



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

NCCC-134

APPLIED COMMODITY PRICE ANALYSIS, FORECASTING AND MARKET RISK MANAGEMENT

Forecasting Hard Red Winter and Soft White Wheat Basis in Washington State

by

Wenxing Song and T. Randall Fortenbery

Suggested citation format:

Song, W., and T. R. Fortenbery. 2017. "Forecasting Hard Red Winter and Soft White Wheat Basis in Washington State." Proceedings of the NCCC-134 Conference on Applied Commodity Price Analysis, Forecasting, and Market Risk Management. St. Louis, MO. [<http://www.farmdoc.illinois.edu/nccc134>].

Forecasting Hard Red Winter and Soft White Wheat Basis in Washington State

Wenxing Song and T. Randall Fortenbery¹

*Paper presented at the NCCC-134 Conference on Applied Commodity Price Analysis,
Forecasting, and Market Risk Management
St. Louis, Missouri, April 24-25, 2017.*

Copyright 2017 by Wenxing Song and T. Randall Fortenbery. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.

¹Wenxing Song is a Ph.D Candidate in the School of Economic Sciences at Washington State University. E-mail: wenxing.song@wsu.edu. T. Randall Fortenbery is a Professor and Small Grains Endowed Chair in the School of Economic Sciences at Washington State University. E-mail: r.fortenbery@wsu.edu.

Forecasting Hard Red Winter and Soft White Wheat Basis in Washington State

The objective of the study is first to identify economic factors that influence two specific classes of wheat: hard red winter (HRW) and soft white (SWW) wheat, and develop models to improve the forecast performance of basis in Washington State. Earlier work has investigated basis behavior of some other classes of wheat, but none has examined soft white wheat. This class is unique because there is no direct futures contract-it is usually priced off the soft red wheat futures contract. The models we estimate include: 1) a simple moving average model to serve as a benchmark, 2) an econometric fundamental model, 3) an ARMA time series model, and 4) an ARMAX hybrid model. The econometric fundamental and ARMAX models include supply/demand factors suggested by economic theory and literature. We estimate all the models and then compare their forecast performance. Based on empirical results, we find the best HRW model at the 4-month and 11-month forecast horizons is the econometric fundamental model, at the 5-month, is an ARMA(3,0,0) model, and the best model for the rest of the forecasts is an ARMAX (3,0,0). For SWW, the econometric fundamental model is the best overall. In addition, the ARMAX models perform better than the ARMA models in most cases, except SWW in Odessa, WA.

Key words: Basis forecast, hard red winter wheat, soft white wheat, time series analysis.

I. Introduction

Washington State is ranked fifth in the nation's top wheat producing states with more than 2.3 million acres in production. Forecasting wheat prices accurately is important for wheat's production and marketing decisions as well as the implementation of risk management strategies. While wheat producers can access national futures prices with low cost, they often care more about local cash prices. The price discovery benefit of futures trading is predicated on the assumption that futures prices reflect the combined views of a large number of buyers and sellers, all expressing their perceptions of the future value of some commodity (Fortenbery and Zapata, 1997). Expectations of future cash price are often developed by forecasting basis. Basis is defined as the difference between a local cash price and a future contract price at a particular delivery time and location. Wheat basis reflects the equilibrium condition between the local supply/demand conditions at the current time and those of the larger market at futures contract expiration. To minimize the time component basis is usually measured as the nearby basis, where "nearby" denotes the future contract closest to delivery. Wheat has five futures contracts each year. They are March, May, July, September, and December.

The objective of the study is first to identify economic factors that influence two specific classes of wheat: soft white (SWW) and hard red winter (HRW) wheat, and then develop several models to improve the forecast performance of basis in two elevators in Washington State: Clarkston, WA and Odessa, WA. The reasons that we choose these two elevators will

be presented later in the paper. Earlier work has investigated basis behavior of some other classes of wheat, but none has examined soft white wheat. This class is unique because there is no direct futures contract-it is usually priced off the soft red wheat (SRW) futures contract.

This research is unique in two ways: 1) it will be the first to examine the extent to which basis for a cross-hedged crop, soft white wheat, is predictable, and 2) it will examine the efficacy of hybrid structural/time series models (ARMAX models) in forecasting wheat basis for both hard red winter and soft white wheat. The results will help the two classes of wheat producers in the Pacific Northwest, improve their production and marketing decisions based on expected cash prices, and aid in the implementation of risk management strategies focused on both forward pricing and storage decisions.

Based on empirical results, we identify the model with the highest forecast accuracy, and also determine whether certain models are preferred based on planning horizon. Root mean square error (RMSE) is used to measure forecast performance. RMSE is defined as the square root of the sum of squared errors between predicted and true basis over each planning horizon (Months).

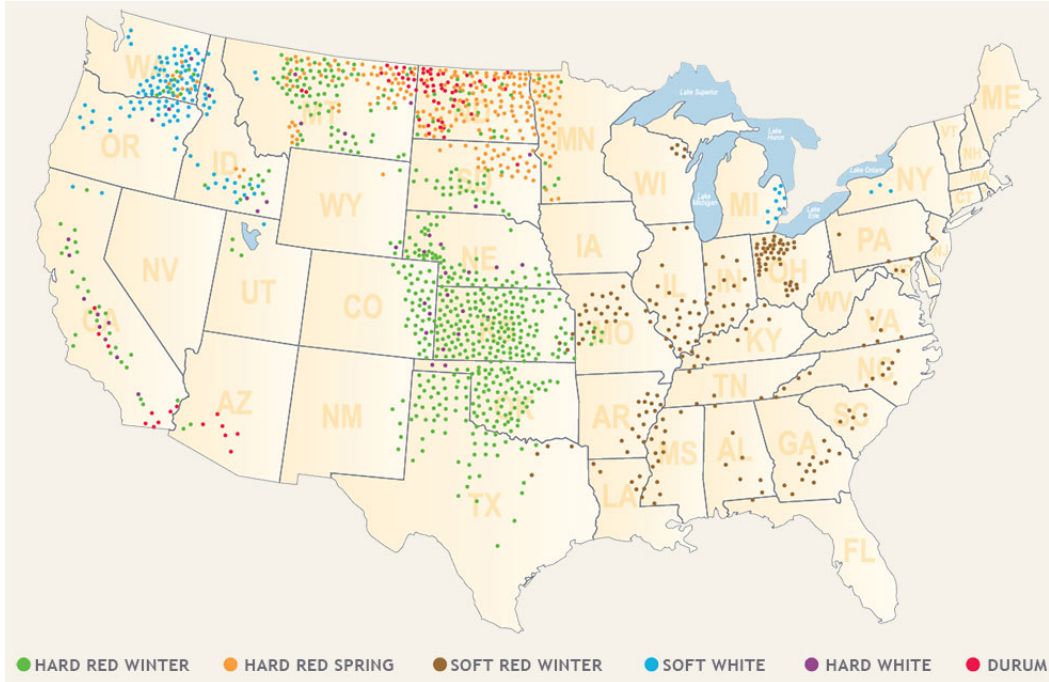
The remainder of this research is organized as follows. Section II discusses some previous research. Section III lays out the empirical model. Section IV describes the data, presents the estimation results, and discusses forecast performance. Section V concludes.

II. Literature Review

There are six classes of wheat grown in the U.S. designated by color, hardness, and growing season. With a range of quality characteristics within these classes, customers can produce and use flours made from U.S. wheat for almost every possible end product. The six classes of wheat are hard red winter (HRW), hard red spring (HRS), soft red winter (SRW), soft white (SWW), hard white (HWW), and durum. Each class has a somewhat different end use and production tends to be region-specific (see Figure 1). HRW and HRS represent the majority of wheat produced in U.S. Washington State mainly produces HRW-planted in the fall, HRS-planted in the early spring, and SWW. Eastern Washington is home to some of the best wheat quality grown in the world.

Basis is measured as the difference between a local cash price and a future price. Identifying the relationship between local cash markets and future markets is crucial to localize futures prices. Fortenbery and Zapta (1993) and Fortenbery *et al.*(1997) analyzed the price linkages between future and cash prices for grain markets and fluid milk, respectively, and tested the cointegration relationships between them. Cointegration implies cash and futures markets have established a long-run equilibrium, and is a necessary condition for concluding that cash and futures markets are both serving as efficient pricing centers. Cointegration was found for fluid milk and grain markets between cash and future markets. Fortenbery and

Figure 1: U.S. Wheat by Class



Note: The figure is published by U.S. Wheat Associates and available at <http://www.uswheat.org/wheatClasses>.

Zapata (1997) also conducted cointegration analysis for cheddar cheese markets but found no evidence of a stable long-run relationship between cash and futures markets for cheddar cheese.

A few researchers have studied the behavior of wheat basis. Bekkerman *et al.* (2016) considered basis patterns in the northern U.S. hard red spring and hard red winter wheat markets. Using nine different models of basis behavior, they showed that recent futures price, protein content, and harvest information were more important for accurate basis forecasts than historical basis averages. Tilly and Campbell (1988) also evaluated the impact of government programs on hard red winter wheat basis in Kansas.

Many others investigated the basis behavior of other crops, such as cotton, corn, and soybeans. Jiang (1997) included storage costs, transportation costs, and regional supply and demand variables to explain corn and soybean basis behavior. He employed a number of forecast techniques for the basis, including a simple three-year moving average, a structural econometric model, a modified three-year moving average model, artificial neural networks, seasonal ARIMA time-series models, state-space models, and composite forecasts. He concluded that the three-year-average-plus and seasonal ARIMA models were the most practical, much easier to implement than alternative models, and slightly outperformed the simple three-year-average forecast.

Garcia and Good (1983) reviewed the theory of basis to identify and quantify appropriate

explanatory variables that determined corn basis in Illinois. They believed the magnitude of the corn basis was influenced by three sets of factors: cost, stocks, and flow factors. Welch *et al.* (2009) developed a new and straightforward economic model of corn basis forecast. The results showed the new model based on economic fundamentals performed better than basis estimates using a three-year moving average. Seamon *et al.* (2001) examined cotton basis graphically and statistically to determine if the basis differed across U.S. production regions and within the crop year as economic theory predicted. The analysis indicated that basis differed for some, but not all, regions consistent with the theory. Results also suggested that the typical seasonal patterns were not apparent for regions which exported most of their cotton. Sanders and Manfredo (2006) compared ARMA and VAR models to the five-year average, one year ago, and no change methods for forecasting basis in the soybean complex: soybeans, soybean meal, and soybean oil. The results indicated that time-series models only resulted in small improvement. Taylor *et al.* (2006) compared practical methods of forecasting basis, using current market information for wheat, soybeans, corn, and milo in Kansas. Their research found a five-year average was the best method for forecasting wheat harvest basis.

Considerable research has been conducted on modeling or forecasting the basis for livestock. Wheat is storable while livestock are not. As factors such affecting basis may be different based on storability. Kastens *et al.* (1998) examined the forecast accuracy of five competing naive and futures-based localized cash price forecasts. Commodities examined included the major grains, slaughter steers, slaughter hogs, several classes of feeder cattle, cull cows, and sows. Relative forecast accuracy across forecast methods was compared using regression models of forecast error. They found the traditional forecast method of deferred futures plus historical basis had the greatest accuracy. Adding complexity to forecasts, such as including regression models to capture nonlinear bases or biases in future markets, did not improve accuracy.

Both Leuthold (1979) and Parcell *et al.* (2000) studied the behavior of live cattle basis. Leuthold found the hypothesis that the futures-cash price spread for live cattle reflects the expected change in cash price over time, caused by shifts in supply. Important supply variables for explaining the cattle basis were slaughter, cattle on feed, prices of corn, feeder steers and fat cattle, and seasonal shift variables. On the other hand, Parcell *et al.* analyze factors affecting live cattle basis. The four main factors were corn price, market fundamental and seasonal components, and changes in the value of the Choice-to-Select spread.

Liu *et al.*(1994) and Tonsor *et al.*(2004) also studied cattle basis. Liu *et al.* estimated four structural economic models, in which basis was a function of lag of basis, supply variables, demand variables, a delivery cost variable and futures market variables. The models differed in the number of lags of different variables. Tonsor *et al.* addressed the impact of adopting a time-to-expiration approach, as compared to the more common calendar-data approach on the optimal number of years to include in calculations when forecasting livestock basis using historical averages, and the effect of incorporating current basis information into a historical-average-based forecasts. Results revealed that use of the time-to-expiration approach had little impact on forecast accuracy compared to using a simple calendar approach, but fore-

cast accuracy was improved by incorporating at least a portion of current basis information into basis forecasts.

Leuthold and Peterson (1983) used a three-equation model to explain the cash-futures basis for hogs. Important explanatory variables were supply shifts including current slaughter, expected marketings measured by the number of hogs in a given weight class as well as cold storage.

In conclusion, most previous studies used at least a simple moving average method to forecast the basis and concluded it was efficient in terms of effort and accuracy.

III. Empirical Model

The State of Washington is one of the nation's leading wheat-exporting states, with 85 to 90% of its production exported each year. The state's wheat is mostly exported via Pacific Northwest (PNW) ports in Portland. Over 60% of Washington's wheat is shipped out from on-farm storage or nearby commercial grain elevators to the PNW ports along the 400-mile long Snake/Columbia River between Lewiston, Idaho and Portland, Oregon (see Figure 2).

About 36% of the wheat is transported by rail to coastal grain terminals. Barge traffic on the river is the most efficient form of transportation available². Transportation costs for elevators located along the river are lower than those aren't. In order to determine the effect of transportation cost on wheat basis, we choose Clarkston, WA and Odessa, WA due to data availability and the fact that Clarkston is a port along the river, so it mainly uses barges to transport its wheat, while Odessa does not have direct access to the river and mainly uses trains. Basis for the two elevators are estimated independently.

In this study, we focus on forecasting HRW and SWW basis independently. The models we estimate include: 1) a simple three-year moving average model to serve as a benchmark, 2) an econometric fundamental model, 3) an ARMA time series model, and 4) an ARMAX hybrid model. The econometric fundamental and ARMAX models include supply/demand factors suggested by economic theory and literature.

We estimate these models and measure their forecast performance using national futures and Washington local cash price data spanning the last six market years (June/2010-May/2016). The market year begins in June and ends in next May. We forecast average monthly basis 11 months out of sample and calculate RMSE. More specifically, we first estimate each model using the first three years (June/2010-May/2013) and then forecast 11 months out of sample, which is June/2013-April/2014. Then we update the model with one more month (June/2013) and forecast another 11 months out of sample (July/2013-May/2014). We keep updating and forecasting until reaching the last observation (May/2016). From July/2015, there is insufficient data to forecast 11 months out, so we have to decrease

²A tug pushing barges can haul a ton of wheat 576 miles on a single gallon of fuel, compared to 413 miles by rail and 155 miles by truck.

Figure 2: Snake/Columbia River



Note: The figure is available at https://en.wikipedia.org/wiki/Columbia_Basin.

the forecast horizon by one month a time. For example, when we are at July/2015, we can only forecast 10 months out of sample (August/2015-May/2016). When we are at April/2016, we can only forecast 1-month out of sample (May/2016). The other forecast horizons are not available. As a result, there are 36 observations for the 1-month forecast horizon and 26 observations for the 11-month forecast horizon. Each model is described below.

