

Prospects for Hedging Federal Farm Program Budgetary Risks

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The federal treasury has long been used to absorb financial uncertainties of business and agriculture through such programs as federal mortgage guarantees, deposit guarantees, and farm price supports. In recent years, it has become increasingly obvious that the government's ability to absorb such financial risks is not inexhaustible. Possibilities for reducing the government's financial obligations and shifting part of its financial commitment to private investors or speculators deserve exploration. Private traders operating through efficient markets may be able to carry some of these risks at lower cost than the government. The futures markets appear to offer potentials for spreading government financial uncertainties among private traders. This article examines possibilities for hedging farm program budgetary uncertainties through agricultural commodity futures. The analysis also relates to recent proposals for replacing current farm programs with programs to subsidize farmers' use of futures or options.

For over half a century, the federal government has guaranteed returns to farmers through commodity price support and storage programs. The realized costs of these programs frequently differs markedly from budget estimates due to fluctuations in crop yields, export demand, and market prices. For example, total Commodity Credit Corporation (CCC)¹ program costs deviate from budget estimates by

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¹The CCC is a federally owned and operated corporation within the U.S. Department of Agriculture that handles all the money transactions involved in the administration of farm commodity price and income support programs.

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more than \$5 billion in 7 of the 10 years from 1980–1989 (Fig. 1). Although the deviations between actual and estimated costs shown in Figure 1 are not large relative to the overall federal budget, such deviations make planning less efficient within the Department of Agriculture, the Office of Management and Budget, and Congress.² Moreover, accurate estimates of prospective government outlays and receipts are more important since the passage of the Gramm–Rudman–Hollings (GRH) Deficit Reduction Act which requires spending reductions if the estimated federal deficit exceeds specified target levels.

To assess the potential for shifting farm program budgetary risk to the private traders, correlations between budgeting errors and futures price movements are estimated. Estimates of minimum-variance government hedging levels and risk-shifting effectiveness are also developed. Institutional changes that would be involved are outlined, and the capacity of the futures markets to carry the large open positions that would be required are examined. Spreading farm program budgetary uncertainties among private traders makes sense only if the farm programs themselves are justified. This article does not evaluate farm programs, nor does it measure the benefits from reducing budgetary uncertainty or estimate the effects of government hedging on average or expected farm program outlays.³

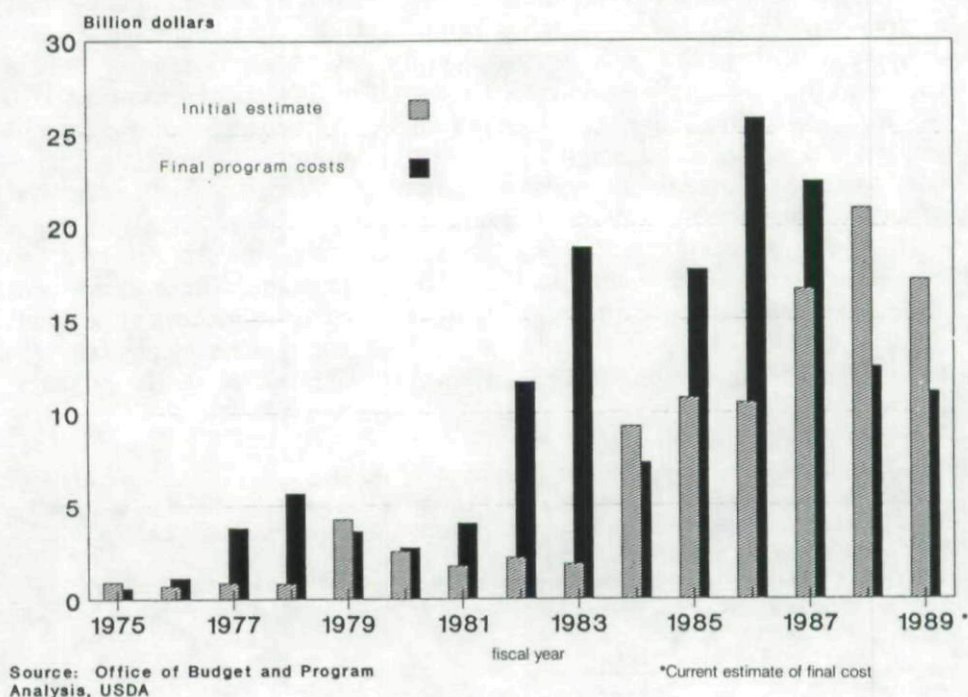


Figure 1
CCC total program costs.

²See U.S. General Accounting Office (1988), pp. 25–26.

³The effect on average CCC outlays depends upon the magnitudes of risk premiums and transactions costs which are very difficult to forecast. It is possible that the risk premiums might be substantial at the outset of CCC risk shifting, but would become small over time with increasing competition among speculators.

THE NATURE OF FARM PROGRAM BUDGETARY UNCERTAINTY

Budgetary uncertainty occurs when actual expenditures cannot be predicted accurately when budgets are formulated. The degree of uncertainty in any given year is not observable—it may vary from year to year depending upon economic conditions. The general magnitude of uncertainty over a historical period can be estimated by calculating the mean squared or mean absolute deviations between actual and budgeted expenditures.

Federal budgeting begins about 18 months before the fiscal year starts, when departments and agencies within the government prepare their budget recommendations for the Administration. The President's budget is submitted to Congress in January—about nine months before the beginning, and 21 months before the end of the fiscal year. Congress normally completes action on the budget by sometime in the summer. In recent years, the budget frequently is not passed before October 1, the beginning of the fiscal year. This necessitates the use of continuing resolutions to finance government activities.

CCC net outlays fluctuate widely between years due to the risk-absorbing role of farm programs.⁴ The standard deviation of actual CCC net outlays is 7.6 billion dol-

