In Sync
Rural Land Prices Mirror Commodity Values

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This is the second article of two focusing on Texas commodities (most notably oil, cotton, cattle, and corn) and how the prices of those products affect land prices. Real Estate Center researchers found that land price response to commodity prices differed between regions depending on whether oil, cotton, cattle, and corn were produced and how much acreage was devoted to each in the state's seven rural land market areas.

To determine if commodity prices have a significant impact on land prices, Real Estate Center researchers tested the validity of several commonly held perceptions.

- Are commodity price fluctuations and their impact on land prices proportionate to the production (quantity) of a commodity in a region?

- Do the types of commodities produced lead to different land price effects between rural land regions?

The Takeaway

Estimates show that changes in commodity prices lead changes in rural land prices. Of the four commodities, oil and cotton seem to have the strongest relationship with rural land prices, and their impact can be seen in rural land prices for more than two years.

- As commodity prices increase, is a commensurate positive impact felt in land prices?

- Will both short-term and long-term relationships between commodity prices and land prices emerge?

- Will divergence occur in the short-run from supply and demand factors but not be sustained over the long-run?
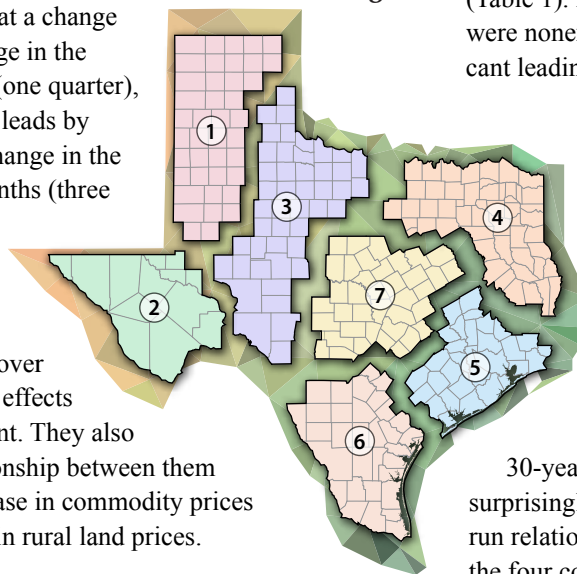
Do Commodity Prices Always Lead Land Price Changes?

At the state level, all four commodities exhibited significant leading indicator characteristics with respect to rural land prices (Table 1). The results imply that a change in the price of oil leads a change in the price of land by three months (one quarter), while a price change in cotton leads by 15 months (five quarters). A change in the price of beef leads by nine months (three quarters), and corn leads by six months (two quarters). The analysis shows that Texas rural land prices have a time-delayed response spread over different time periods, and the effects of each commodity are different. They also demonstrated a positive relationship between them collectively, meaning an increase in commodity prices generally leads to an increase in rural land prices.

Overall, the four commodity prices demonstrated a statistically significant leading indicator relationship with land prices for the seven rural land regions (Table 1). The length of the lead varies between regions and commodities. In region one, all four commodities exhibited a significant lead compared with region seven, where only beef and corn price changes were found to be statistically significant (Table 1). A commodity leads a change in the price of rural land by a minimum of three months

**Figure 1
Land Market Regions**

to a maximum of 33 months. While the four commodities exhibited different lead times when compared to one another, the three historical Texas commodities—oil, cotton, and beef—exhibited stronger statistical leading relationships than corn (Table 1). In regions where commodities were nonexistent or minimal, no significant leading indicator status was observed.

Short-Run, Long-Run Relationships

The consistent significant results obtained from the estimates show commodity prices, especially oil and cotton, do have a significant direct short-run impact on Texas rural land prices for the 30-year sample period (Table 2). Not surprisingly, region seven had no short-run relationship because virtually none of the four commodities were produced in that region (Table 2).

No short-run relationship was exhibited between corn and any of the rural regions compared with the three commodity pillars of the Texas economy—oil, cattle, and cotton (Table 2). Changes in cotton prices seemed to exhibit a short-run relationship in six of the seven regions followed by oil with five out of seven, and beef with one out of seven regions (Table 2).

Research Methodology

Real Estate Center researchers examined the relationship between oil, cotton, beef, and corn prices and rural land prices in the seven regional land markets in Texas from 1Q1980 to 3Q2016. The regional land markets were defined by the Center (Figure 1). The analysis controlled for U.S. long-term interest rate effects. Quarterly land price data in dollars per acre were adjusted for inflation and seasonally adjusted; quarterly commodity prices were adjusted for inflation

and seasonality; and the long-term rate of the ten-year Treasury note yield in percent per annum was adjusted based on the expectations of the Federal Reserve Board of Governors.

Rural land prices seem to follow commodity price movements (Figures 2–8); oil prices especially seem to lead rural land prices. A linear transfer function (LTF) model approach was used to evaluate the leading relationship between each commodity and the price of rural land. This allowed

identification of a leading statistical relationship between them and eliminated the possibility of any false relationship between them.

To examine both short-run and long-run impacts of commodity prices on rural land prices at the state and regional level, a vector autoregression (VAR) and a vector error correction model (VECM) were employed. The VAR model was used to investigate the short-run relationships, and the VECM will provide information on long-run relationships.

Table 1. Leading Statistical Relationship Between Commodity Prices and Texas Rural Land Prices

	Oil	Cotton	Beef	Corn
Texas	3 months (1 quarter)*	15 months (5 quarters)*	9 months (3 quarters)*	6 months (2 quarters)*
Region 1	21 months (7 quarters)**	15 months (5 quarters)*	15 months (5 quarters)*	9 months (3 quarters)***
Region 2	12 months (4 quarters)**	15 months (5 quarters)*	3 months (1 quarter)*	–
Region 3	12 months (4 quarters)***	15 months (5 quarters)*	36 months (12 quarters)*	–
Region 4	3 months (1 quarter)*	33 months (11 quarters)*	–	27 months (9 quarters)***
Region 5	18 months (6 quarters)**	12 months (4 quarters)*	–	12 months (4 quarters)*
Region 6	12 months (4 quarters)***	21 months (7 quarters)***	27 months (9 quarters)*	–
Region 7	–	–	18 months (6 quarters)***	9 months (3 quarters)**

*1 percent significance, **5 percent significance, ***10 percent significance
Linear Transfer Function (LTF) model results. The sign of the commodity coefficients are all positive.
Source: Real Estate Center at Texas A&M University

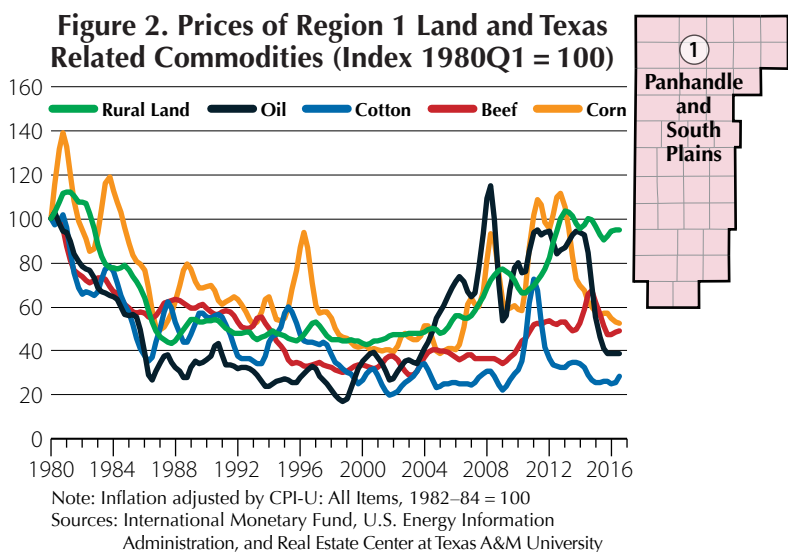**Table 2. Short-Run and Long-Run Relationship Between Commodity Prices and Texas Rural Land Prices**

	Oil	Cotton	Beef	Corn
Texas	Short-run**	Short-run**	Short-run*	Short-run** and long-run*
Region 1	Short-run***	Short-run***	–	–
Region 2	Short-run* and long-run*	Short-run* and long-run*	–	–
Region 3	–	–	–	–
Region 4	Short-run** and long-run*	Short-run*** and long-run***	–	–
Region 5	Short-run* and long-run***	Short-run* and long-run*	–	–
Region 6	Short-run* and long-run*	Short-run* and long-run*	Short-run**	–
Region 7	–	–	–	–

*1 percent significance, **5 percent significance, ***10 percent significance
Vector Autoregressive (VAR) and Vector Error Correction (VEC) model results.
For the VAR model the null hypothesis is that the real commodity price coefficients are jointly equal to zero in the real land price equation.
The Johansen Cointegration Test at the 5 percent critical value and the negative and significance of the error correction term in the VEC model.
Source: Real Estate Center at Texas A&M University

The long-run estimates showed consistent significant results revealing a long-run relationship between oil and cotton in four out of seven rural land regions (Table 2), demonstrating the strong ties between these two commodities and rural land prices for the past 30 years. Unexpectedly, only a long-run relationship at the state level was found with corn prices (Table 2), meaning that by region there is no significant relationship, but an aggregate long-run relationship exists between rural land prices and corn prices.