Moving Average Model

The three-year moving average model is defined as the average of the same month basis spanning the last three years. The expression is as:

$$Basis_{t,j} = \sum_{i=t-1}^{t-3} Basis_{t,i}, \quad (1)$$

where t denotes month and j denotes year.

For the three-year moving average model, unlike the other three models, it only uses

the past 36 months to forecast basis 11 months out of sample. For example, if we are at May/2013, then we use data from June/2010 to May/2013 to forecast 11 months out of sample basis (June/2013 to April/2014). June/2010, June/2011, and June/2012 basis are used to predict June/2013 basis. January/2011, January/2012, and January/2013 basis are used to predict January/2014 basis, and so on. When we update the model with another month (June/2013), we use data from July/2010 to June/2013 to predict basis for the next 11 months.

Econometric Fundamental Model

Based on economic theory and literature, six variables are chosen for inclusion in the econometric model of wheat basis. The variables are the nearby future price, U.S. projected monthly ending stocks, transportation costs, and three quarter dummies. We assume if all the exogeneous variables are equal to zero, then basis will be zero as well. An intercept is excluded from the model. We use diesel prices as a proxy of transportation costs, because both barges and trains mainly consume diesel fuel.

The econometric fundamental model is proposed as:

$$\begin{aligned} Basis_t = & \beta_1 Nearby\ futures_t + \beta_2 Ending\ stock_t + \beta_3 Diesel_price_t + \beta_4 Spring\ dummy_t \\ & + \beta_5 Summer\ dummy_t + \beta_6 Fall\ dummy_t, \text{ for } t = 1, \dots, 36, \end{aligned}$$

where

- *Nearby futures_t* is the futures closest to delivery (monthly);
- *Ending stock_t* is the projected ending stocks of wheat reported by the U.S. Department of Agriculture (USDA), updated monthly;
- *Diesel price_t* is the proxy of transportation costs.
- *Spring dummy_t* is a dummy variable when the date is in March, April, and May;
- *Summer dummy_t* is a dummy variable when the date is in June, July, and August;
- And *Fall dummy_t* is a dummy variable when the date is in September, October, and November.

The specific forecast procedure is as follows:

- 1) Estimate the model using historical data;
- 2) Treat each exogenous variable as a univariate time series set and forecast 11 months out of sample independently to then be used to forecast basis.

We use the average of the current month futures price for each contract as a forecast for nearby futures contracts . For example, when we are at May/2013, we need forecast the nearby future contract prices from June/2013 to April/2014. The predicted nearby future for June/2013 is the average May futures for July/2013 contract, for July/2013 and August/2013, it is the average May futures for September/2013 contract, etc.

Next we check the properties of ending stocks and diesel fuel prices by ACF and PACF plots and determine their time series properties, and conclude ending stocks follow an AR(1) and diesel fuel prices AR(2). We then forecast them 11 months out of sample using the AR results, and use the predicted values as right hand side variables in forecasting basis.

After generating predicted values of the exogeneous variables, we forecast basis 11 months out of sample.

Time Series Models

Based on the economic theory, cash prices and future price are assumed cointegrated, with basis being a stationary process. This allows specification of the following ARMA.

The ARMA (p,q) model:

$$Basis_t = \theta_1 Basis_{t-1} + \dots + \theta_p Basis_{t-p} - \phi_1 e_{t-1} - \dots - \phi_q e_{t-q} + e_t. \quad (2)$$

The ARMAX (p,q) model is specified as follows:

$$Basis_t = \alpha * exogenous + \theta_1 Basis_{t-1} + \dots + \theta_p Basis_{t-p} - \phi_1 e_{t-1} - \dots - \phi_q e_{t-q} + e_t. \quad (3)$$

The ARMA model represents a univariate analysis while ARMAX model is multivariate. To identify the appropriate time series structure of basis, we examine the ACF and PACF plots. The exogeneous variables in the ARMAX model are those variables used in the econometric fundamental model, and their forecasts. After determining the best model to fit the data, we do a robustness check by considering 1 or 2 other time series specifications to find the best model to forecast HRW and SWW basis.

IV. Data and Result

In this study the data are monthly. Cash and futures prices are the daily averaged for the month. Their unit is dollars/bushel. HRW and SRW futures contracts are traded at the Chicago Trade of Board and the Kansas Trade of Board, respectively. Projected ending stocks are published by USDA each month in the World Agricultural Supply and Demand Estimates (WASDE). Their units are million bushels. Diesel fuel prices are published by

Energy Information Administration (EIA) each day, also as a monthly averages. The unit is dollars/gallon. Data spans from June/2010 to May/2016, with 72 observations.

The final estimation results from the econometric fundamental, ARMA, and ARMAX models are presented in Tables 1 and 2. Final means we use all the 72 observations, which is not the model when we forecast basis. The magnitude of the coefficient might change a little, but we can get a rough idea of how each variable affects basis.

HRW

Table 1: Econometric fundamental model

Variable	Clarkston				Odessa			
	Estimate	Std.Error	t-value	p-value	Estimate	Std.Error	t-value	p-value
Ending stock	0.0001	0.0006	0.2443	0.8077	0.0002	0.0007	0.2247	0.8229
Future	-0.1155	0.0416	-2.7784	0.0071 ***	-0.2205	0.0645	-3.4179	0.0011 ***
Diesel	0.3834	0.1044	3.6726	0.0005 ***	0.4281	0.1367	3.1307	0.0026 ***
Spring	-0.0175	0.0677	-0.2592	0.7963	-0.0443	0.1133	-0.3908	0.6972
Summer	-0.0331	0.0781	-0.4244	0.6726	0.0392	0.1297	0.3022	0.7635
Fall	0.0120	0.0676	0.1779	0.8594	0.1305	0.1137	1.1474	0.2554

Note: *, **, *** denote statistical significance at 10%, 5%, and 1%, respectively.

We estimate the linear model using the generalized least square method (GLS) to resolve autocorrelation problems. Based on the significance tests, we drop ending stock and all season dummies from the ARMAX model. The nearby futures contract has a negative impact on basis. Basis weakens as futures price levels increase. Diesel price has a positive impact on basis. This is not what we expected. We thought that increased transportation cost would result in a weaker basis. Diesel price has a larger effect on basis in Odessa than in Clarkston.

The time series and ARMAX models generate the following results for HRW:

The ARMA Model-Clarkston: AR(1)

$$Basis_t = 0.9803Basis_{t-1} + e_t, \\ (0.0179^{***})$$

and ARMA Model-Odessa: AR(1)

$$Basis_t = 0.8068Basis_{t-1} + e_t. \\ (0.0679^{***})$$

The ARMAX Model-Clarkston:

$$Basis_t = 0.9366Basis_{t-1} - 0.1147Future + 0.3891Diesel + e_t,$$

$$(0.0523^{***}) \quad (0.0395^{***}) \quad (0.1031^{***})$$

and ARMAX Model-Odessa:

$$Basis_t = 0.6906Basis_{t-1} - 0.2353Future + 0.4785Diesel + e_t,$$

$$(0.0933^{***}) \quad (0.0643^{***}) \quad (0.1230^{***})$$

numbers in parenthesis are standard errors and *** denotes statistical significance at the 1% level.

The magnitude and sign of each estimate are consistent with the parameters in the econometric fundamental model.

SWW

Table 2: Econometric fundamental model

Variable	Clarkston					Odessa				
	Estimate	Std.Error	t-value	p-value		Estimate	Std.Error	t-value	p-value	
Ending stock	-0.0167	0.0060	-2.7679	0.0073	***	-0.0104	0.0025	-4.1656	0.0001	***
Future	0.5100	0.1112	4.5847	0.0000	***	-0.2530	0.0446	-5.6739	0.0000	***
Diesel	-0.4542	0.2156	-2.1069	0.0389	**	0.6076	0.0885	6.8677	0.0000	***
Spring	0.1070	0.1872	0.5715	0.5696		-0.1444	0.0731	-1.9746	0.0525	*
Summer	0.0994	0.2149	0.4626	0.6452		-0.0753	0.0843	-0.8925	0.3754	
Fall	0.0774	0.1886	0.4106	0.6827		-0.1553	0.0736	-2.1080	0.0388	**

Note: *, **, *** denote statistical significance at 10%, 5%, and 1%, respectively.

Again, the estimation method is GLS. Based on the significance tests, we drop all season dummies from the ARMAX model. Interestingly for SWW, the future contract and diesel fuel variables have opposite between the two elevators. In Clarkston, the futures contract has a positive effect while diesel fuel negatively impacts on basis, but in Odessa, they are the opposite.

newline

The time series and ARMAX model results for SWW are:

The ARMA Model-Clarkston: AR(1)

$$Basis_t = 0.8332Basis_{t-1} + e_t,$$

$$(0.0616^{***})$$

and ARMA Model-Odesa: AR(1)

$$Basis_t = 0.9046Basis_{t-1} + e_t.$$

(0.0461^{***})

The ARMAX Model-Clarkston:

$$Basis_t = 0.7572Basis_{t-1} + 0.5015Future - 0.4205Diesel - 0.0166Endingstock + e_t,$$

(0.0749^{***}) (0.1061^{***}) (0.1998^{***}) (0.0058^{***})

and ARMAX Model-Odesa:

$$Basis_t = 0.7900Basis_{t-1} - 0.2381Future + 0.5677Diesel - 0.0112Endingstock + e_t,$$

(0.0926^{***}) (0.0447^{***}) (0.0970^{***}) (0.0030^{***})

numbers in parenthesis are standard errors and ^{***} denotes statistical significance at the 1% level.

The magnitude and sign of each estimate are consistent with the parameters in the econometric fundamental model. While there are some curious results, and some signs what do not match initial expectation, we move on to analyzing forecast performance and leave economic interpretation of the estimated results for later work.

Forecast performance is based on RMSE comparisons. The smaller the RMSE, the better a forecast model performs. RMSEs from each model are presented in Table 3 for all 11 forecast horizons.

The three-year moving average model is never superior. Overall, the ARMAX models perform better than the ARMA models. For HRW, at the 4-month and 11-month horizons, the best model is the econometric fundamental model, at the 5-month, the best is an ARMA(3,0,0) model, and the best model for the other horizons is an ARMAX (3,0,0). For SWW, the econometric fundamental model performs best overall even though the diesel fuel variable has a sign opposite our initial expectations. See the Appendix for the details of error tables.

V. Conclusion

This research investigates the best model to forecast HRW and SWW in Washington State. Four types of model are considered: a three-year moving average, an econometric fundamental model, an ARMA, and an ARMAX model. Based on RMSE, for HRW we find that model selection is a function of forecast horizon. For SWW, the econometric fundamental model performs best overall. In addition, the ARMAX models perform better than the ARMA models in most cases, except SWW in Odessa, WA. At no time for either wheat class does

Table 3: RMSE, June/2013-May/2016

Method	Forecast Horizon (Months)										
	1	2	3	4	5	6	7	8	9	10	11
HRW											
Clarkston											
3-yr Moving Average	0.4904	0.4830	0.4690	0.4435	0.4223	0.4187	0.4145	0.4048	0.3853	0.3574	0.3477
Econometric	0.3795	0.5222	0.4335	0.3276	1.0275	0.3815	0.6061	0.8288	0.6641	0.4551	0.2228
ARMA(3,0,0)	0.1926	0.2951	0.3494	0.3635	0.3556	0.3487	0.3488	0.3757	0.4135	0.4262	0.4023
ARMAX(3,0,0)	0.1847	0.2775	0.3235	0.3341	1.1243	0.3162	0.3159	0.3291	0.3465	0.3421	0.3321
Odessa											
3-yr Moving Average	0.4985	0.5013	0.4914	0.4626	0.4483	0.4454	0.4443	0.4377	0.4208	0.3958	0.3899
Econometric	0.4855	0.5760	0.3266	0.1928	2.1386	0.2092	0.4564	0.6487	0.5117	0.3947	0.2152
ARMA(3,0,0)	0.2916	0.3157	0.3319	0.3555	0.3399	0.3431	0.3460	0.3615	0.3794	0.3778	0.3855
ARMAX(3,0,0)	0.2676	0.2800	0.2893	0.3170	2.1600	0.3085	0.3324	0.3375	0.3392	0.3450	0.3644
SWW											
Clarkston											
3-yr Moving Average	0.8196	0.8304	0.8409	0.8418	0.8427	0.8471	0.8558	0.8488	0.8616	0.8717	0.8810
Econometric	0.3696	0.2741	0.3539	0.2487	0.2574	0.3524	0.2087	0.2377	0.6410	0.9613	1.5370
ARMA(1,0,0)	0.4107	0.6207	0.7309	0.7804	0.7905	0.8057	0.8303	0.8668	0.9119	0.9527	0.9700
ARMAX(1,0,0)	0.3440	0.5191	0.6504	0.7319	0.7645	0.7211	0.6711	0.6459	0.6613	0.6878	0.6976
Odessa											
3-yr Moving Average	0.7580	0.7680	0.7622	0.7506	0.7439	0.7497	0.7506	0.7488	0.7471	0.7534	0.7675
Econometric	0.2172	0.2402	0.2230	0.3600	0.2002	0.2352	0.4365	0.5443	0.2557	0.2874	0.2714
ARMA(1,0,0)	0.2089	0.2940	0.3458	0.3842	0.4117	0.4437	0.4804	0.5202	0.5508	0.5709	0.5972
ARMAX(1,0,0)	0.2008	0.3052	0.3863	0.4348	0.4910	0.5334	0.5852	0.6390	0.6755	0.7086	0.7515

the three-year moving average performs a superior forecast.

