Farm Level Effects of Counter-Cyclical Payments

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ABSTRACT

The paper analyzes the role of counter-cyclical (CC) payments in stabilizing farm incomes and investigates whether the payments could affect farmers' planting decisions. Our analysis, based on representative farmer approach, finds that CC payments provide a relatively modest enhancement to farm welfare. However, much depends on market price conditions, which change from year to year, and on base acreage (which is determined by planting history). We find little interaction between revenue insurance and CC payments.

Key Words: Counter-Cyclical Payments, Farm Policy, Risk Management, Crop Insurance, Base Acres.

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Shiva S. Makki, Agapi Somwaru, and Demcey Johnson

This paper analyzes the role of counter-cyclical (CC) payments in stabilizing farmers' income and reinforcing their safety net. Farming is often characterized as a risky business, with cyclical price swings that destabilize farm incomes. Factors that contribute to the unstable nature of agricultural markets include extreme weather conditions, production variability, and changing demand in domestic and foreign markets. To mitigate the potential negative effects on farm income of the cyclical swings in farm prices, Congress enacted a Counter Cyclical (CC) payment program in the Farm Security and Rural Investment Act of 2002. CC payments were offered as a formal replacement for the *ad hoc* market loss assistance (MLA) payments given to producers in the late 1990s.

While previous studies have analyzed the economic effects of loan deficiency payments and direct payments, few studies have analyzed the impacts of the CC payments. To date, most studies of CC payments have analyzed effects at a sectoral or national level (Westcott, Young, and Price, 2002; Anton, 2002; OECD 2003). This study attempts to fill a gap by analyzing the effects of CC payments on farm-level income variability, as well as crop choice and acreage allocation. Specific objectives of this paper include: (i) review the CC payment rules and mechanisms specified in the 2002 farm bill; (ii) analyze the wealth and insurance effects of CC payments; (iii) assess the interaction between CC payments and crop insurance in stabilizing and smoothing yearly variability of farm income; and (iv) analyze the possible effects of counter-cyclical payments on crop choice and acreage decisions of farmers.

Counter-Cyclical Payments

CC payments are made when the higher of the U.S. loan rate or the U.S. season average price for the marketing year, plus the direct payment rate, is below the target price for a commodity. Payments are based on historical area and yields and are not tied to current production of the covered commodity. However, because CC payments are linked to market prices, it is possible that the payments may influence production choices. This might occur through an 'insurance effect,' by reducing the variability of net revenues associated with production of program crops. CC payments may also augment incentives for farmers to build base acres in anticipation of program benefits under future farm legislation. The long-run effects of a program like CC payments are largely unknown.

The 2002 Farm Bill contains three different types of income support programs for farmers – direct payments, CC payments, and loan deficiency payments. The direct payment rates are fixed for the years 2002 through 2007. The CC payments, on the other hand, are determined by the average market price during the year. Loan deficiency payments are determined by both market price and production.

The Farm Bill establishes a direct payment rate, loan rate, and a target price for each of the covered crops (Table 1). A typical farm's CC payment is equal to the product of the national CC payment rate, farm's program yield, and 85% of its base acres. The CC payment rates at the national level are obtained by subtracting the direct payment rate plus higher of loan rate or market price from the target price.

Westcott, Young, and Price (2002) provided the first economic assessment of CC payments. They used the Farm Agricultural Policy Simulation (FAPSIM) model to assess the

impacts of the farm act on markets for program commodities and livestock. Two major

conclusions of their study were: (i) CC payments do not affect marginal revenues and, therefore,

their effects on production decisions are limited; and (ii) revenue risk reduction effects of CC

payments may affect supply response through potential reduction in revenue risk associated with

commodity price volatility. Recent work by Anton, et al. (2002, 2003) provides an assessment of

CC payments using the Policy Evaluation Matrix (PEM) model. PEM is a partial equilibrium

model that is designed to analyze the effects of agricultural policy changes of major OECD

countries. Anton et al. (2002) argue that CC payments have a risk reduction effect that can

increase optimal production levels for major program crops. They perform sensitivity analysis

with their model, showing that the effects of CC payments can vary significantly with base acres

planted, the level of expected market prices, and the risk preferences of farmers. Both FAPSIM

and PEM are aggregate models and, therefore, offer limited insights into the effects of CC

payments at the farm level.

Anton and Le Mouel (2003), incorporating farmers' risk-averse behavior into their

deterministic model, find that the risk effects of CC payments are smaller than those of loan

deficiency payments. Production incentives due to CC payments are smaller when production is

large relative to the base production. Finally, they find that when farmers are risk averse, the CC

payments program can encourage production through risk-reduction effects.

Zulauf (2002) argues that CC payments can increase variability of farmers' returns when

a national drought emerges after planting and the price expected at harvest is less than the target

price minus the fixed payment rate. In this situation, the CC payment breaks the natural hedge or

negative correlation that prevails between yield and price, within a certain price range. [1] Without

CC payments, effects of lower yields are partially offset by higher prices. With CC payments, on

the other hand, higher prices associated with lower (aggregate) yields cause CC payments to

decline. Thus, net return per bushel does not increase as yield declines since the higher price is

offset by lower CC payments. In short, farmers' revenue is more exposed to downside income

risk due to lower yields when CC payments are expected at planting than when CC payments are

not expected at planting. By breaking the natural hedge, current U.S. farm policy might cause an

increase in income variability that would not exist in the absence of CC payments.

Hauser, Sherrick, and Schnitkey (2003) argue that the risk reducing effects of CC

payments differ from that of crop insurance. CC target prices for major field crops are expected

to remain the same for cropping years 2004 through 2007. Thus, the CC payment program can

provide risk protection to producers from changing prices across crop years. In contrast, crop

insurance provides only intra-year risk protection because many crop insurance features are re-set

each year depending on the level of market price in a given crop year.

