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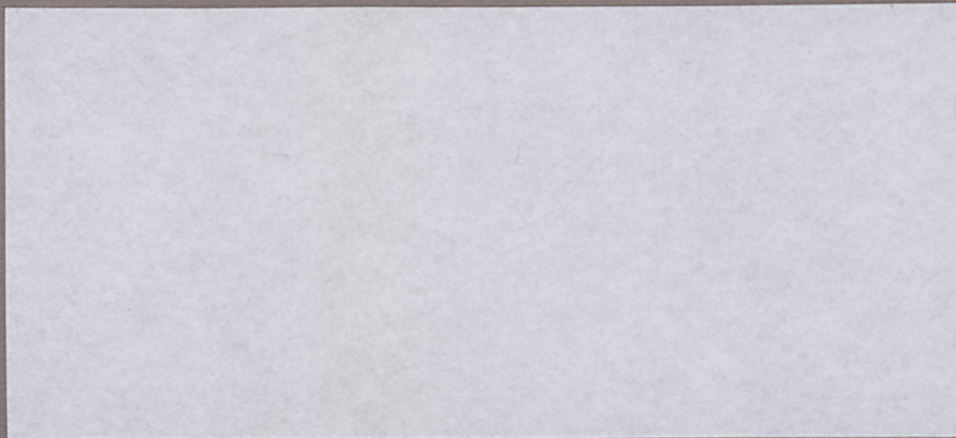
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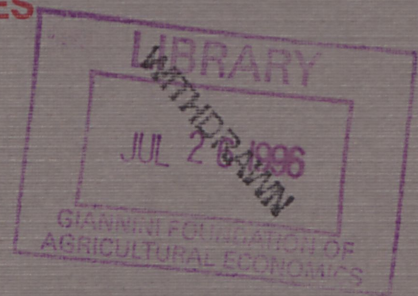
TRADE REFORM WITH VERTICALLY-RELATED MARKETS

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Abstract

Most policy analysis in agricultural economics typically ignores the existence of the food processing, distribution and retail sectors. If these sectors were perfectly competitive, their exclusion would not significantly affect the welfare changes following policy reform. However, since these sectors are typically imperfectly competitive, excluding them does matter. In a theoretical model of a vertically-related food market, this paper shows that welfare changes of policy reform are lower than the 'perfectly competitive' case since there is imperfect pass-through of price changes occurring at the farm-gate. The model shows that the pass-through effects depend on the nature of strategic interaction in the food market, and the degree of product differentiation of the final food products. The theoretical model is applied to the recently proposed changes to the European Community (EC) banana regime, a sector characterized by the existence of a few large firms.

Introduction

Pressure for the reform of agricultural trade policies has intensified in recent years, most notably in the GATT, and also unilaterally as evidenced by the MacSharry proposals in the European Community (EC). Economists have played an increasing role in this reform process by making the costs of current agricultural support and trade policies transparent, the most notable examples being the OECD's Trade Mandate Model (OECD, 1987), Roningen and Dixit (1990), and the work of Tyers and Anderson (1992). Essentially, this research indicates that the potential benefits to consumers, taxpayers and exporting countries from policy reform would outweigh costs to producers who benefit from current transfers.

However, much of this policy analysis typically ignores the existence of the food processing, distribution and retail sectors. As such, it is implicitly assumed that consumers are either consuming raw agricultural products purchased directly from farmers or that farmers are undertaking processing activities. Clearly neither is true. But, in terms of analyzing the welfare effects of policy reform, the question arises as to whether the omission of the food processing sectors really matters? If these sectors were characterized by perfect competition, the answer would probably be no. However, it is known from several studies of the food processing/retailing sectors in developed countries are typically imperfectly competitive, relevant well-known studies being Connor *et al.* (1985), and, more recently, Sutton (1991). Of course, the existence of further links in the food system has received attention in the literature (Gardner, 1975;

Chambers, 1983), but when the focus has been on policy issues, perfectly competitive markets have been assumed. The important concern, therefore, is how does the existence of oligopolistic market structures in a vertically-related food system affect applied policy analysis?

This is the principal concern of this paper. It is shown that the existence of oligopoly at any stage of the food system will lead to incomplete pass-through of changes in prices of raw or semi-processed products arising from trade and/or agricultural policy reform. Consequently, when examining trade liberalization or reductions in agricultural support, consumer prices will be reduced, but not by as much as the change in tariffs (or tariff-equivalents) and intervention prices. As such, consumer welfare will increase with policy reform, but the increase will be lower with imperfectly competitive market structures than with perfect competition. Consequently, modelling exercises which ignore these vertically-related but oligopolistic markets, will typically over-estimate consumer surplus increases following policy reform.