Appendix

Error is defined as the difference between predicted and actual basis and the error table from each model is presented as below:

Table 4: HRW-Moving Average-Clarkston

Ending month	Forecast				Horizon (months)						
	1	2	3	4	5	6	7	8	9	10	11
May-13	0.7020	0.8270	0.9944	0.8861	0.5217	0.5282	0.6338	0.7714	0.8419	0.5534	0.2162
Jun-13	0.8270	0.9944	0.8861	0.5217	0.5282	0.6338	0.7714	0.8419	0.5534	0.2162	0.0878
Jul-13	0.9944	0.8861	0.5217	0.5282	0.6338	0.7714	0.8419	0.5534	0.2162	0.0878	0.0176
Aug-13	0.8861	0.5217	0.5282	0.6338	0.7714	0.8419	0.5534	0.2162	0.0878	0.0176	0.5718
Sep-13	0.5217	0.5282	0.6338	0.7714	0.8419	0.5534	0.2162	0.0878	0.0176	0.5718	0.4594
Oct-13	0.5282	0.6338	0.7714	0.8419	0.5534	0.2162	0.0878	0.0176	0.5718	0.4594	0.8500
Nov-13	0.6338	0.7714	0.8419	0.5534	0.2162	0.0878	0.0176	0.5718	0.4594	0.8500	0.8805
Dec-13	0.7714	0.8419	0.5534	0.2162	0.0878	0.0176	0.5718	0.4594	0.8500	0.8805	0.6532
Jan-14	0.8419	0.5534	0.2162	0.0878	0.0176	0.5718	0.4594	0.8500	0.8805	0.6532	0.2636
Feb-14	0.5534	0.2162	0.0878	0.0176	0.5718	0.4594	0.8500	0.8805	0.6532	0.2636	0.0564
Mar-14	0.2162	0.0878	0.0176	0.5718	0.4594	0.8500	0.8805	0.6532	0.2636	0.0564	0.1089
Apr-14	0.0878	0.0176	0.5718	0.4594	0.8500	0.8805	0.6532	0.2636	0.0564	0.1089	0.1065
May-14	0.0176	0.5718	0.4594	0.8500	0.8805	0.6532	0.2636	0.0564	0.1089	0.1065	-0.0526
Jun-14	0.5718	0.4594	0.8500	0.8805	0.6532	0.2636	0.0564	0.1089	0.1065	-0.0526	-0.1785
Jul-14	0.4594	0.8500	0.8805	0.6532	0.2636	0.0564	0.1089	0.1065	-0.0526	-0.1785	-0.0063
Aug-14	0.8500	0.8805	0.6532	0.2636	0.0564	0.1089	0.1065	-0.0526	-0.1785	-0.0063	-0.2189
Sep-14	0.8805	0.6532	0.2636	0.0564	0.1089	0.1065	-0.0526	-0.1785	-0.0063	-0.2189	0.0365
Oct-14	0.6532	0.2636	0.0564	0.1089	0.1065	-0.0526	-0.1785	-0.0063	-0.2189	0.0365	0.1305
Nov-14	0.2636	0.0564	0.1089	0.1065	-0.0526	-0.1785	-0.0063	-0.2189	0.0365	0.1305	-0.0936
Dec-14	0.0564	0.1089	0.1065	-0.0526	-0.1785	-0.0063	-0.2189	0.0365	0.1305	-0.0936	-0.0007
Jan-15	0.1089	0.1065	-0.0526	-0.1785	-0.0063	-0.2189	0.0365	0.1305	-0.0936	-0.0007	-0.0137
Feb-15	0.1065	-0.0526	-0.1785	-0.0063	-0.2189	0.0365	0.1305	-0.0936	-0.0007	-0.0137	-0.0462
Mar-15	-0.0526	-0.1785	-0.0063	-0.2189	0.0365	0.1305	-0.0936	-0.0007	-0.0137	-0.0462	-0.4067
Apr-15	-0.1785	-0.0063	-0.2189	0.0365	0.1305	-0.0936	-0.0007	-0.0137	-0.0462	-0.4067	-0.3943
May-15	-0.0063	-0.2189	0.0365	0.1305	-0.0936	-0.0007	-0.0137	-0.0462	-0.4067	-0.3943	-0.1019
Jun-15	-0.2189	0.0365	0.1305	-0.0936	-0.0007	-0.0137	-0.0462	-0.4067	-0.3943	-0.1019	0.2938
Jul-15	0.0365	0.1305	-0.0936	-0.0007	-0.0137	-0.0462	-0.4067	-0.3943	-0.1019	0.2938	NA
Aug-15	0.1305	-0.0936	-0.0007	-0.0137	-0.0462	-0.4067	-0.3943	-0.1019	0.2938	NA	NA
Sep-15	-0.0936	-0.0007	-0.0137	-0.0462	-0.4067	-0.3943	-0.1019	0.2938	NA	NA	NA
Oct-15	-0.0007	-0.0137	-0.0462	-0.4067	-0.3943	-0.1019	0.2938	NA	NA	NA	NA
Nov-15	-0.0137	-0.0462	-0.4067	-0.3943	-0.1019	0.2938	NA	NA	NA	NA	NA
Dec-15	-0.0462	-0.4067	-0.3943	-0.1019	0.2938	NA	NA	NA	NA	NA	NA
Jan-16	-0.4067	-0.3943	-0.1019	0.2938	NA	NA	NA	NA	NA	NA	NA
Feb-16	-0.3943	-0.1019	0.2938	NA	NA	NA	NA	NA	NA	NA	NA
Mar-16	-0.1019	0.2938	NA	NA	NA	NA	NA	NA	NA	NA	NA
Apr-16	0.2938	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 5: HRW-Econometric-Clarkston

Ending month	Forecast Horizon (months)										
	1	2	3	4	5	6	7	8	9	10	11
May-13	0.3870	0.5620	0.4948	0.3342	0.3469	0.4828	0.7704	1.0023	0.8206	0.5878	0.3504
Jun-13	0.3635	0.5461	0.4633	0.3030	0.3256	0.4523	0.7411	0.9785	0.7913	0.5556	0.3157
Jul-13	0.3778	0.5462	0.4641	0.3117	0.3277	0.4566	0.7495	0.9843	0.7889	0.5579	0.3248
Aug-13	0.3199	0.4893	0.4134	0.2575	0.2759	0.4091	0.7018	0.9290	0.7443	0.5211	0.2826
Sep-13	0.3547	0.5252	0.4474	0.2936	0.3117	0.4443	0.7248	0.9620	0.7831	0.5535	0.3237
Oct-13	0.3660	0.5428	0.4636	0.3045	0.3189	0.4389	0.7276	0.9674	0.7799	0.5561	0.3160
Nov-13	0.3522	0.5260	0.4451	0.2837	0.2935	0.4184	0.7139	0.9456	0.7666	0.5337	0.2931
Dec-13	0.2776	0.4450	0.3627	0.2007	0.2159	0.3535	0.6438	0.8892	0.7029	0.4717	0.2382
Jan-14	0.2686	0.4393	0.3503	0.1910	5.5956	0.3397	0.6390	0.8728	0.6861	0.4582	0.2186
Feb-14	0.2813	0.4479	0.3662	0.2106	0.2261	0.3621	0.6525	0.8869	0.6996	0.4684	0.2291
Mar-14	0.2996	0.4701	0.3943	0.2361	0.2610	0.3897	0.6803	0.9175	0.7314	0.5003	0.2576
Apr-14	0.3499	0.5248	0.4433	0.2942	0.3091	0.4368	0.7301	0.9640	0.7773	0.5390	0.2994
May-14	0.3088	0.4790	0.4064	0.2486	0.2651	0.3965	0.6876	0.9225	0.7365	0.5057	0.2580
Jun-14	0.2615	0.4433	0.3620	0.2032	0.2249	0.3528	0.6428	0.8804	0.6939	0.4535	0.2141
Jul-14	0.2082	0.3792	0.2988	0.1498	0.1663	0.2957	0.5904	0.8254	0.6304	0.3995	0.1710
Aug-14	0.1738	0.3465	0.2711	0.1116	0.1259	0.2562	0.5454	0.7702	0.5832	0.3624	0.1226
Sep-14	0.1345	0.3076	0.2259	0.0665	0.0811	0.2086	0.4916	0.7253	0.5502	0.3185	0.0954
Oct-14	0.2082	0.3823	0.2952	0.1295	0.1346	0.2503	0.5321	0.7701	0.5782	0.3572	0.1145
Nov-14	0.2780	0.4446	0.2912	0.1192	0.1236	0.2401	0.5739	0.8002	0.5743	0.3382	0.0953
Dec-14	0.3483	0.5020	0.3985	0.2129	0.1962	0.2838	0.5484	0.7525	0.5494	0.3051	0.1348
Jan-15	0.4946	0.6668	0.5584	0.3510	0.3253	0.4014	0.6382	0.8331	0.6149	0.3931	0.1351
Feb-15	0.4175	0.5555	0.4237	0.2046	0.1711	0.2722	0.5275	0.7341	0.5385	0.2918	0.0415
Mar-15	0.3541	0.4676	0.3208	0.1131	0.1277	0.2240	0.4904	0.7207	0.5228	0.2840	0.0258
Apr-15	0.4110	0.5609	0.4393	0.2571	0.2332	0.3265	0.5798	0.7890	0.5820	0.3635	0.1107
May-15	0.3351	0.4513	0.3439	0.1504	0.1394	0.2616	0.5377	0.7619	0.5777	0.3418	0.1064
Jun-15	0.3982	0.5618	0.4492	0.2599	0.2611	0.3648	0.6341	0.8798	0.6789	0.4209	0.1717
Jul-15	0.3511	0.4614	0.3853	0.4404	0.3174	0.4069	0.2463	0.2600	0.3941	0.5718	NA
Aug-15	0.4260	0.5448	0.4866	0.5253	0.3991	0.4954	0.3195	0.3388	0.4578	NA	NA
Sep-15	0.4485	0.5741	0.4965	0.5344	0.4197	0.5062	0.3425	0.3526	NA	NA	NA
Oct-15	0.4286	0.5319	0.4526	0.5022	0.3782	0.4779	0.3052	NA	NA	NA	NA
Nov-15	0.4394	0.5461	0.4809	0.5214	0.4104	0.4999	NA	NA	NA	NA	NA
Dec-15	0.4932	0.6222	0.5517	0.6059	0.4849	NA	NA	NA	NA	NA	NA
Jan-16	0.5666	0.6862	0.6281	0.6730	NA	NA	NA	NA	NA	NA	NA
Feb-16	0.6196	0.7548	0.6888	NA	NA	NA	NA	NA	NA	NA	NA
Mar-16	0.5491	0.6507	NA	NA	NA	NA	NA	NA	NA	NA	NA
Apr-16	0.4696	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 6: HRW-ARMA(3,0,0)-Clarkston

Ending month	Forecast Horizon (months)										
	1	2	3	4	5	6	7	8	9	10	11
May-13	-0.0293	-0.1678	0.0373	-0.0114	-0.1385	-0.0920	0.0670	0.3878	0.6521	0.4955	0.2933
Jun-13	-0.1370	0.0710	0.0229	-0.1037	-0.0570	0.1023	0.4231	0.6875	0.5309	0.3287	0.1177
Jul-13	0.2184	0.1875	0.0648	0.1150	0.2760	0.5982	0.8634	0.7072	0.5051	0.2940	0.2533
Aug-13	-0.0400	-0.1843	-0.1382	0.0186	0.3385	0.6021	0.4448	0.2420	0.0307	-0.0098	0.3197
Sep-13	-0.1459	-0.0962	0.0602	0.3803	0.6436	0.4862	0.2832	0.0716	0.0308	0.3600	0.3515
Oct-13	0.0500	0.2161	0.5351	0.7978	0.6389	0.4344	0.2211	0.1786	0.5061	0.4957	0.8120
Nov-13	0.1646	0.4798	0.7422	0.5828	0.3782	0.1650	0.1225	0.4501	0.4399	0.7564	1.0085
Dec-13	0.3156	0.5710	0.4117	0.2070	-0.0060	-0.0480	0.2802	0.2708	0.5881	0.8411	0.6781
Jan-14	0.2491	0.0803	-0.1224	-0.3331	-0.3722	-0.0412	-0.0476	0.2728	0.5289	0.3691	0.0196
Feb-14	-0.1927	-0.4093	-0.6195	-0.6563	-0.3219	-0.3248	-0.0008	0.2589	0.1026	-0.2432	-0.2527
Mar-14	-0.1982	-0.4039	-0.4417	-0.1094	-0.1148	0.2066	0.4638	0.3050	-0.0434	-0.0554	0.2166
Apr-14	-0.1921	-0.2293	0.1035	0.0986	0.4204	0.6778	0.5190	0.1705	0.1583	0.4300	0.4948
May-14	-0.0050	0.3383	0.3365	0.6596	0.9177	0.7592	0.4107	0.3982	0.6695	0.7335	0.5703
Jun-14	0.3439	0.3422	0.6652	0.9231	0.7644	0.4157	0.4031	0.6741	0.7380	0.5747	0.3089
Jul-14	-0.0386	0.2936	0.5557	0.3995	0.0536	0.0439	0.3182	0.3854	0.2255	-0.0366	0.0483
Aug-14	0.3345	0.5949	0.4378	0.0912	0.0808	0.3544	0.4209	0.2604	-0.0023	0.0820	-0.1606
Sep-14	0.2374	0.0746	-0.2682	-0.2735	0.0055	0.0774	-0.0777	-0.3351	-0.2455	-0.4828	-0.1549
Oct-14	-0.1879	-0.5366	-0.5418	-0.2616	-0.1881	-0.3416	-0.5973	-0.5059	-0.7414	-0.4116	-0.2557
Nov-14	-0.3237	-0.3291	-0.0510	0.0203	-0.1355	-0.3935	-0.3044	-0.5422	-0.2147	-0.0611	-0.0877
Dec-14	0.0369	0.3047	0.3719	0.2153	-0.0436	0.0443	-0.1948	0.1311	0.2830	0.2545	0.3432
Jan-15	0.2607	0.3285	0.1722	-0.0868	0.0010	-0.2382	0.0876	0.2395	0.2111	0.2999	0.2241
Feb-15	0.0317	-0.1014	-0.3538	-0.2679	-0.5082	-0.1822	-0.0299	-0.0579	0.0314	-0.0436	0.0914
Mar-15	-0.1372	-0.3866	-0.2999	-0.5403	-0.2144	-0.0620	-0.0899	-0.0005	-0.0754	0.0597	-0.0689
Apr-15	-0.2308	-0.1601	-0.4067	-0.0810	0.0706	0.0412	0.1291	0.0527	0.1864	0.0564	0.1083
May-15	0.1069	-0.1652	0.1499	0.3014	0.2715	0.3575	0.2789	0.4105	0.2785	0.3283	0.4856
Jun-15	-0.2900	0.0380	0.1949	0.1649	0.2509	0.1732	0.3058	0.1746	0.2254	0.3837	0.5931
Jul-15	0.3610	0.4898	0.4491	0.5327	0.4519	0.5804	0.4451	0.4919	0.6462	0.8516	NA
Aug-15	0.1043	0.0981	0.1933	0.1172	0.2515	0.1227	0.1758	0.3362	0.5477	NA	NA
Sep-15	-0.0118	0.0949	0.0215	0.1561	0.0284	0.0828	0.2445	0.4572	NA	NA	NA
Oct-15	0.1077	0.0329	0.1670	0.0389	0.0930	0.2544	0.4669	NA	NA	NA	NA
Nov-15	-0.0842	0.0600	-0.0649	-0.0102	0.1523	0.3660	NA	NA	NA	NA	NA
Dec-15	0.1512	0.0186	0.0710	0.2329	0.4458	NA	NA	NA	NA	NA	NA
Jan-16	-0.1444	-0.0787	0.0869	0.3007	NA	NA	NA	NA	NA	NA	NA
Feb-16	0.0752	0.2290	0.4395	NA	NA	NA	NA	NA	NA	NA	NA
Mar-16	0.1491	0.3657	NA	NA	NA	NA	NA	NA	NA	NA	NA
Apr-16	0.2066	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 7: HRW-ARMAX(3,0,0)-Clarkston

