Monetary Policy and Bubbles in US REITs

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Abstract

In this article, we analyze the effects of monetary policy on the bubbles in the Real Estate Investment Trusts (REITs) sector of the United States. We use a time-varying vector autoregressive (VAR) model over the quarterly period of 1972:1 to 2018:1. We find protracted periods, starting from the onset of the recent financial crisis to the end of the sample period, where contractionary monetary policy is associated with increases in the bubble component in the REITs of the US economy. This result, which is robust to alternative REITs indexes, is contrary to the "conventional" view, as well as to the predictions of standard models of bubbles.

Keywords: REITs, Bubbles, VAR, Monetary Policy

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1. Introduction

The root of the global economic and financial crisis of 2008-2009 is commonly associated with the rapid decline in real estate prices, following a prolonged boom. Since there exists a large literature on the impact of monetary policy on general real estate prices and vice versa (see for example, Del Negro and Otrok (2007), Bjørnland and Jacobsen (2010), Bjørnland and Jacobsen (2013), Rahal (2016), Simo-Kengne, Miller, Gupta, and Balcilar (2016), Marfatia, Gupta, and Cakan (2017)), Huber and Punzi (2018), Plakandaras, Gupta, Katrakilidis, and Wohar (2018), it is not surprising that there is now a revived interest in the long standing debate on whether and how monetary policy should respond to perceived deviations of real prices from fundamentals. Given the beliefs that asset price bubbles are difficult to detect and measure, and that interest rates are a blunt instrument to prick a bubble resulting in unintended collateral damage, the consensus view is that central banks should only focus on stabilizing inflation and the output gap (Bernanke and Gertler (1999); Bernanke and Gertler (2001); Kohn (2006)). The recent crisis has, however, challenged this consensus and strengthened the viewpoint that monetary authorities should raise the interest rate to counteract asset price bubbles, even at the cost of temporarily deviating from their (inflation or output gap) targets, since any losses associated with such deviations would be more than offset by the avoidance of the consequences of a future burst of the bubble (this has come to be known as "leaning against the wind").

A central assumption of the case for the above "leaning against the wind" monetary policy is the belief that an increase in interest rates will reduce the size of an asset price bubble. Barring the cases of Gali and Gambetti (2015) and Caraiani and Calin (2018), who analyze the impact of monetary policy on stock market bubbles, and find empirical evidence contradicting this view,[2] to the best of our knowledge, no empirical testing of the same type has been conducted for real estate markets. This we find quite baffling, given that the recent global crisis originated from the burst of the bubble in the real estate market of the US.[3]

Against this backdrop, following Gali and Gambetti (2015) and Caraiani and Calin (2018), we provide evidence on the dynamic time-varying response of Real Estate Investment

[2]Caraiani and Calin (2018) revisited the results in Gali and Gambetti (2015) by re-estimating their time-varying vector autoregressive (TVP-VAR) model, including a measure of shadow rate instead of the Federal funds rate to capture monetary policy during the zero lower bound. These authors, when looking at the results during and in the aftermath of the crisis, found that, with the shadow rate, the impact of monetary policy shocks on asset prices became negative, unlike Gali and Gambetti (2015)'s observation of protracted episodes in which stock prices end up increasing persistently in response to an exogenous tightening of monetary policy. In addition, Caraiani and Calin (2018) also detected a much lower positive impact of monetary policy shocks on bubbles, when using the shadow rate.

[3]For detailed discussions on detection of bubbles in US REITs, see for example, Anderson, Brooks, , and Tsolacos (2011), Nneji, Brooks, , and Ward (2013), Escobari and Jafarinejad (2016), and Pavlidis, Yusupova, Paya, Peel, Martinez-Garcia, Mack, and Grossman (2016) for bubbles in international housing markets.

