Wheat Futures Contracts Performance and Hedging Effectiveness

Marjaneh Aghvami[1], Julieta Frank[2]

[1]Graduate Research Assistant, [2]Assistant Professor, Department of Agribusiness and Agricultural Economics,
University of Manitoba - Winnipeg, MB, Canada - R3T 2N2
(E-mail: aghvamim@cc.umanitoba.ca; Julieta_Frank@umanitoba.ca)

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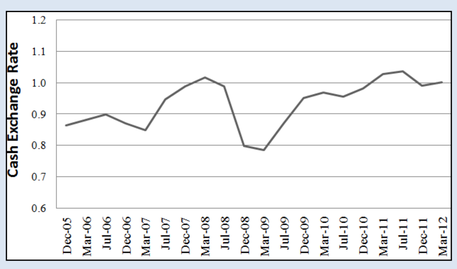
Introduction

- At the end of 2011 the government signed into law a bill which changed the Canadian Wheat Board's (CWB) role of sole buyer of wheat to a voluntary marketing option for Canadian wheat producers.
- Wheat futures contracts trade in various exchanges worldwide, most noticeably in the Minneapolis Grain Exchange (MGEX), the Kansas City Board of Trade (KCBT), and the Chicago Mercantile Exchange Group (CME).
- The relative performance of these contracts and their hedging effectiveness for Canadian market participants has not been fully explored.
- Because of their higher liquidity and longer history, U.S. wheat futures contracts are attractive for Canadian hedgers.
- The U.S. wheat future contracts are priced in U.S. dollars, which introduces an additional source of risk—currency risk (Frank, Brewin and Patiño 2011). The following graph shows how the currency changes over time.



Objectives

- Examine existing U.S. futures contracts performance and their usefulness as a hedging tool, focusing on basis behaviour and management of basis and currency risk.
- Examine the ex-ante basis risk in terms of forecastability.
- Develop different hedging strategies to assess hedging effectiveness of all three wheat futures contracts.

Data

- ***Wheat foreign futures prices***

  North American wheat futures contracts:

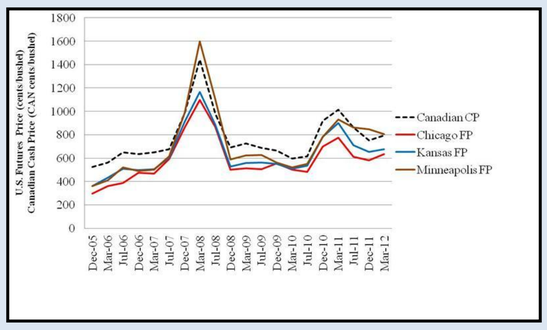
	CME Group	MGEX	KANSAS CITY BOARD OF TRADE	ICE
	Chicago Mercantile Exchange	**Minneapolis Grain Exchange**	**Kansas City Board of Trade**	**ICE Futures Canada**
Contract Name	Soft Red Winter Wheat Futures	Hard Red Spring Wheat Futures	Hard Red Winter Wheat Futures	Milling Wheat Futures
Launch of Trading	1898	1881	1876	Jan 23, 2012
Contract Size	5000 bushels	5000 bushels	5000 bushels	100 metric tons (3674 bushels)
Delivery Months	March, May, July, September, December	March, May, July, September, December	July, September, December, March, May	March, May, July, October ,December

- ***Exchange rate***

  Cash exchange rate is from the foreign exchange market. Future Exchange rates for March, July and December futures are from the International Monetary Market.

Data (cont'd)

- Futures prices (FP) for U.S. markets and cash prices (CP) for the Canadian market for a 3-month forecast horizon, 2005-2011.



- ***Wheat Canadian cash prices***

  Daily Price Contract (DPC) and FlexPro as producer payment options (PPOs) for the period 2005-2011.

Methods

Price risk decomposition

Producers make decisions based on price forecasts. The accuracy of the forecasts is assessed using the mean square error (Novak & Unterschultz 1996):

$$MSE = \frac{\sum_{t=-j+1}^{T-j}(NP_{t+j} - N\tilde{P}_{t+j})^2}{T-1}$$

NP_{t+j} is the realized net price for period $t+j$
$N\tilde{P}_{t+j}$ is the forecasted net price for period $t+j$
T is the total number of periods
j is the forecast horizon

Hedging strategies

We study three different hedging strategies:

