HARALD VON WITZKE AND ULRICH HAUSNER*

The Political Economic Myth and Reality of Agricultural Producer Price Support: The 'Agricultural Treadmill' Revisited

Abstract: The *myth* of agricultural price policy is that it can counteract the economic effect of the 'agricultural treadmill'. In this paper it is shown that this is not the case. The political economic *reality* of farm price programs is that a growth in agricultural supply leads to lower levels of price support, all other things bring equal. In US wheat and grain policy, the extent of endogenous policy adjustments has been in the same order of magnitude as price changes that would have occurred without price policy.

INTRODUCTION

In his book *Farm Prices: Myth and Reality*, the agricultural economist Willard W. Cochrane (1958) has characterized the economic mechanism that drives the long-term adjustment processes of agriculture in the course of economic development. The core of his argument is that in growing industrialized countries the growth in supply tends to outstrip the demand growth. Therefore, food and agricultural commodities become more abundant, and the long term trend of agricultural producer prices is negative. The growth in demand is limited because both the income elasticity of demand for food and the population growth tend to be low in developed countries. The growth in production is high because farmers are price takers and, therefore, the adoption of technological change is the most important way to increase individual incomes. However, collectively the race to increase output ultimately leads to lower prices and, given the low price elasticity of demand for food in developed countries, farm incomes tend to grow at lower rates than non-farm incomes.

Cochrane's treadmill theory is formulated in a closed economy framework. Hayami and Ruttan (1985) and Tyers and Anderson (1992) demonstrate that this phenomenon can, in principle, be observed on a global scale as well. As a consequence, the real world market prices of food and agricultural commodities tend to decline in the long run.

In most industrialized countries, government programs are in place which provide agricultural producers with prices above those prevailing on the world markets. Price support programs are maintained in an attempt to off-set or, at least, to alleviate the effects of the agricultural treadmill on relative farm incomes. Without government market intervention an increase in the supply of an agricultural commodity causes the market price to decline, whereby the price decline is determined by the extent of the supply growth and the price elasticity of demand, all other things being equal. The myth of farm price support programs is that a government set minimum producer price acts to change the effective demand elasticity faced by farmers to infinity. No matter what the supply is, farmers will always receive the minimum price, provided that the world market price is lower. This is typically reflected in textbook analyses of the social welfare effects of minimum producer price programs such as deficiency payments or variable levies. Government support is

* Centre for International Food and Agricultural Policy and Department of Agricultural and Applied Economics, University of Minnesota, respectively.

exogenously given. A change in supply does not affect the producer price and the resulting change in producer surplus is unambiguously positive.

However, public choice theory stipulates that policy decisions are endogenous rather than exogenously given. Agricultural economists have made a lot of progress in recent years analysing the determinants of agricultural policy decisions. One of the insights of this type of analysis is that not everything remains unchanged and that important variables may change when there is a growth in supply, some of which, in turn, may influence agricultural policy.

In the remainder of this paper we will develop a simple public choice model of agricultural producer price support. The model will be tailored to suit US wheat and corn policy, and it will be tested empirically for these two markets. We will then show that the reality of farm price support programs is that a growth in supply ultimately results in endogenous policy changes for US farmers which essentially lead to the same price reactions as would be observed in the absence of direct government market intervention.

A POLITICAL ECONOMIC FRAMEWORK: US CORN AND WHEAT TARGET PRICES

In the vast majority of developed countries, the government supports agricultural producer prices. In the United States, agricultural price policy is now almost six decades old. Since the early 1960s, US agricultural price support in wheat and corn has been characterized by two central mechanisms. One is the loan rate. This is the price at which the government provides loans to farmers. It enables them to hold crops for later sale. If the market price is below the loan rate farmers may forfeit the crops placed under loan to the government. The other mechanism consists of direct payments to farmers based on production or acreage planted to these crops. The resulting producer support price has been referred to as target price since the early 1970s. By setting the target price above and the loan rate at the expected world market price the government ran subsidize agriculture as much as desired while the commodities usually can be moved to the export markets without direct subsidy.

