

## Estimating Agricultural Sector Adjustments

This study was designed to provide an indication of changes in agricultural production, trade, and prices that would result from full compliance with the Pyramid serving recommendations. Potential changes in agricultural production, trade, and prices were determined by applying the percent change in food consumption needed to meet the recommendations (table 2) to data on commodity production, trade, and nonfood uses from the ERS food supply and utilization series for 1991-95. All adjustment scenarios assumed that average diets would meet the Pyramid serving recommendations regardless of price effects—essentially fixing food demand at the point where average consumption meets these targets (see box).

The following example illustrates how acreage adjustments were estimated for all commodity groups in this study. To meet the Pyramid recommendations, the average consumer would have to increase consumption of dark-green leafy and deep-yellow vegetables by 333 percent (table 2), from 7.3 pounds per capita per year to 31.6 pounds. Average domestic production of dark-green leafy and deep-yellow vegetables in 1991-95 was 11.8 billion pounds on 430,000 acres (or 27,500 pounds per acre). After adjusting for imports (adding 0.57 billion pounds) and exports (subtracting 0.45 billion pounds), we estimate that almost 12 billion pounds (farm product weight) of dark-green leafy and deep-yellow vegetables were consumed domestically. To meet a 333-percent increase in demand suggested by the Pyramid serving recommendations, production would need to increase to 39.8 billion pounds, or 1.4 million harvested acres.

The production and crop acreage adjustments presented here represent maximum adjustments, and are not

intended to be comprehensive. The size and economic complexity of the U.S. food system presupposes that a diverse and almost infinite number of foods, production methods, and trade adjustments could work together to move diets toward the Pyramid recommendations.

Food consumption is just one of several components of demand for agricultural products, such as animal feed, exports, and nonfood or industrial uses. The food supply is made up of domestic production and imports. While not measured in this study, offsetting adjustments in price, supplies, or other demand components thus will likely reduce the magnitude of the final adjustment in any single commodity sector.

This discussion assumes that the adjustments in diet and agricultural production will occur in the future. The likely timeframe for adjustments is discussed when appropriate for a limited number of commodities, such as fruits and livestock. Past consumption trends suggest that dietary change is a slow process for most people. Thus, the agricultural sector will likely have a long lead time to respond to such demand shifts. Existing domestic farm legislation and U.S. commitments under global trade agreements may also affect the pace of the adjustment in some sectors. But these are also subject to change over time and will impact some commodity sectors more than others. We also made the simplifying assumption that only U.S. consumers change their eating habits. Many of the impacts discussed here would be magnified if consumers in other countries were to make similar adjustments.

## Supply and Demand Adjustments

The analytical approach used in this study can be illustrated with a simple supply and demand model. The domestic food demand for a commodity in the initial base period is represented by  $D_f$  in figure 1.  $D_f$  is downward sloping because food demand responds to price changes. In the initial base period, consumers purchase  $Q_f$  of food at price  $P_o$ .

$D_{f_{gp}}$  is the new level of food demand prompted by Pyramid recommendations. At this point, demand is assumed to be perfectly inelastic at the point where average consumption meets the Pyramid serving recommendation, hence a vertical demand curve. In this illustration, we assume that supplies available for domestic consumption adjust in such a way as to hold commodity prices constant.

DIF is the difference between the quantity consumed during the 1991-95 base period ( $Q_f$ ) and the new consumption quantity ( $Q_{f_{gp}}$ ) prompted by the Pyramid serving recommendations. It is this change in quantity demanded that formed the basis for the agricultural sector adjustments detailed in this report. DIF can be either positive or negative. That is, depending upon the commodity,  $Q_f$  may be more or less than  $Q_{f_{gp}}$ . From table 2, we would see  $Q_f > Q_{f_{gp}}$  for added fats but  $Q_f < Q_{f_{gp}}$  for vegetables.

Many agricultural commodities, however, have a number of uses other than for domestic food. An increase in food demand, for example, prompted by Pyramid recommendations shifts total commodity demand outward ( $D_t$  to  $D_{t_{f_{gp}}}$  in figure 2).

$D_{t_{f_{gp}}}$  responds to prices because it includes other demands or uses for the product, such as exports and industrial uses. Increased food demand will result in higher food prices. The other uses, exports and industrial uses, will decline in response to the higher food prices. These higher prices will also lead to increased food supplies—which are determined by domestic production and imports. This combination of changes in other uses and in supplies will tend to moderate the effect of Pyramid-induced demand adjustments, resulting in a new equilibrium at  $Q'$  and  $P'$ .

The analysis is further complicated through interactions between agricultural commodity markets. Products can be substituted in consumers' diets. For example, if spinach prices increase relative to broccoli prices, consumers may substitute broccoli for spinach. Some products are used in combination with others, such as milk and cookies. Similarly, farmers can often shift production among commodities on the same piece of land, depending on price changes. For example, wheat, corn, soybeans, and vegetables can frequently, depending on the climate and soil conditions, be grown on the same plot of land. Alternatively, some food products, such as lowfat milk, butter, and cheese are produced jointly from the same raw agricultural commodity—milk. Consequently, producers and processors may alter the supply of final food products, depending on relative prices and changing technologies. Lack of data and appropriate economic models prevented us from exploring many of these potential adjustments in more detail.

