Not Lost in Translation:
The Impact of USDA Reports on International Corn Markets

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Background

- An important part of USDA's mission is to inform domestic market participants about U.S. supply and demand fundamentals for agricultural commodities.
- Several researchers have shown that U.S. markets react to USDA news (Isengildina-Massa et al., 2008; Adjemian, 2012; Dorfman and Karali, 2015), and that this news is incorporated quite quickly (Lehecka et al., 2014; Adjemian and Irwin, 2017).
- Many commodity markets are globally integrated; prices across borders tend to follow a common trend, subject to differences in quality and transportation costs (Janzen and Adjemian, 2017).
- We explore whether announcement effects from USDA reports can be detected in international futures markets as well as U.S. markets.

Objectives

1. Determine the impact of USDA corn production surprises and *Grain Stocks* reports on international futures market prices.
2. Explore varying responses to USDA reports across markets in light of differentiated market structures and government policies.

Model and Estimation Approach

- To avoid empirical problems associated with volatility clustering, we use a GARCH(1,1) approach to estimate the relationship between international corn returns and USDA news.
- At each time t for country c, we model the conditional mean of corn returns r_t^c (approximated by differenced log prices) as a function of a constant, its own lags r_{t-j}^c, lags of foreign returns r_{t-k}^{-c}, the USDA corn surprise Sup_t^{corn}, and the USDA soybean surprise Sup_t^{soy} (on the first trading day that either announcement could have affected each market), and a residual $\epsilon_t | \varphi_t \sim N(0, \sigma_t^2)$:

Equation (1)

$$r_t^c = \beta_0 + \sum_{j=1}^{J} \beta_c r_{t-j}^c + \sum_{-c=1}^{3} \sum_{j=k}^{K} \beta_{-c} r_{t-k}^{-c} + \beta_{corn} Sup_t^{corn} + \beta_{soy} Sup_t^{soy} + \epsilon_t$$

- We specify the conditional variance as a function of a constant, GARCH and ARCH terms, and indicators for seasonality (such that $Month_i$=1 if a commodity returns observation occurred in month i, and zero otherwise), as well as trading days that may have been affected by $Stocks$ or $Crop$ reports:

Equation (2)

$$\sigma_t^2 = \alpha_0 + \alpha_{ARCH} \epsilon_{t-1}^2 + \alpha_{GARCH} \sigma_{t-1}^2 + \sum_{i=1}^{11} \alpha_i Month_i + \alpha_{Stocks} Stocks + \alpha_{Crop} Crop$$

Data

- We use nearby contract corn price returns data from four futures markets over October 15, 2009-January 31, 2016: the U.S. (Chicago Board of Trade), Japan (Tokyo Commodity Exchange), China (Dalian Commodity Exchange), and Brazil (BM&F Bovespa).
- The "surprise" associated with each USDA *Crop Production* report (in August, September, October, November, and January) is the percent difference between the USDA forecast for corn (and soybeans) and the pre-report private expectation as published by Dow Jones/Sparks/Informa/Conrad Leslie.
- Chinese and Japanese day trading sessions end at 3:30 am ET and 2:30 am ET, respectively. For those markets, we associate USDA surprises and report indicators with the *next* trading day since that is the first commodity returns value that could reflect the USDA news.

Results

- U.S., Brazilian, and Japanese markets were more volatile on trading days with USDA report releases, while the Chinese market was less volatile on such days.
  - Overall, the U.S. corn market was much more volatile than the Chinese market, ranging from about 3 times more volatile on days without report releases to 16 times more volatile on *Grain Stocks* report days (table 1).
  - China's lower price volatility comes at a cost. While Chinese corn prices appear unresponsive to the same shocks that govern the movement of U.S. prices, they are consistently higher (in $/metric ton) than—and at times more than double—U.S. prices over the entire period (figure 1).
    - During October 2009-January 2016, the Chinese Government maintained price controls and import restrictions for corn.
    - The Japanese futures contract trades U.S. corn delivered in Japan, so its price must account for the cost of transportation.
- Private and government expectations of commodity production can differ substantially in the U.S.—at times by over 3 percent for corn, and nearly 5 percent for soybeans (table 2).

