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POLICY INTERDEPENDENCE, CAUSALITY AND SUPPLY
RESPONSE IN WORLD MARKETS: THE CASE OF
U.S. AND AUSTRALIAN TOBACCO*

by

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*Brian Schmiesing and Jeff Kalbus provided useful comments on this paper, but the author is solely responsible for any remaining omissions or errors.

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ABSTRACT

The economic impact of international policy interdependence is illustrated using the world tobacco market as an example. The price discovery process is assessed using U.S. and Australian data. It appears that world tobacco prices are set through an oligopolistic rule-of-thumb pricing system with the U.S. being the tacit price leader. As a result, there has been a causal relationship between U.S. and Australian tobacco prices. However, no direct supply response to U.S. prices was observed in Australian markets.

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Agricultural trade is increasingly influenced by international policy interdependence (Sarris and Schmitz). As a result, the world price discovery process is affected. For example, there is evidence of international policy interdependence such that U.S. tobacco prices influence the world price trend (Hicks, Blank and Davis). These points are significant because to the extent that the U.S. plays a major role in world tobacco price formation, it may indirectly influence policy decisions in other countries concerning prices and levels of assistance and, as a result, may influence the supply response of the world industry.

Although the choice of price levels is made by market forces in some countries, in many countries it is made by conscious administration, such as in the U.S. and Australia. The choice concerning administered price levels influences the levels of protection and assistance offered to domestic tobacco industries. When that choice is made by small importing nations such as Australia, international market implications (if any) may not be considered directly (Industries Assistance Commission). When domestic price levels are determined by large exporting nations, such as the U.S., international market reactions must be considered because those responses can be significant.

Objective of the Study

To understand the economic impact of international policy interdependence it is necessary to understand the world market. Therefore, the objective of this paper is to evaluate the role played by the U.S. in the world tobacco market by analyzing the price discovery process in that market. In doing so, the following questions will be considered: (1) does the U.S. government,

through its policies, influence world prices?, (2) if so, how does the U.S. influence world prices?, and (3) is there an international supply response to U.S. prices?

In this paper Australia is presented as an example of how pricing choices are made on international markets. Australia is a useful case study because its government has recently addressed the issues involved in reducing the level of assistance to its tobacco industry through adjustments in price levels. In that process they gave much consideration to their largest source of imported tobacco -- the U.S.

World Market and Prices

Before the issue of U.S. impacts on world prices can be discussed it is necessary to first identify a representative "world" price and to define the world market from which that price comes. Flue-cured tobacco represents approximately half of total world production and over 40 percent of total world exports so it will be the product form used in the analysis.

The method used here to define a "world market" specifies countries as "firms" within a world-wide "industry." The world price defined here is a weighted average of f.o.b. export prices of major trading nations, which is only an indicator of "world" prices. Export f.o.b. prices are used because they are more likely to represent "free market" levels than would government-supported domestic prices.

To determine which countries are to be included in the weighted average to arrive at the world price, it is necessary to calculate the proportion of total world exports that have been contributed by each country. These nations are identified by considering export volumes over the three-year period 1979-81, rather than total production volumes, so as to specify their true impact on the world market. Using the standard approach of evaluating market concentration ratios leads to choosing the largest 4, 8 or 20 firms (exporting nations),

whichever number results in a ratio high enough to be considered representative of the entire market (Caves). In this study the 8 largest countries were used because a majority of the market was represented (Table 1). The prices from each of those countries are weighted according to their relative proportion of the total export quantities for the eight nations used to get the world price indicator. Due to the fact that the U.S. is the largest exporter, two world prices were calculated. Countries 1-8 in Table 1 are the largest exporters (representing 85% of trade) and would normally be used in calculating the weighted average world price. However, to allow analysis of the relationship between U.S. and international prices, a second weighted average price was calculated using countries 2-9 (representing 58% of world exports).

The Influence of U.S. Prices

There has been a strong relationship between U.S. and world tobacco prices in the past. U.S. export prices are highly correlated ($r = .99$) with both the world price series described above. U.S. export prices are also correlated with the f.o.b. export prices of the eight other exporters listed in Table 1 ($r > 0.6$ in all cases). Yet, the existence of such a relationship implies nothing about the influence (if any) of one market participant (the U.S.) over other participants.

