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FAPRI-MU US Biofuels, Corn Processing, Distillers Grains, Fats, Switchgrass, and Corn Stover Model Documentation

FAPRI-MU Report #09-10

Providing objective analysis for over 25 years

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Overview of FAPRI-MU Biofuels, Corn processing, Distillers Grains, Fats, Switchgrass, and Corn Stover Model Documentation

The model equations listed here represent US biofuel, corn processing, distillers grains, fats, switchgrass, and corn stover markets. The equations and data represent annual conditions on a crop or calendar year. The model is defined as follows.

- *A subset of FAPRI-MU models.*
  These equations are linked to other equations that represent US markets for crops, other crop products, livestock, and livestock products, with additional equations to calculate consumer and government expenditures. These market representations include trade equations that simulate the responses in US exports or imports for changing market conditions. Trade equations can be replaced by links to more complete international model systems, as when linked to FAPRI-ISU models to generate a world baseline.

- *The version of March 2010.*
  Data used in this and other FAPRI-MU models are updated twice each year. Equations are revised as circumstances warrant.

- *The deterministic version of the model.*
  A model solution involves one set of input and one set of output. One path for each exogenous variable is taken for the ten-year period, then the model is solved over that ten year period. The alternative is stochastic simulation: many alternative paths for exogenous variables are used as input, and each one generates a corresponding set of output. Each stochastic simulation involves hundreds of solutions over a ten-year period, each consistent with a different set of assumptions about external conditioning factors. Although the equations listed below are very similar to the FAPRI-MU stochastic version, there are some differences.

The model is intended for forward-looking analysis of policy options. The equations represent current and expected market structures. Where possible, equations and parameters are based on historical data. However, in most instances, the rapid recent changes in biofuel market structure and policy prevent reliable statistical testing of model structure or parameters. Analysts seek feedback from industry experts at formal annual events and informally.

We do not provide impact multipliers. The reader is asked to look at the following publications that use some version of this model to see how various shocks affect key market indicators.

Meyer, Thompson. 2010. "US Biofuel Baseline Briefing Book." FAPRI-MU Report 04-10.

Meyer, Westhoff, Thompson. 2009. "Impacts of Selected US Ethanol Policy Options." FAPRI-MU Report 04-09.

Westhoff, Thompson, Meyer. 2008. "Biofuels: Impact of Selected Farm Bill Provisions and other Biofuel Policy Options" FAPRI-MU Report 06-08.

Donahue, Meyer, Thompson. 2010. "RIN Risks: Using Supply and Demand Behavior to Assess Risk in the Markets for Renewable Identification Numbers used for Renewable Fuel Standard Compliance." Paper presented at the NCCC-134 Applied Commodity Price Analysis, Forecasting, and Market Risk Management. St. Louis, Missouri.

Thompson, Meyer, Westhoff. 2009."How Does Petroleum Price and Corn Yield Volatility Affect Ethanol Markets with and without an Ethanol Use Mandate?" *Energy Policy* 37 (2): 745-749.

Thompson, Meyer, Westhoff. 2010. "What to Conclude about Biofuel Mandates from Evolving Prices for Renewable Identification Numbers?" *American Journal of Agricultural Economics*. Forthcoming.

Thompson, Meyer, Westhoff. 2010. "The New Markets for Renewable Identification Numbers." *Applied Economic Perspectives and Policy*. Forthcoming.

Contents

Model variables and equations

RINs and RFS

RINs and RFS – Variable names and units

BDDEXN	Biodiesel net exports, Oct-Sep	million gallons
BDEQV	Equivalence values, biodiesel	conversion factor
BDPPLTM	Biodiesel price, rack, Oct-Sep	dollars per gallon
BDSPRDOS	Biodiesel production, Oct-Sep	million gallons
BDTAXCR	Biodiesel tax credit, cal. yr.	dollars per gallon
CEWAIVE	Cellulosic RFS-2 Waiver, 1=waived	binary variable
ETCECRFC	Ethanol, cell. credit, FCEA	dollars per gallon ethanol
ETDTESSA	Ethanol ending stocks, Sep-Aug	million gallons
ETEQVCEL	Equivalence values, cellulosic	conversion factor
ETIMCESA	Ethanol cellulosic Imports, Sep-Aug	million gallons
ETNCADV	Non-corn ethanol as advanced	percentage
ETPADSA	Ethanol, other advanced price	dollars per gallon
ETPCEL	Ethanol, cellulosic price	dollars per gallon
ETPFBSA	Ethanol price, Omaha, Sep-Aug	dollars per gallon
ETPRTRSA	Rack equiv. retail price	dollars per gallon
ETSIMPSA	Ethanol imports, Sep-Aug	million gallons
ETSPCESA	Ethanol cellulosic prod, Sep-Aug	million gallons
ETSPNCSA	Ethanol non-corn prod, Sep-Aug	million gallons
ETSPRDSA	Ethanol production, Sep-Aug	million gallons
ETSSUGSA	Domestic sugar ethanol production	assumed zero
ETTAXEX	Fed. ethanol tax credit, cal. yr.	dollars per gallon
RFAD	Renewable fuel standard, advanced biofuels	million gallons
RFADC	Advanced ethanol mandate cost	million dollars
RFADCPG	Advanced ethanol mandate cost (RIN price)	dollars per gallon
RFADRIND	Advanced RIN demotion	million RINs

RFADRINS	Advanced RIN carry out	million RINs
RFADROLO	Advanced RIN carry out rate	percent
RFADSA	RFS, advanced biofuel, Sep-Aug	million gallons
RFADSAE	RFS, effective other advanced biofuel	million gallons
RFADSALC	RFS, advanced mandate adjusted for any waiver	million gallons
RFBD	Renewable fuel standard, biodiesel	million gallons
RFBDC	Biodiesel cost of mandate	million dollars
RFBDCPG	Biodiesel cost of mandate (RIN price)	dollars per gallon
RFBDRIND	Biodiesel RIN demotion	million RINs
RFBDRINS	Biodiesel RIN carry out	million RINs
RFBDROLO	Biodiesel RIN carry out rate	percent
RFBDSA	RFS, biodiesel, Sep-Aug	million gallons
RFBDSAE	RFS, effective biodiesel	million gallons
RFBIOFC	Total biofuel cost of mandate	million dollars
RFCE	Renewable fuel standard, cellulosic	million gallons
RFCEC	Cellulosic mandate cost	million dollars
RFCECPG	Cellulosic ethanol mandate cost (RIN price)	dollars per gallon
RFCERINS	Cellulosic ethanol RIN carry out	million RINs
RFCEROLO	Cellulosic RIN carry out rate	percent
RFCESA	RFS, cellulosic, Sep-Aug	million gallons
RFCESAE	RFS, effective cellulosic	million gallons
RFCNC	Conventional ethanol mandate cost	million dollars
RFCNCPG	Conventional ethanol mandate cost (RIN price)	dollars per gallon
RFCNROLO	Conventional ethanol RIN carryout	million gallons
RFETC	Total ethanol cost of mandate	million dollars
RFOAROLO	Other advanced RIN carry out	million gallons
RFTO	Renewable fuel standard, overall	million gallons
RFTORINE	Total biofuel RIN expiration	million RINs
RFTORINS	Total biofuel RIN carry out	million RINs

RFTOROLO	Total biofuel RIN carry out rate	percent
RFTOSA	RFS, total, Sep-Aug	million gallons
RFTOSAE	RFS, Effective total, Sep-Aug.	million gallons
RFTOSALC	RFS, overall mandate adjusted for any waiver	million gallons

RFS and RINs – Equations

Biodiesel RIN carry out rate

RFBDROLO

```
= MAX  (
          +0.15
         -0.13 *   min(1,RFBDCPG*.66)
         -0.02 *   RFBDCPG*.66
                   , 0  )
```

Biodiesel RIN carry out

RFBDRINS

```
          =   RFBDROLO * lead(RFBDSA)
```

RFS, effective biodiesel

RFBDSAE

```
          =   RFBDSA+RFBDRINS-lag(RFBDRINS)
```

Biodiesel RIN demotion

RFBDRIND

```
          =   BDSPRDOS + BDDEXN
          -   RFBDSAE
```

Cellulosic RIN carry out rate
RFCEROLO
= 0

Cellulosic ethanol RIN carry out
RFCERINS
= RFCEROLO * lead(RFCESA)

RFS, effective cellulosic
RFCESAE
= MAX (ETSPCESA+ETIMCESA ,
RFCESA*(1-CEWAIVE)+(RFCERINS-lag(RFCERINS)))

Adv. ethanol RIN carry out rate
RFADROLO
= MAX (
+0.2
-0.18 * min(1,RFADCPG*1.5)
-0.02 * RFADCPG*1.5
, 0)

Adv. ethanol, RIN carry out
RFADRINS
= RFADROLO * lead(RFADSA)

RFS, advanced mandate adjusted for any waiver
RFADSALC

= RFADSA-RFCESA

RFS, effective other advanced biofuel
RFADSAE

= RFADSA-RFCESA+RFADRINS-lag(RFADRINS)

Adv. ethanol, RIN demotion
RFADRIND

= ETSPNCSA*ETNCADV+ETSIMPSA+ETSSUGSA
+(BDSPRDOS-BDDEXN)*BDEQV
- RFADSAE

Total biofuel RIN carry out rate
RFTOROLO

= MAX (
+0.2
-0.18 * min(1,RFCNCPG*2.5)
-0.02 * RFCNCPG*2.5
, 0)

Total biofuel RIN carry out
RFTORINS

= RFTOROLO*lead(RFTOSA)

RFS, overall mandate adjusted for any waiver
RFTOSALC

= RFTOSA-RFCESA

RFS, Effective total, Sep-Aug.
RFTOSAE

= RFTOSA-RFCESA+RFTORINS-lag(RFTORINS)

Total biofuel RIN expiration
RFTORINE

= (ETSPRDSA-ETSPCESA)+lag(ETDTESSA)-ETDTESSA
+(ETSIMNSA)+BDEQV*(BDSPRDOS-BDDEXN)
- RFTOSAE

RFS, advanced biofuel, Sep-Aug
RFADSA

RFAD/3+lead(RFAD)*2/3

RFS, biodiesel, Sep-Aug
RFBDSA

RFBD*(1/3)+lead(RFBD)*(2/3)

RFS, cellulosic, Sep-Aug
RFCESA

RFCE/3+lead(RFCE)*2/3

RFS, total, Sep-Aug
RFTOSA

= RFTO/3+lead(RFTO)*2/3

Conventional ethanol RIN carryout
RFCNROLO

= RFTORINS-RFADRINS

Other advanced RIN carry out
RFOAROLO

= RFADRINS-BDEQV*RFBDRINS-ETEQVCEL*RFCERINS

Conventional ethanol mandate cost
RFCNC

= RFCNCPG*((ETSPRDSA-ETSPNCSA*ETNCADV-ETSPCESA
-ETSSUGSA)+lag(ETDTESSA)-ETDTESSA
-(ETSIMPSA-ETSIMNSA))

Other adv. ethanol mandate cost
RFADC

= RFADCPG*(ETSPNCSA*ETNCADV+ETSIMPSA+ETSSUGSA)

Cellulosic mandate cost
RFCEC

= RFCECPG*(ETSPCESA+ETIMCESA)

Total ethanol cost of mandate
RFETC

= RFCNC
+ RFADC
+ RFCEC

Biodiesel cost of mandate
RFBDC
= RFBDCPG*(BDSPRDOS-BDDEXN)

Total biofuel cost of mandate
RFBIOFC
= RFETC
+ RFBDC

Ethanol price, Omaha, Sep-Aug
ETPFBSA
= ETPRTRSA+(ETTAXEX/3+lead(ETTAXEX)*2/3)+RFCNCPG

Biodiesel price, rack, Oct-Sep
BDPPLTM
= BDPREQ+(BDTAXCR/4+lead(BDTAXCR)*3/4)+RFBDCPG

Ethanol, other advanced price
ETPADSA
= ETPRTRSA+(ETTAXEX/3+lead(ETTAXEX)*2/3)+RFADCPG

Ethanol, cellulosic price
ETPCEL
= ETPRTRSA+(ETTAXEX/3+lead(ETTAXEX)*2/3)
+(ETCECRFC/3+lead(ETCECRFC)*2/3)+RFCECPG

Ethanol use

Ethanol use – Variable names and units

ETADD	Ethanol additive dummy	proportion
ETADEXPCL	Ethyl alcohol exports, cal. yr.	thousand liters
ETADEXPSA	Ethyl alcohol exports, Sep-Aug	thousand liters
ETASIMNCL	Ethyl alcohol net imports, cal. yr.	million gallons
ETASIMNSA	Ethyl alcohol net imp., Sep-Aug	million gallons
ETASIMPCL	Ethyl alcohol imports, cal. yr.	thousand liters
ETASIMPSA	Ethyl alcohol imports, Sep-Aug	thousand liters
ETDADSA	Ethanol additive market, Sep-Aug	million gallons
ETDE10SA	Ethanol E10 use, Sep-Aug	million gallons
ETDE85SA	Ethanol E85 use, Sep-Aug	million gallons
ETDISCL	Ethanol disapp., cal. yr.	million gallons
ETDISSA	Ethanol disapp., Sep-Aug	million gallons
ETDTESCL	Ethanol end stocks, cal. yr.	million gallons
ETDTESSA	Ethanol ending stocks, Sep-Aug	million gallons
ETE10PEN	Ethanol E10 pen. rate, Sep-Aug	proportion
ETE85PEN	Ethanol E85 pen. rate, Sep-Aug	proportion
ETME10SA	Ethanol E10 market, Sep-Aug	million gallons
ETME85SA	Ethanol E85 market, Sep-Aug	million gallons
ETPBLMG	Blenders margin assumption	dollars per gallon
ETPFBCL	Ethanol price, Omaha, cal. yr.	dollars per gallon
ETPFBSA	Ethanol price, Omaha, Sep-Aug	dollars per gallon
ETPPIACL	Ethanol plant price, IA, cal. yr.	dollars per gallon
ETPPTIA	Ethanol plant price, IA, Sep-Aug	dollars per gallon
ETPRTCL	Ethanol implied retail pr., cal. yr.	dollars per gallon
ETPRTSA	Ethanol implied ret. pr., Sep-Aug	dollars per gallon
ETSIMPCL	Ethanol imports, cal. yr.	million gallons
ETSIMPSA	Ethanol imports, Sep-Aug	million gallons

ETSPCESA	Ethanol cellulosic prod, Sep-Aug	million gallons
ETSPCOSA	Eth. cellulosic prod, ex stover ex switchgrass, Sep-Aug	million gallons
ETSPRDCE	Ethanol production, from Stover and Switchgrass	million gallons
ETSPRDCL	Ethanol prod., cal. yr.	million gallons
ETSPRDSA	Ethanol production, Sep-Aug	million gallons
ETTARS	Ethanol specific tariff, cal. yr.	dollars per gallon
ETTARSSA	Ethanol specific tariff, Sep-Aug	dollars per gallon
ETTARV	Ethanol ad valorem tariff, cal. yr.	percent
ETTARVSA	Ethanol ad val. tariff, Sep-Aug	percent
ETTAXEX	Fed. ethanol tax credit, cal. yr.	dollars per gallon
MGSTOTSA	Motor gas. supplied, Sep-Aug	million gallons
MTDISSA	MTBE disapp., Sep-Aug	million gallons
PDCGNP	GDP deflator	index
PPI	Producer price index	index
PPIRPPSA	Ref. petrol. product pr. ind., Sep-Aug	index
UGPFBCL	Unl. gas. pr., Omaha, cal. yr.	dollars per gallon
UGPRTCL	Unl. gas. retail price, cal. yr.	dollars per gallon
UGPRTSA	Unl. gas. retail price, Sep-Aug	dollars per gallon

Ethanol use – Equations

Ethanol additive market, Sep-Aug

ETDADSA

$$
\begin{aligned}
&= \\
&+100 \\
&-100 * (ETPRTSA)/PPIRPPSA \\
&+ MGSTOTSA*ETADD \\
&-0.9 * MTDISSA
\end{aligned}
$$

Ethanol E10 market, Sep-Aug
ETME10SA

	=	
+0.98		MGSTOTSA*(0.1-ETADD)

Ethanol E10 pen. rate, Sep-Aug
ETE10PEN :
LN(ETE10PEN / (1- ETE10PEN))