The following political economic analysis focuses on the target price. It is based on a straightforward public choice model where a single agricultural policy maker has preferences over agricultural producers and non-producers (that is, taxpayers). The policy maker's problem is:

(1) $\max U(Y,B)$

(2) $\text{s.t.} f_1(P) \geq Y$

(3) $f_2(P) \geq B$

where Y = producer income, B = budgetary expenditures of price policy, and P = target price.

Equation (1) is assumed to be continuous and concave, where $\partial U/\partial Y > 0$ and $\partial U/\partial B < 0$. The political economic constraints in Equations (2) and (3) are assumed to be continuous and linear. The target price is chosen to maximize utility (equation 1). The optimum condition of this maximization problem is:

$$(4)\quad (\partial U/\partial Y) \cdot (\partial f_1 / \partial P) = (\partial U/\partial B) \cdot (\partial f_2 / \partial P)$$

The interpretation of Equation (4) is straightforward. The policy maker sets the target price such that the marginal political economic benefits of raising the target price (via growing support from producers) equal its marginal political economic costs (via declining support from taxpayers).

Given the assumptions about the curvatures of Equations (1) through (3) it follows immediately from the Implicit Function Theorem that there is a solution for P in principle. However, unless the functional forms of Equations (1) through (3) are known there is no *a priori* information about its functional form. Let the (approximation for the) solution for t be linear:

$$(5)\quad P_t^0 = \alpha_0 + \alpha_1 Y_t + \alpha_2 B_t$$

In Equation (5), P_t^0 denotes the optimum price for t. Of course, in the real world policy makers are not perfectly free to adjust the target price from one year to the other. To account for policy inertia assume that the target price adjustments over time are Nerlovian:

$$(6)\quad P_t - P_{t-1} = \gamma\left(P_t^0 - P_{t-1}\right) + \theta_t$$

where $0 < \gamma \leq 1$ and the error term θ_t = NID.

From Equations (5) and (6) it follows:

$$(7)\quad P_t = \beta_0 + \beta_3 P_{t-1} + \beta_1 Y_t + \beta_2 B_t + \theta_t$$

where $\beta_0 = \gamma\alpha_0$, $\beta_3 = 1-\gamma$, $\beta_1 = \gamma\alpha_1$, and $\beta_2 = \gamma\alpha_2$.

EMPIRICAL EVIDENCE: 1962–63 — 1983–84

When the decisions on the target price in t are made, the policy makers do not know Y_t and B_t. Hence these variables have to be substituted by their expected values. If the policy maker has rational expectations then $Y_t = Y_t^* + v_t$ and $B_t = B_t^* + w_t$, where Y_t^* and B_t^* denote the expectations of Y_t and B_t respectively, and v_t and w_t are error terms which are NID. Hence, the empirical model is:

$$(8)\quad P_t = \beta_0 + \beta_3 P_{t-1} + \beta_1 Y_t^* + \beta_2 B_t^* + \varepsilon_t$$

Obviously, in developed countries one would expect the signs of both β_1 and β_2 to be negative. That is a relatively low (high) expected producer income as well as relatively low (high) expected budgetary expenditures will result in a relatively high (low) support price, all other things being equal. Moreover, $0 \leq \beta_3 < 1$, as $\beta_3 = 1 - \gamma$ and $0 < \gamma \leq 1$. Notice that $\varepsilon_t = \theta_t + \beta_1 v_t + \beta_2 w_t$, and, therefore, instrument variables have to be used for Y_t^* and B_t^*. The instruments have been estimated via auto regressions. The time lag

was chosen for each time series based on the significance of the coefficients (see the appendix).

The empirical analysis covers the time period 1962–63 to 1983–84. The data used are from USDA (1984, 1989) publications. All monetary variables have been deflated by the CPI. As detailed information on US wheat and corn producer incomes is not available, the US share in total world exports was used as a proxy. The results of the regressions which are corrected for first order autocorrelation of the residuals are presented in Table 1. All coefficients have the expected signs and are highly significant.

Table 1 *The Determinants of the US Target Price in Wheat and Corn*

	Wheat	Corn
β_0	4.207	1.023
	(2.90)	(3.90)
β_1	–0.0808	–0.0090
	(–2.73)	(–3.04)
β_2	–0.6049	–2.898
	(–2.59)	(–2.74)
β_3	0.6362	0.9313
	(5.21)	(762)
$\bar{R}^2$	0.853	0.801
δ	–0.291	–0.175
	(–1.16)	(–0.696)

Source: Own computations based on USDA (1984, 1989).