To explain the observed pricing behavior, it is necessary to consider the market structure. For the most part, the world tobacco market is made up of producer marketing boards, national trading agencies and a few large multinational firms. Sarris and Schmitz argue that under this market structure it may be more appropriate to use oligopoly theory, rather than the traditional competitive model, to analyze pricing in international markets. This position is supported by the fact that the world flue-cured tobacco industry, as defined here, fits the description of a "homogeneous oligopoly" provided by

TABLE 1. WORLD EXPORTS OF FLUE-CURED TOBACCO, 1979-81

	Percent of World Exports
1. U.S.A.	28.2
2. Brazil	15.3
3. Zimbabwe	15.1
4. India	11.6
5. Thailand	4.5
6. Canada	4.4
7. Malawi	3.3
8. Korea, Rep.	2.7
9. Philippines	1.5

Source: U.S.D.A.

Breimyer (p. 66-67). Breimyer says that firms in such an industry are highly sensitive to price competition and "price leadership or tacit collusion is highly likely" (p.67).

A common oligopolistic pricing system is that of price leadership by the dominant firm. The price correlations described above are consistent with both competition and price leadership; therefore, it is possible that the U.S. may be performing the role of price leader for the world flue-cured tobacco market. Two factors give the U.S. market power: (1) it consumes about 14 percent of all unmanufactured tobacco and is the largest exporter and importer of flue-cured tobacco; and (2) the structure and size of its information collection and dissemination system is unmatched by other market participants. Yet, Sarris and Schmitz question whether standard industrial organization pricing models, such as price leadership, are realistic when governments, rather than firms, set prices.

An alternative explanation for the observed price relationships may be provided by the model of rule-of-thumb pricing. Rule-of-thumb pricing is an example of a method that can lead to monopolistic price formation through tacit co-ordination of independent actions of the market participants (Sarris and Schmitz). A typical rule-of-thumb pricing method is that of "full costing," as described by Breimyer (p. 53-62). Full costing is often used by governments when establishing minimum prices (IAC). Other rule-of-thumb methods involve setting prices according to specific economic variables such as inflation rates or product quality. In the case of tobacco, consumers have considered U.S. leaf to be of superior quality; thus, the observed prices reflect quality differences (Johnson; Reed and Schnepf).

When developing a new formula for administering domestic prices the Australian government decided to use the apparent price leader (the U.S.) as the base, rather than prices from smaller trading nations. The formula specifically requires that Australian prices be set at a predetermined level

expressed in terms of its relationship to U.S. prices (such as 70% of the export value of U.S. flue-cured tobacco) (Blank). Clearly, this is a case of rule-of-thumb pricing which creates policy interdependence.

The discussion above implies that a causal relationship may exist between U.S. and Australia (and other countries') tobacco prices if the smaller trading nation follows U.S. price movements by using some rule-of-thumb pricing method. This question raises a second issue: if other countries set their tobacco prices in accord with U.S. price movements, is there a resulting foreign supply response to U.S. price changes? Both of these issues are evaluated below for the case of Australia.

Causal Relationship Between Prices

The new formula for setting Australian domestic tobacco prices assures that a causal relationship will exist in the future between U.S. and Australian prices. To determine whether U.S. price movements have influenced Australian price movements in the past, a causality test suggested by Granger and refined by Geweke is applied to annual data from 1960-82.

The test, as outlined by Bessler and Brandt, directly utilizes ordinary least squares (OLS) regression on levels of the time series. To test causality running from U.S. f.o.b. export prices (X) to Australian domestic prices (Y) of flue-cured tobacco at time t , the following specification is used:

$$(1) \quad Y_t = a_{10} + \sum_{j=1}^p a_{1j} Y_{t-j} + e_{1t} ,$$

$$(2) \quad Y_t = a_{20} + \sum_{j=1}^p a_{2j} Y_{t-j} + \sum_{k=1}^q b_{2k} X_{t-k} + e_{2t}$$

where p and q are the number of lags (j and k) used to eliminate autocorrelation, e_{1t} and e_{2t} are white noise residuals, a_{1j} and a_{2j} are parameters relating Y_t and its lagged values, and b_{2k} are parameters relating Y_t and past values

(from time $t-k$) of X . The sum of squared errors from OLS regressions on (1) and (2) are used to calculate the well-known statistic, F^* , which tests the hypothesis that X causes Y (Pierce and Haugh).