	=	
+1		
-2	*	ETPRTSA/UGPRTSA
+24	*	max(0,0.8-ETPRTSA/UGPRTSA)
+16	*	max(0,0.8-lag(ETPRTSA/UGPRTSA))
+8	*	max(0,0.8-lag2(ETPRTSA/UGPRTSA))

Ethanol E10 use, Sep-Aug
ETDE10SA

	=	ETME10SA * ETE10PEN

Ethanol E85 market, Sep-Aug
ETME85SA

	=	
+0.9	*	lag(ETME85SA)
+3	*	(ZTIME - 1980)
+5000	*	max(0,0.67-ETPRTSA/UGPRTSA)
+15000	*	max(0,0.67-lag(ETPRTSA/UGPRTSA))
+10000	*	max(0,0.64-ETPRTSA/UGPRTSA)
+40000	*	max(0,0.64-lag(ETPRTSA/UGPRTSA))

Ethanol E85 pen. rate, Sep-Aug
ETE85PEN :
LN(ETE85PEN / (1-ETE85PEN))

	=	
	+0	
	-2 *	ETPRTSA/UGPRTSA
	+100 *	max(0,0.67-ETPRTSA/UGPRTSA)

Ethanol E85 use, Sep-Aug
ETDE85SA

	=	ETME85SA*ETE85PEN

Ethanol disapp., Sep-Aug
ETDISSA

	=	
	+	ETDADSA
	+	ETDE10SA
	+	ETDE85SA

Ethanol disapp., cal. yr.
ETDISCL

	=	
	+	ETSPRDCL
	+	ETSIMPCL
	+	lag(ETDTESCL)
	-	ETDTESCL

Ethyl alcohol net imports, cal. yr.
ETASIMNCL

= lag(ETASIMNSA*2/3+(ETASIMNSA)/3)

Ethyl alcohol exports, cal. yr.
ETADEXPCL

=
+3785 * lag(ETADEXPSA*2/3+(ETADEXPSA)/3)

Ethanol ending stocks, Sep-Aug
ETDTESSA

=
+375
-10000 * ETPFBSA/lead(PDCGNP)
+0.05 * ETSPRDSA

Ethanol end stocks, cal. yr.
ETDTESCL

=
-15
+0.9 * lag(ETDTESSA)
+0.007 * ETSPRDSA

Blenders margin assumption
ETPBLMG

= lag(ETPBLMG)*(1+(PPI/lag(PPI)-1)/3+(lag(PPI)/lag2(PPI)-1)*2/3)

Ethanol plant price, IA, cal. yr.
ETPPIACL

= ETPFBCL*(ETPPTIA(t=2007) /ETPFBSA(t=2007))

Ethanol plant price, IA, Sep-Aug
ETPPTIA

= ETPFBSA*(ETPPTIA(t=2007) /ETPFBSA(t=2007))

Ethanol implied retail pr., cal. yr.
ETPRTCL

= ETPFBCL+UGPRTCL-UGPFBCL-ETTAXEX

Ethyl alcohol net imp., Sep-Aug
ETASIMNSA

= ETASIMPSA-ETADEXPSA

Ethanol imports, Sep-Aug
ETSIMPSA

= lag(ETSIMPSA)+(ETASIMPSA-lag(ETASIMPSA))

Ethanol cellulosic prod, Sep-Aug
ETSPCESA

= ETSPCOSA+ETSPRDCE

Ethanol specific tariff, Sep-Aug
ETTARSSA

= ETTARS/3+lead(ETTARS)*2/3

Ethanol ad val. tariff, Sep-Aug
ETTARVSA

= ETTARV/3+lead(ETTARV)*2/3

Ethyl alcohol imports, cal. yr.
ETASIMPCL

= ETSIMNCL*3.785*1000+ETADEXPCL

Conventional ethanol production

Conventional ethanol production – Variable names and units

CLPRCH	Corn oil price, Chicago	cents per pound
CRDGAS	Corn fuel alcohol use	million bushels
CRDGDM	Corn, ethanol dry mill	million bushels
CRDGLD	Corn glucose & dextrose	million bushels
CRDGWM	Corn, ethanol wet mill	million bushels
CRDHFC	Corn HFCS use	million bushels
CRDOWM	Corn, other wet mill	million bushels
CRDSTR	Corn starch use	million bushels
CRGMWH	HFCS wet mill gross mar.	dollars per bushel
CRNRBDM	Corn dry mill net ret., Sep-Aug	dollars per bushel
CRNRBWM	Corn wet mill net ret., Sep-Aug	dollars per bushel
CROTCDM	Corn other dry mill costs	dollars per gallon
CROTCWM	Corn, other wet mill costs	dollars per gallon
CRPFRM	Corn farm price, U.S.	dollars per bushel
DGPMKT	DDG price, Lawrenceburg	dollars per ton
DGYLDDM	DDG yield, dry mill	pounds per bushel
ETCAPDM	Dry mill capacity, Sep-Aug avg.	million gallons
ETCAPTO	Ethanol total capacity, Jan	million gallons
ETCAPWM	Wet mill capacity, Sep-Aug avg.	million gallons
ETCUSDM	Eth. dry mill cap. use, Sep-Aug	proportion
ETCUSWM	Eth. wet mill cap. use, Sep-Aug	proportion
ETPADSA	Ethanol, other advanced price	dollars per gallon
ETPFBCL	Ethanol price, Omaha, cal. yr.	dollars per gallon
ETPFBSA	Ethanol price, Omaha, Sep-Aug	dollars per gallon
ETPRTRSA	Rack equiv. retail price	dollars per gallon
ETPRTSA	Ethanol implied ret. pr., Sep-Aug	dollars per gallon

ETSPCESA	Ethanol cellulosic prod, Sep-Aug	million gallons
ETSPNCSA	Ethanol non-corn prod, Sep-Aug	million gallons
ETSPRDCL	Ethanol prod., cal. yr.	million gallons
ETSPRDSA	Ethanol production, Sep-Aug	million gallons
ETTAXEX	Fed. ethanol tax credit, cal. yr.	dollars per gallon
ETYLDDM	Ethanol yield--dry mill, Sep-Aug	gallons per bushel
ETYLDWM	Ethanol yield--wet mill, Sep-Aug	gallons per bushel
FCNRT	Fractionation net return, exc. corn	dollars per gallon
FCSHR	Share of dry mills fractionating	proportion
GFPR21	Gluten feed pr, 21%, IL Pts	dollars per ton
GFYLDWM	Gluten feed yield, wet mill	pounds per bushel
GMPR60	Gluten meal pr, 60%, IL pts	dollars per ton
PDCGNP	GDP deflator	index
PPINGAS	PPI for gas fuels, 1982=100	index
SGPFRM	Sorghum farm price, U.S.	dollars per bushel
UGPRTSA	Unl. gas. retail price, Sep-Aug	dollars per gallon
WHPFRM	Wheat farm price, U.S.	dollars per bushel

Conventional ethanol production – Equations

Rack equiv. retail price

ETPRTRSA

=	
+	ETPRTSA
0	(ETTAXEX1*2/3+ETTAXEX/3)
-1	(UGPRTSA-UGPFBSA)

Ethanol price, Omaha, cal. yr.
ETPFBCL

	=	
+0.333	*	ETPFBSA
+0.667	*	lag(ETPFBSA)

Corn dry mill net ret., Sep-Aug
CRNRBDM

	=	
+1	*	ETPFBSA*ETYLDDM
+1	*	DGPMKT*DGYLDDM/2000
+1	*	FCSHR * FCNRT*ETYLDDM
-1	*	CRPFRM
-0.00095	*	(lead(PPINGAS)*2/3+PPINGAS/3)*ETYLDDM
-1	*	CROTCDM*ETYLDDM

Corn other dry mill costs
CROTCDM

	=	CROTCDM*AVERAGE(PDCGNP/lag(PDCGNP),1)

Dry mill capacity, Sep-Aug avg.
ETCAPDM

```
                =   MAX (
              +0
            +1 *  lag(ETCAPDM)
         -0.04 *  lag10(ETDCAPDM)
       +10000 *   (CRNRBDM-0.5)/PDCGNP
       +25000 *   lag((CRNRBDM-0.5)/PDCGNP)
       +70000 *   lag2((CRNRBDM-0.5)/PDCGNP)
       +45000 *   lag3((CRNRBDM-0.5)/PDCGNP)
       +10000 *   lag4((CRNRBDM-0.5)/PDCGNP)
                  ,
            +1 *  lag(ETCAPDM)
         -0.04 *  lag10(ETDCAPDM)
                  )*(1+0.07*FCSHR)
```

Eth. dry mill cap. use, Sep-Aug
ETCUSDM :
LN(ETCUSDM / (1-ETCUSDM))

```
                =
              +0
          +450 *  CRNRBDM/PDCGNP
```

Corn, ethanol dry mill
CRDGDM

```
                =   ETCUSDM*ETCAPDM/ETYLDDM
```

Corn wet mill net ret., Sep-Aug
CRNRBWM

```
                =
                +   ETPFBSA*ETYLDWM
                +   GFPR21*GFYLDWM/2000
                +   GMPR60*GMYLDWM/2000
                +   CLPRCH*CLYLDWM/100
                -   CRPFRM
     -0.00075 *     (lead(PPINGAS)*2/3+PPINGAS/3)*ETYLDWM
                -   CROTCWM*ETYLDWM
```

Corn, other wet mill costs
CROTCWM

```
                =   CROTCWM*AVERAGE(PDCGNP/lag(PDCGNP),1)
```

Wet mill capacity, Sep-Aug avg.
ETCAPWM

```
                =   MAX (
               +0
               +1 *     lag(ETCAPWM)
             -0.04 *    lag10(ETCAPWM)
            +1000 *     (CRNRBWM-0.5)/PDCGNP
            +2500 *     lag((CRNRBWM-0.5)/PDCGNP)
            +4500 *     lag2((CRNRBWM-0.5)/PDCGNP)
            +3000 *     lag3((CRNRBWM-0.5)/PDCGNP)
                        ,
               +1 *     lag(ETCAPWM)
             -0.04 *    lag10(ETCAPWM)
                        )
```

Eth. wet mill cap. use, Sep-Aug
ETCUSWM :
LN(ETCUSWM / (1-ETCUSWM))
=
+1
+450 * CRNRBWM/PDCGNP
-20 * CRGMWH/PDCGNP

Ethanol total capacity, Jan
ETCAPTO
=
+ (lag2(ETCAPDM)+lag2(ETCAPWM)+lag2(ETSPCESA))/6
+ (lag(ETCAPDM)+lag(ETCAPWM)+lag(ETSPCESA))*5/6

Corn, ethanol wet mill
CRDGWM
= ETCUSWM*ETCAPWM/ETYLDWM

Corn fuel alcohol use
CRDGAS
= CRDGDM+CRDGWM

Corn, other wet mill
CRDOWM
= CRDHFC+CRDGLD+CRDSTR

Ethanol non-corn prod, Sep-Aug
ETSPNCSA

```
                =
             -170
           +0.6 *  LAG(ETSPNCSA)
          +5000 *  (0.75*ETPADSA+0.25*ETPFBSA)/PDCGNP
           +250 *  (0.75*ETPADSA+0.25*ETPFBSA)/SGPFRM
           +150 *  (0.75*ETPADSA+0.25*ETPFBSA)/WHPFRM
```

Ethanol production, Sep-Aug
ETSPRDSA

```
                =
                +  ETYLDDM*CRDGDM
                +  ETYLDWM*CRDGWM
                +  ETSPNCSA
                +  ETSPCESA
```

Ethanol prod., cal. yr.
ETSPRDCL

```
                =  lag(ETSPRDSA)*2/3+ETSPRDSA/3
```

Biodiesel

Biodiesel – Variable names and units

BDCAPRO	Canola oil biodiesel capacity	million gallons
BDCAPSO	Biodiesel capacity, Oct-Sep avg.	million gallons
BDCUSRO	Biodiesel cap. use-canola oil	proportion
BDCUSSO	Biodiesel capacity use-soyoil	proportion
BDDDOM	Biodiesel consumption, Oct-Sep	million gallons
BDNRTRO	Canola oil biodiesel net returns	dollars per gallon
BDNRTSO	Biodiesel net returns	dollars per gallon
BDOTCSO	Biodiesel other op. costs	dollars per gallon
BDOTPRD	Other biodiesel, Oct-Sep (exc. canola)	million gallons
BDPPLTM	Biodiesel price, rack, Oct-Sep	dollars per gallon
BDPREQ	Biodiesel retail price equiv.	dollars per gallon
BDROPRD	Biodiesel from canola oil, Oct-Sep	million gallons
BDSOPRD	Biodiesel from soyoil, Oct-Sep	million gallons
BDSPRD	Biodiesel production, cal. yr.	million gallons
BDSPRDOS	Biodiesel production, Oct-Sep	million gallons
BDSYLD	Biodiesel yield	pounds per gallon
DIPRSM	Diesel, refiner sales price, Oct-Sep	dollars per gallon
DISLS	Highway diesel sales, cal. yr.	billion gallons
GYPR	Glycerin price, Sep-Aug	dollars per pound
PDCGNP	GDP deflator	index
ROPMKT	Canola oil price	dollars per cwt.
SODBIO	Soybean oil for biodiesel, Oct-Sep	million pounds
SOPMKT	Soybean oil price, Decatur	dollars per cwt

Biodiesel – Equations

Biodiesel consumption, Oct-Sep

BDDDOM

=
+5100
-4675 * (BDPREQ/(DIPRSM))
+0.01 * DISLS

Biodiesel other op. costs

BDOTCSO

= lag(BDOTCSO)*(1+0.5*(PDCGNP/lag(PDCGNP)-1))

Biodiesel net returns

BDNRTSO

= BDPPLTM
+0.97 * GYPR
- SOPMKT*BDSYLD/100
- BDOTCSO

Biodiesel capacity, Oct-Sep avg.
BDCAPSO

	=	MAX(
+1	*	lag(BDCAPSO)
-0.05	*	lag10(BDCAPSO)
+10000	*	(BDNRTSO-0.2)/PDCGNP
+25000	*	lag((BDNRTSO-0.2)/PDCGNP)
+60000	*	lag2((BDNRTSO-0.2)/PDCGNP)
+20000	*	lag3((BDNRTSO-0.2)/PDCGNP)
		,
+1	*	lag(BDCAPSO)
-0.05	*	lag10(BDCAPSO)
		)

Biodiesel capacity use-soyoil
BDCUSSO :
LN(BDCUSSO / (1-BDCUSSO))

	=	
-3.5		
+550	*	BDNRTSO/PDCGNP
+0.4	*	$LN((BDCAPSO-BDCAPSO_{1996})/BDCAPSO_{1996})$

Biodiesel from soyoil, Oct-Sep
BDSOPRD

	=	BDCAPSO*BDCUSSO

Soybean oil for biodiesel, Oct-Sep
SODBIO

	=	BDSOPRD*BDSYLD

Other biodiesel, Oct-Sep (exc. canola)
BDOTPRD

	=	MAX(
-100		
+0.5 *		lag(BDOTPRD)
+0.15 *		BDSOPRD
+10000 *		BDPPLTM/PDCGNP
		, 0)

Canola oil biodiesel net returns
BDNRTRO

	=	BDPPLTM
+0.97 *		GYPR
	-	ROPMKT*BDSYLD/100
	-	BDOTCSO

Canola oil biodiesel capacity

BDCAPRO

= MAX(
+1 * lag(BDCAPRO)
-0.05 * lag10(BDCAPRO)
+5000 * (BDNRTRO)/PDCGNP
+10000 * lag((BDNRTRO)/PDCGNP)
+25000 * lag2((BDNRTRO)/PDCGNP)
+12500 * lag3((BDNRTRO)/PDCGNP)
,
+1 * lag(BDCAPRO)
-0.05 * lag10(BDCAPRO)
)

Biodiesel cap. use-canola oil

BDCUSRO :

LN(BDCUSRO / (1-BDCUSRO))

=
-1
+250 * BDNRTRO/PDCGNP
+0.25 * ((BDCAPRO-$BDCAPRO_{1995}$)/$BDCAPRO_{1995}$)

Biodiesel from canola oil, Oct-Sep

BDROPRD

= BDCAPRO*BDCUSRO

Biodiesel production, cal. yr.