The paper is organized as follows. Section 1 outlines a theoretical model that will form the basis for the main propositions of the paper. Section 2 establishes these main propositions highlighting factors which determine the extent of policy-price transmission. As an illustrative example, these propositions are highlighted with a case-study of changes in the EC banana market which has been the subject of much debate in the EC in recent months. This discussion is presented in Section 3 while Section 4 summarizes and concludes.

1. A Model of Vertically-Related Markets

In this section, a model of a multi-stage food chain is outlined. The model is kept as simple as possible in order to keep the derivations tractable and the results transparent. Consider the case of an agricultural sector a along with a two-stage processing/marketing system, $s = 1,2$ comprised of a first stage, $s = 1$, where firms convert a raw agricultural product which is then sold on to a second stage, $s = 2$. Farm-gate prices and tariff levels are determined by government policy, while stages $s = 1,2$ are characterized by oligopolistic market structures, the first stage selling a processed, homogeneous food input to the second stage which then sells consumers differentiated products. At each stage, the food input from the previous stage enters the firms' production function where further value is added, the technology at all stages being one of constant returns to scale. In addition, while firms at the first stage compete with other firms for farm produce, the farm sector serves different and segmented markets; hence, there are no spillover effects from other processed food sectors, and the issue of monopsony does not arise with respect to the farming sector.

In order to describe the structure of demand at the second stage, a standard model of differentiated oligopoly, similar to that adopted by Singh and Vives (1984), Dixit (1988), and Cheng (1989), is used. There are two principal reasons for adopting this model: first, it follows a general conjectural variations approach so that a wide class of oligopolistic structures can be captured; second, following Dixit (1987), the model can be used to generate an empirical assessment of the extent of policy-price transmission.

The second-stage firms, i=1,2, are assumed to combine output purchased from the first stage with other inputs in a fixed proportions, constant costs technology where the output relationship can be written in the simple form:

(1)
$$Q_{2i} = \phi_i Q_{1i} \qquad i = 1,2$$

where Q_{1i} and Q_{2i} are outputs at the first and second stages respectively, and ϕ_i is the constant coefficient of production, representing the share of Q_{1i} used in production at the second stage[1]. In addition, it is assumed that second-stage firms take the price of first-stage output as given, i.e. there is arms' length pricing.

In terms of consumer demand, other sectors of the economy can be regarded as a competitive *numeraire* so that the consumer's utility function is linear and separable in the *numeraire*. Thus income effects can be ignored and partial equilibrium analysis can be conducted. The representative consumer maximizes:

(2)
$$U(Q_{2i}) - \sum_{i=1}^{2} p_{2i} Q_{2i} \qquad i = 1,2$$

where Q_{2i} and p_{2i} are the amount and price of each product respectively at the second stage, and $U(Q_{2i})$ is given by:

(3)
$$U(Q_{21}, Q_{22}) = a_1 Q_{21} + a_2 Q_{22} - (b_1 Q_{21}^2 + b_2 Q_{22}^2 + 2k Q_{21} Q_{22})/2$$

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[1] This is a structure originally suggested by Greenhut and Ohta (1979).

where (3) is quadratic and concave, and the parameters a_i and b_i are assumed positive. Maximizing expression (2) generates the inverse demand function for product i at stage two:

$$(4) \qquad p_{21} = a_1 - b_i Q_{21} - k Q_{22}$$

$$(5) \qquad p_{22} = a_2 - b_2 Q_{22} - k Q_{21}$$

where $b_1 b_2 - k^2 > 0$ if the products are imperfect substitutes, $b_1 b_2 - k^2 = 0$ if they are perfectly substitutable and $k = 0$ if they are independent.