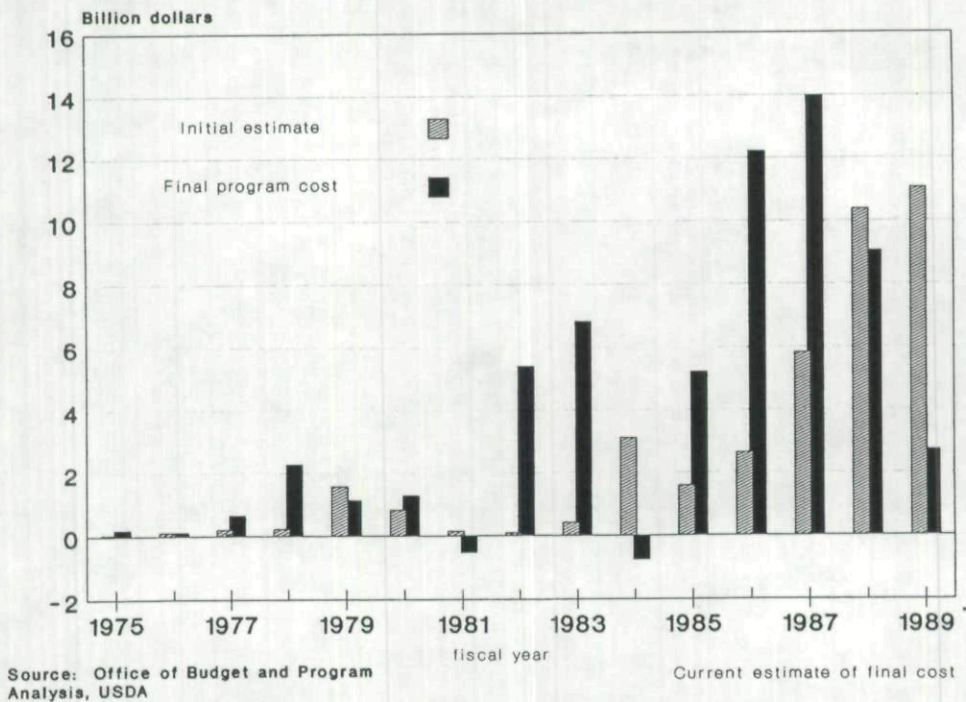


Figure 2
CCC feed grain program costs.

⁴The CCC copes with the budgetary uncertainty inherent in farm price and income support programs by operating as a revolving fund with borrowing rights from the Treasury. Therefore, CCC programs are not constrained by appropriations made in advance in the same way most government programs are. However, accurate estimates of CCC net outlays are needed for program decision making and for estimating total outlays for overall agricultural as well as fiscal or budget policy-making purposes.

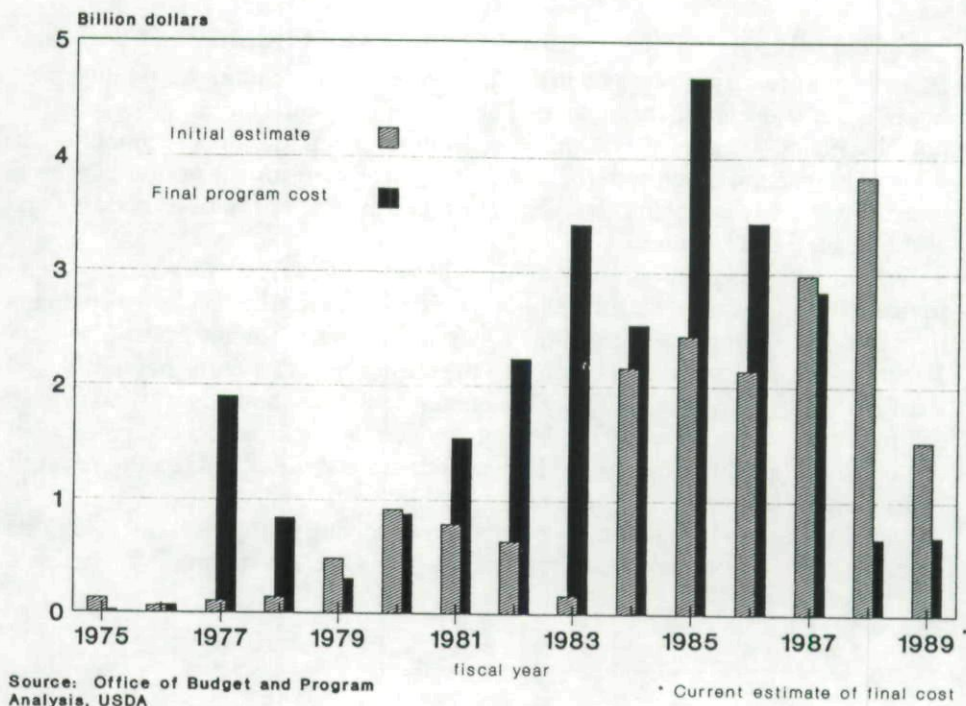


Figure 3
CCC wheat program costs.

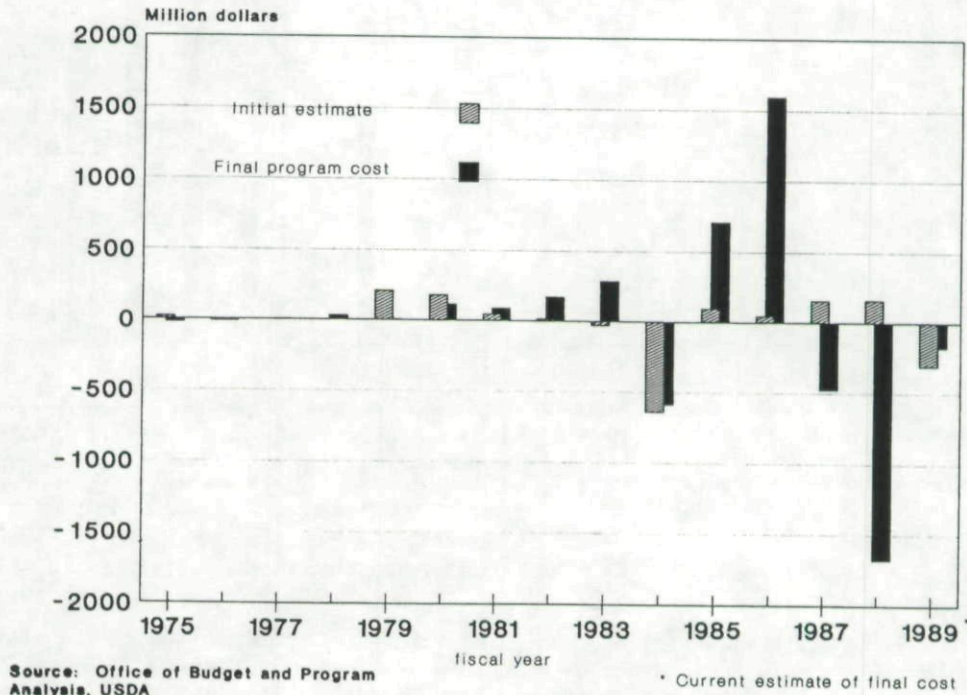


Figure 4
CCC soybean program costs.

