FEWS NET
FAMINE EARLY WARNING SYSTEMS NETWORK

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DEVELOPING PRICE PROJECTIONS FOR FOOD SECURITY EARLY WARNING

Guidance document number 3

FEWS NET Guidance Document Series

Scenario Development	Rainfall	Price Projections	Malnutrition & Mortality	Humanitarian Assistance	Herd Dynamics
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FEWS NET Guidance Document Series

The Famine Early Warning Systems Network (FEWS NET) developed this series to provide guidance on scenario development – the core methodology used by FEWS NET to make food security projections – and the integration of advanced sectoral concepts and techniques into the scenario development process. Other guidance documents in the series include *Scenario Development for Food Security Early Warning*, *Building Rainfall Assumptions for Scenario Development*, *Integrating Acute Malnutrition and Mortality into Scenario Development*, *Integrating Humanitarian Assistance into Scenario Development*, and *Integrating Livestock Herd Dynamics into Scenario Development*.

About FEWS NET

Created in response to the 1984 famines in East and West Africa, FEWS NET provides early warning and integrated, forward-looking analysis of the many factors that contribute to food insecurity. FEWS NET aims to inform decision makers and contribute to their emergency response planning; support partners in conducting early warning analysis and forecasting; and provide technical assistance to partner-led initiatives.

To learn more about the FEWS NET project, please visit www.fews.net.

Acknowledgments and Disclaimer

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Acronyms and Abbreviations

CHIRPS	Climate Hazards Group InfraRed Precipitation with Station
FBS	Food balance sheet
FAO	Food and Agriculture Organization of the United Nations
FEWS NET	Famine Early Warning Systems Network
FSNAU	Food Security and Nutrition Analysis Unit – Somalia
HEA	Household Economy Analysis
IDP	Internally displaced person
IPC	Integrated Food Security Phase Classification
kg	Kilogram
MT	Metric ton
NGO	Nongovernmental organization
SCP	Structure Conduct Performance
SOS	Somali Shilling
SST	Scenario Summary Table
ToT	Terms of trade
USAID	United States Agency for International Development
USGS	Unites States Geological Survey
WFP	World Food Programme

Introduction

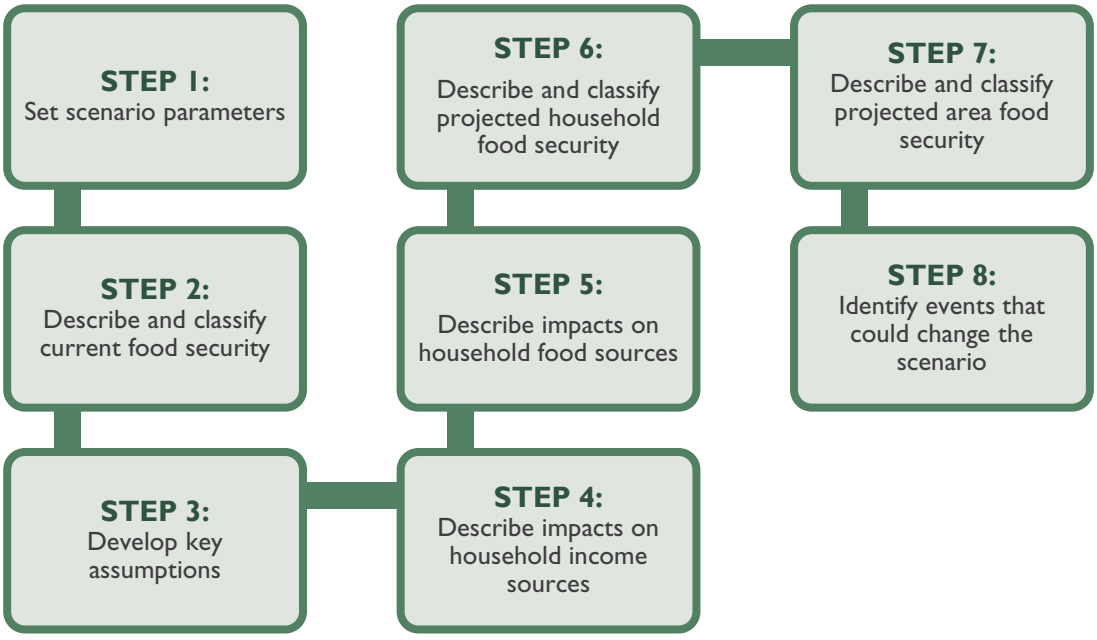
This document is part of a series of guidance documents developed by FEWS NET on integrating advanced sectoral concepts and techniques into scenario development. Scenario development is an important methodology underpinning FEWS NET's food security analysis and projections about the evolution of food security in a particular area. The eight-step process (outlined below) involves the development of specific assumptions about key factors or shocks (anomalies), analysis of how these factors will impact food and income sources of the populations of concern, and consideration of likely responses by various actors. FEWS NET analysts combine these assumptions with a strong understanding of current conditions to estimate future food security outcomes and designate the level of food insecurity using the Integrated Food Security Phase Classification (IPC) scale, the global standard for classifying food security. FEWS NET uses scenario development to prepare its Food Security Outlook reports, which provide decision makers with early warning and projections of food security outcomes eight months ahead. Analysts use the Scenario Summary Table (SST) presented in Annex I to conduct the scenario development process.

Assumptions – about factors such as rainfall, price behavior, conflict, income opportunities, and harvest prospects, among many others – are at the core of the scenario development process. The strength of a scenario depends upon the development of evidence-based and well-informed assumptions about the future. FEWS NET created this series of guidance documents on the most critical assumptions to help food security analysts develop robust scenarios.

In developing assumptions, FEWS NET analysts rely on FEWS NET's knowledge base of historical and contextual information and data related to the main sectors that typically influence food security: rainfall, markets and trade, nutrition, and livelihoods. Analysis also includes a range of other political, social, and economic information relevant to a particular situation or area. FEWS NET's analysis is *livelihoods-based*: all steps of scenario development are grounded in an understanding of how households in an area access food, earn income, and cope with shocks.

Markets often play a key role in food security outcomes, as they make important contributions to food and income sources across the developing world. The availability and prices of inputs, cash crops, staple foods, and livestock are therefore central to our understanding of the first and second pillars of food security: food availability and access. At FEWS NET, market and price analysis is carried out to inform food security early warning analysis using the scenario development approach.

FEWS NET's Steps to Scenario Development



This guidance describes how to develop assumptions about future price trends (price projections) using an integrated approach that incorporates verifiable and credible information about factors that influence prices with expert judgment. Rather than focusing solely on a single indicator or the output from a single mathematical model, analysts will understand how to incorporate contextual information (often qualitative) about the determinants of prices (market fundamentals) into their projections. In doing so, the analyst will study key factors that affect supply and demand patterns, along with macro-level factors such as global supply issues and institutional policies and frameworks. While this document provides guidance specific to price projections for staple food commodities (the most common price assumptions developed at FEWS NET), analysts can apply this same process to other important market prices, including cash crops, livestock, fuel, and even labor wages and exchange rates.

By using this guidance, readers should be able to do the following:

- Know which tools and staff resources are available to help FEWS NET analysts develop substantive and clear price projections to support wider food security projections in a region, country, community, or locality (e.g., Livelihoods Products, *Market Fundamentals Reports*, price, production, and trade databases, commodity balance sheets);
- Use qualitative and quantitative data to analyze key events and situational dynamics that impact food availability, food flows, local access, trader behavior, and market system performance;
- Identify the relative likely impact of local, national, regional, and global supply and price shocks on local staple commodity prices and likely patterns;
- Contextualize current price observations and anticipated trends against historical time-series price data; and
- Develop strong and evidence-based price projections based on an understanding of the fundamental determinants of prices (supply- and demand-side factors), any anticipated anomalies, and technical analysis of historical price trends.

Notes on use of this guidance

For a list of key terms used in this guide, see Annex II. This guide assumes a solid understanding of market systems, price analysis, and market monitoring processes used by FEWS NET. Analysts may also refer to Markets and Trade guidance documents, and other reference materials such as *Market Fundamentals Reports* and country-specific reporting.

For practical applications of this guidance, analysts are strongly encouraged to utilize the "Price Projections Toolkit," which consists of the Guidance Note Summary (Annex III), the Integrated Price Projections Worksheet (Annex IV), and the Technical Price Projections Excel workbook (available to FEWS NET analysts; see Annex V and Annex VI for additional information).

TIP

If the price projection guidance is used for purposes outside the typical scope of FEWS NET livelihood-based food security analysis and early warning, the analyst should follow the same steps but will likely need to incorporate other contextual information to orient the selection of reference markets and specific commodities for analysis.

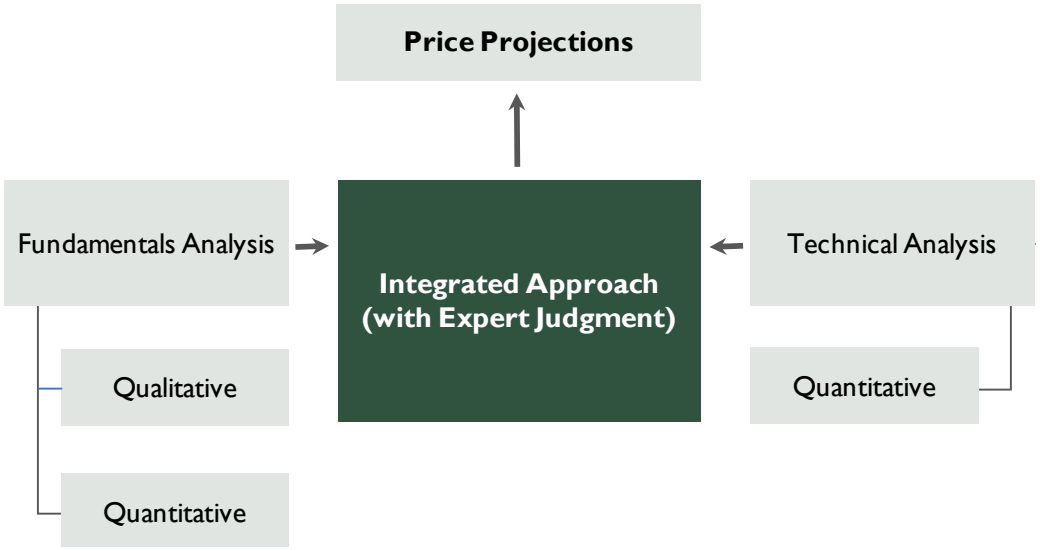
Core Concepts for Developing Integrated Price Projections

This guidance emphasizes price as a key assumption and indicator in scenario development. This is because prices provide an indication of food access and are often the only easily and regularly observable output of a much broader economic system that is vulnerable to various economic, political, and social factors. Price is the cost or value of a good or service expressed in monetary terms. The prevailing price at a given level or stage of the market (e.g., farm gate, wholesale, retail) represents the negotiated equilibrium point reached between buyers and sellers at that stage of the market. Price signals can carry information about the cost of production, transportation, storage, perceptions, desires, and distortions. For food security and early warning, prices perform specific and important functions for analysts. Additionally, prices:

- Express the value of commodities as determined by both producers and consumers;
- Relate information about the level of supply in a market (relative to demand);
- Provide evidence about how people involved in trading commodities perceive future supply and demand; and
- Act as an incentive or a disincentive to trade (especially relative prices) and to production.

Prices synthesize a variety of unobservable data present in the marketing system. The modeling and analysis of historical price data alone to formulate price projections therefore omits much of the rich contextual information about the intrinsic factors that shape them. Furthermore, such an approach does not take into account anticipated anomalous events that may affect market and price trends in the future. Examples include an anticipated poor harvest during the projection period, or a drastic change in the macroeconomy. Moreover, in many of the country contexts where FEWS NET is actively engaged in food security analysis, prices (and price projections) are frequently influenced by the general structure and conduct of the marketing system, including government policies and programs. The development of price projections therefore requires an integrated analytical approach that incorporates both an understanding of the determinants of prices (fundamentals analysis) and a close examination of price data trends (technical analysis), enriched with expert judgment and assessment (Figure 1).

Figure 1. Price Projections using an Integrated Approach



Source: *Perakis, Ibrahim, and Awuor (2013).*

Fundamentals analysis involves a thorough review of the determinants of prices, considering both qualitative and quantitative data and should include, but is not limited to, supply and demand factors, marketing and transaction costs, and macroeconomic issues (see below). For example, understanding the determinants of imported rice or maize meal is likely to include a review of ongoing price and marketing programs and policies. Conversely, the exchange of locally or regionally produced staple foods typically responds to the seasonal forces of supply and

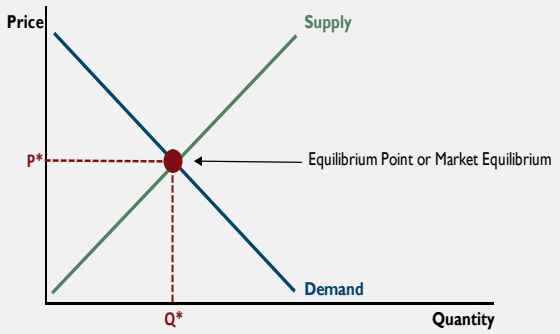
demand and, consequently, should be reflected in the current and projected price for the commodity. The fundamentals analysis evaluates all of these dynamics, which are part of the underlying price discovery process (see below).

Price Determination versus Price Discovery

Price determination is the result of the interaction of supply and demand. This process occurs naturally when particular market conditions are in place and refers to naturally occurring exchanges between market actors. Factors at play likely include: complete markets (no market failures), perfect information; no transaction costs, many buyers, and sellers; no market power, profit maximizing/cost minimizing behavior, and instantaneous interactions. The result is typically a price equilibrium (see Figure 2).

Price discovery may result as a response to imperfect market conditions that influence the interaction between buyers and sellers, and the negotiation of prices based on an individual estimation of supply and demand. This process may occur over spot market negotiations, public auctions, formula pricing, interlinked contracts, or administered prices. Prices may also be discovered through institutional policies (price setting or controls).

Figure 2. Equilibrium Price



Source: *Staatz (2007).*

Source: *Ward and Shroeder (2002); Staatz (2007); Dembélé, Staatz, and Adjao (2008).*

Technical analysis, on the other hand, is more quantitative in nature, and includes a more rigorous assessment of historical price trends when possible. Although analysts should emphasize both fundamentals and technical analysis, reliable and complete historical price data may not exist in all settings where FEWS NET operates. In such cases, analysts should rely on the analysis of fundamental drivers of prices and individual expert judgment. Expert judgment is not just limited to that of the analyst, but should also be solicited from other key actors, such as traders, local and regional experts, technical partners, and colleagues, as appropriate and warranted (see the definitions below).

Fundamentals versus Technical Analysis

Fundamentals analysis considers the multiple contributing factors, often external, that impact food prices, and includes both quantitative and qualitative data. Fundamentals analysis is essentially a thorough review of the determinants of prices and should include, but is not limited to, supply and demand factors, marketing and transaction costs, as well as sociopolitical and macroeconomic issues.

Technical analysis is a quantitative assessment of historical price trends and mathematical modeling of future prices.

Source: *Ferris (2005); Kantrovich (2013).*

In the development of assumptions about projected price trends, the distinction between price projections, predictions, and forecasting is important. Though these terms can be used interchangeably, for the purpose of this guidance and the larger FEWS NET scenario development process, a forecast or prediction describes "what will happen," whereas a projection is designed to tell us "what will likely happen if." Developing projections therefore requires both analysts' technical understanding of a wide range of topics ranging from markets to agroclimatology, nutrition, and household-level behavior, but also their expert judgment to be able to identify a reasonable "if-then" statement in a given setting.

Price Projection versus Prediction

FEWS NET analysts are accustomed to the adoption of projections, which provide a strong indication of the most likely outcome based on the most likely supportive or disruptive factors expected during the selected time period. Analysts develop thorough statements constructed in an "if x, then y" format, which also allows for adjustments and corrected margins of error or mis-estimations that are revealed as the time period plays out. Analysts should not attempt to predict the future or forecast outcomes, as these approaches negate the importance of the "most likely" events that ultimately shape price projections.

Through this process, analysts must be able to answer basic foundational questions to assure that fundamentals and technical analysis is comprehensive and applicable. These essential questions guide the remainder of this guidance document.

Key questions to answer when developing integrated price projection:

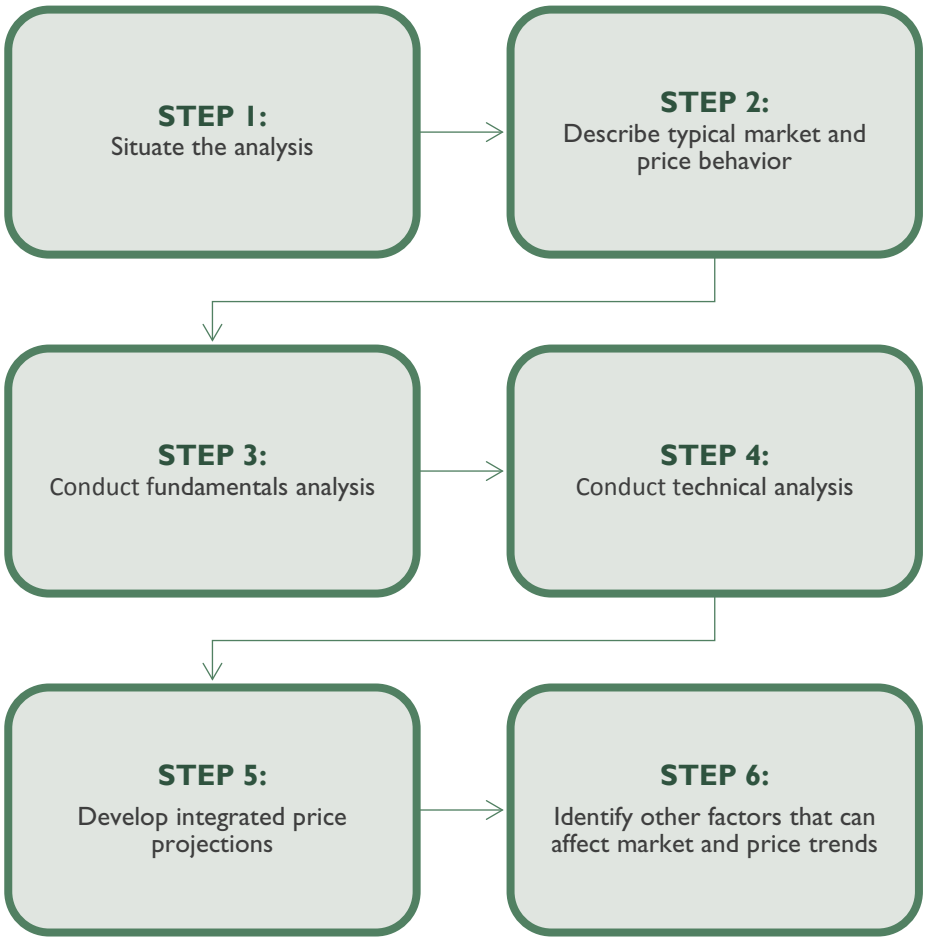
- What normally takes place in the marketing system now and over the price projection period (market context)?
- What is currently taking place and why (market monitoring)?
- How are key market drivers expected to evolve over the price projection period and beyond (key assumptions)?
- What are the implications for projected market supply, demand, and resulting prices (key assumptions)?
- What key events could change our projections?

Overview of Steps for Developing Integrated Price Projections

Within the overarching scenario development process, this guidance mostly supports Step 3 (see the Steps to Scenario Development in the Introduction and the Scenario Summary Table template in Annex I), in which analysts formulate the key assumptions underlying the scenario. The guidance should be used in combination with other food security monitoring to assess the potential impacts of projected changes in staple commodity prices on household food access. Through the development of market and price assumptions, analysts often also identify key events that could possibly change the food security scenario, thereby supporting Step 8 of scenario development.

There are six basic steps to developing integrated price projections (Figure 3). These steps are outlined below and summarized in Annex III, which analysts can use as a standalone reference. Both fundamentals analysis and technical analysis are core components of the six basic steps for developing price projections for food security early warning at FEWS NET. Analyzing historical price trends alone (technical analysis), without broader contextual information (fundamentals analysis), will likely yield unreliable price projections and is therefore strongly discouraged. Similarly, a lack of complete or reliable historical price data makes it difficult to conduct technical price analysis, thereby reducing the reliability of price projections. Technical price analysis should be supplemented by a comprehensive incorporation of expert judgment from relevant industry actors and/or local experts across related sectors (agriculture, marketing, climatology, pastoralism, cereal production, etc.). Each component of the six-step process to developing price projections using an integrated approach is summarized below and described in detail in subsequent sections.

Figure 3. Steps to FEWS NET Integrated Price Projections



Step 1: Situate the Analysis in Time and Space

- Identify the geographic area of the analysis and the projection period.
- Select commodities for the analysis based on their relative importance to local livelihoods, and indicate whether the area is deficit or surplus in the commodities in question.
- Select representative markets based on relative importance to the relevant marketing system.
- Use Livelihoods and Markets and Trade products and tools to help situate the analysis.
- Select price type (producer, retail, wholesale, export) based on the focus of the analysis and the strategic position of the identified representative markets in the marketing system.
- Consider key characteristics of the representative market(s) or market system, and identify external or intrinsic factors that may influence these markets.
- Inspect price data and address data gaps and reliability concerns, as possible.

➢ Suggested resources and tools: Livelihoods products (maps, descriptions, profiles, baselines), commodity flow maps, *Market Fundamentals Reports*, agricultural production data (national and subnational), historical price data, and other secondary market data and information.

Step 2: Describe Typical Market and Price Behavior (Current and for Projection Period)

- Develop an understanding of market behavior and drivers and obtain reliable and relevant data and information regarding: typical market and price trends at the time of the analysis (inclusive of the projection period); expected determining factors for supply and demand; and other influences that shape food prices on a cyclical or seasonal basis. Data can be qualitative and qualitative in nature.
- At this point it may be useful for the analyst to:
  - Identify any key substitutes or complements.
  - In deficit areas, describe the market behavior in key source markets and price transmission patterns.
  - In surplus areas, outline and describe dynamics in key destination markets.
- Analyze historical price trends for selected commodities as relevant to the focus country, region, or locality.

➢ Suggested resources and tools: Seasonal calendars, historical price data, historical production data, commodity balances, trade data (formal and informal), *Market Fundamentals Reports*, and other secondary data and reports.

Step 3: Conduct Fundamentals Analysis

- Describe market and price trends, using the findings from Step 2 to clearly identify any current or projected anomalies in the marketing system and their root causes. Develop assumptions about anticipated price drivers and their implications over the projection period.
- **STEP 3A: Describe current market conditions**
  - Describe current market and price trends.
  - Identify the nature and timing of observed anomalies relevant to the selected market system, as they relate to the normal drivers in the marketing system.
  - Define root causes of anomalies, and if they are time-bound, singular, continuous, and/or predictable.
  - Identify relevant reference years to compare and contextualize market conditions, including anomalies and their determinants.
- **STEP 3B: Develop assumptions about market conditions over the projection period**
  - Explain any root causes of expected anomalies, and whether they are time-bound, singular, continuous, and/or predictable.
  - Highlight the timing and nature of any expected anomalies relevant to the selected market system and projection period.
  - Conclude with clear assumptions about market conditions in the projection period based on descriptions of the expected impact or influence of the projected anomalies. These assumptions should include qualitative statements about likely price impacts of any projected anomalies.

➢ Suggested resources and tools: Price Bulletin, Price Watch, field assessment findings and reports (FEWS NET and partners), and inputs from key informants.

Step 4: Conduct Technical Analysis (Annexes V and VI)

- Building on Step 2, demonstrate how prices normally behave during the period of analysis, and how they will likely behave given current price levels.
- Use a mathematical model to develop a simple technical price projection if more than 24 months of price data are available.
- Where available, consult with relevant research institutions (local, regional, or international) that develop short- and long-term price forecasts using more robust statistical tools.
- Introduce a margin of error (based on historical price variations) to illustrate price uncertainty over the projection period.
- Conclude with nominal projected prices based only on the mathematical model(s) used for each month of the projection period. It is also useful to present the technical projections graphically, including how they relate to historical price levels.

➢ Suggested resources and tools:
  - Relevant historical price databases, and existing Excel spreadsheets with prepopulated formulas. The results should be presented in tabular format to clearly show the distinction between the technical projections and historical price levels.
  - Technical price analysis should be presented both in tables and graphically. When the data allow, analysts are expected to develop technical projections based on the basic multiplicative model or smoothing regression methods. This analysis can be completed in Excel.

Step 5: Develop Integrated Price Projections

- Use a "convergence of evidence" from the fundamentals analysis (including the concluding statements from Step 3B) and technical analysis (Step 4), and expert judgment of FEWS NET analysts to identify the most likely price path, as well as an upper and lower bound that convey the analyst's perception of the level of uncertainty in the marketing system.
- Augment and refine this information with expert judgment from FEWS NET analysts, technical partners, and the private sector (such as traders).
- Convey uncertainty through upper and lower bounds that are established through an analysis of historical price variation, expert judgement, and the analyst's understanding of the market context.
- Conclude with the analyst's final, most likely price assumption for the projection period. Unless otherwise specified, nominal projected prices should be presented for each month of the projection period in tabular form.
- Incorporate this assumption, along with any other contextual information, into the Scenario Summary Table, under Step 3 (see FEWS NET's Steps to Scenario Development in the Introduction and Annex I).

➢ Suggested resources and tools: Relevant historical data, technical analysis, and integrated projections should be presented both graphically (showing how prices over the projection period compare to selected reference periods (including livelihood baseline year) as relevant, and in tabular formats that clearly demonstrate how price levels (including the percentage difference) compare to selected reference periods.

Step 6: Identify Other Factors That Can Affect Market and Price Trends

- Review analogous historical examples, and describe the factors that are similar and divergent, to further contextualize and strengthen the applicability of the price projection. Consider other locally relevant/applicable issues that may not be regularly reflected in annual price trends, but that the analyst is aware of in the marketing system.
- Include relevant geopolitical events, trade concerns, policy or border management, conflict, local/regional or national stock levels, pests and crop disease, and other issues that may not be regularly reflected in annual price trends but could influence future prices.
- The other factors that could affect market and price trends in Step 6 can be among the factors considered in Step 8 of scenario development (see FEWS NET's Steps to Scenario Development in the Introduction and Annex I).

Framing the Guidelines – Somalia 2017 Food Crisis Example

To better illustrate the concepts and recommendations explained in these guidelines, each step will refer to a specific and real-time country example as presented in the light-yellow text boxes. The primary example used throughout the guidelines relates to market analysis elaborated to inform the integrated food security analysis in Somalia conducted by FEWS NET during early 2017. It is worthwhile noting that this example builds on a large body of historical analysis and benefits from extensive data availability through FEWS NET, the Food Security and Nutrition Analysis Unit – Somalia (FSNAU), and other partners. Such a rich evidence base (including historical and monitoring data) is not always present in the countries FEWS NET monitors. Analysts therefore often need to rely on short series of historical data and increasingly on qualitative data and expert judgment from analysts and the private sector. These guidelines offer a framework that is flexible enough to use and implement in either context.

Box 1. Somalia Food Crisis **SOMALIA CASE STUDY**

In early 2017, FEWS NET projected a credible risk of famine in Bay/Bakool and Northern Inland Pastoral livelihood zone of Somalia. Analysis presented in the September 2017 Food Security Outlook indicated that, at the national level, 2.9 million people may be affected by IPC 3 (Crisis) or IPC 4 (Emergency) levels of food insecurity. Given similarities in the seasonal anomalies (low rainfall, poor production, decreasing labor and terms of trade (ToT), poor projections for second harvest and grazing regeneration) reported in early 2011 (the last declared famine in Somalia), FEWS NET engaged in an intensive analytical process to examine likely price trends through the lean season. An abundance of graphic and data-rich text from that body of work is presented for reference in these guidelines.

Somalia's four main staple foods are domestically produced maize and sorghum and imported rice and wheat. The two main harvests in Somalia are the January to March *Deyr* harvest, which, on average (2011–2016) comprises roughly 60% of annual coarse grain production, and the July to September *Gu* harvest, which contributes the remaining 40%, on average. The lean season peaks in June just prior to the start of the *Gu* harvest. On average, local sorghum and maize production cover domestic requirements, making Somalia self-sufficient for these staples. Agriculture is largely rainfed and dependent on inconsistent and significant interannual variations in rainfall, and subsequently production levels. The southern part of the country (including Lower Shabelle, Gedo, Lower Juba, Bay, Bakool, and Hiraan Regions) is the surplus-producing area of Somalia. Production in the northern and central areas do not satisfy local needs, except for a small surplus-producing area around Hargeisa.

The 2017 food security crisis in Somalia was largely driven by poor seasonal rainfall that resulted in *Deyr* production shortfalls of nearly 70–80% across the producing areas of the country. In February 2017, sorghum prices were already 74% above average and maize prices were just over 40% above average; high prices early in the season presented specific concerns for projected price levels during the lean season, despite a second (*Gu*) harvest in June. Of particular note to Somalia is the confluence of national dependence on domestically produced cereals (primarily sorghum and maize), and international imports of rice and wheat, which are significant even in a normal year. For this reason, analysts are advised to pay special attention to price projection processes for both domestic staples and international imports, and the factors or determinants that are relevant on a broader analytical scale for other country contexts and market system variations.

Source: FEWS NET (2017a; 2017b).

STEP 1: Situate the Analysis in Time and Space

The first step in making price projections is to situate and contextualize the analysis. Within the scenario development process, this takes place during Step 1, when analysts identify the **geographic focus** of the analysis and the **projection period** (months for which price projections will be developed). However, the process of developing price projections requires additional contextual orientation. Analysts should refer to the worksheet presented in Annex IV to help organize their analysis and complete Step 1 through Step 6 of this guidance document.

Step 1 Overview

- Identify the geographic focus of the analysis and the projection period
- Select commodities based on their relative importance to local livelihoods
- Select representative markets based on relative importance to the relevant marketing system and availability of up-to-date, complete, and reliable data
- Use Livelihoods and Markets and Trade products and tools

Livelihood information plays a significant role in orienting the level of analysis (national, regional, or livelihood zone-specific) and situating the analysis in time and space. Analysts may also rely on a series of factors and the acute nature of the food security context to refine the depth and scope of analysis. Situating the analysis in consideration of livelihood and food security contexts allows the analyst to refine any follow-on questions for field staff, project partners, and private sector counterparts, whose input can ultimately reinforce the overall analysis. In this step, analysts will also rely on livelihood information and market context data to select focus commodities and key reference markets.

The following guiding questions should be used to identify any important features of the marketing year, geography, and/or seasonality when contextualizing the analysis:

- What distinguishing features in the selected livelihood zone affect the market system and/or marketing of staple foods in general (for example, proximity to key transportation arteries, key markets, or border areas)?
- What is the time period being analyzed? How does the selected projection period fit into the seasonal calendar?
- What is the level of overall market dependence in the area of analysis (i.e., proportion of the population, or segment of the population most likely to be affected)?
- Are there idiosyncrasies relevant to production, trade, marketing, and price behavior in this area?
- Are prices typically stable in this area, or is some degree of volatility expected given unique or distinguishable price trends?

TIP

The examples put forth throughout this guidance document focus on staple foods. However, the approach and steps are general enough that they can easily be applied to cash crops, livestock, and other traded goods or services.

The remainder of this section provides guidance on selecting the area and market to use for analysis and commonly available guiding tools to support this process.

Identify the geographic focus of the analysis and the projection period

The first part of Step 1 is to situate the analysis by identifying the geographic focus and projection period. FEWS NET's integrated food security analysis is typically livelihood zone-based, although the geographic focus could also be the intersection of administrative and livelihood zone boundaries, national, or regional, depending on the particularities of a country or region's early warning analysis and reporting. Based on an understanding of local livelihood systems (using the Livelihood products described below), analysts choose the zones of focus for market and price analysis.

