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A Note on the Theory of Price Determination in the Australian Beef Market

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The view is taken that institutional factors operating in the international beef market limit the usefulness of a competitive spatial equilibrium model for understanding the process of price formation in the Australian beef market. A simple theoretical model is developed to demonstrate the impact of the U.S. beef quota and Australia's meat export control scheme on Australian beef prices. It is argued that Australian beef prices are related to the weighted average of export prices rather than any "world" price. Implications for the direction and volume of Australia's beef exports are discussed.

The spatial competitive equilibrium model has frequently been used as a basis for modelling international trade in commodity markets (McGamy 1969; MacAulay 1977; Martin and Zwart 1975). In the case of world beef trade and, in particular, Australia's trade with the U.S.A., we argue in this paper that the standard spatial equilibrium model is inappropriate. We develop an alternative theoretical model which takes explicit account of institutional constraints, in particular, Australia's Export Control Scheme[1] and beef import quotas imposed by the U.S.A.

The basic ideas expressed here are not new. They were first suggested by Freebairn and Gruen (1977) and further developed by Reeves (1979). The present exposition is a graphic refinement which we hope will add to the understanding of price determination mechanisms in the Australian beef market.

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[1] In earlier years this was called the Export Diversification Scheme. For details see Freebairn and Gruen (1977).

Price Determination Under Spatial Equilibrium

Consider a trade model in which there is one exporting country and two importing countries. In a free-trade situation a world equilibrium price will be established when excess demands are, in sum, equal to excess supply. This situation is shown in Figure 1, which is similar to the conventional "back-to-back" trade diagram, although transport and transaction costs are ignored for ease of exposition. In the left half, *FG* represents the excess supply curve for country 1, the exporting country, while *AB* represents the excess (or import) demand curve for country 3. On the right, SS_2 and DD_2 represent the normal supply and demand curves for country 2, an importer. Under free trade, an equilibrium world price of P_w will be established such that the distance *CD* is equal to *HI*. That is, country 1 exports *OC'*, country 2 imports *HI* while country 3 imports *OD'*.