Based on these findings, Center researchers proceeded to evaluate how an unpredictable change (shock) in the price of the four commodities affects rural land prices in the short- and long-run. The analysis was done only for the regions where a significant relationship was found. This analysis reveals the
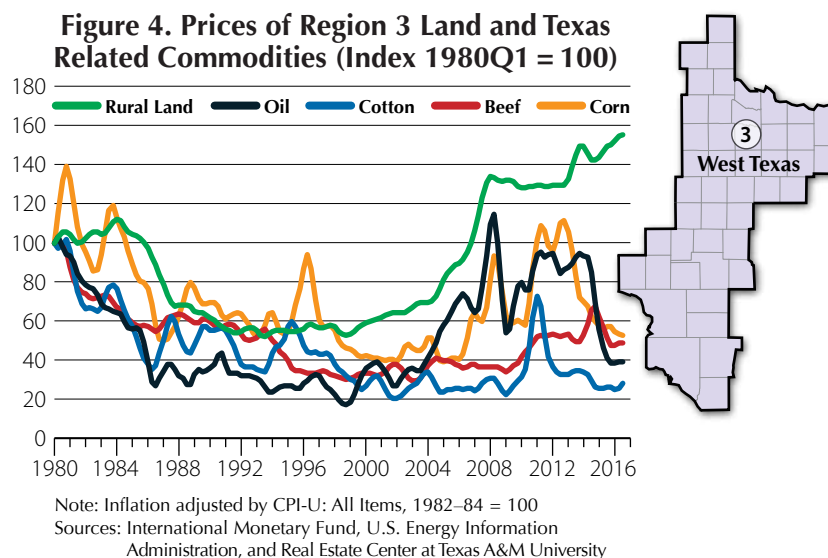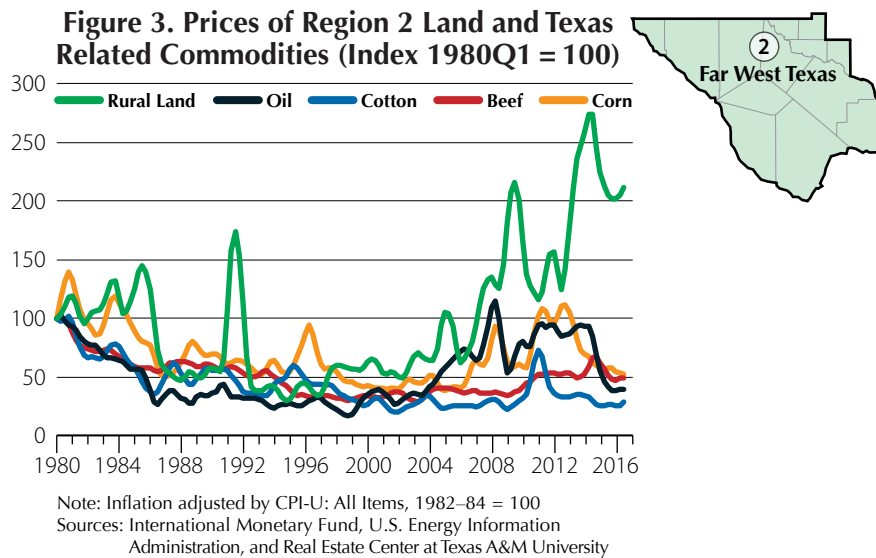
isolated way an unexpected movement (shock) in the real price of commodities affects real rural land prices over time. As the figures show, the response of land prices in the

Figure 2. Prices of Region 1 Land and Texas Related Commodities (Index 1980Q1 = 100)

Legend: Rural Land, Oil, Cotton, Beef, Corn

Note: Inflation adjusted by CPI-U: All Items, 1982–84 = 100
Sources: International Monetary Fund, U.S. Energy Information
Administration, and Real Estate Center at Texas A&M University
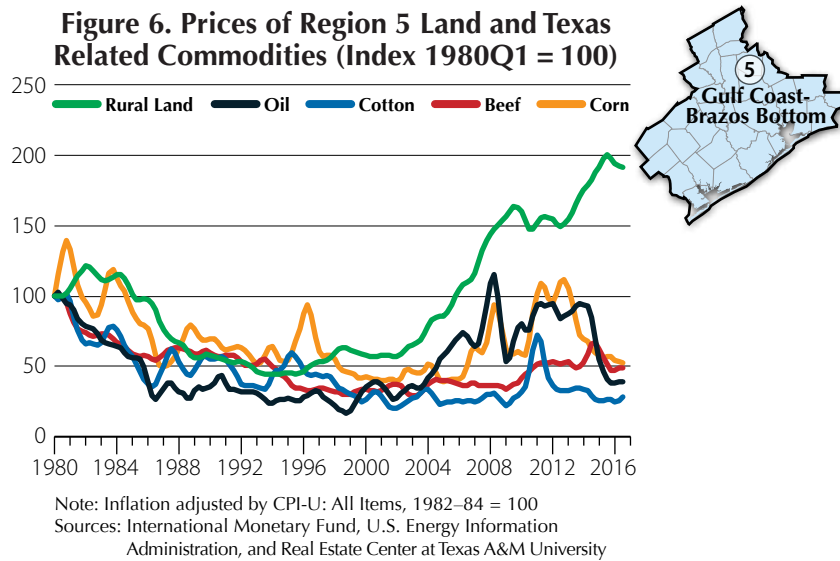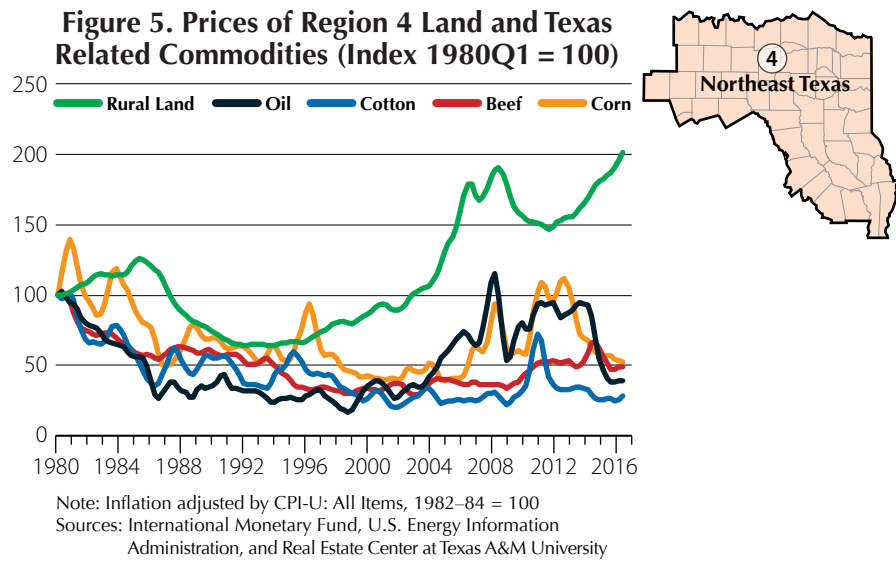
① Panhandle and South Plains

full sample to a positive change in the price of the commodities is statistically positive (Figures 9–33), meaning a positive unexpected change in the price of one of these commodities leads to a positive change in rural land prices. The inverse is true if commodity prices fall; that is, it would cause a negative change in rural land prices. The results mean that the effects of the commodity price changes are felt through time in the price of rural land.

For more information, see Center publication number 2151, "Oil, Cattle, Cotton: Commodities Affect Land Prices." ⬥

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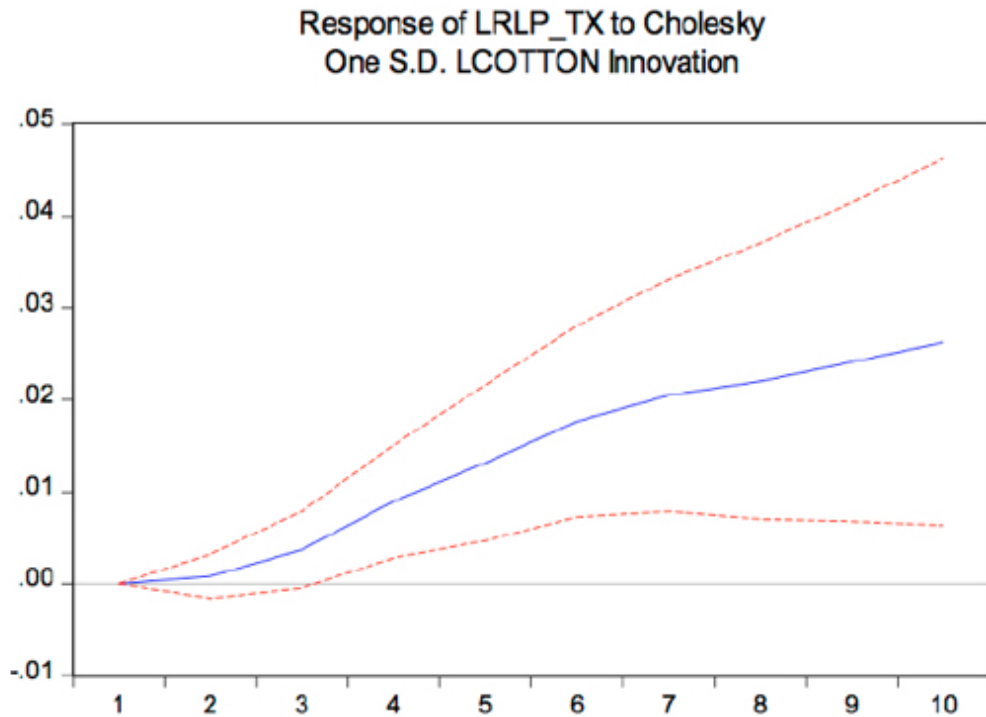
Figure 3. Prices of Region 2 Land and Texas Related Commodities (Index 1980Q1 = 100)