Trusts (REITs) prices[4] to monetary policy shocks using a time-varying vector autoregressive (TVP-VAR) model,[5] and try to use that evidence to infer the nature of the impact of interest rate changes on the (possible) bubble component of REITs prices. Based on a TVP-VAR comprising of quarterly data (on measures of output, general and commodity prices, dividends, interest rate and REITs), over the period of 1972:1 to 2018:1, our goal is to assess the empirical merits of the "conventional" view, which predicts that the size of the bubble component of REITs prices should decline in response to an exogenous increase in interest rates. Since the fundamental component is expected to go down in response to the same policy intervention, any evidence pointing to a positive response of observed (sum of the fundamental and bubble components) REITs prices to an exogenous interest rate hike would call into question the conventional view regarding the effects of monetary policy on REITs price bubbles. The remainder of the paper is organized as follows: In Section 2 we provide the theoretical and empirical frameworks, while Section 3 lays data and the results, with Section 4 concluding the paper.

2. The Econometric Framework

We model the impact of monetary policy shocks on bubbles through the use of a time-varying Bayesian VAR approach which is inspired by the earlier specifications of Primiceri (2005). Following in the footsteps of Gali and Gambetti (2015) we also adopt the identification scheme developed by Christiano, Eichenbaum, and Evans (2005). Formally, the model can be expressed in the following way:

$$x_t = A_{0,t} + A_{1,t}x_{t-1} + ... + A_{p,t}x_{t-p} + u_t \tag{1}$$

In Equation 1, $A_{0,t}$ represents a vector of time-varying intercepts and the $A_{i,t}$ matrices quarter the time-varying coefficients. Moreover, the innovation vector u_t follows a zero mean and Σ_t covariance matrix white noise Gaussian process. We consider that the above mentioned innovations are linear transformations of the structural shocks, such that: $E\{\epsilon_t \epsilon_t'\} = I$, $E\{\epsilon_t \epsilon_{t-k}'\} = 0$ and also $S_t S_t' = \Sigma_t$.

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[4]The decision to use REITs prices instead of housing prices, in this paper at this stage, is primarily because of the fact that, unlike the REITs price index, which is homogeneous across the country, housing markets are regional in nature, with tremendous heterogeneity in terms of their response to monetary policy (Gupta and Kabundi (2010); Gupta, Jurgilas, Kabundi, and Miller (2012a); Gupta, Miller, and van Wyk (2012b).

[5]The TVP-VAR model, not only allows us to accommodate for structural changes, but also to model empirically the fact that the overall effect on the observed stock price may change over time as the relative size of the bubble changes, since changes in interest rates have a different impact on the fundamental and bubble components.

We use the following data series: $y_t, p_t, p_t^e, i_t, q_t, d_t$, standing for log of output, log of the price level, the log of commodity prices index, the central bank's interest rate, log of the REITs index, as well as the corresponding log of the dividend series (both in real terms). The following vector of endogenous variables is employed: $x = [\Delta y_t, \Delta d_t, \Delta p_t, \Delta p_t^e, i_t, \Delta d_t]$.

We assume that $\theta_t = vec(A_t')$ with $A_t = [A_{0,t}, A_{1,t}, ..., A_{p,t}]$, where $vec()$ denotes the column stacking operator. We use the following process for θ_t:

$$\theta_t = \theta_{t-1} + \omega_t \tag{2}$$

Here ω_t denotes a Gaussian process characterized by a zero mean and a constant covariance Ω.

We decompose the time-varying covariance matrix Σ_t in $\Sigma_t = F_t D_t F_t'$. Here, F_t is lower-triangular with a main diagonal consisting of ones, while D_t is a diagonal matrix. The vector σ_t is characterized by diagonal elements of $D_t^{1/2}$, and by $\phi_{i,t}$ the column vector. The latter has nonzero elements of the row $(i+1)$ of F_t^{-1} for $i = 1, .., 5$. We further assume that:

$$\begin{aligned} log\sigma_t &= log\sigma_{t-1} + \zeta_t \\ \phi_{i,t} &= \phi_{i,t-1} + \nu_{i,t} \end{aligned} \tag{3}$$

Furthermore, we consider that the innovations ζ_t, ν_t are assumed to follow a Gaussian process characterized by a zero mean and constant covariances denoted by Ξ and by Ψ_i.