BDSPRD

= lag(BDSPRDOS)*0.75+BDSPRDOS*0.25

Biodiesel production, Oct-Sep
BDSPRDOS
= BDSOPRD+BDOTPRD+BDROPRD

Biofuel and RIN Market-clearing

Biofuel and RIN Market-clearing – Variable names and units

BDDDOM	Biodiesel consumption, Oct-Sep	million gallons
BDDEXN	Biodiesel net exports, Oct-Sep	million gallons
BDEQV	Equivalence values, biodiesel	conversion factor
BDPREQ	Biodiesel retail price eqiv.	dollars per gallon
BDSPRDOS	Biodiesel production, Oct-Sep	million gallons
ETCECR10	Ethanol, cell. allowance, from 2010	dollars per gallon ethanol
ETDTESSA	Ethanol ending stocks, Sep-Aug	million gallons
ETIMCESA	Ethanol cellulosic Imports, Sep-Aug	million gallons
ETNCADV	Non-corn ethanol as advanced	percentage
ETPRTSA	Ethanol implied ret. pr., Sep-Aug	dollars per gallon
ETSIMNSA	Ethanol net imports, Sep-Aug	million gallons
ETSIMPSA	Ethanol imports, Sep-Aug	million gallons
ETSPCESA	Ethanol cellulosic prod, Sep-Aug	million gallons
ETSPRDSA	Ethanol production, Sep-Aug	million gallons
ETSSUGSA	Domestic sugar ethanol production	assumed zero
RFADCPG	Oth. adv. eth. mandate cost/gal.	dollars per gallon
RFADSAE	RFS, Eff. other advanced biofuel	million gallons
RFBDCPG	Biodiesel cost of mandate/gal.	dollars per gallon
RFBDSAE	RFS, Effective biodiesel	million gallons
RFCECPG	Cell. ethanol mandate cost/gal.	dollars per gallon
RFCNCPG	Conv. ethanol mandate cost/gal	dollars per gallon
RFTOSAE	RFS, Effective total, Sep-Aug.	million gallons

Biofuel and RIN Market-clearing – Equations

Biofuel markets

Ethanol market clearing (solves for ETPRTSA)

```
0 =  ETSPRDSA+lag(ETDTESSA)+ETSIMNSA
     -ETDTESSA-ETDISSA
```

Biodiesel market clearing (solves for BDPREQ)

```
0 =  BDSPRDOS-BDDEXN-BDDDOM
```

RIN markets

Conventional RIN price

Equation to solve RFCNCPG

Conventional RIN clearing with complementary slackness

```
0 =  (
     (ETSPRDSA-ETSPCESA)+lag(ETDTESSA)-
     ETDTESSA
        +(ETSIMNSA)+BDEQV*(BDSPRDOS-
     BDDEXN)
   - RFTOSAE
     ) * RFCNCPG
```

Advanced RIN price

Equations to solve RFADCPG

Alternative 1

Advanced RIN clearing with complementary slackness

0 = (
ETSPNCSA*ETNCADV+ETSIMPSA+ETSSUGSA
+(BDSPRDOS-BDDEXN)*BDEQV
- RFADSAE
) * RFADCPG

Alternative 2

RIN price associated with broader mandate

RFCNCPG

RFADCPG

= MAX (Alternative 1, Alternative 2)

Cellulosic RIN price

Equations to solve RFCECPG

Alternative 1

Cellulosic RIN clearing with complementary slackness

0 = (
ETSPCESA+ETIMCESA
- RFCESAE
) * RFCECPG

Alternative 2

RIN price associated with broader mandate

RFADCPG

Alternative 3

Credit established by EISA in the event that the cellulosic mandate is waived

ETCECR10

RFCECPG

= MIN (MAX (Alternative 1, Alternative 2),
Alternative 3)

Biodiesel RIN price

Equations to solve RFBDCPG

Alternative 1

Biodiesel RIN clearing with complementary slackness

0 = (
BDSPRDOS-BDDEXN
- RFBDSAE
) * RFBDCPG

Alternative 2

RIN price associated with broader mandate

RFADCPG

RFBDCPG

= MAX (Alternative 1, Alternative 2)

Motor fuel use

Motor fuel use – Variable names and units

DIPRS	Diesel, refiner sales price, cal. yr.	dollars per gallon
DIPRSM	Diesel, refiner sales price, Oct-Sep	dollars per gallon
DIPRT	Retail #2 diesel price, cal. yr.	dollars per gallon
DIPRTM	Retail #2 diesel price, Oct-Sep	dollars per gallon
DISLS	Highway diesel sales, cal. yr.	billion gallons
ETPRTSA	Ethanol implied ret. pr., Sep-Aug	dollars per gallon
MGSTOTCL	Motor gas. supplied, cal. yr.	million gallons
MGSTOTSA	Motor gas. supplied, Sep-Aug	million gallons
PDCGNP	GDP deflator	index
POILRAP	Refiners' crude oil acquisition price	dollars per barrel
POILWTI	West TX Interm. oil price	dollars per barrel
POPTOTW	Population	million
PPIRPP	Ref. petrol. product pr. ind.	index
PPIRPPSA	Ref. petrol. product pr. ind., Sep-Aug	index
RFBDC	Biodiesel cost of mandate	million dollars
RFETC	Total ethanol cost of mandate	million dollars
UGPFBCL	Unl. gas. pr., Omaha, cal. yr.	dollars per gallon
UGPFBSA	Unl. gas. pr., Omaha, Sep-Aug	dollars per gallon
UGPRTCL	Unl. gas. retail price, cal. yr.	dollars per gallon
UGPRTSA	Unl. gas. retail price, Sep-Aug	dollars per gallon
ZCE92W	Real consumer expend.	billion 1992 dollars

Motor fuel use – Equations

Refiners' crude oil acquisition price
POILRAP
=
-2
+0.95 * POILWTI

Ref. petrol. product pr. ind.
PPIRPP
=
+0.1
+0.003 * PDCGNP
+0.022 * POILRAP

Unl. gas. pr., Omaha, Sep-Aug
UGPFBSA
=
+ PPIRPPSA

Unl. gas. pr., Omaha, cal. yr.
UGPFBCL
=
+ lag(UGPFBSA)*2/3 + UGPFBSA/3

Unl. gas. retail price, Sep-Aug
UGPRTSA

=

+0.47

+ UGPFBSA

+ RFETC/MGSTOTSA

+0.001 * PDCGNP/3+ lead(PDCGNP)*2/3

Unl. gas. retail price, cal. yr.
UGPRTCL

=

+ lag(UGPRTSA)*2/3 + UGPRTSA/3

Diesel, refiner sales price, cal. yr.
DIPRS

=

+ PPIRPP

Diesel, refiner sales price, Oct-Sep
DIPRSM

=

+ 0.25*DIPRS+0.75*lead(DIPRS)

Retail #2 diesel price, cal. yr.
DIPRT

```
            =
         +0.5
            +  DIPRS
            +  RFBDC/DISLS
      +0.001 *  PDCGNP
```

Retail #2 diesel price, Oct-Sep
DIPRTM

```
            =
            +  0.25*DIPRT+0.75*lead(DIPRT)
```

Motor gas. supplied, Sep-Aug
MGSTOTSA

```
            =  (
         -143
       +0.75 *  lag(MGSTOTSA)/(lag(POPTOTW)/3+POPTOTW*2/3)
       -2000 *  UGPRTSA/(PDCGNP/3+lead(PDCGNP)*2/3)
       -1500 *  lag(UGPRTSA)/(lag(PDCGNP)/3+PDCGNP*2/3))
        -140 *  ETPRTSA/(PDCGNP/3+lead(PDCGNP)*2/3)
        -105 *  lag(ETPRTSA)/(lag(PDCGNP)/3+PDCGNP*2/3)
        +110 *  ln((ZCE92W/3+lead(ZCE92W)*2/3)/(POPTOTW/3+lead(POPTOTW)*2/3))

          -1 *  (ZTIME-1980)
                )
                *(POPTOTW/3+lag(POPTOTW)*2/3)
```

Motor gas. supplied, cal. yr.
MGSTOTCL

```
            =
            +  lag(MGSTOTSA)*2/3+MGSTOTSA/3
```

Highway diesel sales, cal. yr.
DISLS

```
            =  (
          -45
       -800 *  DIPRT/PDCGNP
        +60 *  ln(ZCE92W/POPTOTW)
         +0 *  (ZTIME-1980)
               )
               *POPTOTW
```

Cellulosic ethanol

Cellulosic ethanol – Variable names and units

BPYLDST	Stover, byproduct yield from ethanol production	ton per ton
BPYLDSW	Switchgrass, byproduct yield from ethanol production	ton per ton
BRENRS	Barley expected net returns	dollars per acre
CRENRS	Corn expected net returns	dollars per acre
CRNRML	Corn market + LDP net returns	dollars per acre
CROTCDM	Corn other dry mill costs	dollars per gallon
CRSYLD	Corn yield	bushels per acre
CRVARC	Corn variable production costs	dollars per acre
CTENRS	Cotton expected net returns	dollars per acre
ETCAPCEST	Stover ethanol capacity	million dry tons
ETCAPCEST_E	Stover ethanol effective capacity	million dry tons
ETCAPCEST_ST	Stover ethanol capacity using stover	million dry tons
ETCAPCEST_SW	Stover ethanol capacity using switchgrass	million dry tons
ETCAPCESW	Switchgrass ethanol capacity	million dry tons
ETCAPCESW_E	Switchgrass ethanol effective capacity	million dry tons
ETCAPCESW_ST	Switchgrass ethanol capacity using switchgrass	million dry tons
ETCAPCESW_SW	Switchgrass ethanol capacity using Switchgrass	million dry tons
ETCCAPST	Facility capital costs for stover	dollars per ton
ETCCAPSW	Facility capital costs for switchgrass	dollars per ton
ETCECR10	Ethanol, cell. allowance, from 2010	dollars per gallon ethanol
ETCECRFC	Ethanol, cell. credit, FCEA	dollars per gallon ethanol
ETCECRM	Ethanol, cell. credit min., Sep-Aug	dollars per gallon ethanol
ETCECRMC	Ethanol, cellulosic allowance min.	dollars per gallon ethanol
ETCECRT	Ethanol, cell. credit trigger, Sep-Aug	dollars per gallon gas
ETCECRTC	Ethanol, cellulosic allowance trigger	dollars per gallon gas
ETCEVARC	Cellulosic variable costs	dollars per gallon

ETCUSCEST	Stover ethanol effective capacity utilization	percent
ETCUSCESW	Switchgrass ethanol effective capacity utilization	percent
ETNRBST	Ethanol net returns using Stover	dollars per ton
ETNRBSW	Ethanol net returns using Switchgrass	dollars per ton
ETPADSA	Ethanol, other advanced price	dollars per gallon
ETPBPST	Price of byproduct of ethanol from stover	dollars per ton
ETPBPSW	Price of byproduct of ethanol from switchgrass	dollars per ton
ETPCEL	Ethanol, cellulosic price	dollars per gallon
ETPRTRSA	Rack equiv. retail price	dollars per gallon
ETPSUBST	Subsidy to ethanol production from stover	dollars per gallon
ETPSUBSW	Subsidy to ethanol production from switchgrass	dollars per gallon
ETSPCOSA	Ethanol cellulosic prod, ex stover ex switchgrass, Sep-Aug	million gallons
ETSPRDCE	Ethanol production, from Stover and Switchgrass	million gallons
ETSPRDST	Cellulosic (from ST) ethanol production	million gallons
ETSPRDSW	Cellulosic (from SW) ethanol production	million gallons
ETTAXEX	Fed. ethanol tax credit, cal. yr.	dollars per gallon
ETVBPEST	Electricity value coproduced with ethanol from stover	dollars per ton
ETVBPESW	Electricity value coproduced with eth. from switchgrass	dollars per ton
ETYLDST	Ethanol yield, stover	gal per ton
ETYLDSW	Ethanol yield, switchgrass	gal per ton
ETYTECSW	Trend Ethanol yield, switchgrass	gal per ton
HAPFRM	Hay price	dollars per ton
OTENRS	Oats expected net returns	dollars per acre
PDCGNP	GDP deflator	index
PNENRS	Peanuts expected net returns	dollars per acre
PPINGAS	PPI for gas fuels, 1982=100	index
PPIRPPSA	Ref. petrol. product pr. ind., Sep-Aug	index
RCENRS	Rice expected net returns	dollars per acre

S2ENRS	Soybean-wheat (double cropped) expected net returns	dollars per acre
SBENRS	Soybean expected net returns	dollars per acre
SBNRML	Soybean market + LDP net returns	dollars per acre
SBVARC	Soybean variable production costs	dollars per acre
SFENRS	Soybean expected net returns	dollars per acre
SGENRS	Sorghum expected net returns	dollars per acre
ST_MGR	Stover gross returns	dollars per acre
ST_NRS	Stover net returns	dollars per acre
STC__FUL	Stover production costs, fuel	dollars per ton
STCTOTNF	Stover production costs, non-fuel	dollars per ton
STCTRANS	Stover cost of transport, farm edge to final	dollars per ton
STCVARTR	Stover variable costs	dollars per ton
STDENG	Stover energy use	million dry tons
STDGET	Stover for ethanol production	million dry tons
STDTES	Stover ending stocks	million dry tons
STEMGR1	Stover expected gross returns t+1	dollars per acre
STENRS1	Stover estimated net-returns t+1	dollars per acre
STEPFM1	Stover expected price	dollars per ton
STEYLD1	Stover expected yield	dry tons per acre
STOTCET	Ethanol production costs, other, stover	dollars per ton
STPFRM	Stover farm edge price	dollars per ton
STPPLT	Stover plant price	dollars per ton
STPRISK1	Policy risk to discount stover returns (1=none)	coefficient
STPRSUB	Stover, BCAP subsidy	dollars per ton
STRMRT	Stover removal rate, % of total available	percent
STRMRTMX	Maximum corn stover removal rate, national average	percent
STRMRTPA	Maximum corn stover removal rate, one farm	percent
STSPRD	Stover production	million dry tons
STSYLD1	Stover yield, t+1	dry tons per acre

STVENG	Stover, direct burn energy value	dollars per ton
SWACSLIP	Switchgrass slippage rate	percent
SWC__FUL	Switchgrass production costs, fuel	dollars per ton
SWCTOTNF	Switchgrass production costs, non-fuel	dollars per ton
SWCTRANS	Switchgrass cost of transport, farm edge to final	dry tons per acre
SWCVARTR	Switchgrass variable costs	dollars per ton
SWDENG	Switchgrass energy use	million dry tons
SWDFED	Switchgrass 'other' use	million dry tons
SWDGET	Switchgrass for ethanol production	million dry tons
SWDTES	Switchgrass ending stocks	million dry tons
SWEMGR1	Expected switchgrass gross returns	dollars per acre
SWENRS	Switchgrass net returns	dollars per acre
SWENRS1	Expected switchgrass net returns	dollars per acre
SWEPFM1	Switchgrass expected farm price	dollars per ton
SWEYLD1	Switchgrass expected yield	dollars per ton
SWOTCET	Ethanol production costs, other, switchgrass	dollars per ton
SWPFRM	Switchgrass farm price	dollars per ton
SWPMIN	Lower bound on switchgrass price	dollars per ton
SWPPLT	Switchgrass plant price	dollars per ton
SWPRISK1	Policy risk to discount switchgrass returns (1=none)	coefficient
SWPRSUB	Switchgrass, BCAP subsidy	dollars per ton
SWSHAR	Switchgrass area harvested	million acres
SWSPLT1_Y1	Switchgrass area planted 1 year old t+1	million acres
SWSPLT1_Y2	Switchgrass area planted 2 year old t+1	million acres
SWSPLT1_Y3	Switchgrass area planted 3+ year old t+1	million acres
SWSPRD	Switchgrass production	million dry tons
SWSYLD1	Switchgrass yield average t+1	dry tons per acre
SWSYLDA1	Switchgrass yield, area 1 year old, t+1	dry tons per acre
SWSYLDB1	Switchgrass yield, area 2 year old, t+1	dry tons per acre