- The average direct effect of +1-percent USDA surprise in expected corn production is strongest for U.S. returns (-1.4 percent), followed by Brazil and Japan (figure 2). The long-term USDA announcement effect—combining the direct effect with any feedback effects that occur through the lag structure of the model—is both statistically and economically insignificant after a single trading day (figure 3).
  - U.S. corn surprises that indicate larger crops are associated with lower market prices, as expected.
  - Immediate U.S. and Brazilian announcement effects are economically significant and indistinguishable from each other.
  - While still significant, smaller Japanese effects are probably due to the fact that, by design, their futures market prices also include the price of transportation from the U.S.
  - Chinese corn prices do not appear to respond to U.S. Government news about corn. This is likely due to China's corn price floor and import restrictions over the course of this study.

- Selected estimates from the conditional variance equation (2) indicate that:
  - USDA *Grain Stocks* reports are associated with heightened conditional volatility in U.S., Brazilian, and Japanese corn futures markets; trading days that include the publication of a USDA *Crop Production* report also exhibit higher volatility in the U.S.
  - No USDA report is associated with higher volatility in the Chinese corn market, and *Grain Stocks* reports are actually associated with lower volatility in the Chinese market (this is marginally significant).

Conclusions

- Futures markets in the U.S., Brazil, and Japan all respond to USDA production and inventory news about corn, and that news is incorporated in prices by the end of the first trading session after a report is issued.
- In contrast, Chinese corn prices do not respond, likely due to Government policies that decouple the domestic from the world corn market. While these policies successfully insulated the Chinese market from global shocks, its corn prices were far higher than elsewhere.
  - Recent changes in these policies appear to be allowing Chinese corn prices to moderate and be more responsive to world fundamentals.

References

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Table 1. Absolute futures returns in the U.S., Brazil, and Japan—but not China— were more volatile on USDA report days, 2009-2016

	USDA Crop Production Days						**Grain Stocks Days**				
	Avg	Std. Dev.	Min	Max	N		Avg	Std. Dev.	Min	Max	N
Brazil	1.39%	1.29%	0	4.99%	31	*Brazil*	1.81%	1.56%	0	4.99%	25
China	0.32%	0.56%	0	3.20%	31	*China*	0.26%	0.34%	0	1.39%	25
Japan	1.48%	1.64%	0	5.33%	31	*Japan*	3.20%	2.29%	0	8.05%	25
US	2.48%	1.89%	0.34%	7.10%	31	*US*	4.24%	2.66%	0.32%	9.89%	25

	Other Days										
	Avg	Std. Dev.	Min	Max	N						
Brazil	0.87%	0.87%	0	7.58%	1535		-	-	-	-	-
China	0.36%	0.52%	0	5.09%	1534						
Japan	1.06%	1.30%	0	10.20%	1534						
US	1.24%	1.08%	0.00%	7.62%	1535						

Source: Authors' calculations based on Futuresource data.

