The Impact of Recent Energy Price Changes on the U.S. Cotton Industry

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Motivation

- In recent years, energy prices have fallen sharply, with crude oil and natural gas prices down more than 40 percent and 20 percent, respectively.

- Corn and cotton prices have both declined as well.

- The agricultural sector benefits from lower energy price because of reduced production cost, but oil price volatility has concerned producers and policymakers.

- The question is how does energy price volatility effect the U.S. cotton industry?

OBJECTIVES

- To analyze the response of U.S. cotton prices to the fluctuations in oil prices and ethanol prices shocks.

- To examine whether the transmission of the fluctuations in crude oil prices to cotton prices is driven by crude oil supply shocks or demand shocks.

- To use the results for analysis of welfare changes and income stabilization policies for cotton farmers.

- To find the impact of crude oil price shock on agricultural commodities such as corn (Rapsomanikis & Hallam, 2006; Campiche et al., 2007; Yu, Bessler, & Fuller, 2006; Zhang & Reed, 2008; Harri, Nalley, & Hudson, 2009).
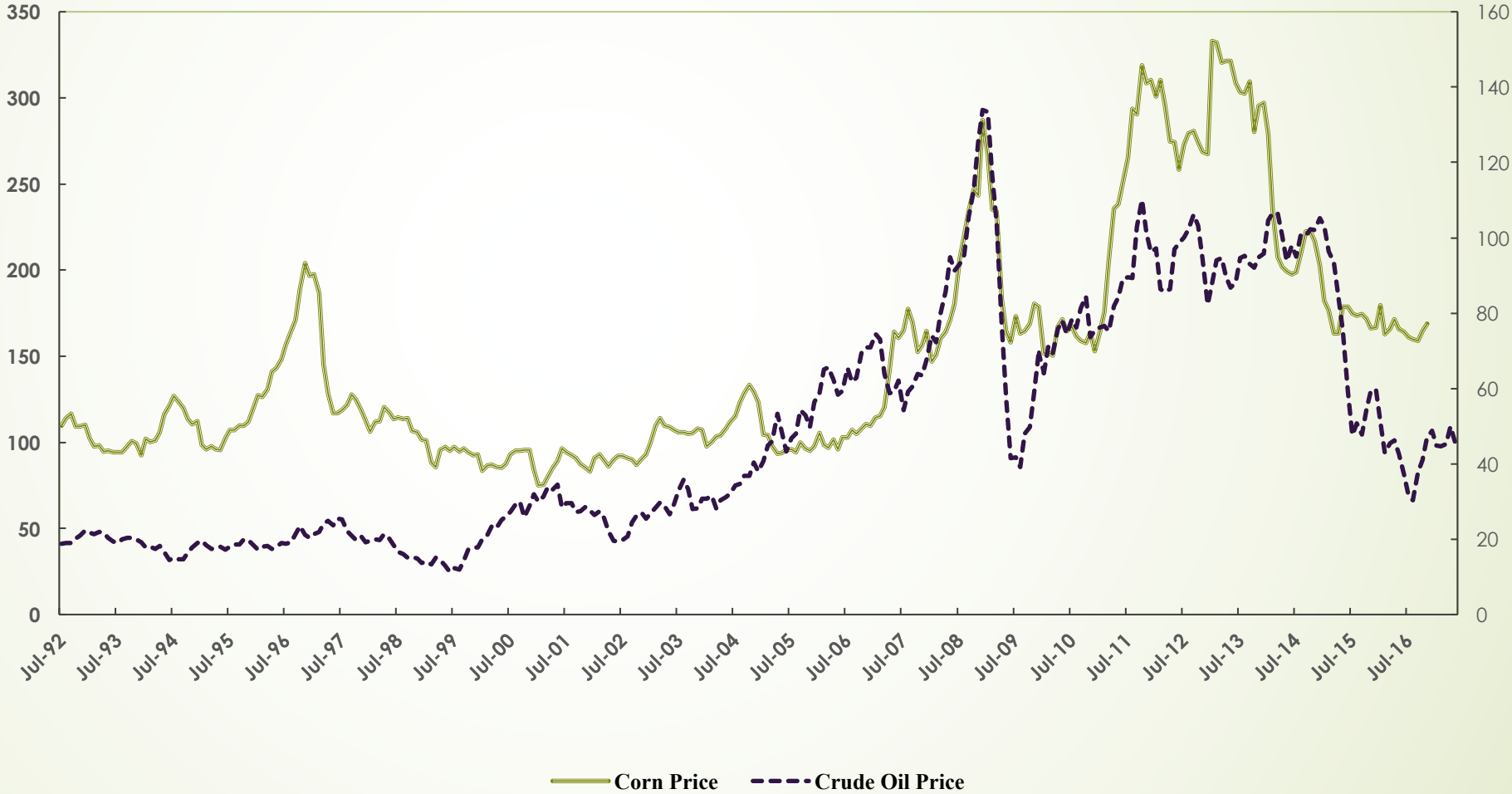
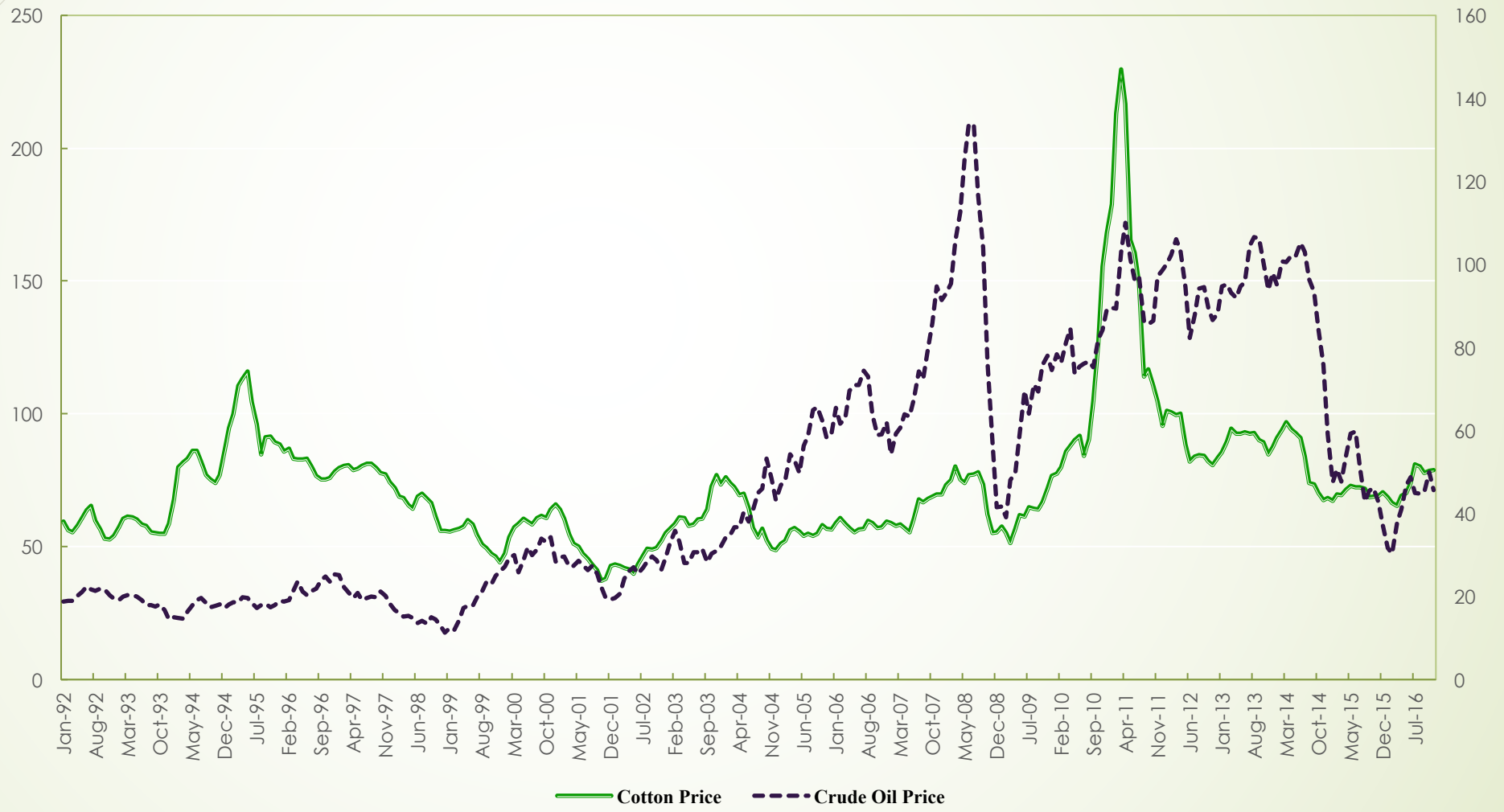# FIGURE 1: CORN PRICE VS. CRUDE OIL PRICE

