Time-Varying Impact of Uncertainty Shocks on the US Housing Market

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Highlights

- We study the impact of macroeconomic uncertainty shocks on US housing variables.
- A TVP-FAVAR model is used.
- Results show that the uncertainty shock negatively affects all housing variables.

Abstract

This paper investigates the impact of uncertainty shocks on the housing market of the United States using the time-varying parameter factor augmented vector autoregression (TVP-FAVAR). We use a comprehensive quarterly time-series dataset on real economic activity, price, and financial variables, besides housing market variables, covering the period 1963:Q1 to 2014:Q3. In addition to housing prices, we also consider variables related to home sales, permits and starts. In general, the results of the cumulative response of housing variables to a one standard deviation positive uncertainty shock at the one-, four-, eight-, and twelve-quarter-horizon tends to change over time, both in terms of sign and magnitude, with the uncertainty shock primarily negatively affecting the housing variables, in particular prices, permits and starts, in longer-runs (i.e., two- and three-years-ahead horizons).

JEL Classifications: C15, C32, E32, R31

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1. Introduction

The rapid decline in housing prices of the United States (US), following a prolonged boom, is generally associated with the global economic and financial crisis of 2008-2009 (Leamer, 2015; Nyakabawo et al., 2015). Naturally, from a policy perspective, understanding what shocks drive the housing market performance is now of paramount importance in order to avoid the repeat of the catastrophic effects observed under the "Great Recession". In this regard, there exists a large number of studies that have analyzed the role of both conventional and unconventional (in the wake of the zero lower bound (ZLB) scenario) monetary policies (see for example, Claus et al., (2016), Rahal (2016), Simo-Kengne et al., (2016), Huber and Punzi (forthcoming), Nyakabawo et al., (forthcoming) and the papers cited therein), as well as, more recently fiscal policy (see for example, El Montasser et al., (forthcoming) and Gupta et al., (forthcoming) for exhaustive reviews of earlier studies), besides the role of aggregate demand and supply shocks (Marfatia et al., 2017; Gupta et al., 2018a; Plakandaras et al., forthcoming).

More recently, in the wake of the Great Recession, a growing number of studies (see for example, Miles (2009), Sum and Brown (2012), Ajmi et al., (2014), Antonakakis et al., (2015, 2016), El Montasser et al., (2016), André et al., (2017), Christou et al., (2017), Aye and Gupta (2018); Christidou and Fountas (2018), Strobel et al., 2018, Aye et al., (forthcoming)), have also started relating real estate (housing and Real Estate Investment Trusts (REITs)) market-related variables to measures of macroeconomic uncertainty, which in turn, was at unprecedented levels during the crisis.[1] But majority of these studies have analyzed movements in real estate market prices to uncertainty in constant parameter models, and even if time-variation (which have been shown to be of paramount importance for the US housing market by Simo-Kengne et al., 2015) was allowed based on either

[1] Understandably, there also exists a large literature analysing the impact of uncertainty shocks on macroeconomic and financial market variables (see Chuliá et al., (2017), and Gupta et al., (2018b) for detailed reviews in this regard).

dynamic conditional correlation or rolling estimations, the models in general were restricted to only few macroeconomic variables. Given the well-known fact that the US real estate market is affected by large number of variables (see, Gupta et al., (2011), Gupta et al., (2012a, b), and Akinsomi et al., 2016 for detailed discussions in this regard), we use an extended factor augmented vector autoregressive (FAVAR) model (as proposed by Mumtaz and Theodoridis (2018)), based on a dataset of 45 variables for the US, that allows the estimation of a measure of macroeconomic uncertainty which encompasses volatility of the real and financial sectors. In addition, we allow for time-varying parameters (TVP) in the proposed FAVAR model (TVP-FAVAR), which in turn allows us to estimate time-varying response of not only house prices, but home sales, permits and starts, as well as sentiment associated with the housing market to uncertainty shocks, thus allowing the investigation of temporal shifts in the overall housing market in a coherent manner.

Theoretically, uncertainty can affect the housing market activity either negatively or positively. Housing is an irreversible form of investment. Due to the irreversible nature of housing investment which causes agents to delay their decisions (Bernanke, 1983), uncertainty should be decreasing housing investment. Further, under risk-aversion and incomplete markets, uncertainty and investment is likely to be negatively related (Craine, 1989). But when risk aversion or incomplete markets do not apply, the effect of uncertainty may be positive on investment (Hartman, 1972). Moreover, Caballero (1991) presents a model of asymmetric adjustment costs to show that the effect of uncertainty on investment is not always negative, as it depends also on the degree of competition. In this regard, Abel and Eberly (1999) also show that depending on the relative size of parameters, uncertainty may increase or decrease the long-run capital stock (investment) under irreversibility relative to the case of reversible investment. Given this, whether the impact of uncertainty is negative or positive on housing market activity is an empirical question, and is likely to vary over time based on which of the theoretical channels are in place.

