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Price versus Quota Reductions: U.S. Flue-Cured Tobacco Policy

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ABSTRACT

Declining domestic cigarette consumption, increased global competition, and loss of import restrictions indicate decreased demand for U.S. flue-cured tobacco. The effects of 10% declines in domestic and export demand are evaluated under a policy of reducing quota to maintain price versus a policy of allowing price to fall to maintain quota. Changes in prices, quantities, revenues, and economic rents are simulated. Losses to nonfarming quota owners are minimized under a policy of price maintenance, while losses in revenues to tobacco-producing areas are minimized by a policy of quota maintenance. Aggregate losses to tobacco growers are greater under a policy of quota maintenance.

Key Words: flue-cured, policy, price reduction, quota, tobacco.

Tobacco production is an economically important crop in the southeastern United States, with gross farm revenues in recent years of $2.8 to $3 billion (U.S. Department of Agriculture). The U.S. produces two major types of cigarette tobacco: flue-cured and burley. Gross revenues from sales of U.S. flue-cured tobacco have ranged from $1.3 to more than $1.5 billion in recent years. Flue-cured tobacco is produced in five southeastern states, with North Carolina being the largest producer.

Since the 1930s, the flue-cured tobacco program has held U.S. tobacco price above free market levels by restricting supply, initially through acreage quotas and more recently through marketing quotas. In addition, because of quality differentiation, U.S. flue-cured tobacco growers have enjoyed unprecedented pricing power in the world tobacco market. The combination of this market power and the supply restrictions enforced by the tobacco program has effectively created a cartel (Johnson and Norton). However, this pricing power appears to be waning. In 1975, the U.S. marketed 1.5 billion pounds of flue-cured tobacco. Twenty years later, the U.S. marketed less than 900 million pounds of flue-cured tobacco. Still, this amount could not have been sold at the prevailing support prices (which had been reduced in 1986) except for severe import limits and an agreement with U.S. cigarette manufacturers to purchase excess inventories held by the grower-owned cooperative. During this same period, U.S. cigarette production has increased to record levels as world cigarette consumption and demand for tobacco have risen. Nevertheless, there has been an overall decline in U.S. flue-cured marketings which can be attributed to lower tobacco use per cigarette, declining U.S. cigarette consumption, and intense competition from rising tobacco production and improved quality in countries such as Brazil and Zimbabwe.

Tobacco state legislators, faced with a declining marketing quota under the current

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price support levels, organized an advisory committee in early 1995 to consider policy options (Barnett). One important option considered was whether or not to lower price supports in an effort to slow or prevent further erosion in the marketing quota.

The analysis presented in this study was originally completed for the congressional advisory committee. The study examines the effects of allowing market prices to fall by lowering price supports versus the effects of maintaining the current price support levels and allowing the marketing quota to decline. Impacts on tobacco growers, nonproducing quota owners, and total revenues to tobacco-producing areas are evaluated. Following a brief synopsis of the tobacco program, a model and economic parameters for evaluating the policy changes outlined are presented. Empirical results are then given, with policy implications discussed.

The U.S. Tobacco Program

Burley and flue-cured tobacco production are controlled by similar, but distinct, government programs. Although this analysis addresses only flue-cured production, many of the findings of this study are also applicable to burley. Production and prices of burley and flue-cured tobacco are controlled under the U.S. tobacco program through a combination of price supports and marketing quotas. Price support levels are determined by a weighted average of changes in production costs and lagged market prices. National marketing quotas are set each year. The marketing quota is determined by the sum of purchase intentions for the year in question as announced by the domestic cigarette manufacturers, a three-year average of exports of tobacco, and an adjustment for inventories held by the producer- and buyer-financed tobacco cooperatives. The cooperatives purchase tobacco not bringing at least one cent above the support price on the auction markets held for farmers' tobacco each season. Cooperative inventories above (below) a predetermined level result in a negative (positive) adjustment in the formula for the next year's national quota.

While the price support formula includes lagged market prices, the inclusion of production costs combined with the fact that downward movement in market prices is limited by the price support structure means that price supports are not very responsive when demand decreases. However, the inclusion of domestic purchase intentions and the adjustment for cooperative inventories in the quota formula makes the national marketing quota very responsive to downward shifts in demand for U.S. tobacco. Thus, in the case of declining demand, it is reasonable to describe the tobacco program as maintaining price by shifting supply via the marketing quota. Allowing price, instead of quota, to fall can only be accomplished by lowering price supports through legislative action.