No hedging	$NP_{t+j} = p_{t+j}$	$MSE = \frac{\sum_{t=-j+1}^{T-j}[(f_{t+j}e_{t+j} - f_t e_t) + (B_{t+j} - \tilde{B}_{t+j})]^2}{T-1}$
Commodity hedging only	$NP_{t+j} = p_{t+j} + (f_t - f_{t+j})\, e_{t+j}$	$MSE = \frac{\sum_{t=-j+1}^{T-j}[f_t(e_{t+j} - e_t) + (B_{t+j} - \tilde{B}_{t+j})]^2}{T-1}$
Combined commodity-currency hedging	$NP_{t+j} = p_{t+j} + (f_t - f_{t+j})\, e_{t+j} + f_t(x_t - x_{t+j})$	$MSE = \frac{\sum_{t=-j+1}^{T-j}[(B_{t+j} - \tilde{B}_{t+j})]^2}{T-1}$

t is the trading day when the hedge is placed,
$t+j$ is the trading day when the hedge is lifted,
p is the cash price; f is the futures price,
e is the currency spot rate, and x is the futures exchange rate
B_{t+j} and $\tilde{B}_{t+j}$ are the realized and forecast basis when the hedge is lifted

Basis forecast

The price difference (domestic cash price –foreign futures price adjusted for currency) is known as the basis. Hedging decisions are usually driven by the predictability of the basis. The basis forecasting model used in this research is (Working 1953):

Basis forecast

$$\Delta B_t = C_1 + C_2 B_t + C_3 D_t + \varepsilon_t$$

$\Delta B_t = B_{t+j} - B_t$ is the change in the basis,
B_t is the basis at the beginning of hedging period,
D_t is a seasonal dummy variable.
C_i, $i = 1,2,3$ are coefficients and ε_t is a random error

Optimal hedging ratios

Using mean-variance framework (Thompson & Bond 1987) the objective is specified as the maximization of:

$$\Omega_t = E(NP_{t+j}) - \lambda V(NP_{t+j})$$

where λ is the decision maker's risk aversion coefficient and estimates of $E(NP_{t+j})$ and $V(NP_{t+j})$ are conditional on the information available to the decision maker at time t.

$$NP_{t+j} = Q_t P_{t+j} + H_t (f_t - f_{t+j})\, e_{t+j} + G_t (x_t - x_{t+j})$$

Q_t is the quantity of wheat sold in the local cash market
H_t is the quantity of wheat futures contracts
G_t is the quantity of currency future contracts

Solving for H_t / Q_t yields the optimal commodity hedge ratio.

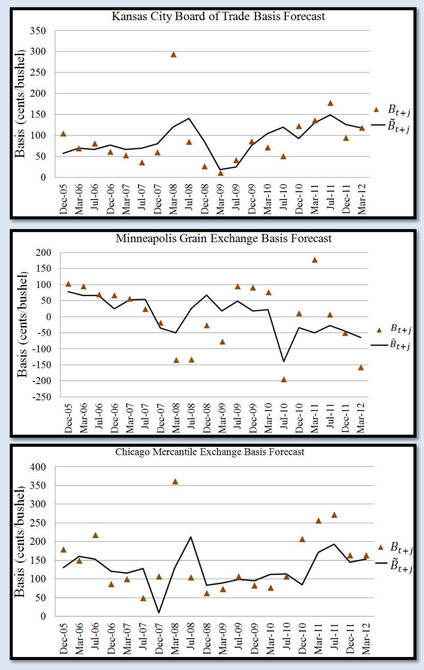
Results

- Calculated NPs and corresponding MSEs for 3-month forecast horizons using U.S. futures contracts:

Strategy	Chicago		Kansas		Minneapolis	
	Mean NP	MSE	Mean NP	MSE	Mean NP	MSE
No hedging	771.24	19194.79	738.80	22920.09	771.23	24867.36
Commodity hedging	775.68	6149.12 (67.96%)	713.66	3088.45 (86.53%)	722.57	7442.78 (70.07%)
Commodity currency hedging	779.51	5703.50 (70.29%)	715.49	2784.31 (87.85%)	726.28	5554.24 (77.66%)

Note: Numbers in parentheses indicate the percentage reduction in the MSE (price risk) with respect to the no hedging strategy.

- Basis forecast for 3-month forecast horizons for each U.S. futures contract :



- Optimal commodity hedge ratios for wheat using U.S. futures contracts and a combined commodity-currency strategy:

Strategy	Chicago	Kansas	Minneapolis
H_t / Q_t	0.265	0.249	0.634

Conclusions

- Commodity hedges using U.S. futures contracts appear to be effective to reduce price risk.
- Hedging wheat removes approximately 68%, 86% and 70% of the price risk for a 3-month hedging horizon using Chicago, Kansas and Minneapolis futures markets respectively.
- Combined wheat and currency hedging removes approximately 70%, 87% and 77% of the risk for a 3-month hedging horizon using Chicago, Kansas and Minneapolis futures markets respectively. The remaining price risk is due to the basis variability.
- Exposure to exchange rate risk has an effect on decisions to hedge commodity.

References

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