Note: Inflation adjusted by CPI-U: All Items, 1982–84 = 100
Sources: International Monetary Fund, U.S. Energy Information
Administration, and Real Estate Center at Texas A&M University

Figure 4. Prices of Region 3 Land and Texas Related Commodities (Index 1980Q1 = 100)

Note: Inflation adjusted by CPI-U: All Items, 1982–84 = 100
Sources: International Monetary Fund, U.S. Energy Information
Administration, and Real Estate Center at Texas A&M University

Figure 5. Prices of Region 4 Land and Texas Related Commodities (Index 1980Q1 = 100)

Northeast Texas (4)

Note: Inflation adjusted by CPI-U: All Items, 1982–84 = 100
Sources: International Monetary Fund, U.S. Energy Information
Administration, and Real Estate Center at Texas A&M University

Figure 6. Prices of Region 5 Land and Texas Related Commodities (Index 1980Q1 = 100)

Gulf Coast-Brazos Bottom (5)

Note: Inflation adjusted by CPI-U: All Items, 1982–84 = 100
Sources: International Monetary Fund, U.S. Energy Information
Administration, and Real Estate Center at Texas A&M University

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Figure 7. Prices of Region 6 Land and Texas Related Commodities (Index 1980Q1 = 100)

Legend: Rural Land, Oil, Cotton, Beef, Corn

Note: Inflation adjusted by CPI-U: All Items, 1982–84 = 100
Sources: International Monetary Fund, U.S. Energy Information
Administration, and Real Estate Center at Texas A&M University

6 South Texas

Figure 8. Prices of Region 7 Land and Texas Related Commodities (Index 1980Q1 = 100)

Legend: Rural Land, Oil, Cotton, Beef, Corn

Note: Inflation adjusted by CPI-U: All Items, 1982–84 = 100
Sources: International Monetary Fund, U.S. Energy Information
Administration, and Real Estate Center at Texas A&M University

7 Austin-Waco-Hill Country

Figure 9. Short-Run Response of Texas Rural Land to an Oil Price Shock

Response of LRLP_TX to Cholesky
One S.D. LROIL Innovation

Source: Real Estate Center at Texas A&M University
Source: Real Estate Center at Texas A&M University

Figure 10. Short-Run Response of Texas Rural Land to a Cotton Price Shock

Response of LRLP_TX to Cholesky
One S.D. LCOTTON Innovation

Vector Autoregressive (VAR) results
Source: Real Estate Center at Texas A&M University

Figure 11. Short-Run Response of Texas Rural Land to a Beef Price Shock

Response of LRLP_TX to Cholesky
One S.D. LBEEF Innovation

Vector Autoregressive (VAR) results
Source: Real Estate Center at Texas A&M University

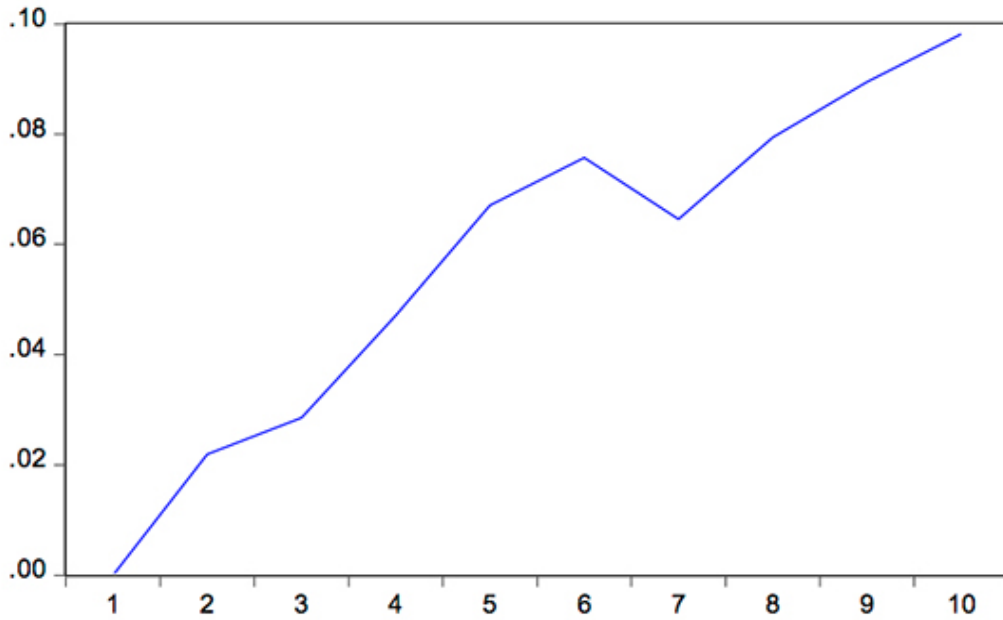**Figure 12. Short-Run Response of Texas Rural Land to a Corn Price Shock**

Response of LRLP_TX to Cholesky
One S.D. LCORN Innovation

Vector Autoregressive (VAR) model results
Source: Real Estate Center at Texas A&M University

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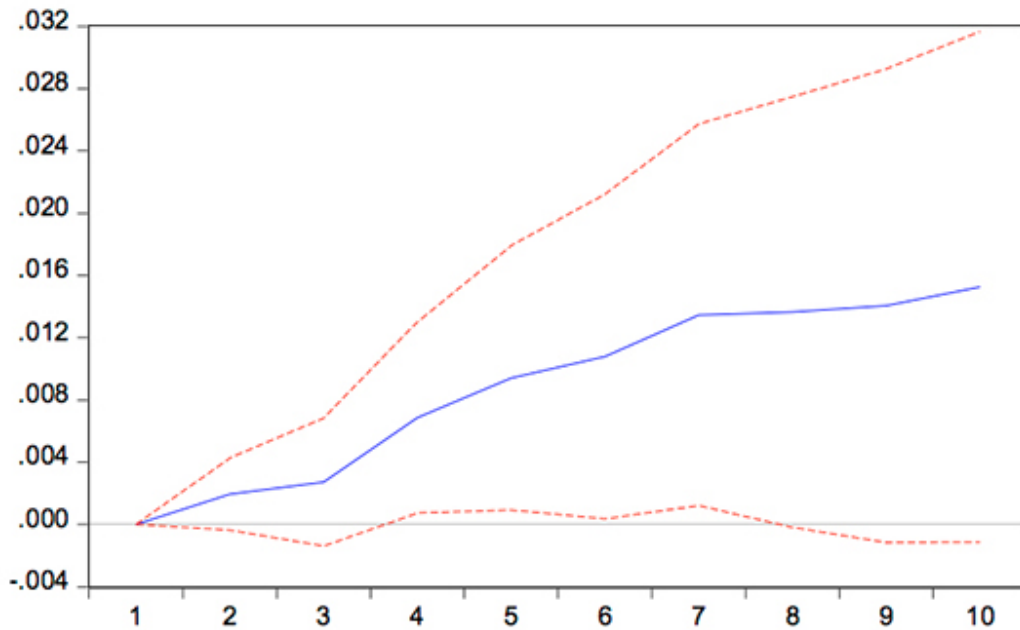
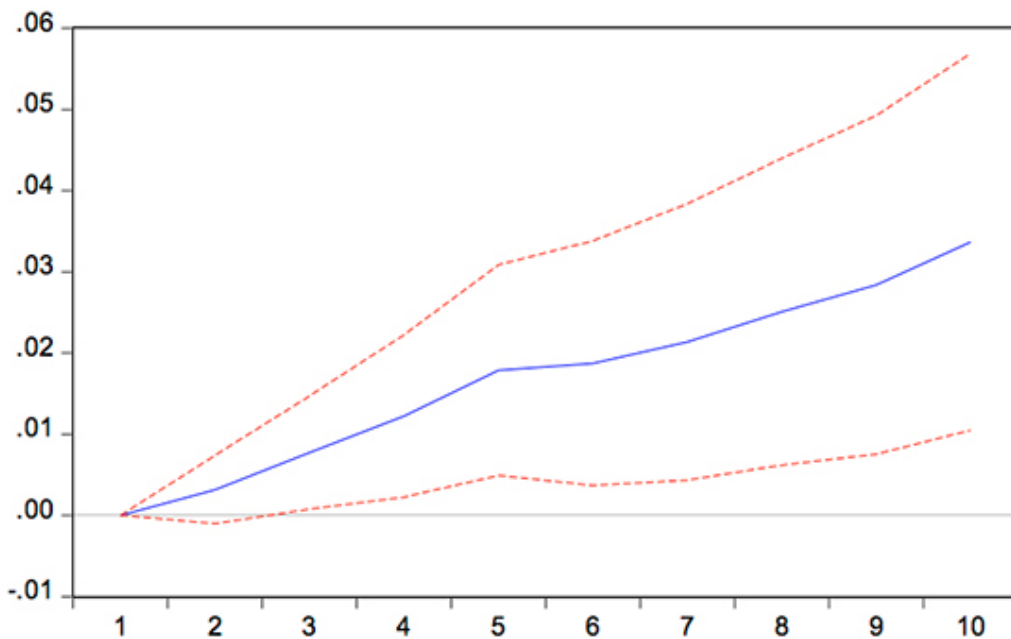# Figure 13. Long-Run Response of Texas Rural Land to a Corn Price Shock