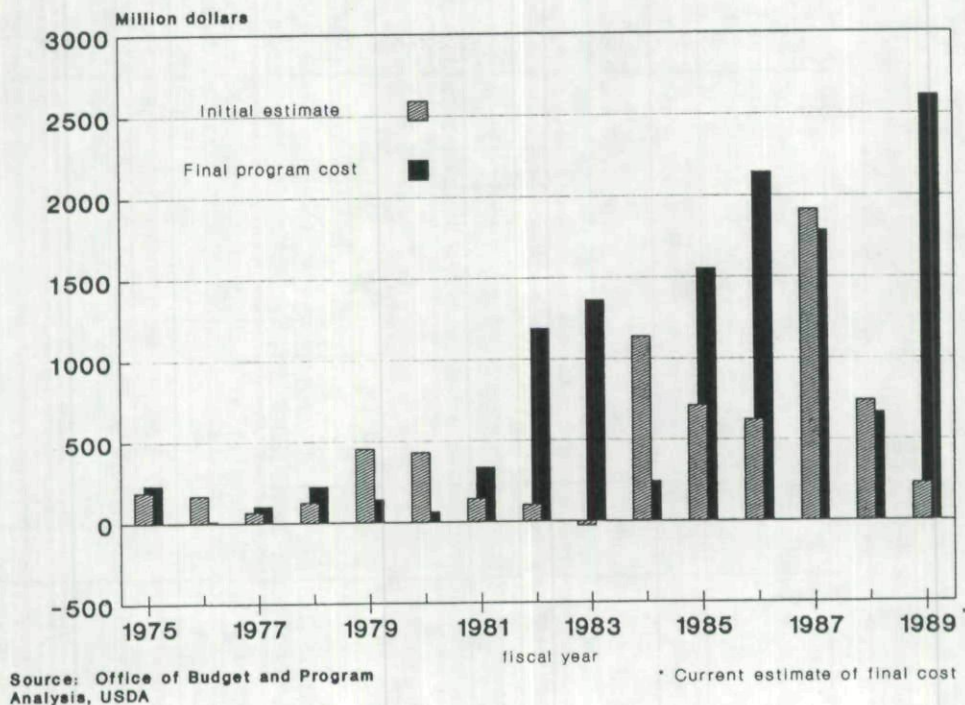
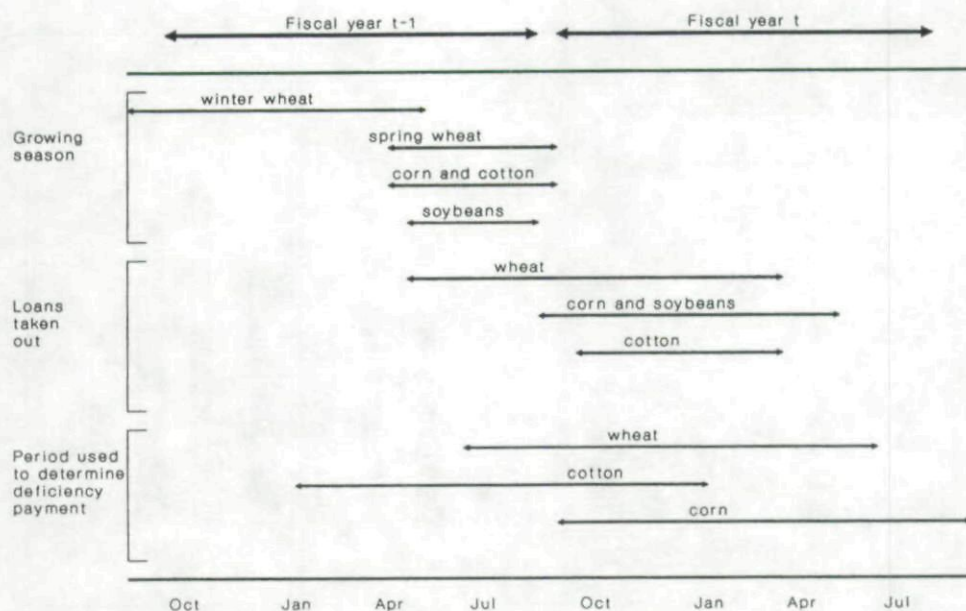


Figure 5
CCC cotton program costs.

lars or about 56% of the mean outlay level over fiscal years 1980–1989. The mean absolute percentage error of the estimates of CCC net outlays made in the annual President's budget is 52% (of actual levels) over the same period.

Estimated and actual program costs by commodity for feed grains, wheat, soybeans, and cotton during fiscal years 1975–1989 are shown in Figures 2–5. These commodities account for about two thirds of total CCC net outlays during the study period. The estimated costs are those used to construct the President's January budgets. Both estimated and actual outlays and the differences between them tend to be much larger from 1981–1989 than during the preceding years. The largest underestimates occur for feed grains in 1982, 1983, 1986, and 1987, but large errors also occur for wheat and cotton during the 1980s. These estimation errors, while exceptionally large in dollar terms over the past decade, are similar in percentage terms to long-term historical levels. The mean absolute percentage error for total CCC net outlay estimates presented in the President's budget averages 58% for the fiscal years 1950–1989.

In contrast to the price risks in holding commodity inventories, which essentially begin and end with the storage period, the farm program cost uncertainties borne by the government are spread over a long and vaguely delimited time interval. The government's commitments begin with the passing of legislation, increase with the announcement of price support levels, and extend over the period of program sign-up, the growing season, and the periods allowed for taking out loans, and determining deficiency payments (Fig. 6). The government's budgetary uncertainty is high at the time when specific price support levels are announced and declines as



Source: Agricultural Stabilization and Conservation Service USDA

Figure 6
Calendar for government's price risk exposure.

farmers sign up, as yields are determined, and as farmers take out loans.⁵ With a large crop that results in low market prices, large deficiency payments, and substantial government takeovers, budgetary uncertainty remains high after harvest. The government's budget uncertainties regarding the loan program end if and when the loans are repaid by farmers. If the farmer forfeits the commodity, the government's budget uncertainties continue. Its position changes from being, in effect, a grantor of put options to being long in the commodity.

The uncertainties associated with supporting farm incomes are pooled with other budgetary uncertainties in the overall federal budget. Farm program costs do not exceed 2.6% of total federal outlays in any recent year (Table I). Moreover, the correlation between CCC budgeting errors and other federal budgeting errors is slightly negative (-0.12) for 1980-1989 using real dollars.⁶ Thus, completely eliminating errors in estimating CCC outlays would have a relatively small impact on uncertainties about total federal expenditures. Nevertheless, even small reductions in budgetary uncertainty are potentially important since automatic spending reductions under GRH are sensitive to small changes in budget deficit estimates in many cases. In addition, CCC budgeting accuracy is important in making decisions about agricultural programs.