SWSYLDC1	Switchgrass yield, area 3+ year old, t+1	dry tons per acre
SWVENG	Switchgrass, direct burn energy value	dollars per ton
UGPFBSA	Unl. gas. pr., Omaha, Sep-Aug	dollars per gallon
WHENRS	Wheat expected net returns	dollars per acre
WHNRML	Wheat market + LDP net returns	dollars per acre
WHVARC	Wheat variable production costs	dollars per acre
WPI051	Coal prices paid index	index

Cellulosic Ethanol - Equations

Ethanol, cellulosic price

ETPCEL

= MAX(
ETPADSA ,
+ (ETPRTRSA+(ETCECR10*1/3+ETCECR10(-10*2/3)
+(ETTAXEX*1/3+ETTAXEX(-1)*2/3))
+ (ETCECRFC/3+lag(ETCECRFC)*2/3)

Ethanol, cell. allowance, from 2010

ETCECR10

= MAX(ETCECRMC,ETCECRTC-UGPFBSA)

Ethanol, cell. credit, FCEA

ETCECRFC

= 1.01-ETTAXEX

Ethanol, cell. credit min., Sep-Aug

ETCECRM

= ETCECRMC*1/3+lead(ETCECRMC)*2/3

Ethanol, cellulosic allowance min.
ETCECRMC

= lag(ETCECRMC) * (1+(PDCGNP/lag(PDCGNP)-1))

Ethanol, cell. credit trigger, Sep-Aug
ETCECRT

= ETCECRTC*1/3 + lead(ETCECRTC)*2/3

Ethanol, cellulosic allowance trigger
ETCECRTC

= lag(ETCECRTC) * (1+ (PDCGNP/lag(PDCGNP)-1))

Cellulosic variable costs
ETCEVARC

=
+0.0005 * CRVARC
+0.001 * WHVARC
+0.001 * SBVARC
+0.002 * HAPFRM
+0.0005 * CRNRML
+0.002 * WHNRML
+0.0008 * SBNRML
+0.0005 * (PPINGAS1*2/3+lag(PPINGAS1)/3)
+2 * CROTCDM

Ethanol cellulosic prod, ex stover ex switchgrass, Sep-Aug
ETSPCOSA

=
+0.5 * ETPCEL/ETCEVARC*lag(ETSPCOSA)
+30 * max(0,ZTIME-2010)

Stover expected price
STEPFM1

= (
+0.25
+0.75 * lag(STSYLD1/STEYLD1)
)
* STPFRM

Switchgrass expected farm price
SWEPFM1

= (
+0.25
+0.75 * lag(SWSYLDC1/SWEYLD1)
)
* SWPFRM

Stover expected gross returns t+1
STEMGR1

=
STEPFM1*STEYLD1*STRMRTPA

Expected switchgrass gross returns
SWEMGR1

=
0.9 SWEPFM1*SWEYLD1

Stover estimated net-returns t+1
STENRS1

= STEMGR1 - (STCTOTNF+STC__FUL) + STPRSUB

Stover gross returns
ST_MGR

= STPFRM*lag(STSYLD1)

Stover net returns
ST_NRS

= ST_MGR - (STCTOTNF+STC__FUL) + STPRSUB

Expected switchgrass net returns
SWENRS1

= SWEMGR1 - (SWCTOTNF+SWC__FUL) + SWPRSUB

Stover cost of transport, farm edge to final
STCTRANS

=
+0
+1 * STCVARTR
+0 * ln(ETSPRDST+.0001)
+10.604 * PPIRPPSA/PPIRPPSA2008
+0 * PPIRPPSA*ln(ZTIME-1999)

Switchgrass cost of transport, farm edge to final
SWCTRANS

	=	
+0		
+1	*	SWCVARTR
+0	*	ln(ETSPRDSW+.0001)
+7.0089	*	PPIRPPSA/PPIRPPSA2008
+0	*	PPIRPPSA*ln(ZTIME-1999)

Stover plant price
STPPLT

	=	STPFRM + STCTRANS

Switchgrass plant price
SWPPLT

	=	SWPFRM + SWCTRANS

Switchgrass area planted 1 year old t+1

```
SWSPLT1_Y1
                    =  MAX(
                   -1
                 -0.05 *  BRENRS/PDCGNP*2/3+lag(BRENRS/PDCGNP)/3
                 -0.05 *  (CRENRS+lag(STENRS1))/PDCGNP*2/3
                             +lag((CRENRS+lag(STENRS1))/PDCGNP)/3
                 -0.05 *  CTENRS/PDCGNP*2/3+lag(CTENRS/PDCGNP)/3
                 -0.05 *  OTENRS/PDCGNP*2/3+lag(OTENRS/PDCGNP)/3
                 -0.05 *  PNENRS/PDCGNP*2/3+lag(PNENRS/PDCGNP)/3
                 -0.05 *  RCENRS/PDCGNP*2/3+lag(RCENRS/PDCGNP)/3
                 -0.05 *  SBENRS/PDCGNP*2/3+lag(SBENRS/PDCGNP)/3
                 -0.05 *  S2ENRS/PDCGNP*2/3+lag(S2ENRS/PDCGNP)/3
                 -0.05 *  SGENRS/PDCGNP*2/3+lag(SFENRS/PDCGNP)/3
                 -0.05 *  SFENRS/PDCGNP*2/3+lag(SFENRS/PDCGNP)/3
                 -0.05 *  WHENRS/PDCGNP*2/3+lag(WHENRS/PDCGNP)/3
                  +1.6 *  SWENRS/PDCGNP*2/3+lag(SWENRS/PDCGNP)/4
                          , 0)
```

Switchgrass area planted 2 year old t+1

```
SWSPLT1_Y2
                    =  MAX(
                   +1 *  min(0,SWENRS/PDCGNP)
                 +0.97 *  lag(SWSPLT1_Y1)
                          , 0)
```

Switchgrass area planted 3+ year old t+1
SWSPLT1_Y3

```
                =  MAX (
          +0.5 *  min(0,SWENRS/PDCGNP)
         +0.97 *  lag(SWSPLT1_Y3)
         +0.97 *  lag(SWSPLT1_Y2)
                  , 0.001)
```

Switchgrass area harvested
SWSHAR

```
                =
         +0.95 *  lag(SWSPLT1)
```

Stover removal rate, % of total available
STRMRT

```
                =  MAX ( EXP(
           -12
          +0.2 *  (ZTIME-2000)
           +30 *  max(0,(ST_NRS-20)/PDCGNP)
           +30 *  (ST_NRS)/PDCGNP
                  ) / (1 + EXP (
           -12
          +0.2 *  (ZTIME-2000)
           +30 *  max(0,(ST_NRS-20)/PDCGNP)
           +30 *  (ST_NRS)/PDCGNP
                  ) ) , STRMRTMX)
```

Stover yield, t+1
STSYLD1

= lead(CRSYLD)*56/2000

Stover expected yield
STEYLD1

= lead(CRSYLD)*56/2000

Switchgrass yield average t+1
SWSYLD1

=
+ SWSPLT_Y1*lag(SWSYLDA1)/SWSPLT
+ SWSPLT_Y2*lag(SWSYLDB1)/SWSPLT
+ SWSPLT_Y3*lag(SWSYLDC1)/SWSPLT

Switchgrass yield, area 1 year old, t+1
SWSYLDA1

=
+0.3333 * SWSYLDC1

Switchgrass yield, area 2 year old, t+1
SWSYLDB1

=
+0.6666 * SWSYLDC1

Switchgrass yield, area 3+ year old, t+1
SWSYLDC1

=
+3.89
+0.1075 * (ztime-1999)

Switchgrass expected yield
SWEYLD1

=
+3.89
+0.1075 * (ztime-2007)

Stover production
STSPRD

= lag(CRSHAR1*STSYLD1)*STRMRT

Switchgrass production
SWSPRD

= SWSHAR*lag(SWSYLD1)

Ethanol net returns using Stover
ETNRBST

= ETPCEL*ETYLDST
+ ETPBPST*BPYLDST
- STPPLT
+ ETPSUBST*ETYLDST
+ ETVBPEST
- STOTCET

Electricity value coproduced with ethanol from stover
ETVBPEST

= +0.03681 * 1/3*PPINGAS+2/3*lead(PPINGAS)

Ethanol net returns using Switchgrass
ETNRBSW

= ETPCEL*ETYLDSW
+ ETPBPSW*BPYLDSW
- SWPPLT
+ ETPSUBSW*ETYLDSW
+ ETVBPESW
- SWOTCET

Electricity value coproduced with eth. from switchgrass
ETVBPESW

= +0.04104 * 1/3*PPINGAS+2/3*lead(PPINGAS)

Stover ethanol capacity

ETCAPCEST

```
                =  MAX(
                +  lag(ETCAPCEST)
          -0.04 *  lag10(ETCAPCEST)
          +300 *   (ETNRBST*lag(STPRISK1)-ETCCAPST)/(PDCGNP)
         +1500 *   lag1(ETNRBST*lag(STPRISK1)-ETCCAPST)/(PDCGNP))
          +300 *   lag2(ETNRBST*lag(STPRISK1)-ETCCAPST)/(PDCGNP))
          +200 *   lag3(ETNRBST*lag(STPRISK1)-ETCCAPST)/(PDCGNP))
           +50 *   lag4(ETNRBST*lag(STPRISK1)-ETCCAPST)/(PDCGNP))
                   ,
                +  lag(ETCAPCEST)
          -0.04 *  lag10(ETCAPCEST)
                   , 0)
```

Stover ethanol capacity using stover

ETCAPCEST_ST

```
                =
               +1
               -1 *  max(0,ETNRBSW*.9-ETNRBST)/PDCGNP
               -2 *  max(0,ETNRBSW*.8-ETNRBST)/PDCGNP
```

Stover ethanol capacity using switchgrass

ETCAPCEST_SW

```
                =  (1-ETCAPCEST_ST)
```

Switchgrass ethanol capacity

ETCAPCESW

= MAX(
1 lag(ETCAPCESW)
-0.04 lag10(ETCAPCESW)
300 (ETNRBSW*lag(SWPRISK1)-ETCCAPSW)/(PDCGNP)
1500 lag1(ETNRBSW*lag(SWPRISK1)-ETCCAPSW)/(PDCGNP)
300 lag2(ETNRBSW*lag(SWPRISK1)-ETCCAPSW)/(PDCGNP)
200 lag3(ETNRBSW*lag(SWPRISK1)-ETCCAPSW)/(PDCGNP)
50 lag4(ETNRBSW*lag(SWPRISK1)-ETCCAPSW)/(PDCGNP)
,
1 lag(ETCAPCESW)
-0.04 lag10(ETCAPCESW)
, 0)

Switchgrass ethanol capacity using Switchgrass

ETCAPCESW_SW

=
+1
-1 * max(0,ETNRBST*.9-ETNRBSW)/PDCGNP
-2 * max(0,ETNRBST*.8-ETNRBSW)/PDCGNP

Switchgrass ethanol capacity using switchgrass

ETCAPCESW_ST

= (1-ETCAPCESW_SW)
Baseline

Stover ethanol effective capacity
ETCAPCEST_E

= ETCAPCEST_ST*ETCAPCEST
+ ETCAPCESW_ST*ETCAPCESW

Switchgrass ethanol effective capacity
ETCAPCESW_E

= ETCAPCESW_SW*ETCAPCESW
+ ETCAPCEST_SW*ETCAPCEST

Stover ethanol effective capacity utilization
ETCUSCEST
LN (ETCUSCEST / (1-ETCUSCEST))

=
+0
+15 * ETNRBST/PDCGNP

Switchgrass ethanol effective capacity utilization
ETCUSCESW
LN (ETCUSCESW / (1-ETCUSCESW))

=
+3
+15 * ETNRBSW/PDCGNP

Ethanol production, from Stover and Switchgrass
ETSPRDCE

= ETSPRDST+ETSPRDSW

Ethanol yield, switchgrass
ETYLDSW
=
+71.9
+ ETYTECSW*(ZTIME-2009)

Ethanol yield, stover
ETYLDST
=
71.9
+ ETYTECSW*(ZTIME-2009)

Cellulosic (from ST) ethanol production
ETSPRDST
= ETCAPCEST_E*ETCUSCEST

Cellulosic (from SW) ethanol production
ETSPRDSW
= ETCAPCESW_E*ETCUSCESW

Switchgrass for ethanol production
SWDGET
= ETSPRDSW/ETYLDSW

Stover for ethanol production
STDGET
= ETSPRDST/ETYLDST

Stover ending stocks
STDTES :
LN (STDTES / (1-STDTES))

=
+17
-75 * (STPFRM/(PDCGNP*1/3+PDCGNP2/3))
+0 * (STSPRD + lag(STDTES))

Switchgrass ending stocks
SWDTES :
LN (SWDTES / (1-SWDTES))

=
+25
-100 * (SWPFRM/(PDCGNP*1/3+PDCGNP2/3))
+0.1 * (SWSPRD + lag(SWDTES))

Stover, direct burn energy value
STVENG

=
+ WPI051*(7593/11412.975)/1.168713024*36.48

Switchgrass, direct burn energy value
SWVENG

=
+ WPI051*((7267/11412.975)/1.168713024)*36.48

Stover energy use
STDENG

```
                =  (STVENG-STPPLT)
+4000 *  max(0,STVENG-STPPLT)
```

Switchgrass energy use
SWDENG

```
                =
+4000 *  max(0,SWVENG-SWPPLT)
```

Switchgrass 'other' use
SWDFED

```
                =
   +1 *  MAX(0,(SWPMIN-SWPFRM))
```

Switchgrass slippage rate
SWACSLIP

```
                =  (
 +0.1 *  lag(SWSPLT1)
 +0.1 *  max(0,lag(SWSPLT1)-1)
 +0.1 *  max(0,lag(SWSPLT1)-2)
 +0.1 *  max(0,lag(SWSPLT1)-3)
 +0.1 *  max(0,lag(SWSPLT1)-4)
 +0.1 *  max(0,lag(SWSPLT1)-5)
 +0.1 *  max(0,lag(SWSPLT1)-6)
 +0.1 *  max(0,lag(SWSPLT1)-7)
 +0.1 *  max(0,lag(SWSPLT1)-8)
 +0.1 *  max(0,lag(SWSPLT1)-9)
         )/lag(SWSPLT1))
```

Corn stover market clearing (solves for STPFRM)

0 = STSPRD+lag(STDTES)
-STDTES-STDGET-STDENG

Switchgrass market clearing (solves for SWPFRM)

0 = SWSPRD+lag(SWDTES)
-SWDTES-SWDGET-SWDENG-SWDFED

Corn fractionation

Corn fractionation – Variable names and units

CLPRCH	Corn oil price, Chicago	cents per pound
CRDGDM	Corn, ethanol dry mill	million bushels
DGPMKT	DDG price, Lawrenceburg	dollars per ton
DGYLDDM	DDG yield, dry mill	pounds per bushel
FCDCR	Fractionated corn	million bushels
FCNRT	Fractionation net return, exc. Corn	dollars per gallon
FCPRDCL	Corn oil prod. from fractionization	million pounds
FCSHR	Share of dry mills fractionating	proportion
FCSHRCH	Change in share of dry mills fract.	proportion
FCSHRDMF	Front end share of fractionation	proportion
FCYLDCL	Corn oil yield on fractionated	lbs. per bushel
FCYLDCLB	Corn oil yield on fractionated, back end	lbs. per bushel
PDCGNP	GDP deflator	index
PPINGAS	PPI for gas fuels, 1982=100	index

Corn fractionation – Equations

Corn oil yield on fractionated

FCYLDCL

= FCSHRDMF * FCYLDCLF

\+ (1-FCSHRDMF) * FCYLDCLB

Fractionation net return, exc. corn

FCNRT

=

\- .0093*PDCGNP + .0227*PPINGAS

\+ CLPRCH*0.1686

\- 2.95*DGPMKT/2000

Change in share of dry mills fract.
FCSHRCH

```
                =   MAX(
               +0
              +4 *   *( FCNRT  / PDCGNP)
              +8 *   *lag( FCNRT  / PDCGNP)
              +4 *   *lag2( FCNRT  / PDCGNP)
                     ,
                     -0.005
                     )
```

Share of dry mills fractionating
FCSHR

```
                =   MAX( MIN (
                +   lag(FCSHR)
                +   FCSHRCH
                     ,
                     1 ) , 0 )
```

DDG yield, dry mill
DGYLDDM

```
                =
             +16.85
            +0.01 *   (ZTIME-1980)
             -2.95 *   FCSHR
```