Response of LRLP_TX to Cholesky
One S.D. LCORN Innovation
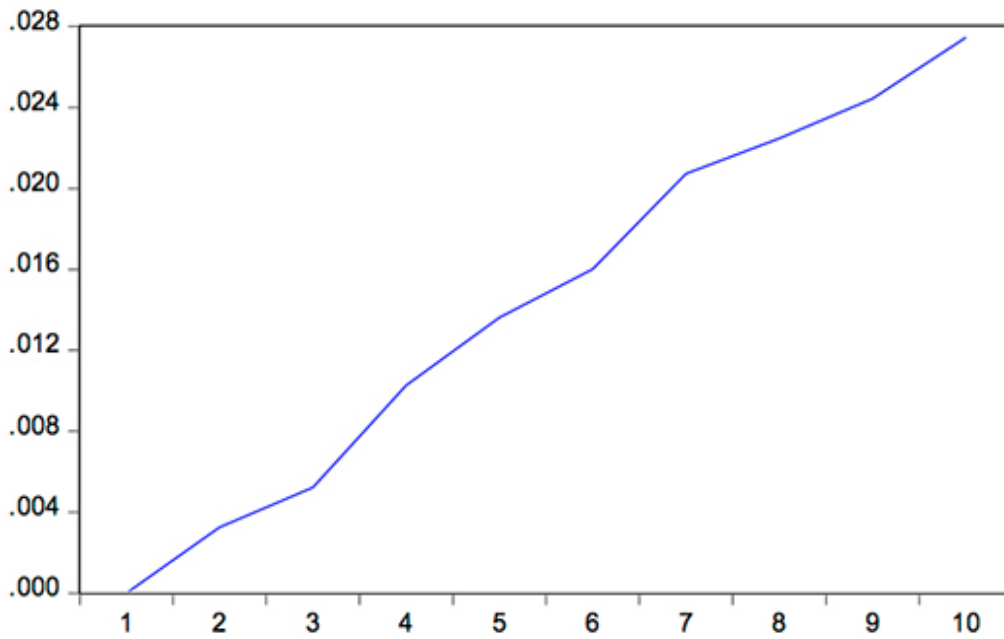
Vector Error Correction (VEC) model results
Source: Real Estate Center at Texas A&M University

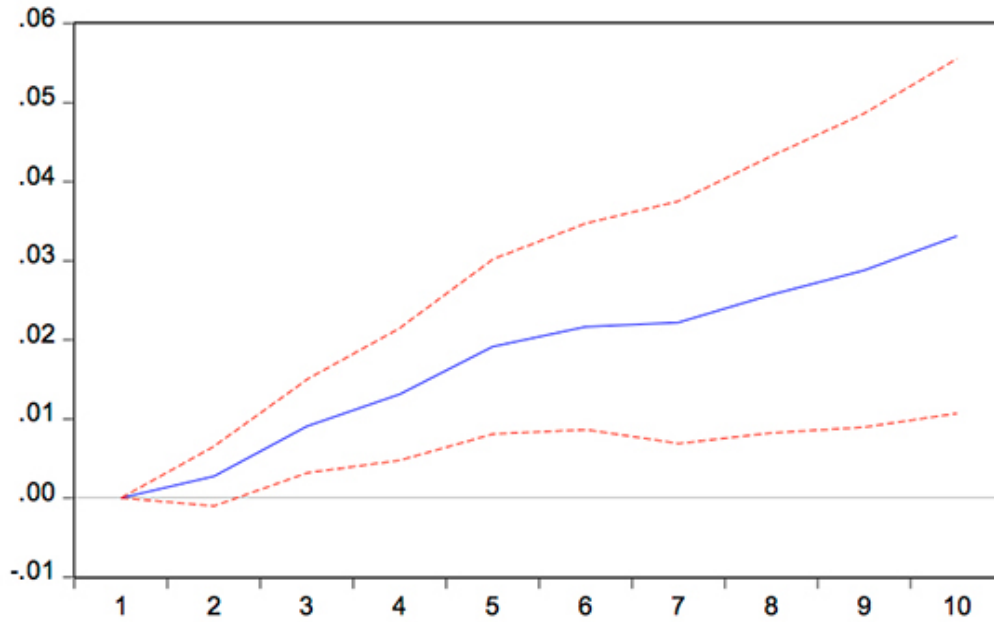# Figure 14. Short-Run Response of Region 1 to an Oil Price Shock
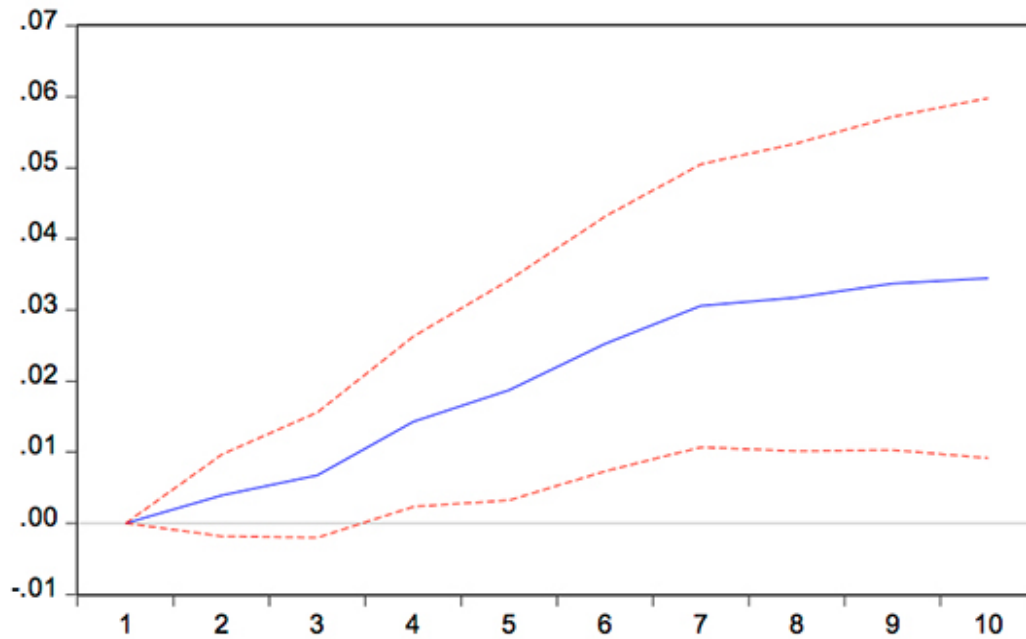
Response of LRLP_R1 to Cholesky
One S.D. LROP Innovation

Vector Autoregressive (VAR) model results
Source: Real Estate Center at Texas A&M University

Figure 15. Short-Run Response of Region 1 to a Cotton Price Shock
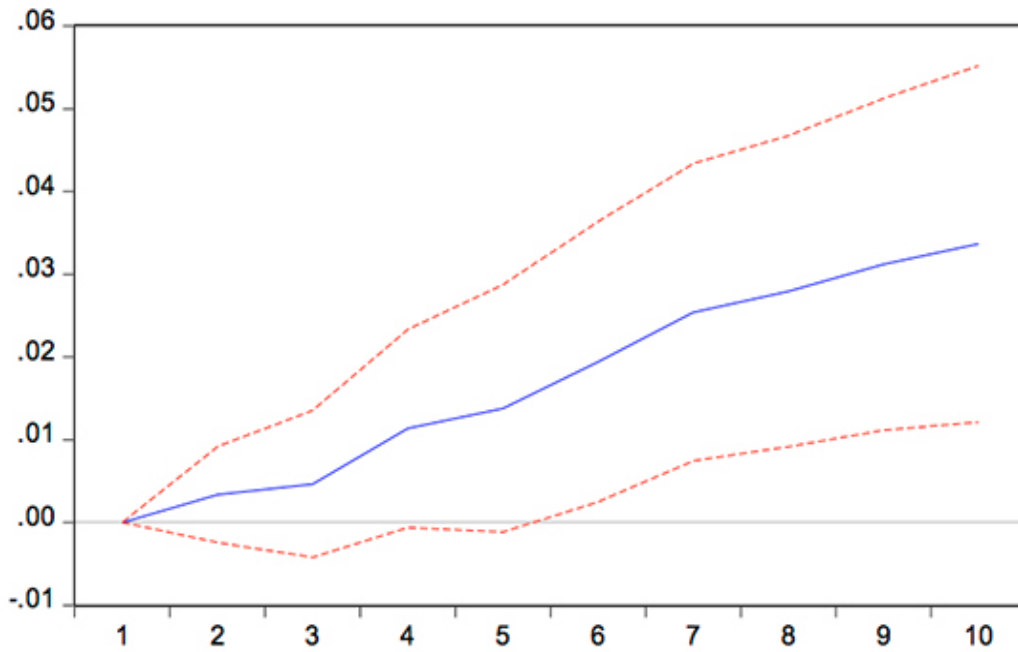
Response of LRLP_R1 to Cholesky
One S.D. LCOTTON Innovation