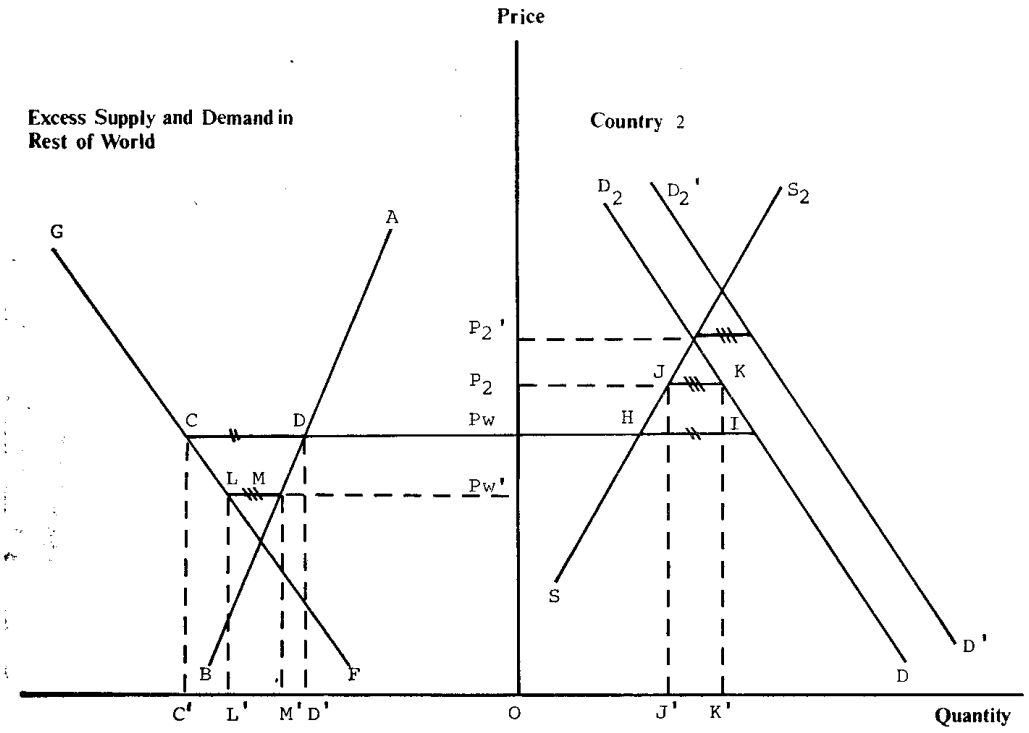

Figure 1: *Price Determination under Spatial Equilibrium*

Influence of Import Quota in Country 2

Suppose now that country 2 imposes an effective quota represented by *JK*. The price in country 2 will now rise to P_2 while the price in the rest of the world will fall to P'_w. This is established where *JK* is equal to *LM*. World trade (equal to the volume of exports by country 1 *i.e.*, *OL'*) has been reduced while the volume imported by country 3 (*OM'*) is increased.

If the demand curve in country 2 now shifts out to D'_2D', the price in country 2 will increase to P'_2. However, since the volume imported under quota, JK (equal to LM) remains unchanged, the increased demand and price in country 2 will have no influence on the prices prevailing in country 1 or country 3. That is, the price prevailing in the rest of the world is unrelated to the price in country 2 when a fixed quota is effective in limiting imports into that country. Any change in the size of the quota will, of course, lead to changes in prices in the other two countries.

In the context of Australia (analogous to country 1) and its relationship to major beef importers, the U.S.A. (analogous to country 2) and "other markets" (analogous to country 3), there is much empirical evidence to support the claim that beef prices in Australia closely follow those in the U.S.A. despite the U.S. quota (*e.g.*, Papadopoulos 1973; Hinchy 1978). In general, a free-trade model is not entirely satisfactory in explaining the observed facts. If the size of the quota remains relatively constant then under a free-trade model, U.S. and Australian prices would be expected to be completely unrelated. One of the factors at issue is the distribution of the economic rent represented by JK multiplied by $(P_2 - P'_w)$ when a quota JK is in force. In the absence of any export control scheme by the exporting country, most of this rent would be captured by importing firms in country 2.

Price Determination under the Export Control Scheme

Consider now the case where the exporting country 1 operates an export diversification or control scheme (see Freebairn and Gruen 1977; Waugh and Murphy 1979; AMLC 1980 for details) so that supplies to country 2 are controlled via an entitlement scheme which enables the exporting sector of country 1 to capture the rent represented by JK $(P_2 - P'_w)$. Assuming competitive forces within the export sector of country 1, this rent will be distributed back to the domestic market of country 1 so that zero excess profits are earned in the export sector. The net effect is that exporting country 1 price discriminates between its markets.

The market situation specific to country 1 is illustrated graphically in Figure 2, in which market equilibria with and without an export control scheme are depicted. The curve AB again represents the excess demand by country 3 which is faced by exporters in country 1, while the quantity $O\bar{Q}_2$ represents the quota set by country 2. Price OP'_2 prevails in country 2 when $\bar{Q}_2$ is effective. The total excess demand curve faced by exporters in country 1 can be represented by P'_2CDE, which is the horizontal summation of excess demand from country 2 $(P'_2C\bar{Q}_2)$ and that from country 3 (AB). If FG is the excess supply curve for country 1, the equilibrium trade price, given no export control scheme operating in country 1, will be P'_w. This will also be the price prevailing within country 1. The exporter will ship $O\bar{Q}_2$ to country 2 and $OQ'_E - O\bar{Q}_2$ to country 3, and total export revenue will be area $OP'_wIQ'_E$.