The marketing quotas for U.S. tobacco were initially divided among tobacco growers based on production history. Over the years, the quota has been dispersed among heirs of tobacco farmers, nonproducers who purchased farms with tobacco quota, and, of course, active tobacco farmers who inherited or purchased quota. Also, the quota can be rented or sold under certain restrictions (Rucker, Thurman, and Sumner). As such, quota is an asset with its own rental and sales market. The annual rental value of the quota is the annual cartel rent accruing from the tobacco program. Flue-cured tobacco growers own about one-third of the national flue-cured marketing quota (Clauson and Grise); the remainder is owned by nonproducers who rent their quota to growers. As will be shown, potential conflicts between the interests of nonproducing quota owners and tobacco growers are very important to the policy process.

The Model

A log-linear equilibrium displacement model is developed to simulate changes in flue-cured tobacco prices and quantities, and the resulting changes in economic rents due to exogenous changes in domestic or export demand for flue-cured tobacco. A particular exogenous change in demand is not identified since the focus of the study is the supply policy re-

Table 1. Definitions of Endogenous and Exogenous Variables and Parameters

Symbol	Definition	Value
Endogenous Variables:		
P	Farm sales price of U.S. tobacco	
Q_d	Quantity of U.S. flue-cured tobacco purchased by U.S. manufacturers	
Q_e	Quantity of U.S. unmanufactured flue-cured tobacco exports	
Q	Total quantity of domestically produced flue-cured tobacco	
R	Total domestic flue-cured tobacco revenue	
L	Market rental rate for flue-cured tobacco quota	
M	Cartel rents accruing to flue-cured tobacco quota holders	
S	Producers' surplus	
Exogenous Variables:		
ET_d	Proportionate change in domestic demand for U.S. flue-cured tobacco due to an exogenous demand shifter	−0.10
ET_e	Proportionate change in export demand for U.S. flue-cured tobacco due to an exogenous demand shifter	−0.10, 0
Parameters:		
η_c	Wholesale price elasticity of demand for cigarettes	−0.4
α_c	U.S. tobacco share of domestic wholesale cigarette costs	0.035
η_d^*	Compensated elasticity of domestic demand for flue-cured tobacco	−0.45
η_{te}	U.S. export price elasticity of demand for domestic tobacco	−3
β_{td}	Quantity share of domestic tobacco used in U.S. cigarettes	0.55
ϵ	Domestic tobacco output response elasticity	0, ∞
α_L	Average cost share of quota rent in tobacco production	0.20
μ	Elasticity of marginal cost of tobacco production	0.25

sponse; thus, only negative shifts in demand are considered. Such shifts in demand result from, for example, increases in cigarette taxes, increased smoking restrictions, changes in trade policy, decreases in the price of foreign-grown flue-cured tobacco, and increased quality of foreign-grown tobacco. The model is presented below:

$$(1) \qquad EQ_d = \eta_d EP + ET_d,$$

where $\eta_d = \eta_d^* + \lambda_c \eta_c$;

$$(2) \qquad EQ_e = \eta_e EP + ET_e;$$

$$(3) \qquad EQ = \beta_d EQ_d + (1 - \beta_d) EQ_e;$$

$$(4) \qquad EQ = \epsilon EP.$$

Here, the endogenous variables are proportional changes in quantities and prices, and exogenous variables are proportional changes in demand shifters. Further definitions of variables and parameters are given in table 1. Substituting (1) and (2) into (3) and equating the resulting equation with (4) to solve for EP yields equation (5), which gives the proportionate change in flue-cured tobacco price for exogenous changes in domestic and/or export demand:

$$(5) \qquad EP = ET \div (\epsilon - \eta),$$

where $ET = \beta_d ET_d + (1 - \beta_d) ET_e$, and $\eta = \beta_d \eta_d + (1 - \beta_d)\eta_e$. Substituting EP from (5) into (1) and (2) then gives the resulting proportionate change in the amounts of flue-cured tobacco used domestically and exported. Note that as ϵ approaches infinity, EP approaches zero, i.e., the supply response given by the current tobacco program. If $\epsilon = 0$, then $EQ = 0$, and the demand shock is absorbed by EP.