The projection period is likewise typically defined by Step 1 of scenario development and documented in the analyst's SSTs (FEWS NET's Steps to Scenario Development and Annex I). The standard projection period (and period

of analysis for Food Security Outlook reporting) is eight months into the future. However, price projections are used by FEWS NET for other analyses and reporting (such as Household Economy Analysis (HEA) Outcome analysis and Supply and Market Outlook Reports) that may focus on a shorter or longer period of analysis. For example, there are times when a major production shock is anticipated due to the progress of a given rainy season. In those cases, projections for the entire upcoming consumption year could be developed, especially when the level of anticipated resulting acute food insecurity is great. When the projection period is particularly long or spans multiple marketing years, it is especially important to define the months when confidence in the projections is highest/lowest and to monitor and update the analysis regularly.

Select commodities based on their relative importance to local livelihoods

The commodities for which price assumptions need to be developed for Step 3 of scenario development vary considerably across and within countries and can include staple foods, cash crops, and livestock, among others. The only restriction on the selection of the commodities in question, for the purpose of this guidance, is that they need to be relevant to understanding livelihoods and food security in the selected area of analysis. At a minimum, price projections should be completed for the cheapest locally relevant and available staple cereal/tuber, as this information is critical for analyzing likely food access during the projection period. However, depending on the time of year and the population of interest, other price projections may be important. FEWS NET's Livelihoods products document commodities of interest to price projections and ultimately, food security analysis.

TIP

To develop projections about terms of trade (ToT), the analyst must develop projections for both food prices and indicators of income levels. This may include grain and livestock in pastoral and agropastoral settings, grain and cash crops in agricultural settings, or grain and labor wages in urban settings.

Select reference markets based on relative importance to the relevant marketing system and data availability

Early in the process, the analyst should conduct a rapid review of existing historical price data (from FEWS NET, market information systems, other reliable sources). The analyst will, in most cases, select the reference market with the most reliable and extensive historical price data to accurately portray any diversions in typical price patterns (at least 24 months of recent price data are recommended).

TIP

Be sure to confirm that at least 24 months of historical price data are available for the selected reference market. Verifying the availability of other price data for key source or destination markets, as well as prices for key substitutes, is also helpful.

The analyst will select the physical market (or set of markets) that will be used to analyze, project, and monitor the marketing system and price trends for the purpose of early warning. As mentioned above, depending on the level of food security analysis, this could be a single wholesale or retail market in a given livelihood zone (which may be appropriate if HEA Outlook analysis has already been completed), or, where more detailed information is not available, a wholesale/retail market that is considered broadly representative of the area of analysis. Most importantly, whatever path is taken, the price series observed in the market in question should represent general market conditions experienced throughout the geographic area of the food security analysis. FEWS NET's Livelihoods products often provide an indication of these representative markets, although they should always be cross-checked with markets highlighted in the corresponding production and trade flow maps, and with local staff and resident expertise.

Once the process of review and analysis is complete, the analyst should be mindful of selecting the most relevant reference market and prices for a selected commodity. When situating the analysis, the analyst should select only one reference market for a given commodity; price projections from the selected reference market may yield information regarding prices for multiple commodities (for example, maize, cowpea, and goats). The analyst should not present multiple price projections for the same commodity from multiple reference markets for a single area of concern (or livelihood zone).

If the geography of a livelihood zone is such that there are multiple representative markets with varying conditions, the analyst should identify and document the geographic coverage/boundary of the influence of the markets

identified. This can be done through a review of production and trade flow maps (see below), mathematical estimates (such as simple price correlation analysis or more rigorous price cointegration analysis), or key informants (such as traders). One would then need to (1) complete a separate livelihood zone-based food security analysis associated with each key reference market or (2) make assumptions about the relative weight (or influence) of one market versus another and proceed with the analysis using the market associated with the greatest relative weight.

TIP

If multiple reference markets are identified for a given area of concern, the analyst should consider the relative size (in terms of quantities traded), strategic importance, and position in the marketing system. Price correlation analysis can help confirm whether historical price trends for the selected reference market and commodity move in tandem adequately with other candidate reference markets or not.

Once the market is selected, the analyst should describe important characteristics, and identify influential external or intrinsic factors. Placing the analysis in the broader market system context and incorporating elements of market structure, conduct, and performance such as trader behavior and market dynamics in this way will allow the analyst to better anticipate market response, more fully define relevant scenarios, and formulate precise expectations as the projection period unfolds. The analyst is therefore able to draw upon additional sources of useful market information to tell a more comprehensive story about food security and how markets will impact expected outcomes. Situating the analysis should carefully consider the type of market, the population it serves, the location of the market, integration with other markets, proximal markets that influence local prices, major commodities traded, and the source of commodities traded (locally produced versus flowing in from other regions or international areas).

Use Livelihoods and Markets and Trade products and tools

Many commonly available tools from the FEWS NET project's knowledge base and reporting can help support the analyst to situate projections analysis.

Livelihoods products

Livelihoods products are a useful tool for understanding market function and the role of markets in a specific livelihood system, and can serve to highlight markets important for analysis and price projections. Livelihood analysis provides insights into the level of reliance that a community might have on market purchases versus its own production for food access. Livelihood analysis, as stated earlier, can guide the analyst to determine the likely commodities and staple foods consumed by the population, and thus refine market selection and subsequently, price projection efforts, to the most important foodstuffs. Additionally, this analysis can direct the analyst to establish a baseline view of local market systems, household market dependence, lean season timing and trends (corroborated by the seasonal calendar), purchasing power and income sources, and ultimately, how price shocks might impact food access based on the household economy in question. FEWS NET uses three core Livelihoods products as the foundation of food security scenario development, and to build price projections. Each tool plays a different role in orienting the analyst to areas of further research, and in situating the current analysis in the context of variable livelihood strategies, demographic characteristics, and market interaction.

TIP

Analysts should seek out the most up-to-date livelihood information. Profiles or baselines that are more than five years old could be misleading because marketing systems may have changed. Therefore, while this is an essential starting point, other contextual information is useful (e.g., recent market studies) and should be consulted.

***Livelihood zone map*.** The zone map (Box 2), provides a geographical orientation of livelihood systems and a sampling frame for future livelihood zone profiling and livelihood baseline development. For the analyst tasked with developing price projections, this may be a useful tool for basic geographic orientation and for a visual and spatial understanding of how market systems for a given commodity may intersect and how shifts in one livelihood zone may impact staple foods in another zone.

Livelihood zone profile and description. The livelihood profile is a narrative that provides a relative snapshot of livelihood options (food and cash sources) of households in each zone and describes market interaction at the local level. Profiles often include the following:

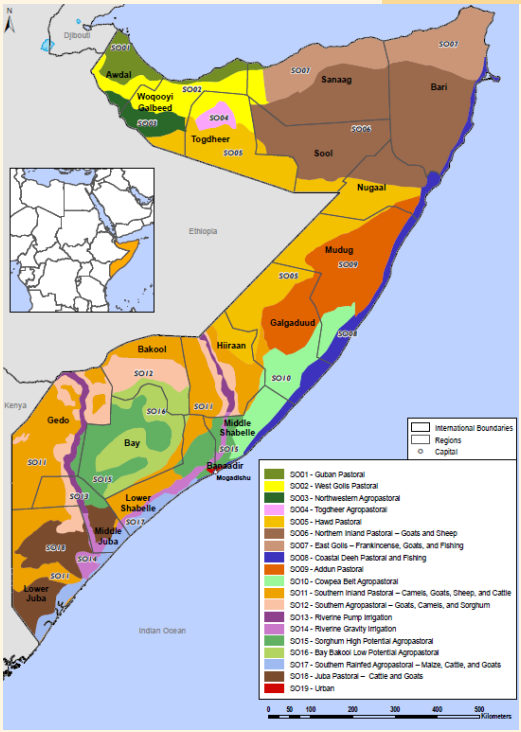
- A detailed description of the primary and substitute food staples for which price projections are most relevant, and that may assist in identifying key commodities for fundamentals analysis (Step 3).
- Useful contextual information about how households engage with market systems such as locally relevant reference markets and commonly produced, consumed, and sold goods, which can serve as candidates for developing price projections. Profiles also describe relevant food access strategies (i.e., market dependence and interaction with purchasing power and price shifts), and assess the potential for reverberating shocks that might occur outside of the defined area of analysis but impact food flows and availability within the broader marketing system.
- Important insights into the timing of commodity production, sales, purchases, and trade flows and the primary actors involved in trade and their roles.
- Other important cash crops or livestock sale patterns that comprise household income earning and that may play an important role in refining the impact of prices (and price changes) on household economies.

Additionally, this tool should allow the analyst to further refine where price shocks might be most relevant, most likely, and most important to project in the interest of early warning against the potential risk of food insecurity.

The livelihood zone description is another Livelihood product that provides much of the same contextual information, but in less detail.

HEA livelihood baseline. The HEA baseline provides a detailed, quantified breakdown of household livelihood options (food, cash, and expenditure patterns) and coping capacity/expandability for different wealth groups in the livelihood zone, highlighting market linkages and constraints and opportunities for economic growth. When available, this tool provides a detailed view of household interaction with market systems, price shocks, and often more institutional factors that impact household access to staple foods.

Box 2. Livelihood Zone Map, Somalia — **SOMALIA CASE STUDY**



This livelihood zone produces a large part of Somalia's sorghum supply. During the reference year, Bay Region generated over 60% of the annual sorghum supplied by Somalia, and much of this came from the area within this livelihood zone. Sorghum trade routes originating in Bay Region extend throughout much of the country. Baidoa market within the Bay Region is the main trading center for sorghum and other cereals. Sorghum is taken by local traders to Baidoa, and then transported to regional and district markets in the south such as Hudur, Tieglow, Bardera and Luq, and Buale markets, and the two Shabelle Regions. Another main destination market for sorghum is Mogadishu, but this depends on the security situation. Hiran and the central regions of Galgadud and Mudug and up north to Puntland provide alternative markets when Mogadishu is inaccessible.

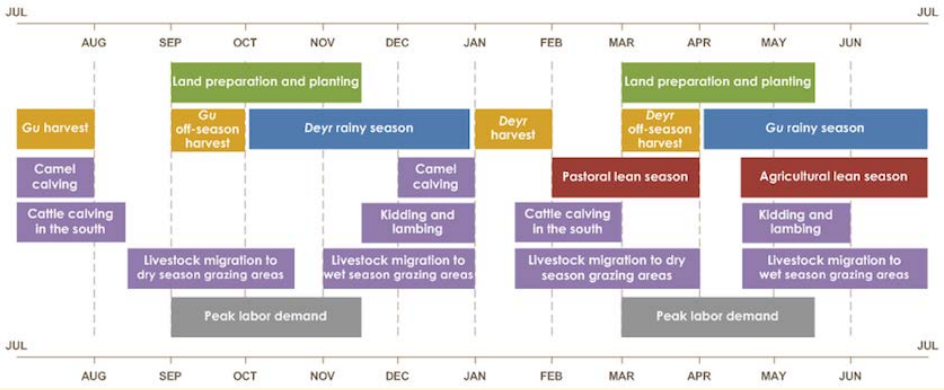
Source: *FEWS NET/FSNAU (2016).*

Seasonal calendar

Among the first steps in situating the analysis is to identify when in the marketing year the analysis (projection period) is taking place. Thus, it is important to understand the relevance of the selected period in the marketing year as a whole and typical events. The seasonal calendar (Box 3) is one tool that allows analysts to understand the typical events and cyclical patterns occurring during the selected period of analysis and corresponding marketing year. The seasonal calendar also plays a key role in (1) explaining the drivers behind current market conditions and (2) identifying anomalies (applicable for Steps 3 and 4). This contextualizing information also helps the analyst to determine which pieces of information will be key to collect (or develop assumptions about) in subsequent steps of the process. For example, if the analysis is happening in the immediate postharvest period, information should be

available about the performance of the current agricultural season. However, if projections are being developed during the middle of lean season, the analyst may not know local production prospects with certainty over the entire projection period and will need to incorporate this uncertainty into the analysis in Step 3B and Step 5. Although not available in all FEWS NET countries, consumption calendars can also be a useful resource.

Box 3. Calendar of Normal Seasonal Events for Somalia **SOMALIA CASE STUDY**



In the case of Somalia, understanding the normal timing of the primary seasonal rainfall periods, as well as the associated harvest, is important. If the current period at the time of the analysis is January–March, the analyst will highlight that the *Deyr* harvest would be underway, with the pastoral lean season typically commencing in February along with livestock migrations. March would signify the normal period for initiating land preparation and the off-season harvest, which helps households to prepare for the upcoming lean season in May.

When developing the baseline of market conditions for June–September (according to Step 1 guidelines for orienting the analysis), the analyst should include clear statements about the typical events that occur during that period of time. In this case, the analyst will highlight that the agricultural lean season would typically be nearly halfway completed in June, with animal births occurring as the *Gu* rainy season starts to wind down. The analyst can note that the *Gu* harvest should occur between July and August, and that by September households would begin land preparation for the *Deyr* cropping season in most places throughout the country.

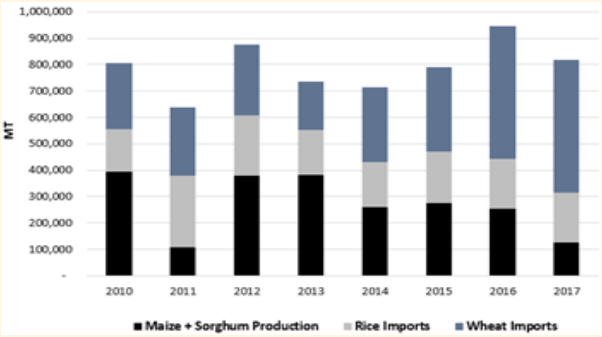
Source: *FEWS NET (2013).*

Commodity or food balance sheet

In addition to livelihood profiles, the national food or commodity balance sheet can point to key staples and the importance of imports and exports in the price projection exercise. Box 4 provides an example of how to summarize food consumption patterns to prioritize the selection of food commodities in the context of Somalia, a heavily import-dependent country. After gleaning commodity information from a review of livelihood data and other reporting, the analyst may use additional inquiry to refine the final selection of commodities to be analyzed:

- What are the preferred, primary staples consumed during the reference period, disaggregated by type (cereal, pulse, etc.)?
- What are the preferred or likely substitutes consumed during the reference period, disaggregated by type?
- What is the role of these foods in the livelihood zone in terms of consumption and calorie source versus other livelihood

Box 4. Somalia Total Grain Supply (MT) **SOMALIA CASE STUDY**



In Somalia, at the subnational level, rice consumption is highest in the northern and central areas, while maize and sorghum dominate in the south. Wheat is mostly consumed by urban, wealthy households. This information is important because, in the context of an expected 2017 production cereal shortfall, price analysis will likely consider staples (maize and sorghum) as well as likely substitutions (imported rice) in deficit areas. The 2017 figures presented in this graphic are projections based on anticipated production and import volumes.

Source: *FEWS NET (2017c).*

strategies, such as processing for sale or small business?

- Are these commodities produced in these areas or primarily imported from other zones?
- Are there tertiary or other commodities that are relevant to this area this year, during the period of analysis?

Production, market, and trade flow maps

Production, market, and trade flow maps may offer useful information regarding the spatial relationships, key characteristics, and relative importance of particular markets and market systems for the selected commodity. The map in Box 5 provides an example that can be referenced to guide the review, refinement, and selection of the most relevant market systems and key commodity markets to analyze in the cereal (staple food) and livestock sectors of Somalia.

In the case of Somalia, the analyst may also review FEWS NET analytical products for markets and trade and FSNAU Market Maps to develop a useful description of market characteristics, for example:

> "By region, markets tend to be more integrated in Southern Somalia because of shorter distances between markets. The main sorghum and maize producing areas of Lower Shabelle, Bay, and Bakool include many trading centers and form the largest and most integrated sorghum and maize marketing basin. Baidoa and Merka are the main reference markets and price leaders. Except for Merka, all coastal markets, including Kismayu, Hara Dhere, Mogadishu, and Bossaso, are price takers. Sorghum and maize price transmission becomes weaker toward Central and Northern Somalia due to poor infrastructure and long distances between markets" (FEWS NET 2017c).

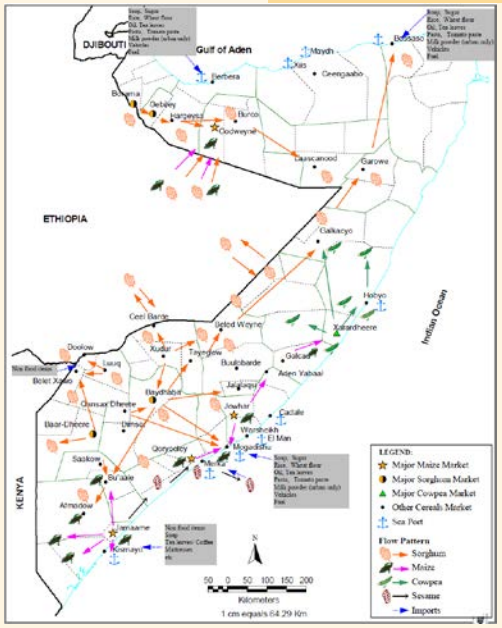
To further inform market selection, the analyst may refer to FEWS NET reports and analysis, and consult with local field offices to refine selected markets based on their role in the system, and in supplying specific areas with staple commodities. Another example from the FEWS NET 2017 *Supply and Market Outlook* explains:

> "Rice and wheat markets are more strongly integrated and price-making markets are more geographically distributed than the sorghum and maize markets, resulting in generally faster price transmission. As the main points of entry, the country's ports, as well as a few markets along trade routes between the Northern and Southern regions, such as Hara Dhere and Beletwein, are the main price-leaders for rice and wheat."

Box 5. Somalia Cereal Market Flow Maps **SOMALIA CASE STUDY**

Reviewing this map, the analyst can determine the location of wholesale and assembly markets. This information can guide the analyst to select the markets that might be most affected by production shortages, interruptions in transportation and trade routes, and price reverberations. Analysts may select markets where substitution crop prices may also be affected by a shortfall in sorghum production, as projected in Somalia for the 2017 *Deyr* growing season.

During the 2017 first growing season (*Deyr*), sorghum and maize prices were high early in the season, and projected to increase rapidly due to production shortfalls of up to 75% in producing areas in the south. The analyst should consider which destination markets might feel the most acute impact of price differentials and use production and trade flow maps to guide the selection of the important markets for analysis. In the case of Somalia in early 2017, FEWS NET's outlook analysis noted that wide substitution of imported wheat and rice would likely temper the impact of high prices of maize and sorghum throughout the country. In this case, the analyst would also be advised to review likely market channels for these commodities to identify any market systems of interest.



Source: *FSNAU (2005)*

STEP 1 Summary

Before moving to Step 2, the analyst should summarize market information in an easy-to-read and organized format; one frequently used tool presents the information in a tabular format (see Box 6). Given the importance of imported rice, and possibly wheat, in deficit zones where sorghum and maize shortfalls are likely to drive steep price increases, the analyst for Somalia might situate the analysis accordingly.

Box 6. Step 1 Situating the Analysis – Areas of Concern in Somalia (2017) **SOMALIA CASE STUDY**

Area of concern I	Reference market	Baidoa (Merka is another important market that could be considered)
	Country	Somalia
	Region/Province/Livelihood Zone	Agropastoral areas in Lower Shabelle, Bay, Bakool
	Commodity	Red sorghum, although both sorghum and maize could be considered in this particular area
	Currency and unit of measure	SOS/kg
	Projection period (month/year–month/year)	February 2017–September 2017
Area of concern II	Reference market	Mogadishu (Beletwein and Hara Dhere are other important markets that could be considered)
	Country	Somalia
	Region/Province/Livelihood Zone	Agropastoral areas in Lower Shabelle, Bay, Bakool
	Commodity	Imported rice
	Currency and unite of measure	SOS/kg
	Projection period (month/year–month/year)	February 2017–September 2017

Note that the main example used through the remainder of the document relates to red sorghum price projections for Baidoa market. The table highlights the key reference markets for commodities that are primary staples in the selected areas, which are most likely to be affected by projected production shortfalls of around 70%. Reference markets should provide a solid starting point for projecting how high above average prices will be during the lean season and through the next harvest period. The table also highlights a reference market for imported rice. This is because imported food (chiefly rice and wheat) prices will be used to determine food price ceilings. The analyst should consider developing price projections for at least one of the two imported staple food substitutes to monitor price stability and to strengthen assertions about how the projected imported commodity prices will determine the ceiling for other staples in shorter supply (maize and sorghum).

STEP 2: Describe Typical Market and Price Behavior

Step 2 Overview

- Develop an understanding of market behavior and drivers
- Obtain reliable and relevant historical data regarding typical price trends, determinants of supply and demand, and other factors that influence food prices on a cyclical or seasonal basis
- Analyze historical price trends

Developing price projections requires a keen understanding of normal market behavior, characteristics, trends, and features. Describing typical market and price behavior, as well as expected drivers behind typical behavior, is crucial to establishing a baseline for comparison for the defined period of analysis. The baseline creates a starting point that allows the analyst to gauge the severity of any possible anomalies or deviations from what is typically expected in the selected period of analysis, activities that are elaborated in Steps 3 and 4. In other words, Step 2 lays the groundwork for determining how expected conditions will impact projected prices by providing a reliable point of comparison for a normal season. Developing and presenting a comprehensive and accurate overview of the normal market behavior, price patterns, and economic conditions associated with trade (and in some cases, food import requirements) and purchasing power is supported by a series of standard tools and made available to analysts to bolster and substantiate a workable baseline from which to draw conclusions about the impact of potential variations. To provide a full overview of typical market behavior (including storage and spatial arbitrage via trade), the analyst should review the full suite of Markets and Trade Knowledge Base products with other existing documentation about seasonal price trends, market supply, demand, trade flows, market integration, and market coordination at the local, national, and regional levels. This section provides a detailed review of the application of core tools and available open-sourced data, literature, and research that may also support the analysis, and additional guidance regarding the development of a solid, accurate presentation of typical market and price behavior for the selected period of analysis.

The following guidance first introduces the guiding framework for developing a baseline understanding of market conditions and then presents a nonexhaustive inventory of useful tools and resources relevant to each element of the framework. Interested readers can refer to FEWS NET Market Fundamentals Reports for additional considerations. Based on this guidance, the analyst will be able to provide a series of summary statements describing the baseline performance and condition of selected commodity markets, actors, environmental and structural factors, and trade dynamics that support typical or average supply of and demand for staple foods in a good or normal marketing year. The analyst will use this baseline to develop and assess expected anomalies and drivers that are expected to impact expected price levels and associated market drivers.

Develop an understanding of market behavior and drivers

Developing a workable baseline entails a detailed description of typical market conditions for the period of analysis of interest, and should outline drivers of market and price behavior. The Structure Conduct Performance (SCP) framework helps analysts identify the most relevant indicators for describing the market baseline while logically organizing the data and analysis (see the Somalia example on the next page). To achieve this, the analyst should obtain reliable and relevant data regarding typical price trends, expected determining factors for supply and demand, necessary quantities and volumes of imports and domestic production, as well as other influences that shape food prices on a cyclical or seasonal basis. For each selected commodity market or market network, the analyst should fully understand the determinants of price variations over time (stability, volatility, long-term trends), and the interplay between market actors that results in normal or anomalous price behavior. Specifically, analysts should review and consider:

Market structure, which considers key actors in the marketing chain and the relative importance of local production versus imports in aggregate food availability and access, including the geographic distribution of production and consumption (Caves 1992). Some examples of market structure include:

- The number of buyers and sellers of food commodities in the market.

- The number of sellers of agricultural inputs such as fertilizer and veterinary drugs.
- Barriers to entry into the market and the nature of trading relations (vertical coordination mechanisms) among market participants.[1] A market structure characterized by high barriers to entry (e.g., license fees and kinship ties) may result in only a few firms or traders profitably maintaining business activities in, or even entering, certain markets. These few traders may engage in noncompetitive behavior such as collusion and exclusionary or predatory price setting and speculative behavior.[2]
- The geography and seasonality of supply and demand and prices.

Tools and resources for understanding typical market structure

The following tools and resources can help the analyst develop a comprehensive understanding of typical market structure:

- Food (or commodity) balance sheet
- Agroclimatology information
- Domestic crop production trends
- Subnational staple food self-sufficiency
- Spatial distribution of trading centers
- Marketing channel diagrams
- Transportation costs

- The broader macroeconomic context, including programs and policies.
- The level of market thinness in an average year, and any inter- and intra-annual variations, as a potential contributor to price variability.

Market conduct (behavior), which refers to the patterns of behavior that traders and other market participants adopt to affect or adjust to the markets in which they sell or buy.

- Market behavior also reflects and is shaped by the spatial movement and distribution of goods domestically, and across regional and international borders to meet national consumption needs. This includes the reactions and strategies of market actors (traders and others) in response to programs, policies, and other elements of the broader political, economic, or social context.
- For the purposes of price projections and associated analysis, price setting (price determination) behavior is important, in particular the buying and selling practices of key actors in the market chain. For example, in an environment with many buyers and sellers, the market tends to determine the price. If one trader tries to increase his or her price, he or she sells nothing. This means that households buy food commodities or agricultural inputs at prices equal to the costs of producing the last unit of the commodity or input (i.e., the marginal cost). In contrast, if only a few sellers of food commodities operate in a market, these few traders can conspire and charge consumers higher prices, up to the level where consumers can afford to buy from a nearby market at a lower cost.

Market performance, which refers to the extent to which markets result in outcomes that are efficient and deemed good or preferred by society. Market performance reflects how well the market fulfills certain social and private objectives; performance outcomes typically include:

- Price levels and price stability in the long and short term.
- Profit levels at different levels of the marketing system.
- Cost, efficiency, quantity, and quality of food commodities sold.
- The extent to which price signals (reflecting local supply and demand dynamics) transmit from one area of the marketing system to another and allow for trade to take place (market integration). For example, regular and predictable availability of basic food commodities at affordable prices is generally considered a desirable outcome. Other desirable outcomes would be that traders do not obtain excessive profits, and that commodities meet certain sanitary and phyto-sanitary standards. In addition, prices paid by consumers

[1] Vertical coordination mechanisms refer to the trading relations or ways in which transactions are conducted between market participants. Examples are spot market transaction, contracts, cooperatives, vertical integration, and strategic alliances between or among farmers, traders, transporters, processors, and consumers.

[2] Exclusionary or predatory pricing occurs when one firm lowers and maintains its price below costs until other efficient firms exit the market. Predatory pricing eliminates competition (resulting in monopoly power).

should not be excessively above the cost of marketing, processing, and transaction costs for a given commodity, and the prices received by farmers should cover their costs of production. The degree of market integration is often used as a measure of market performance, to understand the extent to which price signals are transmitted from one part of the marketing system to another.

Box 7. Excerpts from WFP Food and Market Supply Situation in Southern Somalia (2011) **SOMALIA CASE STUDY**

These excerpts, which are a smaller component of a thorough market structure review by the World Food Programme (WFP), offer some insight as to trader behavior, engagement, collusion, and potential pitfalls for price stability and supply/demand. The WFP special report offers information regarding the number and type of market actors, sophistication in communication, and movement of commodities. The information reveals a high level of complexity with respect to clan-related strategies to move food staples, as well as the impending and constant security risk posed to the market system by warring factions around the country, and in Mogadishu specifically.

"WFP undertook a review of the structure, conduct and performance of the cereal markets in Somalia in 2009 (WFP 2009). This review showed that the main actors in the cereal markets included importers, wholesalers, shopkeepers and open-air retailers. Trade is widely established as a livelihood in Somalia, as most traders have more than 10 years of experience. Traders are well equipped in communication, transport and storage facilities. The higher-end of the supply chain actors (importers and wholesalers) have greater transport means (motor cars, trucks and ships) and storage facilities (warehouses and stores) than retail shopkeepers and open-air retailers."

"Despite the expansion of the Transitional Federal Government areas, domestic security remains a serious problem which constrains trade within Somalia. Mogadishu itself is divided into 16 areas under control of different warlords. Importers based in Nairobi told the mission that they most commonly sell directly to wholesalers and retailers from their warehouses. However, a number of importers use their own network of wholesalers and retailers, which are located in almost every region, to manage the movement of food-commodities and security-related issues. In general, these importers use primarily their own trucks to move goods and rely on their trusted transport companies to move additional quantities when necessary. To overcome security constraints and transport restrictions within Somalia, import companies hire drivers on a multi-clan basis, whereby clan members take responsibility for driving trucks through their respective regions."

Source: *Sanogo (2011)*.

Food balance sheet (FBS)

The FBS presents a comprehensive breakdown of a national food supply during a specified reference period, and shows the availability and source for each primary staple food commodity and the associated source of supply (FAOSTAT 2001). Market behavior and performance are both reflected in national supply and demand requirements, which are in turn impacted by overall market function and performance.

TIP

Variations in the timing and technical approach to developing the FBS or commodity balance sheet may result in large variations from one source to another. It is important for FEWS NET analysts to understand the sources of the different balance sheet components and select the elements they feel best reflect the situation. FEWS NET regularly develops commodity balance sheets based on a number of different data sources and informed heavily by the analyst's expert judgment.

- The FBS directs the analyst toward a more explicit understanding of the market burden for imports and domestic food flows.
- The analyst may use the FBS to identify the most important commodities consumed, which then informs the selection of a given price series for which projections will be developed, as discussed in Step 1. A balance sheet for an individual commodity (such as sorghum) or group of commodities (cereals) is often elaborated by FEWS NET, focusing on the dominant contributors to caloric intake.
- The total quantity of foodstuffs produced in a country added to the total quantity imported, adjusted for any change in stocks that may have occurred since the beginning of the reference period, gives the supply available during that period.
- Food commodity use is also presented and provides additional insight about the use of the product, such as: quantities exported, fed to livestock or used for seed; losses during storage and transportation; and the residual amount available for human consumption.
- Per capita supply of each such food item available for human consumption is obtained by dividing the respective quantity by the related data on the population consuming it. Data on per capita food supplies

are expressed in terms of quantity and by applying appropriate food composition factors for all primary and processed products in terms of dietary energy value, protein, and fat content.

This information provides the analyst with a comprehensive summary of all food sources and gaps in the reference period, and points to other areas of inquiry that might be important and have implications for price projection. For example, if the country imports a significant amount of staple grain in a typical year, the analyst will understand that additional research on import controls or trade restrictions may be relevant to the period of analysis.

It is important to note that food and/or commodity balance sheets can be obtained as a formal government tool, and may also be developed or updated with sourced data, or by using expert judgment. For example, commodity balance sheets are likely to be developed early in the market year (ex-ante) and may or may not be revised when final production and trade (import/export), carryover stocks, or industrial use data are available.

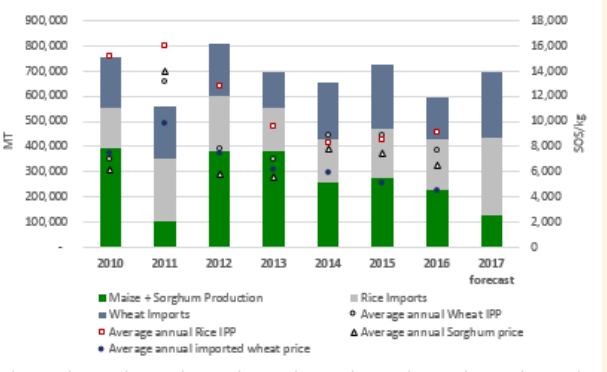
Agroclimatology and seasonal performance

The analyst should consistently refer to seasonal performance indicators (such as rainfall, Box 9, and the Normalized Difference Vegetation Index (NDVI), Box 10) to determine how staple food supply, particularly in rainfed agricultural areas, is impacted or will be impacted by climatic conditions. In many areas, seasonal rainfall is perhaps the most important indicator of how the harvest will perform and how much domestic cereal will be supplied to a given market system compared to an average year.

The analyst should refer to key terms and measures when describing the baseline seasonal agroclimatology for the purpose of developing price projections. Climate variability refers to the fluctuation of the climate (rainfall, temperature, etc.) over seasons and years.

