

# **FORECAST THE NEW ONE-FAMILY HOUSING MARKET IN THE U.S.**

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## **ABSTRACT**

Since 2007, the U.S. housing market slump has become a major concern among the policy makers, investors, home owners, and the general public. What is the outlook for the housing market in the near future and will this problem be over soon? Based on the selected time-series models, our forecast suggests that the new one-family housing market will remain weak in the second half of 2008.

## **INTRODUCTION**

The housing market has been weak since its recent peak in 2005. Then, the sharp drop in the housing prices in 2007 contributed to the subprime loan crisis [1]. This dramatic change in the housing market not only affects the construction industry, it also may have a significant impact on the whole economy [3]. We are still in the midst of the housing problem with the increase in the delinquency rate and foreclosure rate.

In this paper, the time-series models are specified to forecast the new one-family houses sold in the U.S. and analyze its cyclical movement. Through this research, we try to predict the future development of the housing market.

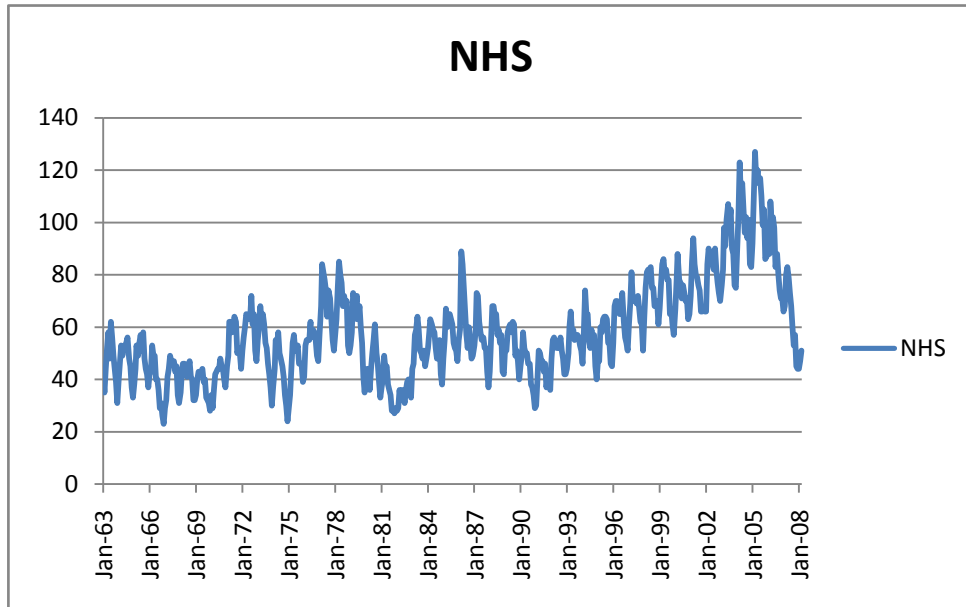
### **Forecast the new one-family houses sold in the U.S.**

Figure 1 shows the non-seasonally adjusted new one-family houses sold (NHS) in the U.S. from January 1963 to June 2008, the most recent data available. From the figure, we can see that NHS data have a trend with seasonality.

To confirm this data pattern of a trend with seasonality, the autocorrelation functions of NHS are calculated and shown in Figure 2. Since they are all significantly different from zero, we have additional evidence of a trend in the NHS data. Figure 3 shows the autocorrelation functions of the first difference in NHS. They are significantly different from zero for lags 12, 24, and 36 months. This implies the existence of the seasonality.

Figure 1

New one-family houses sold (NHS) (in thousands) in the U.S. January 1963 to June 2008