Vector Autoregressive (VAR) model results
Source: Real Estate Center at Texas A&M University

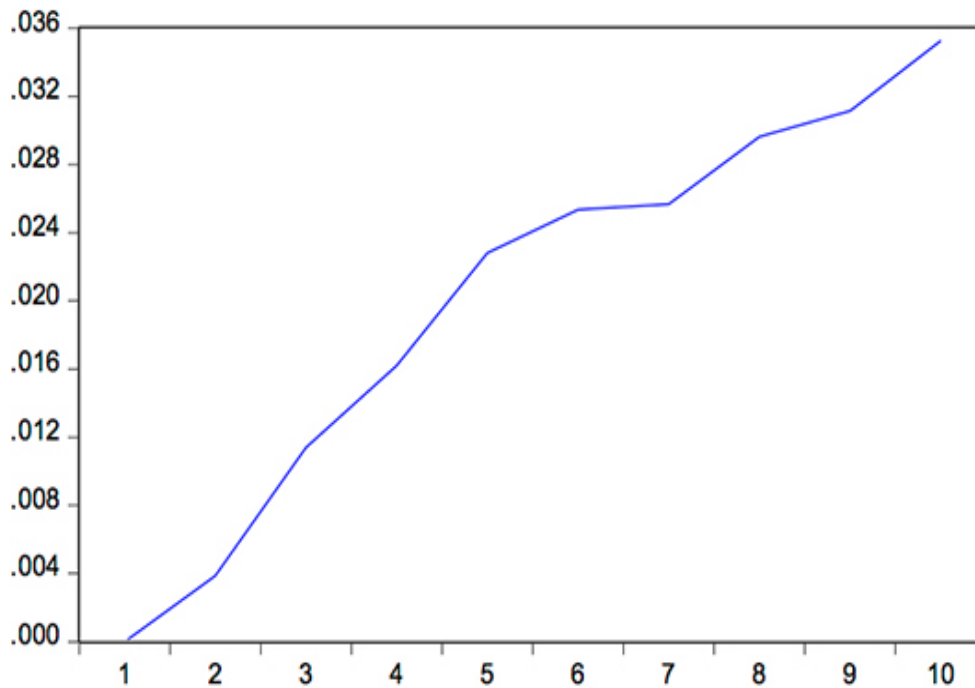**Figure 16. Short-Run Response of Region 2 to an Oil Price Shock**

Response of LRLP_R2 to Cholesky
One S.D. LROP Innovation
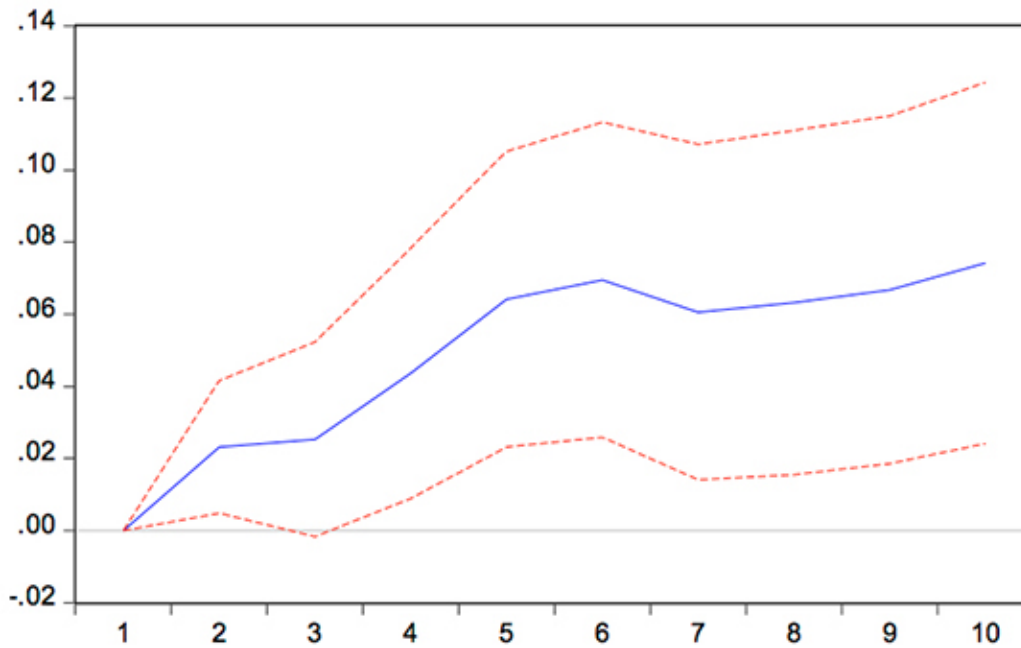
Vector Autoregressive (VAR) model results
Source: Real Estate Center at Texas A&M University

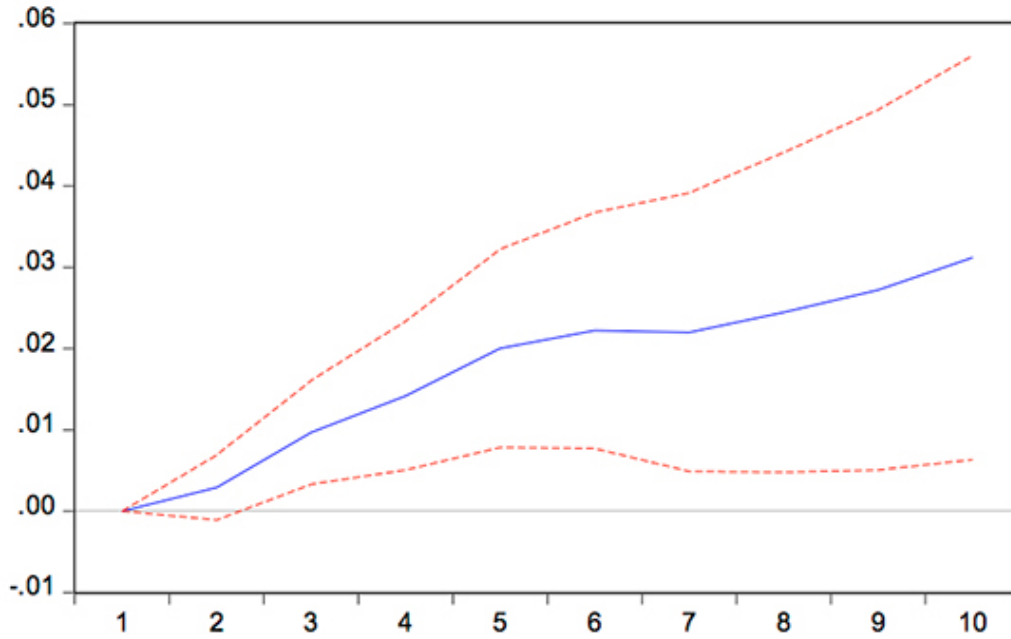## Figure 17. Long-Run Response of Region 2 to an Oil Price Shock

**Response of LRLP_R2 to Cholesky
One S.D. LROP Innovation**
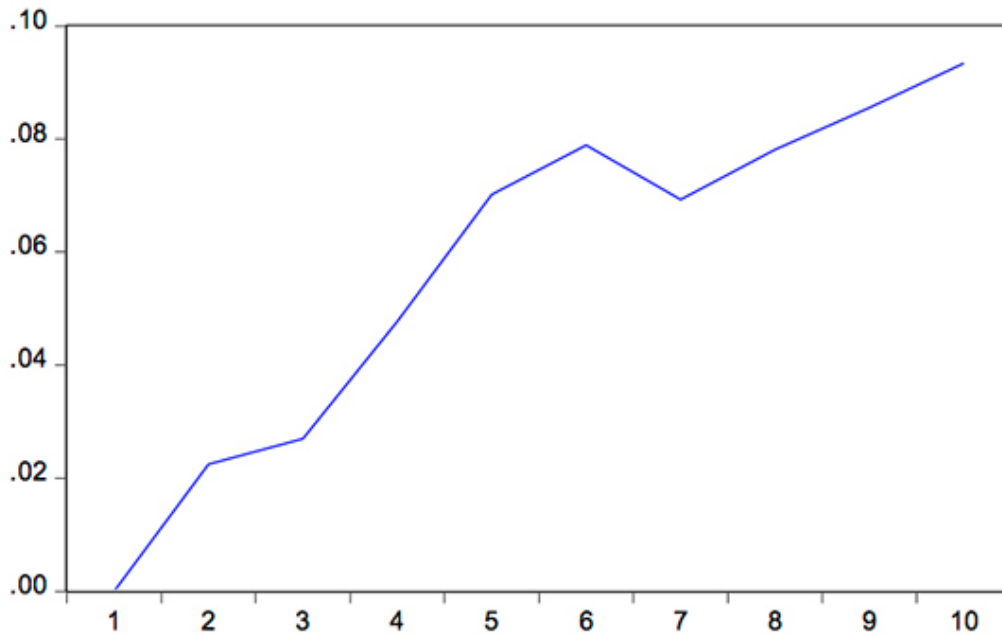
Vector Error Correction (VEC) model results
Source: Real Estate Center at Texas A&M University