Notes: *t* values in parenthesis. The support price is in $ per bushel; budgetary expenditures are in $1000; the US share in world exports is in percent; and δ is the estimated autocorrelation correction parameter.

THE AGRICULTURAL TREADMILL WHEN POLITICAL DECISIONS ARE ENDOGENOUS

The analysis of endogenous agricultural producer price support has immediate implications for the agricultural treadmill. Technical change results in productivity growth in US agriculture which increases both policy determining variables, all other things being equal. This is illustrated graphically in Figure 1 for the small country case.

Technological change shifts the US supply curve from S to S'. At a given support price level (P_s) this increases producer surplus by ABO while budgetary expenditures grow by ABAFT. However, the growth in producer income and budgetary expenditures would result in a declining price support. This is shown in Figure 1 where the support price declines from P_s to P_s' The consequence is that the *effective* demand faced by producers

when policy decisions are endogenous is less than perfectly elastic with regard to the price.

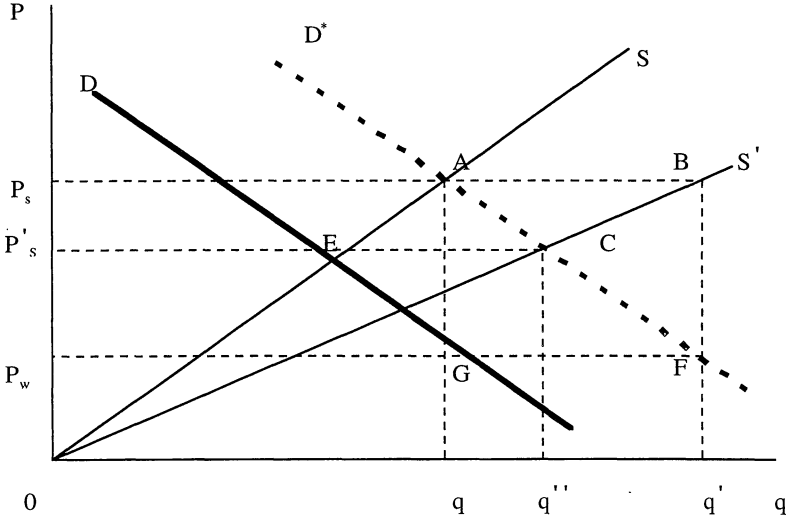

Figure 1 *The 'Agricultural Treadmill' when Price Policy is Endogenous*

Rather it is characterized by a movement from A to C which is extrapolated in Figure 1 to D^*.

As we have seen, the introduction of a minimum producer price does not render the agricultural treadmill dysfunctional. What price programs do, is they create temporary rents for landowners (be they farmers or not) which are eroded in subsequent periods via the endogenous adjustments of support prices, while the social welfare losses and adverse distributive effects continue for as long as the programs are in place. Obviously, the process discussed here can be offset when the political power of agricultural interest groups increases over time such that the minimum price would increase at any given level of agricultural income and budgetary expenditures. This is a phenomenon that has been observed in the course of economic development in many countries, and it explains part of the decline in real agricultural world market prices that has occurred in the last few decades (Tyers and Anderson, 1992). However, once agriculture has undergone major structural adjustments and it has become a small industry, the political power of agricultural interest groups does not grow much over time any more. Consequently, the *reality* of farm programs sets in, producer price support declines, and the agricultural treadmill begins to function again.

To illustrate the effects of the agricultural treadmill with government market intervention at given levels of political influence of agricultural interest groups, consider the empirical results of this study and assume an exogenous and permanent increase in US production each of corn and wheat. This will increase both x_1 and x_2 and will, thus, lead to a lower price in subsequent periods. Obviously, the dynamic nature of Equation (8) which was estimated for wheat and corn (see Table 1), implies that it may take several periods until

the support price converges at its new equilibrium level. In addition to the parameters of these regressions, the extent of the producer support price reduction on each market depends on the domestic supply elasticity, international price transmission elasticities, the world market price elasticity of demand faced by the USA, policy adjustments in other countries, as well as changes in production and consumption in other countries.