POSSIBILITIES FOR GOVERNMENT HEDGING

Possibilities for shifting the commodity price risks currently borne by the government to private traders include: (i) government "hedging" its price support commit-

⁵In a GAO study, the mean absolute percentage error in estimating USDA commodity program outlays for the 1981-1986 period is reduced from 65.6% for the initial estimates to 25.9% at budget reviews a year later. See U.S. General Accounting Office (1988), p. 39.

⁶Prices are deflated using the GNP implicit price deflator with 1989 = 100.

Table I
BUDGETED AND ACTUAL OUTLAYS FOR TOTAL GOVERNMENT AND
CCC PROGRAMS (FISCAL YEARS 1975-1989)

Fiscal Year	Total Government (\$Billions)			CCC (\$Billions)			CCC Share ^b
	Budget Estimate	Actual	Difference ^a	Budget Estimate	Actual	Difference ^a	
1975	304.4	332.3	27.9	0.9	0.6	-0.3	0.2
1976	349.4	371.8	22.4	0.7	1.1	0.4	0.3
1977	394.2	409.2	15.0	0.9	3.8	2.9	0.9
1978	440.0	458.7	18.7	0.8	5.6	4.8	1.2
1979	500.0	503.5	3.5	4.3	3.6	-0.7	0.7
1980	531.6	590.9	59.3	2.5	2.7	0.2	0.4
1981	615.8	678.2	62.4	1.7	4.0	2.3	0.6
1982	739.3	745.7	6.4	2.2	11.6	9.4	1.6
1983	757.6	808.3	50.7	1.8	18.8	17.0	2.3
1984	848.5	851.8	3.3	9.2	7.3	-1.9	0.9
1985	925.5	946.3	20.8	10.8	17.7	6.9	1.9
1986	973.7	990.3	16.6	10.5	25.8	15.3	2.6
1987	994.0	1003.8	9.8	16.6	22.4	5.8	2.2
1988	1024.3	1064.0	39.7	21.0	13.1	-7.9	1.2
1989	1094.2	1137.0	42.8	17.1	13.5	-3.6	1.2

^aDifference is actual outlays minus budgeted outlays. Minus (-) indicates actual outlays were less than budgeted outlays.

^bActual CCC outlays as percent of actual total government outlays.

Source: The President's Budget (various issues) and Office of Budget and Program Analysis, USDA.

ments directly in futures or options, or perhaps indirectly, by purchasing special option-like contracts from dealers who would in turn offset their risks in the futures or options markets; and (ii) subsidizing farmers' use of futures, options, or cash forward contracts in lieu of price supports and deficiency payments.

In offering farmers price supports or deficiency payments, the federal government, in effect, grants put options for the commodities covered.⁷ To offset the risks involved in granting these option-like guarantees, the government would need to either buy puts or sell futures, and hold these positions over periods that correspond to the periods of the price guarantees.

Houthakker (1967) proposed that the government buy and sell futures contracts to stabilize commodity prices. The government would thereby influence interyear stock-carrying without actually holding commodities. In effect, the government would be acting as a large, benevolent, price-manipulating speculator under the Houthakker proposal. This article proposes that the government behave as a hedger to shift budget uncertainties that accompany existing farm programs.

⁷Put options are more like deficiency payments than price support loans. Both options and deficiency payments apply to a specified quantity of product while price supports cover all that the farmer produces on the qualifying acreage. Moreover, price supports involve provisions for removing commodities from the market when the price falls below the support level.

Designing a program for the government to hedge its price commitments involves many considerations. First, the 1-5-year price guarantees embodied in farm legislation clearly cannot be effectively hedged in futures contracts that trade only 12-15 months before maturity. Some new type of contract with longer maturity periods would be needed to hedge such long-term price guarantees. Analysis of these possibilities is outside the scope of this study.

Prospects for hedging the government's shorter-term commodity price commitments are more promising. For example, the CCC might sell futures or buy put options when price support levels are announced, when the program budget is formulated, or when farmers sign up for the program. These positions would be carried and rolled over as necessary until the time for repaying loans passes and price support commitments are fulfilled. If the crop is large and prices low, the CCC would buy back the futures contracts, or sell its put options, which would have appreciated in value, to raise money to help cover price support costs. If, instead, the crop is small and prices high, then price-support costs would be smaller than anticipated and the CCC would either buy back the futures at a loss or let its put options expire unexercised and without value.

The government's price uncertainties could be hedged more simply using put options than futures because the government, in effect, gives farmers put options. This article, however, analyzes government hedging in futures because options were not traded throughout the period studied.

Arrangements for the government to hedge indirectly might be devised if direct government trading in the futures or options markets is found to be objectionable or impractical. Lucterhand's 1986 proposal for the government to buy standardized option-like contracts from a dealer pool and issue them to farmers is in this vein. The contracts would guarantee the holder (the government and then the farmer in this case) the difference between a specified price and the market price. The dealers who sell contracts to the government could, in turn, hedge their commitments under the contracts by taking positions in existing options or futures markets.

The government might also use a dealer pool simply to hedge its price commitments under existing types of price support programs. For this purpose, the government would buy the price-guarantee contracts from members of the dealer pool, hold the contracts, and sell them back as its price support obligations are fulfilled. A possible advantage of a dealer pool would be that large government trades could be absorbed with less market disruption. A possible disadvantage would be additional transactions costs. Questions about the legality of trading commodity option-like contracts through a dealer pool would have to be resolved before such an arrangement could be initiated.

POSSIBILITIES FOR SUBSIDIZING FARMERS' USE OF OPTIONS OR FUTURES

Farm program budgetary uncertainties might be reduced by subsidizing farmer hedging instead of by government hedging. For example, deficiency payments and price support loans might be replaced with payments to farmers for purchasing put options. The government's costs would be known when the put options are purchased; the options would protect farmers from subsequent price declines without further government expenditures. Similar results might be obtained by subsidizing farmers' sale of futures contracts at planting time.

A possible advantage of subsidizing farmer trading instead of government trading is that the actual trading would be more dispersed over time and less disruptive to the markets. Farmers would need to be allowed adequate time and flexibility for making their options or futures trades. However, farmers might trade in bunches as program deadlines approach. In contrast, government trades could be systematically spread out over time to minimize shocks to the market. The potential for reducing government budget uncertainty may be greater with direct government hedging than through subsidized farmer hedging.⁸

ESTIMATES OF RISK-SHIFTING EFFECTIVENESS

The amount of price uncertainty shifted to the marketplace by government hedging, or subsidizing farmer hedging, would depend on when the trades are made. The government would minimize budgetary uncertainty by hedging when it takes on price support obligations. This calls for buying puts or selling futures at or before planting instead of after harvest. If the government waits until harvest to hedge its commitments, it would sometimes have to pay large premiums for in-the-money puts.

