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Asymmetric causality between the U.S. housing market and its stock market: Evidence from state level data

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ABSTRACT

Previous research that investigated the link between the U.S. housing market and its stock market concentrated on the wealth effect by assuming the stock prices to be another determinant of house prices. However, the meltdown of housing market and its subsequent impact on the stock market and the U.S. economy in 2008 pointed to causal relation that could run from housing market to stock market. When we tested this hypothesis using state level data, we found short-run symmetric causality from stock prices to house prices in 10 states and from house prices to stock prices in 20 states. However, when we engaged in asymmetric causality, these numbers increased to 25 and 41 respectively. Surprisingly, in 39 out of 41 states in which house prices caused stock prices, it was decline in house prices that caused stock prices, supporting the events of 2008 as well as asymmetric impacts. We also found cointegration of the two markets in more than half of the states.

1. Introduction

The main cause of the Great Recession of 2008 here in the U.S. was identified to be the burst of the bubble in the U.S. housing market. As house prices began to fall and the U.S. economy entered into a recessionary cycle, the U.S. stock market began to suffer and shares of most firms began to lose.[1] Based on such an observation, we would expect to see house prices to be a determinant of stock prices. Yet, the few studies assessing the impacts of changes in stock prices on house prices, known as the "wealth effect", tend to include stock prices in a model of house price determination. Once they include some other determinants of house prices such as household income and mortgage rates, the main concern has been to determine if the two markets are integrated or segmented. The findings are mixed at best. While early studies such as Liu, Hartzell, Greig, and Grissom (1990), Okunev and Wilson (1997) did not find any link between the two markets, more recent studies that applied advances in error-correction modeling and cointegration approaches, did find support for cointegration between the two markets. Example includes Liow and Yang (2005), Liow (2006), Liu and Su (2010), Tsai, Lee, and Chiang (2012), Ding, Chong, and Park (2014), Lin and Fuerst (2014), and Bahmani-Oskooee and Wu (2017).[2]

The above studies were recently criticized by Bahmani-Oskooee and Ghodsi (2018) for using aggregate data from a specific country. Almost all mentioned studies have used an overall index of house prices and share prices from an individual country. In hope of finding more support for the wealth effect, Bahmani-Oskooee and Ghodsi (2018) used an index of house prices from each state of the U.S. and tried to identify the states that have benefitted from recent gains in the U.S. stock market. Like previous studies, they relied upon a model

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[1] For more see Bahmani-Oskooee and Ghodsi (2016).

[2] For a detailed review of these studies see Bahmani-Oskooee and Ghodsi (2018).

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of house price determination that includes the index of S & P 500 as another determinant of house prices. They did not consider the possibility of causal effect from house prices to S & P 500. To fill this gap, in this paper we consider the short-run and the long-run causality that may exist between S & P 500 index and house prices in each state of the United States. The evidence in support of causal relation between the two variables extends to more states when we engage in asymmetric causality between the two variables. To show how, in Section II we introduce the symmetry and asymmetry causality detection approaches. We then present the results in Section III with our summary that appears in Section IV. Data definition and sources are cited in an Appendix.[3]

2. The model and the methods

Based on our observation of declines in house prices in the U.S. as the main cause of the Great Recession of 2008 and the eventual decline in the stock market, we begin with postulating house prices (HP) as a determinant of stock prices (SP) as outlined by specification (1) below:

$$LnSP_t = a + bLnHP_t + \varepsilon_t \tag{1}$$

Equation (1) outlines house prices as a determinant of stock prices and once it is estimated by any method, estimate of b is said to be a long-run elasticity. However, (1) cannot be used to detect short-run causality that may run from house prices to stock prices. To detect causality between the two variables, a common practice is to rely upon the concept of Granger causality. According to Granger (1969) in detecting causality that may run from house prices to stock prices, we must account for the past history of stock prices by concentrating on a specification such as (2):[4]

$$\Delta LnSP_t = \alpha + \sum_{i=1}^{n1} \beta_i \Delta LnSP_{t-i} + \sum_{i=0}^{n2} \delta_i \Delta LnHP_{t-i} + \mu_t \tag{2}$$