To the best of our knowledge this is the first attempt to use a TVP-FAVAR model provide a comprehensive time-varying analysis of uncertainty shocks on several important housing market variables of the US by controlling for a large number of other macroeconomic and financial variables that affect the housing market. The remainder of the paper is organized as follows: Section 2 presents the methodology, while Section 3 discusses the data and results, with Section 4 concluding the paper.

2. Methodology

We use the following TVP-FAVAR model as in Mumtaz and Theodoridis (2018):

$$Z_t = c_t + \sum_{j=1}^{P} \beta_{tj} Z_{t-j} + \sum_{j=0}^{J} \gamma_{tj} ln\lambda_{t-j} + \Omega_t^{\frac{1}{2}} e_t, \quad (1)$$

where Z_t represents a matrix of endogenous variables. The covariance matrix is defined as:

$$\Omega_t = A_t^{-1} H_t A_t^{-1'}, \quad (2)$$

where A_t denotes a lower triangular matrix whose non-zero elements follow a random walk process

$$a_t = a_{t-1} + g_t, \qquad VAR(g_t) = G, \quad (3)$$

where G is block diagonal.[2] The coefficients of model (1) evolve as follows:

$$B_t = B_{t-1} + \eta_t, \; VAR(\eta_t) = Q_B, \quad (4)$$

where $B = vec([c; \beta; \lambda])$.

The volatility process of the shocks is defined as[3]

$$= \lambda_t S, \qquad S = diag(s_1, \ldots., s_N). \quad (5)$$

The overall volatility follows an AR(1) process given by

$$ln\lambda_t = \alpha + F ln\lambda_{t-1} + \overline{\eta_t}, VAR(\overline{\eta_t}) = Q_\lambda. \quad (6)$$

The matrix Z_t consists of a large number of macroeconomic and financial variables so as to account for possibly omitted variables. As such, the estimate of λ_t represents wide-ranging

[2] See Primiceri (2005).
[3] See Carriero *et al.* (2015).

economic and financial uncertainty. However, it is difficult to achieve the VAR coefficients stability at each point in time when there are more than 4 endogenous variables[4]. Mumtaz and Theodoridis (2018) suggest dealing with this issue by including a factor structure into the model. The observation equation is defined as:

$$X_{it} = \Lambda_t Z_t + R^{1/2}\varepsilon_{it}, \quad (7)$$

where ε_{it} denotes the idiosyncratic elements with a diagonal covariance matrix R, Z_t a set of K unobserved factors, Λ_t is the time-varying factor loading matrix defined as:[5]

$$\Lambda_t = \Lambda_{t-1} + \bar{\eta}_t, VAR(\bar{\eta}_t) = Q_\Lambda. \quad (8)$$

The underlying dataset X_{it} regroups main real activity and nominal variables, financial variables as well as housing variables. As such, the measure of uncertainty λ_t captures the volatility across the main sectors of the U.S. economy.

Following Mumtaz and Theodoridis (2018), the model defined by Equations (1) and (7) are estimated using a Markov chain Monte Carlo (MCMC) algorithm.

3. Data and Empirical Findings

The study uses quarterly data covering the main sectors of the U.S. economy over the period 1975Q3-2014Q3. Following Mumtaz and Theodoridis (2018), the dataset includes real activity variables (consumption, investment, GDP, taxes, government spending, employment, unemployment, hours, and surveys of economic activity), price variables (CPI, consumption and GDP deflator, and the producer price index) as well as financial variables (short-term and long-term interest rates, various corporate bond spreads, money and credit growth, stock prices, commodity prices, and exchange rates).[6] In addition, given that we investigate the time-varying impact of uncertainty shocks on US housing market, we include

[4] See Koop and Potter (2011).
[5] See Del Negro and Otrok (2005).
[6] The reader is referred to Table 1 of Mumtaz and Theodoridis (2018) for further details on the 39 macroeconomic and financial variables used along with their sources and transformations.