Bessler and Brandt also present a test of no instantaneous causality which is based on the residuals from equation (2) and those from

$$(3) \quad Y_t = a_{30} + \sum_{j=1}^p a_{3j} Y_{t-j} + \sum_{k=0}^q b_{3k} X_{t-k} + e_{3t}.$$

Results of the tests for one-way causality between U.S. export prices and Australian domestic prices of flue-cured tobacco are

U.S. \rightarrow Aust $F^* = 25.38$ (significant at the 99% level)

Aust \rightarrow U.S. $F^* = 1.10$ (insignificant at the 95% level).

The equations were estimated using only one lagged value because all lags of more than one year proved to have an insignificant effect on Y_t . The two F^* statistics above indicate that there is strong one-way causality from U.S. to Australian prices while there is no significant one-way causality running from Australian to U.S. prices. In addition, the result $F^* = 0.03$ (insignificant at the 95% level) for the test of no instantaneous causality strengthens the conclusion that Australian tobacco prices are significantly influenced by U.S. prices which, in turn, are determined without any influence from Australian markets.

Foreign Supply Response

The fact that Australian prices are influenced by U.S. prices and that the two price series have been highly correlated ($r = .90$) leads to the expectation that there will be an Australian supply response to U.S. tobacco price changes. Even though Australian producers may evaluate only Australian prices when making their production decisions, the new price setting formula means that indirectly those producers will be responding to U.S. price signals

in the future. In the past the Australian price was not tied directly to the U.S. price so other variables may have been more significant in determining supply response.

The new Australian price setting formula creates a systematic relationship between U.S. export prices and Australian domestic prices whereas the relationship has been somewhat spurious in the past. The new arrangements have transformed the role of the Australian government into one of simply transmitting U.S. export prices to the Australian market after making an adjustment (which is known in advance). Due to the fact that the U.S. announces its planned price levels in advance and that there is a six-month difference between the seasons in the two countries, Australian producers will be responding to U.S. prices. In the past the Australian government played a much more important role in setting prices. Even though there was a causal relationship between U.S. and Australian prices, the Australian government set specific domestic price levels after considering additional variables such as cost of production (BAE, p. 90). This means that the relationship between the two price series was spurious in that U.S. prices influenced the Australian government which, in turn, set Australian domestic prices.

Several types of government intervention influence Australian tobacco markets, thus altering the supply response process. For example, all sales of Australian tobacco are made under an official grade and minimum price schedule drawn up annually by the Australian Tobacco Board. Also, the Commonwealth government is continuing a scheme under which manufacturers must use a certain minimum percentage of Australian leaf in order to qualify for a concessional rate of duty on imported tobacco (BAE, p. 90-1). Therefore, tobacco supply response will not be typical of responses from competitive markets (Pandey, Piggott and MacAulay).

To test whether there has been an Australian supply response to changes in the U.S. export prices a linear model was formulated as follows:

$$(4) \quad Q_t = a + b_0 P_t + b_1 P_{t-1} + \dots + b_n P_{t-n} - c_1 PP_t + c_2 t + U_t$$

where t is time, a linear trend where $t_1 = 1970, \dots, t_{13} = 1982$; Q_t is total Australian acreage (1,000 ha) planted to tobacco at time t ; P_t is the U.S. export price index deflated by the Australian producer price received index; PP_t is the Australian producer prices paid index; a , b 's, and c 's are parameters to be estimated and U_t is an error term in time t . The model, similar to that used by Levins, was estimated directly using OLS regressions of annual data from 1970 to 1982 incorporating only one lagged price variable (P_{t-1}) because it was expected that resources could be shifted in or out of tobacco production from one year to the next. Also, Q_t was specified as acreage total rather than production total to better reflect producer decisions without the added variance which the yield per hectare factor gives to total production figures.

It is believed that estimation results for equation (4) will provide some insight into the nature of the pricing process being used by Australia (in the past) as well as providing a base for describing the supply response to that pricing process. Implicit in the specification of (4) are hypotheses concerning relationships between supply (Q_t) and both U.S. export prices (P_t) and Australian input prices (PP_t). If P_t proves to be a significant influence on Q_t while PP_t is insignificant, the implication is that price leadership may be the prevalent pricing influence in the Australian market. On the other hand, if PP_t is significant and P_t is not, rule-of-thumb pricing is implied since the variable PP_t is a proxy for government actions (the government used "cost of production" as its primary justification for setting prices in the past -- BAE, pp. 90-1). However, if both P_t and PP_t are significant influences on Q_t , both market price leadership and rule-of-thumb processes may be operating, but there would be no evidence as to which was dominant.