On the supply side at the second stage, there are n_{2i} symmetric-sized firms in the two sectors. Profits for a representative firm in each sector are given by:

$$(6) \qquad \pi_{21} = (p_{21} - p_{11} - c_{21}) q_{21}$$

$$(7) \qquad \pi_{22} = (p_{22} - p_{12} - c_{22}) q_{22}$$

where p_{1i} is the price firms at stage one charge for the semi-processed product, and c_{2i} are other stage-two costs. For institutional reasons, it is assumed that there are two sets of suppliers, $i = 1,2$, at the first stage $s = 1$, each supplying only one of the sets of firms at stage two. Since there are n_{2i} firms in each sector at the second stage, such that aggregate output is given by $Q_{2i} = (n_{2i} q_{2i})$, the first-order conditions for profit maximization are given as:

(8)
$$p_{21} - p_{11} - c_{21} - Q_{21}V_{21} = 0$$

(9)
$$p_{22} - p_{12} - c_{22} - Q_{22}V_{22} = 0$$

where the aggregate conjectural variations parameters V_{2i} are given as:

(10)
$$V_{21} = [b_1(1 + (n_{21} - 1)v_{211}) + kn_{22}v_{212}]/n_{21}$$

(11)
$$V_{22} = [b_2(1 + (n_{22} - 1)v_{222}) + kn_{21}v_{221}]/n_{22}$$

where the v_{2ii} (i = 1,2) are the firms' conjectures about how competitors in both parts of stage two will respond to a change in quantities. The values for the v_{2ii}'s are continuous variables whose values capture a range of possibilities concerning firm behavior. For example, if firms play Cournot strategies, then all v_{2ii}'s will equal zero; hence the value of V_{2i} will equal b_i / n_{2i}. If firms play Bertrand strategies, then the v_{2ii}'s will equal -1, and the v_{2ij}'s will equal $k / -b_i$, and V_{2i} will range from 0 to b_i / n_{2i}, depending on the extent of product differentiation[2]. Hence, for conduct more competitive (less competitive) than Cournot, $v_{2ii} < 0$ ($v_{2ii} > 0$). In the limit, $v_{2ii} = -1$, the competitive outcome, or $v_{2ii} = 1$, the collusive outcome. Clearly firms can hold different conjectures about their competitors in the two sectors of stage two.

In order to conduct comparative statics exercises in this vertical system, it is necessary to establish the initial Nash equilibria of both stages one and two. In the case

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[2] See Eaton and Grossman (1986) for a discussion of Bertrand conjectures in a quantity setting.

of stage two, this is done by combining the inverse demand functions (4) and (5) with the first-order-conditions (8) and (9), to give:

$$
(12) \quad \begin{bmatrix} Q_{21} \\ Q_{22} \end{bmatrix} = \frac{1}{\Delta'} \begin{bmatrix} b_2 + V_{22} & -k \\ -k & b_1 + V_{21} \end{bmatrix} \begin{bmatrix} a_1 - p_{11} - c_{21} \\ a_2 - p_{12} - c_{22} \end{bmatrix}.
$$

$$
(13) \quad \begin{bmatrix} p_{21} \\ p_{22} \end{bmatrix} = \begin{bmatrix} a_1 \\ a_2 \end{bmatrix} - \frac{1}{\Delta'} \begin{bmatrix} \Delta + b_1 V_{22} & k V_{21} \\ k V_{22} & \Delta + b_2 V_{21} \end{bmatrix} \begin{bmatrix} a_1 - p_{11} - c_{21} \\ a_2 - p_{12} - c_{22} \end{bmatrix}
$$

where $\Delta = (b_1 b_2 - k^2)$ and $\Delta' = (b_1 + V_{21})(b_2 + V_{22}) - k^2$.

Turning to the first stage of the system, $s = 1$, the inverse demand functions for semi-processed product i, i = 1,2 are defined by re-arranging expressions (8) and (9), and remembering that $Q_{2i} = \phi_i Q_{1i}$:

$$
(14) \quad p_{11} = a_1 - (b_1 + V_{21})\phi_1 Q_{11} - k\phi_2 Q_{12} - c_{21}
$$

$$
(15) \quad p_{12} = a_2 - (b_2 + V_{22})\phi_2 Q_{12} - k\phi_1 Q_{11} - c_{22}
$$

Profits for a representative firms at stage one can be written as:

$$
(16) \quad \pi_{11} = (p_{11} - p_{a1} - c_{11})q_{11}
$$

$$
(17) \quad \pi_{12} = (p_{12} - p_{a2} - c_{12})q_{12}
$$

where p_{ai} is the price that firms at stage one pay for raw agricultural produce, and c_{1i} are other stage-one production costs. Since there are n_{1i} symmetric-sized firms in each part of stage one, such that aggregate output can be given as $Q_{1i} = (n_{1i} q_{1i})$, the first-order conditions for profit maximization can be written as:

(18)
$$p_{11} - p_{a1} - c_{11} - \phi_1 Q_{11} V_{11} = 0$$

(19)
$$p_{12} - p_{a2} - c_{12} - \phi_2 Q_{12} V_{12} = 0$$

where the aggregate conjectural variations parameters V_{1i} are given as:

(20)
$$V_{11} = [(b_1 + V_{21})(1 + (n_{11} - 1)v_{111}]/n_{11}$$

(21)
$$V_{12} = [(b_2 + V_{22})(1 + (n_{12} - 1)v_{122}]/n_{12}$$

where V_{2i} is as previously defined, and v_{1ii} are the stage-one firms' conjectures about how their competitors will respond to a change in quantities. Note that, because of the earlier assumption made about stage one, the cross-conjectures v_{1ij} between the two sections of stage one are not defined as these firms, by assumption, do not compete directly with one another. The first-order conditions (18) and (19) can now be re-written as:

(22)
$$\Lambda_1 - \beta_{21}\phi_1 Q_{11} - k\phi_2 Q_{12} - C_{11} - \phi_1 Q_{11} V_{11} = 0$$

(23)
$$\Lambda_2 - \beta_{22}\phi_2 Q_{12} - k\phi_1 Q_{12} - C_{12} - \phi_2 Q_{12} V_{12} = 0$$

where $\Lambda_i = (a_i - c_{2i})$, $\beta_{2i} = (b_i + V_{2i})$, and $C_{1i} = (c_{1i} + p_{ai})$. Utilizing the inverse demand functions (14) and (15), and the first-order conditions (22) and (23), the initial Nash equilibria for the first stage of the system can be written as:

$$(24) \qquad \phi \begin{bmatrix} Q_{11} \\ Q_{12} \end{bmatrix} = \frac{1}{\Delta''} \begin{bmatrix} (b_2 + V_{22} + V_{12}) & -k \\ -k & (b_1 + V_{21} + V_{11}) \end{bmatrix} \begin{bmatrix} \Lambda_1 - C_{11} \\ \Lambda_2 - C_{12} \end{bmatrix}$$

$$(25) \qquad \begin{bmatrix} p_{11} \\ p_{12} \end{bmatrix} = \begin{bmatrix} a_1 \\ a_2 \end{bmatrix} - \frac{1}{\Delta''} \begin{bmatrix} \beta_{21}\beta_{11} - k^2 & kV_{11} \\ kV_{12} & \beta_{22}\beta_{12} - k^2 \end{bmatrix} \begin{bmatrix} \Lambda_1 - C_{11} \\ \Lambda_2 - C_{22} \end{bmatrix}$$

where $\Delta'' = (b_1 + V_{21} + V_{11})(b_2 + V_{22} + V_{12}) - k^2$, and $\beta_{1i} = (b_j + V_{2j} + V_{1j})$.

Given expressions (13) and (25), it is now possible to derive the extent of policy-price transmission at both stages of the food system.

2. Policy-Price Transmission

The hypothesis that there will not be complete pass-through of changes in policy prices is not entirely new. Colman (1988) has suggested that perfect transmission of policy prices is unlikely to occur for several reasons, e.g. the form of the policy intervention, and differences between the elasticity of supply at the farm-gate and the processing level (see Gardner, *op.cit.*, and Chambers, *op.cit.*). However, no analysis has focused explicitly on the effect of imperfect competition on policy-price transmission.

The aim here is to consider the outcome of a simple experiment whereby government changes farm-gate prices. Such a change can be characterized as either a variation in support prices for a domestically produced agricultural commodity purchased by both sets of firms at stage one, or a symmetric change in both the domestic support price of

the commodity bought by firms in sector i at stage one and the level of protection against the commodity imported by firms in sector j at stage one. These policy changes are first examined for the general case, and then under the assumptions that firms play either Cournot strategies or Bertrand strategies.

(i) General Results

The focus here is on the extent of pass-through of a change in input prices at either stages one or two of the system. So focusing first on stage two of the chain, as the product sold at this stage represents value added to the semi-processed product from stage one, the effect of a change in p_{1i} is found by differentiating (13) with respect to p_{1i}, i =1,2. Policy-price transmission is given by:

$$(26) \qquad \frac{\delta p_{2i}}{(\delta p_{1i} + \delta p_{1j})} = \frac{1}{\Delta'}(\Delta + b_i V_{2j} + k V_{2i}) \qquad\qquad i \neq j$$

where Δ and Δ' are as previously defined. In general, it can be argued that the degree of pass-through at stage two is a function of: the nature of strategic interaction at stage two; the degree of product differentiation; the number of firms at stage two; and the extent of the price change at stage one.