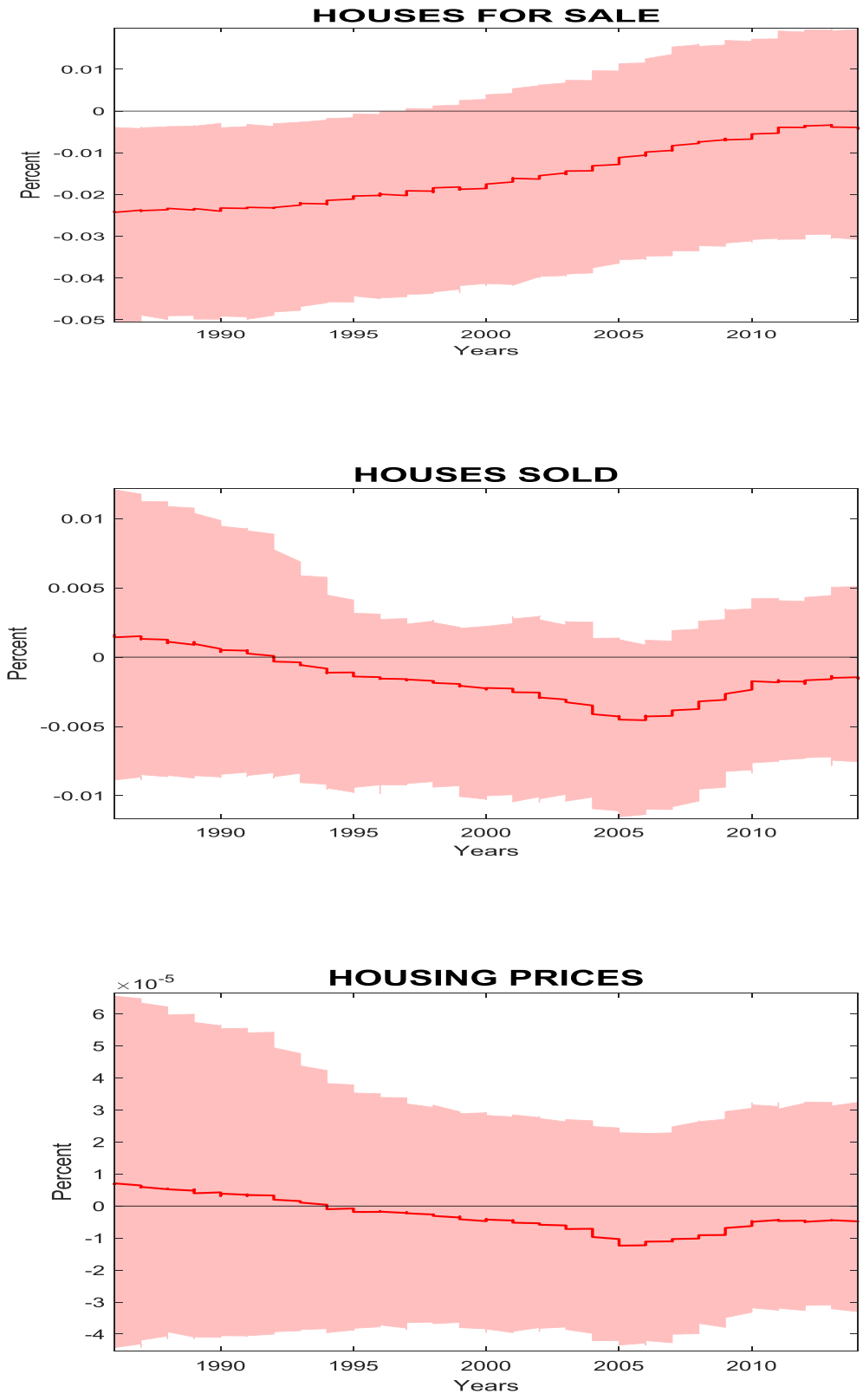
the following housing market variables: new and single-family houses for sale and houses sold, median sales price of new and single-family houses, new private housing units authorized by building permits, and new privately owned housing units started, and housing market sentiment. Barring the sentiment index, all data are from the US Census Bureau. The start and end dates of our sample depend on the availability of the housing sentiment index developed by Bork *et al*., (2017), which in turn, is constructed based on household responses to questions regarding house buying conditions from the consumer survey of the University of Michigan.[7] The sales and price variables are in their growth rate forms to ensure mean-reversion as required by the TVP-FAVAR model.

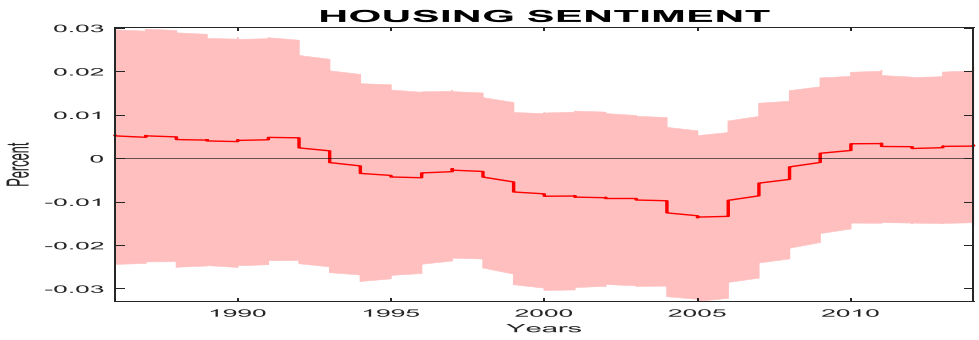
Having discussed the data, we now turn our attention to the results. Figures 1, 2 and 3 display the cumulated response of six housing variables, namely "houses for sale", houses sold", "housing prices", "housing sentiment", housing starts" and "permit", at one-, four- and eight-quarters, respectively. The uncertainty shock is calibrated to be equal to one-standard-deviation.Figure 1 plots the cumulated response of housing variables along with the error bands to a shock to uncertainty at the one-quarter horizon. The response of "houses for sale", "housing starts" and "permit" is estimated to be negative and statistically significant. Furthermore, the response seems to decline over time. Specifically, the responses of "houses for sale" and "housing starts" are statistically significant until 1995 and 1993, respectively. The response of "permit" is more pronounced, and remains statistically significant until 2000. Contrary, our results suggest that the response of "houses sold", "housing prices" and "housing sentiment" is not statistically significant.