Granger (1969) demonstrated that if after accounting for past performance of stock prices, lagged value of house prices (HP) in (2) are jointly significant, the HP causes SP. This is tested by estimating (2) using a lag-selection criterion and establishing the fact that $\sum \delta_i$ / $= 0$ using the F or Wald test. As time-series approaches advance, later Granger (1988, p. 203) identified another source of causality from HP to SP which is detected through an error-correction specification as outlined by (3):

$$\Delta LnSP_t = \alpha + \sum_{i=1}^{n1} \beta_i \Delta LnSP_{t-i} + \sum_{i=0}^{n2} \delta_i \Delta LnHP_{t-i} + \lambda \varepsilon_{t-1} + \mu_t \tag{3}$$

The second source of causality from HP to SP is through lagged error term by establishing the fact that an estimate of λ is negative and significant. Banerjee, Dolado, and Mestre (1998) demonstrate that the *t*-test that is used to test the significance of λ has a new distribution for which they tabulate new critical values. They also demonstrate that if λ is negative and significant, that will be an indication of cointegration between the two variables. Indeed, the first channel is referred to as short-run causality and the second one as long-run causality (Jones & Joulfaian, 1991, p. 151). Note that an alternative way of establishing cointegration or long-run causality is to show that both variables in (1) are integrated of order one, I(1), but the residuals are integrated of order zero, I(0).[5]

What happens if one variable is I(1) and the other I(0)? In a multivariate models, the question will change to what to do when we have combination of I(1) and I(0) variables which are the properties of almost all time-series macro variables. Pesaran, Shin, and Smith (2001) propose an alternative approach within which variables could be combination of I(1) and I(0). They solve (1) for ε_t first, lag the solution by one period, and substitute the result for ε_{t-1} in (3) to arrive at:

$$\Delta LnSP_t = \alpha + \sum_{i=1}^{n1} \beta_i \Delta LnSP_{t-i} + \sum_{i=0}^{n2} \delta_i \Delta LnHP_{t-i} + \lambda LnSP_{t-1} + \lambda bLnHP_{t-1} + \mu_t \tag{4}$$

Once (4) is estimated using a lag selection criterion, Pesaran et al. (2001) propose two tests to establish cointegration. One is the F test to establish joint significance of lagged level variables and the other is the *t*-test to show that an estimate of λ is negative and significant. However, since variables in a given model could be combination of I(1) and I(0), both tests do have new critical values that they tabulate. Note that the long-run effects of HP on SP that is reflected in an estimate of b in long-run model (1) is derived here by normalizing the estimate obtained for $LnHP_{t-1}$ by estimate obtained for $LnSP_{t-1}$. Short-run effects are still inferred by estimates of δ_i's and short-run causality is established by showing that $\sum \delta_i \neq 0$.

In all of the above specifications, there is a common assumption of asymmetric effects of changes in house prices or stock prices, i.e., estimate of b is the same for house price increase as well as house price decrease. However, this need not be the case and indeed it was not the case. The rate at which stock prices dropped during 2008 Financial Crisis because of the collapse of the housing market has not been the same the rate at which both markets have recovered. This implies that the effects of house price changes on stock prices could

[3] Other time-series studies that have emphasized fundamentals but not stock prices are: Chen and Patel (1998), Meen (2002), Apergis (2003), Abbott and De Vita (2012, 2013), Chen, Tsai, and Chang (2007), McQuinn and O'Reilly (2008), Kim and Bhattacharya (2009) and Zhou (2010). There are also several panel studies. The list includes Malpezzi (1999), Gallin (2006), Mikhed and Zemcik (2009), Holly, Pesaran, and Yamagata (2010), Madsen (2012), and Bahmani-Oskooee and Ghodsi (2017).

[4] Note that (2) is based on the assumption that both variables are first-differenced stationary or integrated of order one, I(1).

[5] This is the original theorem proposed by Engle and Granger (1987).