AN ECONOMIC IMPACT ANALYSIS OF THE 2014 FARM BILL ON THE U.S. CROP SECTOR*

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Keywords
2014 Farm Bill, crop sector, Expected net returns, welfare, budget deficit reduction

Abstract
This study establishes a U.S. crop model containing 14 commodities to analyze economic impacts of changes in the 2014 Farm Bill. The forecasting results under the alternative scenario are in line with theoretical expectations. The 2014 Farm Bill is forecasted to decrease expected net returns (ENRs) for producers. The expected changes are in favor of consumers at the cost of producer surplus. Without substantially affecting producers' planting decision, the 2014 Farm Bill is forecasted to contribute to the Federal budget deficit reduction.

* This paper is based on the author's dissertation study.

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I. Introduction

Among recent issues of importance are the impacts of changing farm price and income supports in the 2014 Farm Bill. Since 2000, the U.S. federal budget deficits increased to reach $1.3 trillion in 2011 (OMB). Based on past experience, this undesirable situation is likely to increase pressures to reduce supports/subsidies for U.S. agriculture (Young and Westcott, 1996; Arha et al, 2006; Normile et al, 2004). Given a strong dependence of the sector on price and income payments, taking subsidies away may have massive impacts which could lead to agricultural changes.[1] This reduced revenue may increase difficulties with debt repayment and replacement of machinery for agricultural producers. Moreover, the impacts of support payment cuts are likely to be uneven across regions and crops.[2]

The policy shifter discussed above will affect the U.S. farm economy in several ways. The objective of this study is to analyze the economic impacts of changes in the agricultural supports reduction due to federal budget deficits. Also, this study attempts to measure producer and consumer surplus.

II. Literature Review

A heavy dependence of U.S. agriculture on government payments has caused the sector to be sensitive to farm policy changes. Over the past forty years, a large number of studies were conducted to analyze the impacts of farm bill changes on U.S. agriculture (For example, Houck and Ryan, 1972; Morzuch, Weaver, and Helmberger, 1980; Lee and Helmberger, 1985; White and Shideed, 1991; Chembezi and Womack, 1992; Guyomard *et al*, 1996; Lin *et al*, 2000;

[1] For example, eliminating Direct Payments (DP), $4.7 billion in 2011, will decrease the average revenue per acre by about $17.8 (CBO, 2012; USDA, 2012).

[2] In 2011, total expenditures for cotton and rice Direct Payments (DP) was $950 million or about a half of the DP paid to corn ($1,895 million). However, average payments per acre are much higher for cotton ($43.2/acre) and rice ($137.1/acre) than for corn ($24.2/acre).

Nickerson and Hand, 2009; Ching-Cheng et al, 1992).

Previous farm bills since the mid-1980s tried to reduce U.S. agricultural producers' reliance on the government supports (Normile, Effland, and Young, 2004). The 1990 Farm Bill retained price and income supports, but reduced portions of price subsidies. The 1996 Farm Bill legislation moved toward a more market-orientation by reducing income support measures and expiring supply management program (Young and Westcott, 1996). The policy reforms lead producers to be more market-driven supply responses by reducing market-distorting subsidies and concentrating on farm income stabilization (Johnson, Hanrahan, and Schnepf, 2010). Based on OECD's Producer Support Estimates data, the share of total farm support in gross farm receipts in the U.S. dropped from 24% in 1986 to 7% in 2008. Because U.S. agricultural producers have been encouraged to be more market-oriented, reduced de-coupled payments proposed by the Senate (2012) suggest that a few more of analysis would be a timely contribution to the legislation. As indicated by Johnson and Monke (2010), in the presence of high price volatilities and positive relationships between government supports and farm income, analyzing the magnitude of budget reductions is of importance.

Previous studies support the hypothesis that the issue discussed above affects the U.S. farm economy and structure. However, few researches have analyzed the impacts of the farm support changes in the 2014 Farm Bill. Moreover, because farm bills have continued to reduce farm payments, the effects are likely to differ from those suggested by previous analyses. In this sense, a system analysis incorporating the impacts of policy shifter into a holistic agricultural sector should be conducted.

III. Methodological Discussion

Analyzing impacts of the 2014 Farm Bill on the U.S. agriculture sector can be conducted by computing equilibrium price and quantity under the change(s) and measuring subsequent changes in the farm net gains and planting decision. Assuming that the U.S. livestock sector and macro environments are treated as exogenous, this study will estimate structural supply and demand functions for the U.S. field crops in order to obtain the *status quo* market equilibria. Policy changes will differentially affect price, receipt, and income values. This study's crop model will be a recursive dynamic partial equilibrium model including structural supply and demand equations for the major program crops.[3,4]

3.1. Crop Supply Sector

Estimating the U.S. crop supply begins with equations for regional planted acres and yields. Planted acres are used to estimate harvested acres that are then multiplied by yields to calculate the regional production. Adding a summation of regional production to beginning stocks and imports equals the supply for a specific crop. This study focuses on ten major program crops and uses a geographical division to simplify and enhance effectiveness of the analysis (Table B-1). In each region, a certain crop is considered as major program crop if its average planted acres during 1985-2012 are larger than 5% of total cropland. Data for estimations range from 1985 through 2012. The data are obtained from a variety of source including National Agricultural Statistics Service (NASS) and Economic Research Service (ERS) in the U.S. Department of Agriculture (USDA).[5]

This regional crop mix allows this study to derive inter-crop competition for limited available cropland in each region.[6] When the expected net returns (ENRs, explained in more detail later in this paper) for a certain crop be-

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[3] The term 'major program crops' in this study includes corn, soybeans (SB), wheat, barley, upland cotton, oats, long grain (LG) rice, medium/short grain (MSG) rice, grain sorghum, and peanuts.

[4] Not all specification and estimation results are presented in this paper. More detailed information is available on request.

[5] All the data and relevant sources are available on request.

[6] Corn Belt includes Iowa, Illinois, Indiana, Missouri, and Ohio; Central Plains include Colorado, Kansas, and Nebraska; Delta States include Arkansas, Louisiana, and Mississippi; Far West includes Alaska, California, Hawaii, Idaho, Nevada, Oregon, Utah, Washington, and Arizona; Lake States include Michigan, Minnesota, and Wisconsin; North East includes Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and West Virginia; Northern Plains include Montana, North Dakota, South Dakota, and Wyoming; South East includes Alabama, Florida, Georgia, Kentucky, North Carolina, South Carolina, Tennessee, and Virginia; Southern Plains include New Mexico, Oklahoma and Texas.

comes higher relative to those of other crops in a region, producers will have an incentive to plant more of the crop. Consequently, when other things remain unchanged, planted acres of the crop are likely to increase whereas those of competing crops will reduce. There exists a possibility that this competition between crops might not be perfectly symmetric.

Economic theory suggests that agricultural producers make their decision on planted acres allocation for each crop depending on expected prices or profits. Even if more directly observable, market prices might fail to precisely reflect the main interests of producers (Lee and Chambers, 1986; Key, Sadoulet, and Janvry, 2000). Moreover, the presence of uncertainties influences the allocation of agricultural resources and the subsequent supply response because the prices of commodities can't be realized until they are actually sold (Chavas and Holt, 1990; Hardaker *et al*, 2004). Therefore, this study will use ENRs as the main determinants for their planting decision.

Expected Net Returns (ENRs) may be simply defined as the difference between expected price and expected variable costs. This study will regard the cost components as stochastic and recursive because agricultural producers are exposed to input price variations during planting and harvesting seasons. In this sense, thinking of crop prices and production cost (variable production costs in the short run) as stochastic may make more sense. This property will enable the proposed model to be recursive and dynamic. Also, the government supports should be incorporated into the model through ENRs. Policy tools to be considered during 1985-2012 include Deficiency Payment (Loan Deficiency Payment/Marketing Loan Gains; hereafter LDP/MLG), Direct Payments (DP), and Counter-Cyclical Payment (CCP). Some important policies such as Average Crop Revenue Election (ACRE) and Conservation and Reserve Program (CRP) are not included in the model.