Once EP and EQ have been calculated, then proportionate changes in the economic rents accruing to various participants in the tobacco program are calculated as follows:

$$ER = EP + EQ, \tag{6}$$

$$EL = (1/\alpha)EP - [(1 - \alpha)/\alpha]\mu EQ, \tag{7}$$

$$EM = EL + EQ, \tag{8}$$

$$ES = (1 + \mu)EQ. \tag{9}$$

Parameters

Parameters for the simulations, such as elasticity estimates, and quantity and cost shares are given in table 1. Demand and supply elasticity estimates from prior studies are used in the simulations. There are numerous estimates of the elasticity of domestic demand for cigarettes (e.g., Becker, Grossman, and Murphy; Chaloupka; Wasserman et al.), ranging from −0.28 to −0.8. Brown (1995a) reported a retail export elasticity of demand for U.S. cigarettes of −0.84. However, the cost share of tobacco is small, so that the effect of cigarette price elasticity on the uncompensated price elasticity of U.S. tobacco is very small. A mid-range estimate, −0.6, of the retail cigarette price elasticity is used. Assuming a constant absolute margin with fixed input proportions, this corresponds to a wholesale cigarette price elasticity of −0.4.

Beghin and Chang, using a static model, estimated the compensated price elasticity of domestic demand for U.S. tobacco to be −0.91. Using a dynamic model to allow for costs associated with adjusting stocks of tobacco and capital, Rezitis, Foster, and Brown reported a long-run compensated price elasticity of domestic demand for U.S. tobacco of −0.34 for mean quantity and price for 1950 to 1993. Using the results of Rezitis, Foster, and Brown, and mean quantity and price from 1991 to 1993 implies an elasticity of about −0.45. This estimate is used since a dynamic model should be a more accurate model of the cigarette industry.

Few estimates of the uncompensated elasticity of export demand for U.S. tobacco exist. Johnson and Norton reported an elasticity of −2.33. However, since the 1983 Johnson and Norton study, the export market share of the U.S. has fallen and, according to industry representatives, the quality of foreign-grown flue-cured tobacco has improved. This implies that the elasticity should now be larger. Consequently, an export demand elasticity of −3.0 is used in the simulations here.

A wide range of estimates of the elasticity of the marginal cost of tobacco production can be found. Goodwin and Sumner reported an estimate of 0.25, while the results of Babcock and Foster imply an estimate of about 0.08. More recently, Fulginiti and Perrin reported a supply elasticity for U.S. tobacco of 7.0, suggesting an elasticity of marginal cost of 0.14. The Fulginiti and Perrin estimate is used in the simulations for this analysis. Given the range of available elasticity estimates and the uncertainty surrounding some of them, the sensitivity of the results to extremes in demand and supply elasticities is examined.

Simulations

Two scenarios representing negative shocks to U.S. tobacco demand are examined. First, the case of a negative 10% shift in domestic demand is considered. The source of the exogenous decline in demand is not identified, but sources are easy to envision. Brown (1995a) showed that a $0.45 per pack increase in cigarette taxes coupled with a 60% increase in smoking restrictions could decrease domestic demand for U.S. tobacco by 11%. Zaini, Beghin, and Brown found that a domestic content requirement, in place in 1994 for tobacco in U.S.-produced cigarettes, shifted domestic demand for U.S. tobacco out by about 10%. This domestic content law was repealed in late 1995. As a result, domestic demand for U.S. tobacco is expected to shift back by more than 8%.

In the second scenario, the case of negative 10% shifts in both domestic *and* export demand is considered. While no formal studies exist, sources of such shifts are also easy to envision. A decline in the price of foreign-grown flue-cured tobacco, resulting from changes in exchange rates or burgeoning supplies, would induce negative shifts in both domestic and export demand. Improvement in the quality of foreign-grown flue-cured tobacco (as purported by leaf merchants and ciga-

Table 2. Proportionate Change for $ET_d = -0.1$, and $ET_e = 0$ or -0.1, Under Different Supply Response Policies

ϵ	ET_e	EP	EQ	EQ_d	EQ_e	ER	EL	EM	ES
∞	0.00	0.00	−0.05	−0.10	0.00	−0.05	0.03	−0.02	−0.06
	−0.10	0.00	−0.10	−0.10	−0.10	−0.10	0.06	−0.04	−0.11
1	0.00	−0.02	−0.02	−0.09	0.06	−0.04	−0.09	−0.11	−0.02
	−0.10	−0.04	−0.04	−0.08	0.02	−0.08	−0.17	−0.21	−0.04
0	0.00	−0.03	0.00	−0.09	0.10	−0.03	−0.17	−0.17	0.00
	−0.10	−0.06	0.00	−0.07	0.09	−0.06	−0.31	−0.31	0.00

rette manufacturers) could also induce negative shifts in both domestic and export demand for U.S. flue-cured tobacco.