The budget submitted to Congress by the President in January contains estimates of program expenditures for the fiscal year beginning the next October. This covers most of the price support costs for crops harvested during that calendar year. The end of the marketing year is at least 16 months away for winter wheat and about 20 months away for summer crops when the January budget estimates are made, but the costs for loans and (regular) deficiency payments are determined before the end of the marketing year.⁹ Moreover, major portions of the price uncertainties are associated with crop size, which, by July, is largely known for winter wheat and by October for summer crops, six months and ten months after the January budget estimates, respectively. Thus, to estimate the potential for shifting government risks, it is assumed that the government takes short positions in January in futures contracts that mature at harvest.

The effectiveness of government hedging for shifting budgetary risk depends on the correlations between budgeting errors and futures or options price changes. The correlations between actual minus estimated outlays are calculated for the feed grain, wheat, cotton, and soybean programs, and the returns from holding corresponding short futures positions from January 15 until November 15 for fiscal years 1975–1989.¹⁰ The simple correlations for this time interval range from 0.31 for soybeans to 0.60 for wheat.

For a second approximation, the years from the 1970s which generally exhibit relatively small program expenditures and small differences between actual and estimated program costs are dropped.¹¹ The simple correlations for the 1980–1989

⁸The possibilities for subsidizing farmers' use of futures and options are discussed in Heifner and Sporleder (1988) and Heifner and Wright (1989). Glauber and Miranda (1989) and Plato (1989) use computer simulation to study market-level and farm-level effects of subsidizing farmers' use of options.

⁹"Findley" deficiency payments are determined at the end of the marketing year. "Findley" deficiency payments are made after the Secretary of Agriculture has announced a loan rate below the statutory loan rate and the national weighted average marketing year farm price was below the statutory level.

¹⁰Prices of December corn and wheat and November soybean futures are from the various issues of the Chicago Board of Trade *Statistical Annual*. December cotton futures prices are from the Commodity Futures Trading Commission. *The Wall Street Journal* price quotations are used for the most recent years.

¹¹Percentage errors in estimating program expenditures are similar in the 1970s to the 1980s, but the dollar magnitude of the errors is much smaller in the earlier period.

period range from 0.31 for soybeans to 0.74 for corn. The relationships are plotted in Figures 7–10 for feed grains (using corn futures), wheat, cotton, and soybeans, respectively. The observed correlations imply that a substantial amount of the budget estimating errors results from price changes not anticipated in the marketplace or by budget estimators and could have been offset by hedging.

CAPACITY OF THE FUTURES AND OPTIONS MARKETS TO ABSORB THE RISKS BORNE BY THE GOVERNMENT

It is questionable whether sufficient long private speculation can be developed to absorb the agricultural commodity price risks now borne by the government. Figures 11–14 show the quantities produced, covered by open futures contracts on all exchanges, and placed under loan for corn, wheat, soybeans, and cotton by crop year from 1954 to the present. The figures illustrate that average open interest ranges from 20–30% of production for soybeans, wheat, and cotton in recent years, and 8–15% of production for corn, much of which is fed on the farm where it is produced.

The sizes of the government short futures positions needed to minimize the variance of budget estimation errors for fiscal years 1980–1989 are estimated by regressing actual minus expected expenditures on the returns from the short futures positions. The regressions take the following form:

$$E = \alpha + \beta F + u,$$

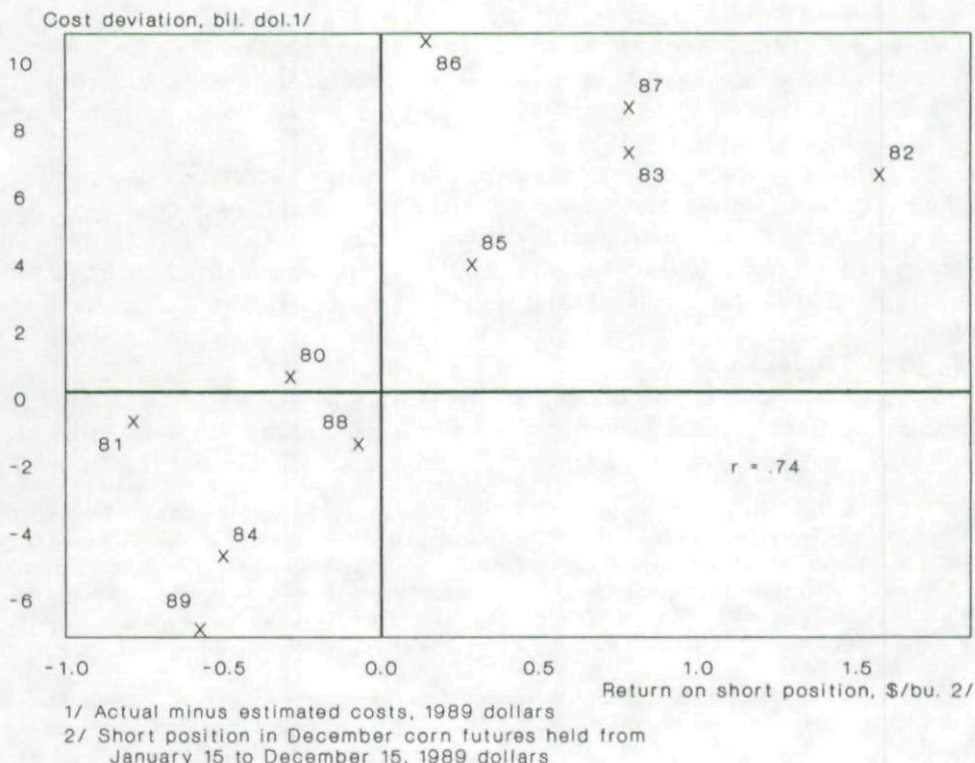
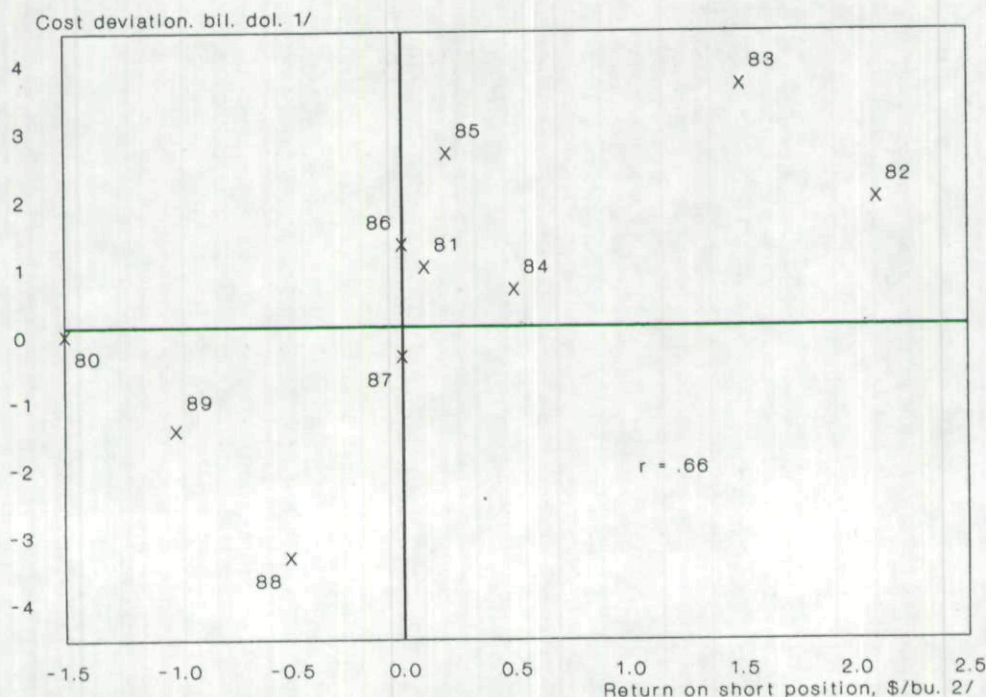