Corn Price ——— Crude Oil Price

FIGURE 2: COTTON PRICE VS. CRUDE OIL PRICE

Legend: —— Cotton Price - - - Crude Oil Price

FIGURE 3: COTTON PRICE VS. CORN PRICE

Cotton Price — Corn Price

FIGURE 4: ETHANOL PRICE VS. CRUDE OIL PRICE

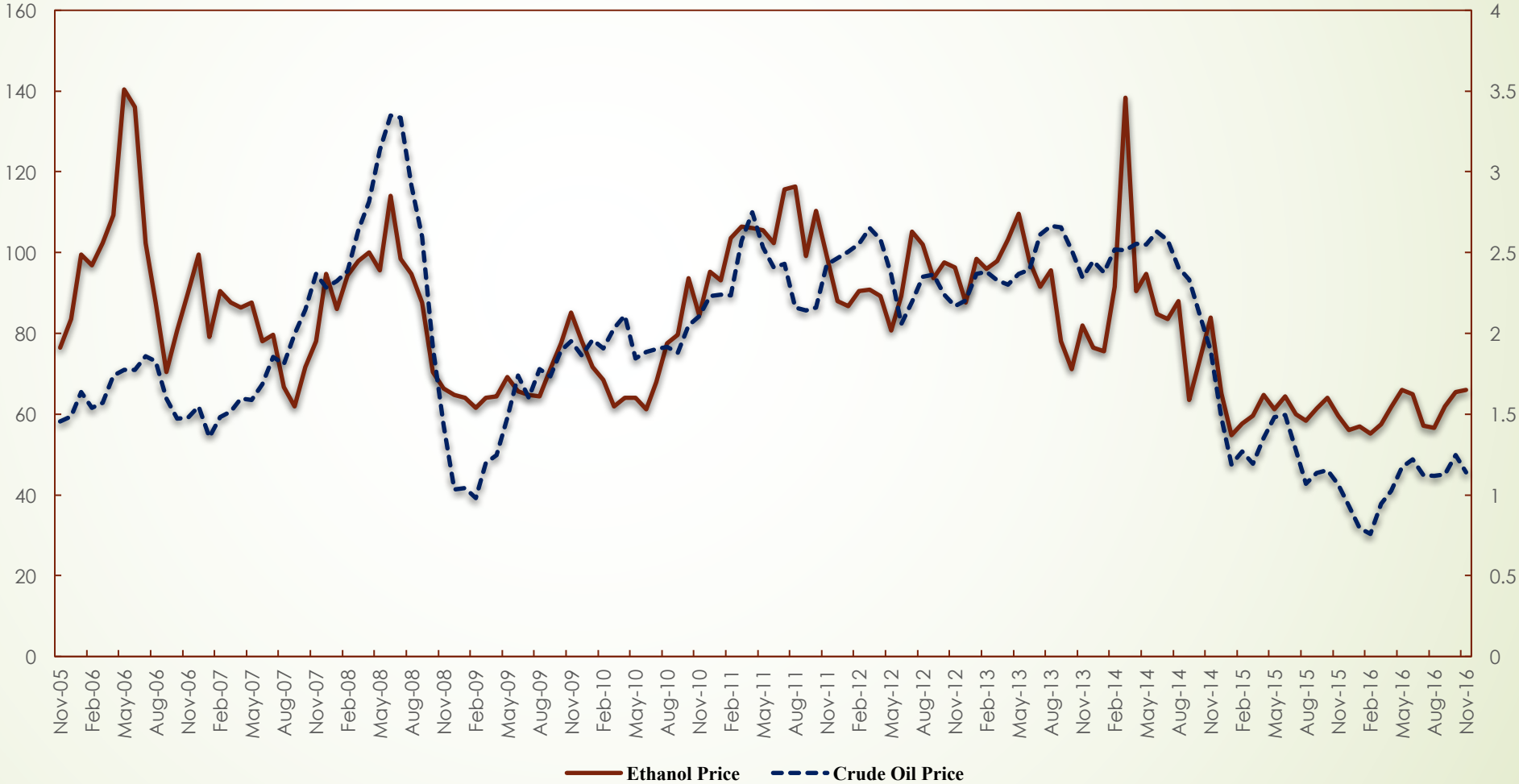Ethanol Price —— Crude Oil Price - - - -

FIGURE 5: TOTAL PETROLEUM AND OTHER LIQUIDS PRODUCTION (1000 BBL/D)

International Total Petroleum and Other Liquids Production

U.S. crude oil and other liquid fuels production
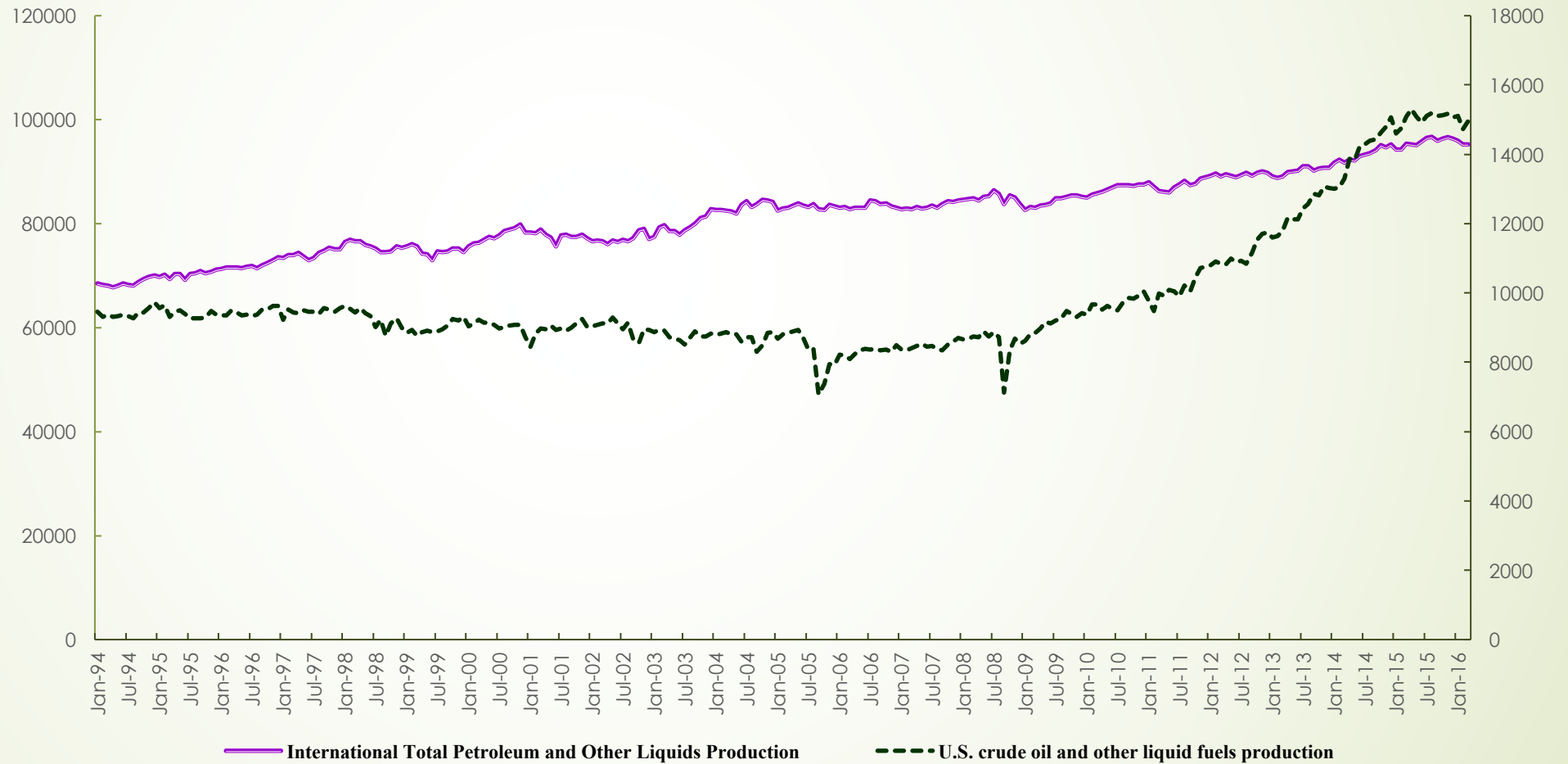
DATA