Source: U.S. Census Bureau

Figure 2 Autocorrelation functions for NHS

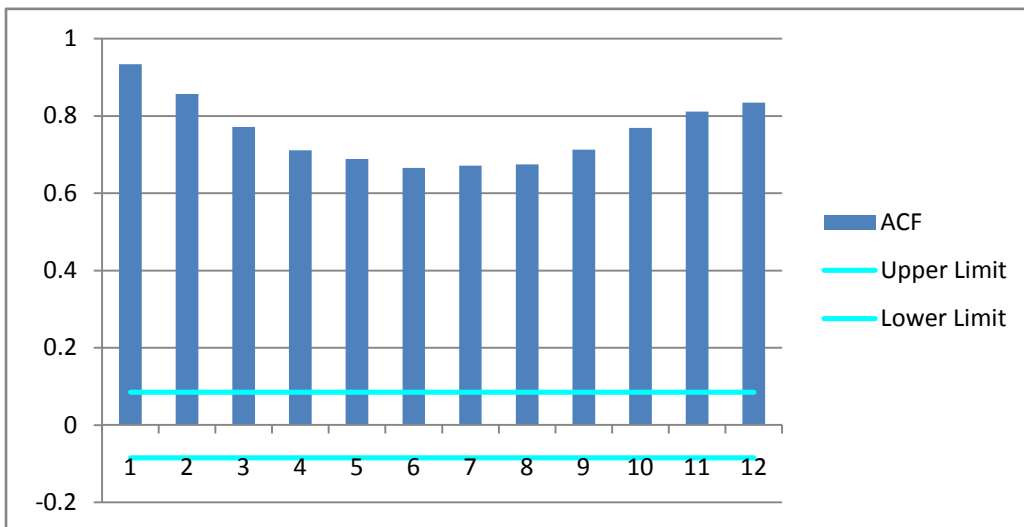
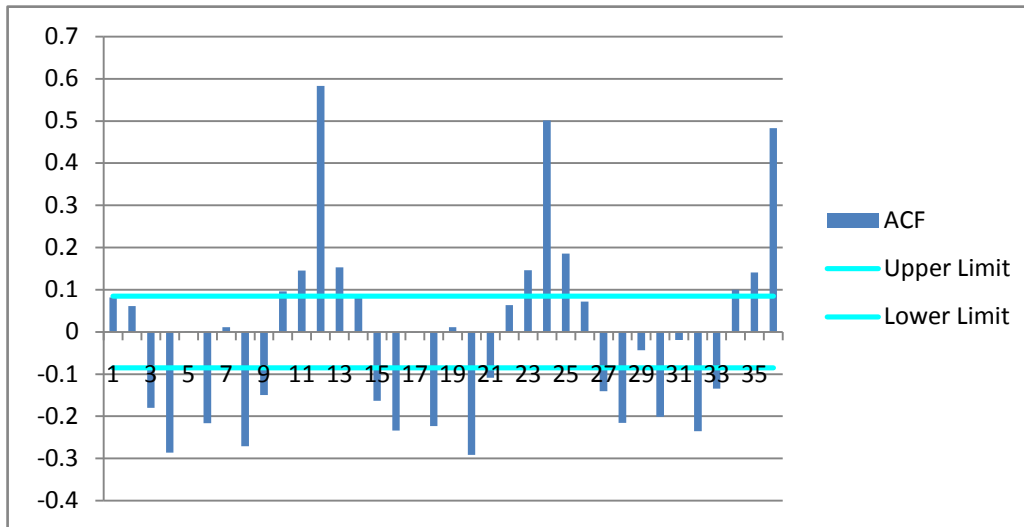


Figure 3

Autocorrelation Functions (ACF) for first difference NHS (DNHS)\*

\*DNHS(t) =NHS(t)-NHS(t-1)



Since the NHS data have a trend with seasonality, three time-series models are chosen for forecasting purposes: Winter’s exponential smoothing, the multiplicative decomposition, and the autoregressive integrated moving average (ARIMA) [4].

We use the data from January 1963 to December 2007 as the historical period for model specification. The period from January 2008 to June 2008 is chosen as the holdout period in which the actual data are available to compare with ex-post forecast in order to evaluate the accuracy of the model.

We use Excel-based Forecast X software for estimation and forecasting [2]. Table 1 shows two error measurements, the mean absolute percentage error (MAPE) and the root-mean-squared error (RMSE), for different models.

Table 1 MAPE and RMSE

Models	Historical period		Holdout period	
	Jan. 1963-Dec. 2007		Jan. 2008-June 2008	
	MAPE	RMSE	MAPE	RMSE
Winter’s exponential smoothing	6.49%	4.51	16.95%	7.76
Decomposition with linear trend	5.81%	4.31	64.12%	26.82
Decomposition with Holt’s exponential smoothing trend	<b>5.53%</b>	<b>3.96</b>	<b>6.31%</b>	<b>2.03</b>
ARIMA(0,1,1)(2,1,1)	6.69%	4.68	20.05%	8.80

For the historical period, the decomposition model either with linear trend or with Holt's exponential smoothing trend has the smallest MAPE and RMSE, while Winter's exponential smoothing and ARIMA are good models too. However, when we perform the ex-post forecast for the holdout period, all models, except the decomposition model with Holt's exponential smoothing trend, have much larger errors.

We choose the decomposition model with Holt's exponential smoothing trend and the data from January 1963 to June 2008 to forecast NHS for the second half of 2008 shown in Table 2 and the appendix. The forecast suggests that the new one-family housing market will remain weak for the second half of 2008.

Table 2 Forecast NHS in thousands for July-Dec. 2008

2008	Actual value	Fitted value	Forecast value
January	44	44	
February	48	47	
March	49	53	
April	49	49	
May	51	47	
June	49	43	
July			<b>39</b>
August			<b>38</b>
September			<b>32</b>
October			<b>29</b>
November			<b>24</b>
December			<b>20</b>

### The cyclical movement in the new one-family housing market

The cyclical factors (CF) in the NHS data, shown in Figure 4, are estimated by using the decomposition method with linear trend. According to the CF data, the new one-family housing market had its recent trough in January 1991 with the cycle factor of 0.64 and reached its recent peak in April 2005 with the cycle factor of 1.37. We specify the ARIMA (2,0,0)(1,0,0) model to forecast CF. Table 3 shows the actual values of CF for 2007 and the first half of 2008, and the forecast values of CF for the second half of 2008. Since the forecast values of CF are around 1.0, using the historical CF data as a guide, this housing slump may not be over soon.