Proportionate and actual changes in price, quantities, and rents to various constituent groups for negative 10% shifts in domestic demand, and both domestic and export demand, are presented in tables 2 and 3, respectively. Results are given for three supply response policies: allowing quota to decline to maintain price (i.e., $\epsilon = \infty$); allowing price to decline to maintain quota (i.e., $\epsilon = 0$); and allowing price and quota to decline by proportionately equal amounts (i.e., $\epsilon = 1$). Relative to a negative 10% shift only in domestic demand, simulating a negative 10% shift in both domestic and export demand slightly less than doubles the impact on price, total quantity, and economic rents. Obviously, the effect on domestic use and unmanufactured exports is very dependent on the market in which the shift in demand occurs. Under the current program, the entire shift in domestic demand is absorbed by a change in total use. However, when price is allowed to dampen the domestic shock, exports actually increase in response to the price decrease, further cushioning the shock to total quantity used. In the case where price absorbs all the shock ($\epsilon = 0$), exports increase 10%, while total quantity used only decreases 3%. In the cases where both domestic and export demand decrease by 10%, exports increase by 2% when $\epsilon = 1$, and by 9% when $\epsilon = 0$. Export and domestic use both decline by 10% when price is held constant ($\epsilon = \infty$).

In the case of a 10% decline in both domestic and export demand, total use of U.S. flue-cured tobacco (Q), falls from 865 million pounds to 778 million pounds under the current program (table 3). For the case where price absorbs all the demand decline, price falls from \$1.71 to \$1.60 per pound for a 10% decline in both domestic and export demand.

The effects of different supply response policies on total farm sales of flue-cured tobacco are quite different. Under a policy of maintaining price ($\epsilon = \infty$), total revenues decline by \$148 million when both domestic and export demand decline by 10%. However, if price is allowed to absorb the demand decline ($\epsilon = 0$), total revenues decline by only \$92 million. Thus, if the policy goal is to minimize the impact on rural tobacco economies, then a policy of allowing price to decline in order to maintain quota is best.

Why, then, are policy makers so reluctant to reduce price supports, thereby allowing the market price to decline instead of the quota?[1] An examination of the change in economic rents to tobacco program participants is very informative in answering this question. The change in economic rents accruing to nonproducing quota owners (those who do not grow tobacco, but rent their quota to tobacco farmers) is found by multiplying the change in cartel rents by the fraction of the national quota owned by nonproducers. Under the current policy of maintaining price and allowing quota to fall, economic rents to nonproducing quota holders fall by only \$9 million (table 3) when

[1] The price supports of U.S. tobacco were reduced in 1986. However, this decision was made only after program costs escalated dramatically, exports plummeted, and inventories held by the grower cooperatives climbed to near disastrous levels over several years.

Table 3. Price, Use, and Changes in Revenues and Economic Rents in Response to ET_d = −0.1, and ET_e = 0 or −0.1, Under Different Supply Response Policies

ϵ	ET_e	Price per Pound ($)	Total Use (mil. lbs.)	Change in Tobacco Revenues (mil. $)	Change in Nonproducing Quota Owner Rents (mil. $)	Change in Grower Rents (mil. $)
∞	0	1.71[a]	818	−80	−5	−11
	−0.1	1.71	778	−148	−9	−19
1	0	1.67	847	−61	−23	−14
	−0.1	1.64	832	−111	−43	−26
0	0	1.65	865[b]	−50	−35	−16
	−0.1	1.60	865	−92	−64	−30

[a] Average weighted price for 1992, 1993, and 1994.
[b] Average total use for 1992, 1993, and 1994.

both export and domestic demand fall by 10%. However, under a policy of allowing price to decline in order to maintain quota, economic rents to nonproducing quota owners fall by $64 million. Thus, if the policy goal is to maximize rents accruing to nonproducing quota owners, then the appropriate policy is the current program of price maintenance.

If the policy goal is to maximize the welfare of tobacco growers, the question becomes more complicated. The change in aggregate rents accruing to tobacco growers is found by multiplying the change in cartel rents by the fraction of the national quota owned by growers and then adding this product to the change in producers' surplus. In aggregate, tobacco growers, who own about 32% of the total flue-cured quota (Clauson and Grise), incur a net loss of $30 million with a policy of price reduction (table 3). Alternatively, under the current policy of allowing quota to fall in order to maintain price, growers incur an aggregate net loss of only about $19 million. However, among individual tobacco growers, the effects from either a quota or price reduction are not uniform. Brown (1995b) shows that the net change in economic rents for a producer depends on the proportion of quota rented versus owned by the producer. In other words, it depends on the extent to which the grower participates in cartel rents. If the change in cartel rents accruing to a grower more than offsets the change in producer's surplus to the grower, then smaller losses will be incurred by the grower under a policy of maintaining price by allowing quota to decline ($\epsilon = \infty$), rather than a policy of price reduction ($\epsilon = 0$). However, if a grower owns only a small share of the quota produced, then smaller losses may be incurred under a policy of price reduction since the change in producer's surplus offsets the loss in cartel rents to that producer.