Fractionated corn
FCDCR

= CRDGDM*FCSHR

Corn oil prod. from fractionization
FCPRDCL

= FCYLDCL*FCDCR

Distillers grains

Distillers grains – Variable names and units

BGSPRD	Brewers grain production	thousand tons
BRDFOD	Barley food use	million bushels
CRDGDM	Corn, ethanol dry mill	million bushels
CRPFRM	Corn farm price, U.S.	dollars per bushel
DGARBE	Beef DDG adoption rate	proportion
DGARBR	Poultry DDG adoption rate	proportion
DGARDY	Dairy DDG adoption rate	proportion
DGARPK	Pork DDG adoption rate	proportion
DGCONBE	DDG consumed by beef	thousand tons
DGCONBR	DDG consumed by poultry	thousand tons
DGCONDY	DDG consumed by dairy	thousand tons
DGCONLV	DDG consumed by livestock	thousand tons
DGCONPK	DDG consumed by pork	thousand tons
DGDCOBE	Beef: corn avg. displacement	proportion
DGDCOBR	Poultry: corn avg. displacement	proportion
DGDCODY	Dairy: corn avg. displacement	proportion
DGDCOPK	Pork: corn avg. displacement	proportion
DGDCOWT	Wtd. avg. corn displacement	proportion
DGDEN	DDG consumed for energy (burned)	thousand tons
DGDEXN	DDG/Brewers net exports	thousand tons
DGDEXP	DDG exports	thousand tons
DGDFZ	DDG consumed for fertilizer	thousand tons
DGDSMBE	Beef: soymeal avg. displacement	proportion
DGDSMBR	Poultry: soymeal avg. displ.	proportion
DGDSMDY	Dairy: soymeal avg. displ.	proportion
DGDSMPK	Pork: soymeal avg. displacement	proportion
DGMAXCBE	Beef: corn technical max displ.	proportion

DGMAXCBR	Poultry: corn technical max displ.	proportion
DGMAXCDY	Dairy: corn technical max displ.	proportion
DGMAXCPK	Pork: corn technical max displ.	proportion
DGMIBE	Beef max inclusion rate	proportion
DGMIBR	Poultry max inclusion rate	proportion
DGMIDY	Dairy max inclusion rate	proportion
DGMINCBE	Beef: corn technical min displ.	proportion
DGMINCBR	Poultry: corn technical min displ.	proportion
DGMINCDY	Dairy: corn technical min displ.	proportion
DGMINCPK	Pork: corn technical min displ.	proportion
DGMIPK	Pork max inclusion rate	proportion
DGPMKT	DDG price, Lawrenceburg	dollars per ton
DGSPRD	Distillers grains production	thousand tons
DGVEN	Energy (burn) value of DDG	dollars per ton
DGVFEBE	Beef DDG feed value	dollars per ton
DGVFEBR	Poultry DDG feed value	dollars per ton
DGVFEDY	Dairy DDG feed value	dollars per ton
DGVFEPK	Pork DDG feed value	dollars per ton
DGVFZ	Fertilizer value of DDG	dollars per ton
DGYLDDM	DDG yield, dry mill	pounds per bushel
GBEEF	Grains used for beef production	thou. bushels, corn equiv.
GBROIL	Grains used for broiler production	thou. bushels, corn equiv.
GDAIRY	Grains used for dairy production	thou. bushels, corn equiv.
GLAYER	Grains used for egg production	thou. bushels, corn equiv.
GPORK	Grains used for pork production	thou. bushels, corn equiv.

GTURKEY	Grains used for turkey production	thou. bushels, corn equiv.
HBEEF	Protein meal used for beef production	thou. tons, soymeal equiv.
HBROIL	Protein meal used for broiler production	thou. tons, soymeal equiv.
HDAIRY	Protein meal used for dairy production	thou. tons, soymeal equiv.
HLAYER	Protein meal used for egg production	thou. tons, soymeal equiv.
HPORK	Protein meal used for pork production	thou. tons, soymeal equiv.
HTURKEY	Protein meal used for turkey production	thou. tons, soymeal equiv.
PPI9NFZ	Nitrogen fertilizer prices paid ind.	index, 90-92=100
SMP48D	Soymeal price, 48% protein, Decatur	dollars per ton
WPI051	Coal prices paid index	index

Distillers grains – Equations

Beef DDG feed value

DGVFEBE

= DGDCOBE*CRPFRM*2000*56

+ DGDSMBE*SMP48D

Pork DDG feed value

DGVFEPK

= DGDCOPK*CRPFRM*2000/56

+ DGDSMPK*SMP48D

Poultry DDG feed value
DGVFEBR
= DGDCOBR*CRPFRM*2000/56
+ DGDSMBR*SMP48D

Dairy DDG feed value
DGVFEDY
= DGDCODY*CRPFRM*2000/56
+ DGDSMDY*SMP48D

Beef: corn avg. displacement
DGDCOBE :
LN[((DGDCOBE-DGMINCBE)/(DGMAXCBE-DGMINCBE))
/(1-(DGDCOBE-DGMINCBE)/(DGMAXCBE-DGMINCBE))]
=
-4 *
+10 * CRPFRM/SMP48D

Beef: soymeal avg. displacement
DGDSMBE
= 1-DGDCOBE

Pork: corn avg. displacement
DGDCOPK :
LN[((DGDCOPK-DGMINCPK)/(DGMAXCPK-DGMINCPK))
/(1-(DGDCOPK-DGMINCPK)/(DGMAXCPK-DGMINCPK))]
=
-4 *
+10 * CRPFRM/SMP48D

Pork: soymeal avg. displacement
DGDSMPK
= 1-DGDCOPK

Poultry: corn avg. displacement
DGDCOBR :
LN[((DGDCOBR-DGMINCBR)/(DGMAXCBR-DGMINCBR))
/(1-(DGDCOBR-DGMINCBR)/(DGMAXCBR-DGMINCBR))
=
-4 *
+10 * CRPFRM/SMP48D

Poultry: soymeal avg. displ.
DGDSMBR
= 1-DGDCOBR

Dairy: corn avg. displacement
DGDCODY :
LN[((DGDCODY-DGMINCDY)/(DGMAXCDY-DGMINCDY))
/(1-(DGDCODY-DGMINCDY)/(DGMAXCDY-DGMINCDY))
=
-4 *
+10 * CRPFRM/SMP48D

Dairy: soymeal avg. displ.
DGDSMDY
= 1-DGDCODY

Beef DDG adoption rate

DGARBE :

LN(DGARBE/(1-DGARBE))

=

-17

+15 * DGVFEBE/DGPMKT

+0.06 * TREND

Pork DDG adoption rate

DGARPK :

LN(DGARPK/(1-DGARPK))

=

-19.6

+15 * DGVFEPK/DGPMKT

+0.06 * TREND

Poultry DDG adoption rate

DGARBR :

LN(DGARBR/(1-DGARBR))

=

-21.5

+15 * DGVFEBR/DGPMKT

+0.06 * TREND

Dairy DDG adoption rate

DGARDY :

LN(DGARDY/(1-DGARDY))

```
            =
        -16.5
       +15 *  DGVFEDY/DGPMKT
     +0.06 *  TREND
```

Distillers grains production MINUS DDG exports

DGSPRD - DGDEXP

```
            =  (lead(GBEEF)*DGMIBE*DGARBE*56/2000*1000)*DGDCOBE
               +(lead(HBEEF)*DGMIBE*DGARBE)*DGDSMBE
            +  (lead(GPORK)*DGMIPK*DGARPK*56/2000*1000)*DGDCOPK
               +(lead(HPORK)*DGMIPK*DGARPK)*DGDSMPK
            +  (lead(GBROIL)+GLAYER1+GTURKEY1)*DGMIBR*DGARBR*56/2000*1000*DGDCOBR
               '*DGMIBR*DGARBR*56/2000*1000*DGDCOBR
               +lead(HBROIL+HLAYER+HTURKEY)
               *DGMIBR*DGARBR*DGDSMBR
            +  lead(GDAIRY)*DGMIDY*DGARDY*56/2000*1000*DGDCODY
               +lead(HDAIRY)*DGMIDY*DGARDY*DGDSMDY
```

Distillers grains production

DGSPRD

```
            =  CRDGDM*DGYLDDM/2
```

Wtd. avg. corn displacement
DGDCOWT

= DGDCOBE*DGCONBE/DGCONLV
+DGDCOPK*DGCONPK/DGCONLV
+DGDCOBR*DGCONBR/DGCONLV
+DGDCODY*DGCONDY/DGCONLV

Energy (burn) value of DDG
DGVEN

=
+0.7 * (WPI051/WPI051$_{1996}$)*36.48

DDG consumed for energy (burned)
DGDEN

=
+500 * max(0,(DGVEN-DGPMKT))

Fertilizer value of DDG
DGVFZ

=
+180 * PPI9NFZ/PPI9NFZ$_{1997}$*0.26/0.82

DDG consumed for fertilizer
DGDFZ

=
+500 * max(0,(DGFZV-DGPMKT))

DDG exports
DGDEXP

= DGDEXN-lag(DGDEXN)+lag(DGDEXP)

Brewers grain production
BGSPRD

= 17*48/56*BRDFOD/2

Distillers grain market clearing (solves for DGPMKT)

0 = DGSPRD-LDDGC-DGDEN-DGDFZ-DGDEXP

Other corn processing

Other corn processing – Variable names and units

CLDDOM	Corn oil domestic use	million pounds
CLDEXN	Corn oil net exports	million pounds
CLDTES	Corn oil ending stocks	million pounds
CLPRCH	Corn oil price, Chicago	cents per pound
CLSPRD	Corn oil production	million pounds
CLYLDWM	Corn oil yield, wet mill	pounds per bushel
CRDBEV	Corn beverage alcohol	million bushels
CRDCER	Corn cereals & other	million bushels
CRDGLD	Corn glucose & dextrose	million bushels
CRDGWM	Corn, ethanol wet mill	million bushels
CRDHFC	Corn HFCS use	million bushels
CRDOWM	Corn, other wet mill	million bushels
CRDSTR	Corn starch use	million bushels
CRGMWH	HFCS wet mill gross mar.	dollars per bushel
CRNRBWM	Corn wet mill net ret., Sep-Aug	dollars per bushel
CRPFRM	Corn farm price, U.S.	dollars per bushel
DGPMKT	DDG price, Lawrenceburg	dollars per ton
FCPRDCL	Corn oil prod. from fractionization	million pounds
GFDDOM	Gluten feed domestic use	thousand tons
GFDEXN	Gluten net exports	thousand tons
GFPR21	Gluten feed pr, 21%, IL Pts	dollars per ton
GFSPRD	Gluten feed production	thousand tons
GFYLDWM	Gluten feed yield, wet mill	pounds per bushel
GMDDOM	Gluten meal domestic use	thousand tons
GMDEXN	Gluten meal net exports	thousand tons
GMPR60	Gluten meal pr, 60%, IL pts	dollars per ton
GMSPRD	Gluten meal production	thousand tons

GMYLDWM	Gluten meal yield, wet mill	pounds per bushel
HFDDOM	HFCS dom. use, cal. yr.	thousand tons
HFDDOMOS	HFCS dom. deliveries, Oct.-Sep	thousand tons
HFDEXMOS	HFCS exports to Mexico, Oct-Sep	thousand tons
HFDEXN	HFCS net exports, cal. yr.	thousand tons
HFDEXNOS	HFCS net exports, Oct.-Sep	thousand tons
HFPRMW	HFCS-42 price, Midwest, Oct-Sep	cents per pound
HFSPRDCL	HFCS prod., cal. yr.	thousand tons
HFSPRDOS	HFCS prod., Oct.-Sep.	thousand tons
HFTRND	HFCS consumption trend	units
HFYLDWM	HFCS yield, wet mill	pounds per bushel
PDCGNP	GDP deflator	index
POPTOTW	Population	million
PPINGAS	PPI for gas fuels, 1982=100	index
SMP48D	Soymeal price, 48% protein, Decatur	dollars per ton
SOPMKT	Soybean oil price, Decatur	dollars per cwt
SUPRAW	Sugar NY raw price	cents per pound
SUPREF	Refined beet sugar price	cents per pound
ZCE92W	Real consumer expend.	billion 1992 dollars

Other corn processing - Equations

Gluten feed pr, 21%, IL Pts

GFPR21

=	
+210	
+0.04 *	SMP48D
+12 *	CRPFRM
+0.35 *	DGPMKT
-25 *	LN(GFDDOM)

Gluten feed domestic use
GFDDOM

= GFSPRD-GFDEXN

Gluten feed production
GFSPRD

= (CRDGWM+CRDOWM)*GFYLDWM/2

Gluten meal pr, 60%, IL pts
GMPR60

=
+240
+1.2 * SMP48D
-20 * LN(GMDDOM)

Corn oil price, Chicago
CLPRCH

=
+36
+1 * SOPMKT
-5 * LN(CLDDOM)

HFCS wet mill gross mar.
CRGMWH

```
                    =
                    +   HFPRMW*HFYLDWM/100
                    +   GFPR21*GFYLDWM/2000
                    +   GMPR60*GMYLDWM/2000
                    +   CLPRCH*CLYLDWM/100
                    -   CRPFRM
          -0.00384 *    lead(PPINGAS)*2/3+PPINGAS/3
```

Corn HFCS use
CRDHFC

```
                    =
              +0.5 *    Lag(CRDHFC)
             +5000 *    CRGMWH/PDCGNP
             -2500 *    CRNRBWM/PDCGNP
                +3 *    (ZTIME-1980)
                  r
```

Corn glucose & dextrose
CRDGLD

```
                    =
                 +235
                -150 *    CRPFRM/SUPRAW
                  +1 *    (ZTIME-1980)
```

Corn starch use
CRDSTR

=
+230
-1000 * CRPFRM/PDCGNP
+2 * (ZTIME-1980)

Corn beverage alcohol
CRDBEV

=
+120
-500 * CRPFRM/PDCGNP
+1 * (ZTIME-1980)

Corn cereals & other
CRDCER

=
+168
-750 * CRPFRM/PDCGNP
+1.5 * (ZTIME-1980)

HFCS dom. deliveries, Oct.-Sep
HFDDOMOS

```
                =  (
              +16
            -3.5 *  HFPRMW/average(SUPRAW,SUPREF)
            -0.4 *  max(0,HFPRMW-.85*average(SUPRAW,SUPREF))
              +3 *  ln(lead(ZCE92W/POPTOTW))
            +0.4 *  HFTRND
                    ) * POPTOTW
```

HFCS exports to Mexico, Oct-Sep
HFDEXMOS

```
                =
             -100
            +0.5 *  lag(HFDEXMOS)
            -200 *  HFPRMW/average(SUPRAW,SUPREF)
             -20 *  HFPRMW/CRPFRM
             +25 *  (ZTIME-1980)
```

HFCS net exports, Oct.-Sep MINUS HFCS exports to Mexico, Oct-Sep
HFDEXNOS
-HFDEXMOS

```
                =
            +160
             -40 *  HFPRMW/average(SUPRAW,SUPREF)
              -4 *  HFPRMW/CRPFRM
```

HFCS prod., cal. yr.
HFSPRDCL

=
+0.75 * Lag(HFSPRDOS)
+0.25 * HFSPRDOS

HFCS net exports, cal. yr.
HFDEXN

=
+0.75 * lag(HFDEXNOS)
+0.25 * HFDEXNOS

HFCS dom. use, cal. yr.
HFDDOM

= HFSPRDCL-HFDEXN

HFCS net exports, Oct.-Sep
HFDEXNOS

= HFDEXMOS-(HFDEXNOS-HFDEXMOS)

HFCS prod., Oct.-Sep.
HFSPRDOS

= CRDHFC*HFYLDWM/2

HFCS market clearing (solves for HFPRMW)

0 = HFSPRDOS-HFDDOMOS-HFDEXNOS

Gluten net exports
GFDEXN

=
+3000
-2500 * GFPR21/PDCGNP
+32000 * CRPFRM/PDCGNP
+180 * SMP48D/PDCGNP
-30 * (ZTIME-1980)

Gluten meal net exports
GMDEXN

=
+1300
-300 * GMPR60/PDCGNP
+300 * SMP48D/PDCGNP
+5 * (ZTIME-1980)