Of course, the extent of the changes in producer support prices depends on the particular scenarios analysed and on the magnitude of the aforementioned parameters. For most of these parameters there exist econometric estimates on which a simulation of the effects of a growth in US production on producer price support can be based.

Table 2 exhibits the results of simulations of an exogenous and permanent 5 percent increase in the US production of wheat and corn respectively for the small and the large country case. Of course, the USA is a large country in both the wheat and the corn market. However, we have elected to analyse the small country case also, because only one additional parameter is needed for each commodity (the US supply elasticity), and there is some consensus about its order of magnitude. For the analysis of the producer support price changes resulting from an increase in production in the large country case, some additional assumptions and parameters are required[1]. As indicated by Table 2, both scenarios resulted in similar reductions of the producer support prices.

Table 2 *The Effect of a Five Percent Increase in US Wheat and Corn Production on the Real US Producer Support Prices in Wheat and Corn*[a]

Crop[b]	Wheat	Corn
x_{3t}	1.44	0.94
	(small country assumption)	
x_{3t+1}	1.36	0.91
x_{3t+5}	1.38	0.83
percent change t, t+5	−4.2	−11.7
	(large country assumption)	
x_{3t+1}	1.37	0.91
x_{3t+5}	1.38	0.82
percent change t, t+5	−4.2	−11.7

Source: Own computation based on USDA (1984, 1989). For details see the appendix.
Notes: [a] x_3 is the real producer support price deflated by the CPI; x_{3t} is the price in the base period.
[b] Base year t is 1983/84 for wheat and 1984–85 for corn.

In view of the nature of the empirical model and the variables used, it is not very surprising that the results of the large country scenario do not differ much from the small country case. Any given growth in production results in a relatively larger increase in budgetary expenditures in the large country case. The partial effect reduces the support price more than in the small country case. However, a growing production in the large

country case reduces the world market price and thus stimulates domestic demand such that US exports increase less than in the small country case. Both partial effects happen to compensate each other in the scenarios analysed here and, therefore, the large country scenario leads to results which are very close to the small country case.

Given the dynamic nature of equations (13) and (14) we have reported the support prices for t+1 and t+5. Generally, the support price converged rather quickly. The price changes reported in Table 1 are in the expected direction. An increase in production reduces the producer support price for each commodity, as it acts to increase both support price determining variables x_1 and x_2. The extent of price reductions is reasonable; the resulting effective price elasticities actually faced by producers when US price support is endogenous was –1.19 for wheat and –0.43 for corn. These numbers are in the range of those reported for the world market demand elasticity faced by US wheat and corn producers (McCalla, Abbott and Paarlberg, 1986).

CONCLUSION

To our knowledge, our estimates of the extent of endogenous support price changes when there is an increase in production are the first of their kind. Further attempts at quantifying the effective producer price elasticity when price support is endogenous may result in estimates that differ from ours, depending on theoretical concepts used, time periods analysed, or scenarios simulated. In view of the fact that the analysis of the quantitative reaction of price support to changes in production is more complex than the more traditional analysis of supply or demand elasticities, it is likely that the range of estimates will be rather wide. Therefore, one must resist the temptation to over interpret the results reported in Table 2. Nevertheless, it is clear that during the time period analysed here, the agricultural treadmill has been functional in US wheat and corn production: An increase in production acts to reduce the level of producer price support and the price reduction is in the range to be expected without government market intervention.

NOTE

[1] The parameters used in the simulations in Table 2 are for each market: domestic US supply elasticity = 0.5; domestic US price elasticity of demand = –0.2; elasticity of transmission of world market to US consumer price = 1.0; effective export price elasticity faced by US producers = –1.65.

REFERENCES

Cochrane, W.W., 1988, *Farm Price: Myth and Reality*, University of Minnesota Press, Minneapolis.

Hayami, Y. and Ruttan, V.W., 1985, *Agricultural Development: An International Perspective*, 2nd ed., Johns Hopkins University Press, Baltimore, Maryland.

McCalla, F., Abbott, P. C. and Paarlberg, P.L., 1986, 'Policy Interdependence, Country Response, and the Analytical Challenge', in USDA-ERS, *Embargoes, Surplus Disposal and U.S. Agriculture*, Washington, D.C.