FEWS NET analysis emphasizes two main dimensions of climate variability: spatial variability of rainfall refers to rainfall distribution across a landscape or over space, whereas temporal variability refers to rainfall distribution over time, and can refer to change within a season or over many years. Rainfall variability between years is referred as interannual variability, while changes within a season reflect intraseasonal variability. The analyst may refer to different datasets a

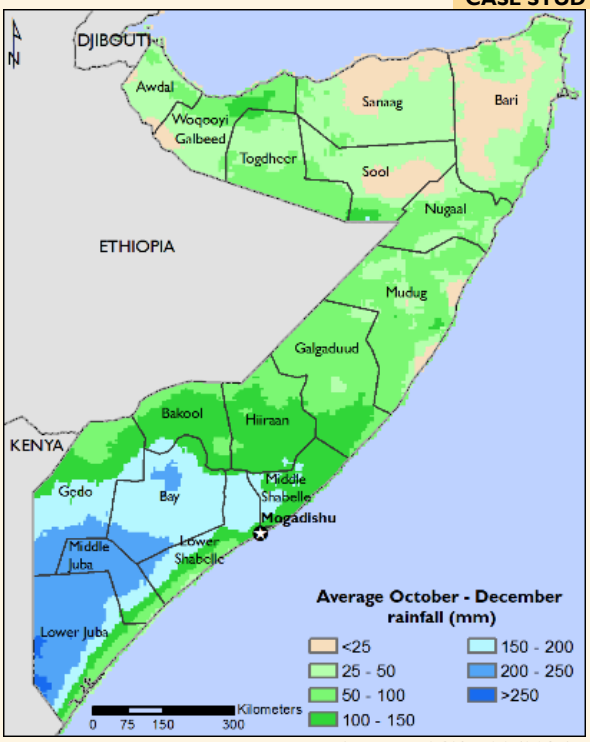
Box 8. Cereal Supply Elements from the Somalia Cereal Balance Sheet **SOMALIA CASE STUDY**



Food balance sheets (and their elements) may be used to project anomalies and changes from the baseline, which is useful for Step 2. In this example, the graphic provides a five-year average for comparison, the forecast, and the degree of anomaly in terms of grain availability for each staple crop. The analyst may parse evidence from this tool and similar tools regarding which anomalies are most relevant to price projections (in this case, for Somalia during a low-production year). The analyst will review the baseline figures and factors for the five-year average and determine the price series that is most likely to demonstrate the impact of the current year anomalies projected in the FBS (or equivalent).

Source: *FEWS NET (2017c).*

Box 9. Average Rainfall (CHIRPS) **SOMALIA CASE STUDY**



Source: *USGS/EROS (2017).*

nd graphics to understand baseline soil moisture levels, timing and volume of rainfall, and vegetation indices.

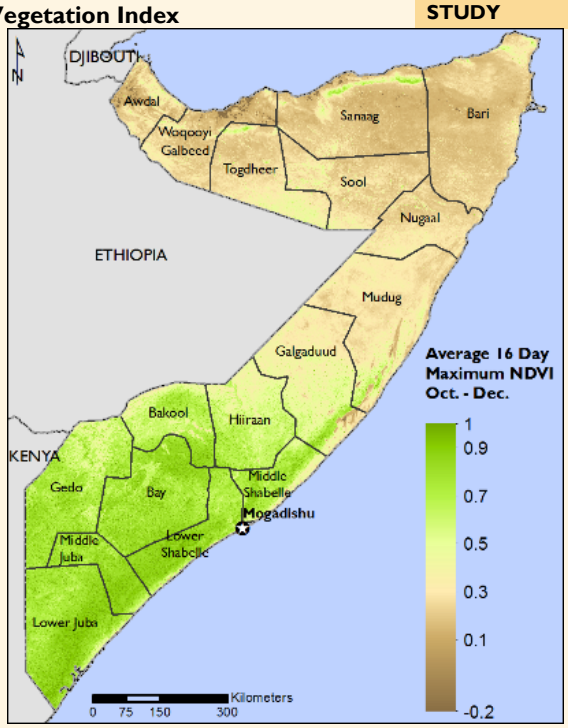
Production and self-sufficiency trends

Another key element is agricultural production levels (on aggregate and in the crop-producing areas that typically supply the source markets for deficit zones). A general understanding of agricultural performance can be formed using remote sensing products, rapid rural appraisals, interviews with traders, or contact with partners on the ground. Understanding historical interannual variations in production can help the analyst contextualize current production trends (see Box 11). Understanding how markets reacted during years of well-below-average production will be especially useful in Step 3B. Disaggregating seasonal-level data and understanding the historical relative importance of one season versus another can be useful in countries with more than one production season.

Box 12 shows region-level grain self-sufficiency for Somalia, and demonstrates the structurally deficit nature of the country in terms of food production. Understanding interstate and international food flows into areas with the most prominent deficits is highly relevant for understanding how market mechanisms typical work to fill food gaps. Additionally, the analyst might review this information in the context of other factors, such as seasonal performance.

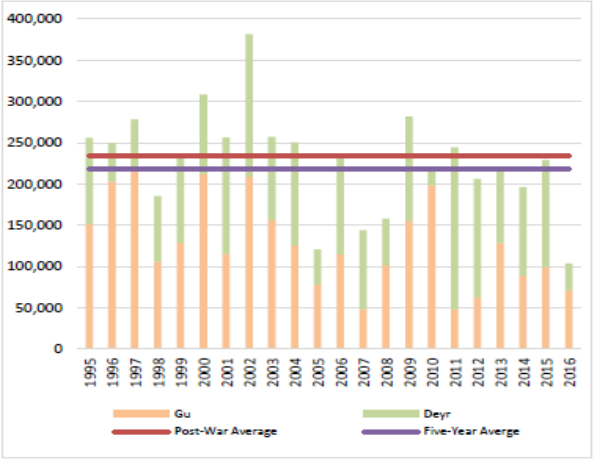
If the seasonal rainfall forecast is poor for an area that normally produces surpluses destined for important consuming or deficit areas, the typical flows emanating from the traditional surplus areas will likely be reduced. Understanding current production levels and anticipated supply flows between areas can be a joint effort conducted in collaboration with field counterparts, and could include reviewing institutional production data and projections, as well as incorporating external data from other agencies or nonprofit organizations. While it is critical to consider the performance of production, especially in surplus areas, it is also important to account for other typical sources of supplies such as those originating in other parts of the country, across regional borders, or from international imports. In practice, analysts should incorporate fundamentals analysis to determine important factors and, where applicable, anomalies that will ultimately impact the flow of sufficient food supplies to deficit areas. While this depth of analysis is more appropriate for Step 5, analysts should begin to

Box 10. Normalized Difference Vegetation Index **SOMALIA CASE STUDY**



Source: *USGS/EROS (2017).*

Box 11. Annual Cereal Production in Somalia, MT 1995–2016 **SOMALIA CASE STUDY**

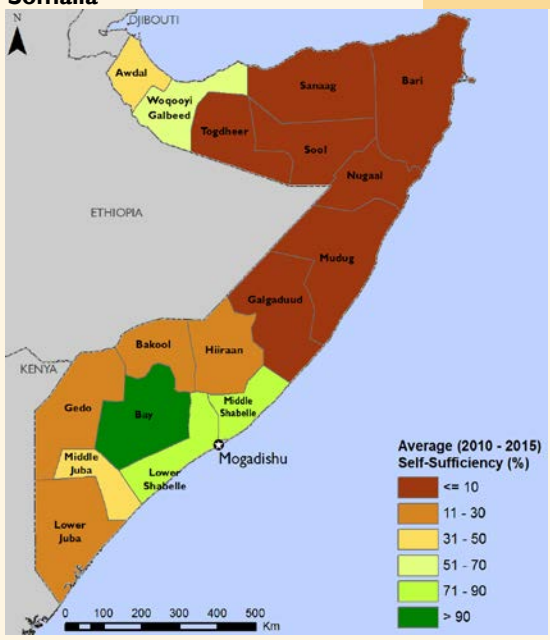


Annual historical production data help the analyst understand the average volumes produced in the focus country and historical variations. Ideally, the analyst will also be able to review regional or livelihood zone-based production data. Identifying historical years (or seasons) of poor production also provides useful context to help analysts orient their search for information (reports and anecdotes) about how market systems previously reacted to production-related shocks. This is particularly important in a country such as Somalia, where production levels vary, and where market supplies and prices fluctuate accordingly.

Source: *FEWS NET estimates based on FSNAU/Somalia (2017).*

develop a sense for potential bottlenecks while situating the price projection analysis in the appropriate time and context.

Box 12. Grain Self-Sufficiency Status in Somalia **SOMALIA CASE STUDY**



Source: *FEWS NET (2017c).*

Tools and resources for understanding typical market conduct

Seasonal calendar

The seasonal calendar, used in Step 1 to situate the analysis, can be a useful reference for the analyst to identify and describe the specific market conditions and factors at play during the selected period of analysis. The analyst should review significant events in the calendar that explain typical price patterns. For example, will price projections reflect the peak of the lean season, when staple foods are scarce, demand is high, and households revert to other consumables? Or, for example, is interannual food assistance typically available during the period of analysis, lessening market dependence (in the case of in-kind assistance) or increasing market activity (in the case of cash-based market programming)? Reviewing the seasonal calendar and noting the significant events and conditions that shape a normal year, or the selected reference year, provides a point of comparison and contextualization that will ensure a more accurate projection of price trends and levels.

Although a seasonal calendar mostly describes how food production and income-earning conditions vary, it can easily be augmented by analysts to include information about other important factors such as (1) annually programmed institutional purchases, (2) demand for storage by traders and agro-industry, and (3) farmer sales to purchase inputs (or in preparation for the marriage/holiday season). This information has important implications for determining price patterns and projecting normal versus atypical factors that may result in higher or lower prices than expected given seasonality and cyclical events.

Observing market behavior and dynamics in surplus and deficit markets

TIP

The following tools and resources can help the analyst develop a comprehensive understanding of typical market behavior:

- Livelihoods products
- Seasonal calendars with key events
- Market reports describing trader behavior

If the selected geographic area is a net deficit zone, meaning that staple foods are imported and transported from other source markets outside of the zone, or within specific areas of the zone to deficit areas, accurate price projections will depend on a strong understanding of which dynamics are currently influencing supply, pricing, availability, and marketing of staple foods. With a good geographic sense of surplus production and distribution (both spatially and in terms of volumes), an analyst should be able to compare current performance, typical flows, and basic food requirements to infer whether unmet demand for food (or specific cereals) from the deficit areas (both major and minor) is likely. If the area has been classified as either a minor or major deficit zone (structurally or due to a shock), the analyst must identify the main source markets (wholesale or assembly) for the livelihood zone-specific representative market. If the area is classified as a surplus zone (structurally or due to a shock), the analyst should identify the main destination markets (wholesale or assembly) for the livelihood zone-specific representative market, keeping in mind that the source/destination market for an area may not located within the area selected or the associated livelihood zone. For this step, the analyst should also identify how source or destination markets vary over the marketing year, and establish a sense for whether the direction and magnitude of trade flows are following typical seasonal trends or demonstrating a different pattern. The grain self-sufficiency status map illustrates how surplus and deficit market flows can provide additional insights to where projected market prices could be highest and of greatest concern in a region or country.

Box 13. Findings Reported in Banadir Region Emergency Market Mapping and Analysis Report **SOMALIA CASE STUDY**

Pricing and price stability: Traders said that they buy their commodities at the prevailing market prices, which are determined by suppliers and informed by many factors, including the exchange rate. Traders determine the selling price based on the purchase price and other expenses as well as by consulting other traders. The main factors influencing the selling price are informal fees and taxes, storage costs, and the purchase price. Traders noted that prices remain constant for between 2 to 3 months on average. Pricing is also affected by demand, which at times varies seasonally. For instance, demand for shelter materials goes up during the rainy season, when traders sometimes raise the price of such materials occasioned by the increased demand. Demand for various food items is relatively stable most of the year but demand for specific food items tends to peak during certain periods like festive seasons. In addition, traders indicated that relatively small events on markets result in minimal price changes in the markets accessed by internally displaced persons (IDPs). The prices of other nonfood items as well as of foodstuffs remain relatively stable. However, the prices of food commodities usually go up during large emergencies such as widespread drought and floods as a result of scarcity of the commodities in the broader marketing system.

Note: This summary was taken from a larger Emergency Market Mapping and Analysis report regarding voucher suitability in urban markets in Somalia, but it provides some basic information about trader and vendor behavior in Bakara Market, Mogadishu. The analyst may note that taxes and informal fees can be a factor for normal price-setting practices, and consider examining whether this contributes to price fluctuations. Additionally, the analyst is informed that food prices in this market are typically stable for most of the year, with well-explained triggers (holidays, emergencies) driving food prices variation. Together, these insights provide contextual information about market behavior and price trends in Mogadishu.

Source: *Korane, Barre, and Ali (2016).*

Tools and resources for understanding typical market performance

Production and trade flow maps

Production and trade flow maps help address some typical questions important to understanding and observing market behavior to and from deficit or vulnerable areas. The primary utility of the maps is to clarify typical movement of food commodities from one area to the next. In Step 1, the analyst might use this tool to guide the selection of a market or market system for the analysis. In Step 2, the analyst will conduct a deeper analysis of linkages, functionality, and vulnerabilities that might impact the flow of staple crops and subsequent price anomalies.

TIP

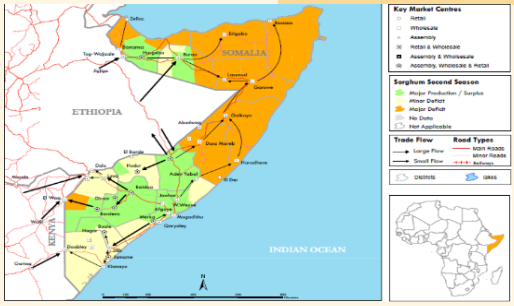
The following tools and resources can help the analyst develop a comprehensive understanding of typical market performance:

- Production and trade flow maps
- Analysis of historical price trends (Price Bulletins, seasonal indices, price integration analysis)

- Trade flow maps illustrate how commodity markets are typically structured spatially, including both commodity flows and points of exchange. They highlight the relationship between surplus-producing areas and destination markets in deficit zones that may be disrupted or enhanced because of a policy or event.
- An analyst can use the maps to determine and anticipate alternative sources of supplies of a commodity or set of substitute commodities in response to potential bottlenecks, delays, or shortages.
- Although FEWS NET analysis is livelihood-based, marketing networks may spill over livelihood zones and even over national boundaries. Production and trade flow maps therefore contribute to analysts' understanding of how a shock in one part of the broader marketing system (domestic, regional, or international) could have implications for local staple food market dynamics.

Box 14. Somalia Production and Market Flow Map – Sorghum **SOMALIA CASE STUDY**

The analyst will note that sorghum supply is distributed through the marketing system via the key commercial trading centers of Baidoa, Quoriley, and Merka. Cross-border sorghum trade also takes place with Ethiopia (Jijiga). The analyst may track prices accordingly to determine interruptions or anomalies pertaining to a range of issues, including cross-border trade flows, security and integrity of domestic flows from surplus regions to deficit regions, secondary market systems that can offset potential price variations, etc. The analyst will develop a sense of the effects that markets in surplus areas have on markets in deficit areas.



Source: *FEWS NET (2008a).*

Historical price trends

To complete a workable baseline, the analyst must determine average prices for specific commodities of relevance to the country, region, or locality. To this end, analysts should fully inspect and analyze relevant historical price databases. This can be done by investigating average price levels and long-term trends (Price Bulletins), average intra-annual price variations (seasonal price index), and spatial price relationships (correlation and cointegration analysis). Not only is the price of a commodity important, but so is its price in relation to consumers' income (called "purchasing power"). Knowledge of livelihoods and consumption patterns provides useful information to determine how significant a commodity is to households.

Historical price series for a particular market are a necessary benchmark against which to measure, assess, and identify atypical price behavior. The monthly Price Bulletins and the Price Watch Annex provide insight into historical average (five-year) price levels, and, more recently, typical month-to-month (seasonal) price changes. The goal of creating the price bulletins — a set of 18–20 price graphs for each country and region displaying price behavior for the most important markets and commodities — is to provide food security analysts and information users with a tool for monitoring price trends; they are also a starting point for asking questions about anomalous behavior and its potential causes and effects in particular areas of concern. A Price Bulletin will show a collection of commodities important to a particular country or sub-region. Particular attention should be given to commodities most important to vulnerable and food insecure populations. An analyst can easily look at the trends of all represented commodities in a market by placing the graphs side by side and looking for similarities and differences. In some markets, the price trends of different commodities might follow the same seasonal progression. In other places, seasonal variability may change from commodity to commodity. Understanding the agricultural calendar and consumption preferences at different times of the year will help an analyst determine the significance of price trends.

Typical seasonal price movements for locally produced commodities tend to be somewhat similar across countries and follow a predictable pattern within the marketing year. For example, at harvest time, prices fall to a seasonal low because supply is high and elastic and market demand is low. As the season progresses, prices tend to rise as supply decreases and becomes more inelastic and as market demand increases. At some point over the year, prices hit a peak, normally when production prospects become clear and/or the green harvest starts, before tending to fall again. In many countries, imported commodities display very limited intra-annual variation in supply and prices.

TIP

Locally produced commodities tend to display distinct seasonal price patterns that reflect challenges in the marketing system, with supply becoming increasingly inelastic as the season progresses. This is different from imported commodities (and some locally processed or value-added goods), for which the elasticity of supply and demand remain more stable within a given marketing year.

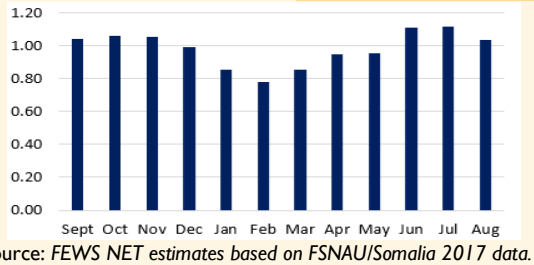
These seasonal variations are reflected in the average seasonal price index (Box 15), another tool that allows analysts to understand the typical events and patterns occurring during the selected period of analysis and corresponding marketing year. The seasonal price index of the commodity reflects typical market conditions over the course of the year. The method for computing a seasonal price index based on historical price data is outlined in Annex V.

The extent to which price shocks reverberate spatially through the marketing system can be captured through an analysis of market price integration. While price correlation can indicate co-movement between disparate historical price series, cointegration analysis can shed light on the statistical relationship between two price series, including but not limited to the extent to which a price shock in one market price is reflected in other market prices (Box 16).

Box 15. Baidoa Sorghum Average Seasonal Price Index

SOMALIA CASE STUDY

Referring to the Somalia example, analysts will explore historical price trends as part of their baseline understanding of market and price behavior. This includes an inspection of the average seasonal variation in prices, as reflected in the average seasonal price index. For the key reference market and commodity in this example, Baidoa sorghum prices typically reach their lowest point of the year during the month of February and reach their peak during the months of June–July.



Source: *FEWS NET estimates based on FSNAU/Somalia 2017 data.*

Box 16. Market Integration and Price Makers, Somalia	**SOMALIA CASE STUDY**
Southern Somalia	Starting with sorghum trade in the south, the centers with the largest network of markets interconnected through the transmission of price signals are mostly found in Lower Shabelle, Bay, and Bakool. To identify for each market its role in price making, we can use the ratio between the number of markets being influenced versus the number of influential markets. Qansah Dere, Baidoa, and Dinsor, all located in Bay Region, can be considered the main price makers, followed by Dolo and Lugh, located in Gedo Region along one of the main corridors within the sorghum belt. El Barde and Kismayo are the main price takers; Mogadishu seems to play the same role.
Central Somalia	Moving to the central area of the country, the number of cointegrating links gets reduced due to both the smaller number of markets and the larger distances between markets. No real price makers or price takers can be found. Abudwak and Galkayo appear to be the two major transit points both receiving and transmitting price signals. The same applies to all other markets considered, with the exclusion of Garowe, which plays a role of price taker.
Northern Somalia	Moving farther north, there seems to be a rather poor degree of price transmission, as signaled by the lack of integrating links involving the main markets of Bosasso and Hargeisa.
	Source: *de Matteis (2015).*

STEP 2 Summary

Before moving to Step 3 in the price projection process, the analyst should develop the foundation of the price projection with a general grasp and context-based description of commodity flows between surplus and deficit areas. The details can be summarized in a tabular format (Box 17).

Box 17. Step 2 Describe Typical Market and Price Behavior and Drivers – Baidoa, Somalia, Red Sorghum	**SOMALIA CASE STUDY**
A. Surplus of deficit area	Surplus
B. Typical main destination (if surplus area) or source (if deficit area) of supply (local production, other domestic markets, regional markets, international market)	Mainly the domestic market, especially markets in southern and central Somalia
C. Typical harvest month(s)	January to March (*Deyr* harvest) and July to September (*Gu* harvest)
D. Typical lean season month(s)	May–June and December–January

E. Description:

Located in the southern region, Baidoa is in the country's main sorghum-producing area and is structurally surplus. From January to March, sorghum supplies are high from the *Deyr* harvest (January–March). Supplies start to reduce in April, with the lean season lasting from May–June, and peaking in June. Supplies rise again in July with the *Gu* harvest in July–September. At the national level, the *Deyr* harvest contributes, on average, approximately 60 percent of annual coarse grain (maize and sorghum) production, and the *Gu* harvest contributes the remaining 40 percent. Baidoa serves as an important source market for domestic sorghum trade through with well-integrated markets

As a locally produced crop, sorghum prices follow seasonal trends and depend on the performance of domestic production. Sorghum prices in Baidoa typically reach their annual low in February, following the *Deyr* harvest. Prices then typically gradually increase from March through June. In July and August prices stabilize or decrease slightly depending on the *Gu* harvest performance.

Maize, the other major locally produced crop, is a substitute for sorghum. Rice and wheat are also staple foods but are not as heavily consumed in the south, and are almost entirely imported. Locally produced cereal markets (maize and sorghum) and imported cereal markets (rice and wheat flour) have not historically been integrated in Somalia, meaning imported cereal price trends do not typically influence price trends of locally produced cereals. Historically, rice and wheat (imported) prices have been the highest in Baidoa, with maize and sorghum at much lower price levels (sorghum is the very lowest).

Remember to complete a due diligence review

To complete Step 2 analysts should complete a due diligence review of all available external data to round out any gaps in information regarding market structure, conduct, and performance, including market drivers, staple food availability trends, and marketing system actor behavior (including household interaction with market systems). Additional questions that may round out the baseline, which informs the fundamentals and technical analysis in subsequent steps, include:

- Which markets typically supply the markets selected for the analysis and price projection development?
- Which markets are typically supplied by the markets or greater market system selected for the analysis and price projection development?
- Are there important seasonal or agroclimatological factors that require additional consideration of typical commodity flows between deficit and surplus areas for the selected period of analysis?
- What are the historical levels (average levels and long-term trends)? During years of poor local production, where are supplies typically sourced and why?
- What behavior is typical of market actors (consumers and suppliers) during the selected analysis period?
- What are the alternate routes for selected commodities to use if primary routes are not possible?
- What are the most important border crossings in terms of commodity trade?
- What substitutes are important to consider?
- What are the most prominent or likely bottlenecks where supply interruptions could occur?

STEP 3: Conduct Fundamentals Analysis

Step 3 Overview

- Describe market and price trends, using the findings from Step 2 to clearly identify any current or projected anomalies in the marketing system and their root causes

Once the analyst has a clear understanding of how market and price trends typically behave through the analysis of market drivers and price behavior, it is possible to contextualize current market conditions and develop assumptions about the determinants of prices over the projection period using concepts from market fundamentals. These assumptions will ultimately contribute to the "convergence of evidence" required to refine justifiable and credible price projections in Step 5. Thus Step 3 is divided into two substeps: Step 3A focuses on describing current market and price conditions (and root causes), while Step 3B focuses on developing assumptions about market drivers over the defined projection period. The analyst will continue to use the SCP framework in both substeps to frame and organize the analysis (Table 1).

Table 1. Using Elements of the Structure Conduct Performance Framework to Guide Step 3

Structure	Conduct	Performance
Food and commodity balance sheet (national and subnational)	Seasonal events	Trade flow patterns
Agroclimatology	Trader behavior (pricing, market supply, storage)	Price transmission
Crop production	Consumer substitution patterns	Price levels and variation compared to historical reference points
Numbers of buyers and sellers		
Barriers to entry		
Transportation costs		
Macroeconomic considerations		

Source: *Authors building on Caves (1992) and Staatz (2007).*

Step 3A: Describe current market conditions

Step 3A Overview

- Describe current market and price trends
- Identify the nature and timing of observed anomalies relevant to the selected market system
- Define root causes of anomalies, and if they are time-bound, singular, continuous, and/or predictable
- Identify relevant reference years to compare and contextualize market conditions, including anomalies and their determinants

In this step, the analyst describes current market drivers and behavior, price levels and trends, and seasonal factors that are relevant to commodity prices. This expands upon the contextual information gathered for understanding the baseline market conditions as a gateway for identifying current market anomalies. The analyst will likely continue to rely heavily on tools used to develop the original baseline, but in a different way. This section reviews how to identify, refine, and calculate the impact of observed anomalies to begin shaping larger assumptions about anticipated market drivers and price behavior.

By the end of this substep, the analyst shall be able to produce a series of thoughtful assumptions regarding any anomalies that will impact price behavior over the expected period of analysis. Specific examples of these statements are presented below. Some questions that may guide the analyst to identify the existence and degree of anomalies include:

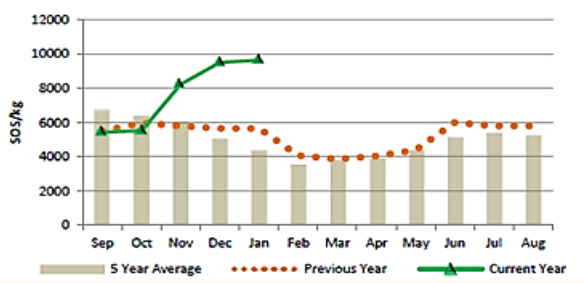
- Are consumers purchasing staple commodities in the expected timeframe and to the expected degree?
- To what degree are consumers purchasing substitute foods? Which foods are currently preferred?
- Are prices shifting at the typical time in the seasonal calendar, and to the expected degree?
- Are seasonal indicators pointing to normal seasonal rainfall? If not, what variations are expected?

Describe current price levels and market conditions

Occurrences or events that deviate from typical conditions over the last few years will most likely result in price trends (levels and variability) that are different from those experienced in the past, called anomalous price behavior. For this reason, including historical prices on graphs for comparison is very helpful. FEWS NET does this by taking the monthly average of the last five years of price data where the data are available. FEWS NET uses averages because a lot of variation arises in agricultural production and prices from year to year and some of that variation can be smoothed out by taking an average. Having as much historical perspective as possible helps an analyst to more easily point out trends different from those in the past or to use past experiences to help interpret current and anticipate future conditions. The analyst is encouraged to refer to FEWS NET Price Bulletins to easily identify anomalies in price trends by comparing this year's prices to an average from the last five years and a reference year.

Box 18. Nominal Retail Prices, Red Sorghum, Baidoa, January 2017 (SOS/kg)

SOMALIA CASE STUDY



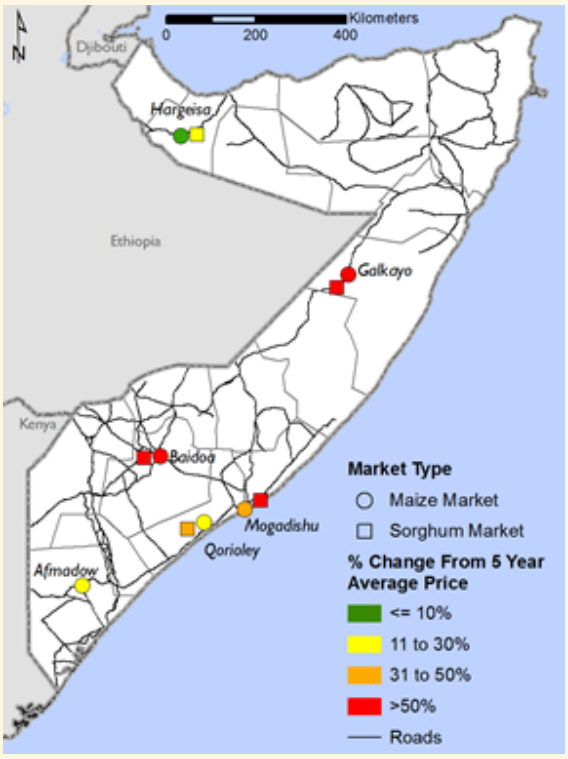
Source: FEWS NET (2017d).

Note: Referring to the February 2017 Somalia Price Bulletin (reporting on January 2017 prices), the analyst will note that sorghum prices are nearly double what they should be in January; this information may also be used to track anomalous price fluctuations in substitution crops in areas that depend on sorghum from the Baidoa market zone. The price anomaly presented here has serious implications. In the case of the 2017 food production shortfalls, price increases are almost certainly pegged to high demand and short supply caused by poor rainfall, low harvests, and possibly opportunistic trader behavior. Additionally, noting that prices typically trend downward in anticipation of the *Deyr* harvest in January, the anomaly suggests that prices may continue to rise. The analyst should describe specifically what this anomaly represents in terms of supply, market performance, trader behavior, and food flows. Projections through the lean season (May/June onset) may well present extreme anomalies and have major food security implications for market-dependent households.

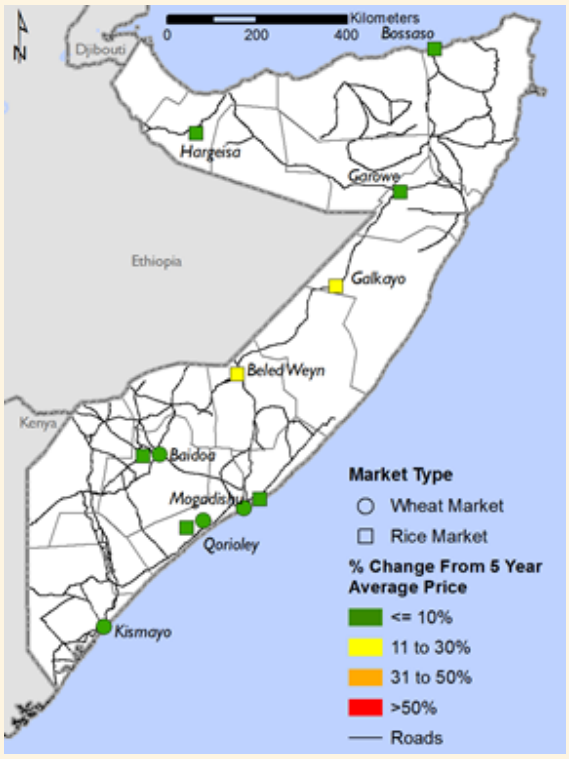
Prices determined through spot transactions frequently move up and down to account for changes in local supply and demand. Price variation itself is normal, which is why an analyst needs to look at trends and put them in the context of geographic and seasonal variability (Box 18). Understanding the typical movement of prices throughout the year is very important to understanding the relative supply and demand for specific staples. From these patterns, an analyst can deduce the times of year households are expected to pay the highest prices for food. If an analyst simply compared prices in one month to the next, a large increase or decrease may be alarming. Unless there is good reason for doing so, an analyst should not focus only on the percentage change in prices from month to month, but rather check to see if this is a sustained increase over several months and whether such a jump in prices is typical for that time of year. Providing seasonal context helps determine times of concern relative to normal patterns. Commodity prices tend to follow a seasonal pattern, unique to every country and region in terms of over which months prices are high and low, how steeply prices rise and fall, and for what duration of time they remain high or low. Generally, prices tend to be highest during the hunger season (when supply is low and market demand is at a peak) and lowest during harvest (supply is high and many consumers withdraw from the market and consume their own production). Unimodal production systems will tend to have more pronounced patterns because most supply is produced at one time during the year, creating a large influx. Then, as stocks deplete over time, supply decreases relative to demand. Bimodal production systems will likely have two peaks and troughs, meaning two points at which fresh stocks are available on the market and two points at which supply is low relative to demand. Looking at seasonal patterns and comparing the current year to previous years can help identify anomalies.