Gluten meal domestic use
GMDDOM

= GMSPRD-GMDEXN

Gluten meal production
GMSPRD

= (CRDGWM+CRDOWM)*GMYLDWM/2

Corn oil production
CLSPRD

= CRDGWM*CLYLDWM
+ CRDOWM*CLYLDWM
+ FCPRDCL

Corn oil net exports
CLDEXN

=
+900
-1500 * CLPRCH/PDCGNP
+1000 * SOPMKT/PDCGNP
+1 * (ZTIME-1980)

Corn oil ending stocks
CLDTES

=
+250
-500 * CLPRCH/PDCGNP
+0.05 * CLSPRD
-2 * (ZTIME-1980)

Corn oil domestic use
CLDDOM

= CLSPRD+lag(CLDTES)-CLDEXN-CLDTES

Fats

Fats – Variables and units

BDTAXCR	Biodiesel tax credit, cal. yr.	dollars per gallon
BFPROD	Beef Production	million pounds
CKYPROD	Broiler Production	million pounds
LRPRC	Lard price, Oct-Sep	cents per pound
LRSPRD	Lard production, cal. year.	million pounds
LRSPRDMY	Lard production, Oct-Sep	million pounds
LRSYLD	Lard yield per cwt, cal. year	pounds per cwt of live weight
NVOPRC	Virgin vs non tax credit differential	cents per gallon
PFSPRDMY	Poultry fat production, Oct-Sep	million pounds
PFSYLD	Poultry fat yield	lbs of fat per lbs of meat
PKHGSLT	Hog Slaughter	thousand animals
PKSLTWT	Hog Slaughter Weight	pounds per animal
PKSYLD	Pork carcass yield, cal. Year	lbs pork per lbs liveweight
SBSPRD	Soybean production	million bushels
SODFOD	Soybean oil, other uses	million pounds
TEPRC	Edible tallow price, Oct-Sep	cents per pound
TESPRDMY	Edible tallow rendered, Oct-Sep	million pounds
TIPRC	Inedible tallow price, Oct-Sep	cents per pound
TISPRDMY	Inedible tallow, grease produced	million pounds
YGPRC	Yellow grease price, Oct-Sep	cents per pound

Fats – Equations

Pork carcass yield, cal. Year

PKSYLD

+0.7083

+0.0012 * (ZTIME-1977)

Lard production, cal. year.
LRSPRD

= LRSYLD*(PKSLTWT/PKSYLD)*PKHGSLT/100/1000

Lard production, Oct-Sep
LRSPRDMY

= 0.25*(LRSPRD)+0.75*lead(LRSPRD)

Poultry fat yield
PFSYLD

=
+0.0132
+0.0125 * ln(ZTIME-2000)

Poultry fat production, cal. year
PFSPRD

= PFSYLD*CKYPROD

Poultry fat production, Oct-Sep
PFSPRDMY

= 0.25*PFSPRD+0.75*lead(PFSPRD)

Edible tallow rendered, Oct-Sep
TESPRDMY

=
+116.92889
-1.95405 * 0.25*BFPROD+0.75*lead(BFPROD)
+0.0010084 * (0.25*BFPROD*ZTIME)+(0.75*lead(BFPROD)* ZTIME1)

Inedible tallow, grease produced
TISPRDMY

```
                =
        +3464.426
        +0.08196 *  0.25*BFPROD+0.75*lead(BFPROD)
         +0.0535 *  SODFOD
```

Lard price, Oct-Sep
LRPRC

```
                =  (
         +0.793761
        -2.833426 *  ln(lead(PKSLTWT*PKHGSLT)/(lead(PKSLTWT*PKHGSLT)
                      +(PKSLTWT*PKHGSLT)+lag(PKSLTWT*PKHGSLT)))
        +0.025889 *  ln(ZTIME-1977)
                     ) * SOPMKT
```

Edible tallow price, Oct-Sep
TEPRC

```
                =  (
         +0.743441
       -1.0897896 *  ln(TESPRDMY/(TESPRDMY+lag(TESPRDMY)/2)
         +0.03154 *  ln(ZTIME-1977)
                     ) * SOPMKT
```

Inedible tallow price, Oct-Sep

TIPRC

```
                =  (
        +0.5109315
        -0.7327487 *  ln(TISPRDMY/(TISPRDMY+lag(TISPRDMY)
                         +lag2(TISPRDMY)/3)
        +0.0819333 *  ln(ZTIME-1977)
                      ) * SOPMKT
```

Yellow grease price, Oct-Sep

YGPRC

```
                =  (
          +0.15357
         -0.089004 *  (BDTAXCR-NVOPRC)
        +0.000176 *  SBSPRD
                     ) * SOPMKT
```

Trade

Trade – Variable names and units

BDDEXN	Biodiesel net exports, Oct-Sep	million gallons
BDPGER	Biodiesel price, Germany, Oct-Sep	dollars per gallon
BDPPLTM	Biodiesel price, rack, Oct-Sep	dollars per gallon
BDTAXCR	Biodiesel tax credit, cal. yr.	dollars per gallon
CRPFRM	Corn farm price, U.S.	dollars per bushel
DGDEXN	DDG/Brewers net exports	thousand tons
DGPMKT	DDG price, Lawrenceburg	dollars per ton
ETADEXPSA	Ethyl alcohol exports, Sep-Aug	thousand liters
ETASIMNSA	Ethyl alcohol net imp., Sep-Aug	million gallons
ETASIMPSA	Ethyl alcohol imports, Sep-Aug	thousand liters
ETDISSA	Ethanol disapp., Sep-Aug	million gallons
ETPADSA	Ethanol, other advanced price	dollars per gallon
ETPBZAMA	Anhydrous ethanol price, Brazil	dollars per gallon
ETPFBSA	Ethanol price, Omaha, Sep-Aug	dollars per gallon
ETSIMNSA	Ethanol net imports, Sep-Aug	million gallons
ETTARSSA	Ethanol specific tariff, Sep-Aug	dollars per gallon
ETTARVSA	Ethanol ad val. tariff, Sep-Aug	percent
PDCGNP	GDP deflator	index
POILRASA	Refiners' crude oil acq. pr., Sep-Aug	dollars per barrel
SMP48D	Soymeal price, 48% protein, Decatur	dollars per ton

Trade – Equations

Ethyl alcohol imports, Sep-Aug

ETASIMPSA

```
                =
             -650
        +20000 *  ETPADSA/PDCGNP
          +300 *  ETPADSA
                    /((ETPBZAMA)*(1+ETTARVSA)+ETTARSSA)
         +1500 *  max(0,ETPADSA-ETTARSSA
                    -(1+ETTARVSA)*(ETPBZAMA))
        +25000 *  max(0,ETPADSA-ETTARSSA
                    -(1+ETTARVSA)*(ETPBZAMA)-.11)
          +0.04 *  ETDISSA
```

Ethyl alcohol exports, Sep-Aug

ETADEXPSA

```
                =
             +330
          -200 *  ETPFBSA/ETPBZAMA
         +5000 *  max(0,ETPBZAMA-ETPFBSA)
```

ETSIMNSA

```
                =  ETASIMNSA
```

Anhydrous ethanol price, Brazil
ETPBZAMA

```
                =
             +0.8
  +0.008832 *  POILRASA
  +0.000124 *  ETSIMNSA
```

Biodiesel price, Germany, Oct-Sep
BDPGER

```
                =
             +3.3
   +0.012 *  POILRASA
  -0.0005 *  BDDEXN
```

Biodiesel net exports, Oct-Sep
BDDEXN

```
                =  MAX(
          +1300
           +0.4 *  lag(BDDEXN)
          -1500 *  (BDPPLTM-BDTAXCR/4-lead(BDTAXCR)*3/4
                     +BDTAREU+0.2)/BDPGER
            +1 *  (ZTIME-1980)
                   , 0)
```

DDG/Brewers net exports
DGDEXN

```
                =
             -3300
           -5000 *   DGPMKT/PDCGNP
         +120000 *   CRPFRM/PDCGNP
           +500 *    SMP48D/PDCGNP
           +300 *    (ZTIME-1980)
```

Data sources

The sources of the variables used in the preceding sections are listed here. Three averages are shown in the right-most columns for each variable:

1) 2001-05,
2) 2006-10, and
3) baseline assumed or projected values for 2011-15.

The list is alphabetized by variable name.

BDCAPRO	Assumed historically	2	28	30
BDCAPSO	www.biodiesel.org/pdf_files/fuelfactsheets/Production_Capacity.pdf	268.4904	1957.11	2758.116
BDCUSRO	Calculated	0.25787	0.194671	0.214304
BDCUSSO	Calculated	0.520573	0.195051	0.189428
BDDDOM	Calculated historically	69.21	490.1657	1033.084
BDDEXN	Calculated from below	-2.3814	134.9551	13.93952
BDEQV	EPA-Energy Policy Act 2005	0	1.3	1.5
BDNRTRO	Calculated	0.47859	-0.434278	-0.266399
BDNRTSO	Calculated	0.78151	0.309278	0.404544
BDOTCSO	Personal contact with IHS Global Insight. To include refining, reagents, labor, transportation at one time.	0.482915	0.546961	0.569111
BDOTPRD	Historical data are calculated, typically as total less amount from soybean oil	2.781531	273.5945	518.1945
BDPGER	FAPRI-ISU	3.212666	4.2559	4.750653
BDPPLTM	AFI figures for Des Moines	3.30385	3.722252	4.033149
BDPREQ	Historically based on other prices and tax credit	2.31	2.373014	2.43503
BDROPRD	Assumed historically	0.782712	5.467919	6.429135
BDSOPRD	Historical data are calculated, typically from soybean oil for biodiesel	64.50037	346.0584	522.3994
BDSPRD	www.biodiesel.org/pdf_files/fuelfactsheets/Production_Graph_Slide.pdf	30.408	553.7574	986.9831
BDSPRDOS	www.biodiesel.org/pdf_files/fuelfactsheets/Production_Graph_Slide.pdf	67.74	625.1208	1047.023
BDSYLD	Assumed	7.7	7.7	7.7
BDTAXCR	Assumed	0.5	1	1
BFPROD	WASDE	25836	26217.4	25339.09
BGSPRD	Computed based on assumed yield from barley food use	1090.67	1182.308	1216.144
BPYLDST	Assumed zero historically and in projection period	0	0	0
BPYLDSW	Assumed zero historically and in projection period	0	0	0
BRDFOD	www.ers.usda.gov/data/feedgrains	149.6998	162.2776	166.9218
BRENRS	Calculated from returns and variable cost data	77.76098	137.3383	149.1943
CEWAIVE	Assumption about EISA implementation in future	0.4	1	1

CKYPROD	WASDE	33136.48	36028.1	38251.42
CLDDOM	Oil Crop Yearbook; projections = production + beg. stocks - end. stocks - net exports	1595.608	1783.324	2083.509
CLDEXN	Oil Crop Yearbook; updates from FATUS	825.6	754.5484	768.8277
CLDTES	Oil Crop Yearbook	146.4	198.4693	202.7516
CLPRCH	Oil Crop Yearbook, updated with Oilseed Outlook	25.756	41.41227	39.53485
CLSPRD	www.census.gov/manufacturing/cir/historical_data/m311j/index.html	2437.8	2538.591	2853.007
CLYLDWM	Calculated for 1980-2006 based on total wet milling and USDA-reported corn oil production;	1.738515	1.679094	1.671312
CRDBEV	USDA feed grains data base, updated with Feed Outlook, Table 5; equation for 2004/05 forward	132.36	135.1092	138.7819
CRDCER	USDA feed grains data base, updated with Feed Outlook, Table 5; equation for 2004/05 forward	187.9	192.947	200.3356
CRDGAS	USDA feed grains data base, updated with Feed Outlook, Table 5; sum of dry and wet milling for ethanol for 2004/05 forward	1159.106	3558.512	5018.926
CRDGDM	Computed for 1991-2003; equation for projection period	788.5882	3136.802	4594.185
CRDGLD	USDA feed grains data base, updated with Feed Outlook, Table 5; equation for 2004/05 forward	223.0994	235.266	236.9103
CRDGWM	Computed for 1980-2003; equation for projection period	370.5174	421.7101	424.7405
CRDHFC	USDA feed grains data base, updated with Feed Outlook, Table 5; equation for 2004/05 forward	530.3754	483.2288	479.4849
CRDOWM	Computed, sum of HFCS, glucose & dextrose, and starch	1018.861	965.5053	958.6091
CRDSTR	USDA feed grains data base, updated with Feed Outlook, Table 5; equation for 2004/05 forward	265.3866	247.0105	242.2138
CRENRS	Calculated from returns and variable cost data	162.0857	299.1342	363.6485
CRGMWH	Calculated	2.978652	6.092237	6.700236
CRNRBDM	Calculated, crop year	1.738147	1.349716	0.839433
CRNRBWM	Calculated, crop year	1.846469	1.69573	1.055042
CRNRML	Calculated	163.2687	329.8113	350.4849
CROTCDM	USDA sugar ethanol report for 2002-2005	0.265761	0.324196	0.337325
CROTCWM	USDA sugar ethanol report for 2002-2005	0.435085	0.51344	0.534233
CRPFRM	USDA/NASS Online Database	2.154	3.721378	3.823465

CRSYLD	USDA/NASS Online Database	153.0057	167.9653	178.8758
CRVARC	USDA/ERS cost of production survey.	169.13	249.7134	285.003
CTENRS	Calculated from returns and variable cost data	181.8632	157.9859	131.875
DGARBE	Historically based on expert assessment and aligned to overall DDG use numbers	0.182223	0.598688	0.76984
DGARBR	Historically based on expert assessment and aligned to overall DDG use numbers	0.07	0.216191	0.281109
DGARDY	Historically based on expert assessment and aligned to overall DDG use numbers	0.249598	0.7005	0.838244
DGARPK	Historically based on expert assessment and aligned to overall DDG use numbers	0.083	0.275843	0.422193
DGCONBE	Calculated from adoption rates and animal product output	3744.171	13341.13	18770.64
DGCONBR	Calculated from adoption rates and animal product output	650.4274	2180.923	3246.282
DGCONDY	Calculated from adoption rates and animal product output	1438.669	4345.593	5502.603
DGCONLV	Calculated from adoption rates and animal product output	6507.092	22414.05	31953.76
DGCONPK	Calculated from adoption rates and animal product output	673.8332	2555.496	4434.277
DGDCOBE	Assumed level historically	0.9	0.913626	0.917508
DGDCOBR	Assumed level historically	0.75	0.777252	0.785017
DGDCODY	Assumed level historically	0.9	0.937783	0.951263
DGDCOPK	Assumed level historically	0.875	0.888626	0.892508
DGDCOWT	Assumed level historically	0.881603	0.902874	0.906392
DGDEN	Assumed zero historically	0	0	0
DGDEXN	FATUS-reported trade; projections from equation	878.5239	4744.744	7144.165
DGDEXP	Calculated based on previous value and change in net exports	180.8409	4048.321	6447.742
DGDFZ	Assumed zero historically	0	0	0
DGDSMBE	Assumed level historically	0.1	0.086374	0.082492
DGDSMBR	Assumed level historically	0.25	0.222748	0.214983
DGDSMDY	Assumed level historically	0.1	0.062217	0.048737
DGDSMPK	Assumed level historically	0.125	0.111374	0.107492
DGMAXCBE	Assumed technical factor	0.95	0.95	0.95
DGMAXCBR	Assumed technical factor	0.85	0.85	0.85
DGMAXCDY	Assumed technical factor	0.95	0.99	1
DGMAXCPK	Assumed technical factor	0.925	0.925	0.925