The Representative Farmer

The model used in this analysis is developed from the perspective of a representative farmer in

Clay County, Minnesota. The farmer faces cropping and insurance alternatives prior to spring

planting. Available land is fixed and can be planted to corn, spring wheat, or soybeans. Costs of

production ($/acre) are known *a priori*, as are farm program parameters (loan rates, program

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1 Implicitly, this argument assumes that base acres are planted to the same program crops.

acres, direct payments) and the terms of crop insurance programs. The farmer is assumed to be

risk averse, with a utility function characterized by constant relative risk aversion:

(1) $U = \{1/(1-r)\}W^{(1-r)}$

where r is the coefficient of relative risk aversion and W is wealth. The certainty equivalent

ending wealth (W^{CE}) is obtained by subtracting the risk premium from ending wealth (W^T):

(2) $W^{CE} = W^T - \{r/(2W^T)\}\sigma^T$

where σ^T is the variance of ending wealth.

Sources of uncertainty include harvested yields, local market prices, national average

prices (used to determine CC payments), and harvest-period futures prices (used to determine

payoffs under CRC revenue insurance). The farm level data on costs of production, rental value

of land, and harvested yields are obtained from crop budgets prepared by the North Dakota State

University Extension Service for the cropping year 2002-03. Historical data on county, state, and

national level prices and yields are from NASS, while farm program parameters and terms of

crop insurance are from various USDA publications. Data on futures prices are obtained from

Chicago Board of Trade. Historical data on prices and yields used in the study are for the 1980-

2002 period.

The representative farmer has 1200 acres (Table 2). Base acres are assumed to be 600

acres under wheat, 300 acres under corn, and 300 under soybeans. Program yields are 38.90

bushels per acre for wheat, 103.70 bushels for corn, and 32.39 bushels per acre for soybeans.

The farmer has a risk aversion coefficient of 2.0, and initial net worth of $250,000. Farmers can

also purchase either federally subsidized revenue insurance or yield insurance to guard against

shortfalls in revenue or yield. Crop Revenue Coverage (CRC) and Average Production History

(APH) are the most popular revenue and yield insurance products purchased by farmers (Makki and Somwaru, 2002). Both insurance products are available at various coverage levels, from 50% to 85%. For most part of the analysis we assume that the farmer purchases 70% coverage, as this is the most common level of coverage purchased by farmers in the region.

The Simulation Model

We use our model to simulate the farm-level impacts of CC payments. For the simulation, we estimated regression models for harvested yields and harvest-period prices and developed the representative farmer's price and yield distributions and their correlations. Harvested yields were fitted to a time trend, while harvest-period prices were regressed on planting-period futures. Residuals from the regression models were used to characterize the distribution of random variables in the simulation. All prices and yields are assumed to be normally distributed,[2] with means derived from regression forecasts and standard deviations equal to regression standard errors. The simulated random variables also have a correlation structure derived from regression residuals.

The objective is to evaluate the impact of CC payments (along with other 2002 Farm Bill features, Table 1) and crop insurance on farmer's welfare. We measure the wealth effects of the CC payments reflected in terms of changes in the level and stability of farm revenues, as well as changes in cropping decisions. Specifically, we compute the certainty equivalent (CE) of wealth and its coefficient of variation (CV) under various policy alternatives and crop insurance options.

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2 There seems to be no consensus in the literature regarding skewness of yield distributions, but some of the recent literature supports the robustness of normality assumption. Just and Weninger (1999), for example, fail to reject normality tests for yield distribution of Kansas farm-level wheat, corn, and sorghum yield data. In another study, Just et al. (1999) assume a normal distribution for corn yield histories.

Each realization of random variables (prices and yields) in the simulation generates market revenue, program payments, total income, risk premium, and CE income. Expected utility is found by averaging across 10,000 realizations. By comparing the certainty equivalent of ending wealth—under different assumptions about programs, acreage allocations, and market conditions—we can gauge the relative significance of CC payments for farmer's welfare. We also assess the risk reduction effects of CC payments, as well as their interaction with crop insurance.

Wealth and Insurance Effects of CC Payments

Figure 1 shows the wealth and insurance effects of different policies. With acreages fixed (and matching the program acres), the 2002 Farm Bill has a relatively modest impact on the certainty equivalent of wealth. CC payments contribute measurably to farmer welfare (measured by the certainty equivalent) while reducing risk exposure (measured by the coefficient of variation). Interestingly, crop revenue insurance coverage (CRC) provides no net welfare benefit, given the price protection afforded by marketing loans and CC payments—although it does reduce risk.

Figure 2 compares the wealth and insurance effects of policies under different market conditions (price levels). We chose years 2002, 2003, and 2004 as representative of different price conditions, with 2002 a comparatively low-price year and 2004 a high-price year (see Table 2). The simulation results confirm that the CC payments have a greater welfare effect when prices are low, as in 2002. As expected, the figure also shows that risk is higher in the high-price year, thanks to stabilizing effects of marketing loans and CCP when prices are low (Figure 2).

Interaction between CC Payments and Crop Insurance

Figure 3 compares the CE of wealth under alternative coverage levels of revenue and yield insurance products, with and without CC payments. One would expect the CE of wealth to remain the same (higher coverage entails higher risk premium) across different levels of coverage. This holds for both revenue and yield insurance products, except at high coverage levels of revenue insurance (more than 75%). For those purchasing revenue insurance (e.g. CRC), the CE of wealth increases slightly at 80 and 85 percent coverage levels. Changes are less pronounced for high levels of APH coverage. The vertical distance between lines in Figure 3 (for both CRC and APH coverage) is nearly constant, indicating that the contribution of CC payments to farmer welfare is not affected by the choice of coverage level.