Figure 7

Corn program cost deviations related to returns on short positions, fiscal years 1980–1989.



1/ Actual minus estimated costs, 1989 dollars
 2/ Short position in December Chicago wheat futures held
 from January 15 to December 15, 1989 dollars

Figure 8

Wheat program cost deviations related to returns on short positions, fiscal years 1980-1989.

where E = actual expenditures - budgeted expenditures in billions of dollars, F = futures price on January 15 - futures price at harvest in dollars per bushel, α and β are coefficients to be estimated, and u is a random disturbance. Results are reported in Table II. The regression coefficients can be interpreted as estimates of minimum variance hedging levels. If these hedging levels had been applied, the mean squared errors in anticipating program costs would have been 44-55% less for corn, wheat, and cotton, and 10% less for soybeans.

The smaller effect for soybeans appears to be due to differences between the soybean program and the programs for the other commodities. Regular deficiency payments constitute a major component of the program costs for the other crops. Regular deficiency payment levels are determined during the first few months of the marketing year, and thus are relatively closely related to harvest-time prices. Soybeans had a loan program but no deficiency payments. The costs for loan programs depends on decisions made by farmers later in the year about forfeiting commodities to the government. Thus, soybean program costs may have been more sensitive to price changes which occurred after harvest.

These estimates show that the government would have needed to have held very large short positions (up to one half to three fourths of a normal U.S. crop) to minimize budgeting errors for the feed grain, wheat, and cotton programs over the period analyzed. This is several times the average futures open interest in these

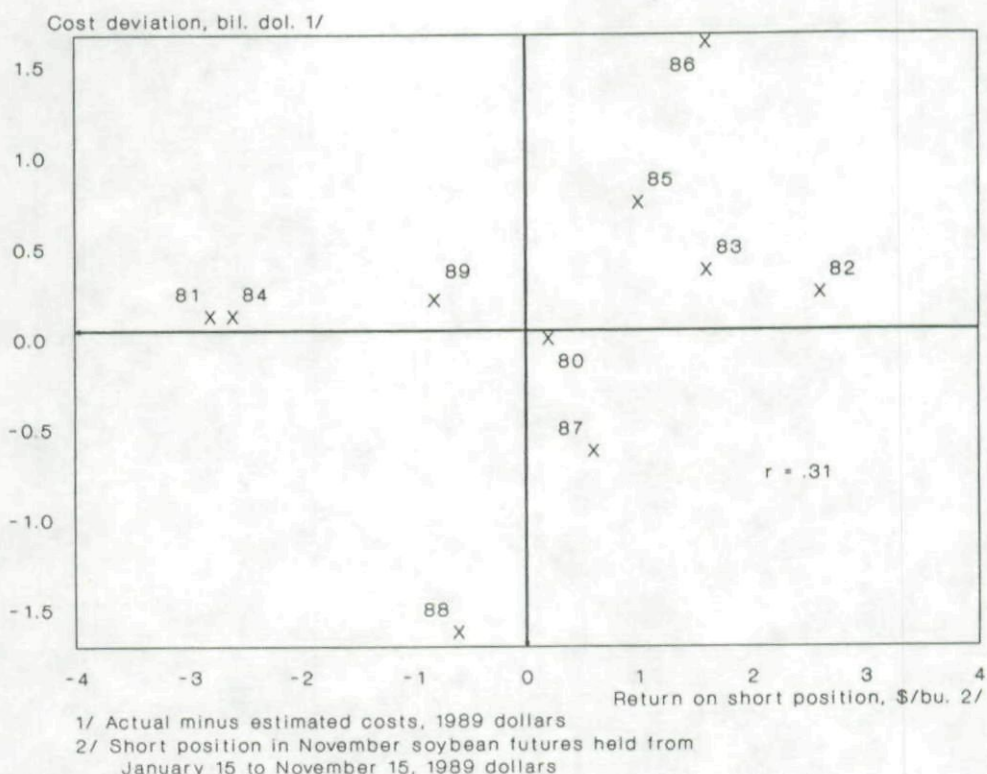


Figure 9

Soybean program cost deviations related to returns on short positions, fiscal years 1980-1989.

commodities (in past years). The magnitude of the risk premiums required to entice speculators to hold the long side of such large positions is unknown.

Considerable reduction in farm program budgetary uncertainty would be possible with smaller government positions than those indicated above. Nonetheless, the amount of government trading, or subsidized farmer trading, necessary to shift to the marketplace a major portion of price risks borne by the government under current farm programs, is quite large.

PROBLEMS WITH GOVERNMENT TRADING

Government trading of futures on the scale needed to effectively shift CCC budgetary uncertainty could pose a number of problems. The government would have dual and perhaps competing roles under such a scheme. Program administrators might be tempted to tinker with farm program provisions to enhance the value of the government's futures positions. Government involvement in futures and options markets might lead to questions about the integrity of government reports which are important sources of information about these markets. Government trades could constitute a major proportion of the trades during many time intervals. The efforts of private traders would be diverted from anticipating other demand and supply changes to anticipating government actions.