DGMIBE	Assumed level historically	0.4	0.42	0.47
DGMIBR	Assumed level historically	0.2	0.21	0.235
DGMIDY	Assumed level historically	0.25	0.26	0.285
DGMINCBE	Assumed technical factor	0.85	0.85	0.85
DGMINCBR	Assumed technical factor	0.65	0.65	0.65
DGMINCDY	Assumed technical factor	0.85	0.85	0.85
DGMINCPK	Assumed technical factor	0.825	0.825	0.825
DGMIPK	Assumed level historically	0.2	0.21	0.235
DGPMKT	Feed Situation and Outlook Yearbook, April 2004, p. 55, updated with Feed Outlook, May 2004, Table 4; projection based on equation	86.726	125.1102	126.238
DGSPRD	Computed based on dry milling and assumed yield	6687.933	26462.37	38401.51
DGVEN	Calculated from coal price	22.81781	34.02743	38.5554
DGVFEBE	Calculated from corn and soybean meal prices	88.48411	146.4948	148.5967
DGVFEBR	Calculated from corn and soybean meal prices	105.8174	167.8058	167.9417
DGVFEDY	Calculated from corn and soybean meal prices	88.48411	142.4469	143.6681
DGVFEPK	Calculated from corn and soybean meal prices	91.373	150.3561	152.247
DGVFZ	Calculated from fertilizer price	43.96378	75.64454	83.78502
DGYLDDM	Assumed	16.96893	16.87993	16.71959
DIPRS	EIA: www.eia.doe.gov/emeu/mer/pdf/pages/sec9_8.pdf	1.0612	2.180607	2.421667
DIPRSM	EIA: www.eia.doe.gov/emeu/mer/pdf/pages/sec9_8.pdf	1.265067	2.181331	2.497096
DIPRT	EIA: tonto.eia.doe.gov/dnav/pet/hist/ddr001A.htm	1.6884	2.922489	3.198337
DIPRTM	EIA: tonto.eia.doe.gov/dnav/pet/hist/ddr001M.htm	2.21425	2.941307	3.276646
DISLS	EIA: www.eia.doe.gov/oil_gas/petroleum/data_publications/fuel_oil_and_kerosene_sales/foks.html	35961.27	37979.83	38076.12
ETADD	Assumed--ethanol as "additive" share of motor gasoline market	0.03	0.0348	0.039
ETADEXPCL	FATUS 2207	223157.6	427393.2	397365.9
ETADEXPSA	FATUS 2207	53.59691	123.7601	103.1711
ETASIMNCL	Calculated from ISU data historically	128.1111	374.0549	417.4041
ETASIMNSA	Calculated from USDA data historically	201.0478	333.9467	517.3608

ETASIMPCL	FATUS 2207	708058.2	1843191	1977240
ETASIMPSA	FATUS 2207	254.6447	457.7067	620.5318
ETCAPCEST	Assumed zero or near-zero historically	0	1.65	23.95
ETCAPCEST_E	Assumed zero or near-zero historically	0	1.65	23.95
ETCAPCEST_ST	Assumed zero or near-zero historically	1	1	1
ETCAPCEST_SW	Assumed zero or near-zero historically	0	0	0
ETCAPCESW	Assumed zero or near-zero historically	0	0	0
ETCAPCESW_E	Assumed zero or near-zero historically	0	0	0
ETCAPCESW_ST	Assumed zero or near-zero historically	0	0	0
ETCAPCESW_SW	Assumed zero or near-zero historically	1	1	1
ETCAPDM	Assumed	2248.623	9415.511	13923.76
ETCAPTO	www.ethanolrfa.org/industry/statistics/	2744.1	8263.2	14787.38
ETCAPWM	Assumed	1083.248	1169.635	1201.065
ETCCAPST	Assumptions based on EPA impact analysis	116.56	116.56	99.64
ETCCAPSW	Assumptions based on EPA impact analysis	116.56	116.56	99.64
ETCECR10	Calculated from legislation and assumptions	0	0.195972	0.779062
ETCECRFC	Calculated from legislation and assumptions	0	0.224	0.56
ETCECRM	Calculated from legislation and assumptions	0	0.186341	0.271849
ETCECRMC	Calculated from legislation and assumptions	0	0.151708	0.268686
ETCECRT	Calculated from legislation and assumptions	0	2.236091	3.262185
ETCECRTC	Calculated from legislation and assumptions	0	1.820501	3.224227
ETCEVARC	Assumed based on equation	1.399236	1.98044	1.998621
ETCUSCEST	Assumed zero or near-zero historically	0.95	0.935505	0.999238
ETCUSCESW	Assumed zero or near-zero historically	0.95	0.636957	0.646737
ETCUSDM	Calculated	0.934315	0.921335	0.92238
ETCUSWM	Calculated	0.912126	0.969177	0.962085
ETDADSA	Assumed	1755.512	4827.256	5417.33

ETDE10SA	Calculated	1570.587	5214.171	8254.93
ETDE85SA	Calculations on ethprice spreadsheet, based on EIA reports	30.18991	113.7492	1335.552
ETDISCL	Calculated	2912.283	9022.014	14565.75
ETDISSA	Calculated	3356.289	10155.18	15007.81
ETDTESCL	EIA: tonto.eia.doe.gov/dnav/pet/hist/mfestus1m.htm	235.5444	541.338	818.1774
ETDTESSA	EIA: tonto.eia.doe.gov/dnav/pet/pet_stoc_typ_d_nus_SAE_mbbl_m.htm	284.3736	644.922	857.2107
ETE10PEN	Calculated	0.165596	0.5989	0.997633
ETE85PEN	Calculated	0.117103	0.231483	0.775828
ETEQVCEL	EPA-Energy Policy Act 2005	0	1	1
ETIMCESA	Assumed	0	0	0
ETME10SA	Calculated	9487.137	8923.049	8274.547
ETME85SA	Assumed	258.7923	474.8085	1517.972
ETNCADV	Assumed	0	0	0
ETNRBST	Calculated historically based on other assumptions	-54.09412	22.73733	73.40383
ETNRBSW	Calculated historically based on other assumptions	-38.79197	29.55237	77.8337
ETPADSA	Calculated	1.6425	2.016615	1.984732
ETPBLMG	Assumed	0.11	0.108491	0.116473
ETPBPST	Assumed zero historically and in projection period	0	0	0
ETPBPSW	Assumed zero historically and in projection period	0	0	0
ETPBZAMA	FAPRI-ISU	1.042137	1.589453	1.536252
ETPCEL	Calculated	1.6425	2.511254	3.142264
ETPFBCL	Nebraska: www.neo.ne.gov/statshtml/66.html	1.488	2.164927	1.809945
ETPFBSA	Nebraska: www.neo.ne.gov/statshtml/66.html	1.6425	2.016615	1.831451
ETPPIACL	AMS: www.ams.usda.gov/mnreports/lswethanol.pdf	n.a.	1.829568	1.635675
ETPPTIA	AMS: www.ams.usda.gov/mnreports/lswethanol.pdf	n.a.	1.734276	1.65511
ETPRTCL	Calculated	1.567	2.305807	1.99927
ETPRTRSA	Historically based on other prices and tax credit	1.123167	1.518615	1.353201
ETPRTSA	Calculated	1.73005	2.145849	1.995651
ETPSUBST	Assumed zero	0	0	0

ETPSUBSW	Assumed zero	0	0	0
ETSIMNSA	Calculated	201.0478	333.9467	517.3608
ETSIMPCL	EIA: tonto.eia.doe.gov/dnav/pet/hist/mfeimus1A.htm	64.5876	475.566	n.a.
ETSIMPSA	EIA: tonto.eia.doe.gov/dnav/pet/pet_move_imp_dc_NUS-Z00_mbbl_m.htm	150.7044	403.2428	560.4678
ETSPCESA	Assumed	0	1.940883	192.5259
ETSPCOSA	Assumed	0	0.325508	168.5947
ETSPNCSA	Assumed	101.0762	198.9677	317.931
ETSPRDCE	Calculated historically based on other assumptions	0	1.620077	23.93125
ETSPRDCL	EIA: tonto.eia.doe.gov/dnav/pet/pet_pnp_oxy_dc_nus_mbbl_m.htm	2802.341	8743.391	14181.1
ETSPRDSA	EIA: tonto.eia.doe.gov/dnav/pet/pet_pnp_oxy_dc_nus_mbbl_m.htm	3196.46	9902.204	14515.53
ETSPRDST	Assumed zero or near-zero historically	0	1.622575	23.93125
ETSPRDSW	Assumed zero or near-zero historically	0	0	0
ETSSUGSA	Assumed or zero historically	n.a.	0	0
ETTARS	Assumed	0.54	0.54	0.54
ETTARSSA	Calculated	0.54	0.54	0.54
ETTARV	Assumed	0.025	0.025	0.025
ETTARVSA	Calculated	0.025	0.025	0.025
ETTAXEX	Assumed	0.522	0.486	0.45
ETVBPEST	Assumptions based on EPA impact analysis	0	8.141126	8.515871
ETVBPESW	Assumptions based on EPA impact analysis	0	9.076489	9.494291
ETYLDDM	Assumed	2.6928	2.73	2.796
ETYLDST	Assumptions based on EPA impact analysis	71.9	72.05	74.9
ETYLDSW	Assumptions based on EPA impact analysis	71.9	72.05	74.9
ETYLDWM	Assumed	2.6664	2.6875	2.7205
ETYTECSW	Assumptions based on EPA impact analysis	0	0.15	0.75
FCDCR	Historical data are assumed	32.93194	278.4272	721.3305
FCNRT	Historical data are assumed	-0.010689	0.080874	0.10065
FCPRDCL	Historical data are assumed	24.69896	208.8204	540.9978
FCSHR	Historical data are assumed	0.03765	0.084771	0.156072

FCSHRCH	Historical data are assumed	0.00753	0.010646	0.015385
FCSHRDMF	Historical data are assumed	0.75	0.75	0.75
FCYLDCL	Assumed	0.75	0.75	0.75
FCYLDCLB	Assumed	0.75	0.75	0.75
GBEEF	Calculated from production and average rations	2038.276	2068.366	1999.073
GBROIL	Calculated from production and average rations	1338.297	1378.947	1383.748
GDAIRY	Calculated from production and average rations	893.7744	892.451	853.0948
GFDDOM	Computed: Production - net exports	4130.197	6743.648	7212.354
GFDEXN	FATUS-reported trade; projections from equation	3789.262	1163.48	672.7385
GFPR21	Feed Situation and Outlook Yearbook, April 2004, p. 55, updated with Feed Outlook, May 2004, Table 4; projection based on equation	63.254	87.15689	86.96772
GFSPRD	Computed: dry mill ethanol * assumed yield	7919.459	7907.128	7885.093
GFYLDWM	Assumed	11.4	11.4	11.4
GLAYER	Calculated from production and average rations	365.536	361.2532	361.614
GMDDOM	Computed: Production - net exports	1149.731	1152.772	1248.905
GMDEXN	FATUS-reported trade; projections from equation	934.3376	928.0514	826.1193
GMPR60	Feed Situation and Outlook Yearbook, April 2004, p. 55, updated with Feed Outlook, May 2004, Table 4	270.618	447.1416	443.0528
GMSPRD	Computed based on wet milling and assumed yield	2084.068	2080.823	2075.024
GMYLDWM	Assumed	3	3	3
GPORK	Calculated from production and average rations	1576.181	1693.941	1709.461
GTURKEY	Calculated from production and average rations	287.5842	289.1134	288.2618
GYPR	Personal contact with IHS Global Insight for data to 2003, assumed thereafter	0.152098	0.034	0.03
HAPFRM	USDA/NASS Online Database	92.92	122.815	108.637
HBEEF	Calculated from production and average rations	3642.876	3696.654	3572.811
HBROIL	Calculated from production and average rations	10968.72	12277.13	13357.02
HDAIRY	Calculated from production and average rations	5081.679	5865.685	6354.863
HFDDOM	Sugar and Sweeteners yearbook, Table 30, projections = production - net exports	9139.4	8489.596	7987.384
HFDDOMOS	www.ers.usda.gov/Briefing/Sugar/data/table28.xls	9139.6	8324.637	7976.459
HFDEXMOS	www.ers.usda.gov/Briefing/Sugar/data/table32b.xls	79.9312	425.903	802.1069

HFDEXN	www.ers.usda.gov/Briefing/Sugar/data/table30.xls	56.6	472.4881	845.7589
HFDEXNOS	Pre-2007: Production - deliveries	94.6	520.5317	899.331
HFPRMW	www.ers.usda.gov/Briefing/Sugar/data/Table09.xls	13.63833	24.22237	25.90502
HFSPRDCL	www.ers.usda.gov/Briefing/Sugar/data/table30.xls	9195.6	8962.084	8833.143
HFSPRDOS	www.ers.usda.gov/Briefing/Sugar/data/table29.xls	9234.2	8845.168	8875.79
HFTRND	Assumed	17	14.5	12
HFYLDWM	Calculated based on USDA-reported corn used for HFCS and HFCS deliveries; fixed at average of 2002/03 and 2003/04 for future years	34.82374	36.61316	37.02135
HLAYER	Calculated from production and average rations	2655.83	2786.221	2956.934
HPORK	Calculated from production and average rations	11076.04	12201.89	12618.41
HTURKEY	Calculated from production and average rations	2220.783	2366.096	2497.147
LRPRC	ERS Oilseed Yearbook, personal correspondence with ERS	20.27067	34.78266	36.73141
LRSPRD	ERS Oilseed Yearbook	754.4185	836.9021	875.3274
LRSPRDMY	Correspondence with ERS for historical data	764.6867	847.0574	888.6652
LRSYLD	Calculated	2.8	2.8	2.8
MGSTOTCL	EIA: tonto.eia.doe.gov/dnav/pet/hist/mgfupus1A.htm	136996.2	139805.7	138463.3
MGSTOTSA	EIA: tonto.eia.doe.gov/dnav/pet/hist/mgfupus1M.htm	138296.5	139589.3	138416.7
MTDISSA	Calculated	2613.169	26.1072	0
NVOPRC	ERS Oilseed Yearbook, personal correspondence with ERS	0.1	0.3	0
OTENRS	Calculated from returns and variable cost data	37.35197	51.22294	43.76637
PDCGNP	IHS Global Insight	122.8921	139.7568	151.2541
PFSPRDMY	Census, Monthlies	1123.405	1488.289	1804.486
PFSYLD	Calculated (PFSPRD/CKYPROD)	0.030325	0.039579	0.045772
PKHGSLT	Calculated	102594.4	112351.5	116684.9
PKSLTWT	Calculated	198.7354	202.3919	206.9645
PKSYLD	Calculated	0.742599	0.750041	0.75599
PNENRS	Calculated from returns and variable cost data	313.8127	220.8359	279.2694
POILRAP	IHS Global Insight	32.56083	69.12045	80.45257
POILRASA	History from tonto.eia.doe.gov/dnav/pet/pet_pri_rac2_dcu_nus_m.htm, projections based on IHS Global Insight data	37.57333	69.39731	83.08659
POILWTI	IHS Global Insight	36.278	73.62717	86.3637

POPTOTW	IHS Global Insight	291.032	304.9725	319.9983
PPI	IHS Global Insight	1.415004	1.755542	1.911104
PPI9NFZ	Calculated based on IHS Global Insight data	150	269.0553	298.0097
PPINGAS	IHS Global Insight	201.8	248.2841	223.3909
PPIRPP	IHS Global Insight	1.0948	2.102697	2.403534
PPIRPPSA	History from data.bls.gov/cgi-bin/dsrv, projections based on IHS Global Insight data	1.242533	2.108724	2.470582
RCENRS	Calculated from returns and variable cost data	226.3441	433.8509	239.4969
RFAD	Energy Indep. & Security Act of 2007	n.a.	310	3070
RFADC	Assumed or zero historically	n.a.	7.99785	144.8512
RFADCPG	Assumed or zero historically	n.a.	0.025	0.181531
RFADRIND	Assumed or zero historically	n.a.	n.a.	n.a.
RFADRINS	Assumed or zero historically	n.a.	202.3333	319.4453
RFADROLO	Assumed or zero historically	n.a.	0.19	0.145541
RFADSA	Calculated from calendar RFS	0	490	3856.667
RFADSAE	Calculated from legislation and assumptions	0	385.2667	2016.256
RFADSALC	Calculated from legislation and assumptions	n.a.	445.8333	2023.333
RFBD	Energy Indep. & Security Act of 2007	n.a.	230	960
RFBDC	Zero historically	0	196.4398	618.3227
RFBDCPG	Zero historically	0	0.349238	0.59812
RFBDRIND	Assumed or zero historically	n.a.	n.a.	n.a.
RFBDRINS	Assumed or zero historically	n.a.	71.23935	90.78617
RFBDROLO	Assumed or zero historically	n.a.	0.092376	0.090786
RFBDSA	Calculated from calendar RFS	0	336.6667	986.6667
RFBDSAE	Calculated from legislation and assumptions	0	355.8318	984.7687
RFBIOFC	Assumed or zero historically	n.a.	509.6058	1325.587
RFCE	Energy Indep. & Security Act of 2007	n.a.	20	1300
RFCEC	Assumed or zero historically	n.a.	1.943528	144.4665
RFCECPG	Assumed or zero historically	n.a.	0.269965	0.779062
RFCERINS	Assumed or zero historically	n.a.	0	0
RFCEROLO	Assumed or zero historically	n.a.	0	0
RFCESA	Calculated from calendar RFS	0	53.33333	1833.333