The value of insurance coverage to a producer depends on the presence or absence of other risk-reducing programs. Revenue insurance, in particular, can be made redundant by the availability of CC payments and marketing loans. This is borne out by the welfare comparisons in Figure 1. In the upper panel, the difference between bars 3 and 4 indicates the marginal contribution of CRC when the farmer has access to marketing loans. The difference between bars 5 and 6 indicates the contribution of CRC when the farmer has both marketing loans and CC payments. The second difference is slightly higher, indicating that CC payments substitute for some of the risk-reducing effects of CRC. In other words, CRC is made largely redundant by the availability of CC payments.

It should be noted that CC and crop insurance payments are triggered differently; hence they are not exact substitutes. Crop insurance offers intra-year insurance where the payments are based on the contract price, which is reset every year. CC payments, on the other hand, offer

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inter-year risk protection, where the payments depend on the loan rate and target prices, which change little from year to year (see Hauser, Sherrick, and Schnitkey, 2003). Results from our simulations also reflect specific modeling assumptions, including the alignment of base and planted acres, and expected prices.

Welfare Effects of CC Payments for Different Combinations of Planted and Base Acres

In the above simulations, planted and base acres for corn, soybeans, and spring wheat were held constant. This ignores the potential influence of CC payments on planting decisions. As noted above, it is plausible that CC payments could influence planting decisions in two ways: (1) through an insurance effect, to the extent that payments help to stabilize revenues for a covered crop; and (2) because of base-building incentives. Farmers may expect there will be future opportunities to update their base acres, as was allowed under the 2002 Farm Bill. If that is the case, farmers may seek to increase acreage in crops that offer the prospect of higher payments (including both direct and CC payments) under future farm legislation.

To illustrate the relative importance of these two factors, we calculate the marginal contribution of CC payments to farmer welfare ($ thousands) under different combinations of planted and base acres (Figure 4). In Panel 4-A, total acres are divided between corn and soybeans. Planted acres are shown along the horizontal scale, and base acres are shown along the vertical. The lower left corner corresponds to complete specialization in soybeans (both planted and base acres), while the upper right corner corresponds to complete specialization in corn. The marginal contribution of CC payments is highest when all of base acreage is corn. The level curves are nearly horizontal, suggesting that CC payments do not exert a strong influence on

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current planting decisions.

Panel 4-B is similar, but here we assume (lower) 2002 prices. In this case, the marginal contribution of CC payments is substantially higher—ranging above $20 thousand for our representative farm. However, the level curves are again nearly horizontal. Different combinations of planted acres have relatively little effect on the value of CC payments: the allocation of base acres is vastly more important.

The remaining panels involve different comparisons. In Panels 4-C and 4-D, acreage is divided entirely between corn and wheat. In Panels 4-E and 4-F, it is divided entirely between wheat and soybeans. Results differ somewhat by year—most notably for wheat and soybeans. Under 2004 market conditions (Panel, 4-E), the marginal contribution of CC payments is more dependent on planted acres than base acres. In this instance, the insurance effect of CC payments appears to dominate any incentive associated with (potential) future base building.

Summary and Implications

This paper analyzes the role of counter-cyclical payments in stabilizing and raising farm incomes, and compares their contribution to that of other programs. Our analysis finds that for a representative farmer in Clay County Minnesota, CC payments provide a relatively modest enhancement to farm welfare. However, much depends on market price conditions, which change from year to year, and on base acreage (which is determined by planting history). CC payments can help maintain farm incomes during low market prices. We find little evidence of interaction between revenue insurance products and CC payments.

While past studies have argued that CC payment do not have a significant impact on

cropping decisions in the context of a one-year planning horizon, it is important to consider

whether there are longer-term effects. In particular, to what extent does CC payments provide

incentives to build base acres in particular crops—i.e., those with favorable target prices? The

2002 Farm Bill allowed farmers to revise their base acres, and this may create the expectation

that similar opportunities will be provided under future farm legislation. Our analysis of a

representative farmer suggests that CC payment terms are generally more favorable for corn than

for wheat or soybeans. Combined with differences in direct payments across crops, this may

induce some shift of acres into corn by producers who expect a continuation of current

differentials under future farm programs.

