DIRECT PAYMENTS AND ACREAGE REDUCTION: AN ESTIMATE OF PROGRAM INDUCED EXPORT SUBSIDIES AND TAXES

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Abstract

Estimates of export subsidy or tax equivalents of commodity price and income support programs were made, incorporating participation and slippage effects. If a ten percent or larger acreage reduction program is required the program is an implicit export tax. Larger acreage reductions resulted in larger implicit taxes.

Keywords: Direct Payments, Export Subsidy, Target Prices, Acreage Reduction

Direct Payments and Acreage Reduction: An Estimate of Program Induced Export Subsidies and Taxes

In the Food and Consumer Protection Act of 1973 the concept of deficiency payments was introduced. Rather than setting direct payments equal to a fixed sum as during the 1960s, the new approach would make payments variable, increasing when prices declined, and decreasing when prices were stronger, disappearing completely when prices exceeded target price levels. A primary argument for the new approach was to allow for the reduction in loan rates so that markets could determine prices, and so that U.S. produced commodities could compete for world markets, while protecting farm income in periods of depressed prices with direct payments.

Income Supplements and Export Subsidies

An income supplement program, where the payment is tied closely to the quantity of the commodity produced, leads to increased domestic production as producers respond to the target price rather than the lower market price. The increased domestic production, other things equal, leads to a larger excess supply available to world markets, resulting in lower world prices and a larger market share for the country paying the income subsidy. The payment then, is tantamount to an export subsidy on the commodity.

A graphical illustration using a two country, single commodity model is instructive (Figure 1). If the two countries trade in a freely competitive market the supply in the world market is equal to the excess supply of the exporting country, ES, (total supply, S, less domestic demand, D). Demand in the world market is determined by the excess demand of the importing country, ED, (importing country domestic demand, D*, less importing country domestic supply, S*). Price P_f, and the quantity traded, X_f, are determined in the world market.

Figure 2 illustrates what occurs if the exporting country (in this case the United States) distorts the free trade equilibrium by establishing a guaranteed minimum expected price (a target price). Domestic supply becomes S'aS and excess supply in the world market shifts out to X'bES, resulting in larger exports, X_f' and a lower world price, P'. Supply in the rest of the world falls from S_f^* to S_f', implying a larger market share for the United States. The effect may be the same as if the exporting country paid an export subsidy to producers.

However, the analysis of programs in the United States is not quite as straightforward. Often to become eligible for the deficiency payments farmers are required to idle some acreage. Such an acreage reduction results in a reduction in supply, which increases price and reduces the amount of export subsidy.

Domestic supply shifts inward to S_iCS_i (Figure 3), reflecting the requirement to idle acreage. Note that the shift is less at high prices than at low prices, reflecting the voluntary nature of the U.S. commodity programs. Excess supply shifts into ES_id ES_i. However the amount of the shift illustrated on the graph is arbitrary, hence the effect on price and exports is indeterminate. The acreage restriction could have resulted in curve S_i'c'S_i' and an excess supply of ES_i'd'ES_i' in Figure 3. A factor complicating the effect of supply control programs is slippage. The existence of slippage in U.S. commodity programs is well documented. It results from two basic