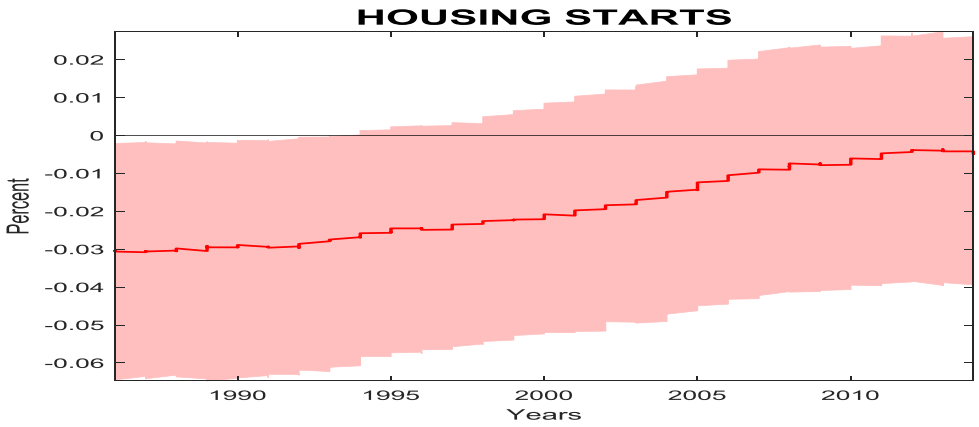
Figure 2 shows the cumulated response of housing variables along with the error bands to a shock to uncertainty at the four-quarter horizon. Time varying response is not statistically significant in the cases of "housing prices" and "housing starts". The responses of "houses for sale" and "permit" are negative and statistically significant only for the periods 1996-

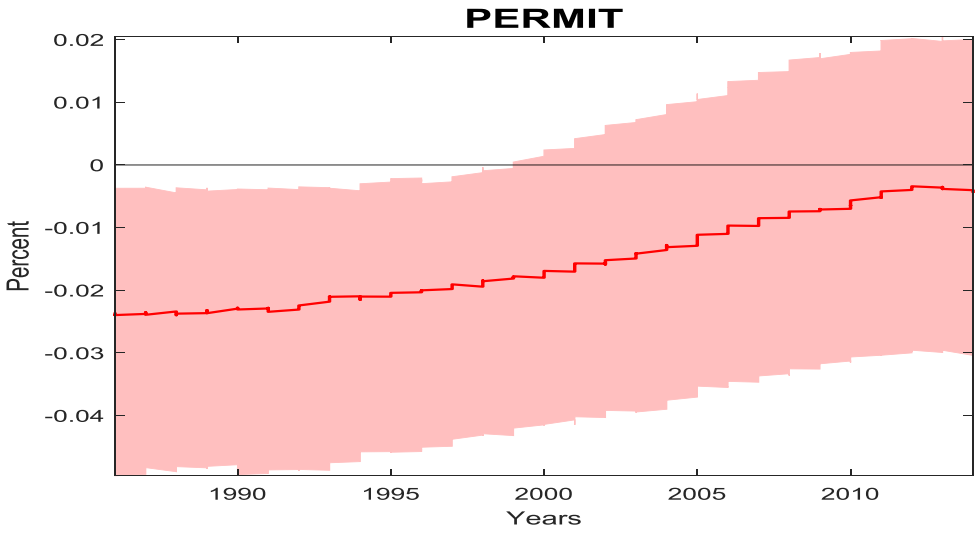
[7] Complete details on how the sentiment index is constructed can be found in Bork *et al*., (2017).