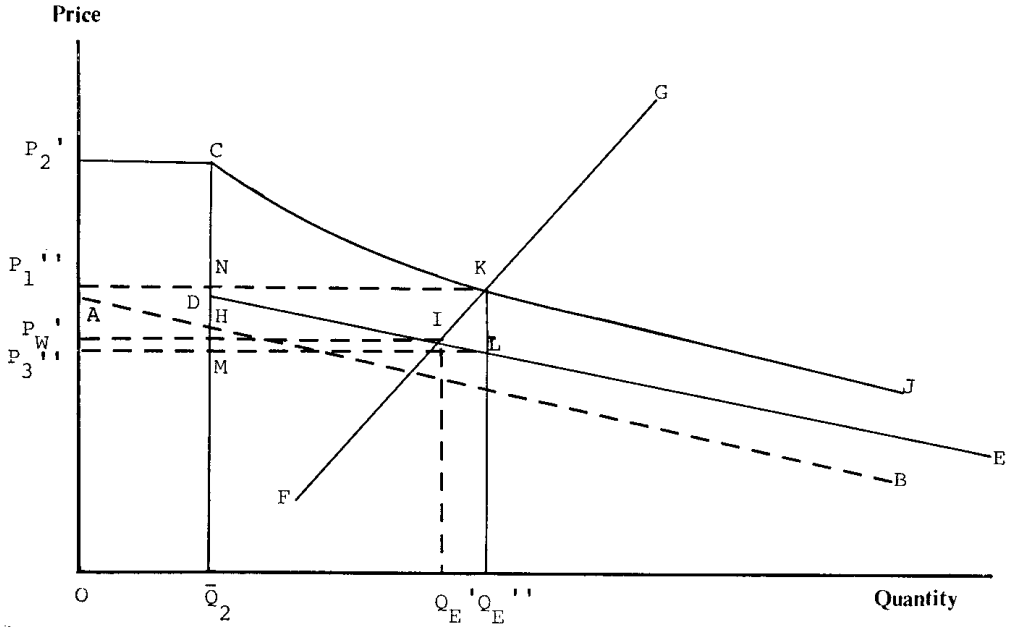

Figure 2: Market Equilibrium With and Without Export Control Scheme

The economic rent represented by area $P'_2\,CH\,P'_w$ is assumed to be taken by importers in country 2. If under an export control scheme in country 1, this economic rent is captured by exporters in country 1 and redistributed to the market in country 1, a weighted average price will prevail in the exporting country.[2] As total exports expand the economic rent is spread over an increasing quantity of exports. The price-quantity relationships, or "demand" facing exporters in country 1 can thus be represented by P'_2CJ. The portion CJ will asympotically approach DE in the limit. FG, assumed to have positive slope, will intersect P'_2CJ at K giving a price in country 1 of P''_1 while a price of P''_3 will prevail in country 3. The long-run effect of the export control scheme therefore is to raise domestic prices in country 1 (Australia) which, in turn, stimulates production[3] and lowers domestic consumption. Excess supply is increased and, given $\bar{Q}_2$ fixed, supplies to "other" markets increase but they attract a lower average price. The extent to which exports to other markets increase and to which the price of exports to other markets decreases will depend upon elasticities of excess demand and of excess supply, as well as the difference between P'_2 and P'_w.

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[2] This can also be readily shown by way of a simple algebraic model.

[3] It is acknowledged that supply response in the beef industry is more complex than alluded to here. The important point is that excess supplies are increased with a rise in domestic prices.

In the above discussion all of the economic rent as represented by $P'_2\ CHP'_w$ is assumed to be captured by Australian exporters and passed back to producers. In this case the geometry of the curve CJ is such that the area $P'_2\ CNP''_1$ is equal to the area $NKLM$. If only a proportion of the rent is captured by Australian exporters or only a proportion is passed back to the market in Australia, the effect would be a lowering of the curve $P'_2\ CJ$ but all other results discussed here would still stand.

Effect of Changes in U.S. Beef Prices and Quotas

The model also provides a means of explaining the linkage between movements in U.S. (country 2) beef prices or quotas, prices in Australia (country 1) and exports and export prices to other markets (country 3). In Figure 3, an example is given of the theoretical impact of an increase in the U.S. price on the Australian beef market given a fixed quota of $O\bar{Q}_2$. The increased U.S. beef price (from P'_2 to P''_2) will raise the weighted average demand for exports, increase domestic prices in Australia (to P'''_1) and lead to increased export supplies to other markets (equal to $OQ'''_E - OQ''_E$). Given $\bar{Q}_2$, shipments to "other" markets will increase but again they will attract a slightly lower price in these markets (P'''_3). Thus, where the elasticity of excess demand from other markets is negative and the excess supply elasticity to other markets is positive (but not perfectly elastic), U.S. price increases lead to an increase in Australian prices, an increase in exports to other markets and to slightly lower prices for exports to these markets.