Figure 1: Free Trade Model for a Single Commodity

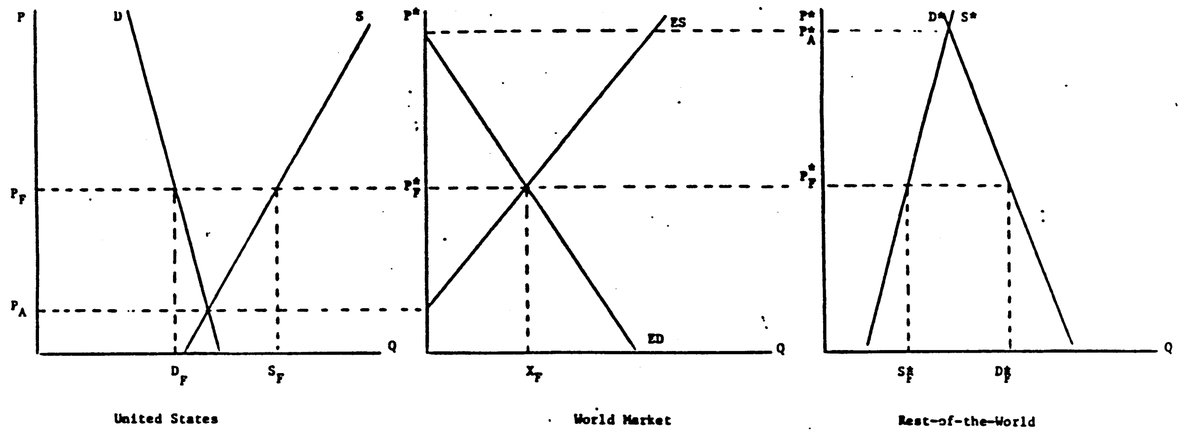


Figure 2. Effect of a Target Price on Trade of a Single Commodity

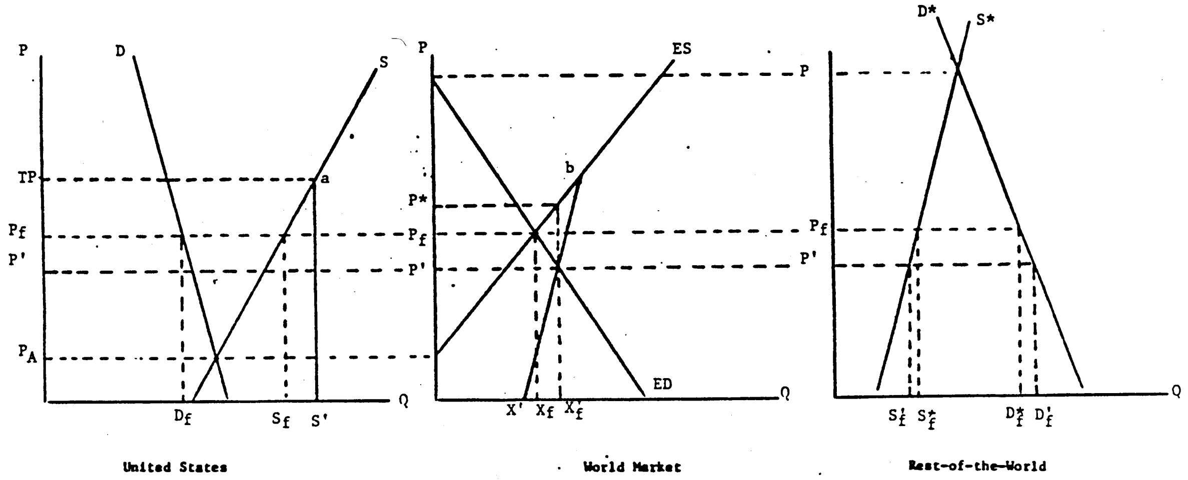
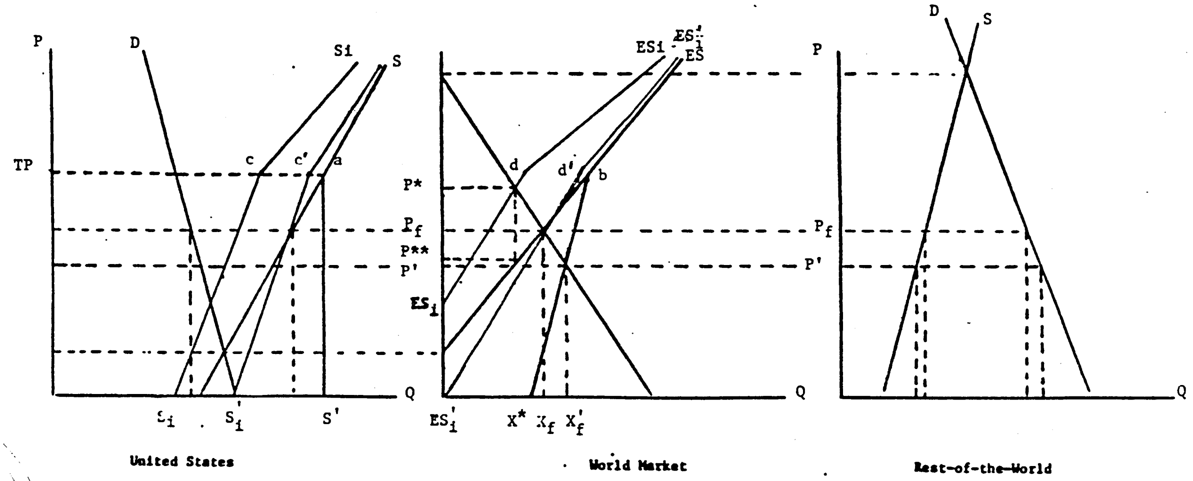