Reflecting each program's eligibility and requirements, the formulation for ENRs can be derived. LDP/MLG is in effect when market price is lower than predetermined Loan Rate (LR). CCP can be paid to eligible producers when the 'effective price' (market price + DP) does not exceed Target Price (TP). Considering the government payments produces a more complete definition of ENRs to be used in this study. The first term is simply equal to the expected per acre market revenue of a certain crop in region k in a given year t. The second term represents the amount of compensation by Loan Rate per unit of crop and per acre. When market price is higher than the pre-announced

Loan Rate level, this term is equal to zero. The third term explains the amount of Direct Payment which has been in effect since 2002. This policy payment is independent of market condition and works to shift ENRs up. The fourth term accounts for CCP which is triggered only if the sum of market price and DP is smaller than TP. If this condition is met, the difference between TP and 'effective price' is multiplied by the predetermined CCP yields and multiplier to obtain the amounts of CCP payments.

$$(1)\ ENRikt = (MPik,t\text{-}1 * YLEikt) + (Max\ (LRit - MPi,t\text{-}1,\ 0) * YLEikt) + (DPRit * DPYit * DPMit) + (Max\ (TPit - DPit) - MPi,t\text{-}1,\ 0) * CCPYit * CCPMit) - VCik,t\text{-}1,$$

where MP = farm price, LR = Loan Rate, DPR = Direct Payment rate, DPY = Direct Payment yield, DPM = Direct Payment multiplier, CCPR = Counter-Cyclical Payment rate, CCPY = Counter-Cyclical Payment yield, CCPM = Counter-Cyclical Payment multiplier, TP = Target Price; VC = variable production costs, and YLE is expected yields.

To allow different crops to compete for the finite croplands in each region, the planted acre equations will include the ENRs. The present study utilizes the ratios of ENRs instead of using ENRs themselves. This attempt is expected to have a pair of advantages; (1) it may enhance the degree of freedom by reducing the number of independent variables; (2) it can contribute to mitigate the problem coming from extraordinarily high prices and thus ENRs in recent years.

When estimating the planted acres, it appears implausible to believe that producers may instantly shift from what they have grown to another crop, which can be accounted for by the concept of partial adjustment. The partial adjustment procedure initially suggested by Nerlove (1956) argues that agricultural producers might not be able to respond instantaneously to market signals in the short run. This study considers adopting the lagged dependent variable as an exogenous variable. Time trend is included to capture the unobservable influences.

$$(2)\ PA_{ikt} = PA(PA_{ik,t-1},\ ENR_{jkt} / ENR_{ikt},\ Time) + \varepsilon_{ikt},\ \forall\ j \neq i,$$

where PA = planted acres, ENR = expected net returns, Time = time trend, ε= error term, and subscripts i, j, k and t represent crop, region, and time.

Once the planted acres function is estimated, harvested acres (HA) can be estimated using the planted acres. Time component for the planted acres on the right-hand side can be either a current year or next year depending on planting schedules. This study assumes that crop yields take an expected form. First, each crop's yield is determined by technology to the extent that advanced technologies encourage producers to increase yields.

(3) $HA_{ikt} = HA(PA_{ikt})+\varepsilon_{ikt}$,

where HA = harvested acres, PA = planted acres, ε= error term, and subscripts i, j, k and t represent crop, region, and time.

(4) $YLE_{ikt}= YLE(Time)+\varepsilon_{ikt}$,

where YLE = expected yields, Time = time trend, ε= error term, and subscripts i, k, and t represent crop, region, and time.

Regional production can be computed by multiplying equations (3) and (4). Total supply for year t equals to the summation of total production, beginning stocks, and imports as shown in equation (6).

(5) $Production_{ikt} = HA_{ikt}*YLE_{ikt}$,

(6) $Supply_{it} = \Sigma\ Production_{ikt} + Beginning\ Stocks_{it} + Imports_{it}$,

3.2. Crop Demand Sector

The U.S. crop demand is composed of domestic and export demand, and will be estimated at the national level. According to the U.S. Department of Agriculture (USDA) categorization, domestic demand is broken into sub-categories by crop.[7] This study assumes that the U.S. livestock sector and the supply/demand in the rest of world (ROW) are exogenous. More detailed demand specifications and estimation results are available upon request.

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[7] Even if not presented in this paper, the model includes equations for biofuel components, bio-ethanol and bio-diesel. The bio-ethanol production is relevant to corn (alcohol) demand. Bio-diesel production affects soybean oil demand, which in turn shifts soybean (crushing) demand.

3.2.1. Corn Demand

In this study, the U.S. corn demand is comprised of seed, feed, food and industrial, ethanol, and export uses.

A major determinant of corn seed use is corn planted acres in the coming year. In most regions, corn is planted in March - May and harvested during August - early October (USDA 2010). Out of this planting-harvesting schedule, it may be inferred that corn seed use in a given year (t) may heavily depend on the expected size of planted acres in the following year (t+1). In this sense, the corn seed use equation describes the quantity demanded in time t as a function of expected magnitudes of planted acres in time (t+1).

Corn is the single most important livestock feed ingredient in the U.S., accounting for 95.3% of domestic feed grain production in 2012 (USDA WASDE 2012). Economic theory suggests that quantity demanded for corn feed use may be influenced by own price, substitutes' prices, and other supply and demand shifters. A corn feed demand equation incorporates corn farm price, soybean meal price, number of grain-consuming animal units, and corn production in the current year.

Food, Alcohol, and Industrial (FAI) demand category used by the USDA is divided into two sub-categories; food and industrial demand and ethanol demand. Corn food and industrial demand is a summation of the use for high fructose corn syrup (HFCS), glucose and dextrose, cornstarch, beverages and manufacturing, and cereal and others. The quantity of corn demanded for alcohol (ethanol) use depends on ethanol production.[8]

Based on research by Collins et al (1980) and Chambers (1981), the export demand equation consists of own price, substitutes' prices, and agricultural trade-weighted exchange rates. Dummy variables are included to account for changes not captured by the variables mentioned above.

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[8] Corn demand for ethanol production is calculated based on the following assumptions: (1) the share of wet milling decreased from 90% in 1985 to 10% in 2012 whereas that of dry milling increased from 10% in 1985 to 90% in 2012; (2) wet and dry milling can produce 2.65 and 2.75 gallons of ethanol from 1 bushel of corn; and (3) 95% of total ethanol production comes from corn.

Table 1. Corn Demand Specifications and Estimation Results

Dependent Variable	Adj. R2	Independent Variable(s)	Coefficient	P-value
Seed Use	0.998	Intercept	0.710***	0.001
		Corn Total Planted Acres (t+1)	0.245***	0.000
Feed Use	0.852	Intercept	-1,491.246	0.346
		U.S. Corn Price (Real)	-463.585***	0.000
		U.S. Soybean Meal Price (Real)	295.758*	0.090
		U.S. Corn Production (t)	0.041	0.319
		Number of Grain-consuming Animal Unit	1,491.225***	0.000
Food and Industrial Use	0.891	Intercept	-38,977.516***	0.000
		Year	20.194***	0.000
		U.S. Corn Price (Real)	-40.854***	0.000
Ethanol Use (DM)	0.914	Intercept	-939,537,982***	0.000
		Year	469,933***	0.000
		Dry-Milling Operation Margins (Real)	2,453,342***	0.002
Ethanol Use (WM)	0.882	Intercept	-61,310,743***	0.000
		Year	31,128***	0.000
		Wet-Milling Operation Margins (Real)	11,865	0.832
Export Use	0.707	Intercept	4,405.874***	0.000
		U.S. Corn Price (Real)	-958.799***	0.001
		U.S. Wheat Price (Real)	278.799***	0.002
		U.S. Sorghum Price (Real)	497.174**	0.020
		Agricultural Trade-weighted Exchange Rate	-21.957**	0.012
		Dummy (2012=1)	-715.252**	0.017
		Dummy (2007~2010=1)	324.153*	0.063

Note 1) ***, **, * denote statistical significance at the 1%, 5%, and 10% level.
2) Corn use for ethanol production is computed by summing up separately estimated ethanol demand, assuming that 1 bushel of corn can produce 2.75 gallons and 2.65 gallons of ethanol with Dry-milling (DM) and Wet-milling (WM), respectively.