Figure 1. Corn prices ($/metric ton) were similar in the U.S., Brazil, and Japan, but tended higher in China
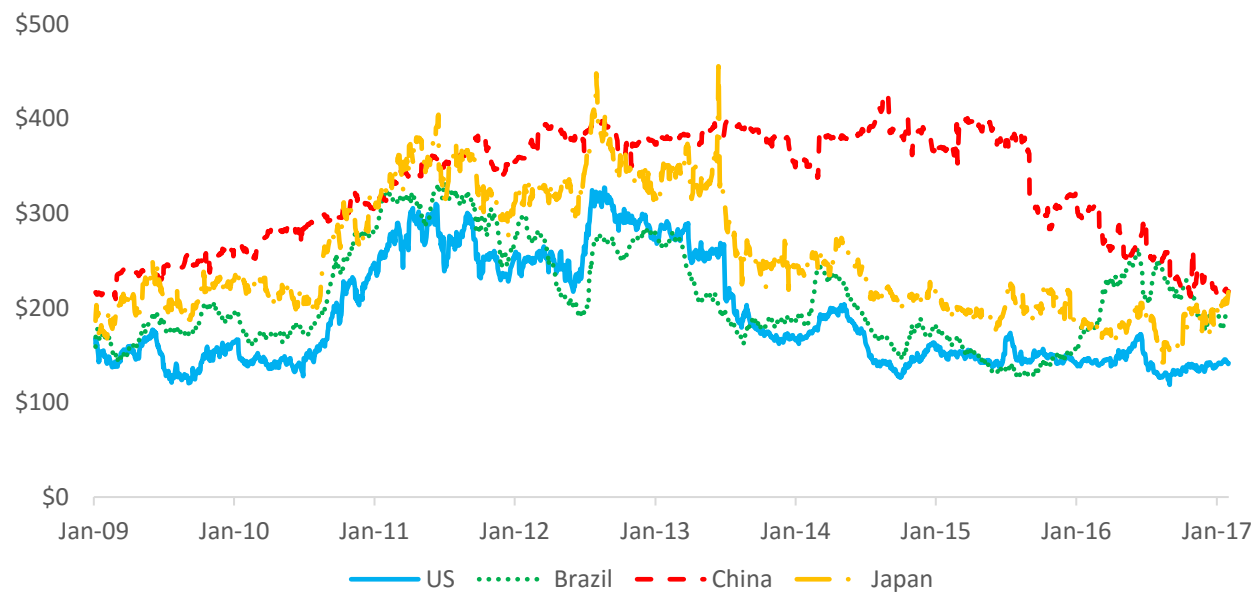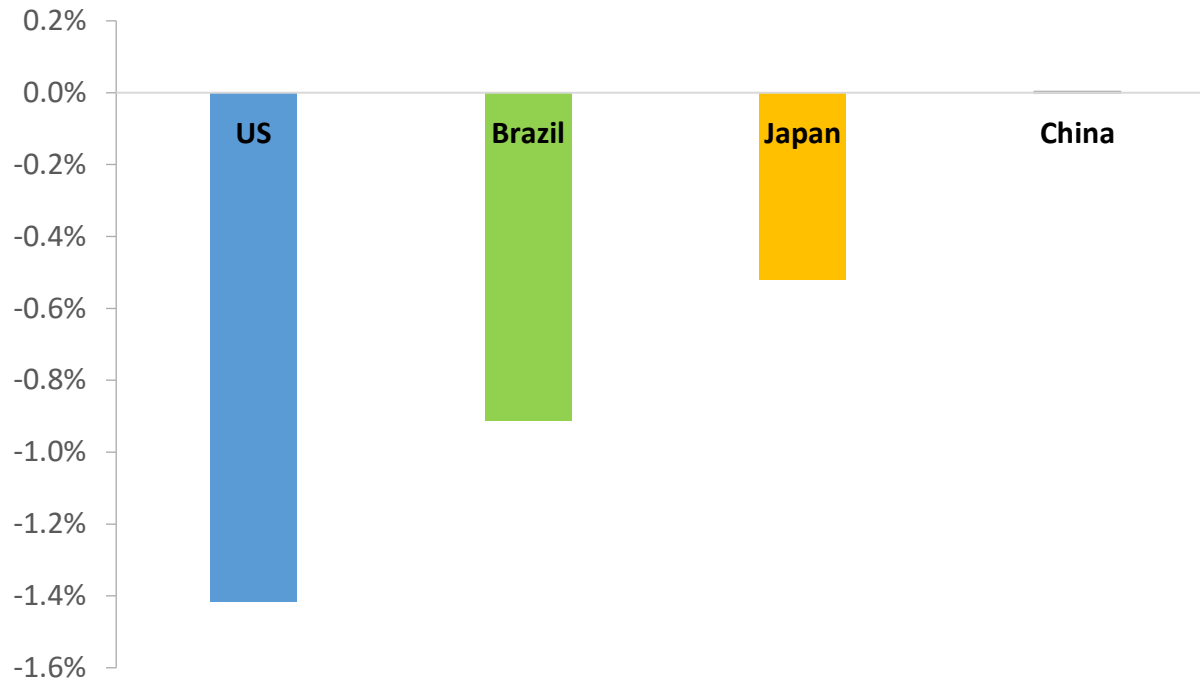

Source: Authors' calculations based on Futuresource and the St. Louis Federal Reserve Board data.