Ending month	Forecast Horizon (months)										
	1	2	3	4	5	6	7	8	9	10	11
May-13	-0.0512	-0.1923	0.0262	-0.0293	-0.1649	-0.1154	0.0330	0.3426	0.6034	0.4352	0.2252
Jun-13	-0.1779	0.0398	-0.0131	-0.1455	-0.0951	0.0562	0.3681	0.6278	0.4608	0.2435	0.0215
Jul-13	0.1913	0.1508	0.0198	0.0702	0.2239	0.5376	0.7952	0.6279	0.4036	0.1795	0.1315
Aug-13	-0.0291	-0.1643	-0.1134	0.0448	0.3637	0.6271	0.4652	0.2456	0.0264	-0.0152	0.3043
Sep-13	-0.1052	-0.0594	0.0991	0.4203	0.6812	0.5216	0.2990	0.0813	0.0386	0.3586	0.3493
Oct-13	-0.0050	0.1550	0.4707	0.7267	0.5598	0.3378	0.1139	0.0680	0.3834	0.3706	0.6744
Nov-13	0.1275	0.4435	0.7009	0.5330	0.3152	0.0902	0.0449	0.3595	0.3471	0.6503	0.8892
Dec-13	0.2877	0.5419	0.3788	0.1670	-0.0510	-0.0883	0.2324	0.2275	0.5354	0.7783	0.6113
Jan-14	0.3584	0.2051	-0.0068	-0.2169	6.0853	0.0770	0.0769	0.3911	0.6399	0.4761	0.1178
Feb-14	-0.0488	-0.2435	-0.4367	-0.4585	-0.1155	-0.1041	0.2236	0.4850	0.3275	-0.0201	-0.0326
Mar-14	-0.1908	-0.3879	-0.4091	-0.0675	-0.0557	0.2710	0.5314	0.3767	0.0281	0.0145	0.2799
Apr-14	-0.1909	-0.2223	0.1167	0.1259	0.4487	0.7053	0.5478	0.1953	0.1778	0.4358	0.4933
May-14	-0.1046	0.2290	0.2311	0.5503	0.8033	0.6404	0.2839	0.2621	0.5227	0.5755	0.3917
Jun-14	0.2732	0.2741	0.5861	0.8321	0.6665	0.3037	0.2761	0.5352	0.5831	0.3952	0.1132
Jul-14	0.0041	0.3346	0.5955	0.4476	0.0994	0.0853	0.3569	0.4161	0.2371	-0.0357	0.0484
Aug-14	0.2931	0.5542	0.4029	0.0533	0.0378	0.3077	0.3657	0.1866	-0.0869	-0.0027	-0.2574
Sep-14	0.2966	0.1531	-0.1782	-0.1772	0.1048	0.1769	0.0128	-0.2491	-0.1539	-0.3990	-0.0634
Oct-14	-0.0891	-0.4006	-0.3838	-0.0884	-0.0073	-0.1592	-0.4129	-0.3106	-0.5471	-0.2053	-0.0529
Nov-14	-0.2594	-0.2481	-0.0235	0.0500	-0.1043	-0.3649	-0.2255	-0.4677	-0.1789	-0.0308	-0.0635
Dec-14	-0.0302	0.2360	0.2934	0.1163	-0.1712	-0.1228	-0.3886	-0.0957	0.0349	-0.0124	0.1395
Jan-15	0.3132	0.4005	0.2266	-0.0742	-0.0224	-0.3112	-0.0385	0.0726	0.0095	0.1047	0.0051
Feb-15	0.0524	-0.0945	-0.3921	-0.3545	-0.6315	-0.3231	-0.1994	-0.2502	-0.1665	-0.2552	-0.1308
Mar-15	-0.1949	-0.4910	-0.4566	-0.7315	-0.3931	-0.2634	-0.3080	-0.2164	-0.2991	-0.1691	-0.3159
Apr-15	-0.2822	-0.2170	-0.4851	-0.1711	-0.0508	-0.1085	-0.0529	-0.1512	-0.0366	-0.1523	-0.1146
May-15	0.0270	-0.2957	0.0025	0.1205	0.0625	0.1400	0.0438	0.1603	0.0240	0.0621	0.2152
Jun-15	-0.2869	0.0473	0.1753	0.1174	0.1923	0.0911	0.2016	0.0796	0.1120	0.2386	0.4324
Jul-15	0.2708	0.3792	0.3106	0.3733	0.2569	0.3524	0.1972	0.2159	0.3545	0.5363	NA
Aug-15	0.1923	0.1743	0.2602	0.1588	0.2655	0.1195	0.1449	0.2898	0.4765	NA	NA
Sep-15	0.0209	0.1370	0.0468	0.1631	0.0262	0.0600	0.2127	0.4062	NA	NA	NA
Oct-15	0.0782	-0.0052	0.1143	-0.0200	0.0158	0.1707	0.3658	NA	NA	NA	NA
Nov-15	-0.0555	0.0796	-0.0478	-0.0078	0.1504	0.3480	NA	NA	NA	NA	NA
Dec-15	0.1503	0.0374	0.0843	0.2439	0.4414	NA	NA	NA	NA	NA	NA
Jan-16	-0.0864	-0.0120	0.1586	0.3634	NA	NA	NA	NA	NA	NA	NA
Feb-16	0.0911	0.2718	0.4826	NA	NA	NA	NA	NA	NA	NA	NA
Mar-16	0.1400	0.3436	NA	NA	NA	NA	NA	NA	NA	NA	NA
Apr-16	0.1657	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 8: HRW-Moving Average-Odessa

Ending month	Forecast Horizon (months)										
	1	2	3	4	5	6	7	8	9	10	11
May-13	0.3845	0.7665	1.0709	0.7944	0.5314	0.4776	0.6044	0.7735	0.8532	0.5267	0.2625
Jun-13	0.7665	1.0709	0.7944	0.5314	0.4776	0.6044	0.7735	0.8532	0.5267	0.2625	0.1172
Jul-13	1.0709	0.7944	0.5314	0.4776	0.6044	0.7735	0.8532	0.5267	0.2625	0.1172	-0.2131
Aug-13	0.7944	0.5314	0.4776	0.6044	0.7735	0.8532	0.5267	0.2625	0.1172	-0.2131	0.3640
Sep-13	0.5314	0.4776	0.6044	0.7735	0.8532	0.5267	0.2625	0.1172	-0.2131	0.3640	0.6765
Oct-13	0.4776	0.6044	0.7735	0.8532	0.5267	0.2625	0.1172	-0.2131	0.3640	0.6765	0.5540
Nov-13	0.6044	0.7735	0.8532	0.5267	0.2625	0.1172	-0.2131	0.3640	0.6765	0.5540	0.8245
Dec-13	0.7735	0.8532	0.5267	0.2625	0.1172	-0.2131	0.3640	0.6765	0.5540	0.8245	0.5326
Jan-14	0.8532	0.5267	0.2625	0.1172	-0.2131	0.3640	0.6765	0.5540	0.8245	0.5326	0.1729
Feb-14	0.5267	0.2625	0.1172	-0.2131	0.3640	0.6765	0.5540	0.8245	0.5326	0.1729	-0.0637
Mar-14	0.2625	0.1172	-0.2131	0.3640	0.6765	0.5540	0.8245	0.5326	0.1729	-0.0637	0.0182
Apr-14	0.1172	-0.2131	0.3640	0.6765	0.5540	0.8245	0.5326	0.1729	-0.0637	0.0182	0.0213
May-14	-0.2131	0.3640	0.6765	0.5540	0.8245	0.5326	0.1729	-0.0637	0.0182	0.0213	-0.0796
Jun-14	0.3640	0.6765	0.5540	0.8245	0.5326	0.1729	-0.0637	0.0182	0.0213	-0.0796	-0.1082
Jul-14	0.6765	0.5540	0.8245	0.5326	0.1729	-0.0637	0.0182	0.0213	-0.0796	-0.1082	0.3355
Aug-14	0.5540	0.8245	0.5326	0.1729	-0.0637	0.0182	0.0213	-0.0796	-0.1082	0.3355	-0.0089
Sep-14	0.8245	0.5326	0.1729	-0.0637	0.0182	0.0213	-0.0796	-0.1082	0.3355	-0.0089	0.9204
Oct-14	0.5326	0.1729	-0.0637	0.0182	0.0213	-0.0796	-0.1082	0.3355	-0.0089	0.9204	0.6991
Nov-14	0.1729	-0.0637	0.0182	0.0213	-0.0796	-0.1082	0.3355	-0.0089	0.9204	0.6991	-0.2860
Dec-14	-0.0637	0.0182	0.0213	-0.0796	-0.1082	0.3355	-0.0089	0.9204	0.6991	-0.2860	-0.0424
Jan-15	0.0182	0.0213	-0.0796	-0.1082	0.3355	-0.0089	0.9204	0.6991	-0.2860	-0.0424	-0.0758
Feb-15	0.0213	-0.0796	-0.1082	0.3355	-0.0089	0.9204	0.6991	-0.2860	-0.0424	-0.0758	-0.0757
Mar-15	-0.0796	-0.1082	0.3355	-0.0089	0.9204	0.6991	-0.2860	-0.0424	-0.0758	-0.0757	-0.4090
Apr-15	-0.1082	0.3355	-0.0089	0.9204	0.6991	-0.2860	-0.0424	-0.0758	-0.0757	-0.4090	-0.3795
May-15	0.3355	-0.0089	0.9204	0.6991	-0.2860	-0.0424	-0.0758	-0.0757	-0.4090	-0.3795	-0.1732
Jun-15	-0.0089	0.9204	0.6991	-0.2860	-0.0424	-0.0758	-0.0757	-0.4090	-0.3795	-0.1732	0.1608
Jul-15	0.9204	0.6991	-0.2860	-0.0424	-0.0758	-0.0757	-0.4090	-0.3795	-0.1732	0.1608	NA
Aug-15	0.6991	-0.2860	-0.0424	-0.0758	-0.0757	-0.4090	-0.3795	-0.1732	0.1608	NA	NA
Sep-15	-0.2860	-0.0424	-0.0758	-0.0757	-0.4090	-0.3795	-0.1732	0.1608	NA	NA	NA
Oct-15	-0.0424	-0.0758	-0.0757	-0.4090	-0.3795	-0.1732	0.1608	NA	NA	NA	NA
Nov-15	-0.0758	-0.0757	-0.4090	-0.3795	-0.1732	0.1608	NA	NA	NA	NA	NA
Dec-15	-0.0757	-0.4090	-0.3795	-0.1732	0.1608	NA	NA	NA	NA	NA	NA
Jan-16	-0.4090	-0.3795	-0.1732	0.1608	NA	NA	NA	NA	NA	NA	NA
Feb-16	-0.3795	-0.1732	0.1608	NA	NA	NA	NA	NA	NA	NA	NA
Mar-16	-0.1732	0.1608	NA	NA	NA	NA	NA	NA	NA	NA	NA
Apr-16	0.1608	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 9: HRW-Econometric-Odessa

Ending month	Forecast Horizon (months)										
	1	2	3	4	5	6	7	8	9	10	11
May-13	0.3905	0.5158	0.5701	0.3673	0.3491	0.4309	0.7247	0.9265	0.7836	0.6414	0.4197
Jun-13	0.3241	0.4733	0.4924	0.2900	0.2943	0.3524	0.6477	0.8609	0.7038	0.5537	0.3252
Jul-13	0.3225	0.4406	0.4606	0.2753	0.2611	0.3218	0.6245	0.8297	0.6508	0.5107	0.2978
Aug-13	0.2751	0.3943	0.4267	0.2295	0.2181	0.2864	0.5862	0.7707	0.6164	0.4942	0.2674
Sep-13	0.3488	0.4684	0.4936	0.2990	0.2848	0.3499	0.6179	0.8259	0.6853	0.5469	0.3410
Oct-13	0.3043	0.4321	0.4554	0.2541	0.2380	0.2800	0.5752	0.7946	0.6372	0.5158	0.2870
Nov-13	0.2557	0.3799	0.4027	0.1992	0.1751	0.2311	0.5440	0.7456	0.6092	0.4668	0.2375
Dec-13	0.1470	0.2621	0.2816	0.0739	0.0586	0.1397	0.4365	0.6665	0.5104	0.3700	0.1555
Jan-14	0.1900	0.3104	0.3147	0.1134	12.0615	0.1707	0.4884	0.6922	0.5357	0.4030	0.1748
Feb-14	0.3290	0.4406	0.4608	0.2675	0.2525	0.3308	0.6278	0.8323	0.6737	0.5332	0.3054
Mar-14	0.3320	0.4519	0.4843	0.2839	0.2887	0.3487	0.6458	0.8560	0.7000	0.5596	0.3241
Apr-14	0.3834	0.5119	0.5321	0.3522	0.3363	0.3953	0.6990	0.9028	0.7462	0.5908	0.3626
May-14	0.2587	0.3783	0.4163	0.2164	0.2022	0.2672	0.5648	0.7699	0.6137	0.4736	0.2280
Jun-14	0.1351	0.2777	0.2982	0.0972	0.0953	0.1545	0.4508	0.6625	0.5060	0.3466	0.1185
Jul-14	0.1227	0.2427	0.2633	0.0789	0.0642	0.1245	0.4285	0.6333	0.4600	0.3197	0.1115
Aug-14	0.0250	0.1468	0.1780	-0.0240	-0.0407	0.0235	0.3188	0.5059	0.3487	0.2286	0.0001
Sep-14	0.0128	0.1366	0.1559	-0.0462	-0.0627	-0.0044	0.2794	0.4829	0.3474	0.2064	0.0083
Oct-14	0.0907	0.2139	0.2279	0.0218	-0.0043	0.0397	0.3275	0.5452	0.3831	0.2659	0.0346
Nov-14	0.1990	0.3146	0.2076	-0.0073	-0.0320	0.0153	0.4034	0.5994	0.3734	0.2278	-0.0039
Dec-14	0.2179	0.3079	0.3057	0.0806	0.0329	0.0433	0.3141	0.4813	0.3082	0.1546	0.0576
Jan-15	0.3321	0.4534	0.4502	0.2004	0.1537	0.1610	0.3985	0.5633	0.3752	0.2713	0.0247
Feb-15	0.2153	0.3067	0.2761	0.0083	-0.0564	-0.0122	0.2492	0.4257	0.2693	0.1131	-0.1259
Mar-15	0.1574	0.2200	0.1666	-0.0837	-0.0692	-0.0419	0.2306	0.4411	0.2731	0.1249	-0.1333
Apr-15	0.2033	0.3104	0.2900	0.0794	0.0245	0.0489	0.3030	0.4820	0.3050	0.2001	-0.0413
May-15	0.1224	0.1866	0.1947	-0.0420	-0.0847	-0.0205	0.2615	0.4554	0.3084	0.1630	-0.0555
Jun-15	0.1695	0.2979	0.2856	0.0527	0.0335	0.0674	0.3422	0.5814	0.4100	0.2300	-0.0082
Jul-15	0.7397	0.8485	-0.1137	0.1104	-0.0958	0.0052	-0.1146	-0.0874	0.0596	0.2116	NA
Aug-15	0.7918	0.9094	-0.0203	0.1721	-0.0391	0.0775	-0.0691	-0.0279	0.0932	NA	NA
Sep-15	0.8210	0.9596	-0.0047	0.1878	-0.0011	0.0962	-0.0272	-0.0044	NA	NA	NA
Oct-15	0.7916	0.8897	-0.0792	0.1349	-0.0756	0.0454	-0.0989	NA	NA	NA	NA
Nov-15	0.7919	0.8941	-0.0475	0.1450	-0.0397	0.0584	NA	NA	NA	NA	NA
Dec-15	0.8367	0.9760	0.0176	0.2363	0.0291	NA	NA	NA	NA	NA	NA
Jan-16	0.9151	1.0328	0.0995	0.2970	NA	NA	NA	NA	NA	NA	NA
Feb-16	0.9678	1.1144	0.1614	NA	NA	NA	NA	NA	NA	NA	NA
Mar-16	0.8793	0.9747	NA	NA	NA	NA	NA	NA	NA	NA	NA
Apr-16	0.7294	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 10: HRW-ARMA(3,0,0)-Odessa