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Figure 1 – Wealth and Insurance Effects of 2002 Farm Act: Comparisons of welfare and risk under different policy assumptions
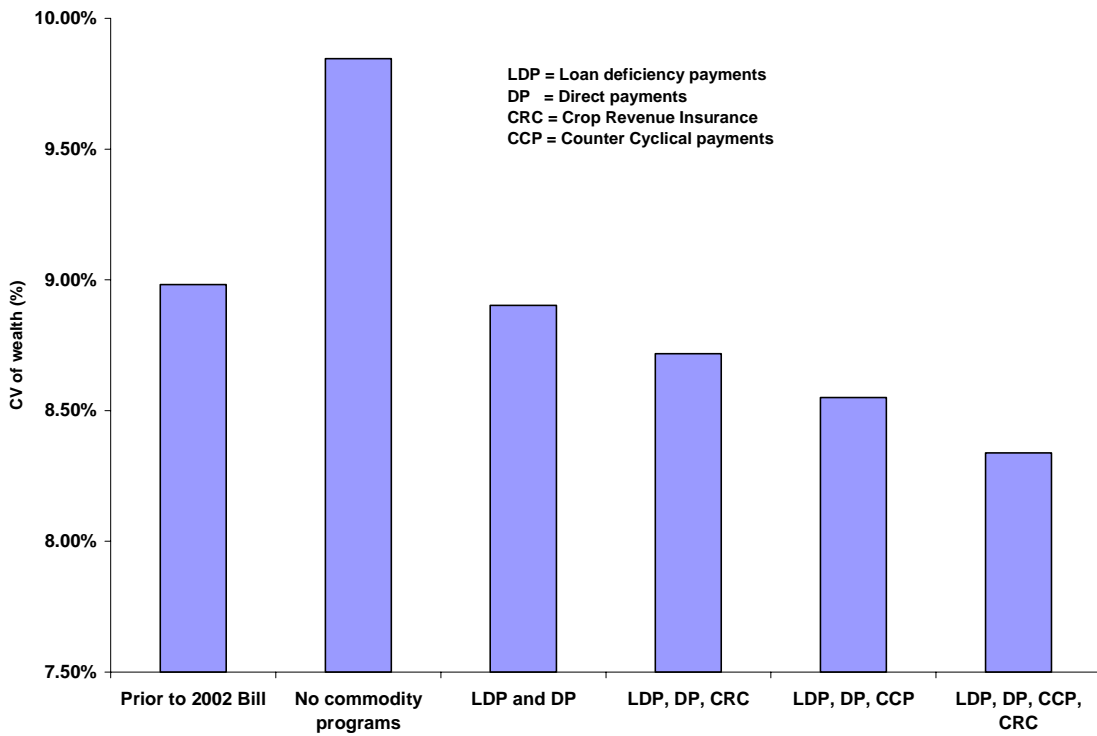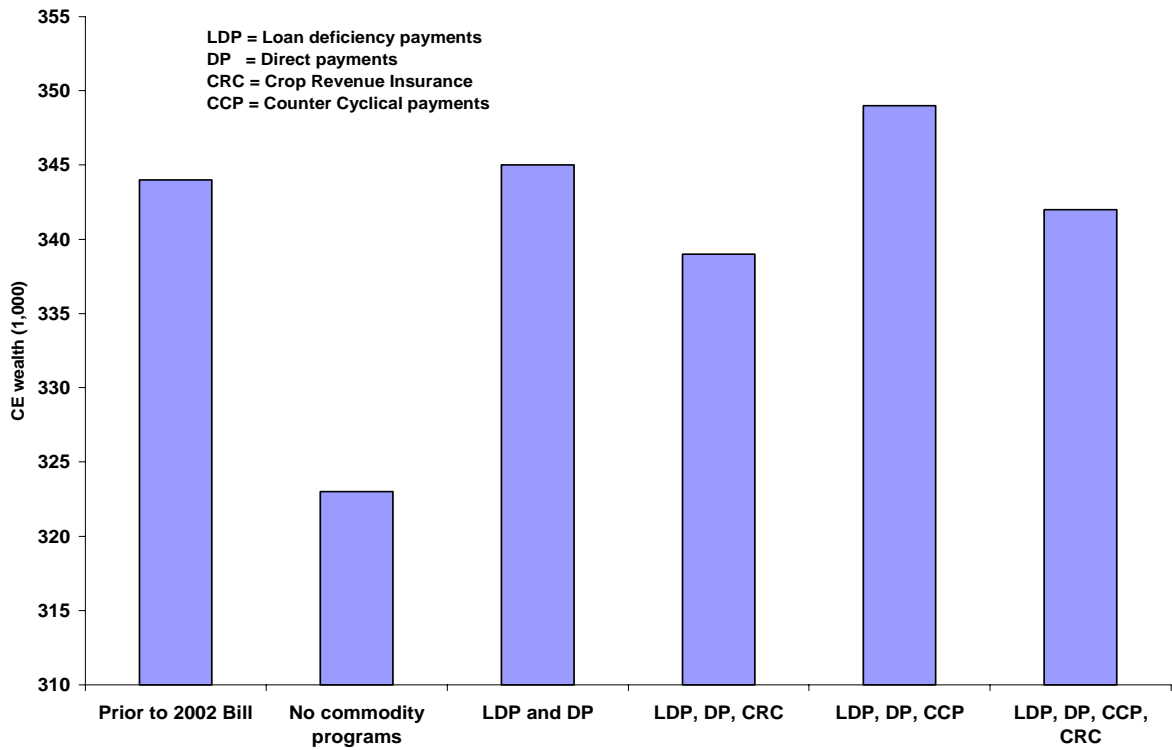
