

Appendix 2.1—India Poultry-Feed Model: Characteristics

The India Poultry-Feed Model used for this study permits analysis of the impacts of the key forces shaping the growth of the poultry industry on major variables, including the production, consumption, and prices of poultry meat, eggs, corn, and soybean meal. The impact of income growth is depicted in fig. A, where higher incomes shift demand in the poultry (and egg) market outward toward D'_p , leading to an outward shift in feed demand in the India market to d'_f . In the import market, in the absence of trade restrictions, the excess demand schedule also shifts outward to ED' , creating a situation where feed imports of Q_f' occur at the world price (P_f^W). The extent to which imports can occur at the world price hinges on the relationship between the domestic price and the world price and on the presence of trade restrictions. In the case of a feed that is exported (excess supply), such as soybean meal in India, the effect would be to reduce exports, rather than induce imports, with the domestic price set by the world market price.

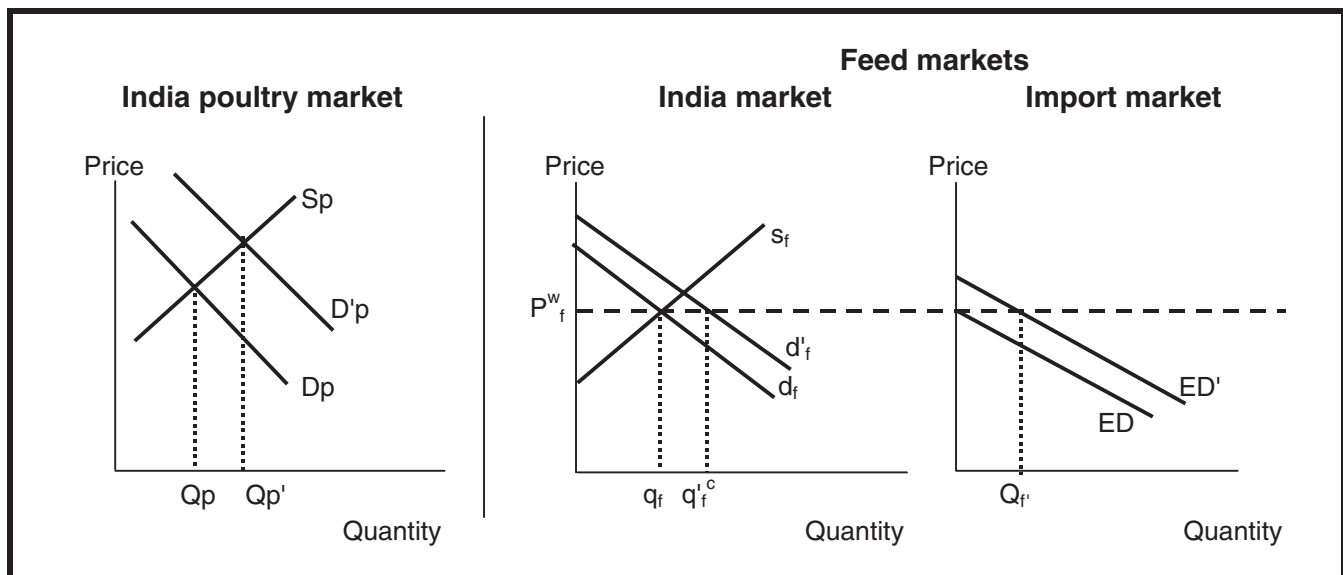
The impacts of vertical integration captured in the framework are shown in fig. B. Vertical integration is leading to both production efficiencies associated with improved technology and marketing efficiencies observed in the form of lower costs for key inputs (DOCs, feed) and smaller margins between farmers

and consumers. These efficiencies are captured in an outward shift in the poultry supply curve in the India market to S'_p . As drawn, the gains in production and marketing efficiency lead to higher levels of production and consumption (Q_p') at a lower price (P_p') in the poultry market. This can occur because, as increased poultry output shifts feed demand outward (d'_f) in the India market, the shift in excess demand (ED') in the import market is met at a world price (P_f^W) that is near the prevailing domestic price. With a world price that is above the domestic price, or trade restrictions that raise the import price above the world price, a smaller quantity of feed imports would occur at a higher price, raising the cost of poultry (and egg) production. As a result, poultry (and egg) supply and demand would shift back toward Q_p and price upward toward P_p . As in the case above, the impact of vertical integration on an exported feed, such as soybean meal in the case of India, would be to reduce excess supplies (exports), with the domestic price continuing to be set by the world price.