3.2.2. Soybean Demand

In this study, the U.S. soybean demand is comprised of seed, feed, and residual, crushing, and export uses. Soybeans have been mostly used for crushing and exports, which, in combination, accounted for more than 94.0% of total quantity demanded during 1985-2012, on average. The mandatory biodiesel usage under the RFS2 has largely increased the demand for soybean oil in recent years. As a result, soybean crushing demand has substantially increased since the mid-2000s.

Soybean seed use is highly related with soybeans planted acres and feed use largely depends on its prices. Soybean crush demand historically has been the largest destination for the U.S. soybean consumption. As soybeans are crushed to produce soybean meal and soybean oil, crush demand can be regarded as a derived demand. A higher profitability of soybean processing is likely to induce processors to purchase more soybeans. In this sense, soybean crushing operating margins center on soybean crush estimation. In this study, the ratio of soybean crushing operating margins and soybean farm price is used to estimate soybean crush demand (Equation (7)).

(7) SB Crushing Operation Margins = (SB Meal Price * SB Meal Yields / 2000 + SB Oil Price * SB Oil Yields) / Avg. SB Farm Price

Table 2. Soybean Demand Specifications and Estimation Results

Dependent Variable	Adj. R2	Independent Variable(s)	Coefficient	P-value
Seed, Feed, and Residual Use	0.790	Intercept	126.084***	0.005
		Soybean Total Planted Acres (t+1)	1.588***	0.005
		U.S. Soybean Price (Real)	-7.132	0.126
		U.S. Soybean Meal Price (Real)	-150.576	0.262
		Dummy (2002~2005=1)	30.941**	0.028
		Dummy (2012=1)	37.791*	0.078
Crushing Use	0.927	Intercept	-59,745.887***	0.000
		Year	30.600***	0.000
		Crushing Operation Margins (Real)	375.384*	0.071
		Dummy (2010~2012=1)	-216.337***	0.000
		Dummy (2000~2001=1)	150.566**	0.042
Export Use	0.887	Intercept	31424.974**	0.013
		Year	16.202**	0.012
		Soybean Export (t-1)	0.449**	0.013
		U.S. Soybean Price (Real)	-129.241	0.259
		Agricultural Trade-weighted Exchange Rate	-2.826	0.346
		Dummy (1985~1987=1)	153.203*	0.089

Note: ***, **, * denote statistical significance at the 1%, 5%, and 10% level.

3.2.3. Wheat Demand

In this study, the U.S. wheat demand is comprised of seed, feed and residual, food, and export uses.

A major determinant of wheat seed use is planted acres in the coming year, based on the analogous reasoning applied to corn. As a feed grain, wheat is not as widely used as other commodities such as corn, and is mainly used to feed hogs. Wheat food use, along with export demand, composes the largest demand sectors for the U.S. wheat. The wheat use for human consumption steadily increased until the late-1990s, and since then has been stable. For human consumption, wheat partially competes with sorghum.

Table 3. Wheat Demand Specifications and Estimation Results

Dependent Variable	Adj. R2	Independent Variable(s)	Coefficient	P-value
Seed Use	0.910	Intercept	-4.289	0.446
		Wheat Total Planted Acres (t+1)	1.413***	0.000
Feed and Residual Use	0.717	Intercept	319.511**	0.018
		U.S. Wheat Price (Real)	-392.322***	0.000
		U.S. Corn Price (Real)	212.126*	0.069
		U.S. Soybean Meal Price (Real)	2666.998**	0.037
Food Use	0.975	Intercept	50.669*	0.082
		WHUSFA_LAG1	0.912***	0.000
		WHSORP	54.941**	0.039
		Dummy (1992~1994=1)	32.621**	0.028
Export Use	0.721	Intercept	16789.989***	0.007
		Year	-7.271**	0.015
		U.S. Wheat Price (Real)	-21.647	0.120
		Agricultural Trade-weighted Exchange Rate	-10.514**	0.011
		Dummy (1987~1988=1)	235.816**	0.026
		Dummy (2007~2010=1)	282.104***	0.001

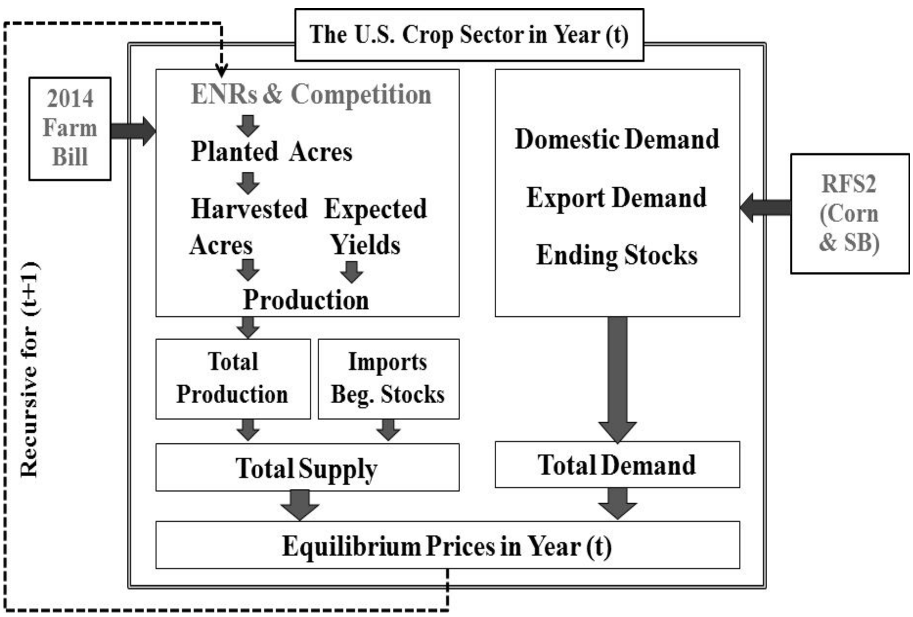
3.3. Dynamics and Regional Price Adjustments

As described in Figure 1, the proposed economic analysis model has recursive dynamic attributes. That is, the solved market-clearing prices and quantities in a given year become exogenous variables and affect decision making in the following year(s). This process is in line with theoretical reasoning of expected profit maximization and partial adjustment. This model assumes that elasticities of supply response are constant over time but vary across region.

The proposed economic analysis model calculates each commodity's equilibrium price by minimizing the non-fitted 'objective' function which is equal to a squared sum of each commodity's excess supply in a given year.[9] Minimizing the objective function enables the entire system to be simultaneously as close to market-clearing status as possible.

A more precise calculation of regional price of a crop requires adjusting the equilibrium price to regional ones to reflect the price variation and producers' responses across region. A producer is expected to make planting decisions based on the market signal it will face with. Thus, it makes more sense to say a producer makes the planting decisions based on the regional crop price rather than national average one.

Figure 1. An Illustrative Description of the Model Structure



[9] A squared sum is used to avoid any potential offset between excess supply and demand of any crops.

3.4. Economic Impact Analysis

Estimating supply and demand sector followed by minimizing the objective function can lead this study to obtain *status quo* partial market equilibria, which are reference points for comparison with those under the changes in policy shifters. The 2014 Farm Bill is expected to exert their influences on ENRs and supply. Reducing U.S. farm program supports will reduce ENRs of major crops, but the impacts will differ across region and by crop. For example, rice and cotton growers might have more severe shocks to planted acres than corn due to greater dependency on DP/CCP and their having relatively fewer substitutes. As a result, eliminating farm program payments might shift a total supply inward differently across regions.

