock are traded by pastoralists against cereals. Similarly, fisherman trade their catch against cereals, while wage laborers trade their work against market purchases of cereals. Monitoring access to food for these groups would require price information on livestock, fish and wages.

Monitoring purchasing power requires relative price analysis as opposed to nominal price analysis. It is likely that increasing cereal prices result in realignments of household budgetary expenditures and decreased demand for other items within the family consumption bundle. Information from expenditure surveys in both rural and urban sectors would facilitate identification of the commodities that make up the bulk of normal household purchasing patterns. These items should then be included in any price information system charged with addressing the multiple goals listed above.

The acknowledged limitations of temporal, spatial and commodity coverage within existing food security monitoring systems and the

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[3]. See Charles Alan May, "Market Information System (SIM) in Chad: Issues and Proposals," FEWS Working Paper 2.4, May 1991.

increased demands on them for information bring into question the future direction of these systems. For example, if expansion of temporal, spatial and commodity coverage is accepted as part of the SIM/SAP mandate, then the question arises whether or not these institutions should cover these other commodities and markets, or is it more within the realm of the national statistical offices (INSD, DNSI, CSA, etc.).

The question is whether SAP and SIM should continue their present independent directions, establish formal data sharing arrangements, contemplate merger of the two systems, or collaborate in a multidisciplinary group charged with integrating data from multiple sources within each country and the region. If these alternatives are not openly addressed, the increasing demands on these systems will likely result in expanded overlapping mandates and institutional conflict.

D. CLOSING

There are several food security information systems in Africa, in general, and the Sahel, specifically. A single, complete food security information system has been elusive, partly due to the problems posed in multidisciplinary monitoring of large, diverse areas and populations. FEWS experience indicates that no one group can address the entire problem and that coordination efforts between the various information systems is essential and beneficial for all parties concerned, if duplication of effort is avoided.

Standardized monitoring of price data has become a regular part of FEWS trimestral reports since January 1991, roughly six months after the initiative of the Bamako SIM conference sponsored by CILSS, Club du Sahel and COMAC. The early warning and food security monitoring community has greatly benefitted from the open sharing of information between national, regional and international groups fostered at the Bamako Conference. FEWS efforts are dependent upon existing primary data collection institutions and a collaborative atmosphere generates benefits for all concerned.

A final challenge for the early warning and food security community remains the formal establishment of open and shared information, insights, analysis, techniques and experience. The COMAC group has made great strides in this direction and is to be commended for and supported in their work. At present, there are no technical constraints to establishing a system of shared information given increased worldwide use of electronic telecommunications via computers, phone lines and modems. The practical concerns of information sharing across the Sahel remain questions of finance and policy.