- Monthly data over the period April 1994 to March 2016:
  - Global total petroleum and other liquids production (GPRO) [Supply side];
  - U.S. industrial production index as a proxy for global real economic activity (IP) [Demand side];
  - Trade weighted U.S. dollar index: Major Currencies (TWE);
  - Corn price index (COR);
  - Crude oil price (OIL);
  - Cotton price (COT);
  - Ethanol Price (ETH);

Method

- A multivariate structural vector auto-regression (SVAR) model;

$$y_t = A^{-1}A_1^* y_{t-1} + \cdots + A^{-1}A_p^* y_{t-p} + A^{-1}B\varepsilon_t$$

- The vector of endogenous variable is as follows:

$$y_t = [GPRO_t, IP_t, OIL_t, TWE_t, COT_t]$$

- The identification scheme is characterized by the following non-recursive structure

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ k_{21} & 1 & 0 & 0 & 0 \\ k_{31} & k_{32} & 1 & 0 & 0 \\ k_{41} & k_{42} & k_{43} & 1 & 0 \\ k_{51} & k_{52} & k_{53} & k_{54} & 1 \end{bmatrix} \begin{bmatrix} e_t^{GPRO} \\ e_t^{IP} \\ e_t^{OIL} \\ e_t^{TWE} \\ e_t^{COT} \end{bmatrix} = \begin{bmatrix} u_t^{GPRO} \\ u_t^{IP} \\ u_t^{OIL} \\ u_t^{TWE} \\ u_t^{COT} \end{bmatrix}$$

- Impulse-response functions (IRF) analysis;

RESULTS

- The two above panels in Figure 6 show the IRFs of cotton price to the oil supply and demand-side shocks.

- The two below panels show the IRFs of cotton price to the oil price and currency exchange rate shocks.

- The response of cotton price to the unanticipated disruptions in global crude oil production [supply shock] is positive until the three months and then back to equilibrium with a low volatility.

- Unexpected increases in the U.S. industrial production index as a proxy for global real economic activity [demand shock] cause a short-lived increase in cotton prices until the second month, then decrease until the third month and back to equilibrium with a relative volatility.

- The responses of cotton price to the oil price shock is positive, but with a decreasing trend back to equilibrium.

- The responses of cotton price to the indirect effect of oil price, namely, currency exchange rate is also very low and back to equilibrium [after three months] with a low fluctuations.

Figure 6: IRFs of cotton price to the oil supply and demand-side shocks, oil price shock, and exchange rate shock