IV. Specification, Estimation, and Model Validation

As mentioned earlier, impact analysis of the 2014 Farm Bill focuses on corn, soybeans, and wheat in this paper. Again, estimation results are too lengthy to be presented in this paper, and available upon request.

This study validates the model to verify if parameter estimates are consistent with economic theory, if empirical analysis results are consistent with the expected changes and if magnitude of changes makes sense. To this end, the most widely used method of root-mean square error (RMSE) is utilized. In a forecasting model, RMSE of forecasted values of a dependent variable in time t compared to the actual value can be calculated. As RMSE is unit-dependent, mean-absolute-percentage error is accompanied to measure the performance of the model. RMSE and MAPE tests for corn show that 14 out of 15 equations have MAPE values less than 5%. The only exception is corn export demand whose RMSE and MAPE values are 196.22 and 8.29%, respectively. RMSE and MAPE tests for soybeans show that 9 out of 12 equations have MAPE values less than 5%. The MAPE values for other three equations, expected yields in Central Plains, exports demand, and seed, feed, and residual demand, are less than 10%. Model validation results for wheat show that 12 out of 13 equations have MAPE values less than 10%. The only exception, wheat feed and residual demand, has a MAPE value of 22.22% which is mainly due to the presence of unaccountable residual component.

V. Forecasting Results

5.1. Key Assumptions

Based on earlier discussion, this study conducts a long-term forecasting from 2013 through 2022. A baseline scenario assumes that macro and policy environments remain *status quo* when forecasting the changes in the U.S. crop sector over the next decade. The scenario provides a baseline which can be used to analyze the impacts of external shocks of interest. Major assumptions involved in the baseline scenario include the following: (1) the RFS2 mandates are no more in effect during 2013-2022 and (2) agricultural provisions in the 2008 Farm Bill (Loan Rates, Target Price, Marketing Loan Gains, Direct Payments, and Counter Cyclical Payments) are assumed to be maintained at the 2012 level during 2013-2022.

The most important assumption involved in this alternative scenario differs from the assumption (2) in the baseline scenario. That is, among the support provisions in the last farm bill, DP and CCP are assumed to be eliminated and replaced with Price Loss Coverage (PLC) and Agricultural Risk Coverage (ARC), respectively.[10,11]

5.2. Forecasting Results[12]

5.2.1. Corn

The U.S. national corn price has continuously risen since 2009. According to the baseline forecast, the corn price would stabilize, averaging $4.55 per bushel during 2013-2022. A substantial drop in price from $6.95 per bushel in 2012 to $4.27 per bushel in 2013 is likely due to the rebounded production out of

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10 Separate commodity programs designed for upland cotton, STAX and SOC, are not considered in this study.

11 For more detailed information on the 2014 Farm Bill programs, see Chite (2013, 2014).

12 More detailed results are presented in Appendix B.

the recent drought. During the forecast period, the corn price ranges between \$4.31 and \$6.51 per bushel, averaging \$5.73 per bushel. The U.S. corn total planted acre expansion has been spurred by the unusually high crop prices during the mid- through late-2000s.

The forecast results indicate that the total planted acres for corn would return closer to the trend level. The sharp drop between 97.4 million acres in 2013 to 88.0 million acres in 2014 is due to corn producers' responding to the low corn price in 2013 as they allocate less land for corn. After 2014, the total planted acres are projected to increase to reach 93.8 million acres in 2022.

The U.S. corn total demand is forecasted to increase from 13.1 billion bushels in 2013 to 14.8 billion bushels in 2022. The coefficient of variation (4.37%) shows that each category of the corn demand remains stationary during 2013-2022.

An interesting point can be found by comparing the historical and projected demand by categories. First, larger amounts of corn are forecasted to be used to produce ethanol even when assuming the absence of the RFS2. Over the forecast period, the share of corn as energy sources increases from 30.2% in 2013 to 34.7% in 2022. Second, increased use of corn for biofuel production tightens the corn availability for feedstock as was experienced in the mid-2000s.

The corn ENRs are forecasted to be closer to the historical level, but remain at a higher level. It implies that, in spite of increasing variable production costs, the regional producers' average net gains are forecasted to increase owing to favorable market conditions.

Under the alternative scenario of the 2014 Farm Bill, the U.S. corn price is forecasted to remain largely unchanged during 2013-2022. As the forecasted corn price remains stable at a higher level than the historical price, there is little likelihood for PLC or ARC to be triggered. The forecast results demonstrate that the U.S. total planted acres of corn would increase compared to those under the baseline by an average of 0.18% under the 2014 Farm Bill during 2013-2022. Under implementation of PLC and ARC, the increments of total corn demand are forecasted to average 0.12%. The tiny demand changes mainly come from the small changes in the corn price. The 2014 Farm Bill is forecasted to reduce the average corn ENRs by an average of 2.88% during 2013-2022.

5.2.2. Soybeans

The U.S. national average soybean price has risen since 2006, reaching the record level of $14.30 per bushel in 2012. The forecast results show that the soybean price would rise continuously to $15.41 per bushel in 2015. In later years, the soybean price is projected to decline and return to the trend level of $14.87 per bushel in 2019. The price is forecasted to be $14.12 per bushel in 2022.

The U.S. soybean total planted acres had been reduced substantially to 64.7 million acres in 2007, decreased by 14.3% compared to 2006. Since then, total planted acres have again expanded to arrive at 77.2 million acres in 2012. The forecast results indicate that the total planted acres would increase continuously to 86.8 million acres in 2022. Unlike corn planted acres, no sudden or sharp drop in planted acres is forecasted for soybeans. That is, as the forecasted soybean prices are stable at high levels compared to corn price, corn and or other crop producers may have incentives to switch to soybeans.

The U.S. soybean total demand is forecasted to increase from 3.37 billion bushels in 2013 to 4.01 billion bushels in 2022. The coefficient of variation shows the crushing (5.08%) and export demand (6.46%) remain stable over the forecast period. The crushing demand is projected to remain the largest demand sector for U.S. soybeans.

The ENRs are forecasted to increase until 2016 and remain higher than the historical level. The competition with corn and/or other crops might restrict the degree to which the planted acres of soybeans can expand. The forecasted differences of ENRs across regions are due to regional expected yields.

Compared to the baseline, the 2014 Farm Bill is forecasted to lower the U.S. soybean price by an average of 0.82% during 2013-2022. As the forecasted soybean prices and ACR (Actual County Revenue) remain higher compared to the reference prices and BCR (Benchmark County Revenue), there is little chance for PLC or ARC to be triggered. The forecast results indicate that the U.S. soybean total planted acres would increase by an average of 0.10% during 2013-2022, compared to the baseline. Under the 2014 Farm Bill, the U.S. soybean total demand is forecasted to increase by an average of 0.08% during 2013-2022 (figure B-254). Also, crushing (0.08%) and export (0.02%) demands are forecasted to increase. Under PLC and ARC, the soybean crushing margins are forecasted to increase by 3.45~3.61% during 2013-2022. The average ENRs under the 2014 Farm Bill are forecasted to be lower than the baseline by an average of 3.32% during 2013-2022.

5.2.3. Wheat

The U.S. national average wheat price has risen since 2005 except for a sharp drop between 2008 and 2009. The forecast results indicate that the wheat price is projected to increase to $8.44 per bushel in 2013, followed by a radical drop to $6.83 per bushel in 2014. For the rest of the forecast years, the wheat price is projected to slightly decline, averaging $6.06 per bushel.

The U.S. wheat total planted acres had declined to 53.1 million acres in 2009. In the consecutive 3 years, the total planted acres have rebounded to 55.8 million acres in 2012. The forecast results indicate that the temporary expansion in recent years would increase slightly to reach 57.5 million acres in 2014. In later years, continuous decrements are forecasted such that the total planted acres are projected to arrive at 54.0 million acres in 2022. When comparing the planted acres with those of corn and soybeans, it can be shown that a large part of the reduced wheat planted acres is forecasted to be allocated for soybeans and/or corn.