Box 19. Variations in Prices **SOMALIA CASE STUDY**

Variations in Maize/Sorghum Prices Compared to the Five-Year Average, February 2017



Variations in Imported Wheat/Rice Prices Compared to the Five-Year Average, February 2017



Source: *FEWS NET (2017c).*

Note: In this example, sorghum prices in Baidoa, Galkayo, and Mogadishu are at least 50 percent higher than the five-year average and while maize prices did not increase compared to average as much as sorghum in most markets. Upon review of other market data, the analyst could observe that wheat and rice prices are lower than average for the time of year. With this information, the analyst should seek to investigate household-level market purchase behavior to understand whether there is any substitution across commodities.

Deriving comparative statements that present the variation in current prices compared to historical trends is a helpful starting point for fleshing out the anomaly (Box 19). Simply stating the general observation that "prices are increasing" does not provide enough context to help the analyst refine how this may play out during the designated period of analysis. To further highlight or refine price anomalies, an analyst should try to formulate clear observations regarding any observed difference in price behavior:

> *"This year's prices are similar to what they have been over the past five years during the same period."*
>
> *"Prices this season are far above average for this season, up to 40 percent higher in some markets in this region."*

The analyst may consider presenting price trends in a comprehensive graphical form (including charts, such as the example of the Somalia nominal retail prices for red sorghum and the above maps) to assure direct messaging and clear understanding by decision makers. This will also help to clearly articulate the reasoning behind the identification of price changes as anomalous. A graphic may also be useful in detecting geographic trends, or price variations in a particular livelihood, economic zone, or border area. Consolidating price data into a graphical form can also guide more inquiry as to what additional local factors may be affecting prices, particularly when price data are mapped against livelihood zones, agroclimatology (such as rainfall data), and demographic variables such as population density.

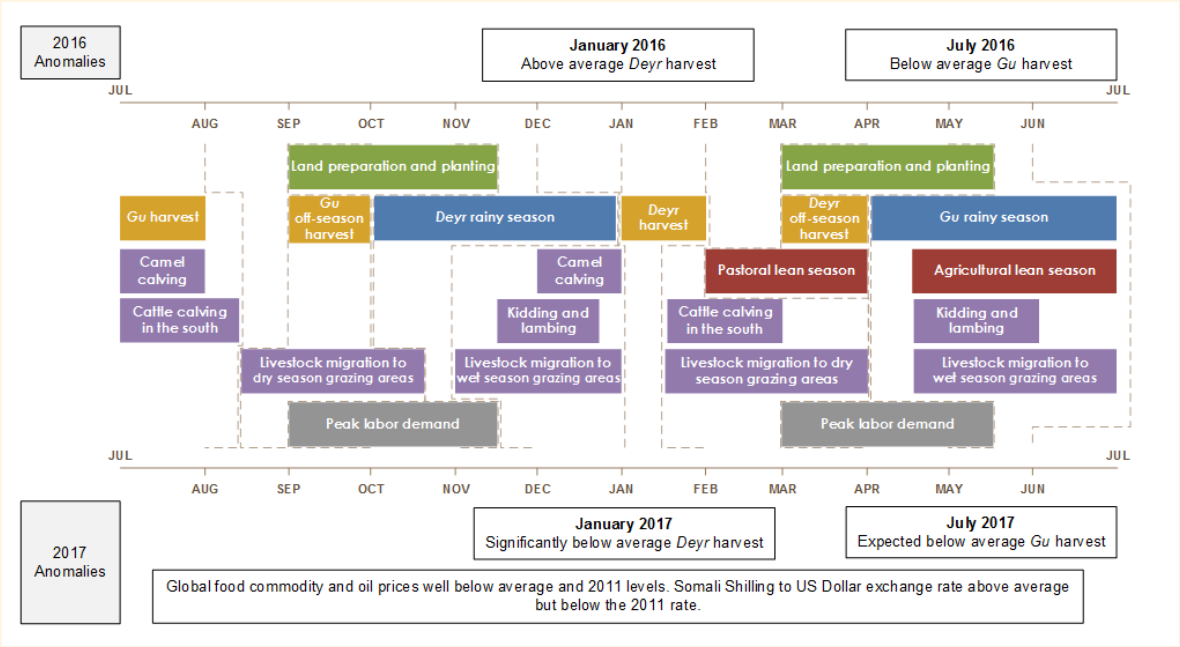
Identify the timing and nature of observed anomalies in price trends of the selected market system

Anomalies are defined as deviations from the norm or average. When prices start to diverge from the normal pattern, an analyst can assume that something is wrong or different with some facet of the supply chain (e.g., production, transporting, marketing, etc.). This situation could point to potential shortfalls in food availability or food access problems that might lead to high food prices and resultant food insecurity. Several anomalies are directly relevant to price shifts and variability; identifying price anomalies, and their driving factors, helps point to access issues, supply shortfalls, or constrained markets. Examples of the types of statements analysts can make based on the observed market and price trends to date include:

> *"During the first half of the season, maize prices in key markets were well above normal for this time of year."*
>
> *"The prices of both cowpea and rice have not yet peaked in September with the normal seasonal trend."*
>
> *"Maize prices continued to increase through the harvest and postharvest periods."*

The analyst may refer to the seasonal calendar or market and trade flow map to note identified shifts in a normal pattern or event, and make a direct observation about the timing, nature, and severity of the shift in production and implications for marketing behavior. For example, the analyst can detail changes in seasonal patterns by adapting the seasonal calendar to reflect current-year developments, as seen in the example below. Analysts can use this tool to think through where atypical seasonal variations in supply are taking place (in terms of both the magnitude/volume and timing of supply) and begin formulating ideas about how current anomalies in seasonal supply variations may result in anomalies over the projection period.

Box 20. Seasonal Calendar, Augmented to Reflect Variations from a Normal Year **SOMALIA CASE STUDY**



Source: *Authors*

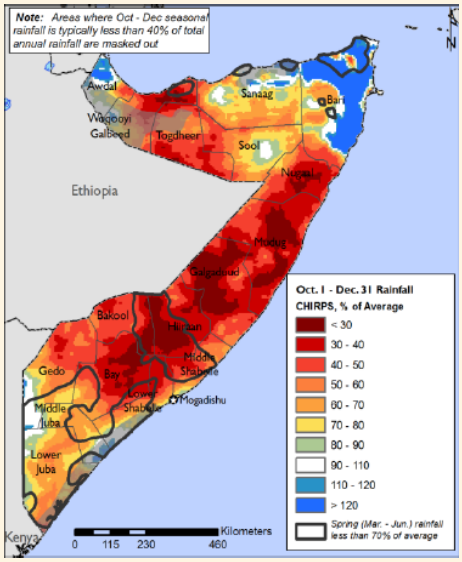
Define the root causes of observation market and price anomalies

Identifying the root causes (drivers) of current price anomalies should include a review of key factors, such as seasonal performance, production shortfalls, and trader behavior, and how these factors may influence availability and food prices and variations. Observations regarding other anomalies or variations in the supporting environment (such as policies, institutional factors, macroeconomic changes) are also important to record and observe, as

they may be root causes of the current price anomaly and therefore are likely to have a significant influence on the development of a price projection. In anticipation of Step 3B, it is useful for the analyst to think about whether any observed anomalies are time-bound, singular, continuous, or predictable in some way. The analyst will rely heavily on the same resources consulted and tools used to establish a baseline understanding of market conditions.

Seasonal performance: Price anomalies, current and projected, may be strongly linked to projected availability of local production, which in turn, is impacted heavily by the performance of seasonal rainfall and other factors that support cropping and harvests. Cross-checking projected performance of rainfall or anticipated dry season conditions should inform the degree and potential duration of price anomalies, and may explain existing price variations even if climatic variables have not yet occurred and are only projected. In FEWS NET countries, rainfall and seasonal performance are often two of the most direct indicators of whether markets will supply normal or typical volumes of staple cereals and pulses. Cross-checking international forecasts with local forecasts and projections in the selected geographic area is also helpful for including or ruling out climate and rainfall considerations as a root cause of any current or projected anomaly. Similarly, the analyst will want to monitor this anomaly over time to inform the accuracy of the assumption and the subsequent impact on prices in the selected zones and market systems.

Box 21. Rainfall as a Percentage of Normal, Oct–Dec 2016, Compared to the 1981–2010 Average **SOMALIA CASE STUDY**

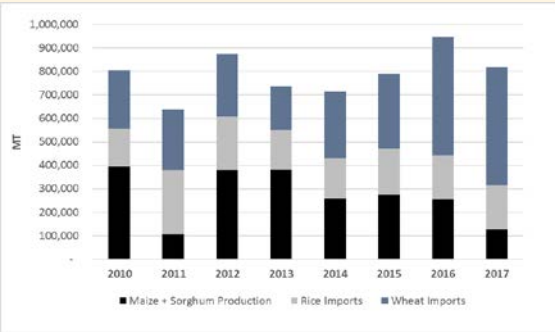


This figure represents the level of rainfall in the season leading up to the 2017 harvest compared to average. In the case of the October to December 2016 rainfall estimate, the analyst will note that the December 2016 rainfall projection estimates that most areas within the country, including the producing regions, are likely to receive less than 30–40 percent of normal rainfall for that period. This has obvious implications on staple food projection and livestock management, which should be expressed in terms of anomalous impacts on both staple food prices and expected terms of trade.

Source: *FEWS NET/USGS, CHIRPS.*

Variations in market supply: Market supply is composed of both production and imports (see the Somalia total grain supply example below), and typically constitutes an essential determinant of observed price trends. Depending on substitution across commodities, the analyst should consider aggregating staple food commodities (in equivalent units of measure for comparison, typically "grain equivalent"). Any atypical variations in aggregate supply (or the distinct components) could be a key underlying cause of anomalies in price trends.

Box 22. Somalia Total Grain Supply (MT), 2010–-2017 **SOMALIA CASE STUDY**



The analyst will note that total staple food supply at the end of 2016 was slightly above average. The availability of rice and wheat imports at relatively stable prices helped to bolster market supplies across Somalia and compensate for below-average 2016 maize and sorghum harvests (including 2016 *Deyr* and *Gu* harvests). International wheat imports were unusually erratic between May and September 2016 but increased exceptionally in October, with around 183,000 MT imported into the country in October alone, when it became clear that the outlook for the 2017 *Deyr* (January 2017) was not favorable.

Source: *FEWS NET (2017c).*

Self-sufficiency status: Referring to baseline data and situating the analysis, recording the current and projected movement of staple foods grown locally, regionally, and nationally, and determining how these transfers and food flows are impacted by production advantages or obstacles (pests, climate, seed and/or yield constraints, conflict or other man-made disruption to otherwise normal cropping seasons) in the period of analysis should point to likely root causes of a price anomaly. This process may also lend specific insight about the duration and severity of price increases depending on whether national or local supply can recover through alternative means of sourcing staple foods.

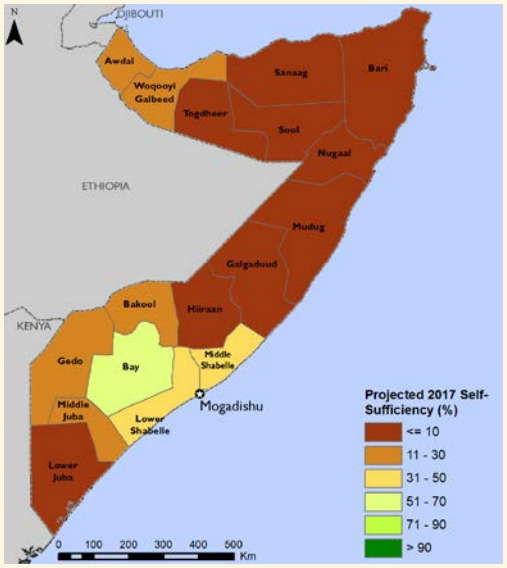
Transportation costs: An analyst should be aware of the types and specific costs of transporting commodities from one location to another and the resulting marketing margins involved. For example, when fuel prices increase suddenly, the cost of moving food commodities increases, which can translate into higher consumer prices. Other important factors might include availability of adequate storage facilities, unexpected climatic or environmental events, the state of transportation networks, security (i.e., feasibility of moving commodities), and demand tolls, informal fees, off-loading costs, etc. If one or more components of the margin significantly increases, an analyst can use production and market flow maps to assess the possible effect on the flow and cost of a commodity.

Trader behavior: Traders manage the storage, movement, and sale of staple foods for which an analyst is preparing the price projection. Small changes in how traders interact with the market system, with consumers, or with each other might influence current and future price anomalies. For example, if traders expect the harvest to be above average, they may sell more of their stock, which will tend to increase supply on the market and accelerate the decline of a commodity's price. If the expectation is for a below-average harvest, then traders may hold higher levels of stocks in anticipation of higher prices. Trader speculation is a common driver of price anomalies, particularly in contexts where production is unreliable and/or international assistance is expected.

Trade flow patterns

Changes in food and trade flows compared to the baseline may be recorded in a visual format that clearly displays current trade flows compared to normal (Box 24). Regardless of whether a graphic is necessary or appropriate for the analysis, the analyst should incorporate information (as available) comparing the

Box 23. Estimated 2017 Subnational Self-Sufficiency — SOMALIA CASE STUDY

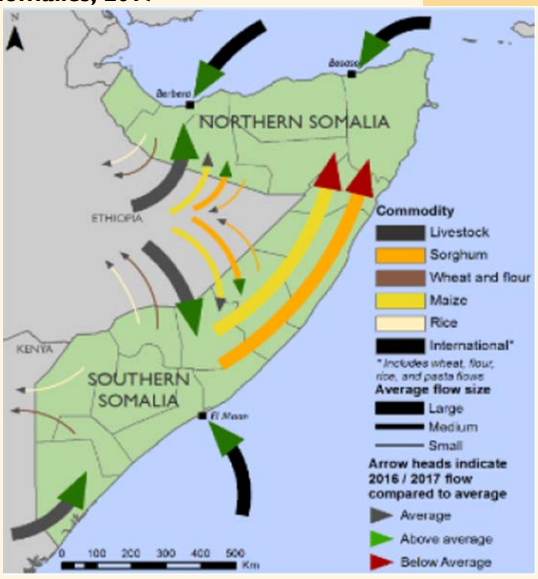


Source: *FEWS NET (2017c).*

The figure above demonstrates the 2017 projected self-sufficiency anomaly for cereals across Somalia. When comparing the average or typical cereal self-sufficiency statistics, the analyst may highlight the degree of deficit production and anticipate the impact on various reference markets for staples, especially sorghum and maize. An assumption about cereal self-sufficiency in the case of 2017 Somalia could be structured in the following way:

"According to government production figures, the projected self-sufficiency for red sorghum production in Hiraan is well below normal, at less than 10%. Typically, this region is able to produce up to 20% of its own cereal needs."

Box 24. Market and Trade Flow Anomalies, 2017 — SOMALIA CASE STUDY



Source: *FEWS NET (2017c).*

current volume, timing, quality, supply chain linkages, and actors to the baseline characteristics of the market system for the selected commodity.

Price transmission refers to the degree of ease with which price information is relayed and communicated among different markets and market participants over geographic area and time. Generally, an analyst is attempting to determine the relationship between prices in two separate markets to understand how some shock in the future in one market will transmit to or affect another. Tracking the price transmission from surplus-producing areas to destination markets will provide quantitative evidence of any predictable or unexpected impact on typical price levels for selected staples. Cross-commodity price transmission can also arise as a result of substitution in consumption from one commodity to another.

Identify relevant reference years to compare and contextualize market conditions and determinants of anomalies

In addition to comparing current prices to average historical conditions, it is useful to do a quick comparison against a reference year, a period of time used to help explain or project into the future the performance and likely impact of observed anomalies on current prices and prices for the period of analysis. For example, previous drought years provide an illustration of the potential progression and outcome of a current drought year, or, in the case of Somalia, a previous famine year (2011). Comparing against a reference or proxy year helps the analyst understand the similarities and differences of how the marketing system reacted to analogous conditions in other years. An analyst can reasonably assume that if conditions are within a reasonable margin of the reference period, prices may also evolve in a similar way during the projection period.

Box 25. Comparison of 2017 Price Trends to Reference Year (2011, Most Recent Famine) **SOMALIA CASE STUDY**

Using the 2011 famine as a reference year for the 2017 production shortfall and associated projection of possible famine, the analyst can demonstrate the similarities and the differences in conditions, market behavior, and other influential factors on price behavior to build an accurate projection. In the example, while sorghum and maize prices reflect a similar degree of disparity, price levels are, in fact, still moderately lower than in the 2011 famine. This information will be important when considering how prices may continue to evolve in these markets for these commodities, and may predict similar food access constraints among populations affected by disruptions to these market systems and cereal supply.

Price Trends	The January 2011 sorghum (Baldoa) and maize (Qoryoley) prices were 256 percent and 135 percent higher, respectively, than the January 2006–2010 average prices.	The January 2017 sorghum (Baldoa) and maize (Qoryoley) prices were 121 percent and 74 percent higher than the January 2012–2016 average prices; in other words, 13 percent lower and similar to 2011 prices, respectively.

Source: *FEWS NET (2017c).*

It is important to note that not all anomalous drivers will have an observable impact on market price trends over the course of the period of analysis. The analyst should carefully explain the logic behind any projected impact from an observed anomaly. In other words, an analyst should not automatically assume that price trends resembling those of a chosen reference year with a similar anomaly presentation will automatically translate into the same price patterns that occurred during the reference year. A reference year helps an analyst make comparisons and better target questions for key informants to make more informed predictions about food security impacts of prices. Making statements that relate back to the reference year help the reader or decision maker better understand the situation as well. Here is an example of a descriptive statement that supports the development of a price projection for the purposes of scenario development and food security analysis: "While maize and sorghum prices are well above average, approaching levels seen in previous crisis years, this is not a cause for concern because households in this area are currently substituting local cereals for imported rice, wheat, and pasta that are readily available on markets and at more stable prices."

If prices are nearing what they were in the "bad" year, the analyst should consider further market analysis to determine the causes and possible effects, particularly as they relate to food availability and the market response in terms of price trends and volatility, if applicable. To corroborate how and whether the impact of current price anomalies will have a similar impact as in the selected period of comparison, the analyst is encouraged to obtain additional information from field counterparts. This is when visits to the field, rapid rural appraisals, and interviews

with key informants (e.g., traders, millers, transporters, marketers, Ministry of Agriculture, universities, donor agencies, NGOs, etc.) become particularly important to price monitoring. Contacts with key participants in the market (in person or by phone) should provide great context to the situation. Market visits, conducted by the analyst or field staff, may be advantageous to verify, corroborate, and add nuance to the root causes of any unusual price behavior. When strange price trends are noticed, it is extremely important that an analyst continue to monitor and report on the situation as it evolves so that the price projection can be updated appropriately.

STEP 3A Wrap Up

Before moving to Step 3B in the price projection process, the analyst should carefully describe and contextualize the fundamental drivers of current price trends. The details can be summarized in a tabular format (Box 26).

Box 26. Step 3A Describe Current Market Conditions – Baidoa, Somalia, Red Sorghum

The analyst will develop assumptions by making a series of statements about observations and assertions regarding observed trends and anomalies recorded during Step 3A. Statements should be brief and review the most relevant trends and anomalies impacting prices. In the example assumptions below, cited from the February 2017 Somalia Food Security Outlook, the analyst is pointing to the events and factors that are most directly related to price variations and projected anomalies.

"Sorghum prices are nearly double their respective average levels and increased atypically during the postharvest period. As a result of slightly below-average *Gu* 2016 production and significantly below-average 2016/17 *Deyr* production domestic staple cereal supply is well below average and similar to that of 2011. Trade flow anomalies include lower than average movement of staple cereals (sorghum and maize) from southern producing areas into northern areas. However, imports for wheat and rice are much higher than average. While still a cause for concern, prices levels for staple cereals are significantly lower at this time of year than in 2011 at the same time."

Identifying observable anomalies

During this process, the analyst may consider answering a series of pointed questions to help identify observable anomalies in price data and in associated market behavior:

- How does this year compare to years in the past, and to the chosen reference year or period of analysis? Are prices near what they have been over the past five years? If not, why, and how different are they? Is this difference significant?
- How do these price movements compare to seasonal patterns? Are they early or late? Higher or lower?
- Did prices start to rise before the hunger season started, meaning also before they have risen in past years?
- Are prices not coming down during the season/months they normally do?
- How are the prices of commodities in the same market moving in relation to each other?
- To what extent is inflation accounted for in the price movements? Is the different greater than the general rate of inflation?
- What about price trends in local markets compared to international price trends?

Step 3B: Develop assumptions about market conditions over the projection period

In Step 3A, the analyst describes market and price trends and identifies current anomalies (and their root causes) present in the marketing system and reflected in observed price trends. In Step 3B, the analyst develops assumptions about anticipated market conditions (fundamentals analysis) and their root causes using the existing evidence base. This section offers some guidance to analysts on how to develop assumptions about the likely impact of these anomalies over the projection period, including expected market supply and demand levels, the behavior of market actors, and trade flow patterns within the local food security context. As a starting point, the analyst should evaluate the current trends and anomalies from Step 3A and determine whether they will persist over the projection period and any resulting impacts on prices (e.g., increase, decrease, stabilize). The following questions may help guide this analyst:

Step 3B Overview

- Explain any root causes of expected anomalies, and whether they are time-bound, singular, continuous, and/or predictable
- Highlight the timing and nature of observed anomalies relevant to the selected market system and projection period
- Conclude with clear assumptions about market conditions in the projection period, including qualitative statements about likely price impacts
- Describe the expected impact or influence of the projected anomalies on market conditions (including prices in the projection period

- Are current market trends (and underlying drivers/root causes) cyclical and/or predictable in terms of timing, duration, and intensity? For example, are they tied to seasonal factors such as rainfall, climate, or annual government commodity procurement plans?
- Can the impact of the anomaly on prices be expected to be resolved by immediate or pending action? For example, are prices high because the government has not yet released stocks or liberalized cross-border transactions?
- How has this type of anomaly impacted market and prices in previous years? Are the conditions similar or different? For example, how did traders, importers, and the government react during previous drought years and why?
- What alternatives do consumers have in terms of food access if the anomaly persists in the short, medium, and long term? What are the implications for cross-commodity price transmission and price ceilings/floors? For example, have consumers (households) historically substituted away from local commodities in favor of imported foods when local commodity prices meet or exceed those of imported commodities?

Explain any root causes of the expected trends or anomalies and whether they are time-bound, singular, continuous, and/or predictable

Root cause of the anomaly: If price trends are not following the normal seasonal pattern (e.g., increasing unseasonably early, or far higher or faster than normal, etc.), the analyst should try to uncover both the reason for, and potential impact of, these price trends over the projection period (Box 27). The analyst should present the primary root causes of the identified anomalies that are expected to ultimately impact price levels over the projection period. This will help provide insight into his or her perception of the likelihood and severity of the anomaly. For example, the root cause of price increases and supply shortages of imported rice or wheat in a country may have more to do with external political and climatic events than with any root cause associated with the domestic marketing system (FAO 2009) or vice versa. The analyst should therefore be careful to include details regarding the root cause of the anomaly to clearly define its relevance to the commodity in question and the period of analysis.

Box 27. Anomaly Comparison to Reference Year, Somalia 2017 **SOMALIA CASE STUDY**

Factor	Conditions in early 2017 compared to early 2011	
Rainfall in the preceding year	Worse in north and far south	Similar in central
Current food insecurity	Worse in northeast and southern agropastoral	Better in central and southern pastoral
Current nutrition	Worse in northeast and central	Better in south
Local cereal supply	Worse	
Local cereal prices	Similar	
International rice/wheat prices	Lower	
Expected rainfall	Similar	
Purchasing power	Similar	
Humanitarian access	Somewhat better	

Source: *FEWS NET (2017c).*

These root causes may relate to any of the factors discussed in Steps 2 or 3A regarding market fundamentals (including the determinants of prices and market structure, conduct, and performance considerations):

- Macroeconomic factors (inflation, deflation, or a financial crisis) or fiscal change at the national, regional, or global level (Annex VII).
- Trade policy, including trade barriers as well as other institutional initiatives that impact food trade.
- Changes in consumers' preferences or effective demand, or other elements of market structure.
- Environmental factors relating to agroclimatology that in turn affect production and harvests.
- Social or political pressures that may lead to interventions or reactionary behavior among market actors.

Describe the expected impact or influence of the projected trends or anomalies on market conditions in the projection period

Impact of the anomaly: The analyst should discuss varying degrees of impact of the anomaly on different populations, geographic areas, or consumer groups/market actors in terms of price expectations. Anomalies that shape staple food price movements may not impact all market actors in the same way. For example, cereal price fluctuations may affect pastoralists, sedentary market-dependent agricultural households, and urban households differently, depending on the evolution of income sources (and terms of trade, ToT) for each group. Livestock prices could evolve in such a way that pastoralist ToT are not affected, while wage rates remain stable, resulting in reductions in ToT for sedentary agricultural and urban households. The analyst should consider whether the impact is:

- Temporary (short or medium term) versus persistent or permanent (long term)
- Sporadic and uncontrolled versus predictable or controllable by other means (policies, imports, subsidies, etc.)
- Significant from a food security standpoint
- Reverberating on other areas of the market system.
- Politically noteworthy
- Large or small/negligible (i.e., the magnitude of the impact)

TIP

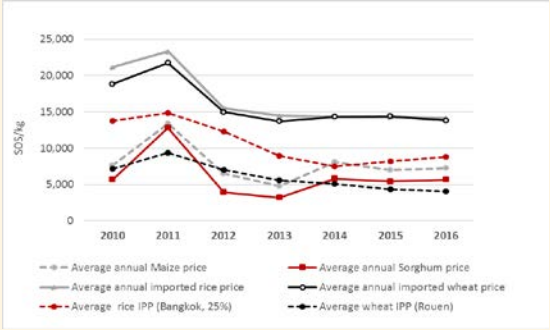
It is important that the FEWS NET analyst is consistent across sectoral assumptions, including those used to develop integrated price projections. For example, if the analyst develops an assumption about agricultural production for use in his or her scenario, it is important to use consistent production assumptions when conducting the fundamentals analysis.

In FEWS NET countries and regions, some types of anomalies are particularly common factors influencing current and projected prices. Some of the most common examples of anomalous drivers that typically inform broader assumptions about market performance and price behavior include:

Unusual commodity movement: Prices in a surplus production area might be low while those in an urban deficit area might be high and rising. This could be a normal occurrence, or might signal poor market integration, insufficient

supply, or potential food security problems. An analyst should gather information from these various locations and be aware of the variation across markets and population groups, which will allow him/her to understand the causes of and probable impact of differences in price. Another reason to look at the price of one particular commodity across markets is to make assumptions about how supply might move in response to market signals. If the difference in prices between locations is large enough to cover transport, handling, marketing costs, etc., as well as provide some margin of profit, a trader might have an incentive to move commodities from surplus areas (low prices) to areas of scarcity (high prices). Typically, this movement should reduce the price difference. Developing valid and well-supported assumptions regarding the potential movement of commodities requires a good understanding of marketing margins.

Box 28. Historical Baidoa Grain Prices (SOS/kg) **SOMALIA CASE STUDY**



Referring to the Somalia example, the analyst will construct the baseline, as well as any anomalous price levels, by reviewing and comparing seasonal averages for a given commodity in a given market against current price levels. Remembering that Baidoa is a key reference market for sorghum, the analyst can evaluate current anomalies throughout the supply and deficit areas where sorghum is likely to be in higher demand and shorter supply due to production shortfalls (in the case of 2017 crop production forecasts). The analyst can also confirm from this figure that imported rice and wheat prices are persistently above those of local cereals.

Source: *FEWS NET (2017c)*.

Atypical or sporadic import or export bans: If formal imports are cut off from a particular region, which geographic regions and populations will be made vulnerable either due to a reduction in supply or an elevation in prices? Are any informal flows expected to mitigate this loss? Regional maps are often the most helpful in determining the impact of this type of policy. Referencing country-level maps of neighboring countries may also provide more detail. Assumptions should note how prices are likely to be impacted by the ripple effects of any change in import or export quantity, quality, timing, and duration.

Trickle-down impact of price ceilings, floors, or fixed prices at any level of the market: If a price is set or controlled at a particular level of the market (e.g., the farmgate), how does this affect the incentive (or disincentive) for traders to bring their stocks to a particular market? Will this policy change the direction or size of flows? Given an understanding of how a price policy will affect trade, analysts can more clearly distinguish the vulnerable geographic areas and population groups most affected by consulting their production and market flow maps. A related assumption might comment on how traders will respond to demand in terms of product volume, stocking, and price setting in a particular area.

TIP

The effects of some macro-level shocks can reverse relatively quickly (within one marketing year). This includes a temporary political crisis, policy measure, or a global price shock that, once resolved, allows for local price drivers and trends in FEWS NET countries to revert to normal. However, other macro-level shocks are more persistent and possibly less predictable based on their nature, such as a civil war, large balance of payment gaps, depleted Central Bank foreign reserves, or a natural disaster that causes extensive damage to a country's essential marketing infrastructure. The pace of any notable improvements in these more persistent drivers of market anomalies can vary considerably depending on the context. Annex VII provides further guidance on this topic.

Shifts or strategic changes to government purchasing programs (such as delays during the marketing year), either from domestic producers or to other countries: If a government purchases stock from one place and moves it to another to sell to food insecure populations (e.g., government programs in Malawi), how will this affect the normal flow of goods? Will this improve food availability and access in places that normally are not otherwise accessible and well-integrated into the broader market network? Will government programs adversely affect the normal flow of goods, or distort prices or normal trader behavior? If a government is purchasing stock from another country and selling locally, how will this affect production areas and producers both locally and in other neighboring countries? Assumptions regarding government purchasing programs might draw upon historical impacts of such action, and point to factors in the current and projected environment that might mitigate or exacerbate the impact on prices.

Fluctuating volumes of interannual government and international food distribution programs: If a government, NGO, or international agency distributes food in a traditionally deficit area, will this complement normal flows of goods to this area or will it compete with them and create a disincentive for private traders? Will the program divert normal flows from one deficit area to another?

Systemic, residual impact of input subsidy programs (for example, fertilizer distribution): Will increased availability or access to inputs promote a supply response through increased efficiency or expansion of area planted and result in greater surpluses? Will this reduce the number of people in food deficit? Will the size of flows be greater once production expands? How will vulnerable population groups be affected? Will their markets be better supplied or will the additional surplus move more toward wealthier urban centers or markets across the border?

Highlight the timing and nature of expected trends and anomalies relevant to the selected market system and projection period

Timing: The analyst should discuss the onset, peak of impact, and evolution of the identified trend or anomaly along the projected time period. The analyst should also include whether the impact or nature of the anomaly will change with seasonal progression. For example, if the analyst is reviewing rainfall data to determine cereal production, the anomaly may be current (i.e., the onset of the season is three weeks late) and the start of season may be offset by the consistency or volume of anticipated rainfall. The expected evolution of the anomaly may still result in a normal or near-normal harvest that is slightly delayed compared to an average year. The subsequent impact on the market system may be minor if supply and demand systems can move food from other areas or if trader or household stocks are sufficient to deter any atypical price increases. Therefore, when describing and highlighting the key aspects of the anomaly, the analyst should be careful to detail the elements of the anomaly that are predictable and any indicators that the anomaly will indeed result in a particular price projection or anticipated trend.

The analyst should define the nature of the trend or anomaly over the projection period. For example, is the anomaly systemic (a financial shock, such as inflation or related to a policy change?) or is it related to a political event such as conflict, an election, or limited access to certain areas? Is the anomaly reversible during the projection period? For example, if the current anomaly is that border traffic in staple foods and commodities is currently slow or halted due to political tension, how likely is it that the border will reopen and permit normal commodity flows, average market supply, and seasonally stable prices?

Step 3B Wrap Up

Before the analyst can move to technical analysis in Step 4, he/she should develop a carefully organized and substantiated assumption regarding the impact of each identified anomaly on future commodity prices. Consideration of relevant contextual data, anticipated and defined anomalies, and the likely impact of anomalies on prices should be consolidated into a detailed but concise assumption. This assumption will ultimately provide the foundation for development and verification of the most likely projected price path (Step 5). This step should end with a concluding statement explaining, based on fundamentals analysis, how prices are likely to evolve (direction of any change and the specific timing of anticipated market and price anomalies). The details can be summarized in a tabular format (Box 29).