Figure 1: Cumulative responses at the one-quarter horizon



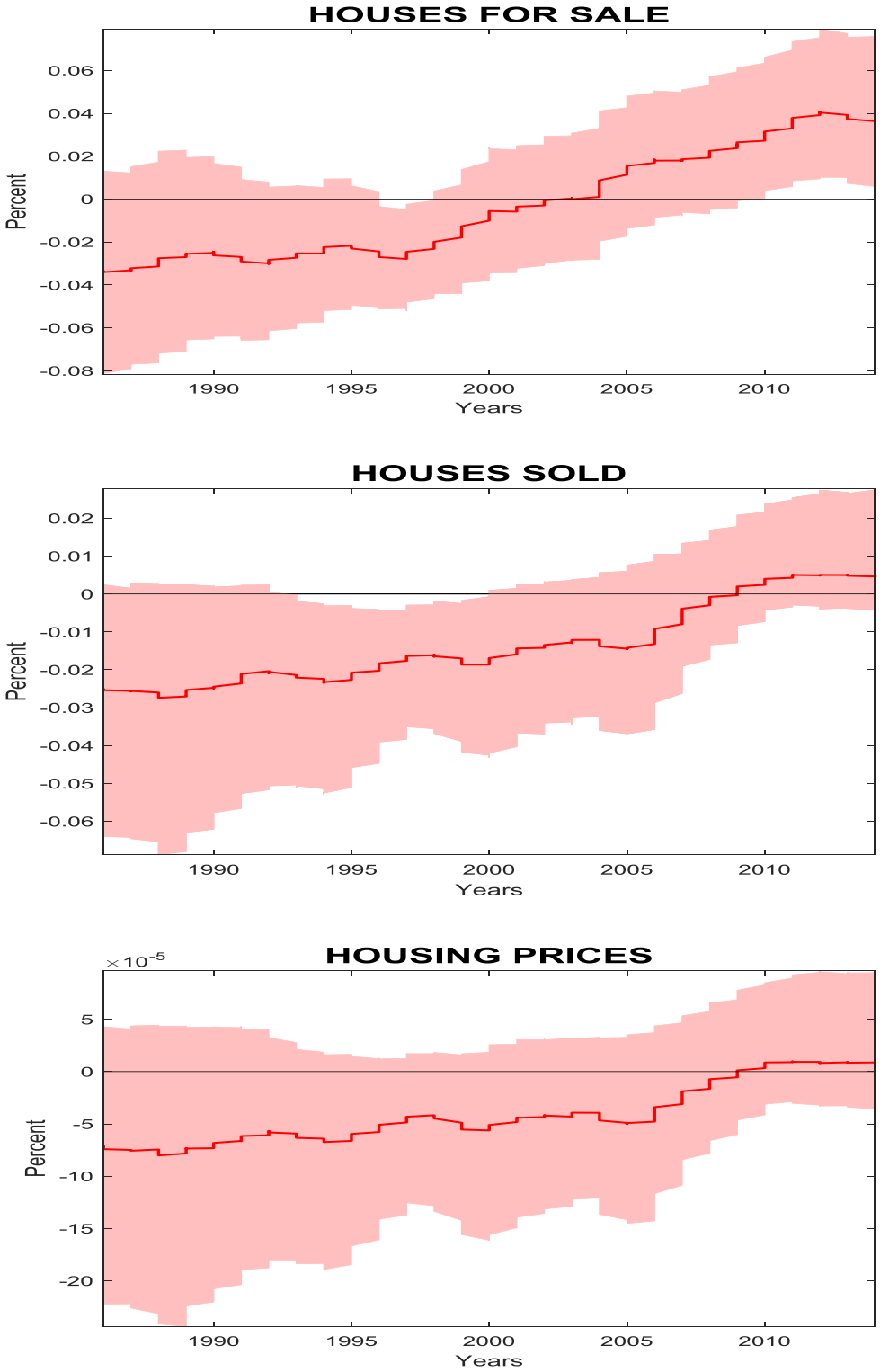


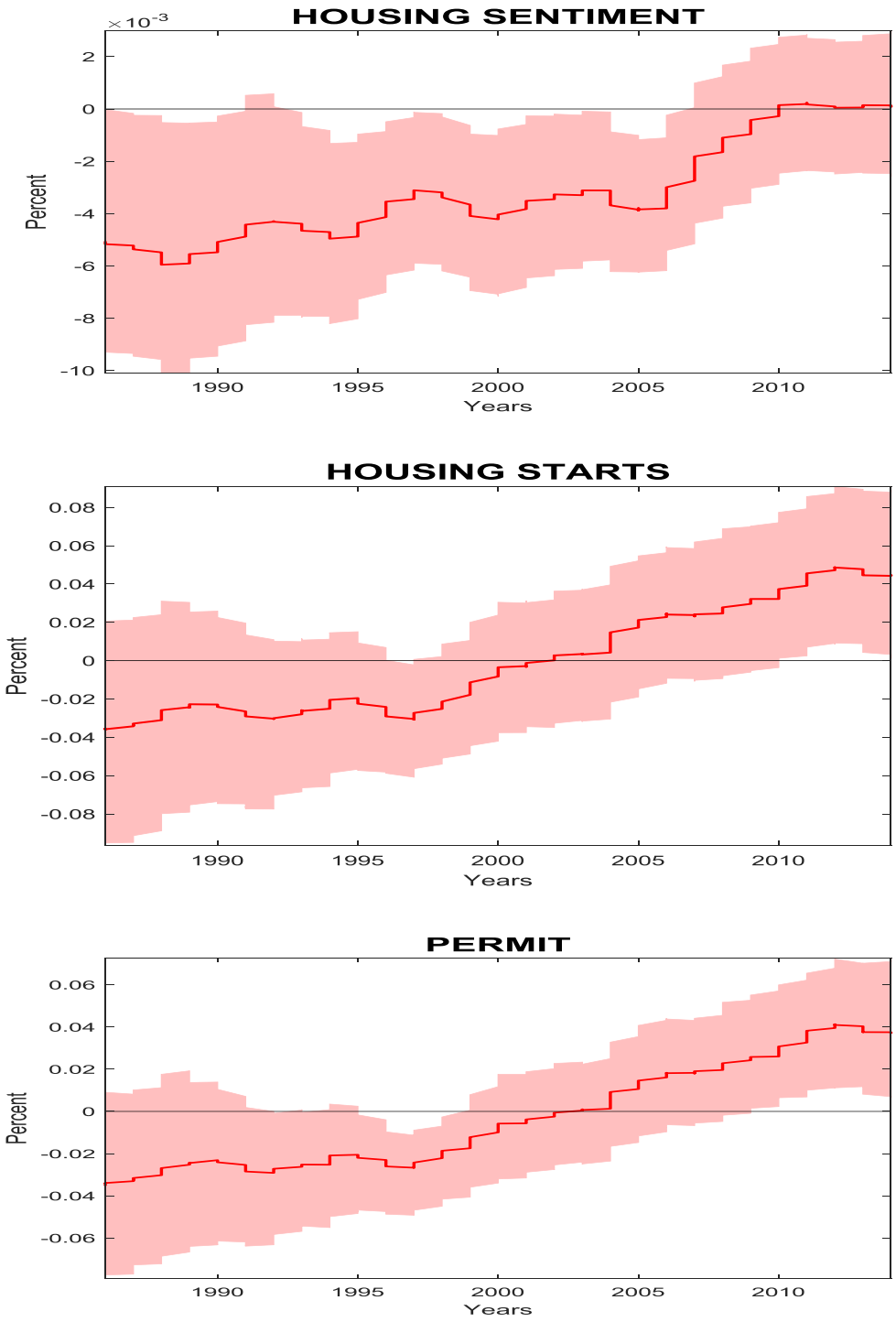




Note: Impulse response of