The U.S. wheat total demand is forecasted to stabilize, averaging 2.4 billion bushels during 2013-2022. Compared to the historical share, the food demand is forecasted to have a larger portion (from 37.8% during 1985-2012 to 40.9% during 2013-2022) relative to export demand (from 48.3% during 1985-2012 to 42.7% during 2013-2022).

The wheat ENRs are forecasted to remain high by 2013. As the wheat price is forecasted to stabilize at a relatively lower level in later years, the wheat ENRs are forecasted to be stable or slightly lower during 2014-2022. In addition, increasing variable production costs will reduce the ENRs across regions. Substantially lower ENRs in the Southern Plains stem from higher production costs and relatively lower expected yields.

Compared to the baseline, the 2014 Farm Bill is forecasted to raise the U.S. national wheat price by an average of 1.05% during 2013-2022. The forecast results indicate that the U.S. wheat total planted acres would reduce under the 2014 Farm Bill. The planted acres are forecasted to decrease compared to the baseline by an average of 0.52% during 2013-2022. The decreases are mainly due to wheat producers' switching to corn and/or soybeans. The 2014

Farm Bill is forecasted to decrease the U.S. wheat total demand by an average of 0.27% compared to the baseline during 2013-2022. The largest reduction is forecasted in the feed and residual demand, reduced by an average of 1.85% during 2013-2022. Over the forecast period, neither PLC nor ARC is forecasted to be triggered to lower the ENRs by an average of 8.04%.

5.3. Measurements of Changes in Welfare and Policy Implications

Under the 2014 Farm Bill, the approximation of welfare changes indicates that the producer surplus (PS) is forecasted to decrease at an average of about $122 million while improving the consumer surplus (CS) by about $67 million during 2013-2022, on average. The PS reduction can be attributed to the elimination of DP which is expected to reduce ENRs. Especially, producers of wheat are forecasted to experience the lower ENRs (-8.02% compared to the average baseline ENRs) under the 2014 Farm Bill.[13] Out of the major program commodities, corn and wheat producers are forecasted to benefit from the higher prices under the proposed Farm Bills. In contrast, the lower prices of soybeans and by-products are forecasted to reduce the welfare of soybean producers.[14]

Elimination of DP and CCP is expected to contribute to the budget reduction where the new provisions are expected to increase the government expenditures when triggered. The expected changes in the government expenditures estimated by this study and the Congressional Budget Office (CBO 2014) are summarized in Appendix B. This study indicates that PLC payments are forecasted to be continuously triggered under the 2014 Farm Bill throughout 2015-2022. The 2014 Farm Bill is forecasted to satisfy one of the largest goals, budget reduction. A large surplus reduction is forecasted for soybean producers and the consumers of corn and wheat. Regarding the expected budget reduc-

[13] Other major programs crops forecasted to suffer from lower ENRs under the 2014 Farm Bill include cotton (-6.40%), long grain rice (-8.17%), medium/short grain rice (-8.78%), and sorghum (-9.91%).

[14] A careful attention is required when interpreting the welfare changes. Arguably, the effect of lower forecasted prices for soybean might exceed that of production increment, leading to reduce PS. Moreover, the welfare change might be in part attributed to recently declined subsidy levels for biofuels in the Renewable Fuel Standard 2 (RFS2). This issue will be further scrutinized. The author would like to appreciate for the anonymous reviewer for the helpful comments.

tions resulting from repealing DP and CCP, this study and the CBO (2014) reach very similar magnitudes. However, when estimating the expected outlay for PLC and/or ARC, the two studies provide largely different estimates. The difference may be due to the possible difference of model used by each study and higher forecasted prices under this study compared to what was used by the CBO. In spite of the difference, both studies support the fact that the 2014 Farm Bill is forecasted to satisfy one of the largest goals, budget reduction.

Ⅵ. Conclusion

When conducting economic impact analysis, many of previous studies focus on either multiple crops in a region (nation) or a single crop in multiple regions. This approach oftentimes leaves other relevant crops or regions as exogenous with respect to the commodity of interest. In this sense, this study's model has an advantage of avoiding potential problems caused by such an assumption. Implementation of the 2014 Farm Bill has a number of important implications. First, repealing the previous provisions (especially DP) is expected to reduce producers' ENRs and thus is likely to decrease producer surplus. Second, in spite of the lowered ENRs, only small changes are forecasted for planted acre allocations. As Westcott and Young (2012) argued, "decoupled payments do not have direct effects on production decisions or agricultural output because they do not change returns to production." Third, the new Farm Bill is expected to drive the producers to be more sensitive to market signals. The likelihood of being more vulnerable to any unfavorable changes will increase in spite of the introduction of the new 'safety net' programs. Fourth, the 2014 Farm Bill is forecasted to meet the initially intended goal of federal budget deficit reductions.

This study can not be free from some caveats or weakness in terms of assumptions and analysis approaches. First, failure to include some relevant programs such as CRP and ACRE may have the forecasted results depart from what they would otherwise be. Second, the assumption of having the U.S. livestock sector and global market exogenous prevents this study from fully capturing the expected responses or feedbacks from the sectors. This assumption also imposes a limitation on analyzing the welfare measurements including those sectors. Third, the 2014 Farm Bill provision analyzed in this study does not encompass the nutrition programs which account for the largest portion of the budget outlay. As the programs are expected to affect the demand side, further analysis with the nutrition programs is necessary. All of the weaknesses of this study mentioned above remain as future works.

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Appendix A: A Brief Overview on PLC and ARC

The enacted 2014 Farm Bill (P.L. 113-79) modified farm programs proposed by the House and the Senate Bill. The 2014 Farm Bill determined to repeal Direct Payments (DP) and Counter-Cyclical Payments (CCP). As an alternative, the 2014 Farm Bill newly introduced Price Loss Coverage (PLC) and Agricultural Risk Coverage (ARC). Both programs provide a safety net for covered crops including barley, corn, oats, long grain rice, medium/short grain rice, grain sorghum, soybeans, wheat, peanuts, pulse crops, and other oilseeds (Shields and Schnepf, 2013).

Price Loss Coverage (PLC)

The 2014 Farm Bill replaced the previous CCP program with PLC. Also, the 2014 Farm Bill introduced ARC in place of ACRE (Average Crop Revenue Election). One of major changes made in the 2014 Farm Bill is that producers cannot select PLC and ARC at the same time. The 2014 Farm Bill suspends the provision of 'permanent price support authority' under the Agricultural Adjustment Act of 1938 and Agricultural Adjustment Act of 1949 until 2018. This study assumes that the provisions in the 2014 Farm Bill will be continuously implemented through 2022.

The new deficiency payment program in PLC plays a similar role to the previous CCP (Babcock and Paulson, 2012). Key definitions of terms relevant to PLC are presented in table A-1. Based on the definitions, PLC payments may be triggered (guaranteed) when an effective price is lower than the predetermined 'reference price'.[15] The effective price equals the higher of the 12-month national average price and national average loan rates. Once the trigger condition is met, PLC payment rates equal the difference between the reference price and the effective price.

Calculating per acre PLC payments requires corresponding payment yields. Basically, historical CCP yields are used as PLC payment yields. Producers participating in PLC will be given a one-time, irrevocable option to

[15] The term ‘reference price’ is analogous to ‘target price’ in the 2008 Farm Bill.

update their payment yields to 90 percent of their 2008-2012 average yields as their payment yields.