Ending month	Forecast Horizon (months)										
	1	2	3	4	5	6	7	8	9	10	11
May-13	0.0050	-0.1031	0.0532	0.1120	-0.0570	-0.0447	0.0413	0.3625	0.5891	0.4535	0.3320
Jun-13	-0.1075	0.0498	0.1082	-0.0611	-0.0486	0.0375	0.3587	0.5855	0.4500	0.3286	0.1183
Jul-13	0.1307	0.1597	-0.0033	0.0099	0.0887	0.4059	0.6303	0.4916	0.3670	0.1540	0.1053
Aug-13	0.0626	-0.0637	-0.0590	0.0188	0.3453	0.5746	0.4386	0.3179	0.1088	0.0633	0.1817
Sep-13	-0.1097	-0.0878	-0.0145	0.3115	0.5453	0.4115	0.2919	0.0846	0.0409	0.1609	0.3419
Oct-13	-0.0077	0.0335	0.3666	0.6011	0.4589	0.3351	0.1255	0.0786	0.1952	0.3736	0.5401
Nov-13	0.0389	0.3696	0.6045	0.4624	0.3379	0.1280	0.0809	0.1973	0.3754	0.5417	0.8289
Dec-13	0.3412	0.5876	0.4427	0.3178	0.1110	0.0653	0.1824	0.3618	0.5292	0.8173	0.5798
Jan-14	0.3394	0.2960	0.1474	-0.0626	-0.0819	0.0486	0.2342	0.4118	0.7101	0.4806	0.1186
Feb-14	0.0369	-0.0093	-0.2404	-0.2667	-0.1121	0.0874	0.2707	0.5781	0.3586	0.0046	-0.0340
Mar-14	-0.0388	-0.2591	-0.2878	-0.1343	0.0674	0.2521	0.5600	0.3414	-0.0116	-0.0495	0.2174
Apr-14	-0.2288	-0.2687	-0.1127	0.0899	0.2721	0.5786	0.3594	0.0054	-0.0335	0.2324	0.3030
May-14	-0.0851	0.0064	0.2196	0.4066	0.6996	0.4714	0.1130	0.0682	0.3277	0.3926	0.3268
Jun-14	0.0736	0.2614	0.4510	0.7451	0.5114	0.1491	0.1022	0.3592	0.4215	0.3535	0.1769
Jul-14	0.2042	0.4160	0.7074	0.4728	0.1155	0.0720	0.3307	0.3952	0.3294	0.1547	0.8145
Aug-14	0.2578	0.6112	0.3690	0.0091	-0.0204	0.2477	0.3170	0.2571	0.0887	0.7538	0.0269
Sep-14	0.4062	0.2417	-0.1259	-0.1595	0.1252	0.2064	0.1527	-0.0084	0.6645	-0.0557	0.7389
Oct-14	-0.0937	-0.3466	-0.3897	-0.1121	-0.0086	-0.0450	-0.1966	0.4870	-0.2216	0.5833	0.7373
Nov-14	-0.2687	-0.3378	-0.0573	0.0483	0.0070	-0.1482	0.5335	-0.1774	0.6250	0.7767	-0.1366
Dec-14	-0.1123	0.0886	0.2012	0.1676	-0.0023	0.6675	-0.0492	0.7465	0.8906	-0.0295	0.2085
Jan-15	0.1854	0.2628	0.2293	0.0625	0.7262	0.0038	0.7965	0.9375	0.0139	0.2487	0.0800
Feb-15	0.1090	0.1357	-0.0344	0.6239	-0.0872	0.7151	0.8607	-0.0580	0.1826	0.0188	0.1586
Mar-15	0.0456	-0.0893	0.5671	-0.1469	0.6621	0.8133	-0.1027	0.1408	-0.0195	0.1231	0.0204
Apr-15	-0.1275	0.5436	-0.1710	0.6367	0.7906	-0.1230	0.1217	-0.0375	0.1066	0.0051	0.0670
May-15	0.6506	-0.1047	0.7043	0.8616	-0.0595	0.1786	0.0161	0.1567	0.0513	0.1098	0.2652
Jun-15	-0.6351	0.3837	0.5151	-0.4304	-0.1508	-0.2822	-0.1298	-0.2197	-0.1422	0.0293	0.2200
Jul-15	0.8301	0.7874	-0.0979	0.1867	0.0070	0.1402	0.0419	0.1019	0.2562	0.4335	NA
Aug-15	0.3233	-0.4601	-0.2432	-0.3784	-0.2017	-0.2844	-0.2032	-0.0253	0.1715	NA	NA
Sep-15	-0.6476	-0.3948	-0.5657	-0.3757	-0.4455	-0.3623	-0.1789	0.0248	NA	NA	NA
Oct-15	0.0253	-0.3191	-0.0356	-0.1097	-0.0828	0.0925	0.2904	NA	NA	NA	NA
Nov-15	-0.3353	-0.0451	-0.1233	-0.0963	0.0812	0.2793	NA	NA	NA	NA	NA
Dec-15	0.1531	0.0073	0.0786	0.2433	0.4168	NA	NA	NA	NA	NA	NA
Jan-16	-0.0856	0.0156	0.1663	0.3464	NA	NA	NA	NA	NA	NA	NA
Feb-16	0.0675	0.2019	0.3896	NA	NA	NA	NA	NA	NA	NA	NA
Mar-16	0.1609	0.3614	NA	NA	NA	NA	NA	NA	NA	NA	NA
Apr-16	0.2634	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 11: HRW-ARMAX(3,0,0)-Odessa

Ending month	Forecast Horizon (months)										
	1	2	3	4	5	6	7	8	9	10	11
May-13	-0.0203	-0.1323	0.0446	0.1059	-0.0654	-0.0341	0.0490	0.3690	0.6094	0.4723	0.3588
Jun-13	-0.1815	-0.0238	0.0489	-0.1192	-0.0946	-0.0086	0.3143	0.5493	0.4128	0.2827	0.0726
Jul-13	0.0675	0.0805	-0.0457	-0.0192	0.0497	0.3764	0.6125	0.4727	0.3252	0.1153	0.0832
Aug-13	0.0192	-0.0974	-0.0817	-0.0105	0.3241	0.5638	0.4265	0.2841	0.0771	0.0490	0.1670
Sep-13	-0.0172	-0.0156	0.0572	0.3949	0.6275	0.4935	0.3426	0.1381	0.1075	0.2270	0.4292
Oct-13	-0.0761	0.0024	0.3350	0.5667	0.4287	0.2905	0.0814	0.0516	0.1685	0.3684	0.5349
Nov-13	-0.0199	0.2912	0.5405	0.4020	0.2656	0.0551	0.0279	0.1415	0.3408	0.5062	0.7921
Dec-13	0.1996	0.4266	0.2990	0.1658	-0.0454	-0.0667	0.0510	0.2553	0.4221	0.7095	0.4847
Jan-14	0.3753	0.3101	0.1287	-0.0847	12.0850	0.0293	0.2268	0.4009	0.6932	0.4643	0.0969
Feb-14	0.2290	0.1785	-0.1083	-0.1269	0.0406	0.2406	0.4102	0.7170	0.4883	0.1244	0.0798
Mar-14	0.0374	-0.1766	-0.2285	-0.0698	0.1578	0.3326	0.6364	0.4233	0.0662	0.0241	0.2803
Apr-14	-0.1487	-0.1973	-0.0433	0.1846	0.3619	0.6660	0.4544	0.0979	0.0564	0.3056	0.3745
May-14	-0.2407	-0.1339	0.1170	0.3033	0.5956	0.3814	0.0296	-0.0136	0.2482	0.3169	0.2346
Jun-14	-0.1064	0.0715	0.2918	0.5923	0.3637	0.0054	-0.0368	0.2270	0.2889	0.2024	0.0258
Jul-14	0.1123	0.2932	0.6090	0.3877	0.0200	-0.0240	0.2405	0.3006	0.2136	0.0360	0.7122
Aug-14	0.1386	0.4861	0.2473	-0.1243	-0.1600	0.1054	0.1644	0.0806	-0.0950	0.5837	-0.1503
Sep-14	0.3876	0.1854	-0.2036	-0.2422	0.0318	0.0957	0.0168	-0.1544	0.5288	-0.2027	0.6127
Oct-14	-0.0307	-0.2748	-0.3663	-0.1067	-0.0105	-0.0759	-0.2522	0.4364	-0.2871	0.5301	0.6704
Nov-14	-0.1557	-0.2568	-0.1156	-0.0206	-0.0818	-0.2615	0.5063	-0.2199	0.5032	0.6419	-0.2824
Dec-14	-0.2033	0.0165	0.1105	0.0373	-0.1666	0.4596	-0.2830	0.4725	0.5983	-0.3358	0.0307
Jan-15	0.2229	0.3062	0.2446	0.0279	0.6637	-0.1082	0.6255	0.7266	-0.2290	0.0425	-0.1459
Feb-15	0.0555	0.0532	-0.1865	0.4095	-0.3386	0.4474	0.5549	-0.3898	-0.1487	-0.3295	-0.2021
Mar-15	-0.0502	-0.2627	0.3150	-0.4358	0.4059	0.5210	-0.4192	-0.1683	-0.3418	-0.2087	-0.3428
Apr-15	-0.2016	0.4499	-0.2971	0.5047	0.6177	-0.3306	-0.1269	-0.3115	-0.1893	-0.2563	-0.2090
May-15	0.5408	-0.2990	0.5264	0.6527	-0.3081	-0.0655	-0.2398	-0.1127	-0.2126	-0.1607	0.0017
Jun-15	-0.6040	0.4499	0.4831	-0.5019	-0.1977	-0.3658	-0.2532	-0.3074	-0.2465	-0.1231	0.0512
Jul-15	0.7178	0.6251	-0.2469	0.0397	-0.1919	-0.0791	-0.1734	-0.1390	0.0144	0.1782	NA
Aug-15	0.3852	-0.4105	-0.2308	-0.3895	-0.2431	-0.3477	-0.2979	-0.1294	0.0397	NA	NA
Sep-15	-0.5666	-0.3480	-0.5783	-0.3982	-0.4857	-0.4438	-0.2662	-0.0887	NA	NA	NA
Oct-15	-0.1009	-0.4610	-0.1491	-0.2617	-0.2803	-0.0856	0.0881	NA	NA	NA	NA
Nov-15	-0.3787	-0.0856	-0.1682	-0.1913	-0.0095	0.1669	NA	NA	NA	NA	NA
Dec-15	0.1318	0.0011	0.0509	0.2092	0.3553	NA	NA	NA	NA	NA	NA
Jan-16	-0.0307	0.0626	0.2006	0.3610	NA	NA	NA	NA	NA	NA	NA
Feb-16	0.1108	0.2641	0.4310	NA	NA	NA	NA	NA	NA	NA	NA
Mar-16	0.1299	0.2987	NA	NA	NA	NA	NA	NA	NA	NA	NA
Apr-16	0.1404	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 12: SWW-Moving Average-Clarkston

Ending month	Forecast Horizon (months)											
	1	2	3	4	5	6	7	8	9	10	11	
May-13	0.2166	-0.3113	-0.8100	-0.8104	-0.6935	0.5216	1.0391	0.3321	-0.5160	0.5798	1.0789	1.7727
Jun-13	-0.3113	-0.8100	-0.8104	-0.6935	0.5216	1.0391	0.3321	-0.5160	0.5798	1.0789	1.7727	1.3720
Jul-13	-0.8100	-0.8104	-0.6935	0.5216	1.0391	0.3321	-0.5160	0.5798	1.0789	1.7727	1.3720	-0.4471
Aug-13	-0.8104	-0.6935	0.5216	1.0391	0.3321	-0.5160	0.5798	1.0789	1.7727	1.3720	-0.4471	-0.5409
Sep-13	-0.6935	0.5216	1.0391	0.3321	-0.5160	0.5798	1.0789	1.7727	1.3720	-0.4471	-0.5409	-0.5926
Oct-13	0.5216	1.0391	0.3321	-0.5160	0.5798	1.0789	1.7727	1.3720	-0.4471	-0.5409	-0.5926	0.1402
Nov-13	1.0391	0.3321	-0.5160	0.5798	1.0789	1.7727	1.3720	-0.4471	-0.5409	-0.5926	0.1402	1.5275
Dec-13	0.3321	-0.5160	0.5798	1.0789	1.7727	1.3720	-0.4471	-0.5409	-0.5926	0.1402	1.5275	1.8421
Jan-14	-0.5160	0.5798	1.0789	1.7727	1.3720	-0.4471	-0.5409	-0.5926	0.1402	1.5275	1.8421	1.8044
Feb-14	0.5798	1.0789	1.7727	1.3720	-0.4471	-0.5409	-0.5926	0.1402	1.5275	1.8421	1.8044	1.2489
Mar-14	1.0789	1.7727	1.3720	-0.4471	-0.5409	-0.5926	0.1402	1.5275	1.8421	1.8044	1.2489	0.6448
Apr-14	1.7727	1.3720	-0.4471	-0.5409	-0.5926	0.1402	1.5275	1.8421	1.8044	1.2489	0.6448	0.1337
May-14	1.3720	-0.4471	-0.5409	-0.5926	0.1402	1.5275	1.8421	1.8044	1.2489	0.6448	0.1337	-0.1709
Jun-14	-0.4471	-0.5409	-0.5926	0.1402	1.5275	1.8421	1.8044	1.2489	0.6448	0.1337	-0.1709	0.4143
Jul-14	-0.5409	-0.5926	0.1402	1.5275	1.8421	1.8044	1.2489	0.6448	0.1337	-0.1709	0.4143	0.2530
Aug-14	-0.5926	0.1402	1.5275	1.8421	1.8044	1.2489	0.6448	0.1337	-0.1709	0.4143	0.2530	-0.1577
Sep-14	0.1402	1.5275	1.8421	1.8044	1.2489	0.6448	0.1337	-0.1709	0.4143	0.2530	-0.1577	-0.1547
Oct-14	1.5275	1.8421	1.8044	1.2489	0.6448	0.1337	-0.1709	0.4143	0.2530	-0.1577	-0.1547	-0.5447
Nov-14	1.8421	1.8044	1.2489	0.6448	0.1337	-0.1709	0.4143	0.2530	-0.1577	-0.1547	-0.5447	-0.7246
Dec-14	1.8044	1.2489	0.6448	0.1337	-0.1709	0.4143	0.2530	-0.1577	-0.1547	-0.5447	-0.7246	-0.3103
Jan-15	1.2489	0.6448	0.1337	-0.1709	0.4143	0.2530	-0.1577	-0.1547	-0.5447	-0.7246	-0.3103	-0.1721
Feb-15	0.6448	0.1337	-0.1709	0.4143	0.2530	-0.1577	-0.1547	-0.5447	-0.7246	-0.3103	-0.1721	-0.5252
Mar-15	0.1337	-0.1709	0.4143	0.2530	-0.1577	-0.1547	-0.5447	-0.7246	-0.3103	-0.1721	-0.5252	-0.6645
Apr-15	-0.1709	0.4143	0.2530	-0.1577	-0.1547	-0.5447	-0.7246	-0.3103	-0.1721	-0.5252	-0.6645	-0.2681
May-15	0.4143	0.2530	-0.1577	-0.1547	-0.5447	-0.7246	-0.3103	-0.1721	-0.5252	-0.6645	-0.2681	-0.3207
Jun-15	0.2530	-0.1577	-0.1547	-0.5447	-0.7246	-0.3103	-0.1721	-0.5252	-0.6645	-0.2681	-0.3207	NA
Jul-15	-0.1577	-0.1547	-0.5447	-0.7246	-0.3103	-0.1721	-0.5252	-0.6645	-0.2681	-0.3207	NA	NA
Aug-15	-0.1547	-0.5447	-0.7246	-0.3103	-0.1721	-0.5252	-0.6645	-0.2681	-0.3207	NA	NA	NA
Sep-15	-0.5447	-0.7246	-0.3103	-0.1721	-0.5252	-0.6645	-0.2681	-0.3207	NA	NA	NA	NA
Oct-15	-0.7246	-0.3103	-0.1721	-0.5252	-0.6645	-0.2681	-0.3207	NA	NA	NA	NA	NA
Nov-15	-0.3103	-0.1721	-0.5252	-0.6645	-0.2681	-0.3207	NA	NA	NA	NA	NA	NA
Dec-15	-0.1721	-0.5252	-0.6645	-0.2681	-0.3207	NA	NA	NA	NA	NA	NA	NA
Jan-16	-0.5252	-0.6645	-0.2681	-0.3207	NA	NA	NA	NA	NA	NA	NA	NA
Feb-16	-0.6645	-0.2681	-0.3207	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mar-16	-0.2681	-0.3207	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Apr-16	-0.3207	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 13: SWW-Econometric-Clarkston