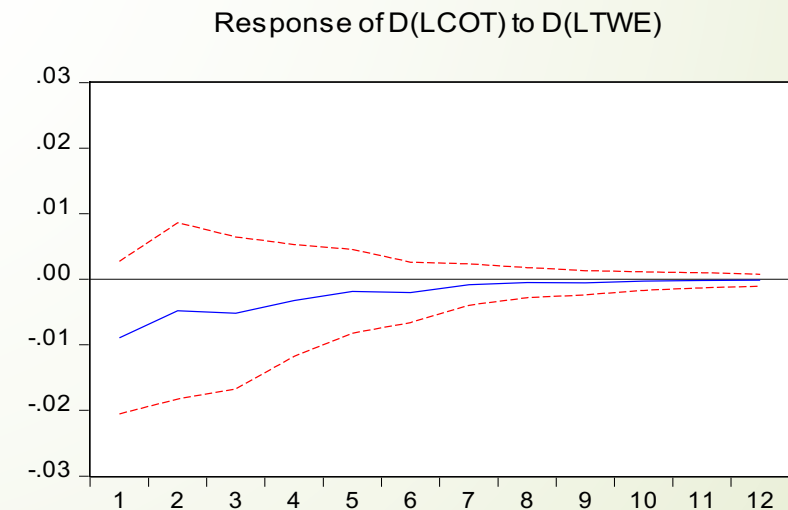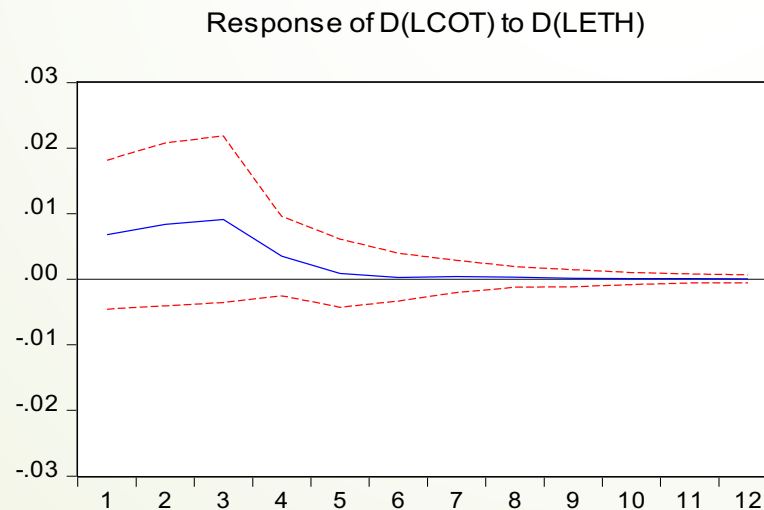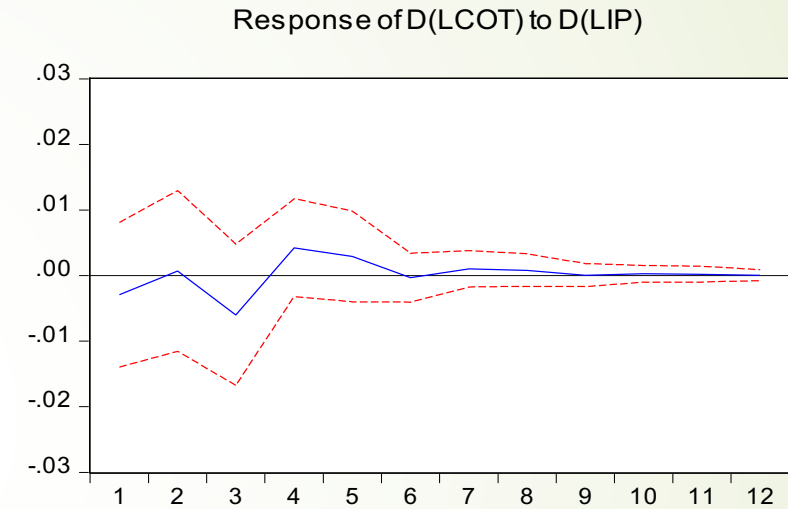Response to Cholesky One S.D. Innovations ± 2 S.E.