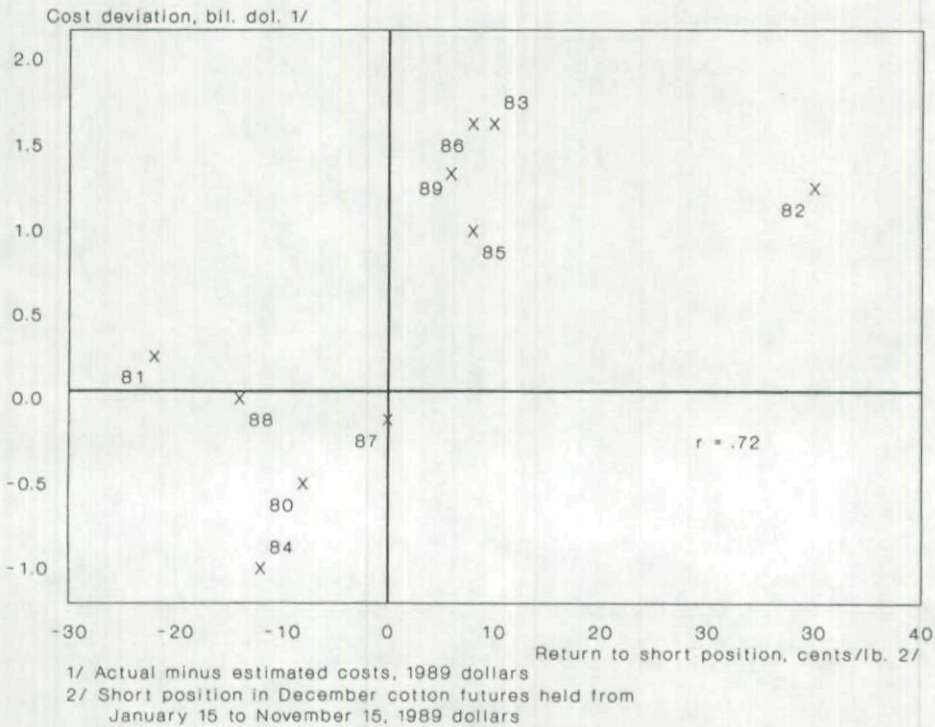


Figure 10

Cotton program cost deviations related to returns on short positions, fiscal years 1980–1989.

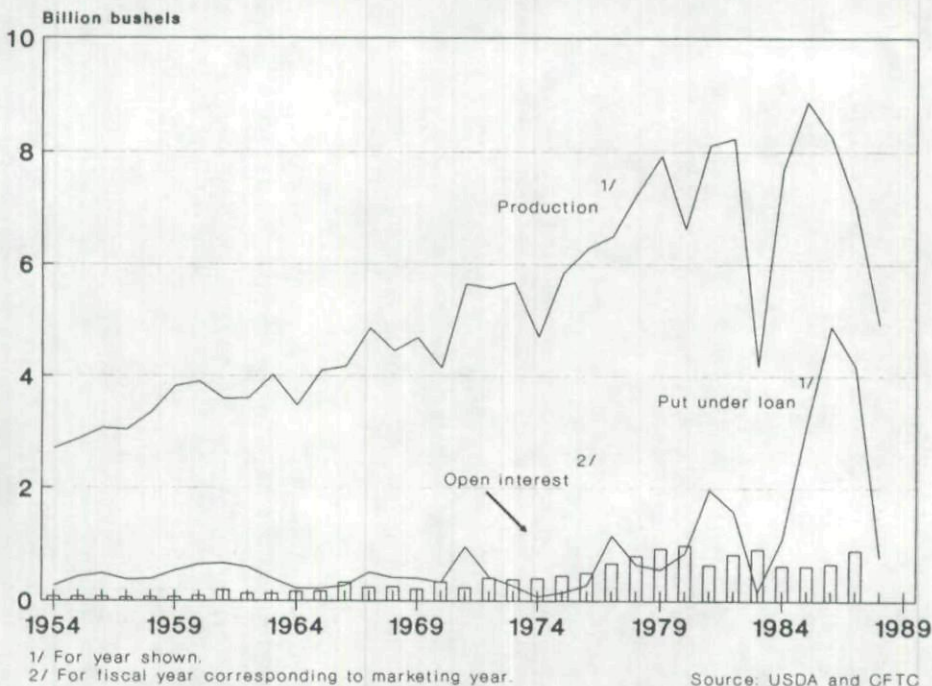


Figure 11

Corn production, put under loan, and in open futures positions.

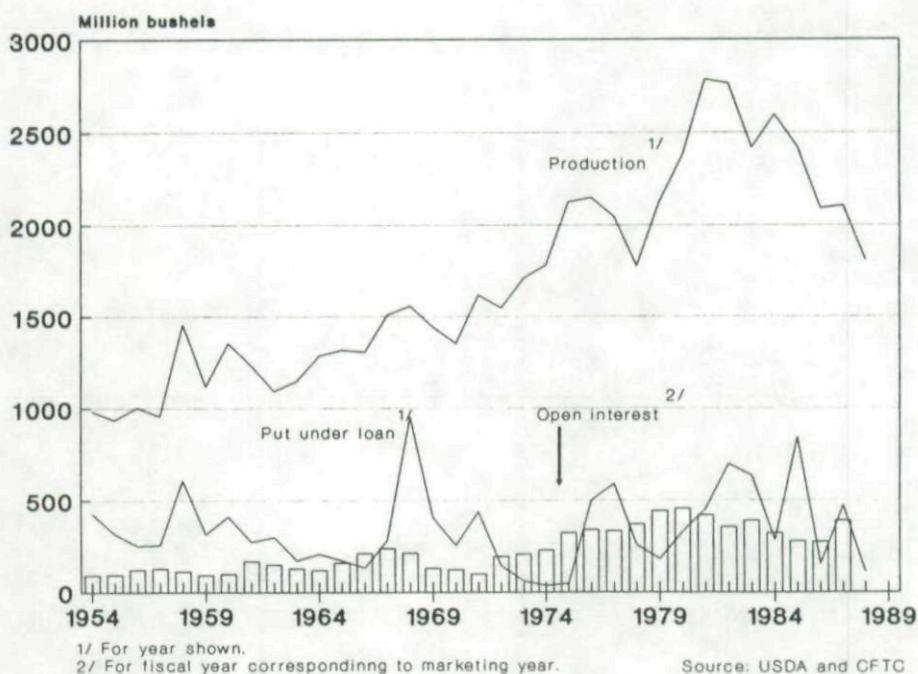


Figure 12
Wheat production, put under loan, and in open futures positions.