Ending month	Forecast Horizon (months)										
	1	2	3	4	5	6	7	8	9	10	11
May-13	-0.4717	-0.3499	-0.5874	-0.3100	-0.1343	-0.0380	-0.3878	-0.4547	0.2865	0.6264	1.1853
Jun-13	-0.2790	-0.2111	-0.3834	-0.1086	0.0078	0.1672	-0.1862	-0.2873	0.4983	0.8412	1.4249
Jul-13	-0.1554	-0.0314	-0.2096	0.0018	0.1662	0.3182	-0.0750	-0.1509	0.6498	0.9832	1.5234
Aug-13	-0.1691	-0.0451	-0.2757	-0.0107	0.1514	0.2744	-0.0871	-0.1371	0.6429	0.9498	1.5298
Sep-13	-0.2799	-0.2071	-0.3924	-0.1325	0.0062	0.1525	-0.1688	-0.2481	0.5019	0.8334	1.3659
Oct-13	-0.1735	-0.0666	-0.2525	-0.0106	0.1539	0.3153	-0.0430	-0.1563	0.6256	0.9068	1.4875
Nov-13	-0.0407	0.0681	-0.1440	0.1225	0.2825	0.4366	0.0374	-0.0370	0.6864	1.0202	1.6003
Dec-13	0.2000	0.2902	0.1071	0.3478	0.5093	0.6178	0.2556	0.1184	0.8970	1.2285	1.7637
Jan-14	0.0924	0.2059	0.0009	0.2644	0.3883	0.5383	0.1196	0.0420	0.8208	1.1102	1.6884
Feb-14	-0.3490	-0.2439	-0.4222	-0.1880	-0.0219	0.0852	-0.2731	-0.3474	0.4076	0.7421	1.3232
Mar-14	-0.4424	-0.3214	-0.5444	-0.2763	-0.1699	-0.0163	-0.3746	-0.5077	0.2743	0.6090	1.1672
Apr-14	-0.4011	-0.3314	-0.5134	-0.3210	-0.1569	-0.0048	-0.4333	-0.5090	0.2716	0.5638	1.1436
May-14	-0.1788	-0.0548	-0.3323	-0.0623	0.1052	0.1787	-0.1784	-0.2516	0.4734	0.8090	1.3602
Jun-14	0.0807	0.0963	-0.0796	0.1917	0.2553	0.4121	0.0565	-0.0841	0.7001	0.9843	1.5672
Jul-14	0.1589	0.2765	0.0945	0.2647	0.4278	0.5790	0.1635	0.0873	0.8308	1.1639	1.6915
Aug-14	0.3624	0.4823	0.2271	0.4985	0.6681	0.7733	0.4184	0.3064	1.0912	1.3764	1.9596
Sep-14	0.3770	0.4333	0.2532	0.5210	0.6512	0.8050	0.4097	0.3353	1.0661	1.4005	1.9113
Oct-14	-0.2019	-0.0714	-0.2305	0.0272	0.2166	0.3635	0.0249	-0.0749	0.7220	1.0110	1.6032
Nov-14	-0.5762	-0.4371	-0.6081	-0.3120	-0.1253	0.0528	-0.1113	-0.1670	0.4828	0.8311	1.4240
Dec-14	-0.4951	-0.3767	-0.5165	-0.2212	-0.0070	0.1476	-0.1709	-0.2631	0.5477	0.9064	1.4706
Jan-15	-0.5380	-0.4055	-0.5536	-0.2197	-0.0239	0.1980	-0.1624	-0.1836	0.6427	0.9721	1.5822
Feb-15	-0.4660	-0.2251	-0.3376	-0.1352	0.0945	0.2330	-0.0774	-0.1123	0.6366	0.9967	1.5980
Mar-15	-0.3781	-0.1855	-0.3388	-0.0071	0.1348	0.3331	0.0103	-0.1104	0.6931	1.0442	1.5861
Apr-15	-0.3073	-0.1829	-0.3109	-0.0695	0.1460	0.3445	-0.0531	-0.0939	0.7165	1.0235	1.6247
May-15	-0.3297	-0.1418	-0.3262	-0.0120	0.1905	0.4066	0.0707	0.0138	0.6771	1.0225	1.5922
Jun-15	-0.5314	-0.4175	-0.5558	-0.2475	-0.0837	0.1032	-0.2261	-0.2957	0.5078	0.8650	1.4620
Jul-15	0.4920	0.3373	0.3677	-0.2374	0.2130	0.2372	-0.0867	-0.0938	0.2197	0.4537	NA
Aug-15	0.5962	0.4222	0.4021	-0.1788	0.2670	0.2625	-0.0421	-0.0703	0.2591	NA	NA
Sep-15	0.5638	0.3615	0.3799	-0.2042	0.2140	0.2308	-0.0920	-0.1043	NA	NA	NA
Oct-15	0.3192	0.1777	0.2166	-0.3710	0.0846	0.1012	-0.1968	NA	NA	NA	NA
Nov-15	0.4166	0.2709	0.2732	-0.2968	0.1251	0.1529	NA	NA	NA	NA	NA
Dec-15	0.3515	0.1656	0.1941	-0.3312	0.1208	NA	NA	NA	NA	NA	NA
Jan-16	0.4086	0.2430	0.2345	-0.3445	NA	NA	NA	NA	NA	NA	NA
Feb-16	0.3456	0.1379	0.1554	NA	NA	NA	NA	NA	NA	NA	NA
Mar-16	0.3739	0.2274	NA	NA	NA	NA	NA	NA	NA	NA	NA
Apr-16	0.3112	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 14: SWW-ARMA(1,0,0)-Clarkston

Ending month	Forecast Horizon (months)										
	1	2	3	4	5	6	7	8	9	10	11
May-13	-0.0232	0.2043	0.3249	0.1464	0.4140	0.5783	0.7292	0.3672	0.2884	1.0654	1.3948
Jun-13	0.2225	0.3391	0.1576	0.4228	0.5851	0.7346	0.3713	0.2917	1.0680	1.3968	1.9721
Jul-13	0.1645	0.0204	0.3151	0.5006	0.6682	0.3192	0.2507	1.0358	1.3715	1.9523	1.3003
Aug-13	-0.1092	0.2130	0.4201	0.6048	0.2692	0.2114	1.0048	1.3471	1.9330	1.2851	0.1424
Sep-13	0.2989	0.4877	0.6580	0.3111	0.2443	1.0308	1.3675	1.9491	1.2978	0.1523	0.1578
Oct-13	0.2522	0.4724	0.1648	0.1290	0.9399	1.2959	1.8927	1.2533	0.1173	0.1302	-0.1425
Nov-13	0.2722	0.0060	0.0030	0.8399	1.2165	1.8297	1.2033	0.0776	0.0987	-0.1674	0.7978
Dec-13	-0.2118	-0.1713	0.7005	1.1050	1.7405	1.1320	0.0206	0.0531	-0.2039	0.7687	1.5024
Jan-14	-0.0021	0.8356	1.2130	1.8268	1.2009	0.0756	0.0971	-0.1688	0.7967	1.5248	1.6391
Feb-14	0.8372	1.2141	1.8276	1.2015	0.0761	0.0974	-0.1686	0.7969	1.5249	1.6392	1.6862
Mar-14	0.5467	1.2955	0.7773	-0.2621	-0.1722	-0.3835	0.6255	1.3884	1.5303	1.5994	1.5480
Apr-14	0.8441	0.4049	-0.5691	-0.4251	-0.5917	0.4542	1.2475	1.4145	1.5043	1.4699	1.1600
May-14	-0.3197	-1.1899	-0.9559	-1.0448	0.0680	0.9188	1.1351	1.2671	1.2687	0.9896	0.5950
Jun-14	-0.9107	-0.7129	-0.8339	0.2507	1.0766	1.2712	1.3842	1.3693	1.0758	0.6688	0.5693
Jul-14	0.0361	-0.2180	0.7571	1.4929	1.6134	1.6654	1.6004	1.2657	0.8248	0.6975	1.0399
Aug-14	-0.2468	0.7340	1.4744	1.5986	1.6536	1.5910	1.2582	0.8188	0.6926	1.0361	1.0704
Sep-14	0.9309	1.6316	1.7240	1.7537	1.6708	1.3219	0.8696	0.7332	1.0684	1.0963	0.8581
Oct-14	0.8908	1.1346	1.2846	1.2976	1.0249	0.6333	0.5452	0.9188	0.9772	0.7634	0.5967
Nov-14	0.4066	0.6899	0.8119	0.6283	0.3096	0.2810	0.7033	0.8014	0.6200	0.4798	0.5094
Dec-14	0.3442	0.5184	0.3797	0.0993	0.1034	0.5534	0.6752	0.5138	0.3905	0.4344	-0.1361
Jan-15	0.2216	0.1242	-0.1202	-0.0849	0.3922	0.5374	0.3962	0.2902	0.3490	-0.2087	0.2500
Feb-15	-0.0684	-0.2873	-0.2296	0.2672	0.4295	0.3032	0.2102	0.2802	-0.2678	0.1993	0.2344
Mar-15	-0.2286	-0.1793	0.3103	0.4663	0.3347	0.2371	0.3032	-0.2481	0.2161	0.2487	-0.0495
Apr-15	0.0141	0.4738	0.6045	0.4515	0.3358	0.3865	-0.1778	0.2754	0.2988	-0.0073	-0.0188
May-15	0.4618	0.5944	0.4429	0.3285	0.3804	-0.1830	0.2711	0.2951	-0.0104	-0.0214	0.3037
Jun-15	0.2072	0.1183	0.0564	0.1523	-0.3741	0.1109	0.1609	-0.1229	-0.1156	0.2247	0.4666
Jul-15	-0.0575	-0.0928	0.0258	-0.4814	0.0200	0.0838	-0.1882	-0.1709	0.1779	0.4269	NA
Aug-15	-0.0441	0.0669	-0.4467	0.0492	0.1085	-0.1673	-0.1533	0.1928	0.4395	NA	NA
Sep-15	0.1039	-0.4156	0.0754	0.1305	-0.1489	-0.1379	0.2057	0.4504	NA	NA	NA
Oct-15	-0.5031	0.0018	0.0685	-0.2010	-0.1817	0.1689	0.4193	NA	NA	NA	NA
Nov-15	0.4224	0.4203	0.0932	0.0643	0.3745	0.5913	NA	NA	NA	NA	NA
Dec-15	0.0688	-0.1992	-0.1790	0.1722	0.4230	NA	NA	NA	NA	NA	NA
Jan-16	-0.2567	-0.2270	0.1320	0.3894	NA	NA	NA	NA	NA	NA	NA
Feb-16	-0.0132	0.3102	0.5378	NA	NA	NA	NA	NA	NA	NA	NA
Mar-16	0.3211	0.5469	NA	NA	NA	NA	NA	NA	NA	NA	NA
Apr-16	0.2798	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 15: SWW-ARMAX(1,0,0)-Clarkston