Upon estimation the first specification of the model had two insignificant variables so a second specification was estimated with those variables omitted, yielding the following:

$$(5) \quad Q_t = 10.2 + .574P_t - .045PP_t$$

(5.96) (0.98) (8.57)

where $\bar{R}^2 = .92$, $DW = 2.27$, and the numbers in parentheses are the t-test values for the variables. The two remaining variables each have the expected signs, but the U.S. price variable is not significant.

The results above indicate (1) there was not an Australian supply response to U.S. export prices, and (2) government-induced rule-of-thumb pricing methods appeared to be dominant in the Australian tobacco market. Therefore, it is expected that in each country where the government plays a significant role in the price setting process using some type of rule-of-thumb, there will not be a direct supply response to U.S. prices, even though prices will generally follow the trend set by the U.S.

Concluding Remarks

It appears that the U.S. may be performing the function of a price leader in an oligopolistic world flue-cured tobacco industry. The eight largest tobacco exporting nations (including the U.S.) represent 85 percent of world tobacco exports at this time, implying the existence of an oligopoly. In an oligopoly it is expected that small firms (trading nations) will follow the price trend set by a price leader. Such interdependent behavior is evident in the "world" tobacco industry, although the U.S. may not have purposely taken the leadership role. It is likely that other nations (such as Australia) simply chose to follow the largest trader, the U.S., by adopting policies involving a rule-of-thumb method of pricing.

A major implication of such market behavior is that change in U.S. tobacco prices may cause an indirect international supply response as other nations adjust their prices accordingly. However, the extent of any response depends on how choices concerning domestic market prices and quantities are made in other countries - through market competition or public administration.

REFERENCES

- Bessler, D., and J. Brandt. "Causality Tests in Livestock Markets," American Journal of Agricultural Economics 64 (1982):140-144.
- Blank, S. "A World Price Indicator for Australian Tobacco," paper presented to the Australian Government's Standing Committee on Industry Assistance, Canberra, December 1982.
- Breimyer, H. Economics of the Product Markets of Agriculture, Iowa State University Press, Ames, 1976.
- Bureau of Agricultural Economics, Rural Industry in Australia, Australian Government Publishing Service, Canberra, 1983.
- Caves, R. American Industry: Structure, Conduct, Performance, 5th Edition, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1982, Chapter 1.
- Geweke, J. "Inference and Causality in Economic Time-Series Models," Handbook of Econometrics, ed. Zvi Griliches and Michael Intrilligator, North-Holland Publishing Co., 1980, Chapter 17.
- Granger, C. "Investigating Causal Relationships by Econometric Models and Cross-Spectral Methods," Econometrica 37(1969):424-38.
- Hicks, P., Blank, S. and C. Davis, "World Tobacco Prices: Relevance to the Australian Industry," Quarterly Review of the Rural Economy 5(1983):169-175.
- Industries Assistance Commission, The Australian Tobacco Industry, Report No. 309, Canberra, 1982.
- Johnson, P.R., "Flue-cured Tobacco and International Trade in 1982," Economics Special Report, Department of Economics and Business, North Carolina State University, Raleigh, North Carolina, 1982.
- Levins, R. "Price Specification in Milk Supply Response Analysis," American Journal of Agricultural Economics 64(1982):286-8.

- Pandey, S., Piggott, R. and T. MacAulay, "The Elasticity of Aggregate Australian Agricultural Supply: Estimates and Policy Implications," Australian Journal of Agricultural Economics 26(1982):202-219.
- Pierce, D. and L. Haugh, "Causality in Temporal Systems: Characteristics and a Survey," Journal of Econometrics 15(1977):265-293.
- Reed, M. and R. Schnepf, "The Import Demand for U.S. Burley Tobacco in European Markets," Southern Journal of Agricultural Economics 14(1982):141-145.
- Sarris, A. and A. Schmitz, "Price Formation in International Agricultural Trade," in Imperfect Markets in Agricultural Trade, McCalla, A. and Josling, T. editors, Allanheld & Osmun, Montclair, New Jersey, 1981, pp. 29-48.
- U.S. Department of Agriculture, World Tobacco Situation, Foreign Agriculture Circular, Washington, D.C., October, 1982.