Table A-1. Definition of Terms in PLC Provisions

Term(s)	Definition of Term(s)	
Covered Commodity	Wheat, oats, barley, corn, grain sorghum, long grain rice, medium grain rice, pulse crops, soybeans, other oil seeds, and peanuts.	
Effective Price	The price calculated to determine whether price loss coverage payments are required to be provided for a crop year.	
Payment Acres	85 percent of base acres planted for the year to each covered commodity on a farm	
Reference Price	(1) Wheat: $5.50 per bushel. (2) Corn: $3.70 per bushel. (3) Grain Sorghum: $3.95 per bushel. (4) Barley: $4.95 per bushel. (5) Oats: $2.40 per bushel.	(6) Long Grain Rice: $14.00 per cwt (7) Medium Grain Rice: $14.00 per cwt (8) Soybeans: $8.40 per bushel. (9) Peanuts: $535.00 per ton.

Source: Chite (2014).

Agricultural Risk Coverage (ARC)

ARC provides a safety net for potential shallow losses. ARC will be in effect through crop years 2014-2018. Under the 2014 Farm Bill, producers of covered commodities are prevented from receiving simultaneous payments from PLC and ARC. Also, the trigger condition for ARC works to guarantee 86% of benchmark revenue. ARC allows producers to irrevocably elect a farm or county option when calculating the benchmark revenue. Once a producer elects one of the two, the decision can not be switched.

Table A-2. Definition of Terms in ARC Provisions

Term(s)	Definition of Term(s)
Farm-level Option	(1) Benchmark Revenue = Olympic average of 5-year farm yield * Olympic average of 5-year average national price (2) Payment Rates = (Per acre guarantee – per acre actual revenue) * (0.65 * base acres)
County-level Option	(1) Benchmark Revenue = Olympic average of 5-year county yield * Olympic average of 5-year average national price (2) Payment Rates = (Per acre guarantee – per acre actual revenue) * (0.85 * base acres)

Appendix B: Tables

Table B-1. Regional Division and Major Program Commodity Mix

Region	CB	CP	DS	FW	LS	NE	NP	SE	SP
Barley		O		X	O	O	X	O	
Corn	X	X	X	X	X	X	X	X	X
Cotton	O	O	X	X				X	X
Oats	O	O		X	X	O	X	O	X
Long Grain Rice	O		X						O
Medium/Short Grain Rice	O		X	X					O
Sorghum	O	X	O	O			O	O	X
Soybean	X	X	X		X	X	X	X	O
Wheat	X	X	X	X	X		X	X	X
Peanuts								X	O

Note 1) The symbol 'X' and 'O' represent the major and 'minor' production regions.
2) CB is Corn Belt; CP is Central Plains; Delta States; FW is Far West; LS is Lake States; NE is North East; NP is Northern Plains; SE is South East; and SP is Southern Plains.

Table B-2. Producer and Consumer Surplus Changes under the 2014 Farm Bill, 2013-2022 Average

Crop	Producer Surplus Changes (Mil. $)	Consumer Surplus Changes (Mil. $)
Corn	218.83	-187.51
Soybeans	-461.22	262.67
Wheat	153.90	-92.96
Other Crops	-33.43	84.54
Total	-121.92	66.74

Note: 'Other crops' include barley, upland cotton, oats, long grain rice, medium/short grain rice, sorghum, soybean meal, soybean oil, and peanuts.

Table B-3. Estimated Government Expenditure Changes under the 2014 Farm Bill (Mil. $)

Year	Budget Reduction by Repealing DP and CCP	Budget Increments by Introducing PLC and ARC	Net Budget Reduction
2015	4,915	42	4,873
2016	4,926	18	4,908
2017	4,954	14	4,940
2018	4,968	17	4,951
2019	4,993	18	4,975
2020	5,008	21	4,987
2021	5,025	24	5,001
2022	5040	23	5,017
Average	4,979	22	4,957

Table B-4. Forecasting Results for the U.S. Corn Sector

Year	Scenario	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Planted Acres	BL	97.38	88.02	89.62	89.54	90.55	91.02	91.81	92.45	93.17	93.85
(Mil. Acres)	FB	97.38	87.82	89.58	89.40	90.50	90.92	91.76	92.37	93.13	93.79
Harvested Acres	BL	89.03	80.17	81.70	81.61	82.57	83.00	83.75	84.35	85.04	85.67
(Mil. Acres)	FB	89.03	79.98	81.67	81.47	82.52	82.90	83.70	84.28	84.99	85.61
Yields (Bushels/Acre)	CB	170.4	172.3	174.1	175.9	177.8	179.6	181.4	183.2	185.1	186.9
	CP	154.6	155.5	156.5	157.4	158.4	159.3	160.3	161.2	162.2	163.1
	DS	147.4	149.5	151.6	153.8	155.9	158.0	160.1	162.3	164.4	166.5
	FW	189.5	190.9	192.3	193.7	195.1	196.5	197.9	199.3	200.7	202.1
	LS	161.4	163.3	165.1	167.0	168.8	170.7	172.5	174.4	176.2	178.1
	NE	131.2	132.5	133.7	135.0	136.3	137.5	138.8	140.0	141.3	142.6
	NP	136.0	138.3	140.5	142.7	145.0	147.2	149.4	151.7	153.9	156.2
	SE	122.4	123.7	124.9	126.2	127.5	128.7	130.0	131.3	132.6	133.8
	SP	129.8	130.7	131.5	132.4	133.2	134.1	134.9	135.8	136.6	137.5
Total Supply	BL	13,981.2	13,758.3	14,140.6	14,256.4	14,547.6	14,754.6	15,015.9	15,254.7	15,509.7	15,758.2
(Mil. Bushels)	FB	13,981.2	13,726.5	14,135.1	14,232.6	14,540.1	14,737.3	15,007.1	15,241.5	15,501.0	15,747.3
-Production	BL	12,541.8	12,852.3	13,234.6	13,350.4	13,641.6	13,848.6	14,109.9	14,348.7	14,603.7	14,852.2
(Mil. Bushels)	FB	12,541.8	12,820.5	13,229.1	13,326.6	13,634.1	13,831.3	14,101.1	14,335.5	14,595.0	14,841.3
Total Demand	BL	13,981.2	13,758.3	14,140.6	14,256.3	14,547.6	14,754.6	15,015.9	15,254.7	15,509.7	15,758.2
(Mil. Bushels)	FB	13,981.2	13,726.5	14,135.0	14,232.6	14,540.1	14,737.3	15,007.1	15,241.5	15,501.0	15,747.3
-Seed	BL	22.3	22.7	22.7	22.9	23.0	23.2	23.4	23.5	23.7	24.0
(Mil. Bushels)	FB	22.2	22.7	22.6	22.9	23.0	23.2	23.3	23.5	23.7	24.0
-Feed and Residual	BL	5,625.5	5,457.6	5,621.2	5,604.3	5,705.1	5,752.5	5,831.9	5,897.7	5,974.1	5,981.5
(Mil. Bushels)	FB	5,625.6	5,436.4	5,617.4	5,588.3	5,699.9	5,740.7	5,825.8	5,888.6	5,968.0	5,973.9
-Food and Industrial	BL	1,498.9	1,499.2	1,528.3	1,542.7	1,566.9	1,586.7	1,609.2	1,630.6	1,652.9	1,669.1
(Mil. Bushels)	FB	1,498.9	1,497.5	1,528.0	1,541.4	1,566.5	1,585.8	1,608.8	1,629.9	1,652.4	1,668.5
-Alcohol	BL	3,948.4	3,940.3	4,108.9	4,240.6	4,397.2	4,537.7	4,691.4	4,840.0	4,991.2	5,125.3
(Mil. Bushels)	FB	3,948.4	3,935.6	4,108.1	4,237.1	4,396.2	4,535.2	4,690.2	4,838.2	4,990.0	5,123.9
-Exports	BL	1,995.1	1,947.5	1,968.6	1,954.9	1,964.4	1,963.5	1,969.0	1,971.9	1,976.8	1,967.3
(Mil. Bushels)	FB	1,995.1	1,943.4	1,968.0	1,951.8	1,963.5	1,961.4	1,968.0	1,970.3	1,975.9	1,966.1
Farm Price ($/Bushel)	BL	4.27	4.76	4.54	4.68	4.59	4.59	4.54	4.51	4.46	4.56
	FB	4.27	4.80	4.55	4.71	4.60	4.62	4.55	4.53	4.47	4.57
Loan Rate ($/Bushel)	U.S.	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95
Target (Reference)	BL	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63
Price ($/Bushel)	FB	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70
Price Loss Coverage ($/Bushel)	FB	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Agricultural Risk Coverage ($/Acre)	FB	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Production Costs ($/Acre)	U.S.	279.6	286.1	292.6	299.1	305.5	312.0	318.5	325.0	331.5	338.0

Note 1) BL, FB, and U.S. denote baseline scenario, the 2014 Farm Bill scenario, and common variable, respectively.