Figure 2 – Wealth and Insurance Effects of 2002 Farm Bill: Different Price Conditions
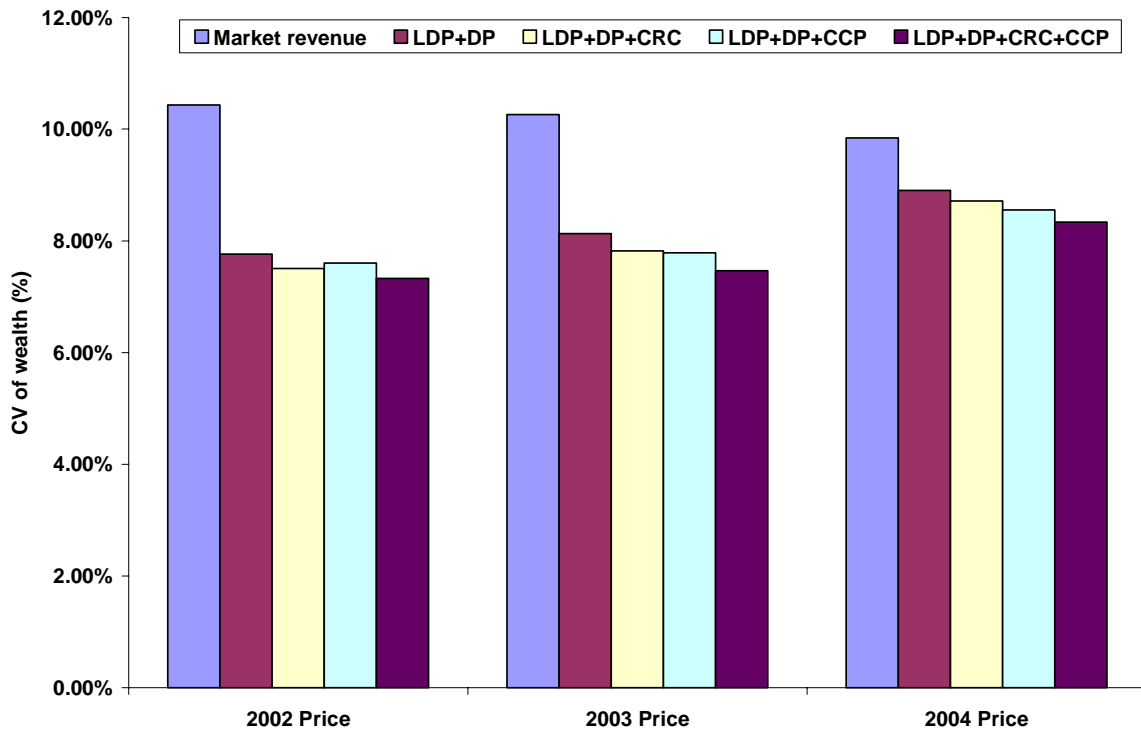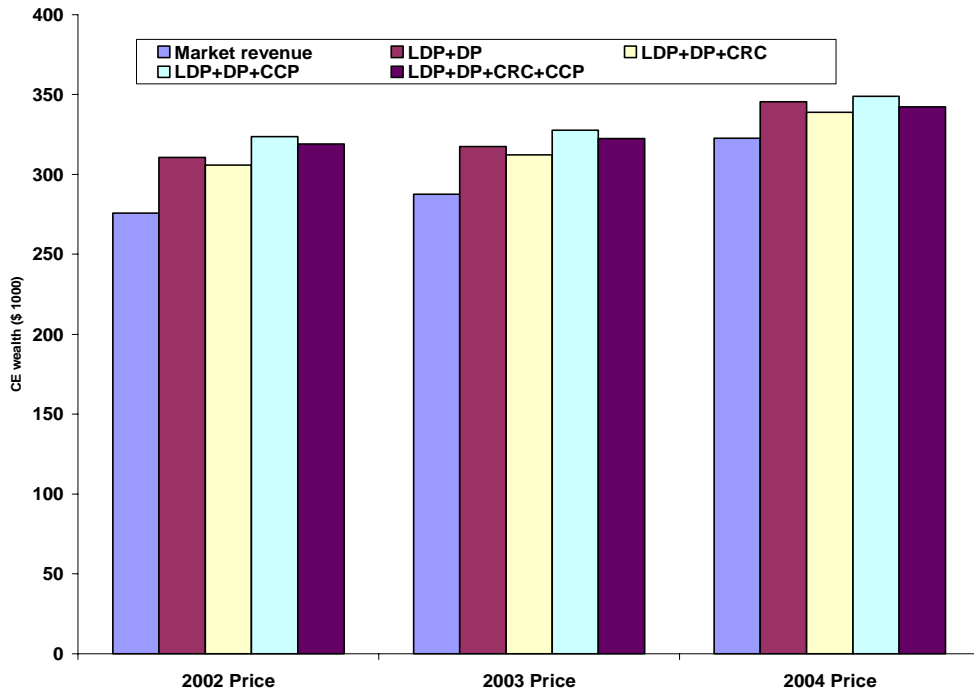
Figure 3 – Interaction between CC Payments and Crop Insurance: Certainty Equivalent Income Under alternative coverage levels of Revenue and Yield Insurance Products