A key issue here with respect to the main results pertains to the identification of monetary policy shocks. We mentioned that we follow Gali and Gambetti (2015) who used the identification scheme of Christiano et al. (2005). The main ingredient here is the assumptions that the monetary policy shocks do not affect contemporaneously the GDP, the dividends or the inflation and that the central bank interest rates do not respond immediately (contemporaneously) to changes in REITs prices.

3. Empirical Analysis

3.1. Data

Our Bayesian VAR model relies on seven US variables, observed at quarterly frequency over the period of 1972:1 to 2018:1, following the specification introduced by Gali and Gambetti (2015). The macroeconomic variables used are real GDP, the GDP deflator and the effective Federal funds rate. These variables have been obtained from the FRED database of the Federal Reserve Bank of St. Louis. However, as suggested by Caraiani and Calin (2018), given the zero lower bound situation of the monetary policy instrument in the wake of the "Great Recession", we use the shadow short rate developed by Wu and Xia (2016) between 2009:1 and 2015:4. Note that, the shadow short rate is the nominal interest rate that would prevail in the absence of its effective lower bound, with it derived by modelling the (three-factors) term structure of the yield curve, and has been shown by Wu and Xia (2016) to be a close approximation of the effective Federal funds rate during the conventional periods of monetary policy decision-making. Secondly, we incorporate a non-energy commodity price index acquired from the World Bank. Finally, we utilize the total returns index and dividends for the FTSE Nareit U.S. REITs. While we focus on the All REITs[6] index in the main text, robustness analyses are presented in the Appendix for Composite,[7] All Equity,[8] Equity,[9] and Mortgage[10] REITs indices, considered in turn. The data on the various REITs and corresponding dividends are derived from the official website of Nareit (www.reit.com).

3.2. Bayesian Estimation

We describe here in a succinct manner the algorithm used in the estimation. The approach is based on the reference contributions by Primiceri (2005) and Del Negro and Primiceri (2015). The algorithm uses the Gibbs sampling, where in each iteration, there are seven steps consisting in draws for a set of parameters conditional on the values of the other parameters of the BVAR model. For a generic column vector w_t, we use the notation $w^T = [w_1', ..., w_T']'$. The seven steps used in each iteration are the following:

1. $p(\sigma^T | x^T, \theta^T, \Phi^T, \Omega, \Xi, \Psi, s^T)$
2. $p(\Phi^T | x^T, \theta^T, \sigma^T, \Omega, \Xi, \Psi)$
3. $p(\theta^T | x^T, \sigma^T, \Phi^T, \Omega, \Xi, \Psi)$
4. $p(\Omega | x^T, \theta^T, \sigma^T, \Phi^T, \Xi, \Psi)$
5. $p(\Xi | x^T, \theta^T, \sigma^T, \Phi^T, \Omega, \Psi)$
6. $p(\Psi_i | x^T, \theta^T, \sigma^T, \Phi^T, \Omega, \Xi)$, $i = 1, 3, 4$
7. $p(s^T | x^T, \theta^T, \sigma^T, \Phi^T, \Omega, \Xi, \Psi)$

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[6]This is a market capitalization-weighted index that includes all tax-qualified real estate investment trusts (REITs) that are listed on the New York Stock Exchange, the American Stock Exchange or the NASDAQ National Market List.

[7]This is a free-float adjusted, market capitalization-weighted index of U.S. Equity and Mortgage REITs.

[8]This is a free-float adjusted, market capitalization-weighted index of U.S. equity REITs. Constituents of the index include all tax-qualified REITs with more than 50 percent of total assets in qualifying real estate assets other than mortgages secured by real property.