Figure 18. Short-Run Response of Region 2 to a Cotton Price Shock
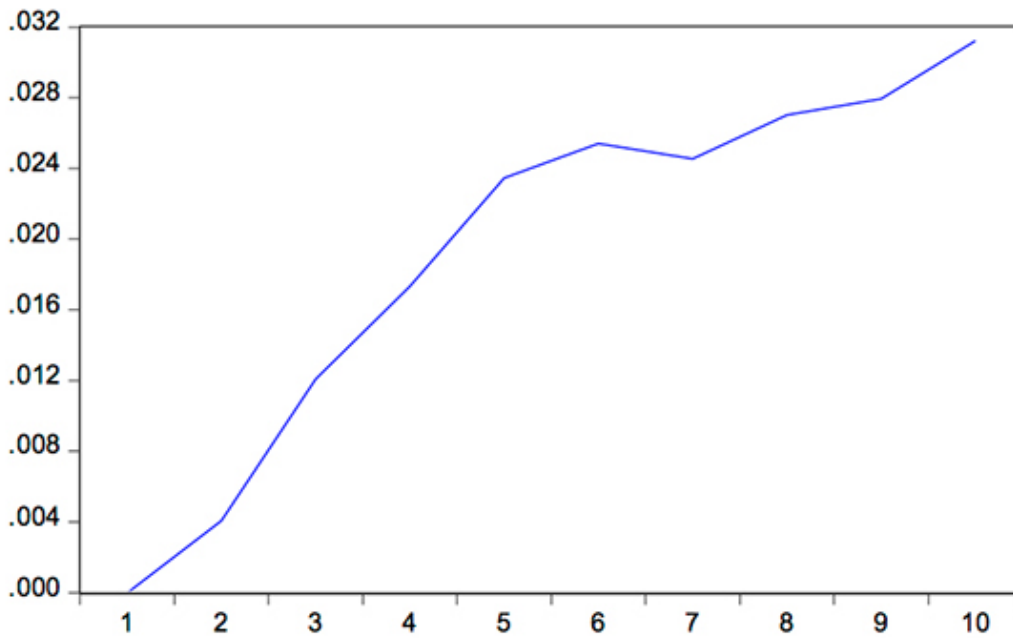
**Response of LRLP_R2 to Cholesky
One S.D. LCOTTON Innovation**
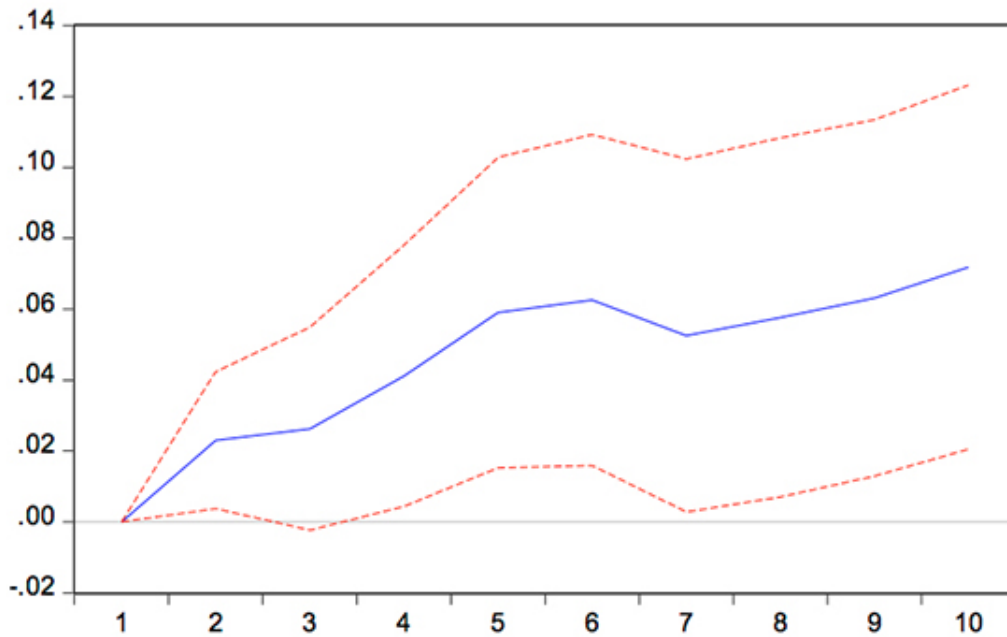
Vector Autoregressive (VAR) model results
Source: Real Estate Center at Texas A&M University

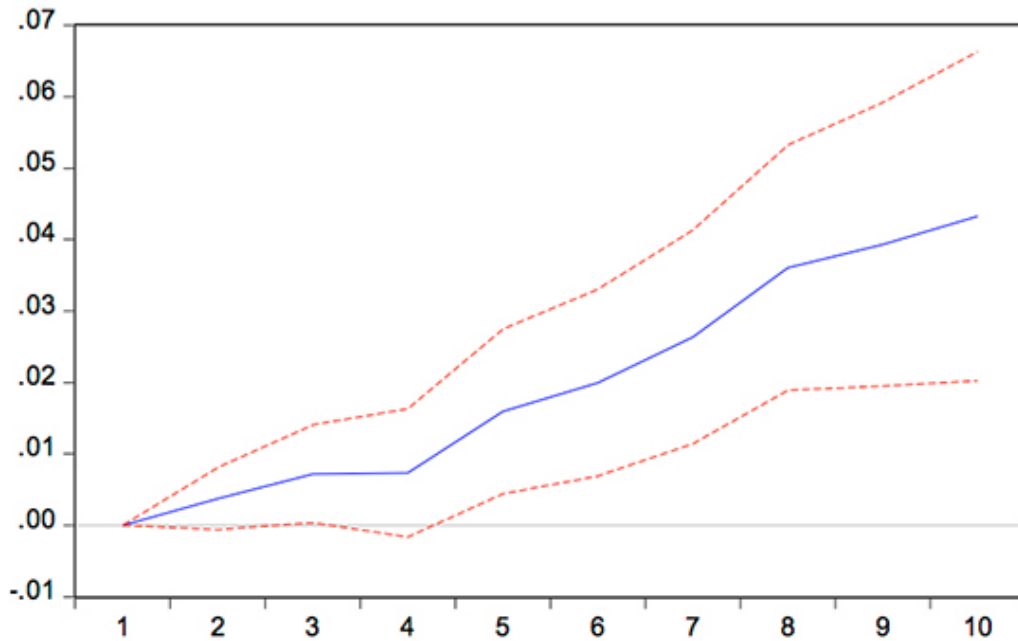**Figure 19. Long-Run Response of Region 2 to a Cotton Price Shock**

Response of LRLP_R2 to Cholesky
One S.D. LCOTTON Innovation

Vector Error Correction (VEC) model results
Source: Real Estate Center at Texas A&M University

Figure 20. Short-Run Response of Region 3 to a Cotton Price Shock

Response of LRLP_R3 to Cholesky
One S.D. LCOTTON Innovation

Vector Autoregressive (VAR) model results
Source: Real Estate Center at Texas A&M University

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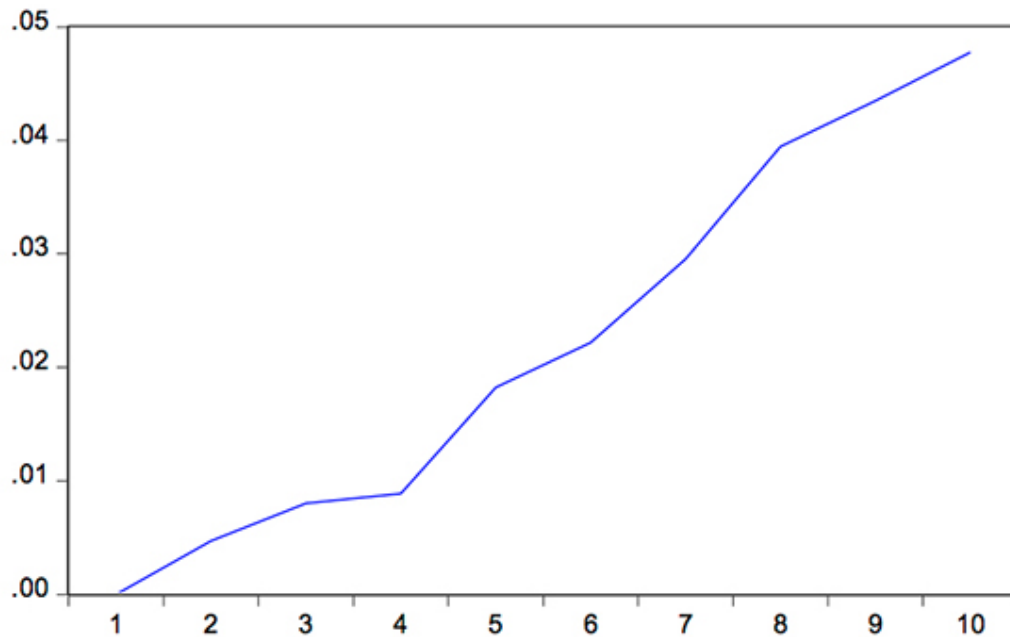**Figure 21. Short-Run Response of Region 4 to an Oil Price Shock**