Revenue Insurance

with CCP

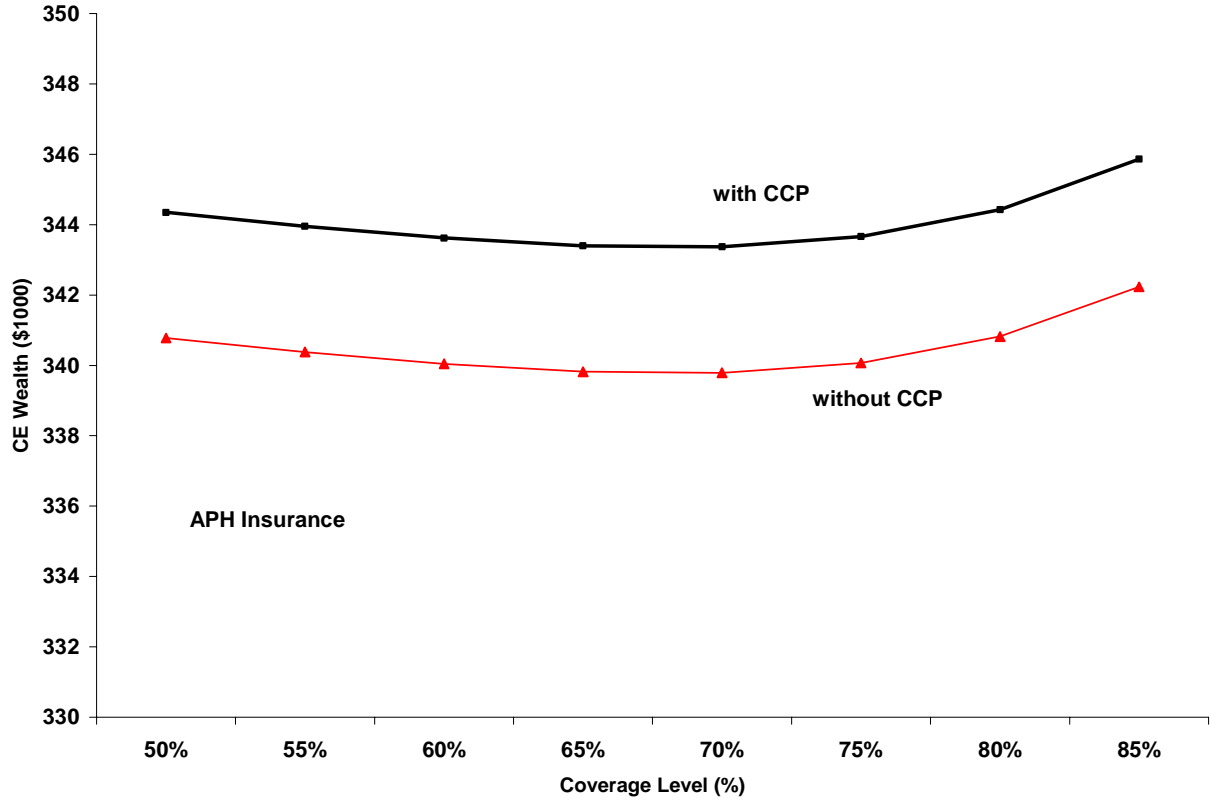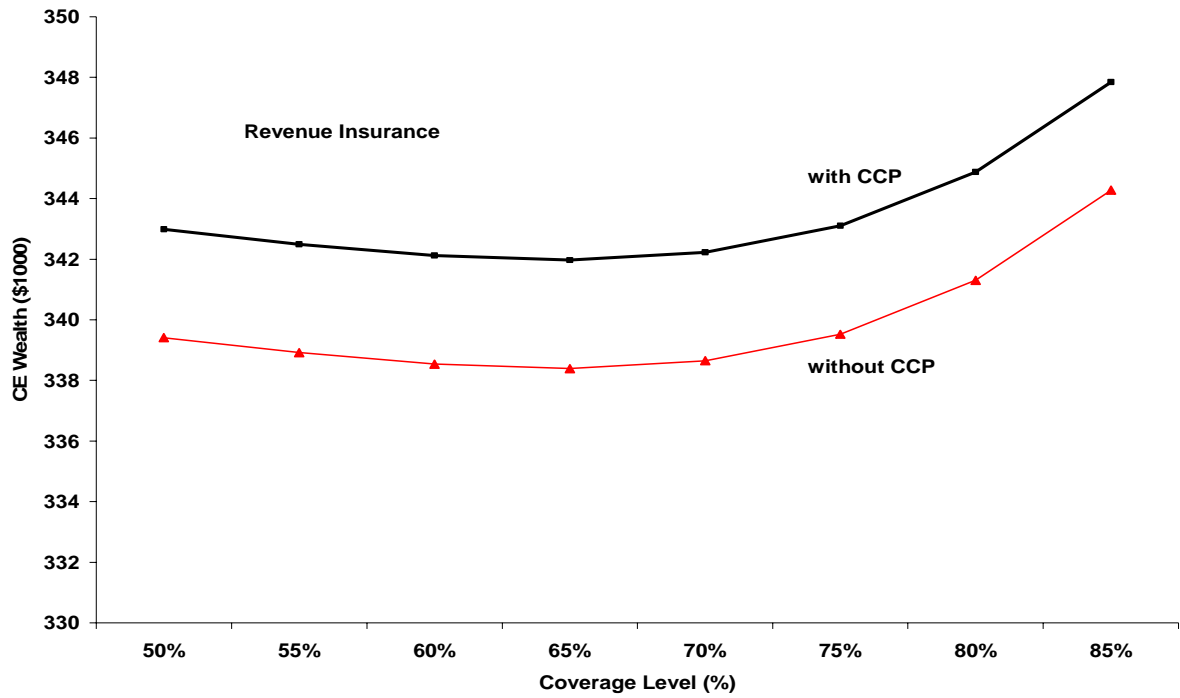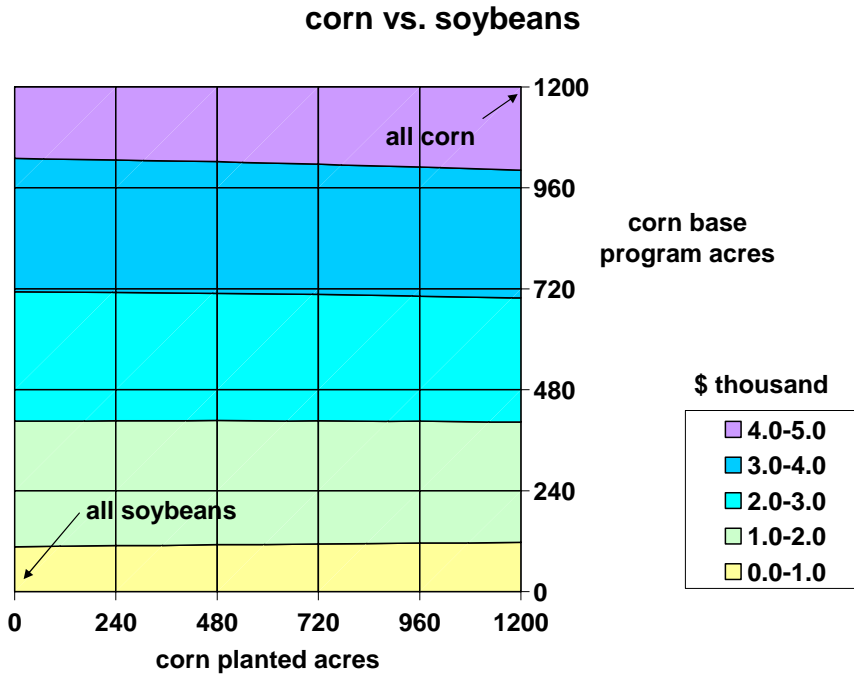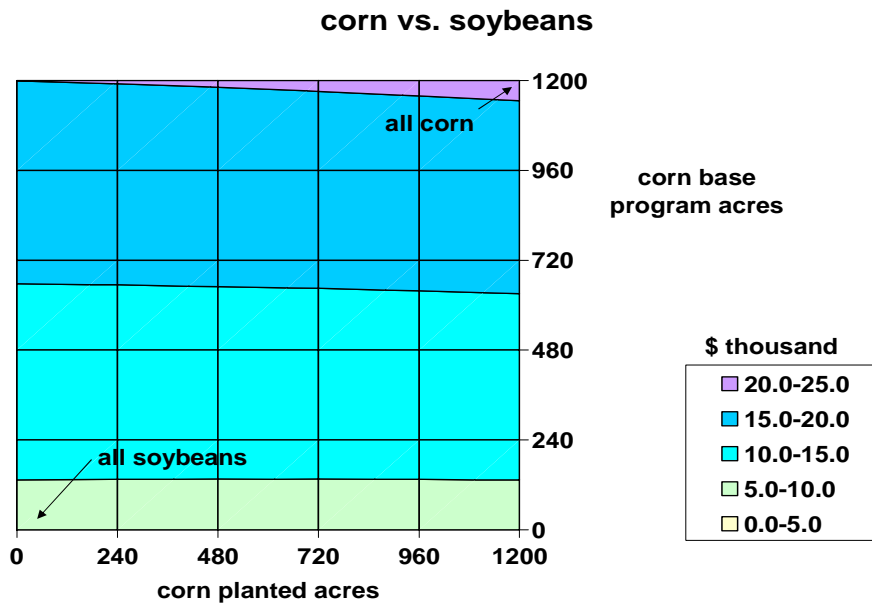without CCP

