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Time variation in the relative importance of permanent and transitory components in the U.S. housing market

N. Kundan Kishor [a,*], Swati Kumari [b,1], Suyong Song [c,2]

[a] Department of Economics, Bolton Hall 822, PO Box 413, University of Wisconsin-Milwaukee, Milwaukee, WI 53201, United States
[b] Department of Economics, Bolton Hall 802, PO Box 413, University of Wisconsin-Milwaukee, Milwaukee, WI 53201, United States
[c] Department of Economics, Bolton Hall 870, PO Box 413, University of Wisconsin-Milwaukee, Milwaukee, WI 53201, United States

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ABSTRACT

This paper uses an unobserved component model with heteroskedastic disturbances based on Harvey et al. (1992) to measure the time-varying importance of permanent and transitory components in the U.S. house prices. Our findings show that the cyclical component in the U.S. housing market is highly persistent and house prices were more than 20% above the trend at the peak of the housing boom in 2006. Our results also suggest that there was a big increase in the relative importance of the transitory shock variance at the peak of the housing crisis.

1. Introduction

The U.S. housing market has witnessed major changes over the last few decades. The recent boom and bust in the house prices naturally leads to a question about the relative importance of permanent

* Corresponding author. Tel.: +1 414 229 6425.
E-mail addresses: kishor@uwm.edu (N.K. Kishor), swati982@gmail.com (S. Kumari), songs@uwm.edu (S. Song).
1 Tel.: +1 414 229 4811.
2 Tel.: +1 414 229 4283.

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and transitory components in house prices. An attractive feature of decomposing house prices into a permanent/transitory or trend/cycle component is that these components can be easily motivated by economic theory. The unobserved component (UC) approach by Clark (1987) is a natural candidate for decomposing house prices into a trend and a cycle because of its flexibility and parsimony.[3] Surprisingly, not much work has been done on the permanent/transitory decomposition of house prices in the U.S. The presence of heteroskedastic disturbances in the error term of asset values like home prices may be one of the reasons why this methodology has not been applied extensively to the housing market in the U.S. (see e.g. Miles (2008)).

In this paper, we decompose U.S. house prices into a trend and a cycle using the UC approach by taking into account the time-varying nature of house price volatility. To do so, we allow the shocks to house prices to have a time-varying permanent and transitory effects. In particular, we apply Harvey et al. (1992) approach to estimate an UC model with heteroskedasticity. We apply the generalized autoregressive conditional heteroskedasticity (GARCH) or integrated GARCH (IGARCH) effect to the conditional variances of the innovations in the trend and the cyclical components.

Our results show that the cyclical component in the U.S. housing market is highly persistent. This is consistent with the existing findings which suggest that housing market has the tendency to deviate from its fundamental value for a very long time. For example, using 355 years of data for Amsterdam, Ambrose et al. (2013) find that deviation of house prices from its fundamentals are long-lasting and persistent and it takes 50–60 years for the house prices to revert back to its trend value. Our results also suggest that the real house prices were more than 20 percent above the trend at the peak of the housing boom in 2006. The results match very strongly with the behavior of the housing market in the U.S.[4] Our approach also allows us to track the relative importance of the variance of permanent and transitory shocks over time. We find that the relative importance of the variance of transitory shocks in the U.S. real house prices has increased over time and there was a big increase in the transitory shock variance at the peak of the housing crisis during 2007–2009.

This paper is organized as follows. In Section 2, the UC model with heteroskedastic disturbances is specified. Section 3 presents state-space representation. Section 4 discusses empirical results and Section 5 concludes.

2. Model specification

We decompose the U.S. house prices using an unobserved component model with heteroskedastic disturbances. For this, we adopt the unobserved component model proposed by Watson (1986) and Clark (1987, 1989) and modify it by incorporating GARCH (1,1) or IGARCH (1,1) disturbances into the model. This is different from the conventional unobserved components model that assumes constant variances of the white noise processes. One of advantages from using the model with heteroskedastic disturbances is that it allows us to measure the relative size of permanent and transitory shocks over time.[5] The UC model with heteroskedastic disturbances has the following structure:

$$Y_t = T_t + C_t \tag{1}$$

where

$$T_t = g + T_{t-1} + u_t, \quad u_t|\psi_{t-1} \sim N(0, h_{u,t}) \tag{2}$$

$$C_t = \phi_1 C_{t-1} + \phi_2 C_{t-2} + e_t, \quad e_t|\psi_{t-1} \sim N(0, h_{e,t}) \tag{3}$$

$$h_{u,t} = \alpha_0 + \alpha_1 u_{t-1}^2 + \alpha_2 h_{u,t-1} \tag{4}$$

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3 For decomposition of macroeconomic variables, see Beveridge and Nelson (1981) and Clark (1987) among others.

4 See Agnello and Schuknecht (2011), Brunnermeier and Julliard (2008), Case and Shiller (1989), Cunningham and Kolet (2011) and among others.

5 An alternative approach to model heteroskedasticity in the permanent and transitory component is the stochastic volatility model. This model has been used extensively in high frequency finance and volatility forecasting. (See Andersen et al. (2006) and Carnero et al. (2004) among others.)