Box 29. Step 3B Describe Likely Market Behavior – Baidoa, Somalia, Red Sorghum **SOMALIA CASE STUDY**

The analyst will develop assumptions by making a series of statements about observations and assertions regarding observed trends and anomalies recorded during Steps 3A and 3B. Statements should be brief and review the most relevant trends and anomalies impacting prices. The example below points to the events and factors that are most directly related to price variations and projected anomalies:

"Atypical sorghum and maize price increases observed between October and December 2016 are expected to continue in early 2017 as limited supplies from the below-average January-to-February *Dyer* harvest are insufficient to exert seasonal downward pressure on prices. Seasonal price increases are expected to begin atypically early and persist until the *Gu* harvest in July. Prices will most likely be erratic and significantly higher than respective 2016 and 2012–2016 average prices across most markets. In Baidoa, sorghum prices are expected to reach more than 200 percent above the respective 2012–2016 average prices, and maize prices 100 percent above 2012–2016 average prices. Global rice markets are well supplied and prices stable. Trade flows for these commodities are expected to remain above average. Substitution between local cereals and imported commodities is anticipated, resulting in imported rice prices serving as a price ceiling (maximum) during the projection period."

STEP 4: Conduct Technical Price Analysis

Technical price analysis, for these guidelines, comprises price trend analysis using time series data. Many price analysis methods and tools exist and can be used to develop forward-looking price projections. For example, several types of econometric models exist that consider the statistical properties of the price data, including autocorrelation structure, among others. Such models can be very accurate and useful when elaborated by trained economists and statisticians. However, FEWS NET staff come from a wide variety of backgrounds and must rely on methods and tools that can be easily learned, adapted, and implemented by project staff and partners.

Step 4 Overview

- Use a mathematical model to develop simple technical price projections if more than 24 months of price data are available
- Introduce a margin of error (based on historical variations around the trend line) to help illustrate the likely upper and lower bound over the projection period
- Conclude with a table showing nominal projected prices for each month of the projection period based only on the mathematical model(s) used

In Step 4 of this process, analysts are encouraged to use one of two methods for developing technical projections: the decomposition approach or the smoothing regression approach. Annex V and Annex VI provide more details on these two types of models, respectively. Analysts can implement these models entirely in Excel. Analysts can use a workbook template for this step, prepopulated with the necessary mathematical formulas.

- The price decomposition approach involves using a series of formulas to parse out the various components of a price series (**seasonality, long-term trend, cyclical component, and an irregular component).** While several ways of decomposing time series variables exist, Annex V focuses on a basic multiplicative model. The Annex demonstrates how analysts can then use a subset of those components, combined with other adjustments and considerations that will be discussed, to make projections about the likely future price path.

TIP

For this step, the analyst can use several different models, including the decomposition method (Excel), smoothing regression analysis (Excel), or more advanced price forecasting models. It can also be useful for the analyst to compare the results across models before proceeding to Step 5.

- The smoothing regression approach, which requires the Microsoft Excel Data Analysis Tool Pack, is another type of technical projection used by FEWS NET staff; it is presented in Annex VI. Where available, analysts are encouraged to consult with relevant local/national, regional, or international research institutions that develop short- and long-term price forecasts using statistical tools relevant for their work.
- Analysts are encouraged to also examine historical variations around the projected trend line (such as the mean squared error between the observed data and the projected values, or the mean variation relative to the long-term time trend) to help illustrate uncertainty and to inform the upper and lower bound over the projection period that will be established in Step 5.
- Please note that a minimum of 24 historical data points are required to implement most time series price models. However, longer complete time series are recommended. When working in data-poor conditions where historical price data are not available for at least the previous 24 months, analysts are encouraged to base their projections on current prices and their "fundamentals analysis," coupled with expert practitioner and/or private sector judgment.

STEP 4 Wrap Up

Before moving to Step 5, the analyst must choose at least one method to develop a forward-looking technical price projection over the period of analysis. Regardless of the source/model, the results from these should be presented in tabular format to clearly distinguish between the projected prices and those observed during the current marketing year. At a minimum, the results from at least one model (designated as Model 1 below) should be filled out in the table. Ideally, projections for at least two models should be filled out in the table to allow for comparison (including any upper or lower bounds resulting from historical deviations between the model and the observed values), as shown in the example below.

Box 30. Step 4 Technical Analysis Baidoa, Somalia, Red Sorghum (SOS/kg) **SOMALIA CASE STUDY**

Month	Year	Observed prices (FSNAU)	Technical projection 1 (Model 1)	Technical projection 2 (Model 1, plus mean absolute deviation)	Technical projection 3 (Model 2)
Sept	2016	5,425			
Oct	2016	5,525			
Nov	2016	8,225			
Dec	2016	9,500			
Jan	2017	9,640			
Feb	2017		4,800	11,568	8,357
Mar	2017		4,182	10,950	7,304
Apr	2017		4,788	11,556	8,674
May	2017		4,958	11,727	10,109
Jun	2017		5,651	12,419	11,476
Jul	2017		6,454	13,222	13,762
Aug	2017		6,799	13,568	13,866

Note: The results from "Model 1" are derived from the simple decomposition model, using seven years of data. The results from "Technical projection 2" are derived from adding the "Mean Absolute Deviation" based on five years of data (see discussion in Annex V for more details) to results from "Model 1". The results from "Model 2" are derived from the smoothing regression approach, with the specific parameters determined by the analyst (see discussion in Annex VI for more details).

STEP 5: Develop Integrated Price Projections

At this stage, the analyst should integrate their market fundamentals and technical price analysis to determine the most likely projected price path. The final price projection for selected commodity prices should reflect all of the identified underlying drivers of current and anticipated market conditions, as elaborated in Step 3. In short, at this stage in the price projection process, the analyst will reconcile and/or consolidate any differences or inconsistencies resulting from fundamentals and technical analysis, and refine the most likely scenario for projected commodity prices.

Step 5 Overview

- Integrate the concluding statement in Step 3B (Conduct Fundamentals Analysis) with the findings from Step 4 (Conduct Technical Analysis)
- Use expert judgement to reconcile any differences between the conclusions from Step 3 and Step 4
- Conclude with the final, most likely, price assumption for the projection period that, along with contextual information, will be incorporated into the SST under Step 3

The analyst will recall that a forecast or prediction describes "what will happen," whereas a projection is designed to tell us "what will likely happen if." Analysis resulting in a description of future food security conditions typically requires several key assumptions, based on 8- to 12-month projections, from a wide range of disciplines. Developing useful price projections therefore requires both analysts' technical understanding of a wide range of topics (ranging from markets to climate, nutrition, and household level-behavior) and their expert judgment to be able to identify what a reasonable "if-then" statement looks like in each setting. Once the analyst has identified how markets and prices typically behave over the period of interest and how things are likely to be different this time around, he/she can identify and communicate a most likely price path (based on the assumptions in Steps 3A/B).

Refine detailed and logical assumptions based on the application of fundamental market principles and drawing from proxy examples

Fundamentals analysis should be integrated with the technical analysis and additional data review that has occurred up to this stage in the development of price projections. Technical review and calculations of prices will provide quantitatively relevant assumptions based on historical price data and trend analysis; however, other factors will also influence the likely price path. The analyst should review macroeconomic factors and developments, including current and projected inflation, trade data, policy, and legal frameworks of relevance to the selected geographic area and period of analysis.

TIP

If the analyst has less than 24 months of historical data, Step 5 will be based on the concluding statements from Step 3.

Using a "convergence of evidence" from all previous data reviewed, analysts should develop graphical representations of price projections that include, at a minimum, the most likely price path over the projection period, and comparisons to selected historical reference periods and proxy examples. The "convergence of evidence" approach uses different types of information to make qualified statements about likely future events. If the analyst has completed all the steps outlined in this guidance, the convergence of evidence that supports all developed assumptions and analysis will be constructed based on inputs and data from multiple internal tools, including, but not limited to seasonal calendars, Price Bulletins, and seasonal indices, as well as historical trend data, trade flow maps, livelihood information, external assessment, and policy data and economic modelling. If the analyst has less than 24 months of historical data, this integrated price projection will be based on the concluding statements from Step 3.

TIP

With appropriate explanation, the upper or lower bounds resulting from the technical analysis in Step 4 may serve as the most likely price path (integrated price projection). Other sources (such as private traders or other analysts) are valid as well, if their underlying logic is clear and documented.

Analysts can introduce a margin of error and communicate inherent uncertainty when reporting on projected prices, based on the local context and historical price trends. This may come in the form of an upper/lower bound or a price ceiling/floor for the most likely situation over the projection period. Analysts are encouraged to provide commentary on the projected price trends, especially if the concluding statements made in Steps 3 and 4 diverge. It is imperative that analysts be very clear when presenting any integrated price projections that deviate from the results from one of the mathematical models used (technical analysis). This must be clearly documented in the notes/explanation that accompany the final integrated projection data table and associated charts (Step 5) and easy to identify based on the results from Step 4, where the analyst will present the outputs of the technical projection models.

STEP 5 Wrap Up

This step should conclude with nominal projected prices based on an integrated analysis for each month of the projection period presented in tabular form (Box 31), along with relevant historical reference prices (average, previous year, among others). It is often useful to present this analysis graphically as well (Box 32).

Box 31. Step 5 Observed and Integrated Price Projections – Baidoa, Red Sorghum (SOS/kg) **SOMALIA CASE STUDY**

Month	Historical average (2012–2016)	Previous year (2015/16)	Observed prices this year (2016/17)	Integrated price projection	Other reference year (2011)	Price ceiling
Sept	5,070	5,500	5,425		5,250	15,000
Oct	5,358	5,950	5,525		5,900	15,000
Nov	5,870	5,800	8,225		7,400	15,000
Dec	5,799	5,650	9,500		10,700	15,000
Jan	5,365	5,650	9,640		11,100	15,000
Feb	3,542	4,060		10,415	11,000	15,000
Mar	3,807	3,858		11,554	11,775	15,000
Apr	3,907	4,035		12,694	16,925	15,000
May	4,391	4,380		13,003	15,200	15,000
Jun	5,126	6,000		13,000	18,125	15,000
Jul	5,379	5,800		13,503	16,850	15,000
Aug	5,245	5,800		13,488	14,360	15,000

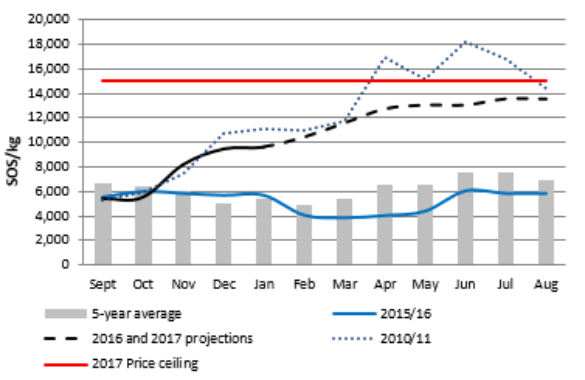
Note: Presenting data from the "other reference year" and a "price ceiling" over the projection period can be useful for the analyst, but is not required.

Compiling these data into visual representations that explain or support the assumption in question is helpful, and adds credibility to the projections. Specifically, communicating the anticipated price path with graphics can combine complex information into a clear and logical form for all readers, regardless of technical background and insight. The example graphic below provides a guide to the anticipated price path of red sorghum prices in Baidoa during a bad production year (2017).

Before moving to Step 6, the analyst should conclude with a final description and explanation of the most likely price path and any qualifications (upper/lower bound or price ceiling/floor, or how projected prices relate to historical reference periods). The description below provides an example of such a description in quantitative terms. It is important to note that the precise projected nominal value is only required by FEWS NET analysts when preparing price projections for HEA Outcome analysis. Otherwise, qualitative statements such as "above average" or "below average" are acceptable for integrated food security analysis and reporting.

Box 32. Step 5 Graphical Presentation and Accompanying Text– Baidoa, Red Sorghum (SOS/kg)

SOMALIA CASE STUDY



Example text to accompany the integrated projected prices

Prices in Baidao are expected to increase atypically during the postharvest season due to the impacts of below-average recent harvests. By August 2017, sorghum prices are expected to reach more than double their respective 2016 levels, and will be over 80 percent above the recent five-year average. The availability of imports of rice and wheat from stable international markets will provide a price ceiling of approximately SOS 15,000/kg, which is still below the very high levels attained in 2011.

Source: *FEWS NET (2017c) based on FSNAU data and authors.*

STEP 6: Identify Other Factors That Could Affect Market and Price Trends

At this stage in the projection development process, the analyst has already used fundamentals analysis as well as technical analysis to develop assumptions about the most likely price path and drivers to scenario development efforts designed to provide early warning, or at least an indication, of any concerns regarding acute food security. The integrated price projections presented in Step 5 are informed by a general review of typical conditions compared to current and expected conditions during the period of analysis. The price projections incorporate the available information to address the degree and duration of staple food price anomalies and their determinants, and convey the analyst's uncertainty about the actual price path.

Step 6 Overview

- Consider other locally relevant/applicable issues that may not be regularly reflected in annual price trends, but that the analyst is aware of in the marketing system
- Include (as applicable) geopolitical events, trade concerns, policy or border management, conflict, local/regional or national stock levels, pests and crop disease, etc.

However, future prices may also be impacted by unexpected or otherwise unpredictable (i.e., not typical drivers of anomalies in the area) yet contextually relevant policies, population movements, and events (global or local) that ultimately may have short- or longer-term impacts on price levels but are not considered part of the most likely scenario. The analyst should be cognizant of what he or she does not know or does not anticipate as part of the most likely scenario, and engage actively with local staff and institutions to gauge what additional factors might impact prices either directly or indirectly. This is critical when developing market/price or food security scenarios and allows the analyst to present an alternative scenario of market conditions that would lead to a different price path if the scenario took place. It is imperative that selected factors or events be realistic and relevant, but not considered as part of the most likely projected market drivers and scenario. This section addresses other avenues for information, and classifies the nature of other factors that might impact markets.

Review analogous/proxy historical examples

The analyst will identify relevant events or other issues that could impact the price projection through a process of context review and research. Often, these events have occurred previously in the region or locale in question, or similar events have occurred that may mirror the impact on food prices during the selected period of analysis. The analyst should carefully select relevant historical examples where the identified event or factor occurred, and draw a detailed comparison, explaining how the historical example may help predict how current or anticipated events impact prices moving forward. The analyst should look for specific differences and similarities to determine whether the identified factors are relevant for the analysis. The analyst may consider various questions when considering apparently analogous examples, including (but not limited to):

- Is the timing of the event the same in the period of analysis as in the example year? Is it later or earlier in the marketing year? What is the difference in terms of when the event occurred during the marketing year or the season?
- Is the production level of the staple food different than in the selected example year? Is production less or more in the specific areas of relevance to the current period of analysis?
- What sociopolitical factors (political stability, social cohesion, conflict, etc.) were present in the example year that are not present in the current period of analysis? If all factors are the same, is the severity or magnitude of price drivers different and noteworthy?
- Are national, region, or international macroeconomic factors (inflation, currency depreciation, government expenditures, etc.) generally comparable?
- What events in the year preceding the example year were different or similar to events that preceded the current period of analysis (i.e., conflict, bumper harvest, pests, or changes in institutional policy)?

Include (as applicable) other issues that may not be regularly reflected in future price trends

An infinite number of issues at the global, regional, or local level may occur or may be projected to impact prices and market function. In other words, a large number of obstacles and obstructions could limit, divert, or prevent flows of a commodity that contribute to the availability and access of food to a particular population or geographic area. The main message in this component is that the analyst address "other factors" aggressively and proactively, while remaining within a reasonable realm of possibility. Information regarding possible events, conditions, and/or concerns may emerge from conversations with field staff, from national or international news sources, through social media, or in academic or area-specific technical documentation. Analysts may glean information about a potential threat to price stability through basic research and review of local publications (such as assessments or area studies), or in consultation with FEWS NET science partners. In short, analysts should make a comprehensive attempt to identify any external or irregular events or conditions that might impact prices, and to harness sufficient information to make an educated assessment of the likely timing and severity of any anticipated impact on market systems and staple food prices. Some illustrative examples are presented in Table 2. The analyst may also assess that external factors, while likely to occur, may not have any noteworthy impact on future prices. In this case, the analyst should provide a comprehensive explanation and refer to appropriate proxy examples if possible. This will increase the validity of presented evidence and provide greater foundational support to the analysis overall.

Table 2. Illustrative Examples of Other Factors that Could Influence Price Trends

Crop disease	Cyclical and epidemic levels of crop diseases and pests are common in many FEWS NET countries. These include locusts, granivorous migratory birds, stalk borers, armyworms, aphids, and red mites. Projecting the price impact of a plant disease or pest outbreak would include a close technical examination of local and regional crop marketing chains to determine whether the outbreak/pest could affect prices through a reduction in supply. It may also be true that information regarding the degree of impact of the outbreak on crop losses (and by extension, prices) is unclear, incomplete, or insufficient, in which case, the price projection for affected cereals might include a qualifying statement that the impact of crop diseases may have an additional impact on projected price increases already anticipated due to growing demand for other processed foods (or whatever the relevant driver may be for the particular context and commodity).
Displacement and humanitarian requirements	In the case of a new wave of IDPs or refugees in a border area, the analyst may want to research the likelihood that the displaced population will remain in camps, versus returning home, and whether humanitarian assistance may alleviate market strain. Additionally, the analyst may want to consider price fluctuations occurring due to increased demand associated with other events occurring at present or imminently, such as the lean season, harvests, or restrictions on trader movement into conflict-affected areas. Finally, the analyst may gauge the ability of the humanitarian community to provide the necessary level of required assistance in the necessary timeframe. As mentioned in Step 3B, the introduction or maintenance of humanitarian assistance is often a consideration in the development of price projections. In this context, the analyst may wish to focus on any possible (but not captured within the most likely scenario) humanitarian pipeline and/or access disruptions that could alter current projected prices to higher levels, with subsequent impact on the degree of the projected price anomaly.
Changes in institutional demand	For example, an industrial producer of processed sorghum products may develop a new product or inherit an increased market share, and draw upon a larger stock than normal to process goods or support production. In this case, the analyst would want to understand the impact that a larger procurement may have on the supply market(s), and what reverberating effect may be observed in other markets, or how traders will behave in anticipation of more institutional or commercial procurement of staple food inputs.
Increase in global commodity prices	A food security analyst should have a good handle on which areas of the country rely on internationally imported commodities and which areas are supplied only by local stocks and production. Watching international price trends is generally indicative of global stock-to-use ratios (and therefore tradeable surpluses), which are somewhat inconsequential for food security outcomes in most countries. Instead, understanding the relationship between international and local prices is more important. If the analyst previously established in Step 2 that imported commodities are relevant and has reason to believe that the global market context could change (but not as part of the most likely scenario), he or she may want to include an assumption about this.

Source: *Authors.*

STEP 6 Wrap Up

Once the analyst has compiled the likely factors that could impact the projection, he/she can organize them in a table or another easy-to-review format that points the reader toward the exact expected implications of the possible factor on the established, most likely, price projection. For example:

Box 33. Step 6 Other Factors that Could Affect Market and Price Trends – Baidoa Sorghum, 2017 **SOMALIA CASE STUDY**

Area	Event	Impact on market outcomes
Somalia	Intensification of conflict, especially as result of parliamentary elections	Increased domestic market disruptions resulting in higher staple food commodity prices across affected markets and regions.
Somalia	Significantly below-average *Gu* 2017 harvest	Will most likely exacerbate the rapid increase of sorghum and maize prices.
Somalia	Intensification of food assistance	Market demand and prices will most likely increase through food and cash vouchers that are presently the main methods of intervention. In-kind assistance would reduce market demand, depressing market prices.
Somalia	Reduction in food assistance	In the event that humanitarian agencies and institutional actors are unable to maintain current levels of assistance, increased pressure on supply and demand for staple foods, particularly sorghum, maize, and wheat, will likely result in additional price increases.
Somalia, especially southern area	Substitution of rice and wheat for maize and sorghum	If households begin to substitute rice and wheat for maize and sorghum, maize and sorghum prices may stop increasing.

Source: *FEWS NET (2017c); Authors.*

Market and Price Monitoring

It is rare that FEWS NET analysts develop price projections and engage in market monitoring in a given geographic area only once. It is far more common for assumptions as inputs to integrated food security analysis be developed and then monitored and updated as needed on a regular basis. For the case of prices, monitoring and any necessary revisions typically take place monthly via the Price Watch, Price Bulletins, and other country-specific special monitoring reports. At times, detailed integrated projections need to be reviewed and revised carefully, especially during crises (such as the example from Somalia 2017 used throughout this document).

Given the importance of understanding the fundamental drivers of market and price trends, both key factors that shape prices and price series themselves should be monitored. While the analyst may have identified a number of key factors in Steps 3 and 6, it is not always feasible to monitor them all every month. Rather, the analyst should strategically identify the essential monitoring indicators that can feasibly be tracked on a regular basis, as well as any essential information gaps that require special attention or effort to gain a better understanding of the underlying local dynamics. This extra attention or effort may come in the way of a special market assessment to the area of focus, other remote desk research efforts, or discussions with key informants. The table below presents such a monitoring plan for the remainder of the 2016/17 marketing year in Somalia.

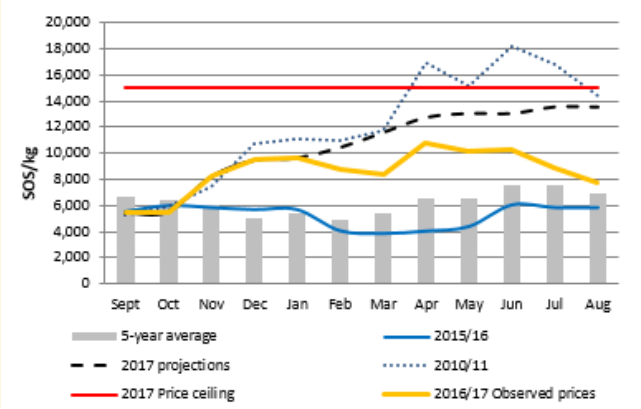
Box 34. Market Monitoring Indicators That Shape Baidoa Red Sorghum Price Trends **SOMALIA CASE STUDY**

Indicator	Justification
Remittances	A significant source of household income, remittances determine household participation in the staple food market, ultimately influencing market effective demand and price trends.
Humanitarian assistance in areas of concern	The role of humanitarian assistance (both in-kind and cash) is important to monitor since it influences demand, and ultimately price levels at subnational levels. This includes regional institutional procurements in preparation for humanitarian assistance needs in 2017.
International import volumes and prices of wheat (flour) and rice	If volumes of imported staple foods are high, especially in the central and northern areas of the country, the prices of these commodities may start declining as traders try to cut losses from oversupply.
Regional imports of sorghum	Regional imports moderate price increases across key markets.
International oil prices	This determines freight costs for imports and transport costs domestically, establishing the final price to consumers.
Foreign exchange rate	This determines the domestic price of imported staple food commodities (rice and wheat).

Source: *FEWS NET (2017c).*

This process is essential to FEWS NET for two dominant reasons. First, FEWS NET's early warning analysis must be as up to date as possible, so that any notable changes in our integrated food security analysis and essential inputs can be communicated effectively to USAID and other key decision makers. Second, the process of developing integrated price projections and then monitoring the actual market and price outcomes serves as a very useful learning exercise and enables FEWS NET analysts to improve their understanding of the local context and likely market response to shocks, thereby refining their expert judgment. Box 35 presents the projected and observed prices for Baidoa sorghum through the third quarter of 2017. As is evident here, a discrepancy arises between the prices that were projected in early 2017 and the observed outcomes. Upon a review of the market monitoring indicators, it became evident that humanitarian assistance was well underway during the period of analysis. However, this factor was not fully understood in February 2017, and therefore it was identified as a factor that could change the outlook.

Box 35. Price Monitoring Outcomes, Baidoa Red Sorghum (SOS/kg) **SOMALIA CASE STUDY**



Note: The projections that were developed in February 2017 are presented here, along with the observed price trends for the remainder of the year. FEWS NET revised its price projections on a monthly basis throughout the crisis as new information about market dynamics became available.

Justification for Differences Between Projections and Observed Price Outcomes

Prices in Baidao are expected to increase. Prices in Baidoa declined during the postharvest period, but not as sharply as usual. The availability of in-kind humanitarian assistance in the form of milled rice as early as February and March 2017 contributed to reducing market-dependent household purchases. In previous large-scale emergencies (2011), assistance was provided much later in the marketing year. The timing and large-scale volume of the 2017 assistance flows were therefore not anticipated or accounted for during the initial development of price projections in February 2017. The availability of relatively stable-priced food imports further reinforced market supplies, despite below-average availability of locally produced sorghum and maize. These two factors alleviated some of the pressure on markets in ways that were not originally anticipated, thereby resulting in observed price trends that were below the projected values, but still well above their respective 2016 and five-year average levels.

Source: *FEWS NET (2017c).*

Annex I. Scenario Summary Table (SST) Template

STEP 1: Set parameters

A Identify the specific geographic area of focus and provide the area's population.		C Choose scenario type[3]	
B Identify the household group that this scenario will focus on.[4] Provide the population estimate for this group and calculate what proportion of the area population this represents.		D Define scenario duration and timing	

STEP 2: Describe and classify current food security

A Summarize evidence of current food security conditions (e.g., seasonal progress, recent harvests, food prices, humanitarian assistance, etc.). (Current means beginning of the first month of the scenario period.)		
B Summarize evidence of current household (HH) food consumption and livelihood change. This could be direct evidence, like the result of a food security survey, or inferred evidence, like the outcome of livelihood-based analysis.	Food consumption:	Livelihood change[5]:
C Based on the response to 2A/2B, classify the current food insecurity of the chosen HH	HH Group (1B) Classification: Choose an item.	

[3] The default option for FEWS NET scenario building is a most likely scenario. In specific cases, additional scenarios can be developed.

[4] The default option for FEWS NET scenario building is the poorest wealth group, typically the "Poor," under the assumption that this group faces the most severe food insecurity and accounts for at least 20 percent of the area's population. Scenarios can also be built for livelihood groups (e.g., nomadic pastoralists) or other groups (e.g., IDPs).

[5] This should describe the different strategies households use to respond to current or expected food consumption deficits – this may include expansion of current livelihood strategies (e.g., increasing livestock sales) or the implementation of additional, new strategies (e.g., sale of agricultural tools). Livelihood change, however, is not included: consumption-based strategies (e.g., reducing number of meals or portion size, shifting to less preferred foods) fall under "Food Consumption"; nor is the loss of livelihoods or extreme loss of assets due to a shock; nor is a shift in livelihoods for reasons other than current or expected food consumption gaps.

group (1B) using the IPC 2.0 Household Scale.[6]	
D Based on the HH classification (2C), and available nutrition/mortality data, classify the overall area (1A) using the IPC 2.0 Area Scale.	Description of available nutrition information: Description of available mortality information: Area Classification: Choose an item. In the absence of emergency assistance would this classification be at least one phase worse? Choose an item.

STEP 3: Develop key assumptions

A List the key factors, relevant to food security, that are expected to behave normally during the scenario period.	•
B List the key shocks or anomalies that are expected to occur during the scenario period and that will affect food security. These events should be relevant to the chosen household group (1B). For each event, describe level of severity and expected timing as specifically as possible.[7]	•
C Is humanitarian assistance during the scenario period planned, funded, and likely? If so, describe these assistance plans (timing, size, mechanism, location). *Remember, we are interested in programs that together will reach the majority of the households covered by this scenario (1B) and provide substantial food or income.*	•

[6] When assigning the classification, consider what household food consumption typically looks like during this period. For example, if the analysis indicates that food consumption during the current lean season is typical, but, during a typical year, food deficits exist during this period, the household group might still be classified in a phase other than IPC Phase 1.

[7] Examples of key topics to be covered in Step 3 include: future rainfall, temperature, crop production, market functioning and staple food prices, conflict, labor wages, and labor demand.

STEP 4: Describe impacts on HH income sources

A List the sources of cash income typically used during the scenario period.	B Typically, how important is each income source during the first four months of the scenario period (ML1)?	C Given the assumptions made in Step 3, how will income from this source compare to average (4B) during the first four months of the scenario period (ML1)?	D Typically, how important is each income source during the second four months of the scenario period (ML2)?	E Given the assumptions made in Step 3, how will income from this source compare to average (4B) during the second four months of the scenario period (ML2)?	F If the level of income from a specific source will be different than usual, please explain why.
1. Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.	
2. Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.	
3. Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.	
4. Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.	
5. Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.	
6.	Choose an item.	Choose an item.	Choose an item.	Choose an item.	
7.	Choose an item.	Choose an item.	Choose an item.	Choose an item.	

G List any atypical sources of cash income likely to be used during the scenario period.[8]	H How important will each income source be during the first four months of the scenario period (ML1)?	J How important will each income source be during the second four months of the scenario period (ML2)?	K Describe the evidence that suggests each atypical income source will be used.
1.	Choose an item.	Choose an item.	
2.	Choose an item.	Choose an item.	
3.	Choose an item.	Choose an item.	

L Given the assumptions in Columns C and H, how will total household income compare to normal during ML1?	Choose an item.	M Given the assumptions in Column E and J, how will total household income compare to normal during ML2?	Choose an item.

[8] This should include any humanitarian assistance provided as cash or voucher.

STEP 5: Describe impacts on HH Food sources

A List the sources of food typically consumed during the scenario period.	B Typically, how important is each food source during the first four months of the scenario period (ML1)?	C Given the assumptions made in Step 3, how will food from this source compare to average (5B) during the first four months of the scenario period (ML1)?	D Typically, how important is each food source during the second four months of the scenario period (ML2)?	E Given the assumptions made in Step 3, how will food from this source compare to average (5B) during the second four months of the scenario period (ML2)?	**F** If the level of food from a specific source will be different than usual, please explain why.
1. Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.	
2. Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.	
3. Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.	
4. Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.	
5. Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.	
6.	Choose an item.	Choose an item.	Choose an item.	Choose an item.	
7.	Choose an item.	Choose an item.	Choose an item.	Choose an item.	

G List any atypical sources of food likely to be consumed during the scenario period.[9]	H How important will each food source be during the first four months of the scenario period (ML1)?	J How important will each food source be during the second four months of the scenario period (ML2)?	**K** Describe the evidence that suggests each atypical food source will be used.
1.	Choose an item.	Choose an item.	
2.	Choose an item.	Choose an item.	
3.	Choose an item.	Choose an item.	

L Given the assumptions in Columns C and H, how will total household food consumption compare to normal during ML1?	Choose an item.	M Given the assumptions in Column E and J, how will total household food consumption compare to normal during ML2?	Choose an item.

[9] This should include any humanitarian assistance provided as food.

STEP 6: Describe and classify projected household food security

A Given current conditions and outcomes (Step 2) and projected access to food and income (Steps 4 and 5) describe the evolution of household food consumption and livelihood change during the two scenario periods for the chosen HH group. *This description should not recap information provided in earlier steps. Rather, it should answer the following key questions: 1. On average, will households be able to meet basic food requirements during the scenario period? 2. Will households have adequate income to afford key nonfood expenditures and protect their livelihoods?* Classify food consumption into one of the five HEA categories described in the IPC Reference Table (e.g., small or moderate "Livelihood Protection Deficit" <80%).	ML1 Food consumption: ML1 Livelihood change: HEA category: Choose an item.	ML2 Food consumption: ML2 Livelihood change: HEA category: Choose an item.
B Based on the response to 6A, classify the chosen HH group (1B) in this area using the IPC 2.0 Household Scale. [10]	HH Group (1B) Classification for ML1: Choose an item.	HH Group (1B) Classification for ML2: Choose an item.

[10] When drawing these final conclusions, be sure to consider what household food consumption typically looks like during the period of interest. For example, if the analysis indicates that food consumption during the lean season will be typical, but, during a typical year, food deficits exist during this period, the household group might still be classified in a phase other than IPC Phase 1.

STEP 7: Describe and classify projected area food security

A Describe how malnutrition and mortality are likely to evolve in this area during the scenario period. Consider current levels of malnutrition and mortality (2D), projected changes to food access (Step 6A), and other factors that may affect malnutrition (e.g., seasonality, disease, and local caring practices).		
B Based on Step 6B and Step 7A, classify this area according to the IPC 2.0 Area Scale. Remember to provide classification for the entire scenario period. *Note that malnutrition and mortality are relevant to IPC classification as supporting evidence of food access constraints.*	Area classification for ML1: Choose an item. If the emergency assistance described in Step 3C did not occur would this classification be at least one phase worse? Choose an item.	Area classification for ML2: Choose an item. If the emergency assistance described in Step 3C did not occur would this classification be at least one phase worse? Choose an item.