[9]This index contains All Equity REITs not designated as Timber REITs or Infrastructure REITs.

[10]This is a free-float adjusted, market capitalization-weighted index including all tax-qualified REITs with more than 50 percent of total assets invested in mortgage loans or mortgage-backed securities secured by interests in real property.

In the above case, s is taken as a $n \times 1$ vector with integer values from 1 to 7 (this is used to draw σ^T). The algorithm also imposes that the covariances matrices Ω, Ξ, Ψ, as well as the initial states $\Theta_0, \Phi_0, log\sigma_0$ are independent. The prior distributions for these initial stats are normal, while the prior distributions for the covariance matrices $\Omega^{-1}, \Xi^{-1}, \Psi_i^{-1}$ are set as Wishart. To set the prior means and variances for the normal distributions, we estimate first a constant-coefficients VAR based on the first 48 observations, equivalent to 12 years.

Following Gali and Gambetti (2015), we use 22000 draws in the estimation and discard 20000 of them, while collecting only half of the remaining 2000 draws. All the results are derived on the basis of the 1000 draws made from the posterior distribution.

3.2.1. Time-Varying Impulse Responses

Our focus here is on the changing responses of the ALL REITs index, and the associated behavior of the bubble and fundamental components of the same, following the contractionary monetary policy shock, displayed in Figures 1-3.[11] As shown in Figure 1, the ALL REITs returns tend to decline in general on impact and over the various horizons over the entire sample period considered. The only exception is at longer horizons, at the early part of the sample period. In Figure 2, we present the response of the gap between the observed and the fundamental values (underlying dividends) of the ALL REITs index. With the exception of the early part of the sample and the period during- and post- the financial crisis, the contractionary monetary policy reduces the bubble component, i.e., the result for the bulk of the sample period is in line with the “conventional” view. However, the dynamics observed for the extreme ends of the sample, where the responses of the bubbles are found to be positive and growing is consistent with the theory of rational bubbles, as outlined by Gali (2014) or Gali and Gambetti (2015).

Figure 3 shows the response of the fundamental REITs index component. The response is initially positive, but remains in the negative territory for the rest of the sample. This rather supports the conventional view, at least for the case of the fundamental component itself.

4. Robustness

4.1. Alternative Measures of REITs

As a robustness check, we re-conducted the above analysis using Composite, All Equity, Equity, and Mortgage REITs indexes, instead of the ALL REITs index. In Figures 4-11, we present the bubble and fundamental component responses for each case. As can be seen

[11] The responses of all the other variables in the TVP-VAR are qualitatively similar to those in Gali and Gambetti (2015) and Caraiani and Calin (2018), and are available upon request from the authors.

from these figures, the results are qualitatively comparable with those reported for the ALL REITs index in Figures 1-3 for both the bubble component (Figures 4, 6, 8 and 10) and for the fundamental component (Figures 5, 7, 9 and 11). These findings support the main result of a positive bubble response in the aftermath of the crisis.

4.2. Sub-sample Analysis with Constant Parameter VAR

In section, we consider a further robustness exercise in which we use monthly data. We estimate a constant-coefficients VAR model with monthly data from February 1971 to May 2018. We use the industrial production instead of GDP, and the consumer price index (CPI), instead of the GDP deflator. The results for All REITs, monthly data are shown in Figures 14 and 15. For comparison, we also estimated the constant-coefficients VAR model on quarterly data, see Figures 12 and 13. Furthermore, we look at pre-2008 data (February 1972 to December 2007), in Figures 16 and 17, and to post-2008 data (January 2008 to May 2018), in Figures 18 and 19).

The results are remarkably similar, as the initial response of the bubble component is positive, in the range of 0.5% to 2%, somehow weaker in the pre-2008 sample.