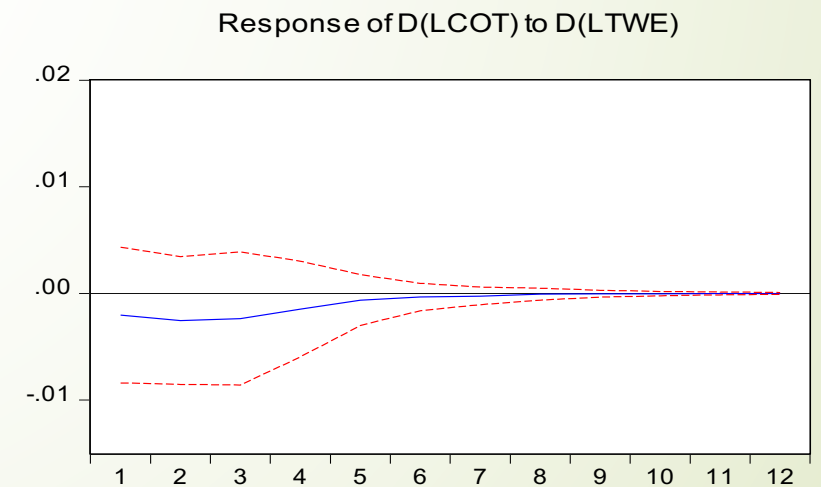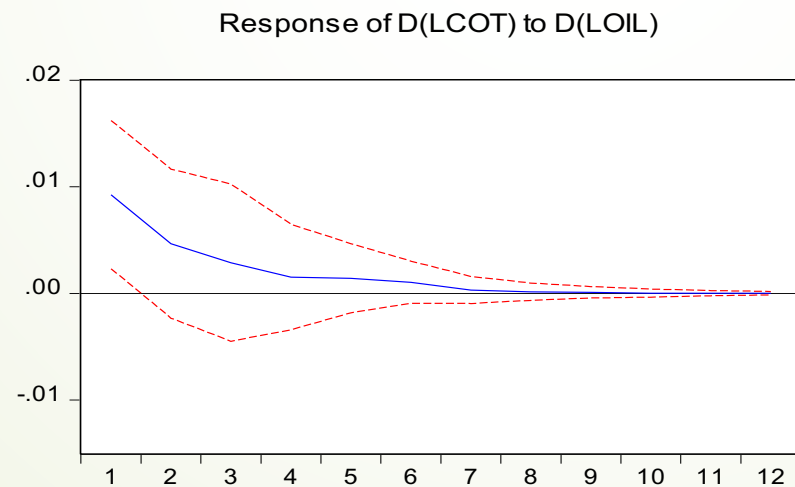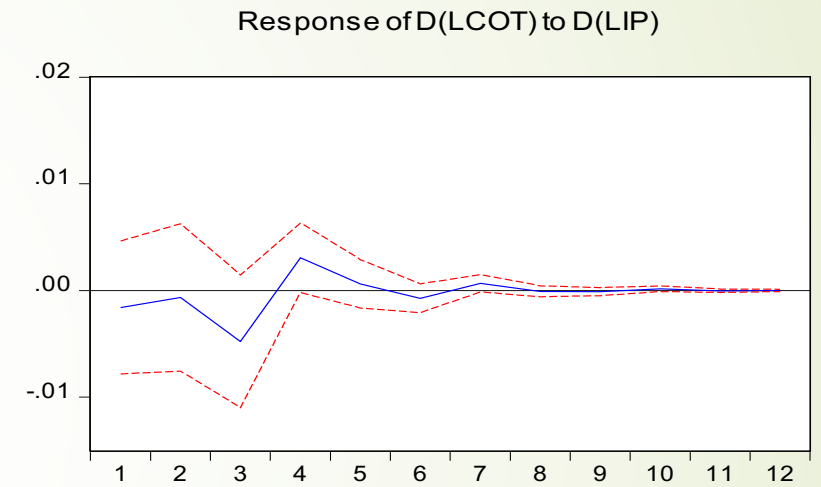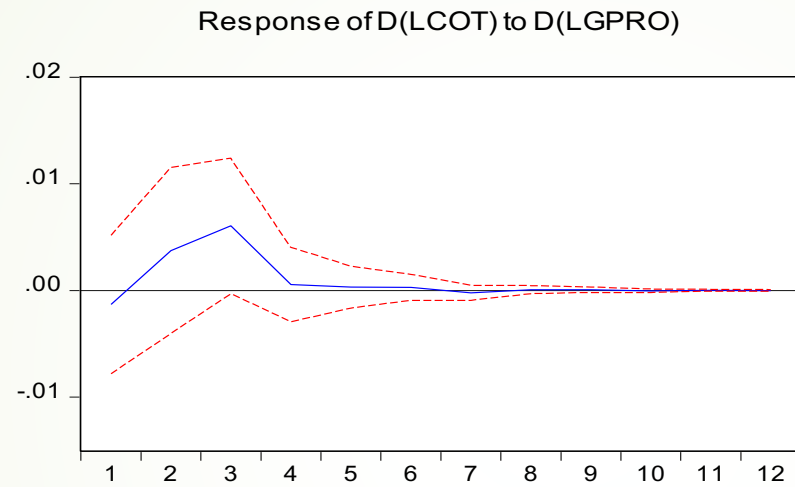
RESULTS (CONT.)