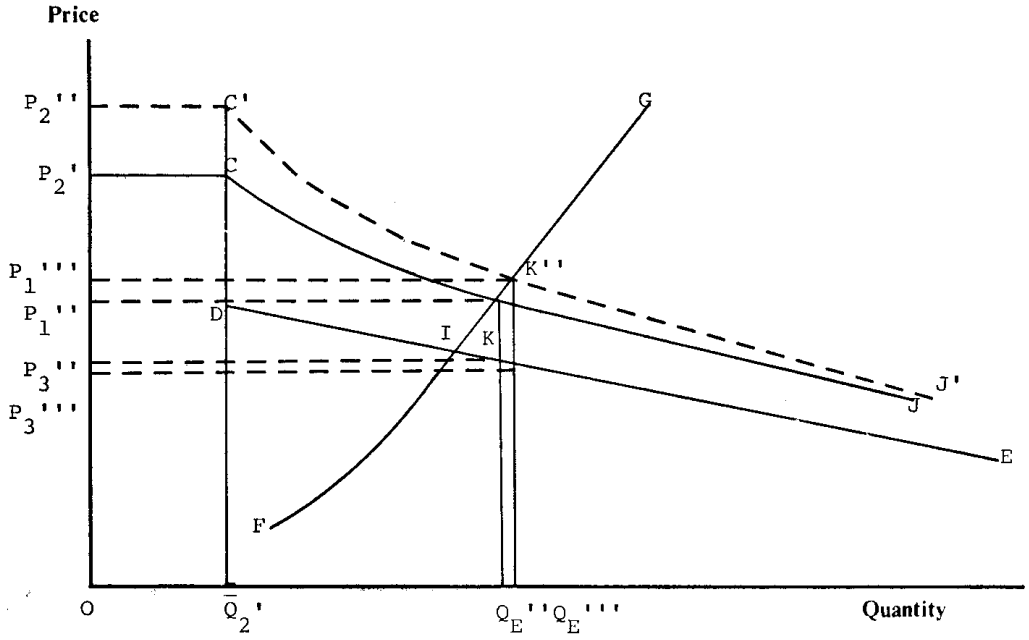

Figure 3: Impact of an Increase in U.S. Price

The implications of an increase in the U.S. quota are less straightforward and depend on the magnitudes of the elasticity of the excess supply curve in country 1 (Australia) and of the elasticity of excess demand from "other" markets. In Figure 4, the impact of an expansion in the quota to $\bar{Q}_2^*$ is shown. In this case, prices in country 1 (Australia) are increased as before (P''_1 to P^*_1), but the increase in total exports is smaller than the increase in the U.S. quota, given for example a relatively inelastic excess supply curve, *FG*. This means that there is some diversion of exports away from country 3 (other markets) to country 2 (the U.S.A.), with the result that prices received for exports to country 3 are higher than in the absence of the quota increase ($P^*_3 > P''_3$ in Figure 4). The alternative case, in which an increase in the U.S. quota induces an increase in exports to other markets and a decline in export prices to other markets, is not shown.