with CCP

without CCP

APH Insurance

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Figure 4 — Marginal contribution of CCP for different combinations of planted and base acres

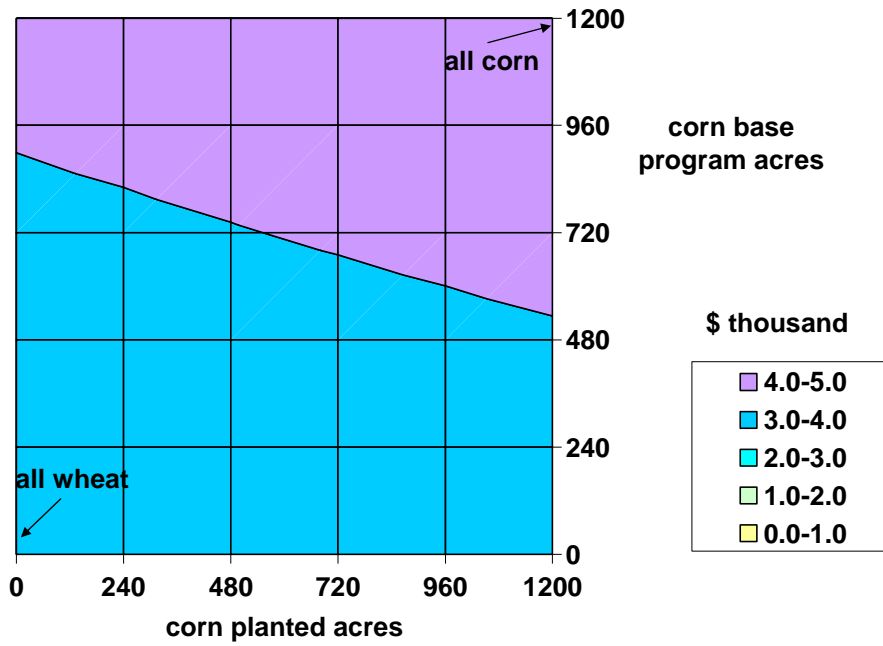**Panel 4-A: Dividing acres between corn and soybeans, 2004 price conditions**

corn vs. soybeans

Panel 4-B: Dividing acres between corn and soybeans, 2002 price conditions
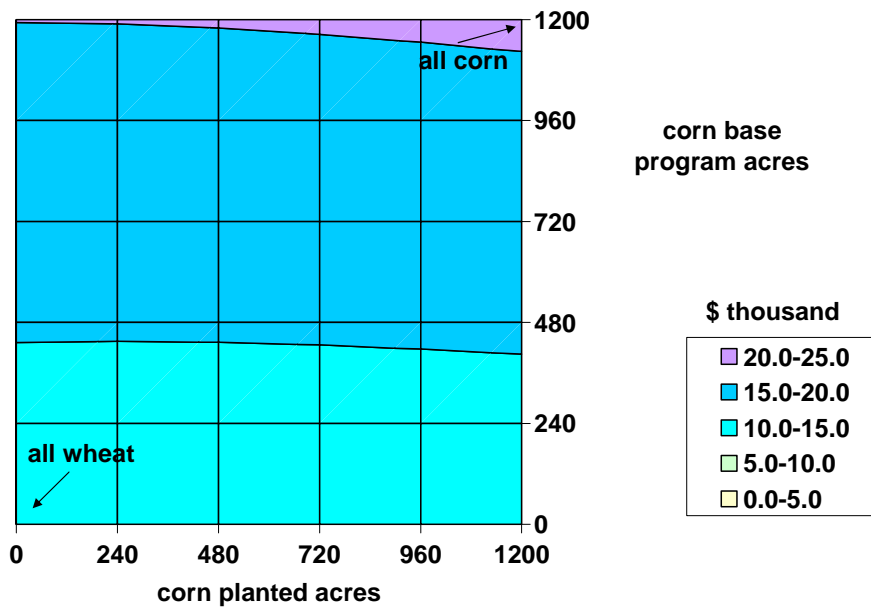
corn vs. soybeans

Panel 4-C: Dividing acres between corn and wheat, 2004 price conditions

corn vs. wheat

Panel 4-D: Dividing acres between corn and wheat, 2002 price conditions.