Figure 3. Effect of Required Acreage Reduction with Target Prices



sources. Farmers participating in the program will generally idle their least productive land, and because only land is idled they tend to increase the use of other inputs on the land remaining in production. Also nonparticipants, or participants who choose not to participate on all of their farms, expecting that the acreage reductions will result in higher prices, will expand acreage. In the remainder of the paper an attempt will be made to estimate the net effect of various combinations of acreage reduction and target price programs. And, after endogenously accounting for slippage, determine whether such programs result in implicit export subsidies or export taxes.

Direct Estimation or Simulation?

Target prices and deficiency payments have been in effect since the 1974 crops for corn and wheat, yielding 11 crop years for observing the effects of the program on participation and exports. However, the lack of consistency in programs, compounded by yield and export variability render direct estimation tenuous, at best. For corn there were 6 years when no acreage reduction was required to receive deficiency payments, 2 years when a non-paid 10 percent acreage reduction was required, and 3 years when a paid diversion plus non-paid acreage reduction program was in effect. For wheat, in 6 years no acreage reduction was required, in one year a non-paid acreage reduction was required and in 4 both paid and non-paid ARP/PLDs were in effect. For corn, deficiency payments were made in 2 of the 11 years (1982 and 1983) and for wheat 6 of the 11 years, (1977-78 and 1981-84).

A Simulation Approach

Several alternative specifications for production response were reviewed (1,3,4,6). The approach used by Bancroft and contained in the USDA's Food and Agricultural Policy Simulator (FAPSIM) was selected because it explicitly predicts the level of farmer participation in commodity programs. For purposes of the estimation of the export subsidy equivalent of the target price program it is essential to utilize an approach which endogenously predicts acreage response for both participants and nonparticipants. Otherwise, selection of an exogenous participation rate would determine the answer.

The acreage response relationships contained in FAPSIM reflect the relative profitability of participation vs nonparticipation in Government programs.

For a program participant the expected net per acre return for crop i is:

$$EPR_i = [(EPP_i*EY_i - VC^i)(1.0 - (ARP_i + PLD_i))] + [SR_i*PY_i(1.0 - (ARP_i + PLD_i))] + [DR_i*PY_i*PLD_i]$$

where:

EPR_i = expected program net return per acre for crop i,

EPP_i = the maximum of the loan rate and the expected market price,

EY_i = expected yield per acre,

VC_i = Variable cost per acre,

SR_i = expected deficiency payment rate (target price less maximum of expected market price or loan rate) per bushel,

PY_i = national program yield,

ARP_i = proportion of each acre in unpaid acreage reduction,

PLD_i = proportion of each acre in paid land diversion,

DR_i = diversion payment rate per bushel.

The expected net return per acre for nonparticipants is:

$$EMR_i = EMP_i * EY_i - VC_i$$

where:

EMR_i = expected market net return per acre for crop i,

EMP_i = expected market price for crop,

EY_i = expected yield for crop i,

VC_i = Variable cost per acre for crop i.

An estimate of expected crop prices and yields is essential for development of expected net returns and the resulting participation decision. There are three alternative approaches which one might take to estimate expected prices and yields; a rational expectations approach (7), the futures market price at harvest time, or the market price prior to planting. Expected prices in FAPSIM are based on the simple average price 1-5 months prior to planting. Expected crop yields are also estimated by regressing actual yields on time.

The expected net return variables are used to estimate acreage response by participants and nonparticipants. Acreage planted in the program is expressed as:

$$PA_i = f\left[\frac{EPR_i}{CPI}, \frac{EMR_i}{CPI}, \frac{APP_i}{CPI}, (1 - ARP_i - PLD_i)\right]$$

where:

PA_i = Program acreage of crop i,

APP_i = Average expected net return of competing crops,

ARP_i = Acreage reduction percentage for crop i

PLD_i = Paid land diversion percentage for crop i

CPI = All item CPI lagged one period.