STEP 8: Identify events that could change the scenario

If the scenario developed above is a "most likely" scenario, list key events that would significantly change the projected outcomes described in Steps 6 and 7. In addition to local events, consider national, regional, and international events. Select events that: *Are possible, but are not included in the scenario. Extremely unlikely events should not be included here.* *Would result in a change in the IPC classification for this area.*	

Annex II. Glossary of Key Terms

The following provides the definitions of several key terms used throughout the guidance document. For more detail on these definitions and other useful terms, consult the FEWS NET Markets and Trade Glossary.

Accessibility
One of the three pillars of food security. A household's ability to physically, economically, and socially obtain a necessary amount of food on a regular basis by purchasing, bartering, borrowing, or receiving food aid or gifts. See also: *availability*.

Anomaly
A deviation from the norm or average.

Assembly market
A market where smaller quantities of a commodity are accumulated or aggregated, usually from different farmers and small-scale traders. Assembly markets facilitate marketing, reduce the costs of marketing, and allow for the movement of commodities, which enables sellers from remote areas to reach distant buyers. See also: *market type*.

Availability
One of the three pillars of food security. The total amount of food that is present in a country or given area by means of domestic production, imports, food stocks, and food aid. See also: *accessibility.*

Bimodal area
An agro-ecological zone with either a single prolonged rainy season with two rainfall peaks or two or more distinct rainy seasons (which could each be unimodal or bimodal), resulting in two or more harvests. The amount of rainfall can be equivalent between rainy seasons or one may be dominant (for all commodities or for a single crop), resulting in differing yields between seasons. See also: *unimodal area.*

Cash crop
An agricultural commodity grown for sale as opposed to consumption on the farm.

Commodity
A raw material or primary agricultural product that has value and can be exchanged. Commodities include food and cash crops, livestock, and nonfood consumer items.

Commodity balance sheet
Shows balances of food and agricultural commodities in a standardized form. The scope of standardization is to present these data in a less detailed form for a selected number of commodities without causing any significant loss of the basic variables monitoring the agriculture sector. The selected commodities include the equivalents of their derived products falling in the same commodity group, but exclude the equivalents of byproducts and derived commodities, which through processing change their nature and become part of different commodity groups.

Deflation
A reduction in the aggregate level of prices in an economy. See also: *inflation*.

Exchange rate
The price of one nation's currency in terms of another nation's currency.

Food balance sheet
Presents a comprehensive picture of the pattern of a country's food supply during a specified reference period. A food balance sheet (FBS) shows an estimate of opening stocks, local production, exports, consumption, and imports and can indicate surpluses within a country or region. An FBS can include population and nutritional conversion factors, allowing for calculation of average per capita availability of calories, protein, and fat.

Forecast
A prediction that is designed to tell "what will happen," typically in the context of prices. See also: *projection*.

Formal trade flow
The exchange of large quantities of a given commodity, transported by road, rail, or sea. These trade flows are inspected, taxed, and reported in official government statistics, and abide by the requirements of the local legal system (including national-level laws and regional trade agreements). For example, in some countries, an importer or exporter is required to obtain a license from the local government or regional trade body that gives authority to engage in import or export activities. Formal trade can often also be thought of as legal trade.

Green harvest
Gathering of an unripe crop.

Inflation
An overall rise in the prices of goods and services in an economy. An inverse relationship exists between the prices of goods and services and the value of money in an economy: other things being equal, as prices rise over time, a given amount of money will be able to purchase fewer and fewer goods and services. See also: *deflation*.

Informal trade flow
Trade flows that typically occur outside of the formal trade system. These exchanges are rarely recorded in official government import and export statistics and are not inspected and taxed through official channels. These trade flows are typically undocumented, unlicensed, and unregistered. Informal trade flows can vary from very small quantities carried by bicycle across small border crossing areas to large volumes exchanged over long distances via barge.

Integrated Food Security Phase Classification (IPC)
A set of standardized tools that aims at providing a "common currency" for classifying the severity and magnitude of food insecurity.

Large trade flows
The volumes traded (through either formal or informal channels) that are estimated to be more important than other trade flow volumes in aggregate terms over the period of analysis. In unimodal FEWS NET countries, this represents the relative importance of trade flows between different geographic areas over a given marketing year. In bimodal areas, these may be season-specific. Because it is not possible to estimate actual trade flow volumes between markets in most FEWS NET countries, these are estimated based on discussions with key informants familiar with the staple food market system of a given country or region.

Lean season
The time of year when a household's access to food and/or cash income is typically most constrained. During this period, households tend to be at greater risk of food insecurity.

Livelihoods
The means by which households obtain and maintain access to essential resources to ensure their immediate, medium-term, and long-term survival.

Market
A place for buyers and sellers to come together to trade. Markets can be viewed as social arrangements that allow buyers and sellers to discover information or carry out a voluntary exchange of goods or services. Markets are normally physical locations, but not always. Transactions can occur on the phone, over the Internet, through intermediaries, etc. Commodities, livestock, and labor can be exchanged through markets. Markets influence the three pillars of food security: availability, accessibility, and stability.

Market conduct
A firm's policies toward its product market and toward the moves made by its rivals in the market. The behavior or conduct of a firm depends on the market type in which it operates. Examples of market conduct include: setting prices, setting product quality and other nonprice policies, and seeking strategic advantage and deterring entry.

Market demand
The choice of specific goods and services that satisfy the wants and needs within the limits imposed by income (purchasing power).

Market dependence
The degree to which individuals depend on markets to access food as opposed to consuming food they produce.

Market integration
The ease with which prices are transmitted from one market to another, usually measured by the degree of correlation between prices in different markets. Generally, a high correlation implies more integration. Integration implies a relationship, but not necessarily causality.

Market performance
The extent to which markets result in outcomes that are deemed good or preferred by society. Market performance reflects how well the market fulfills certain social and private objectives; performance outcomes typically include price levels and price stability in the long and short term, profit levels, costs, efficiency, and quantities and quality of food commodities sold.

Market structure
The economically significant features of a market that affect the behavior of firms in the industry supplying that market. The main elements of market structure are: seller concentration, product differentiation, barriers to entry of new firms, buyer concentration, height of fixed costs and barriers to exit, and growth rate of market demand.

Market supply
The willingness and ability of sellers or suppliers to make available different possible quantities of a good at all relevant prices. Determinants of supply include but are not limited to: own price, price expectations, price of inputs, production technology, and macroeconomic factors.

Market system
The network of actors involved in the production, exchange, and/or consumption of goods and services, which relies on infrastructure and other services and inputs, and operates within the formal and informal regulatory and social frameworks in a given context.

Market type
Various categories of markets based on size, location, different kinds of buyers, sellers, flow of goods and services, and the state, quality, and quantity of goods and services being traded.

Marketing cost
The total cost associated with delivering goods and services to consumers. Includes transport, storing, promotion, and distribution costs. Also known as distribution cost.

Medium trade flows
The volumes traded, through either formal or informal channels, that are estimated to be somewhere in between large and small flows in terms of the aggregate volumes traded over the period of analysis. These are estimated through the same process as large trade flows.

Occasional trade flows
Trade flows that either take place during very specific times of year (for example, in the lean season only) or when certain specific conditions present themselves. These are typically not as important (in aggregate quantity) as other more regular types of trade flows.

Price
The cost or value of a good or service expressed in monetary terms. It is the financial cost paid when one buys a unit of a specific product or service. Prices, in the purest sense, indicate value that has been added to a particular commodity. Price signals can carry information about cost of production, transportation, storage, perceptions and desires, as well as, in some instances, distortions.

Price determination
The result of the interaction of supply and demand. This process occurs naturally when particular market conditions are in place, refers to naturally occurring exchanges between market actors, and yields an equilibrium price.

Price discovery
The interaction between buyers and sellers to determine the spot price of a good or service based on each actor's estimation of supply and demand.

Price transmission
The process in which prices in one market affect prices in another market. Often used to describe the effect of upstream prices on downstream prices.

Projection
A prediction that is designed to tell "what will likely happen if," typically in the context of prices. See also: *forecast*.

Projection period
Months selected for scenario period (e.g., typically eight months for a FEWS NET Food Security Outlook scenario).

Purchasing power
Measurement of the relative value of money in terms of the quality and quantity of goods and services it can buy. It represents the ability of a household to acquire goods and services based on its access to money or other forms of wealth.

Reference market
A local, regional, or international market that provides information about supply, demand, and price conditions in other markets or key markets that influence the performance of others and are directly tied to food insecure and vulnerable populations. See also*: market type*.

Reference period
A period of time used to help explain or project into the future the performance and likely food security outcomes of the current period. For example, previous drought years provide an illustration of the potential progression and outcome of a current drought year.

Seasonal calendar
A graphical presentation of the months in which food and cash crop production and key food and income acquisition strategies take place. It also shows key seasonal periods such as the rains, periods of peak illness, and the hunger season.

Seasonal price index
The average monthly price of a commodity relative to the average annual price.

Seasonality
A process that repeats itself on regular and predictable intervals (usually once every 12 months) often due to biological processes (like the rainy season, which drives market supply) or social events (like holidays, which drive consumption patterns and market demand). Most crops have specific planting, harvesting, and peak consumption times that commonly result in observed seasonal price variation. Livestock body conditions and reproduction patterns also exhibit seasonal patterns, resulting in seasonal price variation.

Scenario development
A hallmark of FEWS NET analysis, a methodology for forecasting future events. It relies on analysis of the current situation, the creation of informed assumptions about the future, a comparison of their possible effects, and a description of the likely response of various actors.

Self-sufficiency ratio
The extent to which a country can satisfy its food needs from its own domestic production. This ratio can be applied at the individual, country, or regional level.

Shock
An atypical event or series of events (either rapid or slow-onset) with significant impact. Shocks can be positive (e.g., a significantly better-than-average harvest) or negative (e.g., a failed below-average harvest or an unseasonable increase in food prices).

Stability
One of the three pillars of food security. Refers to constant and steady access to available food over time that may be threatened by adverse weather conditions, political instability, or economic factors.

Small trade flows
The volumes traded, through either formal or informal channels, that are estimated to be less important than other trade flow volumes in aggregate terms over the period of analysis. These are estimated through the same process as large trade flows.

Spatial arbitrage
The act of taking advantage of a price differential across locations or markets. The differential must exceed all costs of moving the commodity from one location or market to another (costs of the interspatial transfer). A simple measure of potential spatial arbitrage is the difference between the prices observed for the same product in two different locations.

Spot Price
The current price in the market at which a given commodity can be bought or sold.

Substitute good
A commodity that can replace another in consumption or production, such as millet for sorghum. When the price of one commodity rises, consumers will decrease their consumption of that commodity and increase consumption of the substitute commodity.

Trade
The transfer of ownership of a good or service from one person or entity to another in exchange for something (monetary or otherwise).

Trade flow
The movement of goods and services resulting from buying and selling. See also: *formal trade flow, informal trade flow, large trade flows, medium trade flows, small trade flows, occasional trade flows*.

Transaction costs
The costs associated with transacting: includes time, effort, and cash expenses and all costs other than the price. It also includes costs associated with gathering information about the market and market opportunities and enforcing agreements, as well as formal and informal commissions and fees and the cost of physically moving the product from seller to buyer.

Unimodal area
An agro-ecological zone with one distinct rainy season with one rainfall peak and typically a single harvest. See also: *bimodal area.*

Annex III. Integrated Price Projections Guidance Note Summary

Introduction

Link to Scenario Development	Assumptions about food availability and food access, including but not limited to prices, are essential inputs to forward-looking food security analysis. This guidance note summary facilitates the work of food security analysts when developing assumptions about prices for Scenario Development (SD) Scenario Summary Tables (SSTs). This is part of the "Price Projections Toolkit," including the guidance note summary, the integrated price projections worksheet for analysts, and the Technical Projections Excel workbook. This guidance note summary provides an overview of the six basic steps to developing integrated price projections for food security early warning. Analyzing historical price trends alone (technical analysis), without broader contextual information (fundamentals analysis), will likely yield unreliable price projections and is therefore strongly discouraged. Similarly, a lack of complete or reliable historical price data makes it difficult to conduct technical price analysis, thereby reducing the reliability of price projections. Technical price analysis should be supplemented by expert judgment from relevant industry actors and/or local experts across related sectors (agriculture, marketing, climatology, pastoralism, cereal production, etc.). Several steps are linked directly to FEWS NET's SD process and highlighted. In addition to price data, users will rely heavily on existing knowledge of supply, demand, trade, and the macroeconomic context. This knowledge may be gleaned from expert knowledge based on extensive field experience, primary field assessment data, as well as secondary data and reports. When seeking feedback from regional and home office staff, it is imperative that the completed integrated price projections worksheet for analysts be accompanied by any corresponding Excel files used to prepare the analysis and inputs in Step 4 and Step 5.

STEP 1: Situate the analysis in time and space

Informed by SD Step 1	**TIP:** Confirm at least 24 months of historical price data are available for the selected reference market. It is also helpful to verify the availability of other price data for key source or destination markets, as well as prices for key substitutes. ▪ Identify the geographic area of the analysis and the projection period. ▪ Select commodities for the analysis based on their relative importance to local livelihoods. Indicate whether the area is deficit or surplus for the commodity in question. ▪ Select representative markets based on relative importance to the relevant marketing system. ▪ Use Livelihoods and Markets and Trade products and tools to help situate the analysis. ▪ Select price type (producer, retail, wholesale, export) based on the focus of the analysis and strategic position of the identified representative markets in the marketing system. ▪ Consider key characteristics of the representative market or market system, and identify external or intrinsic factors that may influence the market(s). ▪ Inspect price data and address data gaps and reliability concerns, as possible.

STEP 2: Describe typical market and price behavior (current and for projection period)

Informed by SD Step 1	**TIP:** Confirm whether the area of analysis is structurally deficit or structurally surplus, the nature of any trade flows into or out of the area of analysis, and the relationship in price trends between key substitutes. Be sure to include basic commentary on typical seasonal price trends (the seasonal price index is a useful tool for this). Develop an understanding of market behavior and drivers and obtain reliable and relevant data and information regarding typical market and price trends at the time of the analysis (inclusive of the projection period), expected determining factors for supply and demand, and other influences that shape food prices on a cyclical or seasonal basis. Data can be qualitative and qualitative in nature. At this point it may be useful for the analyst to: ▪ Identify any key substitutes or complements. ▪ In deficit areas, describe the market behavior in key source markets and price transmission patterns. ▪ In surplus areas, outline and describe dynamics in key destination markets. ▪ Analyze historical price trends for selected commodities as relevant to the focus country, region, or locality.

STEP 3: Conduct fundamentals analysis

Informed by SD Step 1	Describe market and price trends, using the findings from Step 2 to clearly identify any current or projected anomalies in the marketing system and their root causes. Develop assumptions about anticipated price drivers and their implications over the projection period. ▪ Describe current market conditions. ▪ Develop assumptions about market conditions over the projection period. **STEP 3A: Describe current market conditions** Describe current market and price trends. Identify the nature and timing of observed anomalies relevant to the selected market system, as they relate to the normal drivers in the marketing system. Define root causes of anomalies, and if they are time-bound, singular, continuous, and/or predictable. Identify relevant reference years to compare and contextualize market conditions, including anomalies and their determinants. **STEP 3B: Develop assumptions about market conditions over the projection period** Explain any root causes of expected anomalies, and whether they are time-bound, singular, continuous, and/or predictable. Highlight the timing and nature of any expected anomalies relevant to the selected market system and projection period. Conclude with clear assumptions about market conditions in the projection period based on descriptions of the expected impact or influence of the projected anomalies. These assumptions should include qualitative statements about likely price impacts of any projected anomalies.

STEP4: Conduct technical analysis

Informed by SD Step 1	Use a mathematical model to develop simple technical price projection if more than 24 months of price data are available. **TIP:** For this step, analysts can use the decomposition method (Excel) or smoothing regression analysis (Excel) available in the Technical Projections Excel workbook of the price projections toolkit or more advanced price forecasting models. Building on Step 2, demonstrate how prices normally behave during the period of analysis, and how they will likely behave given current price levels. Where available, consult with relevant research institutions (local, regional, or international) that develop short- and long-term price forecasts using more robust statistical tools. Incorporate the seasonal price index and other institutional data and tools when available. Introduced a margin of error (based on historical price variations) to illustrate price uncertainty over the projection period. Conclude with nominal projected prices based only on the mathematical model(s) used for each month of the projection period. It is also useful to present the technical projections graphically, including how they relate to historical price levels.

STEP 5: Develop integrated price projections

Include in SD Step 3	Use a "convergence of evidence" from the fundamentals analysis (including the concluding statements from Step 3B) and technical analysis (Step 4), and expert judgment of FEWS NET analysts to identify the most likely price path, as well as an upper and lower bound that convey the analyst's perception of the level of uncertainty in the marketing system. **TIP:** If less than 24 months of historical data are available, this will be based on the concluding statement from Step 3. Augment and refine this information with expert judgment from FEWS NET analysts, technical partners, and the private sector (such as traders). Convey uncertainty through upper and lower bounds that are established through an analysis of historical price variation, expert judgement, and the analyst's understanding of the market context. Conclude with the analyst's final, most likely, price assumption for the projection period. Unless otherwise specified, nominal projected prices should be presented for each month of the projection period in tabular and graphical form. This assumption, along with any other contextual information, will be incorporated into the analyst's SSTs under Step 3.

STEP 6: Identify other factors that could affect market and price trends

Include in SD Step 8	Review analogous historical examples and describe the factors that are similar and divergent to further contextualize and strengthen the applicability of the price projection. Include (as applicable) geopolitical events, trade concerns, policy or border management, conflict, local/regional or national stock levels, pests and crop disease, and other issues that may not be regularly reflected in annual price trends and that could influence future prices.

Annex IV. Integrated Price Projections Worksheet Template

Introduction

Link to Scenario Development	Assumptions about food availability and food access, including but not limited to prices, are essential inputs to forward-looking food security analysis. This integrated price projections worksheet for analysts facilitates the work of food security analysts when developing assumptions about prices for Scenario Development (SD) Scenario Summary Tables (SSTs). This is part of the "Price Projections Toolkit," including the guidance note summary, the integrated price projections worksheet for analysts, and the Technical Projections Excel workbook. This worksheet guides users through the six-step process for developing integrated price projections developed by the FEWS NET Markets and Trade team. This includes both fundamentals and technical analysis of market and price trends. Several steps are linked directly to FEWS NET's Scenario Development (SD) process and highlighted. In addition to price data, users will rely heavily on existing knowledge of supply, demand, trade, and the macroeconomic context. This knowledge may be gleaned from expert knowledge based on extensive field experience, primary field assessment data, and secondary data and reports. When seeking feedback from regional and home office staff, it is imperative that the completed integrated price projections worksheet for analysts be accompanied by any corresponding Excel files used to prepare the analysis and inputs in Step 4 (Conduct Technical Analysis) and Step 5 (Develop Integrated Price Projections) of this worksheet.

STEP 1: Situate the analysis in time and space

Informed by SD Step 1	**TIP:** Confirm at least 24 months of historical price data are available for the selected reference market. It is also helpful to verify the availability of other price data for key source or destination markets, as well as prices for key substitutes.	
	Reference market	
	Country	
	Region/Province/Livelihood Zone	
	Commodity	
	Currency and unit of measure	
	Projection period	
	Price chart and notes from visual inspection of historical price data	

STEP 2: Describe typical market and price behavior (current and for projection period)

Informed by SD Step 1	**TIP:** Confirm whether the area of analysis is structurally deficit or structurally surplus, the nature of any trade flows into or out of the area of analysis, and the relationship in price trends between key substitutes. Be sure to include basic commentary on typical seasonal price trends (the seasonal price index is a useful tool for this). **TIP:** Fill out A-E in table with short responses. In part F, describe typical market and price behavior (current time and over the projection period).	
	A. Surplus or deficit area (typically)	
	B. Typical main destination (if surplus area) or source (if deficit area) of supply (local production, other domestic markets, regional markets, international market)	
	C. Typical harvest month(s)	
	D. Typical lean season month(s)	
	E. Key substitutes or complements	
	F. Description:	

STEP 3: Conduct fundamentals analysis

Informed by SD Step 1	Describe market and price trends, using the findings from Step 2 to clearly identify any current or projected anomalies in the marketing system and their root causes. Develop assumptions about anticipated price drivers and their implications over the projection period. ▪ Describe current market conditions ▪ Develop assumptions about market conditions over the projection period **TIP:** This step should conclude with clear assumptions about market conditions in the projection period based on descriptions of the expected impact or influence of the projected anomalies. These assumptions should include qualitative statements about likely price impacts of any projected anomalies.

STEP 4: Conduct technical analysis

Informed by SD Step 1

Use a mathematical model to develop simple technical price projections if more than 24 months of price data are available.

TIP: For this step, analysts can use the decomposition method (Excel), the smoothing regression analysis (Excel) available in the Technical Projections Excel workbook of the price projections toolkit, or more advanced price forecasting models.

TIP: This step should conclude with nominal projected prices based only on the mathematical model(s) used for each month of the projection period. It is also useful to present the technical projections graphically, including how they relate to historical price levels.

Month	Observed prices this marketing year	Technical projection (Model 1)	Technical projection (Model 2)	Technical projection (Model 3)

Chart	Notes

STEP 5: Develop integrated price projections

Include in SD Step 3

Use a "convergence of evidence" from the fundamentals analysis (including the concluding statements from Step 3B) and technical analysis (Step 4), and expert judgment of FEWS NET analysts to identify the most likely price path, as well as an upper and lower bound that convey the analyst's perception of the level of uncertainty in the marketing system.

TIP: If less than 24 months of historical data are available, this will be based on the concluding statement from Step 3.

TIP: This step should conclude with the analyst's final, most likely, price assumption for the projection period. Unless otherwise specified, nominal projected prices should be presented for each month of the projection period in tabular and graphical form. This assumption, along with any other contextual information, will be incorporated into the analyst's SSTs, under Step 3.

Month	Historical average (YYYY-YYYY)	Previous year (YYYY)	Observed prices this year (YYYY)	Integrated price projection	Other reference year (YYYY)	Lower bound	Upper bound

Chart	Notes

STEP 6: Identify other factors that could affect market and price trends

Include in SD Step 8	Include (as applicable) geopolitical events, trade concerns, policy or border management, conflict, local/regional or national stock levels, pests and crop disease, and other issues that may not be regularly reflected in annual price trends and that could influence future prices.

Annex V. Technical Projections using the Decomposition Approach in Excel

As discussed in the main sections of this guidance document, FEWS NET analysts are strongly encouraged to understand and make market and price projections and assumptions based on an understanding of the fundamental drivers of prices (the price determination processes, including market supply and demand) as well as of price trend modeling (technical analysis). FEWS NET market specialists view fundamentals analysis and technical price analysis as inherently complementary. This Annex, which is a part of the Price Projections Toolkit, focuses exclusively on the latter and draws heavily from Negassa and Rashid (2010). Furthermore, analysts are encouraged to use this Annex with the preexisting Technical Projections workbooks containing commonly used formulas and charts available to all project staff.

Many price analysis methods and tools exist and can be used to develop forward-looking price projections. For example, many econometric models exist that take into account the statistical properties of the data, including autocorrelation structure, among others. Such models can be very accurate and useful when elaborated by trained economists and statisticians. However, FEWS NET staff come from a wide variety of backgrounds and must rely on methods and tools that can be easily used by anyone on the project. Thus, Annex V focuses on the ***price decomposition approach*** and some suggested extensions for developing forward-looking technical price projections while Annex VI focuses on ***exponential smoothing methods***. Analysts are nevertheless encouraged to explore other options for the purposes of comparison, and to reach out to FEWS NET Markets and Trade staff for guidance and support when familiarizing themselves with other models and tools.

The price decomposition approach essentially involves using a series of formulas to parse out the various components of one's price series (**seasonality, long-term trend, cyclical component, and an irregular component**). An analyst can then use a subset of those components, combined with other adjustments and considerations that will be discussed, to make projections about the likely future price path.

The starting point for this approach is a common understanding that agricultural prices (including, but not limited to storable staple foods) are driven by short-term and long-term factors. Those factors are directly linked to the fundamental principles of supply and demand and include:

- Seasonality: A process that repeats itself on regular and predictable intervals (usually once every 12 months) often due to biological processes or social events.
- Long-term trends: Factors that shape supply and demand over the long term, like population growth or the general process of agricultural development.
- Cycles: Price movements that occur over several years, such as macroeconomic cycles.
- Random (irregular) factors: Other factors that influence prices but are difficult to predict such as a drought or a macroeconomic shock.

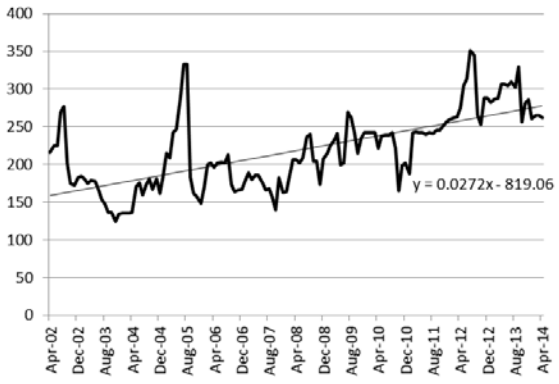
Several ways of decomposing time series variables exist (e.g., additive model, multiplicative model).

The basic multiplicative model used in this Annex is $P_t = T_t \times S_t \times C_t \times I_t$ Where	
P_t	Is the time series variable of interest
T_t	Is the long-term trend in the data
S_t	Is a seasonal adjustment
C_t	Is the cyclical adjustment factor
I_t	Represents irregular or random variation

There likewise exist several different techniques to isolate and examine the different components of time series variables for the purposes of developing forward-looking projections. This guidance note focuses on the **ratio-to-moving average** method.

This guidance note demonstrates how to identify the different components of one's time series (listed above) and how to use a subset of those components (focusing on the product of the seasonal adjustment S_t and the long-term trend T_t, but also allowing for margins of error) to develop a forward-looking technical price projection.

Figure V.1. Millet Prices in Tahoua, Niger (XOF/kg)



Source: *Price data from SIMA, Niger; calculations by FEWS NET.*

Technical projections Step 0: Visual inspection of the data

The first step to carrying out any kind of price trend analysis is to visually inspect the historical price data.[11] This is best done by plotting the data in Excel. Adding a simple trend line can be useful as well (shown here). Many important properties of the data can be identified at that time. For example:

- **Are the data continuous, or are there breaks?** For the case of Tahoua, Niger millet prices, the price series is continuous, with no missing values (Figure V.**1**).
- **Do there appear to be any strong seasonal (repeated short-term) or long-term (over many years) trends?** For the case of Tahoua, Niger millet prices, there do appear to be strong repetitive patterns in the data, increasing between April and July and decreasing between September and December.

> Analysts are recommended to keep all raw data analyzed on one tab of an Excel workbook, labeled "data," and to carry out their analysis (including this visual inspection) on separate but well-labeled tabs that link directly to the original data. This may also come in handy if an analyst wants to carry out price analysis for multiple markets or price series (within the same workbook, or by saving a new version of the workbook and simply changing the data on the "data" tab). Please see the attached workbook for an example.

- **Is there any indication of major structural changes in the data series?** For example, did the data stay within a certain range over a few years and then gradually or abruptly jump up or down and then remain within a new range thereafter? For the case of Tahoua, Niger millet prices, the price series varies within a range of roughly XOF 150–250 between 2002 and 2009, and then after 2009 the price series ranges between roughly XOF 250–350. As an analyst, it is important to understand what happened over the time series of the data to drive such trends and whether the data from before the transition point (roughly 2009 in this case) are relevant for projecting short-term future price trends.

This bring us to an important set of questions that FEWS NET analysts are often asked. Please note that the frequently asked questions presented here (and the responses) are for the purposes of illustration only. When in doubt, analysts should feel free to reach out to the regional markets specialist.

Frequently Asked Question 1: What is the minimum number of data points required to carry out technical price analysis to develop price projections using the price decomposition approach presented here?

Answer 1: Analysts need a minimum of 24 historical data points to calculate a seasonal price index and trend for 12 months (using a centered moving average).

However, when using such information for forward-looking projections, one would need to assume that the behavior of prices (and markets) over the 24-month period is generally normal and roughly represents what the analyst would

[11] The assumption is that the analyst has already identified the appropriate data series to analyze, based on an understanding of the livelihoods of the poor and very poor and local markets.

expect to happen during a typical year. Otherwise, one will obtain biased results that may not be useful when trying to formulate assumptions about likely future price trends.

The length of the time series chosen for analysis may not only be driven by data availability. For example, it is up to the analyst to determine what period of data to use for the purposes of carrying out a price analysis if a major shock to the marketing system occurred at some point during the time series in question. That is to be determined on a case-by-case basis and hinges on the analyst's knowledge of major market events during the period for which he/she has price data. For example, in the Tahoua Niger millet price example, an analyst might not want to use all of the available 12 years of monthly data and might simply focus on the most recent period (from 2009 onward).

As noted elsewhere, one can still formulate market and price assumptions, even if one is unable to carry out the type of price analysis presented in this Annex. Those assumptions will be largely based on the analysis of fundamental drivers of prices and may just speak to actual price trends in a much more qualitative way.

Frequently Asked Question 2: How does one address missing historical data points?

Answer 2: The answer here is really "it depends." While data interpolation models exist, it is up to the analyst to determine how many data points are acceptable to interpolate.

If there is just one missing value, it may be perfectly acceptable for the analyst to just take the average of the adjacent prices to input the missing value. If there are more than one, the analyst can use built-in formulas in Excel (Trend; Step interpolation) or other statistical software packages he/she is familiar with.

If many missing values exist in the middle of the data series being analyzed, it is up to the analyst to determine whether it is best to try and interpolate those missing values or whether there are sufficient data points to just carry out the price analysis using a shorter period, after the break.

Frequently Asked Question 3: Is this type of analysis only possible with monthly data?

Answer 3: This guidance note certainly focuses on price trends analysis for monthly data. However, one can carry out similar analysis using quarterly, weekly, or daily prices. If analysts have access to weekly or daily data, they are encouraged to aggregate those data to monthly averages to facilitate analysis.

Technical projections Step 1: Deseasonalize the data

To develop technical price projections, analysts will first parse out the components of the price series highlighted in the basic multiplicative model. The first step involves deseasonalizing the price data by calculating a 12-month moving average (MA_t) for the series (Figure V.2). This removes the short-term fluctuations that may be present in the data including both seasonal (S_t) patterns and irregular (I_t) components or shocks. Assuming a 12-month period (monthly data), the moving average for a time period t (MA_t) is calculated as the average of 12 months of price data including the six previous time periods, the period in question, and the five following time periods[12]:

$$MA_t = (P_{t-6} + \ldots + P_t + \ldots + P_{t+5}) / 12$$

For monthly data, the number of periods (12) is even and therefore the moving average values need to be centered. The centered moving average (CMA_t) is the average of two adjacent moving average values and is calculated as follows:

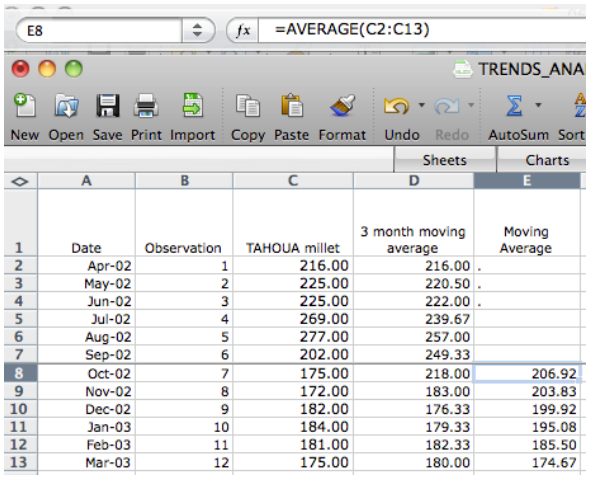
$$CMA_t = (MA_t + MA_{t+1}) / 2$$

$$= T_t \times C_t$$

An important relationship that is relevant for the price decomposition approach is that once we calculate the centered moving average of a time series, the seasonality and irregular components of the data are smoothed out and only long-term time trends and cyclical components remain ($\mathbf{T_t}$ and $\mathbf{C_t}$).