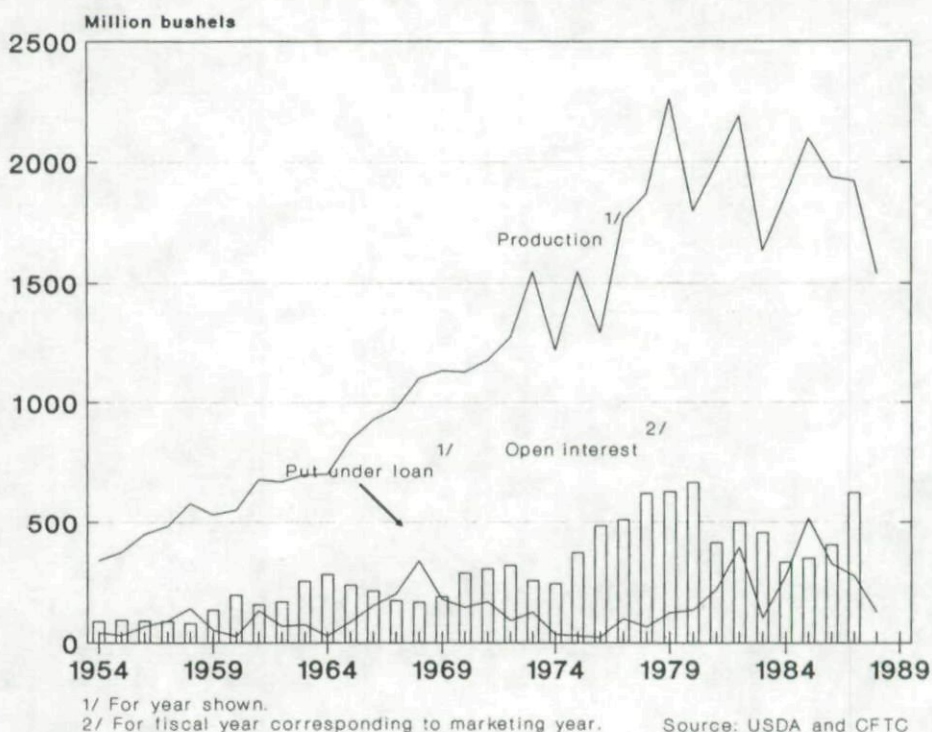


Figure 13
Soybean production, put under loan, and in open futures positions.

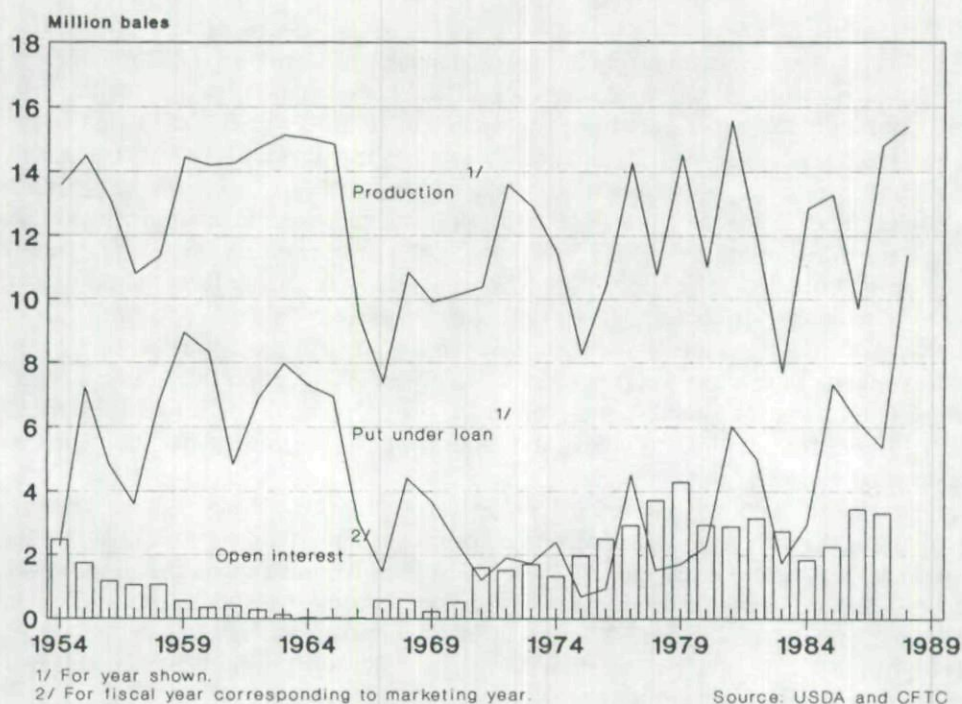


Figure 14
Cotton production, put under loan, and in open futures positions.

Table II
REGRESSION OF ACTUAL MINUS EXPECTED PROGRAM COST ON RETURN
FROM HOLDING A SHORT FUTURES POSITION FROM JANUARY 15
TO DATE INDICATED (1980-1989)^a

Commodity	Ending Date	Constant (in \$ Billion)	Regression Coefficient (in Billions of Bushels)	R ²
Corn	Dec. 15	1.726	5.795 (1.849)	0.55
Wheat	Dec. 15	0.458	1.234 (0.491)	0.44
Cotton	Nov. 15	0.538	0.0453 ^b (0.0153)	0.52
Soybeans	Nov. 15	0.078	0.126 (0.176)	0.06

^aDependent variables are in billions of dollars, independent variables are in dollars per bushel for the grains and soybeans, and cents per pound for cotton. All data are in 1989 dollars. Standard errors are shown in parentheses.

^bUnits are 100 billion lbs. This equals 9.4 million bales.

CONCLUSIONS

The correlations between errors in budget estimates of farm program costs and corresponding futures price movements suggest that a substantial portion of the risks now borne by the government in guaranteeing farm prices could be shifted to private traders. This risk shifting might be accomplished directly through government hedging or indirectly by switching from current types of farm programs to programs that subsidize farmer hedging. The first approach calls for the government to hold large short futures or put option positions from before planting time until much of the crop is utilized. The second approach involves subsidizing farmers' holding of short positions over corresponding time intervals. More than a doubling of private holding of long open positions might be required to take the opposite sides of the government's or farmers' short positions. Because the impact on the futures and options markets could be substantial, any such program should be introduced gradually to give traders time to adjust and determine if government trading generates undesirable effects.

Even large proportional reductions in farm program budgetary uncertainties would have small proportional effects on overall federal budgetary uncertainty, because farm program costs are less than 3% of total federal expenditures. However, more accurate budget estimates could facilitate improved resource use within the Department of Agriculture. The potential for shifting farm program budgetary risks in the future may be less than during the 1980–1989 period examined if loan rates and target prices are lower relative to market clearing prices.

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