Table 2. USDA and private expectations about crop size can differ considerably

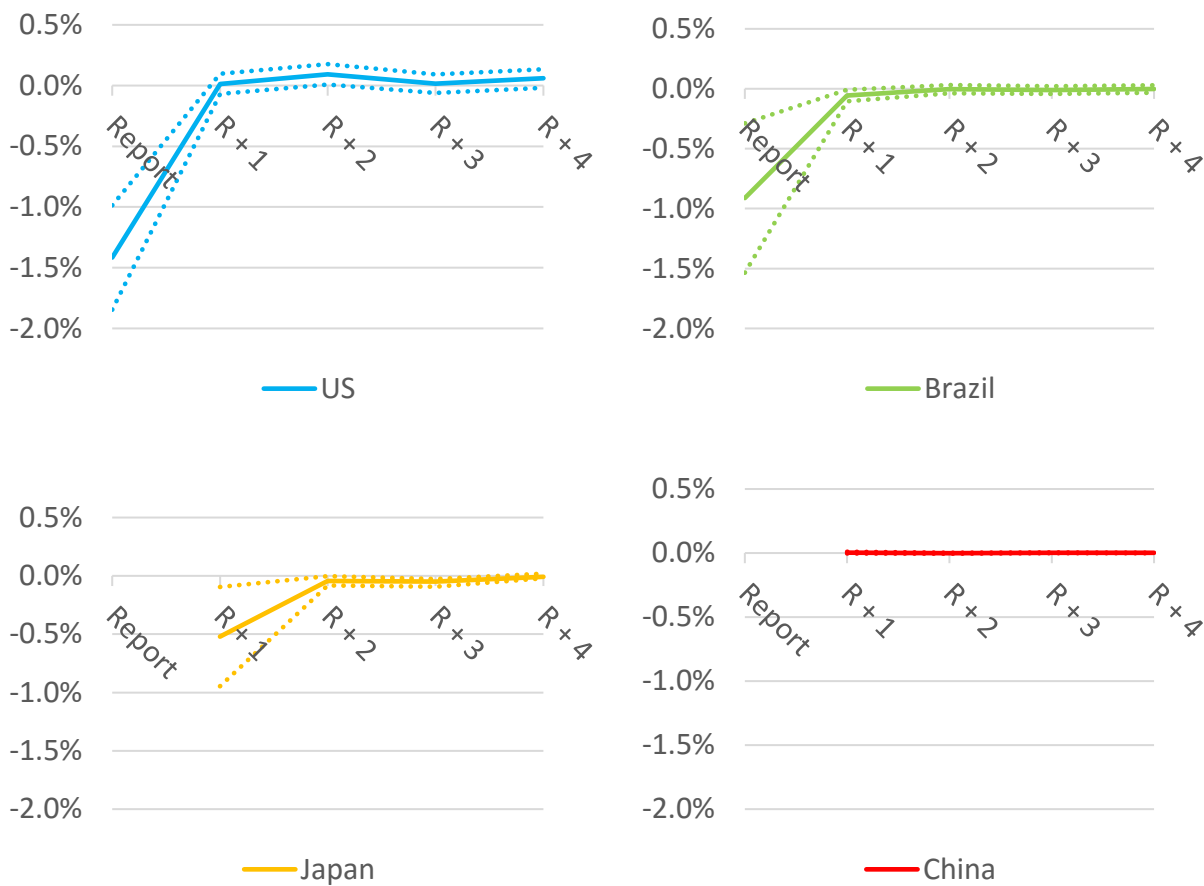|	Crop Production Surprises				
	Avg	St.dev	Min	Max	N
Corn	0.08%	1.29%	-2.21%	3.11%	31
Soybeans	0.23%	1.97%	-3.72%	4.65%	31

Source: Authors' calculations based on Futuresource data.

Figure 2. Direct effect of a +1-percent USDA corn crop surprise

Source: Authors' calculations based on Futuresource data.

Figure 3. A +1-percent USDA corn crop surprise is incorporated in U.S., Brazilian, and Japanese futures prices after a single trading day

Source: Authors' calculations based on Futuresource data.

Table 3. USDA *Grain Stocks* and *Crop Production* reports can also increase price variability in integrated markets

Grain Stocks	Crop Production
US***	US***
Brazil***	Brazil
China*	China
Japan***	Japan

Note: Statistical significance is indicated by asterisks: *** = 99 %; ** = 95%; * = 90%.

Source: Authors' calculations based on Futuresource data.