The impacts of both income growth and vertical integration are potentially influenced by trade policies for feeds. For India, the corn TRQ regime imposes a 15-percent tariff for within-quota (450,000 tons in 2002) imports and a 50-percent tariff for any imports above the quota. The impacts of this policy in the model are

Figure A

Effects of income growth



depicted in fig. C. In the India market, d represents the total demand for corn, aggregated across the various uses. With no tariffs or other trade restrictions, markets are in equilibrium with a domestic price equal to the world price of P_c^F . As drawn, domestic consumption at this price is q_c , which exceeds domestic production of q_p leading to imports of q_e on the excess demand (ED) and supply (ES) schedules in the import market. In the large country case, the importing country would face an upward sloping excess supply curve (ES). In the case of the India model, however, it is assumed that

any imports would not be large enough to affect the world price, so the relevant ES curve is actually the same as the flat dotted line at P_c^F .

India's ad valorem tariff (t) has the effect of rotating the excess demand curve from ED to ED(1-t), reducing imports from q_e to q_t , as well as raising the price and reducing the quantity consumed in the India market (not shown). Impacts on the poultry and egg markets would include higher costs and prices, and smaller quantities produced and consumed. With both

Figure B

Effects of poultry integration

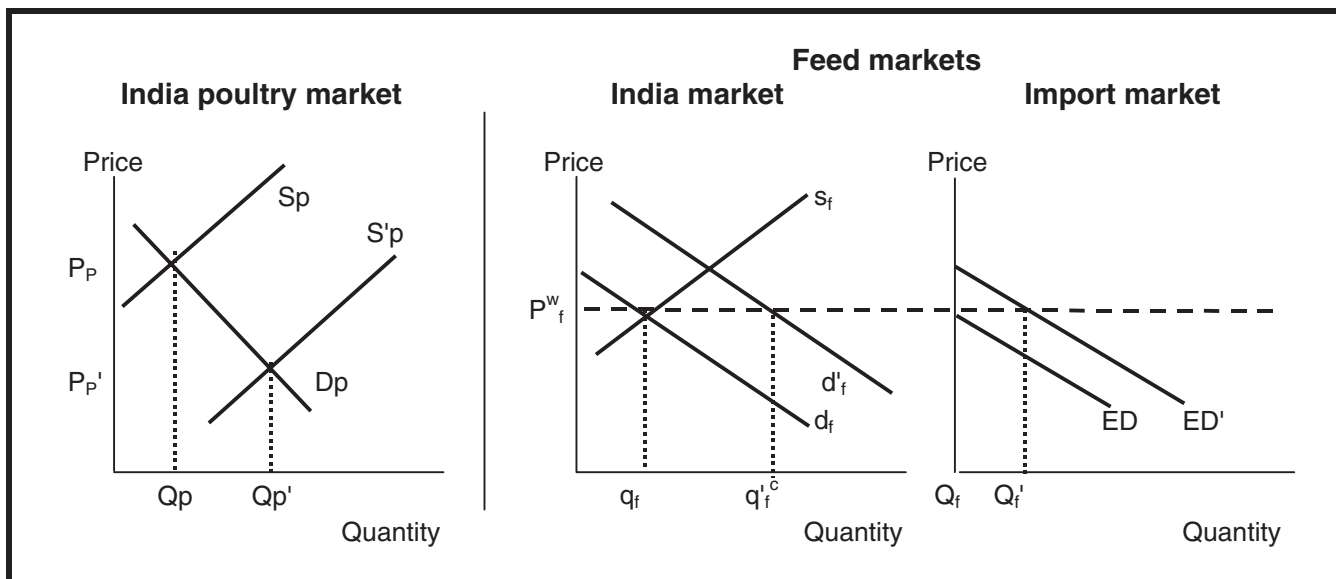
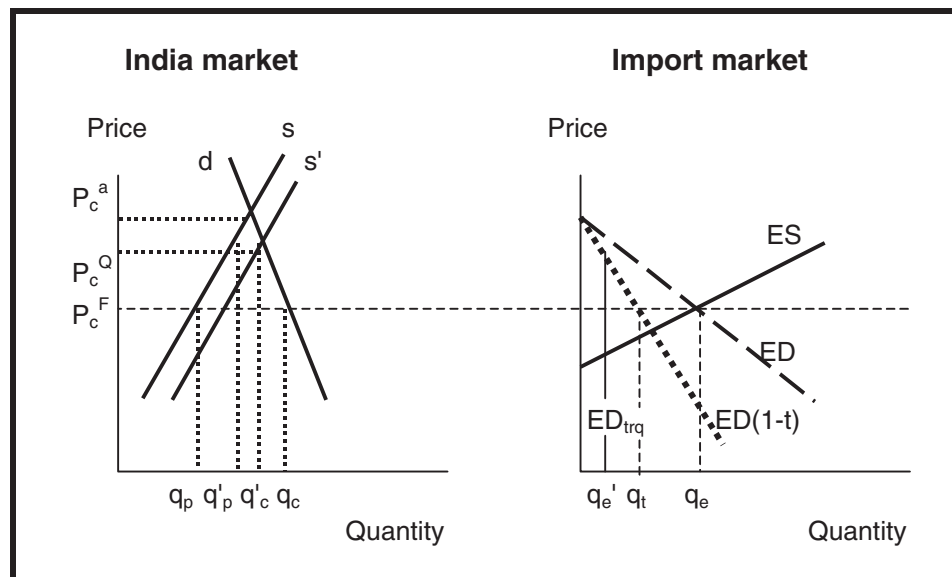