Tyers, R. and Anderson, K., 1992, *Disarray in World Food Markets*, Cambridge University Press.

USDA, 1984, *Background for 1985 Farm Legislation*, USDA-ERS, Washington, D.C.

USDA, 1989, *Background for 1990 Farm Legislation*, USDA-ERS, Washington, D.C.

APPENDIX

Estimates of Instrument Variables

$$Y_t^w = 23.09 + 0.4385\, Y_{t-1}^w$$
$$(2.79) \quad (2.21)$$
$$\bar{R}^2 = 0.151$$

$$B_t^w = 204\ 233 + 448.9\, B_{t-1}^w$$
$$(1.88) \quad (1.98)$$
$$\bar{R}^2 = 0.123$$

$$Y_t^c = 23.66 + 0.639\, Y_{t-2}^c$$
$$(2.96) \quad (1.46)$$
$$\bar{R}^2 = 0.374$$

$$B_t^c = 949\ 233 + 318.6\, B_{t-1}^c$$
$$(2.94) \quad (1.46)$$
$$\bar{R}^2 = 0.096$$

DISCUSSION OPENING — Paavo Makinen *(Ministry of Agriculture and Forestry, Finland)*

Let me start with a seemingly unrelated example from my own country, Finland. The development of agricultural policies had been relatively uneventful for the last 30 years until the latter part of the 1980s. It was generally accepted that the agricultural policies were rather costly, but the necessary funds were annually made available, anyhow, after normal political rethoric and bargaining.

Then along came the concept of PSE, which revealed to the general public and the MPs the agricultural policies actually may cost a lot more than the sum indicated in the budget. The whole concept was strongly disputed by the farmers but applauded by the critics of the policies. The main critical party, the social democrats, had incidentally been in the government for the previous 20 years.

With this added transparency one would have expected that a major change would have occured when the revision of the agricultural income legislation was due in 1990. In spite of big muscle flexing very little change actually took place, notwithstanding the fact that the centre party, the main farmers party, was not in the government. This certainly revealed well the preferences concerning agricultural policies in Finland.

For the last 35 years the centre party has been the leading party in the Government, but the agricultural sector has faced much bigger changes than ever before in the post war period.

Budget expenditures on agriculture have declined significantly, farmers pay a big part of the export subsidies, supply control measures have been tightened and Finland has accepted the GATT deal and negotiated the Treaty of Accession to the European Union,

which both will tighten the economic environment of farmers even further.

All of these changes have been initiated exogenously, through outside events. I underline the word events, because no interest group or political party can claim a victory over agricultural policies through their own action. Due to a deep depression, the national budget became extremely tight and for general national economic and political reasons Finland had to make the deal in the GATT and with the EU.

I think that this example shows some of the complexities and interlinkages we are facing when attempting to model behaviour of policymakers. The discussion we have had so far in the conference has touched many of these issues, but the effects of general economic development and policies, such as fiscal, monetary and exhange rate policies, to agriculture and agricultural policy making have received little attention in our discussion on political economics.

This is also the case in the paper by von Witzke and Hausner. Unfortunately they have not been able to come here personally, and I thank Dr Kennedy for presenting their paper. I will confine here my comments to only the few which I found more important.

In building their model, the authors assume that there is a single agricultural policy maker and that political economic constraints are linear. They do not discuss the validity of these assumptions. Should we now accept that statistically nice results from the empirical part conform to these assumptions and that the specification of the model was right. Perhaps the 'nice' results were mostly due to the use of autocorrelated lagged variables.

I have some doubts to the both of these assumptions. To say that the USA has had a single policy maker over more than 20 years in spite of many changes of admininstration is confusing. We could not generalize this assumption to all countries, at least. This is, of course, an issue much debated here earlier on.

Furthermore, the linearity of the function concerning the budget may also be difficult to defend. Fiscal policies change over time and have an effect to agricultural spending. I am curious why the period for the study was extended only to 83–84 season. Surely the data is available. Some discussion on the validity of the US share of maize and wheat export as a proxy for an income variable would have been welcome. I was actually surprised that such statistics do not exist. Finally, no reference was made to set-aside schemes. Normally the decisions on support prices and set-aside programmes are made more or less simultaneously. This should have been taken into account.