Response of LRLP_R4 to Cholesky
One S.D. LROP Innovation

Vector Autoregressive (VAR) model results
Source: Real Estate Center at Texas A&M University

Figure 22. Long-Run Response of Region 4 to an Oil Price Shock

Response of LRLP_R4 to Cholesky
One S.D. LROP Innovation

Vector Error Correction (VEC) model results
Source: Real Estate Center at Texas A&M University

Figure 23. Short-run Response of Region 4 to a Cotton Price Shock

Response of LRLP_R4 to Cholesky
One S.D. LCOTTON Innovation

Vector Autoregressive (VAR) model results
Source: Real Estate Center at Texas A&M University

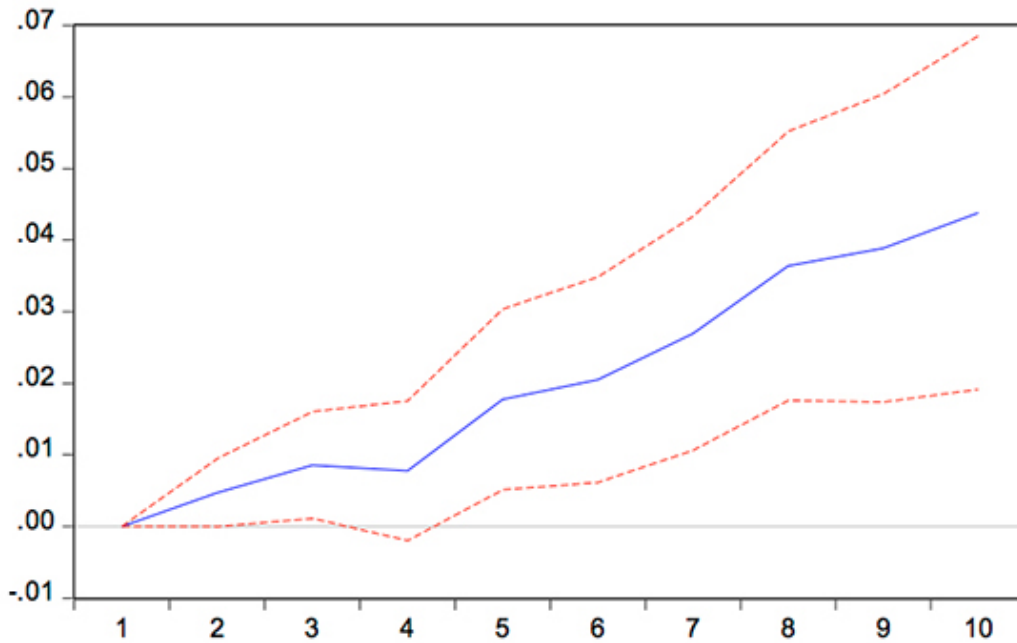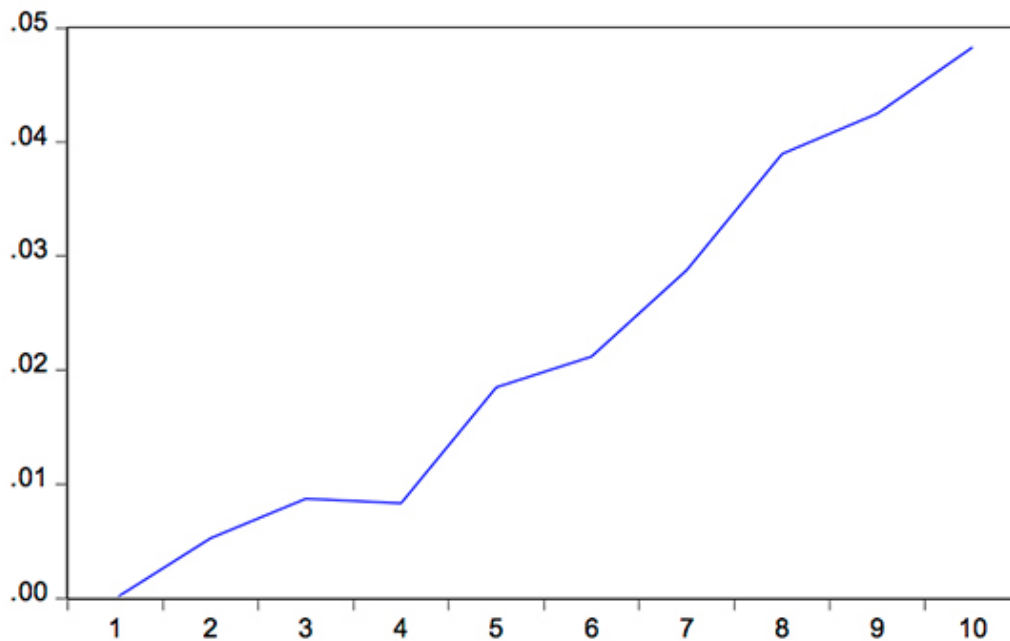**Figure 24. Long-Run Response of Region 4 to a Cotton Price Shock**

Response of LRLP_R4 to Cholesky
One S.D. LCOTTON Innovation

Vector Error Correction (VEC) model results
Source: Real Estate Center at Texas A&M University

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Figure 25. Short-Run Response of Region 5 to an Oil Price Shock

Response of LRLP_R5 to Cholesky
One S.D. LROP Innovation

Vector Autoregressive (VAR) model results
Source: Real Estate Center at Texas A&M University

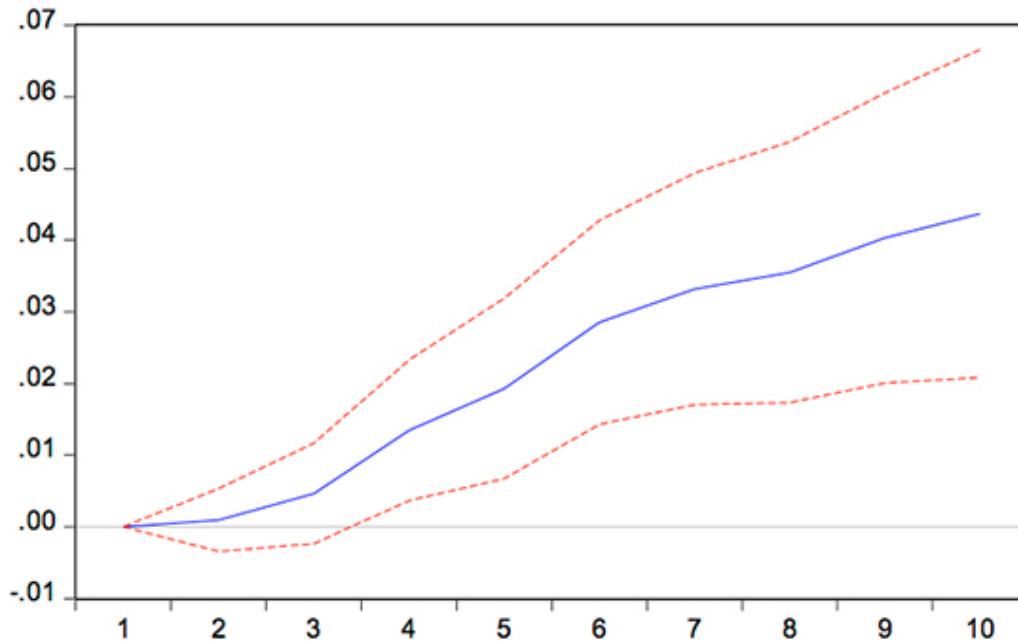## Figure 26. Long-Run Response of Region 5 to an Oil Price Shock

Response of LRLP_R5 to Cholesky
One S.D. LROP Innovation

Vector Error Correction (VEC) model results
Source: Real Estate Center at Texas A&M University

Figure 27. Short-Run Response of Region 5 to a Cotton Price Shock

Response of LRLP_R5 to Cholesky
One S.D. LCOTTON Innovation

Vector Autoregressive (VAR) model results
Source: Real Estate Center at Texas A&M University

Figure 28. Long-Run Response of Region 5 to a Cotton Price Shock

Response of LRLP_R5 to Cholesky
One S.D. LCOTTON Innovation

Vector Error Correction (VEC) model results
Source: Real Estate Center at Texas A&M University