housing variables to a one standard deviation positive uncertainty shock.

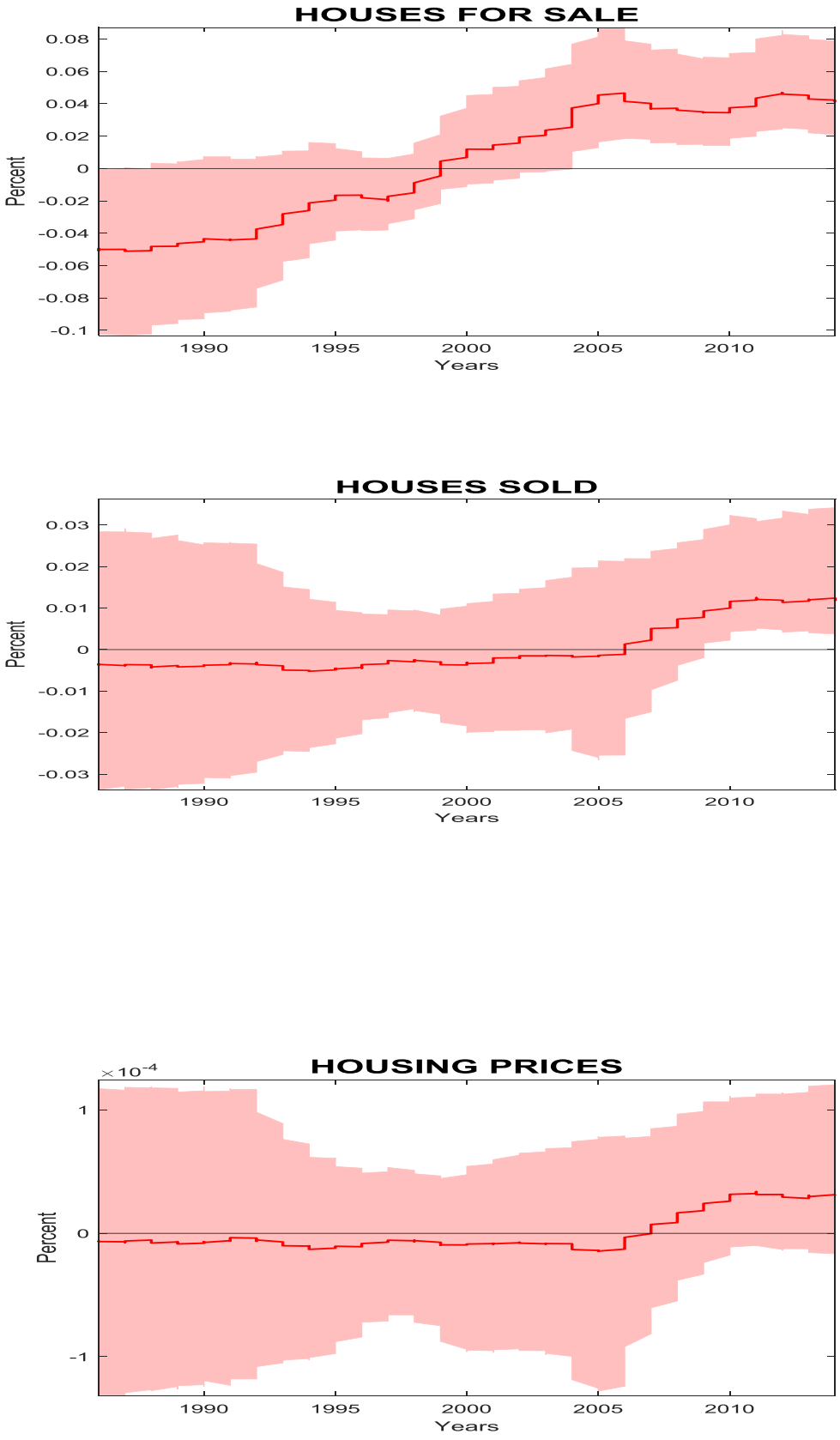
Figure 2: Cumulative responses at the four-quarter horizon