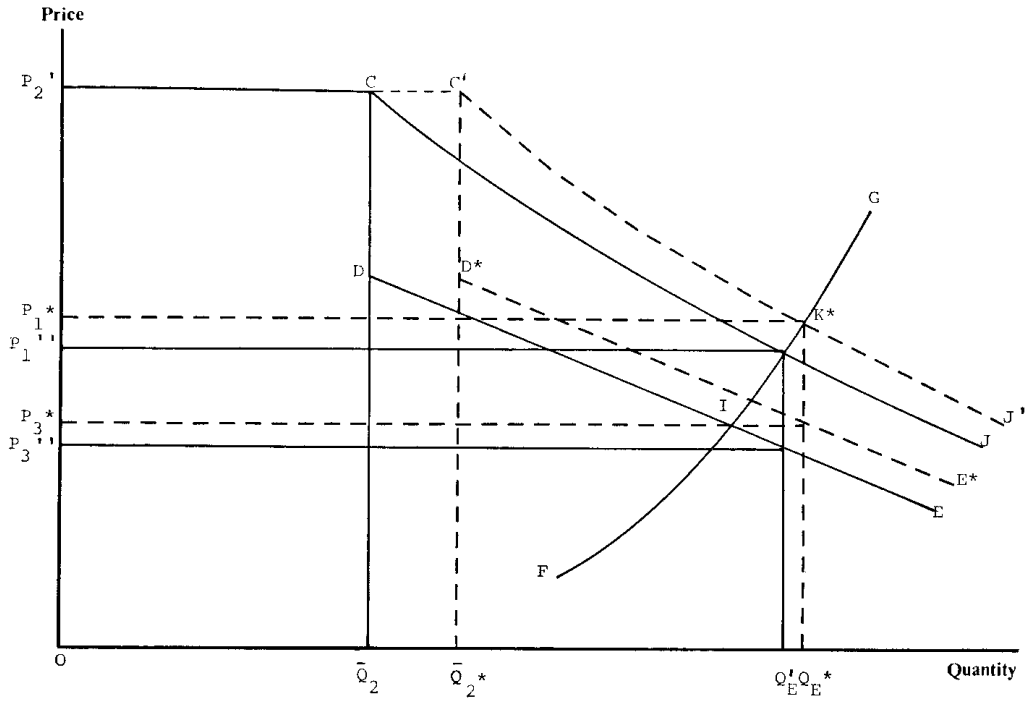

Figure 4: *Impact of an Increase in U.S. Quota*

It could also be argued that an increase in the quota would lower the price in country 2. Any reduction in P'_2 can be expected to be small and would only occur if the global quota increased and not just Australia's share of a fixed quota. Any small change in P'_2 would not greatly influence the basic arguments.

Summary and Conclusions

One of the difficulties in attempting to model price transmission processes for beef between the U.S.A. and Australia is that quotas and other institutional influences vary over time. When the quota legislation is suspended, export control schemes in Australia are also automatically suspended and a free trade model is useful for explaining the price transmission processes. In the absence of quotas in the U.S., beef prices in Australia, other countries, and the U.S.A. should theoretically differ only by transportation and transaction costs (for comparable beef grades of course). A problem arises when quotas are operative and effective in limiting U.S. beef imports. If quotas remain relatively constant there should be no relationship between changes in U.S. prices and Australian prices if the conventional spatial equilibrium model is taken as the theoretical framework. It is our understanding that changes in U.S. prices are reflected in Australian prices despite quotas. It could however be argued that by virtue of the Presidential powers in the U.S. quota legislation, the U.S.A. has by default operated a "countercyclical" import policy since the early 1960's: high prices being associated with low U.S. domestic production and high imports (mostly with quotas suspended) giving rise to high Australian prices, and vice versa. In this context the conventional spatial equilibrium model as a theoretical framework might be "near enough" but we would argue "not good enough". In developing an alternative theoretical framework we have attempted in this paper to take explicit account of institutional factors. In particular, attention has been given to the way such factors influence the distribution of any economic rent arising as a result of prices in U.S.A. being above those in Australia when quotas are operative.

On the basis of arguments presented in this paper, an effective quota imposed by country 2 (U.S.A.) has the effect of lowering world trade prices compared with what would occur in the absence of a quota. Given effective quotas by the U.S.A., the effect of an export control scheme operated by Australia is to raise prices domestically above what they would be in the absence of the scheme, thereby stimulating additional export supply or trade volume, which lowers prices in export markets other than the U.S.A. Given quotas in the U.S.A. and the Export Control Scheme operated by Australia, a price rise in the U.S.A. is likely to increase exports and lower export prices in "other" markets. But an increase in the U.S. quota could theoretically have an effect in either direction depending on the elasticity of Australia's excess supply function and the elasticity of the excess demand function from other markets.

Although this paper has been formed specifically in terms of the Australian beef industry, the model developed could quite readily be applied more generally. In Australia, several agricultural markets are characterized by price discrimination schemes without supply control schemes.

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