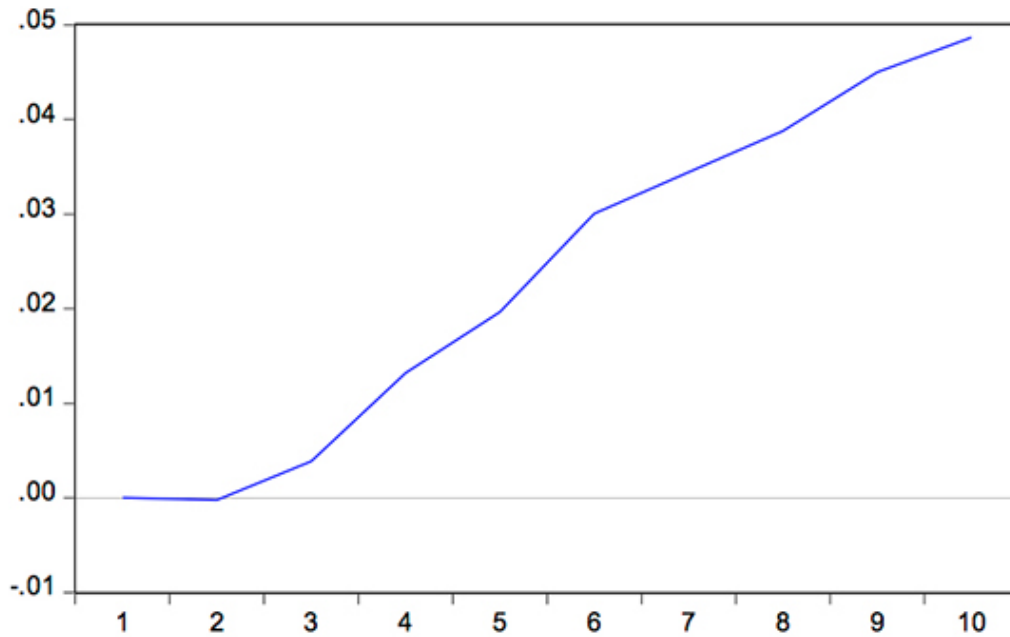## Figure 29. Short-Run Response of Region 6 to an Oil Price Shock

Response of LRLP_R6 to Cholesky
One S.D. LROP Innovation

Vector Autoregressive (VAR) model results
Source: Real Estate Center at Texas A&M University

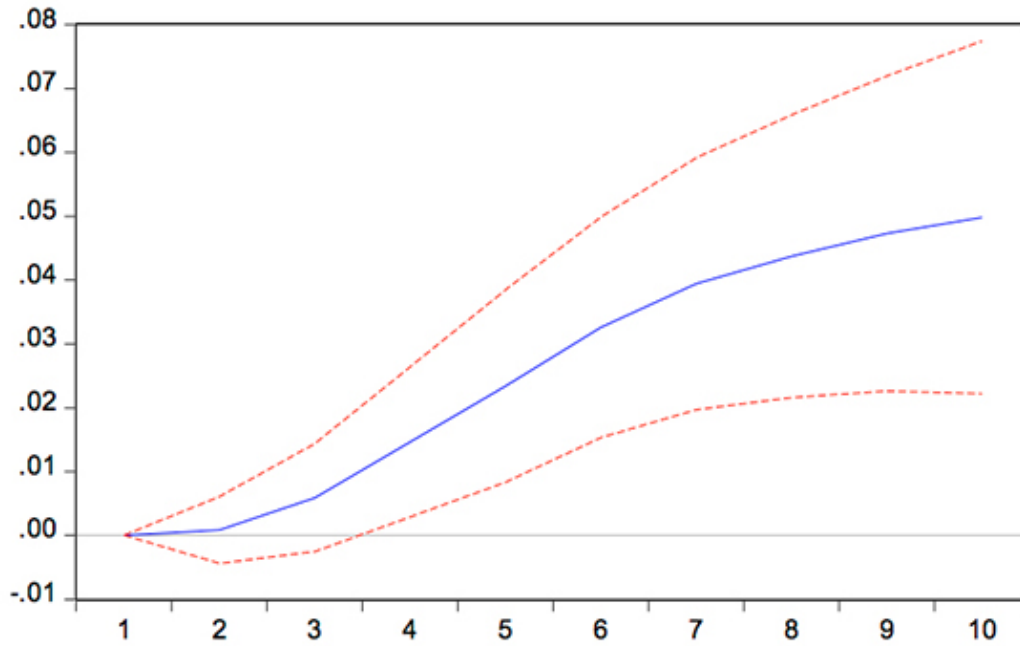## Figure 30. Long-Run Response of Region 6 to an Oil Price Shock

Response of LRLP_R6 to Cholesky
One S.D. LROP Innovation

Vector Error Correction (VEC) model results
Source: Real Estate Center at Texas A&M University

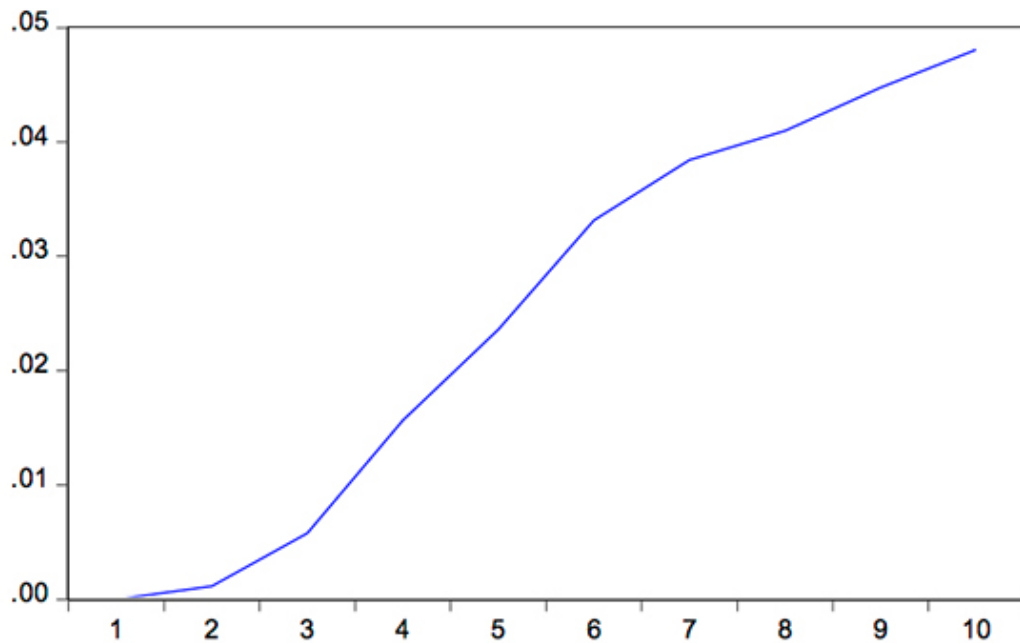## Figure 31. Short-Run Response of Region 6 to a Cotton Price Shock

Response of LRLP_R6 to Cholesky
One S.D. LCOTTON Innovation

Vector Autoregressive (VAR) model results
Source: Real Estate Center at Texas A&M University

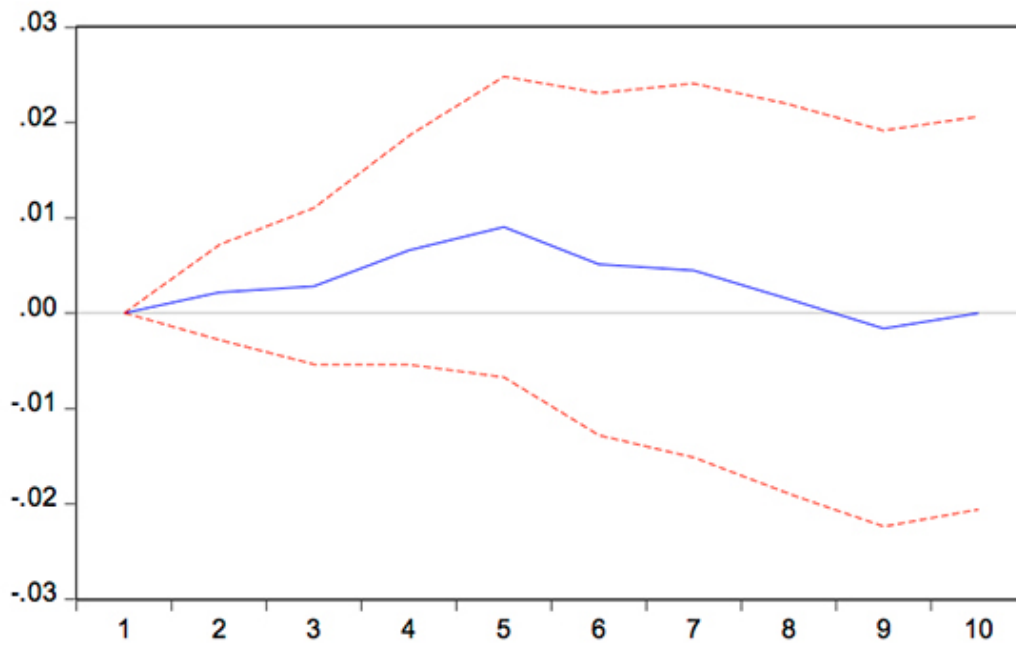## Figure 32. Long-Run Response of Region 6 to a Cotton Price Shock

Response of LRLP_R6 to Cholesky
One S.D. LCOTTON Innovation

Vector Error Correction (VEC) model results
Source: Real Estate Center at Texas A&M University

Figure 33. Short-Run Response of Region 6 to a Beef Price Shock
Response of LLANDP to Cholesky
One S.D. LBEEF Innovation

Vector Autoregressive (VAR) model results
Source: Real Estate Center at Texas A&M University

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