RFCESAE	Calculated from legislation and assumptions		0	53.33333	1833.333
RFCNC	Assumed or zero historically	n.a.		254.1148	417.947
RFCNCPG	Assumed or zero historically	n.a.		0.025	0.02825
RFCNROLO	Assumed or zero historically	n.a.		2084.333	2815.728
RFETC	Assumed or zero historically	n.a.		264.0561	707.2648
RFOAROLO	Assumed or zero historically	n.a.		95.4743	183.2661
RFTO	Energy Indep. & Security Act of 2007	n.a.		8350	16870
RFTORINE	Assumed or zero historically	n.a.		n.a.	n.a.
RFTORINS	Assumed or zero historically	n.a.		2008.75	3135.174
RFTOROLO	Assumed or zero historically	n.a.		0.17	0.185875
RFTOSA	Calculated from calendar RFS		0	9676.667	17976.67
RFTOSAE	Calculated from legislation and assumptions		0	9304.667	16215.6
RFTOSALC	Calculated from legislation and assumptions	n.a.		10912.5	16143.33
ROPMKT	Oil crop yearbook, Oil crop outlook	29.748		47.30583	48.82516
S2ENRS	Calculated from returns and variable cost data	171.9277		296.6269	305.4048
SBENRS	Calculated from returns and variable cost data	146.3368		247.9789	280.8747
SBNRML	Calculated	151.0957		259.8191	275.9696
SBSPRD	USDA/NASS Online Database	2858.561		3082.61	3311.909
SBVARC	USDA/ERS cost of production survey.	82.964		116.1145	139.1991
SFENRS	Calculated from returns and variable cost data	95.79204		167.7334	145.8938
SGENRS	Calculated from returns and variable cost data	39.94618		79.53015	75.78004
SGPFRM	USDA/NASS Online Database	2.05856		3.4342	3.429977
SMP48D	Oil crop yearbook, Oil crop outlook	192.484		287.3566	282.5631
SODBIO	From WASDE historically	502.8129		2664.65	4022.475
SODFOD	Oil crop yearbook, Oil crop outlook	16733.09		14833.42	14766.74
SOPMKT	Oil crop yearbook, Oil crop outlook	22.978		37.64926	40.11161
ST_MGR	Calculated historically based on other assumptions	82.25016		76.03138	88.5264
ST_NRS	Calculated historically based on other assumptions	11.85469		18.28014	16.1178
STC__FUL	Assumptions based on EPA impact analysis	8.2959		8.182893	8.654616
STCTOTNF	Assumptions based on EPA impact analysis	62.09958		61.32709	63.75398
STCTRANS	Assumptions based on EPA impact analysis	43.40987		44.1038	49.76882

STCVARTR	Assumptions based on EPA impact analysis	26.58043	32.21544	35.2573
STDENG	Assumed zero or near-zero historically	0	0	0
STDGET	Assumed zero or near-zero historically	0	0.022335	0.31929
STDTES	Assumed zero or near-zero historically	0	0.107873	0.041467
STEMGR1	Calculated historically based on other assumptions	0	23.8312	89.69138
STENRS1	Calculated historically based on other assumptions	44.40223	75.84173	17.28278
STEPFM1	Assumed historical values used as expected	45.46	39.03474	42.22787
STEYLD1	Assumed historical values used as expected	4.081691	4.431786	4.713663
STOTCET	Assumptions based on EPA impact analysis	83.32	83.32	78.45213
STPFRM	Assumed historical values	45.46	39.03474	42.22787
STPPLT	Assumed historical values	88.86987	83.13854	91.99668
STPRISK1	Assumption about EISA implementation in future and investors' perceptions	1	1	1
STPRSUB	Assumptions based on legislation	0	11.75874	0
STRMRT	Assumed zero or near-zero historically	0.00001	0.000316	0.000584
STRMRTMX	Assumptions based on EPA impact analysis	0.01	0.025	0.135
STRMRTPA	Assumptions based on EPA impact analysis	0.45	0.45	0.45
STSPRD	Assumed zero or near-zero historically	0	0.114643	0.228687
STSYLD1	Assumed historical values used as expected	4.081691	4.431786	4.713663
STVENG	Assumed zero or near-zero historically	21.68747	32.34441	36.64842
SUPRAW	Sugar & Sweeteners Yearbook Table 4	21.3005	23.72109	25.21436
SUPREF	Sugar & Sweeteners Yearbook Table 5	27.5625	33.48281	33.02903
SWACSLIP	Assumptions based on EPA impact analysis	0	0.08	0.1
SWC__FUL	Assumptions based on EPA impact analysis	8.560947	8.44433	8.931124
SWCTOTNF	Assumptions based on EPA impact analysis	113.1099	110.7426	110.9412
SWCTRANS	Assumed historical values	33.08772	38.77641	50.61919
SWCVARTR	Assumptions based on EPA impact analysis	21.07053	25.60318	28.02798
SWDENG	Assumed zero or near-zero historically	0	0	0
SWDFED	Assumed zero or near-zero historically	0	1.63E-05	4.41E-05
SWDGET	Calculated historically based on other assumptions	0	0	0
SWDTES	Assumed zero or near-zero historically	0	1.9E-06	5.55E-06
SWEMGR1	Calculated historically based on other assumptions	0	109.4351	201.2974

SWENRS	Assumed zero or near-zero historically	0	20.16031	85.64452
SWENRS1	Assumed zero or near-zero historically	0	42.30055	81.42502
SWEPFM1	Assumed historical values used as expected	39	40.12245	41.4287
SWEYLD1	Assumed historical values used as expected	4.32	4.8575	5.395
SWOTCET	Assumptions based on EPA impact analysis	79.6	79.6	74.94946
SWPFRM	Assumed historical values	39	39.08245	41.4287
SWPMIN	Assumed historical value of next best use, projected to rise with GDP deflator	39	39.08247	41.42875
SWPPLT	Assumed historical values	77.28772	80.97886	92.0479
SWPRISK1	Assumption about EISA implementation in future and investors' perceptions	1	1	1
SWPRSUB	Assumptions based on legislation	0	15.68245	0
SWSHAR	Assumed very low historical values	0	0.001904	9.5E-06
SWSPLT1_Y1	Assumptions based on EPA impact analysis	0	0	0
SWSPLT1_Y2	Assumptions based on EPA impact analysis	0	0	0
SWSPLT1_Y3	Assumptions based on EPA impact analysis	0.00001	0.00001	0.00001
SWSPRD	Assumed zero or near-zero historically	0	1.73E-05	4.42E-05
SWSYLD1	Assumptions based on EPA impact analysis	0	2.327168	5.395
SWSYLDA1	Assumptions based on EPA impact analysis	1.44	1.619167	1.798333
SWSYLDB1	Assumptions based on EPA impact analysis	2.88	3.238333	3.596667
SWSYLDC1	Assumptions based on EPA impact analysis	4.32	4.8575	5.395
SWVENG	Assumed zero or near-zero historically	20.75634	30.95572	35.07494
TEPRC	ERS Oilseed Yearbook, personal correspondence with ERS	18.13517	31.03133	32.88889
TESPRDMY	ERS Oilseed Yearbook	1889.333	1798.146	1877.841
TIPRC	ERS Oilseed Yearbook, personal correspondence with ERS	16.38126	28.42381	30.63498
TISPRDMY	Census, Monthlies	6429.296	6419.612	6359.584
UGPFBCL	Nebraska: www.neo.ne.gov/statshtml/66.html	1.116	2.08882	2.372836
UGPFBSA	Simple average of Sep-Aug prices from www.nol.org/home/NEO/statshtml/66.html; equation for projections	1.2665	2.083308	2.445165
UGPRTCL	EIA: www.eia.doe.gov/emeu/mer/pdf/pages/sec9_6.pdf	1.717	2.7157	3.012161
UGPRTSA	EIA: www.eia.doe.gov/emeu/mer/pdf/pages/sec9_6.pdf	1.873383	2.710541	3.087615
WHENRS	Calculated from returns and variable cost data	68.5728	122.8047	100.8813
WHNRML	Calculated	66.41706	123.5003	95.98158

WHPFRM	USDA/NASS Online Database	3.312	5.40254	4.866818
WHVARC	USDA/ERS cost of production survey.	70.48	105.6198	121.3523
WPI051	IHS Global Insight	1.044353	1.557535	1.764793
YGPRC	ERS Oilseed Yearbook, personal correspondence with ERS	14.37817	24.54239	26.87769
ZCE92W	IHS Global Insight	6231.474	6969.821	7617.484

Equations elasticities

Ethanol

Variable	Term	short-run	long-run
ETCAPDM	CRNRBDM / PDCGNP	0.04	13.31
ETCAPWM	CRNRBWM / PDCGNP	0.02	5.08
ETCEVARC	CRNRML	0.08	0.08
ETCEVARC	CROTCDM	0.35	0.35
ETCEVARC	CRVARC	0.06	0.06
ETCEVARC	HAPFRM	0.12	0.12
ETCEVARC	PPINGAS	0.08	0.08
ETCEVARC	SBNRML	0.10	0.10
ETCEVARC	SBVARC	0.05	0.05
ETCEVARC	WHNRML	0.11	0.11
ETCEVARC	WHVARC	0.05	0.05
ETDADSA	ETPRTSA/PPIRPPSA	-0.03	-0.03
ETDADSA	MGSTOTSA*ETADD	1.10	1.10
ETDADSA	MTDISSA	-0.09	-0.09
ETDEXPSA	ETPFBSA/ETPBZAMA	-2.84	-2.84
ETDTESCL	ETDTESSA	0.92	0.92
ETDTESCL	ETSPRDSA	0.13	0.13
ETDTESSA	ETPFBSA/PDCGNP	-0.36	-0.36
ETDTESSA	ETSPRDSA	0.64	0.64
ETPBZAMA	ETSIMNSA	0.04	0.04
ETPBZAMA	POILRASA	0.41	0.41
ETPFBCL	ETPFBSA	0.37	0.37
ETPFBCL	lag(ETPFBSA)	0.66	0.66
ETPRTRSA	(UGPRTSA-UGPFBSA)	-0.32	-0.32
ETPRTRSA	ETPRTSA	1.32	1.32
ETSIMPSA	ETPADSA/((ETPBZAMA)*(1+ETTARVSA)+	0.58	0.58
ETSIMPSA	ETPADSA/PDCGNP	0.63	0.63
ETSPNCSA	(0.75*ETPADSA+0.25*ETPFBSA)/PDCGNP	0.74	1.86
ETSPNCSA	(0.75*ETPADSA+0.25*ETPFBSA)/SGPFRM	1.82	4.56
ETSPNCSA	(0.75*ETPADSA+0.25*ETPFBSA)/WHPFRM	0.68	1.70

Biodiesel

Variable	Term	short-run	long-run
BDDDOM	BDPREQ/DIPRSM	-17.35	-17.35
BDDDOM	DISLS	1.27	1.27
BDDEXN	(BDPPLTM-BDTAXCR+BDTAREU+0.2)/BD	-7.49	-12.49
BDOTPRD	BDPPLTM/PDCGNP	2.31	4.63
BDOTPRD	BDSOPRD	0.41	0.82
DIPRS	PPIRPP	0.96	0.96
DIPRSM	DIPRS	0.96	0.96
DIPRT	DIPRS	0.74	0.74
DIPRT	PDCGNP	0.05	0.05
DISLS	DIPRT/PDCGNP	-0.12	-0.12
DISLS	ln(ZCE92W/POPTOTW)	0.46	0.46

Motor fuel

Variable	Term	short-run	long-run
MGSTOTCL	MGSTOTSA	1.00	1.00
MGSTOTSA	ETPRTSA / PDCGNP	-0.01	-0.04
MGSTOTSA	log(ZCE92W / POPTOTW)	0.23	0.94
MGSTOTSA	UGPRTSA / PDCGNP1	-0.09	-0.63
POILRAP	POILWTI	1.00	1.00
PPIRPP	PDCGNP	0.21	0.21
PPIRPP	POILRAP	0.69	0.69
UGPFBCL	UGPFBSA	1.01	1.01
UGPFBSA	PPIRPPSA	1.00	1.00
UGPRTCL	UGPRTSA	1.01	1.01
UGPRTSA	PDCGNP	0.05	0.05
UGPRTSA	RFETC/MGSTOTSA	0.00	0.00
UGPRTSA	UGPFBSA	0.78	0.78

Corn processing and fractionation

Variable	Term	short-run	long-run
CLDEXN	CLPRCH/PDCGNP	-0.63	-0.63
CLDEXN	SOPMKT/PDCGNP	0.35	0.35
CLDTES	CLPRCH/PDCGNP	-0.80	-0.80
CLDTES	CLSPRD	0.64	0.64
CLPRCH	LN(CLDDOM)	-0.12	-0.12
CLPRCH	SOPMKT	0.09	0.09
CRDBEV	CRPFRM/PDCGNP	-0.08	-0.08
CRDCER	CRPFRM/PDCGNP	-0.09	-0.09
CRDGLD	CRPFRM/SUPRAW	-0.09	-0.09
CRDHFC	CRGMWH/PDCGNP	0.35	0.71
CRDHFC	CRNRBWM/PDCGNP	-0.12	-0.24
CRDSTR	CRPFRM/PDCGNP	-0.08	-0.08

Other elasticities

Variable	Term	short-run	long-run
DGDEXN	CRPFRM/PDCGNP	1.15	1.15
DGDEXN	DGPMKT/PDCGNP	-1.84	-1.84
DGDEXN	SMP48D/PDCGNP	0.37	0.37
DGVEN	(WPI051/WPI0511996)*36.48	1.00	1.00
DGVFEBE	DGDCOBE*CRPFRM*2000*56	0.83	0.83
DGVFEBE	DGDSMBE*SMP48D	0.17	0.17
DGVFEBR	DGDCOPK*CRPFRM*2000/56	0.61	0.61
DGVFEBR	DGDSMPK*SMP48D	0.39	0.39
DGVFEDY	DGDCOPK*CRPFRM*2000/56	0.85	0.85
DGVFEDY	DGDSMPK*SMP48D	0.15	0.15
DGVFEPK	DGDCOPK*CRPFRM*2000/56	0.78	0.78
DGVFEPK	DGDSMPK*SMP48D	0.22	0.22
DGVFZ	PPI9NFZ/PPI9NFZ1997*0.26/0.82	0.99	0.99
FCNRT	.0093*GDPD + .0227*PPINGAS	-2.89	-2.89
FCNRT	2.95*DGPMKT/2000	-1.36	-1.36
FCNRT	CLPRCH*0.1686	5.49	5.49
GFDEXN	CRPFRM/PDCGNP	0.35	0.35
GFDEXN	GFPR21/PDCGNP	-0.73	-0.73
GFDEXN	SMP48D/PDCGNP	0.15	0.15
GFPR21	CRPFRM	0.45	0.45
GFPR21	DGPMKT	0.50	0.50
GFPR21	LN(GFDDOM)	-0.30	-0.30
GFPR21	SMP48D	0.12	0.12
GMDEXN	GMPR60/PDCGNP	-0.78	-0.78
GMDEXN	SMP48D/PDCGNP	0.49	0.49
GMPR60	LN(GMDDOM)	-0.05	-0.05
GMPR60	SMP48D	0.76	0.76
HFDDOMOS	HFPRMW/average(SUPRAW,SUPREF)	-0.09	-0.09
HFDDOMOS	ln(ZCE92W/POPTOTW)	0.10	0.10
HFDDOMOS	max(0,HFPRMW-.85*average(SUPRAW,SUP	-0.01	-0.01
HFDEXNOS -HFDEXMOS	HFPRMW/average(SUPRAW,SUPREF)	-0.37	-0.37
HFDEXNOS -HFDEXMOS	HFPRMW/CRPFRM	-0.32	-0.32