5. Conclusions

The "conventional" view of monetary policy suggests that the size of the bubble component of asset prices should decline in response to an exogenous increase in interest rates. Realizing the role played by the real estate sector in the "Great Recession", we use a vector autoregressive model with time-varying coefficients to analyze the impact of monetary policy shocks on US REITs over the quarterly period of 1972:1 to 2018:1. Using an identification scheme which assumes no contemporaneous response of monetary policy to REITs prices, the evidence points to protracted periods, starting from the onset of the recent financial crisis to the end of the sample period, where contractionary monetary policy is associated with increases in the bubble component in the REITs of the US economy. In other words, this result, which is robust to alternative REITs indices, is at odds with the "conventional" view, as well as with the predictions of standard bubble models. In sum, proposals for a "leaning against the wind" monetary policy in response to perceived deviations of asset prices from fundamentals, which in turn, rely on the assumption that increases in interest rates will succeed in shrinking the size of an emerging asset price bubble, are not supported by our study, especially in the period associated with the recent global financial crisis and thereafter.

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The Impact of Monetary Policy Shocks on Bubbles Using ALL REITs Index

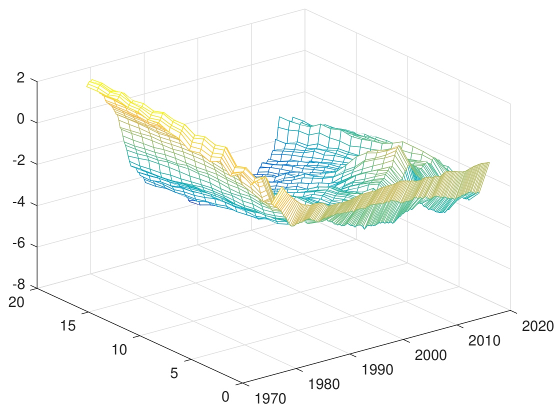

Figure 1: ALL REITs Index Response

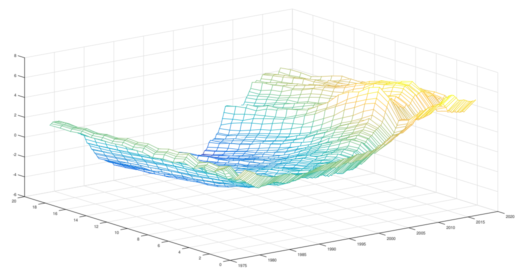

Figure 2: Bubble Response of ALL REITs Index

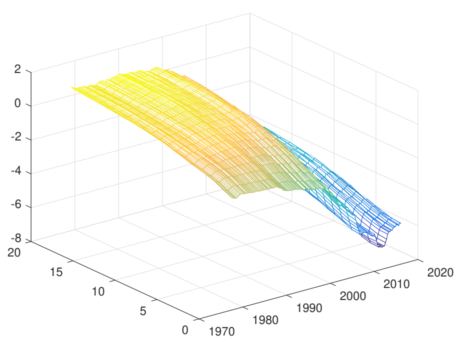

Figure 3: Fundamental Response of ALL REITs Index

The Impact of Monetary Policy Shocks on Bubbles Using Alternative REITs Indices

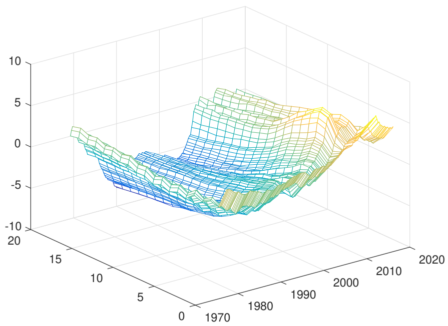

Figure 4: Bubble Response in All Equity REITs Index

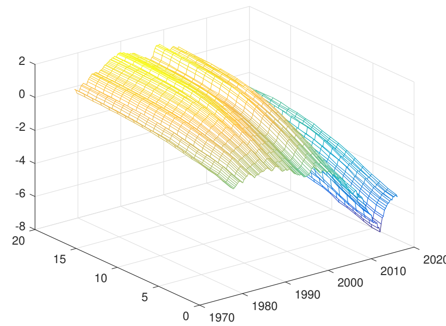

Figure 5: Fundamental Response in All Equity REITs Index

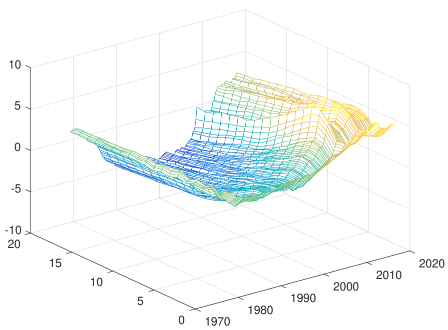

Figure 6: Bubble Response in Composite REITs Index

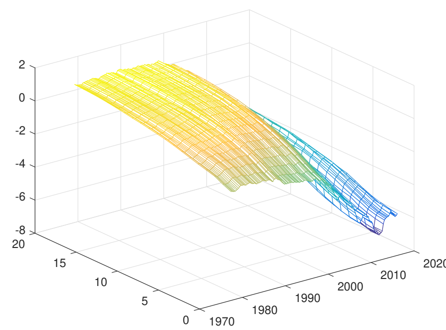

Figure 7: Fundamental Response in Composite REITs Index