Figure C

Effects of a corn import quota



a tariff and a quota of q_e' (equal to 450,000 tons in 2002) imposed on imports, the excess demand curve is shifted from $ED(1-t)$ to ED_{trq} , which is the same as $ED(1-t)$ until it hits the quota q_e' and imports can no longer respond to price (a vertical line).¹ If the quota is large enough, that is to the right of q_t , the quota would be inoperative and imports would be the same as under the tariff-only regime. As drawn, however, the quota is binding, restricting imports below q_t . With this, domestic market prices and quantities for feed are determined from the intersection of d and s' , where s' is the domestic supply including the quota imports (left panel). With the restrictive quota, the domestic corn price rises to P_c^Q , domestic consumption falls to q_c' and domestic production rises to q_p' . Hence, although the TRQ permits domestic prices of corn to be lower than under a trade ban (autarky, P_c^a), prices remain higher, and consumption lower, than would be the case with free trade.² As before, higher corn prices translate into higher poultry and egg prices, and smaller quantities are consumed and produced.

Limitations of the Framework

The analytical framework captures the major economic relationships in the poultry meat and feed sectors, but omits several aspects of potential significance to the results. First, by omitting poultry and egg trade, the framework assumes that trade in these items will remain inconsequential. Significant poultry imports seem unlikely in the medium term due to the limited market for frozen poultry, the high tariff, and relatively low internal market prices. Poultry exports may be more plausible, but are not accounted for in the analysis. India currently exports a relatively small share (less than 1 percent) of its egg production, and it

¹ Also not shown is the distinction between the in-quota and above-quota tariffs. The shift to a 50-percent tariff for imports of 450,000-500,000 MT would rotate further the excess demand curve in the above-quota region, leading to a kinked excess demand curve.

² Note: Figure C is not drawn to scale.

seems likely that the huge internal market, rather than exports, will remain the key driver of the industry.

The framework includes only two products (poultry meat and eggs) and two feeds (corn and soybean meal) and, following Abbott et al. (2000) does not allow for substitution between products or feeds. In the case of the products, both egg and poultry demand are fairly responsive to changes in income and their own price, and it is likely that these income and own-price effects are more dominant than cross price relationships with other foods in driving demand. In the feed markets, available information suggests that integrated poultry meat producers prefer not to substitute for corn or soybean meal in their rations, but that independent growers and egg producers are more likely to substitute alternative ingredients based on price. To the extent that price-based substitution leads to average corn or soybean meal ration shares lower (higher) than those assumed in the analysis, impacts on domestic feed prices and trade are over (under) estimated in the framework. Similarly, by basing nonfeed (starch, food use) demand for corn on historical trends, the model does not build in price-based substitution between feed and nonfeed uses. To the extent that nonfeed uses deviate significantly from trend due to changes in prices, these effects are not captured.

The model, as specified, does not incorporate potential changes in world prices resulting from changes in India's trade of corn or soybean meal. Since India's trade in these commodities remains small relative to world trade in the various scenarios analyzed, this assumption is unlikely to affect the results significantly.

Finally, the validity of analyses conducted using the framework hinges on the reliability of the data, technical relationships, and economic parameters employed. Due to the limited availability of reliable industry data, it is difficult to be completely confident of the data and parameters used. In an attempt to address this problem, a range of estimates for key input data and parameters are used in the analysis to test the validity of the results.