[12] If the analyst only has ***quarterly data***, the moving average for a time period t is calculated as:
$\mathbf{MA_t = (P_{t-2} + P_{t-1} + P_t + P_{t+1}) / 4}$.

Figure V.2. Moving Average



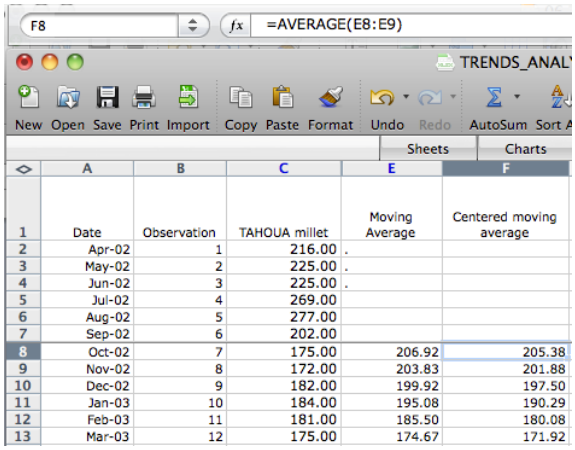
	A	B	C	D	E
1	Date	Observation	TAHOUA millet	3 month moving average	Moving Average
2	Apr-02	1	216.00	216.00	.
3	May-02	2	225.00	220.50	.
4	Jun-02	3	225.00	222.00	.
5	Jul-02	4	269.00	239.67	
6	Aug-02	5	277.00	257.00	
7	Sep-02	6	202.00	249.33	
8	Oct-02	7	175.00	218.00	206.92
9	Nov-02	8	172.00	183.00	203.83
10	Dec-02	9	182.00	176.33	199.92
11	Jan-03	10	184.00	179.33	195.08
12	Feb-03	11	181.00	182.33	185.50
13	Mar-03	12	175.00	180.00	174.67

How to calculate the **moving average (MA_t) in Excel**?

- Use the "average" function in Excel to calculate the average of 12 months of price data, including the current time period, the 6 periods before and the 5 periods after.
- Note that in the example here, the first moving average value is for October 2002, NOT April 2002. Why is that?

$$MA_t = (P_{t-6} + \ldots + P_t + \ldots + P_{t+5}) / 12$$

Figure V.3. Centered Moving Average



	A	B	C	E	F
1	Date	Observation	TAHOUA millet	Moving Average	Centered moving average
2	Apr-02	1	216.00	.	
3	May-02	2	225.00	.	
4	Jun-02	3	225.00	.	
5	Jul-02	4	269.00		
6	Aug-02	5	277.00		
7	Sep-02	6	202.00		
8	Oct-02	7	175.00	206.92	205.38
9	Nov-02	8	172.00	203.83	201.88
10	Dec-02	9	182.00	199.92	197.50
11	Jan-03	10	184.00	195.08	190.29
12	Feb-03	11	181.00	185.50	180.08
13	Mar-03	12	175.00	174.67	171.92

How to calculate the **centered moving (CMA_t) average in Excel?**

- Use the "average" function in Excel to calculate the average of the two adjacent moving average values.

$$CMAt = (MAt + MAt+1)/ 2$$

Technical projections Step 2: Identify the seasonal component of the data

The degree of seasonality in the data is measured by the ratio of the actual value to the deseasonalized value (centered moving average value).

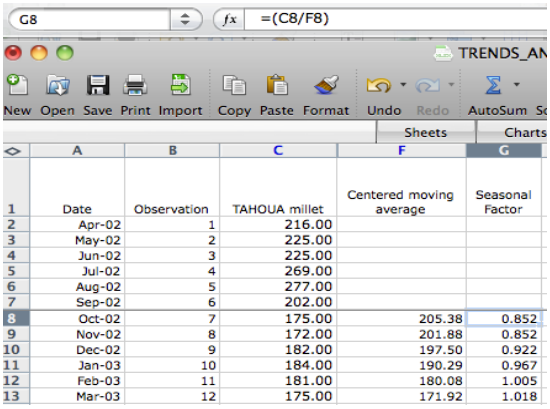
$$SF_t = P_t / CMA_t$$

$$= T_t \times S_t \times C_t \times I_t / T_t \times C_t$$

$$= S_t \times I_t$$

Where SF_t is called the "seasonal factor" and other terms are defined as before. In practice, analysts often multiply this seasonal factor by **100**, but that is not required.

Figure V.4. Seasonal Factor



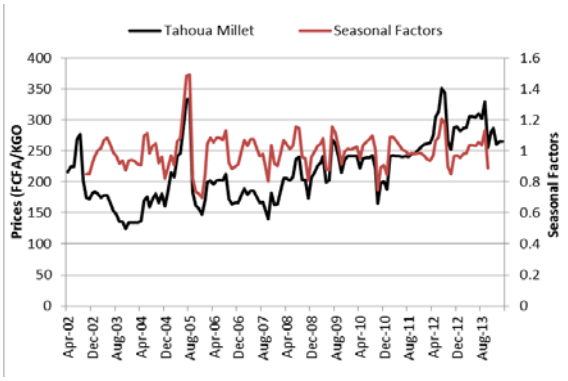
	A	B	C	F	G
1	Date	Observation	TAHOUA millet	Centered moving average	Seasonal Factor
2	Apr-02	1	216.00		
3	May-02	2	225.00		
4	Jun-02	3	225.00		
5	Jul-02	4	269.00		
6	Aug-02	5	277.00		
7	Sep-02	6	202.00		
8	Oct-02	7	175.00	205.38	0.852
9	Nov-02	8	172.00	201.88	0.852
10	Dec-02	9	182.00	197.50	0.922
11	Jan-03	10	184.00	190.29	0.967
12	Feb-03	11	181.00	180.08	1.005
13	Mar-03	12	175.00	171.92	1.018

How to calculate the **seasonal factor in Excel**

- The seasonal factor is simply the ratio of monthly price to the centered moving average for a given time period.

SFt=Pt / CMAt

Figure V.5. Prices and Seasonal Factors for Tahoua Millet Prices



Question for reader

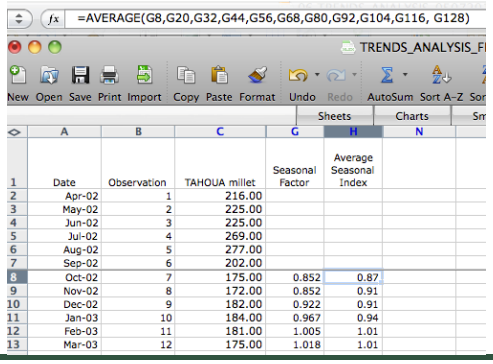
- From the figure on the right, does seasonality appear to play an important role in millet prices in Niger?
- Can you identify one year in which the seasonal factors are more pronounced than in others?
- How important is seasonality in the data you monitor/analyze in your country?

Source: *Price data from SIMA, Niger; calculations by FEWS NET.*

Technical projections Step 3: Compute average seasonal indices

The **average seasonal price index** is the average of seasonal factors for each month. For example, the average seasonal price index for the month of January is the average of the **SFs** for the month of January over the entire data series. It is a good practice to make sure that when you are calculating the average seasonal price index for each month, you use the same number of observations of SFs for each monthly average. This means that you will generally **not** use data from the current marketing year to compute the average seasonal price index values. The **Total Seasonal price index** is the sum of average indices, and should add up to 12 (or 1200, depending on what scale is used).

Figure V.6. Average Seasonal Price Index



	A	B	C	G	H	N
1	Date	Observation	TAHOUA millet	Seasonal Factor	Average Seasonal Index	
2	Apr-02	1	216.00			
3	May-02	2	225.00			
4	Jun-02	3	225.00			
5	Jul-02	4	269.00			
6	Aug-02	5	277.00			
7	Sep-02	6	202.00			
8	Oct-02	7	175.00	0.852	0.87	
9	Nov-02	8	172.00	0.852	0.91	
10	Dec-02	9	182.00	0.922	0.91	
11	Jan-03	10	184.00	0.967	0.94	
12	Feb-03	11	181.00	1.005	1.01	
13	Mar-03	12	175.00	1.018	1.01	

How to calculate the **average seasonal price index in Excel?**

- The average seasonal price index is simply the average of the seasonal factors for a given month.
- This example includes many years of data. In reality, one only needs one seasonal factor for each month if it is taken from an "average" or "normal year."

St = average of SF values for a given month

It is often helpful for analysts to plot the average seasonal price index for their data such as in the figure below. Note that because there is only one average seasonal price index computed for each month, the average seasonal price index value for the month of January, for example, should not change over time. Be sure to double check the formulas used in Excel as this is a common issue.

Figure V.7. Average Millet Seasonal Price Index in Tahoua, Niger

Figure V.7 shows the average seasonal price index for millet prices in Tahoua, Niger.

- When are prices typically highest in Tahou?
- When are prices typically lowest?
- Is this consistent with what you know about the start and end date of the marketing year and lean season?

Source: *FEWS NET.*

Frequently Asked Question 4: In what month should my analysis begin and end?

Answer 4: A rule of thumb is that price analysis coincides with the marketing year. However, recall that the seasonal factor is computed based on a 12-month CMA value. This means that the data used should begin six months prior to the first month of the first marketing year considered in the analysis. For example, in the case of Tahoua, Niger, the marketing year begins in October. This means that the price series used should begin in April.

Frequently Asked Question 5: What happens if changes arise in seasonal patterns over time?

Answer 5: If there are major progressive changes in seasonal price patterns over time, it is up to the analyst to determine whether to include all of the historical data in the calculation of the average seasonal price index, or to include only years that represent what could be considered "normal" at present and over the projection period.

Frequently Asked Question 6: What do we do with the data from a major outlier year?

Answer 6: The general rule of thumb is to remove major outlier years from the calculation of the average seasonal price index. This is because it is intended to show what happens during an average or normal year and should not be heavily biased upward or downward by outliers. It is up to the analyst to identify those outliers and remove them from the calculations.

Technical projections Step 4: Compute the long-term time trend

Steps 1 through 3 provide guidance on how an analyst could parse out the seasonality component from historical monthly price data. This is useful information to inform forward-looking price projections, but not yet adequate. One should also consider the long-term trend in the data, from the deseasonalized data. Indeed, the long-term trend can be obtained from the deseasonalized data using a simple linear regression:

$$CMAT_t = a + b\ (Time)$$

where **Time** = 1 for the first period in the dataset and increases by 1 each month thereafter. This is also the observation number. Furthermore, **a**= the intercept and **b**= the incremental increase in the CMA with each additional time period. The estimated long-term-trend is calculated as the estimated intercept (**a**) plus the estimated slope (**b**) times the observation number (time).

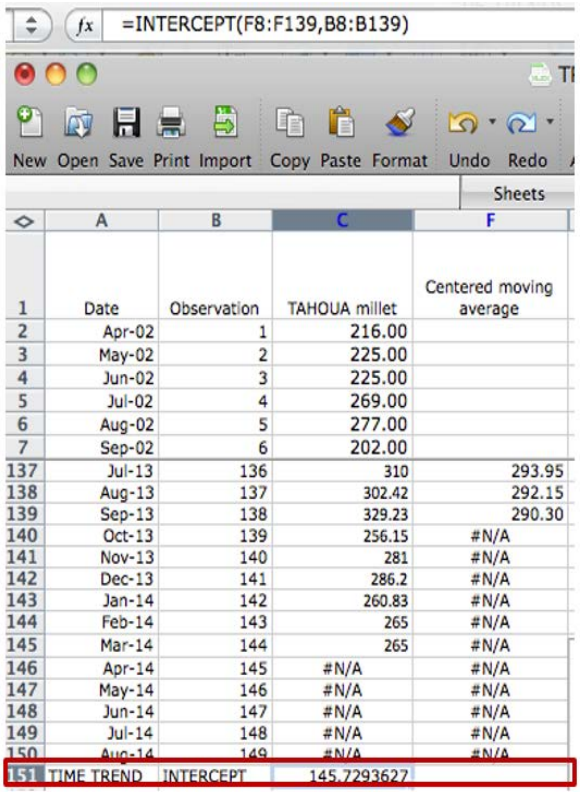
What is the benefit of calculating this time trend from the deseasonalized data, versus the raw price date?

Figure V.8. How to Calculate Time Trend

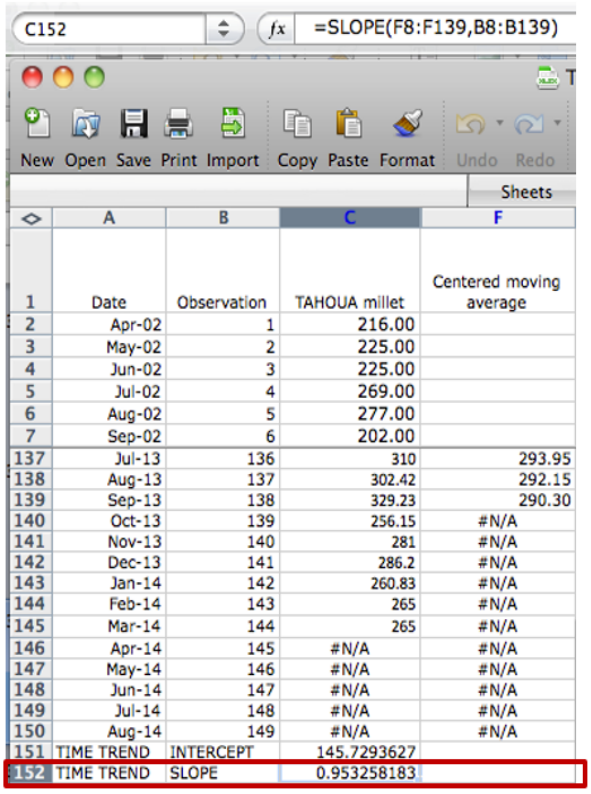
	A	B	C	F
1	Date	Observation	TAHOUA millet	Centered moving average
2	Apr-02	1	216.00	
3	May-02	2	225.00	
4	Jun-02	3	225.00	
5	Jul-02	4	269.00	
6	Aug-02	5	277.00	
7	Sep-02	6	202.00	
8	Oct-02	7	175.00	205.38
9	Nov-02	8	172.00	201.88
10	Dec-02	9	182.00	197.50
11	Jan-03	10	184.00	190.29
12	Feb-03	11	181.00	180.08
13	Mar-03	12	175.00	171.92

How to calculate the **time trend?**

- Begin with a simple linear regression of time on the centered moving average (CMA).
- Before proceeding, create a column in the spreadsheet of observation numbers.
- One option is to use the formulas in Excel to compute the intercept and slope from the simple linear regression. Analysts are encouraged to use other functions/tools in Excel for these calculations as well.

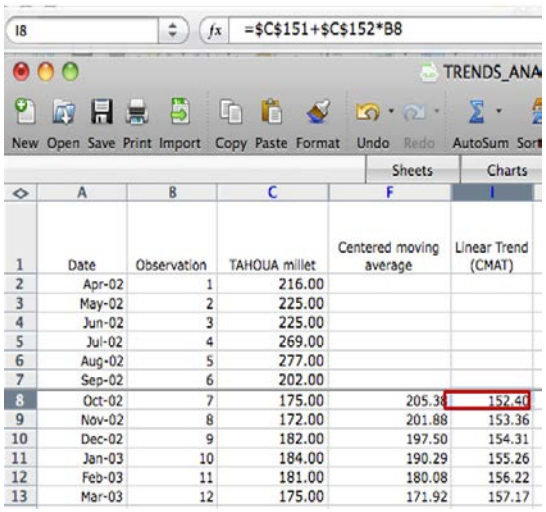


	A	B	C	F
1	Date	Observation	TAHOUA millet	Centered moving average
2	Apr-02	1	216.00	
3	May-02	2	225.00	
4	Jun-02	3	225.00	
5	Jul-02	4	269.00	
6	Aug-02	5	277.00	
7	Sep-02	6	202.00	
137	Jul-13	136	310	293.95
138	Aug-13	137	302.42	292.15
139	Sep-13	138	329.23	290.30
140	Oct-13	139	256.15	#N/A
141	Nov-13	140	281	#N/A
142	Dec-13	141	286.2	#N/A
143	Jan-14	142	260.83	#N/A
144	Feb-14	143	265	#N/A
145	Mar-14	144	265	#N/A
146	Apr-14	145	#N/A	#N/A
147	May-14	146	#N/A	#N/A
148	Jun-14	147	#N/A	#N/A
149	Jul-14	148	#N/A	#N/A
150	Aug-14	149	#N/A	#N/A
151	TIME TREND	INTERCEPT	145.7293627	



	A	B	C	F
1	Date	Observation	TAHOUA millet	Centered moving average
2	Apr-02	1	216.00	
3	May-02	2	225.00	
4	Jun-02	3	225.00	
5	Jul-02	4	269.00	
6	Aug-02	5	277.00	
7	Sep-02	6	202.00	
137	Jul-13	136	310	293.95
138	Aug-13	137	302.42	292.15
139	Sep-13	138	329.23	290.30
140	Oct-13	139	256.15	#N/A
141	Nov-13	140	281	#N/A
142	Dec-13	141	286.2	#N/A
143	Jan-14	142	260.83	#N/A
144	Feb-14	143	265	#N/A
145	Mar-14	144	265	#N/A
146	Apr-14	145	#N/A	#N/A
147	May-14	146	#N/A	#N/A
148	Jun-14	147	#N/A	#N/A
149	Jul-14	148	#N/A	#N/A
150	Aug-14	149	#N/A	#N/A
151	TIME TREND	INTERCEPT	145.7293627	
152	TIME TREND	SLOPE	0.953258183	

Figure V.9. Linear Trend



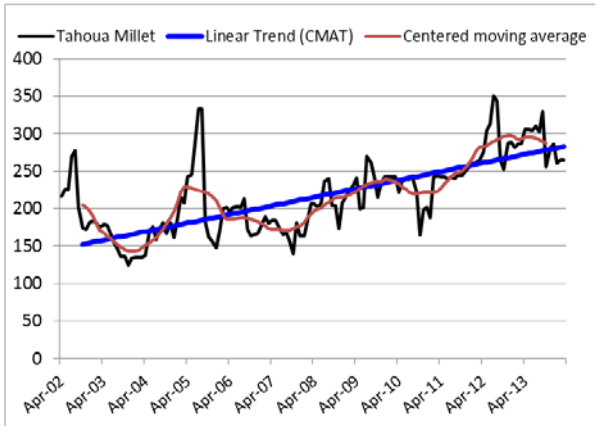
	A	B	C	F	I
1	Date	Observation	TAHOUA millet	Centered moving average	Linear Trend (CMAT)
2	Apr-02	1	216.00		
3	May-02	2	225.00		
4	Jun-02	3	225.00		
5	Jul-02	4	269.00		
6	Aug-02	5	277.00		
7	Sep-02	6	202.00		
8	Oct-02	7	175.00	205.38	152.40
9	Nov-02	8	172.00	201.88	153.36
10	Dec-02	9	182.00	197.50	154.31
11	Jan-03	10	184.00	190.29	155.26
12	Feb-03	11	181.00	180.08	156.22
13	Mar-03	12	175.00	171.92	157.17

How to calculate the **time trend using the intercept and slope parameters estimated in Figure V.8?**

- Simply create a formula using Excel.
- Be sure to keep the intercept and slope values constant (using the "$" symbols) and allow time (observation number) to change.
- In this example, the intercept was calculated in cell C151 and the slope was calculated in cell C152, with the observation numbers listed in column B.

Source: *FEWS NET.*

Figure V.10. Deseasonalized Prices in Tahoua, Niger



- The figure on the right shows the observed prices, the centered moving average (deseasonalized prices), and the long-term trend in millet prices in Tahoua, Niger.
- Are prices increasing, decreasing, or stable over time?
- Do you think it is possible that the trend line would be different if we only considered data after 2009? What are the implications for developing projections based on this long-term trend alone?

Source: *FEWS NET.*

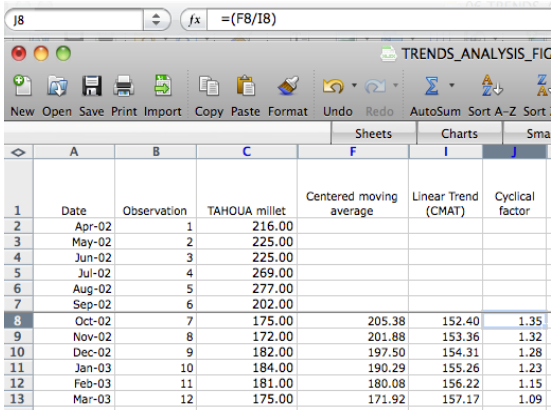
Technical projections Step 5: Compute the cyclical factor

In practice, cyclical factors (CF) of prices are essentially trends that span for longer than one year (which would be otherwise typically be captured in the seasonality component), but that are not part of a long-term trend. It is therefore more of an intermediate component. It is computed as the ratio of the deseasonalized data to the long-term trend.

The CF is given as the ratio of the centered moving average (**CMA_t**) to the centered moving average trend (**$CMAT_t$**) as follows:

$$CF_t = CMA_t / CMAT_t$$

Figure V.11. Cyclical Factor



	A	B	C	F	I	J
1	Date	Observation	TAHOUA millet	Centered moving average	Linear Trend (CMAT)	Cyclical factor
2	Apr-02	1	216.00			
3	May-02	2	225.00			
4	Jun-02	3	225.00			
5	Jul-02	4	269.00			
6	Aug-02	5	277.00			
7	Sep-02	6	202.00			
8	Oct-02	7	175.00	205.38	152.40	1.35
9	Nov-02	8	172.00	201.88	153.36	1.32
10	Dec-02	9	182.00	197.50	154.31	1.28
11	Jan-03	10	184.00	190.29	155.26	1.23
12	Feb-03	11	181.00	180.08	156.22	1.15
13	Mar-03	12	175.00	171.92	157.17	1.09

How to calculate the **cyclical factor?**

- Use Excel to create the ratio of the centered moving average to the time trend.
- Why might we be interested in the cyclical component of price data? What might drive this sort of interannual price variation?

CF = Centered moving average divided by the centered moving average trend

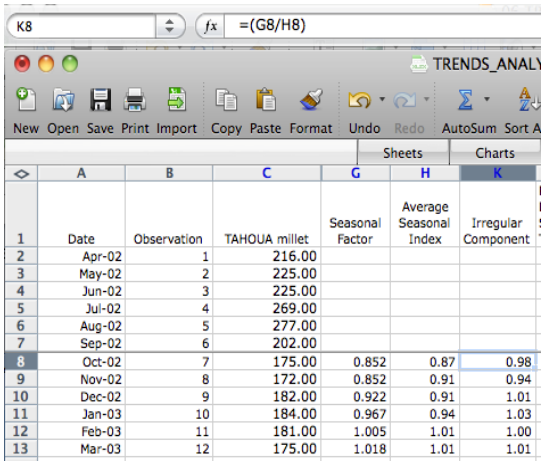
Technical projections Step 6: Compute the irregular component

The last component of the price decomposition is the "irregular" component (or factor) and is calculated as the ratio of a given month's seasonal factor to the average seasonal price index for that month.

$$I_t = SF_t / S_t$$

This demonstrates, for a given month, the component of the price that cannot be attributed to average annual seasonality, the long-term trend, or the cyclical factor.

Figure V.12. Irregular Factor



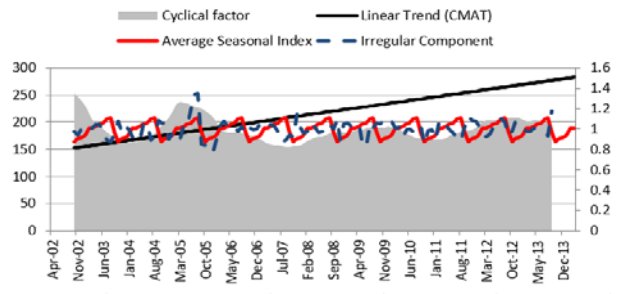
	A	B	C	G	H	K
1	Date	Observation	TAHOUA millet	Seasonal Factor	Average Seasonal Index	Irregular Component
2	Apr-02	1	216.00			
3	May-02	2	225.00			
4	Jun-02	3	225.00			
5	Jul-02	4	269.00			
6	Aug-02	5	277.00			
7	Sep-02	6	202.00			
8	Oct-02	7	175.00	0.852	0.87	0.98
9	Nov-02	8	172.00	0.852	0.91	0.94
10	Dec-02	9	182.00	0.922	0.91	1.01
11	Jan-03	10	184.00	0.967	0.94	1.03
12	Feb-03	11	181.00	1.005	1.01	1.00
13	Mar-03	12	175.00	1.018	1.01	1.01

How to calculate the **irregular factor?**

- Use Excel to calculate the ratio of the seasonal factor to the average seasonal price index.
- Why might we be interested in the irregular component of price data? What might drive this sort of inter- and intra-annual price variation?

IF = Seasonal factor divided by the average seasonal price index

Figure V.13. Millet Price Components for Tahoua, Niger



- The figure on the right illustrates each of the components of the Tahoua, Niger millet price series.
- Is there anything notable about the different components? What may have driven the multiyear cycles or the rapid increase in the irregular component (factor) at certain times?

Source: *FEWS NET.*

Frequently Asked Question 7: What is the difference between the irregular factor and the error?

Answer 7: Here we define the irregular factor as the ratio of the seasonal factor to the average seasonal price index. This is the same as the part of a historical price series that this not explained by average seasonality, the long-term trend, or the cyclical factor. The "error" in this setting, on the other hand, will be discussed below, but is the difference between the observed price and the projected value (from the basic multiplicative model).

Note about cyclical and irregular factors

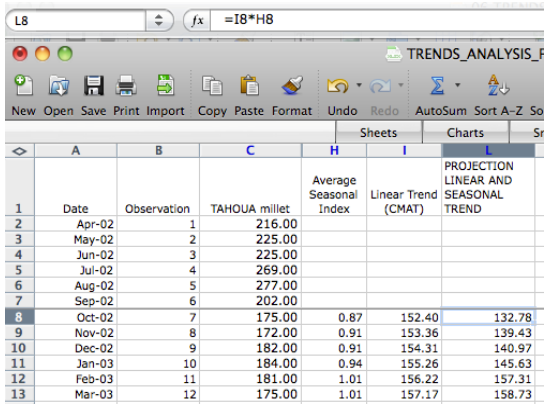
- Note that neither of these can be directly projected into the future based on historical data. Why might that be? How do these price components compare to the long-term trend or average seasonal price index?
- We can, however, make assumptions of what those components might look like, based on analogous historical years/events, and use those to inform our projections.

Technical projections Step 7: Calculate the projected prices

After carrying out the price decomposition in the previous six steps, analysts can use specific components to create price projections using a simple multiplicative model. This is done by multiplying the projected deseasonalized data (linear time trend) by the average seasonal price index to project prices over the period of interest (T*S):

$$Projected\_P_t = T_t \times S_t$$

Figure V.14. Projected Prices Based on the Multiplicative Model



	A	B	C	H	I	L
1	Date	Observation	TAHOUA millet	Average Seasonal Index	Linear Trend (CMAT)	PROJECTION LINEAR AND SEASONAL TREND
2	Apr-02	1	216.00			
3	May-02	2	225.00			
4	Jun-02	3	225.00			
5	Jul-02	4	269.00			
6	Aug-02	5	277.00			
7	Sep-02	6	202.00			
8	Oct-02	7	175.00	0.87	152.40	132.78
9	Nov-02	8	172.00	0.91	153.36	139.43
10	Dec-02	9	182.00	0.91	154.31	140.97
11	Jan-03	10	184.00	0.94	155.26	145.63
12	Feb-03	11	181.00	1.01	156.22	157.31
13	Mar-03	12	175.00	1.01	157.17	158.73

How to develop technical price projections based on the **multiplicative model?**

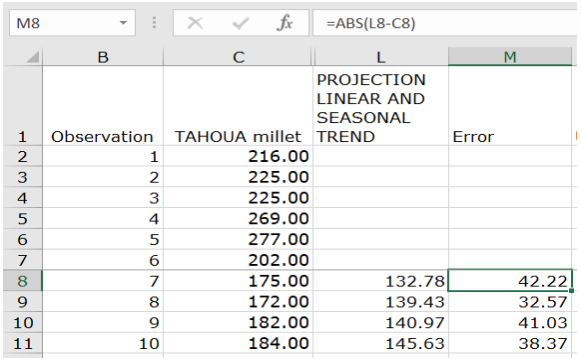
- Use Excel and multiply the average seasonal price index by the long-term trend.
- Note that the projected value in this example is different from the observed values. **Why do you think that is?**

Projected P_t = T_t x S_t

Technical projections Step 8: Calculate lower and upper bounds estimates

Analysts have many methods with which to estimate an upper and lower bound of technical price projections based on historical price data alone. The following example makes use of the historical margin of error introduced by the decomposition approach.

Figure V.15. Upper and Lower Bound Estimates



	B	C	L	M
1	Observation	TAHOUA millet	PROJECTION LINEAR AND SEASONAL TREND	Error
2	1	216.00		
3	2	225.00		
4	3	225.00		
5	4	269.00		
6	5	277.00		
7	6	202.00		
8	7	175.00	132.78	42.22
9	8	172.00	139.43	32.57
10	9	182.00	140.97	41.03
11	10	184.00	145.63	38.37

How to incorporate **upper and lower bound estimates** into technical price projections?

- One option is to look at the historical estimated projection error, calculated as the absolute value of the difference between the observed price and the technical projection value.

Figure V.16. Average Error Value

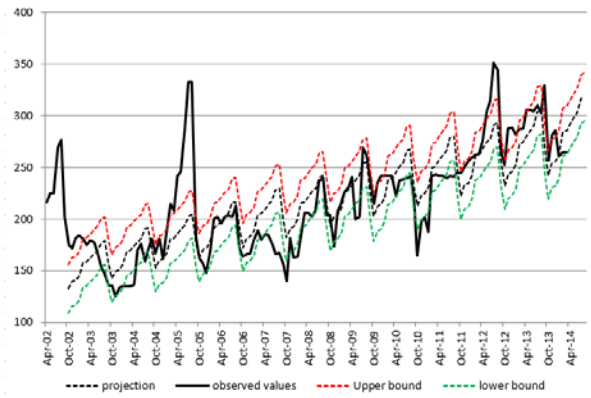
N8 =L8+AVERAGE(M$8:M$139)

	A	B	C	L	M	N
1	Date	Observation	TAHOUA millet	PROJECTION LINEAR AND SEASONAL TREND	Error	Upper bound
2	Apr-02	1	216.00			
3	May-02	2	225.00			
4	Jun-02	3	225.00			
5	Jul-02	4	269.00			
6	Aug-02	5	277.00			
7	Sep-02	6	202.00			
8	Oct-02	7	175.00	132.78	42.22	156.08
9	Nov-02	8	172.00	139.43	32.57	162.72
10	Dec-02	9	182.00	140.97	41.03	164.26
11	Jan-03	10	184.00	145.63	38.37	168.92
12	Feb-03	11	181.00	157.31	23.69	180.60
13	Mar-03	12	175.00	158.73	16.27	182.02

By taking the **average error value**, we get a sense of average margin of error from the technical projection.

- Adding the average error to the projected prices yields an upper bound.
- Subtracting the average error yields a lower bound.

Figure V.17. Projected Price with Upper and Lower Bounds



- The figure on the right illustrates the projected prices for Tahoua, Niger millet using the basic multiplicative model along with the upper and lower bounds.
- Is there anything notable about the projection line? Are there years (historically) when the technical projection is more accurate than others? Is there anything notable about the fundamental drivers of prices during the years when large deviations arise between the observed and projected prices?