Ending month	Forecast Horizon (month)										
	1	2	3	4	5	6	7	8	9	10	11
May-13	-0.2013	-0.1157	-0.1560	-0.3973	-0.1699	-0.0972	0.0397	-0.3292	-0.4571	0.3209	0.6266
Jun-13	0.1700	0.1093	-0.1546	0.0547	0.1243	0.2504	-0.1268	-0.2449	0.5285	0.8628	1.4403
Jul-13	0.1134	-0.1057	0.1312	0.2174	0.3531	-0.0187	-0.1362	0.6384	0.9877	1.5649	0.8716
Aug-13	-0.2238	0.0446	0.1554	0.3029	-0.0616	-0.1684	0.6093	0.9676	1.5465	0.8684	-0.2763
Sep-13	0.0553	0.1330	0.2501	-0.1384	-0.2558	0.5077	0.8716	1.4426	0.7567	-0.3921	-0.4341
Oct-13	0.2505	0.3705	-0.0106	-0.1229	0.6492	0.9857	1.5630	0.8712	-0.2738	-0.3198	-0.5959
Nov-13	0.3005	-0.0230	-0.0989	0.7033	1.0475	1.6402	0.9573	-0.1800	-0.2257	-0.4980	0.4628
Dec-13	0.0165	0.0030	0.8445	1.1968	1.8059	1.1337	0.0034	-0.0387	-0.3079	0.6552	1.3388
Jan-14	-0.0946	0.7492	1.1055	1.7161	1.0481	-0.0813	-0.1203	-0.3890	0.5745	1.2591	1.3728
Feb-14	0.4394	0.7707	1.3599	0.6805	-0.4591	-0.4946	-0.7672	0.1944	0.8937	1.0078	1.0558
Mar-14	0.4075	1.0776	0.4450	-0.6546	-0.6743	-0.9266	0.0494	0.7274	0.8492	0.9029	0.8169
Apr-14	0.7830	0.2340	-0.8038	-0.7928	-1.0128	-0.0134	0.6714	0.8050	0.8671	0.7689	0.4406
May-14	0.0229	-0.8959	-0.8221	-0.9728	0.0800	0.7931	0.9589	1.0462	0.9509	0.6384	0.1845
Jun-14	-0.6727	-0.5981	-0.7433	0.3142	1.0077	1.1771	1.2675	1.1641	0.8539	0.3805	0.2695
Jul-14	-0.0369	-0.2805	0.6998	1.3435	1.4660	1.5201	1.4023	1.0703	0.5957	0.4717	0.7654
Aug-14	-0.0339	0.9376	1.5939	1.7154	1.7703	1.6572	1.3277	0.8519	0.7308	1.0278	1.0678
Sep-14	0.9264	1.6016	1.7227	1.7760	1.6775	1.3457	0.8714	0.7481	1.0440	1.0822	0.7833
Oct-14	0.6785	0.9188	1.0708	1.0548	0.7883	0.3748	0.2939	0.6320	0.6978	0.4327	0.2733
Nov-14	0.0651	0.3284	0.4153	0.2173	-0.1201	-0.1596	0.4263	0.5170	0.1817	0.0373	0.0642
Dec-14	0.3444	0.4317	0.2518	-0.0742	-0.0861	0.3094	0.4236	0.2045	0.0768	0.1173	-0.4925
Jan-15	0.2238	0.0546	-0.2396	-0.2125	0.2284	0.3836	0.1902	0.0945	0.1614	-0.4320	0.0303
Feb-15	-0.0504	-0.2184	-0.1634	0.2028	0.3699	0.1758	0.0847	0.1545	-0.4606	0.0031	0.0341
Mar-15	-0.2192	-0.1653	0.2858	0.4472	0.2399	0.1419	0.2050	-0.4254	0.0329	0.0591	-0.2972
Apr-15	-0.0587	0.3456	0.4740	0.2480	0.1427	0.2053	-0.4254	0.0394	0.0734	-0.2744	-0.2769
May-15	0.3159	0.4617	0.2564	0.1467	0.2005	-0.3292	0.1240	0.1467	-0.2923	-0.3040	0.0006
Jun-15	-0.0667	-0.2116	-0.2810	-0.1892	-0.7572	-0.2733	-0.2238	-0.5277	-0.5197	-0.1739	0.0696
Jul-15	0.2246	0.1347	0.2143	-0.3532	0.1255	0.1713	-0.1360	-0.1307	0.1925	0.4337	NA
Aug-15	0.2281	0.2818	-0.3064	0.1665	0.2103	-0.1020	-0.0954	0.2255	0.4688	NA	NA
Sep-15	0.2473	-0.3449	0.1216	0.1608	-0.1523	-0.1484	0.1767	0.4182	NA	NA	NA
Oct-15	-0.5969	-0.1105	-0.0523	-0.3446	-0.3241	0.0174	0.2731	NA	NA	NA	NA
Nov-15	-0.0721	-0.0200	-0.3279	-0.3075	0.0158	0.2733	NA	NA	NA	NA	NA
Dec-15	-0.1115	-0.4283	-0.4143	-0.0117	0.2468	NA	NA	NA	NA	NA	NA
Jan-16	-0.3579	-0.3593	-0.0460	0.2069	NA	NA	NA	NA	NA	NA	NA
Feb-16	-0.4514	-0.1586	0.0861	NA	NA	NA	NA	NA	NA	NA	NA
Mar-16	-0.1143	0.1443	NA	NA	NA	NA	NA	NA	NA	NA	NA
Apr-16	0.0363	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 16: SWW-Moving Average-Odessa

Ending month	Forecast Horizon (months)										
	1	2	3	4	5	6	7	8	9	10	11
May-13	0.2084	0.9439	1.0766	0.9405	0.5329	0.7241	0.7987	0.7965	0.5491	0.1118	0.1847
Jun-13	0.9439	1.0766	0.9405	0.5329	0.7241	0.7987	0.7965	0.5491	0.1118	0.1847	0.3370
Jul-13	1.0766	0.9405	0.5329	0.7241	0.7987	0.7965	0.5491	0.1118	0.1847	0.3370	0.6704
Aug-13	0.9405	0.5329	0.7241	0.7987	0.7965	0.5491	0.1118	0.1847	0.3370	0.6704	1.1308
Sep-13	0.5329	0.7241	0.7987	0.7965	0.5491	0.1118	0.1847	0.3370	0.6704	1.1308	1.1409
Oct-13	0.7241	0.7987	0.7965	0.5491	0.1118	0.1847	0.3370	0.6704	1.1308	1.1409	1.4865
Nov-13	0.7987	0.7965	0.5491	0.1118	0.1847	0.3370	0.6704	1.1308	1.1409	1.4865	1.3298
Dec-13	0.7965	0.5491	0.1118	0.1847	0.3370	0.6704	1.1308	1.1409	1.4865	1.3298	1.1812
Jan-14	0.5491	0.1118	0.1847	0.3370	0.6704	1.1308	1.1409	1.4865	1.3298	1.1812	1.0173
Feb-14	0.1118	0.1847	0.3370	0.6704	1.1308	1.1409	1.4865	1.3298	1.1812	1.0173	0.3487
Mar-14	0.1847	0.3370	0.6704	1.1308	1.1409	1.4865	1.3298	1.1812	1.0173	0.3487	0.4531
Apr-14	0.3370	0.6704	1.1308	1.1409	1.4865	1.3298	1.1812	1.0173	0.3487	0.4531	0.6943
May-14	0.6704	1.1308	1.1409	1.4865	1.3298	1.1812	1.0173	0.3487	0.4531	0.6943	0.6774
Jun-14	1.1308	1.1409	1.4865	1.3298	1.1812	1.0173	0.3487	0.4531	0.6943	0.6774	0.4870
Jul-14	1.1409	1.4865	1.3298	1.1812	1.0173	0.3487	0.4531	0.6943	0.6774	0.4870	0.4078
Aug-14	1.4865	1.3298	1.1812	1.0173	0.3487	0.4531	0.6943	0.6774	0.4870	0.4078	0.2637
Sep-14	1.3298	1.1812	1.0173	0.3487	0.4531	0.6943	0.6774	0.4870	0.4078	0.2637	-0.1726
Oct-14	1.1812	1.0173	0.3487	0.4531	0.6943	0.6774	0.4870	0.4078	0.2637	-0.1726	-0.1108
Nov-14	1.0173	0.3487	0.4531	0.6943	0.6774	0.4870	0.4078	0.2637	-0.1726	-0.1108	-0.1601
Dec-14	0.3487	0.4531	0.6943	0.6774	0.4870	0.4078	0.2637	-0.1726	-0.1108	-0.1601	-0.3422
Jan-15	0.4531	0.6943	0.6774	0.4870	0.4078	0.2637	-0.1726	-0.1108	-0.1601	-0.3422	-0.5365
Feb-15	0.6943	0.6774	0.4870	0.4078	0.2637	-0.1726	-0.1108	-0.1601	-0.3422	-0.5365	-0.6984
Mar-15	0.6774	0.4870	0.4078	0.2637	-0.1726	-0.1108	-0.1601	-0.3422	-0.5365	-0.6984	-0.9753
Apr-15	0.4870	0.4078	0.2637	-0.1726	-0.1108	-0.1601	-0.3422	-0.5365	-0.6984	-0.9753	-1.0739
May-15	0.4078	0.2637	-0.1726	-0.1108	-0.1601	-0.3422	-0.5365	-0.6984	-0.9753	-1.0739	-0.8434
Jun-15	0.2637	-0.1726	-0.1108	-0.1601	-0.3422	-0.5365	-0.6984	-0.9753	-1.0739	-0.8434	-0.4591
Jul-15	-0.1726	-0.1108	-0.1601	-0.3422	-0.5365	-0.6984	-0.9753	-1.0739	-0.8434	-0.4591	NA
Aug-15	-0.1108	-0.1601	-0.3422	-0.5365	-0.6984	-0.9753	-1.0739	-0.8434	-0.4591	NA	NA
Sep-15	-0.1601	-0.3422	-0.5365	-0.6984	-0.9753	-1.0739	-0.8434	-0.4591	NA	NA	NA
Oct-15	-0.3422	-0.5365	-0.6984	-0.9753	-1.0739	-0.8434	-0.4591	NA	NA	NA	NA
Nov-15	-0.5365	-0.6984	-0.9753	-1.0739	-0.8434	-0.4591	NA	NA	NA	NA	NA
Dec-15	-0.6984	-0.9753	-1.0739	-0.8434	-0.4591	NA	NA	NA	NA	NA	NA
Jan-16	-0.9753	-1.0739	-0.8434	-0.4591	NA	NA	NA	NA	NA	NA	NA
Feb-16	-1.0739	-0.8434	-0.4591	NA	NA	NA	NA	NA	NA	NA	NA
Mar-16	-0.8434	-0.4591	NA	NA	NA	NA	NA	NA	NA	NA	NA
Apr-16	-0.4591	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 17: SWW-Econometric-Odessa

Ending month	Forecast Horizon (months)										
	1	2	3	4	5	6	7	8	9	10	11
May-13	0.1178	0.3272	0.1153	-0.0922	0.2028	0.4230	0.7224	0.8309	0.4061	0.5018	0.4758
Jun-13	0.0745	0.2970	0.0512	-0.1586	0.1597	0.3513	0.6512	0.7736	0.3289	0.4227	0.3854
Jul-13	0.0758	0.2655	0.0168	-0.1685	0.1267	0.3191	0.6343	0.7436	0.2898	0.3853	0.3649
Aug-13	0.0000	0.1923	-0.0286	-0.2332	0.0673	0.2768	0.5815	0.6819	0.2399	0.3496	0.3134
Sep-13	0.0695	0.2836	0.0416	-0.1613	0.1492	0.3477	0.6342	0.7476	0.3184	0.4165	0.4009
Oct-13	0.1403	0.3391	0.0903	-0.1144	0.1741	0.3559	0.6498	0.7704	0.3206	0.4354	0.3939
Nov-13	0.1310	0.3216	0.0779	-0.1443	0.1405	0.3204	0.6286	0.7282	0.3021	0.3908	0.3472
Dec-13	-0.0359	0.1583	-0.0989	-0.3063	-0.0188	0.1865	0.4810	0.6135	0.1641	0.2558	0.2350
Jan-14	0.0134	0.1965	-0.0509	-0.2711	0.0335	0.2170	0.5382	0.6406	0.1898	0.3015	0.2591
Feb-14	0.0406	0.2403	-0.0085	-0.2022	0.0919	0.3070	0.6068	0.7158	0.2845	0.3802	0.3425
Mar-14	0.0690	0.2601	0.0335	-0.1776	0.1462	0.3377	0.6375	0.7757	0.3307	0.4263	0.4000
Apr-14	0.1195	0.3309	0.0775	-0.1019	0.1870	0.3736	0.7033	0.8082	0.3597	0.4727	0.4322
May-14	-0.1502	0.0396	-0.1587	-0.3695	-0.0749	0.1580	0.4582	0.5675	0.1519	0.2477	0.2255
Jun-14	-0.3277	-0.0783	-0.3267	-0.5381	-0.1895	0.0012	0.3002	0.4445	-0.0009	0.1218	0.0838
Jul-14	-0.2539	-0.0665	-0.3182	-0.4824	-0.1905	-0.0011	0.3253	0.4323	0.0046	0.0985	0.0863
Aug-14	-0.4709	-0.2757	-0.4835	-0.6963	-0.4047	-0.1884	0.1092	0.2376	-0.2087	-0.0871	-0.1255
Sep-14	-0.4067	-0.1855	-0.4398	-0.6569	-0.3491	-0.1630	0.1523	0.2570	-0.1636	-0.0710	-0.0731
Oct-14	-0.3755	-0.1712	-0.4242	-0.6283	-0.3478	-0.1532	0.1359	0.2600	-0.1908	-0.0669	-0.1067
Nov-14	-0.1823	0.0076	-0.2464	-0.4768	-0.1989	-0.0243	0.1694	0.2680	-0.1049	-0.0140	-0.0545
Dec-14	-0.1888	0.0179	-0.2622	-0.5092	-0.2641	-0.0950	0.1666	0.2720	-0.1961	-0.1171	-0.1471
Jan-15	0.0534	0.2526	-0.0376	-0.3272	-0.0998	0.0073	0.2645	0.3108	-0.1839	-0.1049	-0.1698
Feb-15	-0.0263	0.0713	-0.2585	-0.4877	-0.2719	-0.1122	0.1329	0.1994	-0.2447	-0.1710	-0.2231
Mar-15	-0.1262	-0.0259	-0.3414	-0.6306	-0.3628	-0.2214	0.0414	0.1606	-0.3011	-0.2154	-0.2326
Apr-15	0.0344	0.1902	-0.1254	-0.3669	-0.1369	-0.0022	0.2870	0.3556	-0.1223	-0.0282	-0.0870
May-15	-0.0981	-0.0002	-0.2957	-0.5674	-0.3197	-0.1789	0.0959	0.1873	-0.2057	-0.1178	-0.1505
Jun-15	0.0794	0.2412	-0.0637	-0.3295	-0.0663	0.0819	0.3450	0.4331	-0.0370	0.0362	-0.0180
Jul-15	0.0419	0.0472	-0.0512	-0.1919	-0.2532	-0.3300	-0.3356	-0.5389	-0.4723	-0.2949	NA
Aug-15	0.2603	0.2722	0.1891	0.0268	-0.0444	-0.1202	-0.1467	-0.3520	-0.3038	NA	NA
Sep-15	0.3678	0.3774	0.2679	0.1016	0.0395	-0.0488	-0.0693	-0.2840	NA	NA	NA
Oct-15	0.1353	0.1343	0.0350	-0.1093	-0.1689	-0.2385	-0.2531	NA	NA	NA	NA
Nov-15	0.1168	0.1209	0.0414	-0.1092	-0.1515	-0.2252	NA	NA	NA	NA	NA
Dec-15	0.2158	0.2496	0.1632	-0.0056	-0.0609	NA	NA	NA	NA	NA	NA
Jan-16	0.3251	0.3443	0.2707	0.1230	NA	NA	NA	NA	NA	NA	NA
Feb-16	0.4461	0.4886	0.4048	NA	NA	NA	NA	NA	NA	NA	NA
Mar-16	0.3726	0.3640	NA	NA	NA	NA	NA	NA	NA	NA	NA
Apr-16	0.2334	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 18: SWW-ARMA(1,0,0)-Odessa