Acreage planted to crop i by nonparticipants is a function of acreage planted to crop i by participants, acreage set aside and diverted, the real expected net return from competing crops, and the real expected market net return from planting crop i.

Slippage

The formulation of the planted acreage equations where acreage planted by nonparticipants is a function of, among other things, acreage planted by participants, accounts for slippage from both participants and nonparticipants in the form of additional acreage planted outside the program. The slippage rate implied by the coefficient estimated on idled acreage is approximately .40 for corn and .33 for wheat (2).

Yield slippage is also accounted for in the equations for yield. Wheat and corn yields per harvested acre decrease with total acreage planted and increase when acreage is idled in the program. Yield slippage implied for wheat is .13 bu. per million acres idled and for corn .47 bu. per million acres idled (2).

The FAPSIM wheat and corn models were simplified by collapsing the demand side equations for food, feed, industrial and export use into linear functions of price. In effect, the other factors affecting these demands, libestock herd size, disposable personal income, population, exchange rates, foreign exchange holdings of importers, etc., were assumed constant and "collapsed" into the intercept term of the simple linear demand equation. Seed demand remains a function of planted acreage the next year.

The supply side of the model more nearly reflects the entire FAPSIM system. The expected price, yield, and net returns etc. were constructed exactly as in the overall system. Expected net returns from competing crops were taken from the current FAPSIM baseline and entered exogenously.

The two commodity models were then coded into a Lotus 1-2-3 spreadsheet for purposes of the simulations. The simulation was conducted for the 1986 crop year assuming that price in 1985 and 1986 was the same. In order to generate an excess supply curve for the two commodities various prices were entered into the models exogenously to determine domestic utilization and production, with the difference equal to excess supply available for world markets. A line was fitted on these prices and quantities to approximate the excess supply "curve" resulting from the simulations for several program alternatives.

The alternatives chosen for corn and wheat were selected to represent the array of probable program alternatives for crop year 1986 under the present legislation. The base case for each crop was no target price and no ARP or PLD - essentially a free market equilibrium. For corn, the base was compared with three alternatives with a $3.03 target price. One with no ARP/PLD, one with a 10 percent ARP and another with a 10/10 ARP/PLD. In the fifth case the effect of a $2.55 loan rate which established a price floor was analyzed. For wheat the base was compared with four alternatives with a $4.38 target price. The first case was a $4.38 target with no ARP/PLD. Other cases studied were a 10 percent ARP, a 20 percent ARP, and a 20/10 ARP/PLD (Tables 1,2). In the sixth case the effect of a $3.30 loan rate which established a price floor was examined.

Excess demand was estimated as the linear export demand equation which obtains when all variables except price are held constant and "collapsed" into the intercept term. Three export scenarios were analyzed. The base case utilized the export demand which corresponded with the base export case contained in the FAPSIM system. That level is consistent with export levels of recent years.

The high and low export demand case assumed exports higher or lower by 100 million bushels. These levels are arbitrary and used only for illustrative purposes.

Calculating the Subsidies and Taxes

The method for calculating the export subsidy is straightforward and is shown graphically in Figure 2. The world price and level of U.S. exports are calculated by equating the appropriate excess demand (export) equation with the program distorted excess supply curve, (P' and X'_F in Figure 2). The level of exports which obtains is then substituted into the free trade excess supply curve to determine the U.S. price which would have to prevail to generate that level of excess supply (P* in Figure 2). The subsidy is calculated by subtracting the world price from the U.S. price (P*-P' in Figure 2). The export tax is calculated in the same way, except that at the calculated level of exports (X* in Figure 3) the world price (P*) exceeds the U.S. price (P**) that is necessary to generate a level of excess supply demanded by the rest of the world. The difference, (P*-P** in Figure 3) is the export tax equivalent of the acreage reduction program.