2) Regional prices are not reported in this table, and are available on request.

Table B-4. (Continued)

Year	Scenario	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Expected Net Returns($/Acre) under BL	CB	502.4	487.4	576.3	539.4	567.3	551.6	555.2	546.7	543.1	535.2
	CP	869.4	403.6	476.4	440.8	460.7	443.4	442.6	431.5	424.6	414.2
	DS	874.3	377.6	448.6	421.4	445.0	434.2	438.7	433.6	432.3	427.6
	FW	442.6	632.9	717.0	680.1	705.2	688.6	690.6	681.0	676.2	667.3
	LS	783.7	418.9	499.5	466.0	491.2	476.9	480.1	472.3	469.0	461.7
	NE	737.2	385.6	458.1	425.8	447.4	432.7	434.2	425.5	420.9	412.8
	NP	435.9	317.8	392.9	364.4	389.6	378.4	383.4	378.2	377.0	372.1
	SE	409.0	304.3	366.4	338.2	356.5	343.5	344.3	336.5	332.2	324.8
	SP	534.2	315.4	370.8	342.4	357.0	342.7	341.3	331.9	325.7	316.8
Expected Net Returns($/Acre) under FB	CB	502.4	463.0	559.4	516.3	548.6	528.9	534.9	524.3	521.8	512.7
	CP	869.4	389.0	458.6	417.5	441.2	420.4	421.7	408.8	402.8	391.4
	DS	874.3	353.2	430.1	398.0	425.1	411.2	417.6	410.8	410.4	404.7
	FW	442.6	611.7	699.9	656.9	686.2	665.9	670.1	658.5	654.7	644.7
	LS	783.7	394.5	481.9	442.7	472.0	454.0	459.5	449.7	447.4	439.1
	NE	737.2	361.2	440.0	402.5	427.7	409.7	413.2	402.8	399.1	390.0
	NP	435.9	293.4	374.7	341.1	369.9	355.4	362.5	355.4	355.2	349.3
	SE	409.0	279.9	347.4	314.7	336.2	320.3	322.9	313.5	310.0	301.8
	SP	534.2	291.0	351.4	318.9	336.3	319.4	319.6	308.8	303.3	293.6

Note 1) BL, FB, and U.S. denote baseline scenario, the 2014 Farm Bill scenario, and common variable, respectively.
2) Regional prices are not reported in this table, and are available on request.

Table B-5. Forecasting Results for the U.S. Soybean Sector

Year	Scenario	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Planted Acres (Mil. Acres)	BL	77.16	79.16	79.68	80.70	81.56	82.53	83.42	84.33	85.21	86.08
	FB	77.16	79.22	79.72	80.77	81.63	82.61	83.50	84.43	85.31	86.19
Harvested Acres (Mil. Acres)	BL	75.90	77.90	78.44	79.47	80.32	81.28	82.17	83.07	83.94	84.81
	FB	75.90	77.95	78.48	79.54	80.39	81.37	82.25	83.17	84.04	84.91
Yields (Bushels/Acre)	CB	48.5	48.9	49.3	49.7	50.1	50.5	50.9	51.3	51.7	52.1
	CP	46.5	47.1	47.6	48.2	48.8	49.4	50.0	50.6	51.2	51.8
	DS	40.5	41.2	41.9	42.5	43.2	43.9	44.6	45.2	45.9	46.6
	LS	42.7	43.0	43.2	43.5	43.8	44.0	44.3	44.5	44.8	45.0
	NE	40.9	41.3	41.7	42.1	42.5	43.0	43.4	43.8	44.2	44.6
	NP	33.3	33.4	33.6	33.7	33.9	34.0	34.2	34.3	34.5	34.6
	SE	36.2	36.6	37.0	37.4	37.8	38.2	38.6	39.0	39.4	39.9
Total Supply (Mil. Bushels)	BL	3,618.6	3,705.9	3,761.4	3,836.5	3,904.8	3,977.6	4,047.6	4,118.9	4,189.2	4,259.5
	FB	3,618.6	3,708.1	3,763.2	3,839.6	3,907.7	3,981.5	4,051.5	4,123.4	4,193.8	4,264.5
-Production (Mil. Bushels)	BL	3,430.0	3,447.9	3,503.4	3,578.5	3,646.8	3,719.6	3,789.6	3,860.9	3,931.2	4,001.5
	FB	3,430.0	3,450.1	3,505.2	3,581.6	3,649.7	3,723.5	3,793.5	3,865.4	3,935.8	4,006.5
Total Demand (Mil. Bushels)	BL	3,618.7	3,705.9	3,761.4	3,836.6	3,904.9	3,977.4	4,047.6	4,118.8	4,189.3	4,259.5
	FB	3,618.7	3,708.1	3,763.2	3,839.9	3,907.8	3,981.3	4,051.5	4,123.3	4,193.9	4,264.6
-Seed, Feed and Residual (Mil. Bushels)	BL	69.8	72.0	66.7	69.5	71.5	75.7	79.6	84.0	88.4	92.7
	FB	69.8	72.8	67.4	70.8	72.8	77.3	81.3	86.0	90.4	94.9
-Crushing (Mil. Bushels)	BL	1,880.0	1,911.8	1,936.7	1,970.5	2,003.6	2,039.4	2,074.9	2,111.2	2,147.5	2,183.8
	FB	1,880.0	1,912.6	1,937.5	1,971.9	2,005.0	2,041.2	2,076.8	2,113.4	2,149.8	2,186.3
-Exports (Mil. Bushels)	BL	1,423.9	1,477.1	1,513.0	1,551.6	1,584.7	1,617.4	1,648.1	1,678.6	1,708.4	1,738.1
	FB	1,423.9	1,477.7	1,513.2	1,552.2	1,584.9	1,617.8	1,648.4	1,678.9	1,708.7	1,738.3
Farm Price ($/Bushel)	BL	14.63	14.77	15.41	15.32	15.29	15.07	14.87	14.62	14.37	14.13
	FB	14.63	14.71	15.34	15.21	15.18	14.92	14.71	14.44	14.19	13.93
Loan Rate ($/Bushel)	U.S.	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Target (Reference) Price ($/Bushel)	BL	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
	FB	8.40	8.40	8.40	8.40	8.40	8.40	8.40	8.40	8.40	8.40
Price Loss Coverage ($/Bushel)	FB	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Agricultural Risk Coverage ($/Acre)	FB	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Production Costs ($/Acre)	U.S.	122.5	125.1	127.7	130.3	132.9	135.5	138.1	140.7	143.3	145.9

Note 1) BL, FB, and U.S. denote baseline scenario, the 2014 Farm Bill scenario, and common variable, respectively.

2) Regional prices are not reported in this table, and are available on request.