Likewise for stage one, policy-price transmission is found by differentiating (16) with respect to a change in agricultural input prices p_{ai}, i = 1,2:

$$(27) \qquad \frac{\delta p_{1i}}{(\delta p_{ai} + \delta p_{aj})} = \frac{1}{\Delta''}(\beta_{2i}\beta_{1i} - k^2 + k V_{1i}) \qquad\qquad i \neq j$$

where Δ'' is as previously defined. In general, it can be argued that policy-price transmission at stage one is a function of: the nature of strategic interaction amongst firms at both stages one and two; the number of firms at both stages; and the degree of product differentiation at stage two.

In order to make conditions (26) and (27) more transparent, it is useful to consider the special cases of Cournot and Bertrand duopoly at stages one and two:

(ii) Cournot Strategies

If the case of duopoly at stage two is considered, i.e. $n_{2i} = n_{2j} = 1$, then (26) can be re-written as:

$$(28) \qquad \frac{\delta p_{2i}^C}{(\delta p_{1i} + \delta p_{1j})} = \frac{2 b_i b_j - k^2 + b_i k}{4 b_i b_j - k^2} \qquad\qquad i \neq j$$

Given the conditions stated earlier concerning the parameters b_i, b_j and k, the following can be stated about the extent of price transmission:

$$b_i b_j - k^2 = 0, \quad \delta p_{2i}^C / (\delta p_{1i} + \delta p_{1j}) = \frac{2}{3};$$

$$b_i b_j - k^2 > 0, \quad \frac{2}{3} < \delta p_{2i}^C / (\delta p_{1i} + \delta p_{1j}) < \frac{1}{2}; \qquad i \neq j$$

$$k = 0, \quad \delta p_{2i}^C / (\delta p_{1i} + \delta p_{1j}) = \frac{1}{2}.$$

Therefore, the extent of policy-price transmission at stage two is less than complete when firms play in a Cournot duopoly, the extent depending on the degree of product differentiation. In particular, the more independent the products, the lower the extent of

pass-through. In addition, relaxing the assumption of duopoly at stage two will increase the extent of pass-through.

Turning to stage one, assuming stage two is a duopoly, and that there is Cournot duopoly in each section of stage two, i.e. $n_{1i} = n_{1j} = 2$, then (27) can be re-written as:

$$(29) \qquad \frac{\delta p_{1i}^{C}}{(\delta p_{ai} + \delta p_{aj})} = \frac{6b_i b_j - k^2 + b_i k}{9b_i b_j - k^2} \qquad i \neq j$$

This expression has a similar interpretation to (28) such that the following can be stated about policy-price transmission:

$$b_i b_j - k^2 = 0, \quad \delta p_{1i}^{C}/(\delta p_{ai} + \delta p_{aj}) = \frac{6}{8};$$

$$b_i b_j - k^2 > 0, \quad \frac{6}{8} < \delta p_{1i}^{C}/(\delta p_{ai} + \delta p_{aj}) < \frac{2}{3}; \qquad i \neq j$$

$$k = 0, \quad \delta p_{1i}^{C}/(\delta p_{ai} + \delta p_{aj}) = \frac{2}{3}.$$

Again, as with stage two, policy-price transmission is incomplete, the degree depending on the degree of product differentiation. Also, an increase in the number of firms at either stage would result in an increase in the extent of pass-through.

(ii) Bertrand Strategies

Similar analysis can also be conducted for the case of Bertrand strategies in the food system. Focusing first on stage two, and again assuming a duopoly market structure, expression (26) can be re-written as:

$$(30) \qquad \frac{\delta p_{2i}^{B}}{(\delta p_{1i} + \delta p_{1j})} = \frac{2b_i b_j + b_i k}{4b_i b_k - k^2} \qquad i \neq j$$

Given the conditions stated earlier concerning the parameters b_i, b_j, and k, the following can be stated about the extent of price transmission:

$$b_i b_j - k^2 = 0, \quad \delta p_{2i}^B/(\delta p_{1i} + \delta p_{1j}) = 1;$$
$$b_i b_j - k^2 > 0, \quad 1 < \delta p_{2i}^B/(\delta p_{1i} + \delta p_{1j}) < \frac{1}{2}; \qquad i \neq j$$
$$k = 0, \quad \delta p_{2i}^B/(\delta p_{1i} + \delta p_{1j}) = \frac{1}{2}.$$

With Bertrand strategies, policy-price transmission at stage two is incomplete as long as there is some product differentiation; however, once products are perfect substitutes, pass-through is complete as would be the case if stage two were perfectly competitive.

