

Implicit Acreage- and Supply-Response Elasticities

Table 2 presents the implicit acreage-response and the implicit supply-response elasticities of all commodities. These were calculated by repeatedly solving the model while perturbing the intercept of each domestic demand function by 10 percent and scaling the new equilibrium solution down to a 1-percent change. Acreage and supply responses are determined by simultaneous adjustments of all quantities and prices to the new equilibrium. The acreage and supply responses are complex and not easily traced. But some factors that influence them are the proportions of total acreage of the commodity under consideration relative to other competing commodities, the slope of the production function of the commodity under consideration relative to the slopes of competing commodities, and the slope of the own-demand function relative to the demand functions of other commodities.

For example, the acreage response for corn is 0.333 percent, that is, a 1-percent increase in the domestic nonfarm demand for corn causes a 0.333-percent increase in corn acreage. Because yield per acre is constant in the EDMP model, corn production also increases by 0.333 percent from a total production level of 11,143 billion bushels. In order to expand the production of corn, it is necessary to reduce the production of the competing commodities in the model, giving rise to cross-elasticities of acreage response. Soybean acreage declines 0.099 percent, wheat acreage declines 0.179 percent, oats declines 0.042 percent, and several other commodities decline by less than 0.04 percent. However, barley, sorghum, and corn silage, which can substitute for corn in livestock feed rations, increase by 0.518, 0.047, and 0.034 percent, respectively. The most responsive commodities—sugar cane, sunflowers, and potatoes—have own-acreage responses above 1 percent. At the other extreme, own-acreage responses for cotton, barley, rice, and sorghum are less than 0.20 percent. Major field crops—soybeans, corn, and wheat—have own-acreage responses of 0.539, 0.333, and 0.334 percent, respectively.

The quantity reconciliation of the implicit supply response for corn begins with the absolute value of the 37.11-million-bushel increase in corn production, then adds 5.24 million bushels from consigning less corn to storage plus 2.87 million bushels from drawing down existing stocks of stored corn, plus 11.07 million bushels from decreased exports, plus 0.77 million bushels from increased imports, plus 5.61 million bushels from decreased onfarm livestock feeding, for a total of 62.67 million bushels, or 1.246 percent of the 5.033-billion-bushel domestic nonfarm demand. Finally, the price of corn increases by 0.273 percent in response to the new equilibrium supply and demand changes. After all adjustments in production, farm sector use, imports and exports, net storage, and own price, the final supply-response elasticity for corn becomes 1.246 percent—quadruple the acreage-response elasticity. A large proportion of the increase in corn supply response over corn acreage response is due to the fact that the divisor of the ratio, domestic nonfarm corn demand, is less than half of total corn production.

Common assumptions from other studies are that supply-response elasticities are 1.0 or less for crop commodities.³ From our results, these common assumptions appear to be not bad; but they bear further examination. Our

³ For example, Sumner (2006) assumed values of supply-response elasticities of 1.0 for corn, wheat, rice, and soybeans in the United States and elasticities of 0.5 to 0.2 for corresponding commodities in the rest of the world in his analysis of potential conflicts of U.S. agricultural support policies and obligations under the WTO. See table 5 of Sumner (2005).

results for acreage responses are grouped around 0.3, but the corresponding supply-response elasticities consistently are as much as three to four times higher, except for commodities that are neither internationally traded, nor storable, nor used on farms. Own-acreage response elasticities ranged from 1.279 for sugar cane to 0.042 for cotton and 0.013 for barley and sorghum. But, because more elastic supply sources (adjustments in exports, imports, storage/dis-storage, and onfarm use) contribute to the magnitudes of implicit domestic supply-responses, supply elasticities for soybeans, wheat, corn, and rice cluster near 1.25. Cotton supply-response is near 1.0, and livestock commodities have supply-response elasticities between 0.78 and 1.15—the smallest for hogs and the largest for broilers.