Table B-5. (Continued)

Year	Scenario	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Expected Net Returns($/Acre) under BL	CB	464.8	610.7	621.5	657.2	656.4	658.6	650.8	643.8	634.0	624.4
	CP	331.6	551.6	564.2	599.7	601.7	606.5	602.0	598.1	591.6	585.1
	DS	488.7	471.5	484.5	517.3	521.3	527.6	525.8	524.5	520.8	517.0
	LS	477.7	501.1	508.4	536.4	533.9	533.9	525.6	518.0	508.2	498.5
	NE	482.8	503.0	513.0	544.4	544.5	547.0	541.0	535.6	527.8	520.0
	NP	349.4	363.6	368.0	388.7	385.3	383.9	376.0	368.7	359.6	350.6
	SE	432.1	432.9	442.0	470.0	470.4	473.0	468.0	463.5	456.8	450.2
Expected Net Returns($/Acre) under FB	CB	464.8	599.2	606.7	642.2	638.9	641.0	631.5	624.2	613.3	603.3
	CP	331.6	540.0	549.6	585.0	584.7	589.4	583.3	579.0	571.4	564.5
	DS	488.7	460.0	470.4	503.1	505.0	511.2	508.0	506.3	501.6	497.5
	LS	477.7	489.5	494.1	522.0	517.4	517.4	507.7	499.8	489.1	479.1
	NE	482.8	491.4	498.6	529.9	527.7	530.3	522.8	517.0	508.2	500.1
	NP	349.4	352.0	354.2	374.9	369.9	368.4	359.4	351.9	342.1	332.9
	SE	432.1	421.3	428.0	455.9	454.3	456.9	450.5	445.7	438.2	431.3

Note 1) BL, FB, and U.S. denote baseline scenario, the 2014 Farm Bill scenario, and common variable, respectively.

2) Regional prices are not reported in this table, and are available on request.

Table B-6. Forecasting Results for the U.S. Wheat Sector

Year	Scenario	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Planted Acres (Mil. Acres)	BL	56.53	57.60	57.51	57.22	56.68	56.06	55.57	55.20	54.82	54.41
	FB	56.53	57.56	57.37	57.01	56.40	55.73	55.22	54.85	54.44	54.01
Harvested Acres (Mil. Acres)	BL	47.89	49.55	49.44	49.18	48.68	48.12	47.68	47.35	47.00	46.63
	FB	47.90	49.52	49.32	49.00	48.44	47.84	47.38	47.04	46.67	46.28
Yields (Bushels/Acre)	CB	61.4	61.8	62.3	62.7	63.2	63.7	64.1	64.6	65.1	65.5
	CP	39.9	40.1	40.3	40.5	40.7	40.9	41.1	41.3	41.5	41.7
	DS	57.3	58.1	58.9	59.7	60.5	61.2	62.0	62.8	63.6	64.3
	FW	70.0	70.5	71.0	71.5	72.0	72.5	73.0	73.5	74.0	74.5
	LS	60.1	60.9	61.8	62.7	63.6	64.4	65.3	66.2	67.1	68.0
	NP	38.6	39.0	39.4	39.8	40.2	40.6	41.0	41.4	41.8	42.2
	SE	64.0	65.1	66.2	67.3	68.4	69.5	70.7	71.8	72.9	74.0
	SP	34.0	34.2	34.4	34.6	34.8	35.0	35.2	35.4	35.6	35.8
Total Supply (Mil. Bushels)	BL	3,021.5	3,242.9	3,232.4	3,258.2	3,262.7	3,243.3	3,242.3	3,247.1	3,250.1	3,251.2
	FB	3,022.3	3,241.5	3,227.2	3,250.6	3,252.6	3,231.6	3,229.8	3,234.6	3,236.9	3,237.2
-Production (Mil. Bushels)	BL	2,198.5	2,300.4	2,312.0	2,317.1	2,312.3	2,304.5	2,303.3	2,307.3	2,310.3	2,311.7
	FB	2,199.3	2,299.0	2,306.8	2,309.5	2,302.3	2,292.9	2,290.9	2,294.8	2,297.1	2,297.7
Total Demand (Mil. Bushels)	BL	3,021.5	3,242.9	3,232.4	3,258.1	3,262.7	3,243.3	3,242.3	3,247.1	3,250.1	3,251.2
	FB	3,022.3	3,241.5	3,227.2	3,250.6	3,252.6	3,231.6	3,229.8	3,234.6	3,236.9	3,237.2
-Seed (Mil. Bushels)	BL	77.1	77.0	76.6	75.8	74.9	74.2	73.7	73.2	72.6	72.0
	FB	77.0	76.8	76.3	75.4	74.4	73.7	73.2	72.6	72.0	71.4
-Feed and Residual (Mil. Bushels)	BL	174.1	363.5	322.2	334.6	344.5	326.9	326.4	331.6	335.1	327.7
	FB	174.7	362.5	318.4	329.4	337.7	319.4	318.7	324.2	327.3	319.5
-Food (Mil. Bushels)	BL	953.3	959.7	965.3	972.5	979.5	985.4	990.3	994.8	999.0	1,003.3
	FB	953.3	960.0	965.5	972.6	979.2	984.8	989.3	993.4	997.3	1,001.2
-Exports (Mil. Bushels)	BL	988.2	1,033.4	1,036.8	1,036.9	1,037.0	1,029.5	1,023.3	1,019.0	1,015.5	1,008.2
	FB	988.4	1,032.9	1,035.5	1,034.9	1,034.5	1,026.4	1,020.1	1,015.9	1,012.4	1,005.0
Farm Price ($/Bushel)	BL	8.44	6.83	6.51	6.28	6.05	6.06	6.03	5.94	5.82	5.82
	FB	7.46	6.08	5.82	5.65	5.46	5.48	5.46	5.38	5.28	5.28
Loan Rate ($/Bushel)	U.S.	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94
Target (Reference) Price ($/Bushel)	BL	4.17	4.17	4.17	4.17	4.17	4.17	4.17	4.17	4.17	4.17
	FB	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50
Price Loss Coverage ($/Bushel)	FB	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Agricultural Risk Coverage ($/Acre)	FB	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Production Costs ($/Acre)	U.S.	100.3	102.4	104.6	106.7	108.9	111.0	113.2	115.3	117.5	119.6

Note 1) BL, FB, and U.S. denote baseline scenario, the 2014 Farm Bill scenario, and common variable, respectively.

2) Regional prices are not reported in this table, and are available on request.

Table B-6. (Continued)

Year	Scenario	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Expected Net Returns($/Acre) under BL	CB	332.2	372.8	288.0	271.1	259.3	247.4	248.2	246.7	241.8	235.7
	CP	189.3	243.8	179.9	166.2	156.2	146.3	145.5	143.2	138.4	132.7
	DS	275.0	331.1	259.8	246.9	238.4	229.7	232.0	232.4	229.7	225.8
	LS	462.4	517.2	406.9	385.3	370.5	355.5	357.0	355.5	349.8	342.3
	NP	376.3	424.3	330.1	313.5	302.6	291.5	295.1	296.0	293.0	288.3
	SE	207.3	269.1	201.0	187.5	178.2	168.7	169.5	168.4	164.6	159.7
	SP	318.2	387.6	304.9	291.2	282.5	273.5	277.7	279.6	277.8	274.4
Expected Net Returns($/Acre) under FB	CB	332.2	357.2	273.7	258.0	247.5	236.4	238.1	236.9	232.1	225.9
	CP	189.3	228.4	165.4	152.5	143.5	134.1	134.1	131.9	127.1	121.4
	DS	275.0	315.6	245.4	233.6	226.2	218.2	221.4	222.0	219.4	215.5
	LS	462.4	501.5	392.9	372.8	359.7	345.8	348.5	347.4	341.6	334.1
	NP	376.3	408.6	315.9	300.7	291.4	281.2	286.0	287.3	284.3	279.5
	SE	207.3	253.6	186.5	174.0	165.7	156.9	158.5	157.7	153.9	148.9
	SP	318.2	372.0	290.6	278.2	270.9	262.8	268.0	270.2	268.5	265.1

Note 1) BL, FB, and U.S. denote baseline scenario, the 2014 Farm Bill scenario, and common variable, respectively.

2) Regional prices are not reported in this table, and are available on request.