For corn and wheat under the moderate export case, export subsidies were estimated to be $.50 and $1.21 per bushel, respectively. Subsidies were positive only for the case where deficiency payments were available without the requirement that acreage be reduced (Tables 1 and 2). In all other cases the combined effect of the program was the equivalent

Table 1. Wheat: Estimates of Subsidy (Tax) Equivalent

	Case I-Free Trade	Case II	Case III	Case IV	Case V	Case VI
Agricultural Programs						
Target Price	--	$4.38	$4.38	$4.38	$4.38	--
ARP %	--	--	.10	.20	.20	--
PLD %	--	--	--	--	.10	--
Loan Rate	--	--	--	--	--	$3.30
Excess Supply Equation						
Slope	237.84	107.97	257.67	272.61	289.79	--
Intercept	967.16	1544.78	851.87	755.41	641.99	--
Moderate Exports: EX= 2310-235P						
World Price	$2.84	$2.32	$2.96	$3.06	$3.18	$3.30
U.S. Exports	1642	1764	1702	1655	1598	1535
Subsidy (Tax) Equivalent	--	$1.03	$(.24)	$(.44)	$(.68)	$(.91)
Q @ $3.30	1752	1913	1700	1652	1594	1535
High Exports: Ex=2410-235P						
World Price	$3.05	$2.52	$3.16	$3.26	$3.37	$3.30
U.S. Exports	1693	1817	1666	1644	1618	1635
Subsidy (Tax) Equivalent	--	$1.05	$(.22)	$(.41)	$(.63)	$(.49)
Q @ $3.30	1752	1901	1702	1655	1598	1635
Low Exports: Ex=2210-235P						
World Price	2.63	$1.94	$2.76	$2.86	$2.99	$3.30
U.S. Exports	1592	1754	1562	1537	1508	1435
Subsidy (Tax) Equivalent	--	$1.37	$(.24)	$(.46)	$(.71)	$(1.33)
Q @ $3.30	1752	1901	1702	1655	1598	1435

Table 2. Corn: Estimates of Subsidy (Tax) Equivalent

	Case I-Free Trade	Case II	Case III	Case IV	Case V
Agricultural Programs					
Target Price	--	$3.03	$3.03	$3.03	--
ARP %	--	--	.10	.10	--
PLD %	--	--	--	.10	--
Loan Rate	--	--	--	--	2.55
Excess Supply Equation					
Slope	1268.36	737.71	1494.14	1616.71	--
Intercept	-508.91	1133.25	-1427.25	-1870.89	--
Moderate Exports: EX=3249.5-379.94P					
World Price	2.28	1.90	2.50	2.56	2.55
U.S. Exports	2383	2529	2301	2275	2281
Subsidy (Tax) Equivalent	--	$.50	$(.28)	$(.37)	$(.35)
Q @ $2.55	2725	3012	2383	2252	2281
High Exports: Ex=3349.5-379.94P					
World Price	$2.34	$1.98	$2.55	$2.61	$2.55
U.S. Exports	2460	2595	2381	2356	2381
Subsidy (Tax) Equivalent	--	$.47	$(.27)	($.35)	($.27)
Q @ $2.55	2725	3012	2381	2252	2381
Low Exports: Ex=3149.5-379.94P					
World Price	$2.21	$1.81	$2.44	$2.51	$2.55
U.S. Exports	2306	2462	2222	2194	2181
Subsidy (Tax) Equivalent	--	$.53	$(.29)	$(.38)	$(.43)
Q @ $2.55	2725	3012	2383	2252	2181

of an export tax ranging from \$.24-\$.91 for wheat and \$.28-\$.37 for corn. In most cases the implicit export taxes associated with the loan rates in effect for the 1985 crops, \$3.30 for wheat and \$2.55 for corn, were larger than those which would result from the acreage reduction requirements alone. As would be expected the subsidies or taxes calculated were largest in the case of lower export demand.

Conclusions and Implications

A simulation approach to the estimation of the export subsidy or tax equivalent of domestic commodity price and income support programs shows that with as little as a 10 percent unpaid acreage reduction program the total program is implicitly an export tax. The larger the acreage reduction the greater the implied tax.

Generally, the export tax resulting from the loan rates in effect for the 1985 crops exceeded the export tax that would prevail as a result of acreage reduction, but in the absence of a loan rate set above market clearing levels. This implies that should changes be made in the 1985 farm legislation to eliminate acreage reduction and reduce support prices to market clearing levels, while retaining target prices, the export subsidy effect would be substantial. On the other hand, lowering the loan rates, or making them responsive to world price levels while maintaining the current set of acreage reduction and target price programs would not likely eliminate the implicit export tax resulting from those programs. Indeed, if the lower loan rates should cause farmers to expect lower market returns relative to program returns, participation in acreage reduction programs could increase, causing the export tax to be even larger.

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