Ending month	Forecast Horizon (months)										
	1	2	3	4	5	6	7	8	9	10	11
May-13	-0.1923	0.0237	0.1921	-0.0802	-0.3133	-0.0389	0.1353	0.4203	0.5165	0.0608	0.1472
Jun-13	0.1962	0.3468	0.0586	-0.1887	0.0728	0.2355	0.5102	0.5971	0.1331	0.2121	0.1598
Jul-13	0.1710	-0.0989	-0.3299	-0.0537	0.1221	0.4086	0.5061	0.0515	0.1390	0.0943	0.4964
Aug-13	-0.2525	-0.4678	-0.1776	0.0109	0.3087	0.4164	-0.0291	0.0666	0.0293	0.4380	0.6679
Sep-13	-0.2413	0.0257	0.1933	0.4723	0.5632	0.1027	0.1848	0.1353	0.5331	0.7533	0.7599
Oct-13	0.2413	0.3859	0.6445	0.7170	0.2401	0.3076	0.2451	0.6312	0.8409	0.8382	1.0367
Nov-13	0.1704	0.4519	0.5451	0.0865	0.1704	0.1225	0.5217	0.7431	0.7509	0.9586	0.8632
Dec-13	0.3001	0.4098	-0.0341	0.0630	0.0268	0.4364	0.6671	0.6832	0.8983	0.8094	0.7157
Jan-14	0.1410	-0.2748	-0.1526	-0.1663	0.2635	0.5123	0.5444	0.7740	0.6981	0.6161	0.6514
Feb-14	-0.4029	-0.2691	-0.2721	0.1674	0.4250	0.4652	0.7021	0.6328	0.5568	0.5976	0.2630
Mar-14	0.0939	0.0548	0.4618	0.6902	0.7040	0.9172	0.8265	0.7312	0.7547	0.4044	0.8120
Apr-14	-0.0285	0.3880	0.6246	0.6459	0.8656	0.7808	0.6906	0.7187	0.3725	0.7836	0.9074
May-14	0.4132	0.6470	0.6657	0.8832	0.7963	0.7044	0.7309	0.3833	0.7932	0.9159	0.8344
Jun-14	0.2795	0.3388	0.5924	0.5377	0.4744	0.5263	0.2013	0.6313	0.7719	0.7063	0.3635
Jul-14	0.0847	0.3615	0.3279	0.2838	0.3532	0.0442	0.4888	0.6426	0.5890	0.2571	0.2702
Aug-14	0.2830	0.2552	0.2165	0.2911	-0.0132	0.4358	0.5937	0.5440	0.2156	0.2321	0.0581
Sep-14	-0.0091	-0.0300	0.0613	-0.2272	0.2366	0.4085	0.3718	0.0557	0.0837	-0.0795	-0.3940
Oct-14	-0.0216	0.0690	-0.2201	0.2432	0.4145	0.3774	0.0609	0.0885	-0.0751	-0.3900	-0.3368
Nov-14	0.0891	-0.2015	0.2605	0.4305	0.3922	0.0746	0.1012	-0.0634	-0.3791	-0.3267	-0.3698
Dec-14	-0.2849	0.1824	0.3576	0.3241	0.0110	0.0418	-0.1187	-0.4307	-0.3748	-0.4146	-0.5104
Jan-15	0.4463	0.6019	0.5502	0.2202	0.2353	0.0601	-0.2654	-0.2220	-0.2734	-0.3801	-0.3955
Feb-15	0.1927	0.1751	-0.1236	-0.0798	-0.2286	-0.5300	-0.4644	-0.4955	-0.5836	-0.5819	-0.6011
Mar-15	-0.0064	-0.2944	-0.2403	-0.3794	-0.6715	-0.5972	-0.6200	-0.7001	-0.6910	-0.7032	-0.6601
Apr-15	-0.2885	-0.2350	-0.3745	-0.6671	-0.5931	-0.6162	-0.6967	-0.6879	-0.7004	-0.6575	-0.8088
May-15	0.0342	-0.1236	-0.4332	-0.3752	-0.4134	-0.5079	-0.5122	-0.5369	-0.5056	-0.6675	-0.5719
Jun-15	-0.1550	-0.4621	-0.4018	-0.4378	-0.5303	-0.5328	-0.5559	-0.5230	-0.6835	-0.5866	-0.3761
Jul-15	-0.3205	-0.2725	-0.3197	-0.4225	-0.4343	-0.4659	-0.4408	-0.6085	-0.5181	-0.3136	NA
Aug-15	0.0176	-0.0572	-0.1849	-0.2193	-0.2713	-0.2647	-0.4491	-0.3739	-0.1830	NA	NA
Sep-15	-0.0730	-0.1992	-0.2322	-0.2830	-0.2752	-0.4585	-0.3824	-0.1907	NA	NA	NA
Oct-15	-0.1333	-0.1727	-0.2293	-0.2267	-0.4148	-0.3429	-0.1551	NA	NA	NA	NA
Nov-15	-0.0523	-0.1205	-0.1284	-0.3260	-0.2627	-0.0826	NA	NA	NA	NA	NA
Dec-15	-0.0731	-0.0855	-0.2871	-0.2275	-0.0507	NA	NA	NA	NA	NA	NA
Jan-16	-0.0192	-0.2270	-0.1729	-0.0012	NA	NA	NA	NA	NA	NA	NA
Feb-16	-0.2095	-0.1570	0.0133	NA	NA	NA	NA	NA	NA	NA	NA
Mar-16	0.0337	0.1868	NA	NA	NA	NA	NA	NA	NA	NA	NA
Apr-16	0.1561	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 19: SWW-ARMAX(1,0,0)-Odessa

Ending month	Forecast Horizon (months)										
	1	2	3	4	5	6	7	8	9	10	11
May-13	-0.1273	0.1445	0.3818	0.1400	-0.0696	0.2521	0.4413	0.7387	0.8658	0.4191	0.5249
Jun-13	0.1497	0.3430	0.0793	-0.1414	0.1702	0.3577	0.6551	0.7760	0.3304	0.4236	0.3860
Jul-13	0.1928	-0.0399	-0.2384	0.0903	0.2895	0.5954	0.7237	0.2822	0.3715	0.3356	0.7626
Aug-13	-0.1870	-0.3673	-0.0242	0.1890	0.5068	0.6427	0.2095	0.3023	0.2719	0.6976	0.9312
Sep-13	-0.2068	0.0795	0.2651	0.5700	0.6972	0.2633	0.3504	0.3219	0.7502	0.9858	1.0260
Oct-13	0.1722	0.3288	0.6095	0.7183	0.2682	0.3578	0.3191	0.7442	0.9736	1.0121	1.2262
Nov-13	0.1804	0.5010	0.6348	0.1963	0.2978	0.2616	0.6891	0.9182	0.9594	1.1728	1.0823
Dec-13	0.2381	0.3981	-0.0197	0.1067	0.0837	0.5224	0.7599	0.8092	1.0277	0.9411	0.8696
Jan-14	0.2942	-0.0718	0.0836	0.0774	0.5253	0.7683	0.8211	1.0415	0.9562	0.8861	0.9126
Feb-14	-0.1321	0.0567	0.0773	0.5440	0.8036	0.8647	1.0963	1.0202	0.9504	0.9837	0.6417
Mar-14	0.1360	0.1175	0.5688	0.8185	0.8815	1.1119	1.0362	0.9831	1.0176	0.6767	1.1039
Apr-14	0.0506	0.5386	0.8070	0.8866	1.1213	1.0472	0.9994	1.0333	0.6916	1.1269	1.2534
May-14	0.2487	0.5059	0.5986	0.8373	0.7694	0.7348	0.7752	0.4394	0.8885	1.0196	0.9608
Jun-14	0.2110	0.3520	0.6147	0.5604	0.5482	0.5936	0.2612	0.7197	0.8527	0.8074	0.4579
Jul-14	0.2197	0.5312	0.5052	0.5039	0.5597	0.2336	0.6885	0.8239	0.7716	0.4227	0.4473
Aug-14	0.2402	0.2412	0.2475	0.3130	-0.0067	0.4514	0.5904	0.5433	0.1972	0.2242	0.0350
Sep-14	0.1268	0.1828	0.2817	-0.0186	0.4431	0.5885	0.5440	0.1997	0.2283	0.0391	-0.2614
Oct-14	0.1672	0.2784	-0.0215	0.4341	0.5733	0.5186	0.1702	0.1918	0.0018	-0.3044	-0.2718
Nov-14	0.3490	0.0851	0.5499	0.6970	0.6325	0.2844	0.1895	-0.0014	-0.2611	-0.2291	-0.2898
Dec-14	-0.1303	0.4254	0.6054	0.5499	0.1885	0.1899	-0.0204	-0.3499	-0.3321	-0.4038	-0.5069
Jan-15	0.5914	0.8204	0.7683	0.3845	0.3476	0.0960	-0.2685	-0.2870	-0.3892	-0.5146	-0.5600
Feb-15	0.3321	0.3390	0.0335	0.1030	-0.1011	-0.4252	-0.4145	-0.4942	-0.5913	-0.6237	-0.6704
Mar-15	0.0387	-0.2432	-0.1853	-0.3536	-0.6398	-0.5965	-0.6469	-0.7148	-0.7257	-0.7547	-0.7005
Apr-15	-0.1950	-0.0948	-0.2357	-0.5080	-0.4604	-0.5130	-0.5855	-0.6053	-0.6443	-0.6008	-0.7739
May-15	0.0601	-0.1468	-0.4689	-0.4463	-0.5129	-0.6462	-0.6682	-0.7068	-0.6225	-0.7930	-0.6945
Jun-15	-0.0003	-0.2843	-0.2389	-0.2984	-0.3991	-0.4289	-0.4781	-0.4596	-0.6419	-0.5664	-0.3730
Jul-15	-0.1447	-0.0939	-0.1587	-0.2739	-0.3167	-0.3797	-0.3747	-0.5703	-0.4977	-0.3160	NA
Aug-15	0.1502	0.1040	-0.0064	-0.0571	-0.1325	-0.1393	-0.3498	-0.2899	-0.1224	NA	NA
Sep-15	0.2435	0.1323	0.0800	0.0014	-0.0109	-0.2258	-0.1736	-0.0105	NA	NA	NA
Oct-15	-0.1129	-0.1478	-0.2113	-0.2117	-0.4147	-0.3522	-0.1794	NA	NA	NA	NA
Nov-15	-0.1447	-0.1970	-0.1855	-0.3865	-0.3144	-0.1424	NA	NA	NA	NA	NA
Dec-15	-0.0715	-0.0382	-0.2275	-0.1898	-0.0173	NA	NA	NA	NA	NA	NA
Jan-16	0.0751	-0.1010	-0.0203	0.1524	NA	NA	NA	NA	NA	NA	NA
Feb-16	0.0394	0.1451	0.3289	NA	NA	NA	NA	NA	NA	NA	NA
Mar-16	0.0349	0.1998	NA	NA	NA	NA	NA	NA	NA	NA	NA
Apr-16	0.0761	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

References

- Bekkerman, A., Brester, G. W., and Taylor, M. (2016). Forecasting a moving target: The roles of quality and timing for determining northern us wheat basis. *Journal of agricultural and resource economics*, 41(1):25–41.
- Bessler, D. A. and Covey, T. (1991). Cointegration: Some results on us cattle prices. *Journal of Futures Markets*, 11(4):461–474.
- Fortenbery, T. R., Cropp, R. A., Zapata, H. O., et al. (1997). Analysis of expected price dynamics between fluid milk futures contracts and cash prices for fluid milk. *Journal of Agribusiness*, 15(2).
- Fortenbery, T. R. and Zapata, H. O. (1993). An examination of cointegration relations between futures and local grain markets. *Journal of Futures Markets*, 13(8):921–932.
- Fortenbery, T. R. and Zapata, H. O. (1997). An evaluation of price linkages between futures and cash markets for cheddar cheese. *Journal of Futures Markets*, 17(3):279–301.
- Garcia, P. and Good, D. L. (1983). An analysis of the factors influencing the illinois corn basis, 1971-1981. In *NCR-134 Conference on Applied Commodity Price Analysis, Forecasting, and Market Risk Management*, pages 306–326.
- Hakkio, C. S. and Rush, M. (1991). Cointegration: how short is the long run? *Journal of International Money and Finance*, 10(4):571–581.
- Hatchett, R. B., Brorsen, B. W., and Anderson, K. B. (2010). Optimal length of moving average to forecast futures basis. *Journal of Agricultural and Resource Economics*, pages 18–33.
- Jiang, B. (1997). Corn and soybean basis behavior and forecasting: fundamental and alternative approaches.
- Jones, F. J. (1981). The integration of the cash and futures markets for treasury securities. *Journal of Futures Markets*, 1(1):33–57.
- Kastens, T. L., Jones, R., and Schroeder, T. C. (1998). Futures-based price forecasts for agricultural producers and businesses. *Journal of Agricultural and Resource Economics*, pages 294–307.
- Leuthold, R. M. (1979). An analysis of the futures-cash price basis for live beef cattle. *North Central Journal of Agricultural Economics*, pages 47–52.
- Leuthold, R. M., Junkus, J. C., and Cordier, J. E. (1989). *The theory and practice of futures markets*. Lexington Books Lexington, MA.
- Leuthold, R. M. and Peterson, P. E. (1983). The cash-futures price spread for live hogs. *North Central Journal of Agricultural Economics*, pages 25–29.

- Liu, S.-M., Brorsen, B. W., Oellermann, C. M., and Farris, A. L. (1994). Forecasting the nearby basis of live cattle. *Journal of Futures Markets*, 14(3):259–273.
- Parcell, J. L., Schroeder, T. C., and Dhuyvetter, K. C. (2000). Factors affecting live cattle basis. *Journal of Agricultural and Applied Economics*, 32(03):531–541.
- Sanders, D. R. and Manfredo, M. R. (2006). Forecasting basis levels in the soybean complex: A comparison of time series methods. *Journal of Agricultural and Applied Economics*, 38(03):513–523.
- Seamon, V. F., Kahl, K. H., Curtis, C. E., et al. (2001). Regional and seasonal differences in the cotton basis. *Journal of Agribusiness*, 19(2):147–162.
- Taylor, M. R., Dhuyvetter, K. C., and Kastens, T. L. (2006). Forecasting crop basis using historical averages supplemented with current market information. *Journal of Agricultural and Resource Economics*, pages 549–567.
- Taylor, M. R., Tonsor, G. T., and Dhuyvetter, K. (2015). Structural change in forward contracting costs for kansas wheat. *Journal of Agricultural and Resource Economics*, 39(2):217–229.
- Tonsor, G. T., Dhuyvetter, K. C., and Mintert, J. R. (2004). Improving cattle basis forecasting. *Journal of Agricultural and Resource Economics*, pages 228–241.
- Welch, J. M., Mkrtchyan, V., Power, G. J., et al. (2009). Predicting the corn basis in the texas triangle area. *Journal of Agribusiness*, 27(1/2):4963.
- Working, H. (1976). Futures trading and hedging. In *The Economics of Futures Trading*, pages 68–82. Springer.