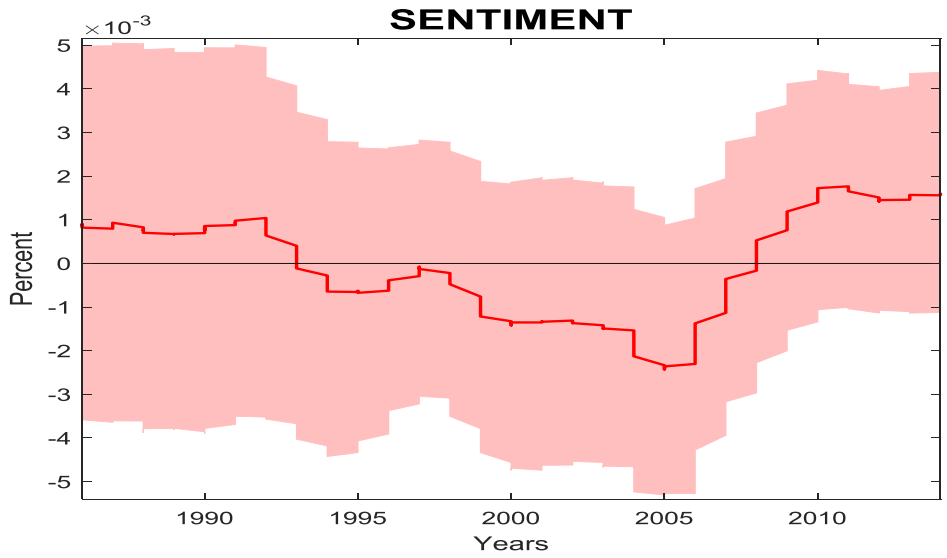


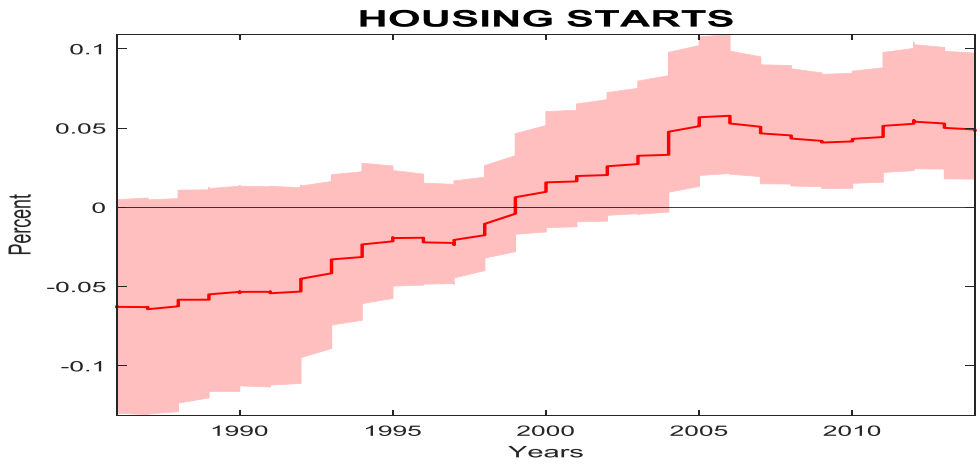


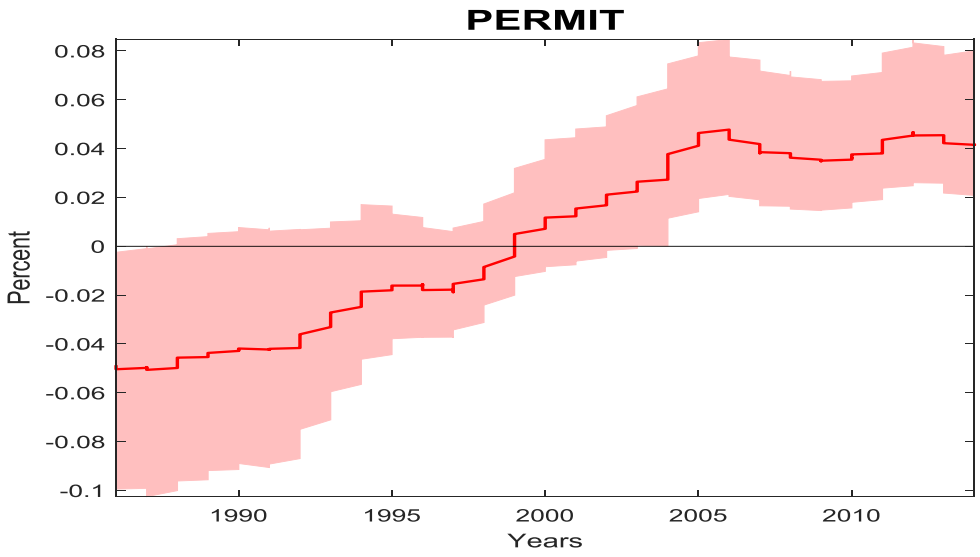
Note: see note to Figure 1.

Figure 3: Cumulative responses at the eight-quarter horizon









Note: see note to Figure 1.

1998 and 1995-1998, respectively, while they are relatively stable over these periods of time. The response of "houses sold" demonstrates similar behavior, although it remains statistically significant for a longer period of time (1993-2000). Lastly, "housing sentiment" responses negatively to an uncertainty shock. The time varying response is statistically significant until 2006 while it declines over time.

Figure 3 reports the cumulated response of housing variables along with the error bands to a shock to uncertainty at the eight-quarter horizon. It is evident that time varying response is not statistically significant in all the cases.

In sum, at the shortest horizon, uncertainty shocks is shown to have a negative and significant impact on houses for sale, permits and starts till the late 1990s. At the one-year-ahead horizon, the strongest negative and statistically significant influence is observed for housing market sentiment, with some negative impact also observed for houses for sale, permits and starts during the mid-1990s, and for homes sold over the entire decade of 1990. Post 2010, we also observe a positive and significant impact on houses for sale, permits and starts. At the longest horizon of two-year-ahead, there is some initial negative impact on houses for sale and permit, but the effect on these variables, along with homes sold and housing start tends to become positive and significant from the mid-2000s and onwards. What is most interesting is the statistically insignificant impact on house prices – a result in contradiction with the existing literature, and is possibly an indication of misspecification due to omitted variable bias in the earlier studies which tended to rely on small-scale models.

Our results tend to suggest either risk neutrality or complete markets were driving the positive effects of uncertainty on housing market activity towards the end of the period of analysis, especially in the longer-run. While the irreversible nature of housing investment, was playing a role in negatively affecting the housing sector, in the early part of the sample. As pointed out by Mumtaz and Theodoridis (2018), increases in uncertainty around the

recent global financial crisis, which in turn led to the ZLB and pursuing of unconventional monetary and real-estate market related policies is likely to have neutralized the impact of uncertainty shocks towards the end of the sample, to the extent that we observed positive impact on sales, permits and starts.

4. Conclusion

This study empirically investigates the impact of macroeconomic uncertainty shocks on US housing market variables (sales, prices, permits, starts, and sentiment), using a TVP-FAVAR model comprising of a comprehensive dataset of other macroeconomic and financial variables. Overall, the results of the cumulative response of housing variables to a 1 standard deviation positive uncertainty shock at the one-, four- and eight-quarter horizon tends to change over time, both in terms of sign and magnitude. The uncertainty shock is shown to affect primarily home sales, permits and starts over short-, medium and long-runs, and housing sentiment in the medium-term. Interestingly, the impact on housing prices is statistically insignificant.

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