Turning to stage one, assuming stage two is a duopoly, and that there is Bertrand duopoly in each section of stage one, i.e. $n_{1i} = n_{1j} = 2$, then (27) can be re-written as:

$$(31) \qquad \frac{\delta p_{1i}^B}{(\delta p_{ai} + \delta p_{aj})} = \frac{6 b_i b_j + b_i k}{9 b_i b_j - k^2} \qquad i \neq j$$

This has a similar interpretation to expression (30) so that the following conditions can be stated:

$$b_i b_j - k^2 = 0, \quad \delta p_{1i}^B/(\delta p_{ai} + \delta p_{aj}) = \frac{7}{8};$$
$$b_i b_j - k^2 > 0, \quad \frac{7}{8} < \delta p_{1i}^B/(\delta p_{ai} + \delta p_{aj}) < \frac{2}{3}; \qquad i \neq j$$
$$k = 0, \quad \delta p_{1i}^B/(\delta p_{ai} + \delta p_{aj}) = \frac{2}{3}.$$

Compared to stage two, policy-price transmission is always less than complete at stage one under Bertrand strategies. In particular, with perfect substitutes at the second stage, the degree of pass-through at stage one is less than at stage two. Also, an increase in

the number of firms at either stage would result in an increase in the extent of pass-through.

In order to compare the extent of policy-price transmission at each stage of a two-stage food chain under both Cournot and Bertrand strategies, the above results are summarized in **Table 1** for the cases of perfect substitutes and independent products. Price transmission for the case of imperfect substitutes will be bounded by these two cases.

Table 1: Policy-Price Transmission

	Stage 1 ($s = 1$)		Stage 2 ($s = 2$)	
	$b_i b_j - k^2 = 0$	$k = 0$	$b_i b_j - k^2 = 0$	$k = 0$
Cournot	6/8	2/3	2/3	1/2
Bertrand	7/8	2/3	1	1/2

From the results in this table, two propositions can be stated:

- *Proposition 1:* Policy-price transmission at individual stages of a vertical market chain is less than complete where markets are imperfectly competitive, the exception being Bertrand competition with perfect substitutes at the final demand stage. In addition, pass-through varies positively with the number of firms at each stage.

- *Proposition 2:* Policy-price transmission is less under Cournot than Bertrand competition, except in the case of independent products, where it is equal.

In summary, when processed food markets are characterized by vertical market linkages, the existence of imperfect competition dissipates the effect of price changes arising at the border or farm-gate. In addition, as the number of firms increases, it can be shown that the initial equilibrium tends towards the competitive outcome.

3. Changes in the EC Banana Regime

Recently, there has been considerable discussion of the EC's banana import regime. Under the Lomé Convention, the EC is formally obliged to ensure access to certain EC markets for banana exports from African, Caribbean and Pacific (ACP) states and, in doing so, ensure remunerative returns. Thus, the EC banana market is segmented, with the ACP countries having preferential access to the UK, French and Spanish markets. Banana exports from non-ACP states (so-called "dollar" countries), have limited access to these markets due to the use of quota restrictions. In contrast, other EC states operate different policies towards banana imports. These countries largely import from "dollar" countries and operate an array of policies ranging from tariffs in the Netherlands and Belgium to a completely free market regime in Germany.

Clearly, with the advent of 1993, the persistence of different trade barriers and market segmentation in the EC would be inconsistent with the aims of the Single Market. Consequently, throughout much of 1992, proposals were discussed with the aim of reforming the EC banana regime in a manner that would be consistent with unrestricted

trade within the EC but at the same time maintain the remunerative returns to ACP banana suppliers. On 17th December, 1992, following much debate, the issue was finally resolved: a tariff-quota scheme covering all banana imports into the EC was to be introduced in 1993 with the basic tariff level being 20 per cent for the first two million tonnes of bananas with excessive tariffs on imports above this level (around 170 per cent).