corn vs. wheat

Panel 4-E: Dividing acres between soybeans and wheat, 2004 price conditions

soybeans vs. wheat

soybean base
program acres

all soybeans

all wheat

$ thousand

- 3.0-4.0
- 2.0-3.0
- 1.0-2.0
- 0.0-1.0

soybean planted acres
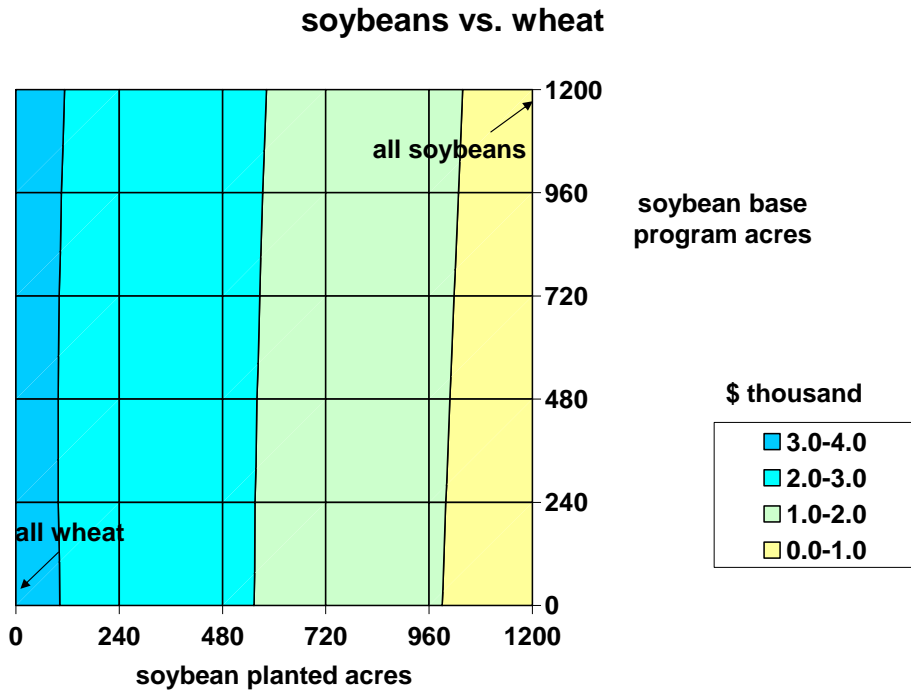
Panel 4-F: Dividing acres between soybeans and wheat, 2002 prices conditions

soybeans vs. wheat

soybean base
program acres

all soybeans

all wheat

$ thousand

- 10.0-15.0
- 5.0-10.0
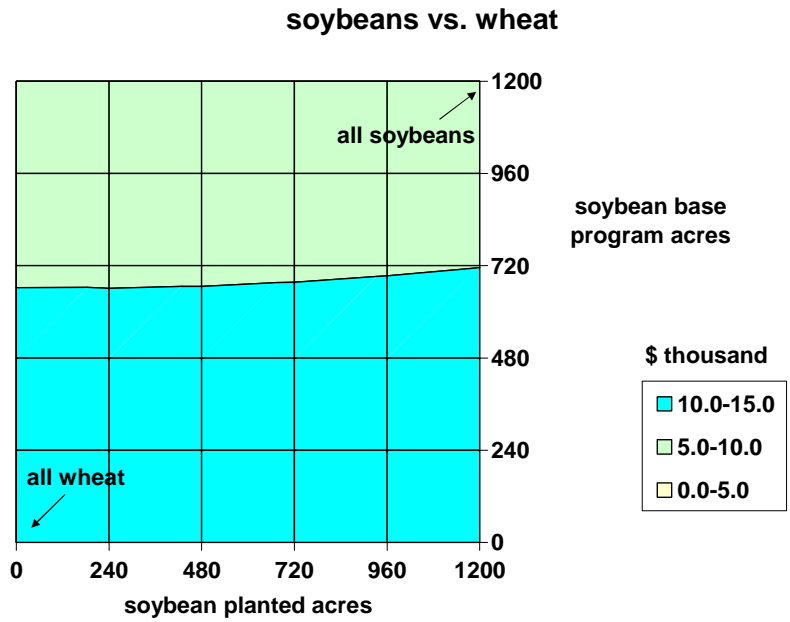- 0.0-5.0

soybean planted acres

Table 1 – The 2002 Farm Act: Direct Payment Rate, Loan Rate, and Target Prices

Commodity	Unit	Direct Payment Rate	Loan Rate		Target Prices	
		2002-07	2002-04	2005-07	2002-03	2004-07
Corn	$/Bu	0.28	1.98	1.95	2.60	2.63
Soybeans	$/Bu	0.44	5.00	5.00	5.80	5.80
Wheat	$/Bu	0.52	2.80	2.75	3.86	3.92
Grain Sorghum	$/Bu	0.35	1.98	1.95	2.54	2.57
Barley	$/Bu	0.24	1.88	1.85	2.21	2.24
Oats	$/Bu	0.02	1.35	1.33	1.40	1.44
Rice	$/Cwt	2.35	6.50	6.50	10.50	10.50
Upland Cotton	$/Lb	0.07	0.52	0.52	0.72	0.72
Other Oilseeds	$/lb				0.098	0.101
Peanuts	$/Ton				495	495

Source: 2002 Farm Bill and USDA.

Table 2 – Simulation Model Parameters

Location	Clay County, Minnesota		
Farm Size	1200 Acres		
Initial Wealth	$250,000		
Risk Coefficient	2.00		
Crop Insurance Choices:			
Yield Insurance	APH		
Revenue Insurance	CRC		
Crops Choices		<u>Corn</u>	<u>Soybeans</u>	<u>Wheat</u>
Costs of Production:				
Variable Cost ($)		125	62	60
Land Cost/Rent ($)		60	60	60
Program Yield (bu/ac)		103.70	32.39	38.90
Program/Base Acres		300	300	600
State Cash Price:				
2002 ($)		1.99	4.74	3.09
2003 ($)		2.09	5.20	3.24
2004 ($)		2.44	6.35	3.69
National Cash Price:				
2002 ($)		2.09	4.77	2.99
2003 ($)		2.20	5.28	3.13
2004 ($)		2.61	6.53	3.60
Harvest Futures Price:				
2002 ($)		2.17	4.79	3.18
2003 ($)		2.28	5.25	3.35
2004 ($)		2.74	6.73	3.99

Source: North Dakota State University Extension Service Newsletter, National Agricultural Statistics Service, and Chicago Board of Trade.   State cash price, national cash price, and harvest future price are forecasts conditional on information available at planting.