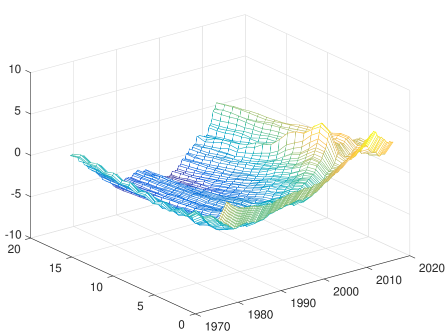

Figure 8: Bubble Response in Equity REITs Index

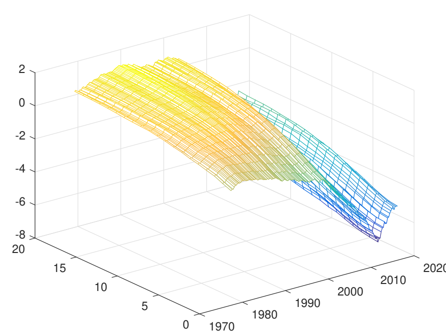

Figure 9: Fundamental Response in Equity REITs Index

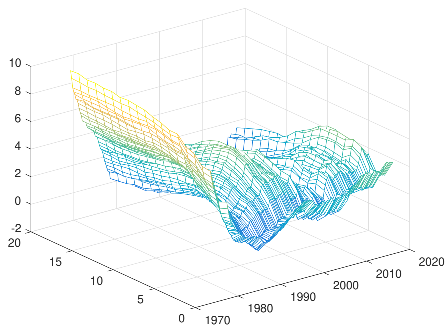

Figure 10: Bubble Response in Mortage REITs Index

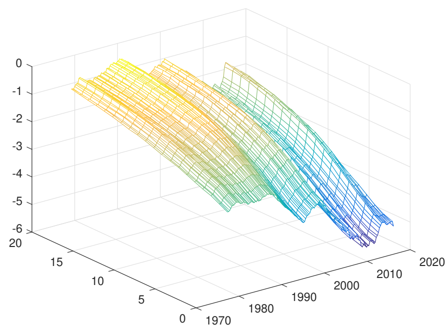

Figure 11: Fundamental Response in Mortgage REITs Index

Results with Classical VAR: quarterly data - All Equity

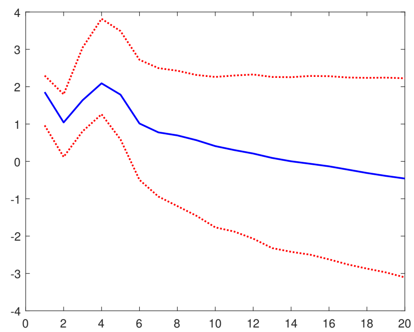

Figure 12: Bubble Response

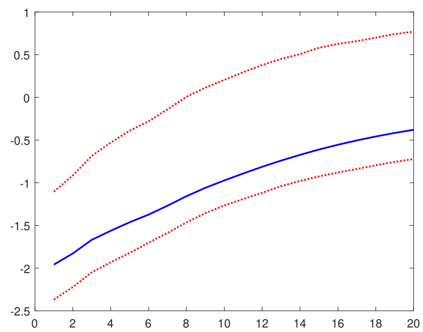

Figure 13: Fundamental Response

Results with Classical VAR: monthly data - All Equity

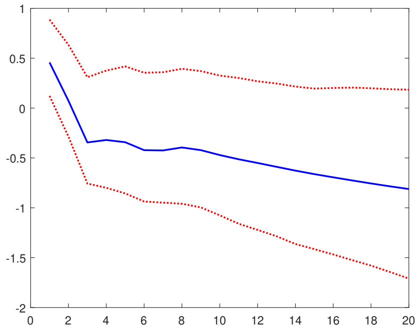

Figure 14: Bubble Response - full sample

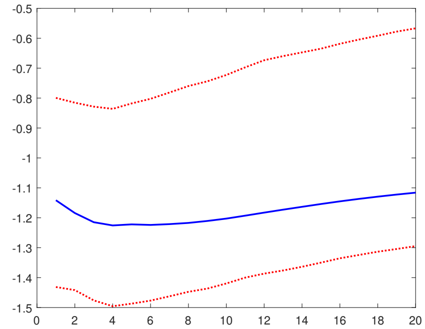

Figure 15: Fundamental Response - full sample

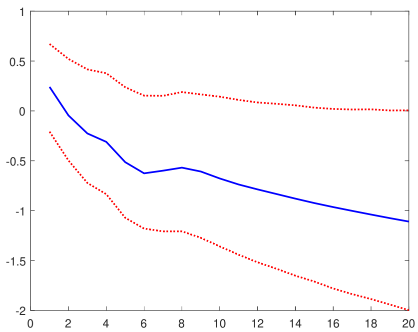

Figure 16: Bubble Response - 1972-2007

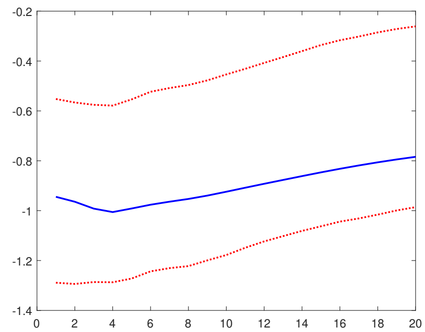

Figure 17: Fundamental Response - 1972-2007

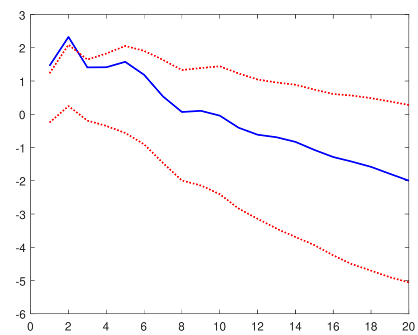

Figure 18: Bubble Response - 2008-2018

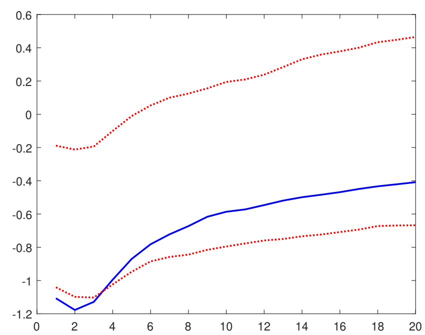

Figure 19: Fundamental Response - 2008-2018