In the course of these discussions, there has been considerable economic analysis of this issue, the most notable papers being those by Borrell and Yang (1990, 1992), and Borrell and Cuthbertson (1991). These papers used non-spatial equilibrium models of the EC banana market to derive the welfare changes following various alternative changes in EC policy. However, these studies, and most others, have assumed the EC banana market to be perfectly competitive. This assumption does not fit with the facts. Wholesaling and distribution of bananas in the EC is highly concentrated with three firms (Chiquita, Dole, and Del Monte) accounting for 66 per cent of the EC market, with Chiquita alone accounting for 43 per cent. Further evidence of market power in the EC is given by the EC Commission's ruling against Chiquita in 1976 that it misused its dominant market position and a new Commission enquiry, again involving Chiquita, which commenced in 1990.

In light of the discussion in Sections 2 and 3, it has been shown that the effect of policy reform on consumer welfare is likely to be dissipated by oligopolistic market

structures, since there will be imperfect transmission of price changes. Of course, by ignoring market structure issues, the work of Borrell and Yang (*op.cit.*) and Borrell and Cuthbertson (*op.cit.*) assumed price changes would be fully transmitted to consumers.

In order to explore the significance of accounting for market structure in policy analysis, the welfare changes resulting from the new EC policy were derived. In its simplest form, the non-cooperative game is assumed to be played by homogeneous ACP suppliers competing with homogeneous non-ACP suppliers, though ACP and non-ACP supplies are assumed to be differentiated to some degree[3]. In order to do this, the demand system associated with (4) and (5) was calibrated using external estimates on elasticities[4]. The elasticity of demand was assumed to be -0.4 (Islam and Subramian, 1989). Bananas from ACP and non-ACP countries (Q_{21} and Q_{22} respectively) were assumed to be good but imperfect substitutes for each other due to perceived differences in quality; consequently, a relatively high value of the elasticity of substitution was assumed. The demand system was calibrated for the UK market where ACP suppliers (Geest and Fyffes) account for around 75 per cent of total banana sales. Prices in the UK have been affected by quota restrictions on non-ACP suppliers, and have, therefore, been relatively high, the tariff-equivalent of pre-1993 restrictions being 34 per cent above

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[3] This accords with existing models of the EC banana market.

[4] See Dixit (1987) for a discussion of the calibration procedure.

world market prices. With the new EC common external tariff of 20 per cent, the tariff-equivalent differential should have fallen by 14 per cent.

What would be the effect on consumer welfare following the more liberal policy in the UK market, and how does market structure affect the outcome? Having calibrated the demand system, pass-through effects can be derived from (26)[5]. Changes in consumer welfare were subsequently derived, the results being reported in **Table 2**.

Table 2: Price Transmission and Welfare Changes Following Changes in EC Banana Regime: Effects of Market Structure.

Market Structure	Degree of Pass-Through (%)		Change in Consumer Surplus ($m)	Change in Consumer Surplus as % of Competitive Case
	p_{21}	p_{22}		
Actual Behavior	0.88	0.87	51.2	0.88
Cournot Oligopoly	0.61	0.78	41.9	0.72
Perfect Competition	1.00	1.00	58.1	-

Ignoring imperfect competition, the degree of pass-through would be 1.00, i.e. the 14 per cent fall in tariffs in the UK banana market would be fully transmitted to

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[5] The focus is on stage two upon the assumption that banana wholesalers face a landed import price that has decreased by the amount of the tariff reduction. Furthermore, the analysis was limited by the availability of data.

consumers. This would result in a US \$58.1m increase in consumer surplus for consumers. However, with either actual or Cournot behavior[6], the degree of price transmission is less, as are the estimated changes in consumer surplus. In the case of actual behavior, the increase in consumer surplus would be 12 per cent less than the competitive case, while if the market exhibited Cournot behavior, it would be 28 per cent less. Clearly, market structure issues appear to make a difference in applied policy analysis.

4. Summary and Conclusions

In this paper, the effects, on policy outcomes, of vertically-related markets where there is imperfect competition at each stage, has been explored. Most agricultural economics analysis ignores vertical market linkages when assessing the effects of agricultural policy and trade reform. However, understanding the role of vertical market linkages is clearly important when focusing on processed food markets and, perhaps more critically, appreciating the significance of imperfect competition that clearly characterizes these sectors. By ignoring such characteristics, policy analysts are likely to over-estimate the degree to which consumer prices will change, and hence, the corresponding change in consumer welfare. This was highlighted with an application to changes in the EC banana regime, a market characterized by two main sources of supply and the existence