Figure 4 The cyclical factors (CF) of NHS

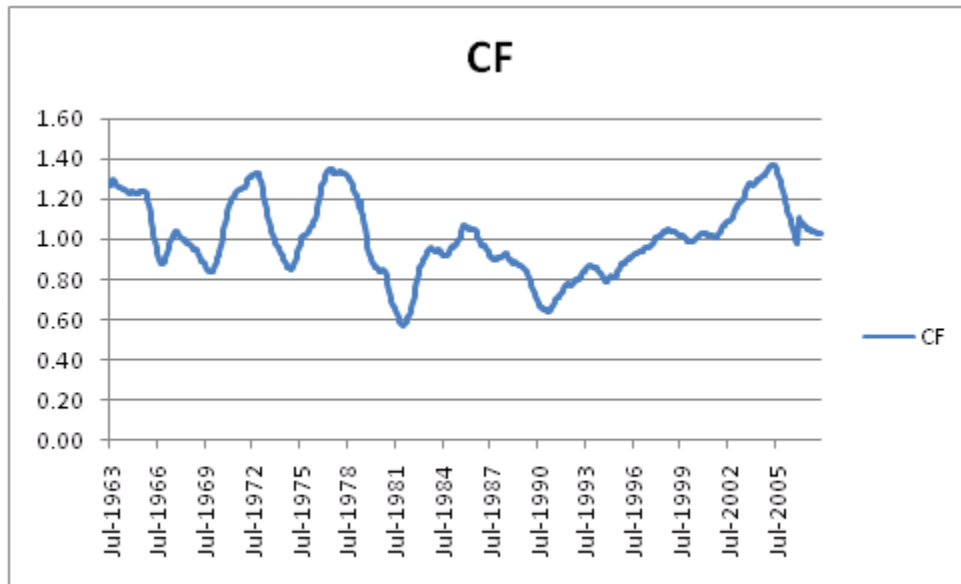


Table 3 The cyclical factors (CF) of NHS 2007-2008

2007	CF	2008	CF
January	1.11	January	1.04
February	1.10	February	1.04
March	1.09	March	1.03
April	1.08	April	1.03
May	1.07	May	1.03
June	1.06	June	1.03
July	1.06	July	<b>0.92</b>
August	1.05	August	<b>0.92</b>
September	1.05	September	<b>0.93</b>
October	1.05	October	<b>0.93</b>
November	1.04	November	<b>0.93</b>
December	1.04	December	<b>0.93</b>

## CONCLUSION

What is the outlook for the housing market in the near future and will this problem be over soon? In this paper, we focus on the new one-family houses sold in the U.S. Base on our forecast and the analysis of the cyclical movement, it seems that this market will remain weak in the second half of 2008.

## Appendix

The forecast output for the second half of 2008 based on the decomposition model with Holt's exponential smoothing trend

Forecast -- Decomposition Selected			
Date	Forecast		
	Monthly	Quarterly	Annual
Jul-2008	39.07		
Aug-2008	37.58		
Sep-2008	31.60	108.25	
Oct-2008	29.10		
Nov-2008	23.86		
Dec-2008	20.41	73.37	181.62
<b>Avg</b>	30.27	90.81	181.62
<b>Max</b>	39.07	108.25	181.62
<b>Min</b>	20.41	73.37	181.62

Summary Comments	
The forecast has an average error of	5.53%
The data has a standard deviation of	18.51
The forecast exceeds the accuracy of a simple average by	95.43%

### Audit Trail - Summary Analysis

### Audit Trail - Statistics

Accuracy Measures	Value	Forecast Statistics	Value
Mean Absolute Percentage Error (MAPE)	5.53%	Mean	57.99
R-Square	95.43%	Standard Deviation	18.51
Root Mean Square Error	3.95		
Theil	0.62		
Method Statistics	Value		
Method Selected	Decomposition		
Basic Method	Double Exponential Smoothing-Holt		
Alpha	1.00		
Gamma	0.00		
Decomposition Type	Multiplicative		

## References

- [1] DiMartino, D. and Duca, J, (2007, Nov. 11). The Rise and Fall of Subprime Mortgages, Economic Letter- Insights from the Federal Reserve Bank of Dallas.
- [2] Forecast X 6.0. John Galt Solutions, Inc.
- [3] Wheelock, D. (2007) Housing Slump Could Lean Heavily on Economy. Federal Reserve Bank of St. Louis.
- [4] Wilson, H. and Keating, B. (2007) *Business Forecasting*. New York, NY: McGraw Hill/Irwin.