Source: *FEWS NET.*

Note about limitations of this approach

- Unless the general outlook is for normal conditions, projections based on seasonal indices are to be used for preliminary, "gut-check" analyses.
- The seasonal analysis is designed to be used under normal conditions, but several factors can alter seasonal patterns:
  - Drought, flood, earthquake, etc.
  - Government policy changes
- To the extent possible, abnormal years should not be included in the computation of seasonal indices.
- This analysis is based on historical data.
  - We must therefore use our qualitative knowledge of fundamental principles supply and demand to qualitatively adjust our projection when we see a shock (or very likely shock) on the horizon.
  - These adjustments must be documented by FEWS NET analysts and incorporated into the development of integrated price projections.

Annex VI. Technical Projections Using the Triple Exponential Smoothing Approach in Excel

The Triple Exponential Smoothing (TES) forecasting method is a technical projection method commonly used by FEWS NET analysts. Analysts are encouraged to download the Microsoft Excel Data Analysis Tool Pack to facilitate the use of this Annex. Furthermore, analysts are encouraged to use this Annex with preexisting technical projection Excel workbooks containing commonly used formulas and charts, available to all project staff.

As with the decomposition method presented in Annex V, TES breaks down time series data into level (base), trend, and seasonal components. To understand TES, there is a need to appreciate in sequence several methods used to forecast time series. After a brief introduction to this background information, this Annex, which is part of the Price Projections Toolkit, provides a step-by-step introduction to the TES method in Excel.

Single Moving Average (SMA)

This method is suitable for time series data with a slowly changing mean. It averages the most recent observations (N) to estimate the value for the next period. Then from one period to the next, the oldest observation is replaced with the newest observation to smoothen (reduce) short-term irregularities, while maintaining the number of the most recent observations used in calculating the average, hence the expression "moving average." The common expression for the moving average is:

$$\hat{y}_i = (y_i + y_{i-1} + y_{i-N-1})/N$$

where $\hat{y}_i$ is the projection for period i, $y_{i....}y_{i-N-1}$ are the most recent observations, and N is the total number of most recent observations.

Weighted Moving Average (WMA)

In the SMA, all observations are equally weighted yet we expect more recent observations to be a better indicator of the future and to therefore be assigned more weight. Hence in the Weighted Moving Average (WMA), each observation is weighted differently, with the most recent observations usually carrying more weight. The common expression for the WMA is:

$$\hat{y}_i = w_t \times y_i + w_{t-1} \times y_{i-1} + w_{t-N-1} \times y_{i-N-1}$$

where w is the weight of each observation such that $\Sigma wt = 1$ (i.e., the sum of the weights is equal to one).

Single Exponential Smoothing

Our model would be able to better predict the future if it gave more weight to more recent observations, and also used all the previous observations. This can be done under the Single Exponential Smoothing (SES) model, an extension of the WMA. The SES model assigns exponentially decreasing weights as the observation gets older. Under SES there are smoothing parameters that are determined first; these then establish the weights assigned to the observations. The formula for SES is:

$$\hat{y}_{i+1} = \alpha\, y_i + (1-\alpha)\, \hat{y}_i$$

This is similar to:

$$\hat{y}_{i+1} = \hat{y}_i + \alpha\,(y_i - \hat{y}_i)$$

which translates into: Projection for the next period = projection for this period + smoothing constant X error for this period,

$$\text{where } 0 \le \alpha \le 1$$

The projection for the current period is a weighted average of all past observations, for which the weight given to past observations declines exponentially. The larger the parameter α, the more weight is given to recent observations. SES works best when the time series fluctuates around a constant base level.

Double Exponential Smoothing (DES or Holt's Method)

SES is used when there is no trend in the time series data. If a trend exists in the time series, then the Double Exponential Smoothing (DES) method can be used. In DES, a second equation with a second constant β, the trend component, is introduced and must be chosen together with α, the coefficient on the level or mean component introduced under SES. DES is outlined in the following two equations.

$$E_i = \alpha\, y_i + (1-\alpha)(E_{i-1} + T_{i-1})$$

$$T_i = \beta\,(E_i - E_{i-1}) + (1-\beta)\,T_{i-1}$$

$$\text{where } 0 \le \alpha \le 1 \quad 0 \le \beta \le 1$$

and:

E_i is the base estimate at time i

T_i is the trend estimate at time i

α is the smoothing constant for the base estimate

β is the smoothing constant for the trend estimate

Under DES, β is added as a second smoothing constant.

After observing the time series at period i (y_i), DES calculates the expected level or base of the time series (E_i), and the expected rate of change per period (T_i). Usually unless stated otherwise, $E_1 = y_1$, and $T_1 = 0$.

$$\hat{y}_{i+1} = E_i + kT_i, \text{ where } k=1,2,3....$$

Triple Exponential Smoothing (TES or Holt Winters Method)

When seasonality is present in a data series in addition to trend, the TES method is used rather than DES because it breaks down the three essential components of the series – level, trend, and seasonality – to forecast the time series. TES is defined through the following four equations:

$E_i = \alpha\,(y_i / S_{i-c} + (1-\alpha)(E_{i-1} + T_{i-1})$	E_i is the base estimate at time i
$T_i = \beta\,(E_i - E_{i-1}) + (1-\beta)\,T_{i-1}$	T_i is the trend estimate at time i
$S_i = \gamma\,(y_i / E_{i-1}) + (1-\gamma)\,S_{i-c}$	S_i is the seasonal factor for period i
	c is the number of periods in a cycle, 12 in case of one year
where $0 \le \alpha \le 1$, $0 \le \beta \le 1$, $0 \le \gamma \le 1$,	α is the smoothing constant for the base estimate β is the smoothing constant for the trend estimate
	γ is the smoothing constant for the seasonality estimate; under TES, γ is added as a third smoothing constant. If γ = 0, then TES becomes DES. If in addition β = 0, then TES becomes SES.
$\hat{y}_{i+1} = (E_i + kT_i)\,S_{i+1-c}$	where k=1,2,3....

To start the process, E_1, S_1, and T_1 must be defined, in addition to S_i for each month of the year. Referring to the technical projection Excel workbook,

- Set α = 0.7 and β=0.1 (Figure VI.1).

- Set the initial estimate value, E_1, equal to the average of the observed prices from the previous 12 months. Then use the formula for E_i for subsequent months, beginning with July 2010 in the figure below.
- Set the initial trend value, T_1, as the first and last observed prices for the previous 12 months, divided by 12. This yields the estimated average monthly change in prices. Then use the formula for T_i for subsequent months, beginning with July 2010 in the figure below.
- Develop the initial estimates of the seasonal factors, Si, as in the decomposition method outlined in Annex V.

Figure VI.1 Setting the Initial Parameters for TES Technical Projections

BI4

	A	B	C	D	E	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL
1	Horizontal Axis	Month	Period	Maize Nairobi/kg			Time Periods	Estimate	Trend	Calculation of initial seasonality-I yearly average	Monthly seasona l factors	Monthly Average seasonality	Triple Exponential Smoothing (Forecast)	Errors	Squared Error	absolute error
2								Alpha	0.7000						MSE	MAD
3								Beta	0.1000						64.7604	7.892822
4								Gamma	0.2000							
5																
6	2009	Jul-09		30							1.1409	1.1128				
7		Aug-09		29							1.1120	1.0234				
8		Sep-09		29							1.1264	0.9637				
9		Oct-09		27							1.0227	0.9232				
10		Nov-09		27							1.0478	0.9599				
11		Dec-09		30							1.1443	0.9612				
12	2010	Jan-10		28							1.0733	0.9698				
13		Feb-10		24							0.9160	0.9456				
14		Mar-10		23							0.8807	0.9419				
15		Apr-10		23							0.8705	0.9807				
16		May-10		22							0.8374	1.0842				
17		Jun-10		22				26	-0.7185	26	0.8280	1.1336				
18		Jul-10		21			1	13	-1.9270		0.8731	1.2081	14	7	54.9986	7.416106
19		Aug-10		20			2	14	-1.6999		0.8237	1.1111	13	7	44.7402	6.688811
20		Sep-10		19			3	14	-1.4993		0.7930	1.0463	13	6	38.3172	6.190087
21		Oct-10		18			4	13	-1.4001		0.7322	1.0023	12	6	32.1489	5.670001

Figure VI.2 Initial Estimates Based on TES Methods and User-Defined Constants

BI4

	A	B	C	D	E	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL
1	Horizontal Axis	Month	Period	Maize Nairobi/kg			Time Periods	Estimate	Trend	Calculation of initial seasonality-I yearly average	Monthly seasona l factors	Monthly Average seasonality	Triple Exponential Smoothing (Forecast)	Errors	Squared Error	absolute error
2								Alpha	0.7000						MSE	MAD
3								Beta	0.1000						64.7604	7.892822
4								Gamma	0.2000							
5																
84	2016	Jan-16		28				13	-0.2123		0.9379	1.5884	21	7	49.9918	7.070489
85		Feb-16		30				14	-0.0859		0.9862	1.5489	22	7	52.0274	7.213001
86		Mar-16		29				14	-0.0912		0.9728	1.5427	22	7	50.7623	7.124764
87		Apr-16		30				14	-0.1120		0.9917	1.6063	22	7	53.2895	7.299965
88		May-16		29				13	-0.2437		0.9848	1.7758	22	8	56.2918	7.502787
89		Jun-16		28				11	-0.3454	30	0.9267	1.8568	20	7	53.2113	7.29461
90		Jul-16		30				11	-0.3019		0.9954	1.9788	22	8	59.9705	7.744064
91		Aug-16		32				13	-0.0837		1.0660	1.8199	24	8	60.9275	7.805605
92		Sep-16		33				14	0.0398		1.0906	1.7138	25	8	60.2454	7.761792
93		Oct-16	1				1						22			
94		Nov-16	2				2						23			
95		Dec-16	3				3						23			
96	2017	Jan-17	4				4						23			
97		Feb-17	5				5						23			
98		Mar-17	6				6						23			

TES estimates the base level, trend, and seasonality components and then uses those elements to develop technical projections. In the initial example here, the analyst defines the parameters/constants. However, Excel Solver is a powerful tool that analysts can leverage to optimize the constants to improve the results.

Figure VI.3 Setting Solver Objective and Constraints

- The objective with Solver is to minimize the mean absolute deviation (error), MAD.
- In this example, select cell BL3.
- Select "Min," as we are seeking to minimize the MAD.
- The constants (weights) should fall between 0 and 1. In this example, the constants are defined in cells BE2, BE3, and BE4.
- Click Solve to optimize the constants.

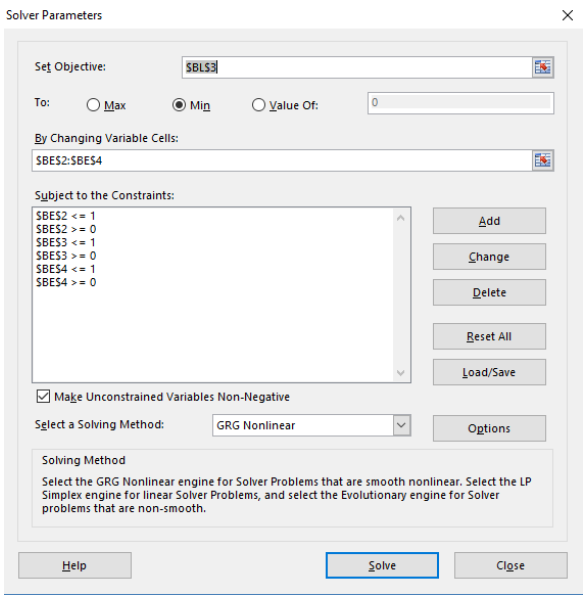


Figure VI.4 Optimization Using Solver

- Once Solver provides a result, select "Keep Solver Solution" and press okay to finish optimizing.
- The new values for the constants and the MAD will appear in the Excel workbook, as shown in the figure on the next page on defining TES parameters using Solver.
- The analyst will note that the MAD improved (reduced in this case) as a result of the optimization using Solver, resulting in more accurate technical projections (see the figure on the initial estimates based on TES methods and user defined constants above versus the TES projections using Solver constants figure on the next page).

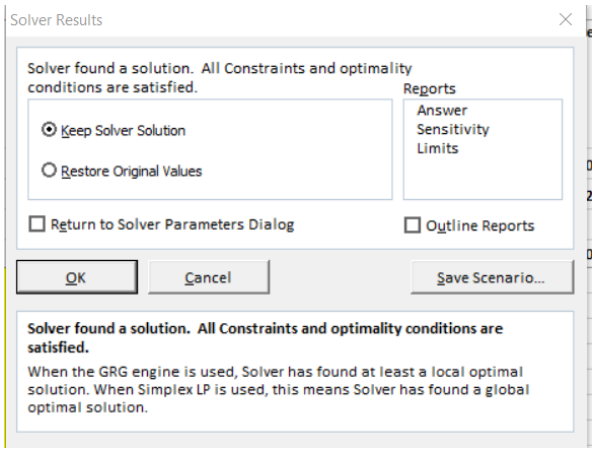
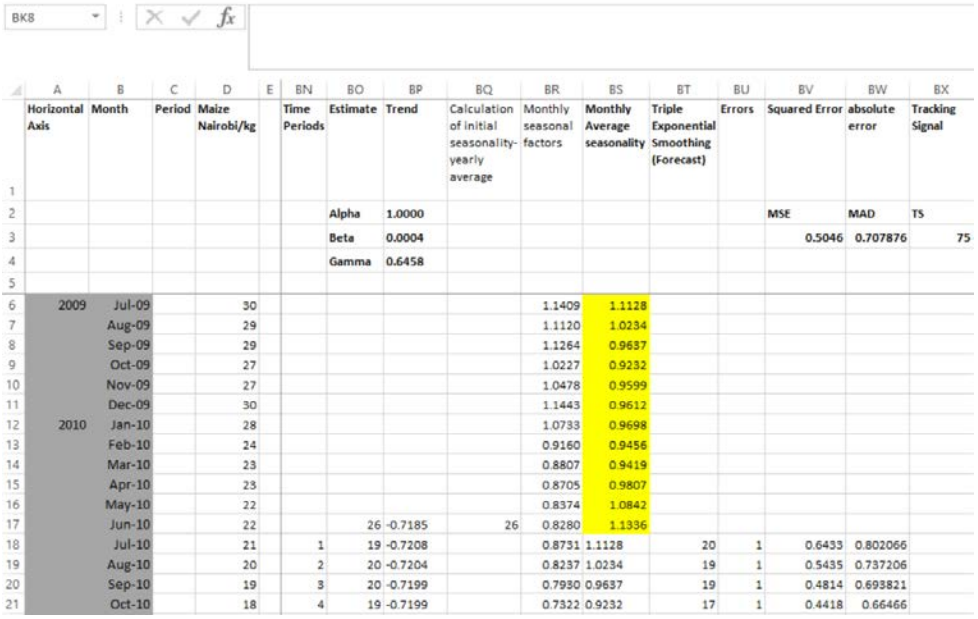
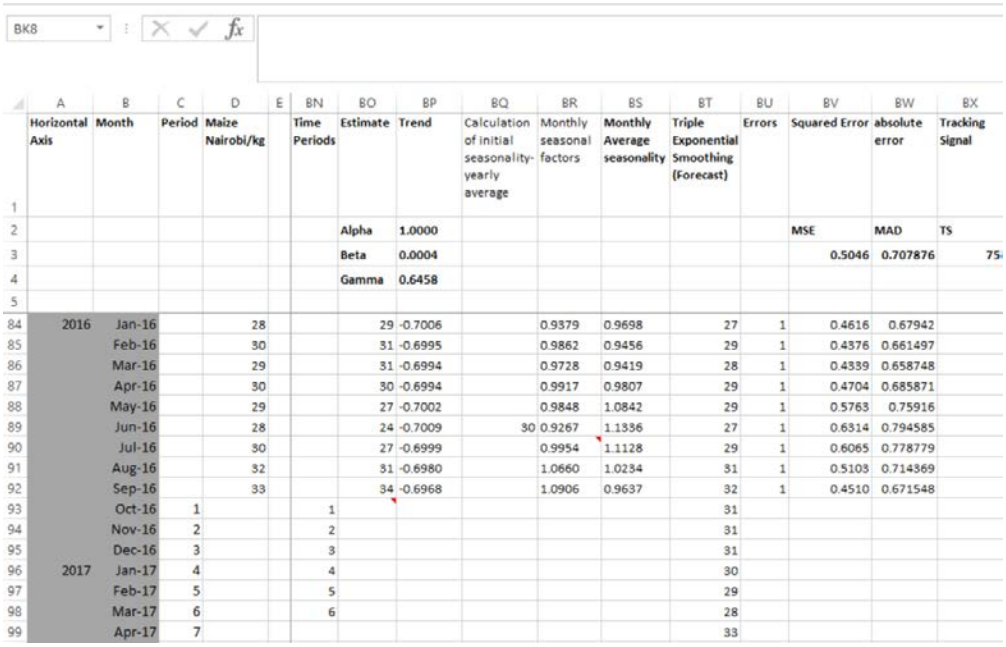


Figure VI.5 Defining TES Parameters Using Solver



	A	B	C	D	E	BN	BO	BP	BQ	BR	BS	BT	BU	BV	BW	BX
1	Horizontal Axis	Month	Period	Maize Nairobi/kg		Time Periods	Estimate	Trend	Calculation of initial seasonality-yearly average	Monthly seasonal factors	Monthly Average seasonality	Triple Exponential Smoothing (Forecast)	Errors	Squared Error	absolute error	Tracking Signal
2							Alpha	1.0000						MSE	MAD	TS
3							Beta	0.0004						0.5046	0.707876	75
4							Gamma	0.6458								
5																
6	2009	Jul-09		30						1.1409	1.1128					
7		Aug-09		29						1.1120	1.0234					
8		Sep-09		29						1.1264	0.9637					
9		Oct-09		27						1.0227	0.9232					
10		Nov-09		27						1.0478	0.9599					
11		Dec-09		30						1.1443	0.9612					
12	2010	Jan-10		28						1.0733	0.9698					
13		Feb-10		24						0.9160	0.9456					
14		Mar-10		23						0.8807	0.9419					
15		Apr-10		23						0.8705	0.9807					
16		May-10		22						0.8374	1.0842					
17		Jun-10		22			26	-0.7185	26	0.8280	1.1336					
18		Jul-10		21		1	19	-0.7208		0.8731	1.1128	20	1	0.6433	0.802066	
19		Aug-10		20		2	20	-0.7204		0.8237	1.0234	19	1	0.5435	0.737206	
20		Sep-10		19		3	20	-0.7199		0.7930	0.9637	19	1	0.4814	0.693821	
21		Oct-10		18		4	19	-0.7199		0.7322	0.9232	17	1	0.4418	0.66466	

Figure VI.6 TES Projections Using Solver Constants

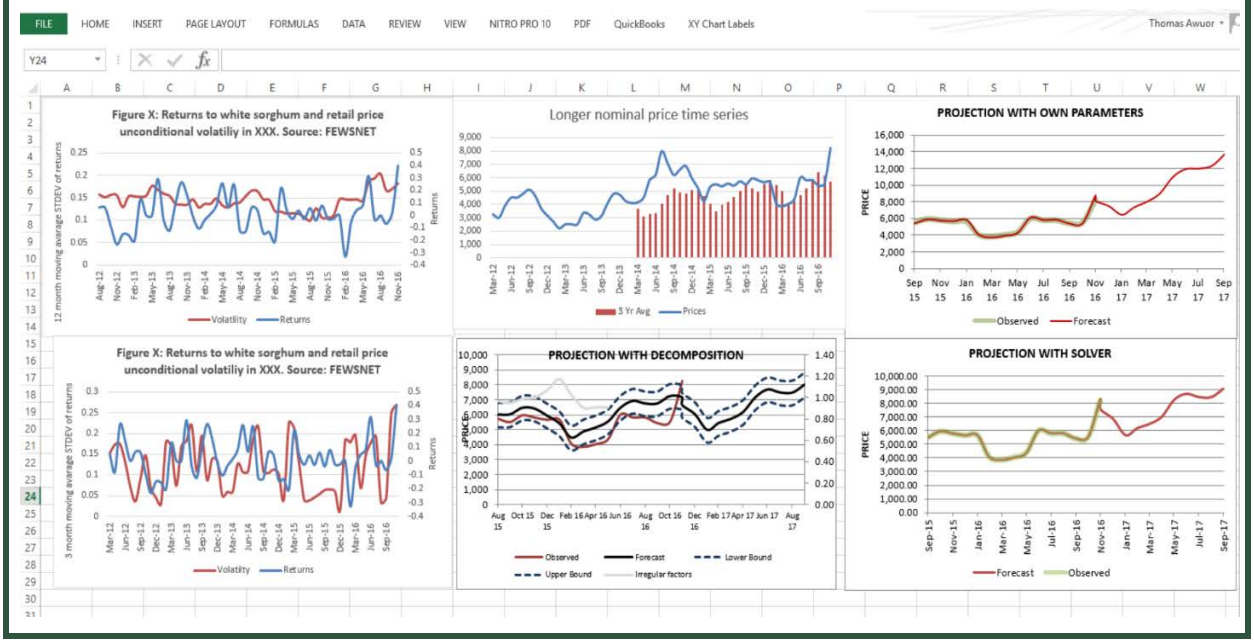


	A	B	C	D	E	BN	BO	BP	BQ	BR	BS	BT	BU	BV	BW	BX
1	Horizontal Axis	Month	Period	Maize Nairobi/kg		Time Periods	Estimate	Trend	Calculation of initial seasonality-yearly average	Monthly seasonal factors	Monthly Average seasonality	Triple Exponential Smoothing (Forecast)	Errors	Squared Error	absolute error	Tracking Signal
2							Alpha	1.0000						MSE	MAD	TS
3							Beta	0.0004						0.5046	0.707876	75
4							Gamma	0.6458								
5																
84	2016	Jan-16		28			29	-0.7006		0.9379	0.9698	27	1	0.4616	0.67942	
85		Feb-16		30			31	-0.6995		0.9862	0.9456	29	1	0.4376	0.661497	
86		Mar-16		29			31	-0.6994		0.9728	0.9419	28	1	0.4339	0.658748	
87		Apr-16		30			30	-0.6994		0.9917	0.9807	29	1	0.4704	0.685871	
88		May-16		29			27	-0.7002		0.9848	1.0842	29	1	0.5763	0.75916	
89		Jun-16		28			24	-0.7009	30	0.9267	1.1336	27	1	0.6314	0.794585	
90		Jul-16		30			27	-0.6999		0.9954	1.1128	29	1	0.6065	0.778779	
91		Aug-16		32			31	-0.6980		1.0660	1.0234	31	1	0.5103	0.714369	
92		Sep-16		33			34	-0.6968		1.0906	0.9637	32	1	0.4510	0.671548	
93		Oct-16	1			1						31				
94		Nov-16	2			2						31				
95		Dec-16	3			3						31				
96	2017	Jan-17	4			4						30				
97		Feb-17	5			5						29				
98		Mar-17	6			6						28				
99		Apr-17	7									33				

Tools Available to Analysts in Technical Projection Workbooks

Now that the analyst understands the mechanics of developing technical price projections, he/she should consider using existing technical projection workbooks, available to all FEWS NET staff. Some examples of the types of charts that can be produced quickly and easily are presented in the figure on the next page. Analysts should always remember to update their Solver parameters when starting a new analysis using an existing workbook. Analysts should also double-check the axes labels in the charts for accuracy.

Figure VI.7 Examples of Analyses Available in Existing Technical Projection Excel Workbooks



Annex VII. Guiding Principles for Incorporating Macroeconomic Information and Analysis into Market Analysis (Including Price Projections)[13]

Introduction

Economic shocks can be defined as exogenous events that have a significant impact on an economic system. While the term is typically used to refer to events that have a negative effect on an economy, some shocks can have a positive impact, such as a technology advancement. Economic shocks can cause unpredictable changes to the aggregate demand and/or aggregate supply in a given country, causing significant changes in the structure, conduct, and performance of markets and trade.

Macroeconomic shocks can have significant effects on food availability and access across an entire country. The economies of many FEWS NET countries are low-performing, fragile, relatively undiversified, and thus highly vulnerable to the impact of exogenous shocks. Most FEWS NET countries are import-dependent to meet their staple food needs and considered to be "small countries" in the global trade context, and are therefore price takers with respect to their exports and imports. As a consequence, macroeconomic shocks can have significant implications for a country's food security, so understanding their effects is an important part of FEWS NET's analysis. Readers are encouraged to consult the FEWS NET guidance note on inflation as one component of the economic context.

Assumptions about macroeconomic shocks and their direct and indirect effects are primarily used in two parts of FEWS NET analysis: (1) Scenario Summary Tables (SSTs) for Food Security Outlook reports, and (2) price projections for Food Security Outlook reports, Supply and Market Outlook reports, and other ad hoc requests. For the SST process, macroeconomic assumptions are used in the national assumptions for a given country, and submitted as part of a national narrative. While the SST is used for subnational assumptions that apply directly to the area of interest, macroeconomic assumptions could be inserted into Step 3 (Develop key assumptions) and Step 8 (Identify events that could change the scenario). Macroeconomic assumptions are also important considerations when developing integrated price projections. Assumptions about macroeconomic drivers, current indicators, and their impacts should be included in Steps 2, 3, 5, and 6 of the integrated price projection process.

Developing Assumptions About Macro-Level Shocks

Clearly identifying if and how macro-level shocks (national and global) will have direct and indirect effects on food availability and food access is an important part of FEWS NET's market monitoring and projections. However, a lack of reliable and timely data often makes providing real-time evidence-based analysis very difficult. ***Therefore, the goal of FEWS NET analysts is to have an understanding of and familiarity with (1) a given country's basic economic structure and status; (2) potential contributing factors for various shocks; and (3) how those factors might affect food availability and food access.***

Basic National Economic Structure

Analysts must be familiar with the structure and key characteristics of the national economy, such as major sources of revenues and export earnings, and national-level sources of food supply (national production versus imports) and demand (national-level demand versus exports), including any seasonal or long-terms trends. It is important to know these characteristics both in a typical year and during or after shocks. Having a baseline understanding of the economy in typical, or pre-crisis, years helps to inform monitoring, identify shocks and anomalies, and conceptualize and measure their direct and indirect impacts. Many of these elements are captured in national FEWS NET *Market Fundamentals Reports*, which are FEWS NET's core Markets and Trade Knowledge base product, under the cross-cutting issues chapter.

[13] This Annex was prepared by Erin M. Collier with Sonja M. Perakis.

Analysts should also be able to compare the economic structure during or after a shock with the same indicators used to describe the economic baseline (pre-shock). Table1 lists the major macro components that comprise the baseline knowledge that should be readily available and monitored by FEWS NET analysts for any given country.

Table VII.1. Core Elements of a Country's Macroeconomic Context

Macroeconomic Element	Description and Significance	Suggested Indicators	Data Sources
National revenue (income)	The total current dollar value earned from all goods and services produced in a given period of time. It is also equal to the national expenditure and the gross domestic product (GDP). This is important because it indicates a country's inflow of capital and currency.	▪ Components of GDP ▪ Top exports (in terms of export earnings, min top 3), volumes, and prices (local and export parity) ▪ Sources of government revenue (min top 3)	FAO World Bank Pink Sheet IMF Article IV consultation reports Ministry of Finance (MoF)
Currency	Physical representation of money. Currency measures can indicate the ability of a country to trade with other countries.	▪ Currency system – pegged, floating, other ▪ Official and unofficial exchange rates with respect to major regional and international currencies ▪ Foreign currency reserves	Ministry of Trade (MoT) Interbank United Nations
Agriculture or trade policies and programs	Government rules or initiatives pertaining to agriculture (behavior or products) or trade. These policies and programs signify how the country is producing food and trading food with other countries.	▪ National policy in support of food availability (production and import subsidies) and food access (price controls, social assistance) ▪ Regional and national trade policy (including trade agreements) ▪ National fiscal policy (particularly taxes related to trade) ▪ Government expenses/budget	Ministry of Agriculture (MoA) MoT Regional trade agreements and bodies
National food sources	Sources of food for a country, including domestic production and imports.	▪ National food balance ▪ Import dependence ▪ Prices of imported commodities (be sure to monitor both local prices and import parity prices)	MoA, Crop and Food Security Assessment Mission (CFSAM), FAO, World Bank Pink Sheet
Political economy	Relationship between individuals, society, markets, and the state, including both political and economic factors. A country's political economy is important because it reflect the level of stability in a country, which impacts the business environment.	▪ Conflict level ▪ Election process and timelines	Logistics Cluster, Armed Conflict Location and Event Data Project (ACLED)
Economic growth	Positive economic performance, or economic progress, is an indicator of a country's economic stability and strength. Economic growth signals positive productivity and sources of income.	▪ GDP or GDP per capita	World Bank FAO

Inflation	A general increase in prices and a decrease in the purchasing value of money. Countries with high inflation rates tend to have poor economic performance.	▪ Consumer price index	Central bank MoF
Monetary system	A system, or set of institutions, by which a government provides money in its economy. This typically consists of a central bank and commercial banks. This is essential to allow for the flow of capital in the country and to have a reserve of hard currency, which is important for currency stabilization.	▪ Functionality of central bank	MoF

Source: *Authors and Garin, Lester, and Sims (2018).*

Causes of Macroeconomic Outcomes

Many contributing factors to macroeconomic outcomes can be easily identified. **Error! Reference source not found.**VII.2 gives some examples of causes and the potential corresponding macroeconomic shock they may lead to. It is important to note that this list includes common sources of macroeconomic shocks in FEWS NET countries. This is therefore not an exhaustive list and analysts are encouraged to explore other issues that may come up in their own context.

Table VII.2. Examples of Possible Impacts of Macroeconomic Shocks on the Economy, Food Availability, and Access

Macroeconomic Element	Macroeconomic Shock	Impact on Economy	Impact on Food Availability	Impact on Food Access
National revenue	Increases	Positive	Increase in hard currency and liquidity →increase in credit →increase in production →increase in food supply	Increase in investment → increase in jobs → increase in wages → increase in food access
	Decreases	Negative	Decrease in hard currency and liquidity →government spending →subsidies and assistance cut → decrease in food supply	Decrease in investment → increased unemployment → wages decrease
Currency	Appreciates	Positive	Imports become cheaper → imports increase → increase in food supply	Imports become cheaper → increase in food access
	Depreciates	Negative	Imports become more expensive → imports decrease → decrease in food supply	Imports become more expensive → decrease in food access
Policies	Export ban	Positive or negative	Depends on level of domestic production. If the country typically exports, an export ban could increase local availability.	Food access may decrease for traders who rely on export wages Food access may increase for consumers who are net-purchasers
	Production subsidy	Positive	Increase in domestic production → increase in food supply	Increase in farmer wages → increase in food access
National food sources	Increases	Positive	Increase in food supply	Depends on prices at source
	Decreases	Negative	Decrease in food supply	Depends on the relationship between imports and domestic production and respective prices

Macroeconomic Element	Macroeconomic Shock	Impact on Economy	Impact on Food Availability	Impact on Food Access
Political economy	Conflict breaks out	Negative	Crops are destroyed during conflict → decrease in food supply	Businesses close → wages decline or salaries are not disbursed → decrease in food access
	Conflict ends	Positive	People return to farming land → production increases → increase in food supply	Security improves → markets and roads reopen → increase in food access
Inflation	Increases	Negative	Increase in general price levels → inputs are more expensive → production may go down → food supply may decrease	Increase in wages → depends on rate of food inflation compared to general inflation
	Decreases	Positive	Decrease in general price levels → inputs are cheaper → food supply may increase	Decrease in wages → depends on rate of food inflation compared to general inflation
Monetary system	Closure or low functionality	Negative	Importers unable to receive credits from bank to import → decline in imports → decrease in food supply	Reduced availability of bank access → reduced liquidity → reduced food access

Source: *Authors.*

Links to Scenario Development and Integrated Price Projections

As previously mentioned, the analysis developed above can be used for assumptions about macroeconomic shocks and impacts for Steps 3 and 8 of scenario development (see SST). Macroeconomic analysis should be implicitly incorporated in the market assumptions developed in Step 3, and should be explicitly incorporated as factors that could change the outlook in Step 8. The process for developing these assumptions, in addition to the guidance provided in this document, should follow the standard assumption development process implemented for scenario development. In addition to scenario development, the macroeconomic analysis developed above should be incorporated into integrated price projections in Steps 2, 3, 5, and 6.

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