- In Figure 7, we replace ethanol price instead of oil price. Almost, we have the same results like the ones in Figure 6.

- The response of cotton price to the unanticipated disruptions in global oil production is positive until the three months and then back to equilibrium.

- Unexpected increases in the U.S. industrial production index cause a short-lived increase in cotton price until the second month, then decrease until the third month and back to equilibrium with a relative volatility.

- The response of cotton price to the ethanol price is positive and increasing until the third month and then back to equilibrium.

- The cotton price will increase with a positive shock in the currency exchange rate and back to equilibrium.

Figure 7: IRFs of cotton price to the oil supply and demand-side shocks, Ethanol price shock, and exchange rate shock
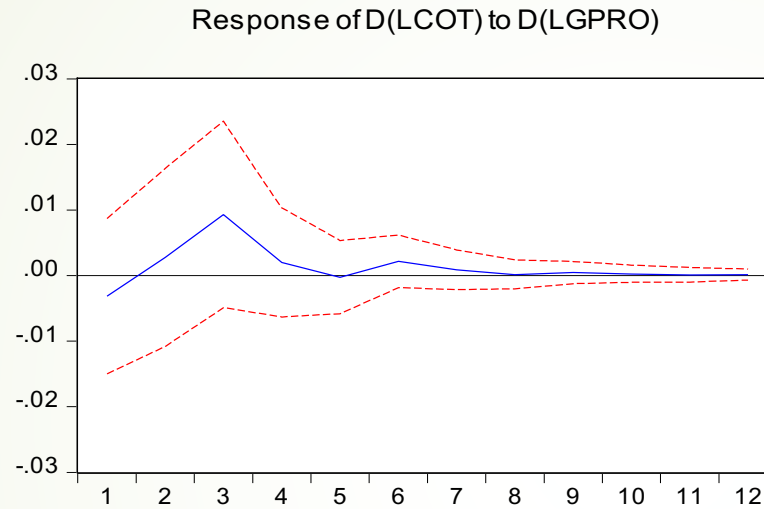
Response to Cholesky One S.D. Innovations ± 2 S.E.

Response of D(LCOT) to D(LGPRO)

Response of D(LCOT) to D(LIP)

Response of D(LCOT) to D(LETH)

Response of D(LCOT) to D(LTWE)

RESULTS (CONT.)

- In other cases, the response of cotton price to the corn price is positive until the second month and then back to equilibrium.

- The cotton price will increase with a positive shock in the currency exchange rate and back to equilibrium.

- The response of corn price to direct effect of crude oil price shock is negative until the first month and then start to increase until the fifth month and back to equilibrium.

- The response of corn price to currency exchange rate is negative until three months [Temporary effect] and then back to equilibrium.

- The response of ethanol price to the crude oil price shock is positive with a decreasing trend until the third month and then back to equilibrium.

- The response of ethanol price to the currency exchange rate is positive until three month and back to equilibrium trend.

SUMMARY

- Cotton is the only major commodity futures market to have registered a significant increase in price during 2015 – up 7% at 64 cents per lb. The major factors such as declining cotton production, higher economic growth, end of Chinese stockpiling, falling oil prices, competing with polyester in the worlds fiber and apparel markets, and seasonal factors are affecting cotton prices in recent year.

- The monthly changes in cotton prices were significantly affected by unexpected increases in the global oil supply and also oil demand driven by increased global real economic activity.

- The monthly changes in cotton prices were significantly affected by unexpected increases in the crude oil price, ethanol price and corn prices.

- The results will be useful in analysis of the welfare effects of different policies in order to support cotton farmers.