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[6] Pass-through with Bertrand behavior is not reported as it proved to be virtually the same as perfect competition.
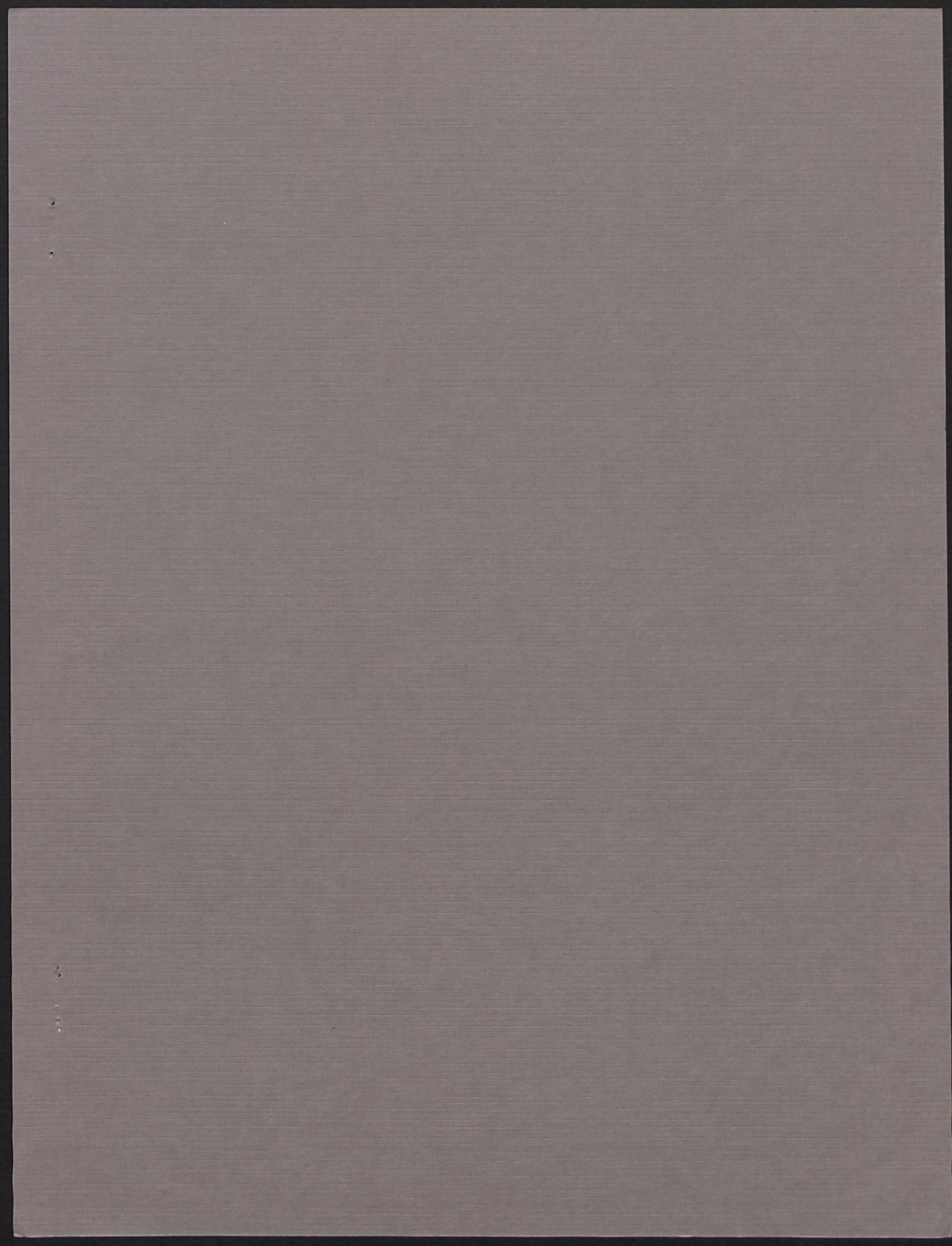
of a few multinational firms. Depending on the nature of oligopolistic behavior, it was estimated that consumer surplus changes could be as much as 45 per cent lower than estimates assuming perfect competition. Consumer surplus changes could be even lower if further vertical linkages were assumed, the changes calculated here assuming only one imperfectly competitive stage.

The question that has been pursued in this paper is whether vertical markets and market structure issues matter in policy analysis? They do. Consequently, this creates an obvious agenda for future research. Only by attempting to derive a more accurate representation of agricultural markets will a better perspective of the effects of policy reform emerge.

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