The tension between cartel rents and producers' surplus can be seen in table 2. Under a policy of allowing quota to decline in order to maintain price, the proportionate change in cartel rents (EM) is −0.04, whereas the proportionate change in producers' surplus (ES) is −0.11 for a 10% decline in both domestic and export demand. Conversely, under a policy of allowing price to decline in order to maintain quota, the proportionate change in cartel rents is −0.31, while the proportionate change in producers' surplus is zero. Quota rental rates (L) actually rise under a policy of maintaining price. However, the increase in rental rates is not enough to completely offset the loss due to a smaller quantity of quota to be rented.

Finally, one other complexity must be added to the analysis: the sensitivity of the results to the demand and supply elasticities used. How do the results change if elasticity estimates of an extreme case of more elastic demand ($\eta_d^* = -0.91$, $\eta_{te} = -5$) and more inelastic supply ($\mu = 0.25$) are used? First,

the conclusions concerning policy effects on rural economies and nonproducing quota owners do not change. With a negative 10% shift in both domestic and export demand, total tobacco revenue declines $148 million under the current policy of maintaining price, but declines only $53 million under a policy of allowing price to fall in order to maintain quota. Economic rents to nonproducing quota owners do not change in response to negative 10% shifts in both domestic and export demand under the current policy of price maintenance. Higher quota rental rates exactly offset fewer pounds of quota. Under a policy of allowing price to fall instead of quota, nonproducing quota owners lose about $37 million in rents. The results for aggregate grower rents do change, however. The reduction in aggregate grower rents is $27 million under the current program, but only $17.5 million under a program of allowing price to fall in order to maintain quota. As before, the effects of either policy are not uniform across growers, but assuming more elastic demand and more inelastic supply elasticities implies that a higher proportion of growers will benefit from allowing price to fall in response to negative shifts in demand.

What about the other extreme of more inelastic demand ($\eta_d^* = -0.45$, $\eta_{te} = -2.33$) and more elastic supply ($\mu = 0.08$)? Once again, the conclusions about rural economies and nonproducing quota owners do not change. In response to negative 10% shifts in both domestic and export demand, total tobacco revenues decrease by $114 million under a policy of allowing price to fall in order to maintain quota, versus $148 million under the current program. Nonproducing quota owners lose $79 million in rents under a policy of allowing price to fall, versus only $14 million under the current policy of maintaining price. Aggregate grower rents decrease $37 million under a policy of allowing price to fall, versus only $15 million under the current program. Under these assumptions, a higher proportion of growers would benefit from keeping the current policy of maintaining price at the expense of quota.

Concluding Remarks

The policy decision of how to respond to negative shifts in demand entails choosing between the interests of cartel participants and rural economies. Nonproducing quota owners would prefer a policy of maintaining price supports; rural economies clearly fare better under a policy of maintaining production. The uncertainty and lack of uniformity in the effects of changes in price and quantity on tobacco growers further complicates the policy decision. The change in aggregate grower rents can be positive or negative depending on the elasticity estimates used. Despite this ambiguity, some growers fare better under a policy of price reduction, and others under a policy of quota reduction. The effects are not uniform across growers.

One other factor adds to the complexity of this matter. Under the current program, quota automatically declines in a declining demand scenario, while changes in the price support to allow market prices to decline require legislation. Some tobacco state legislators feel that introducing any legislative changes to the tobacco program could give anti-tobacco legislators an opportunity to eliminate the program completely. Farm organizations involved in tobacco policy continually look for ways to induce positive shifts in U.S. tobacco demand to avoid declines in either price or quota. Current attempts to gain market access to China for U.S. tobacco exports and the short-lived domestic content law are examples of this activity. However, the prospect of positive changes in demand seems more uncertain than the prospect of negative changes. Given these factors (and barring program elimination by anti-tobacco legislators), the outlook for U.S. flue-cured tobacco seems to be one of status quo—attempts to maintain price at the expense of declining marketing quotas.

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