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House Bubbles, global imbalances and monetary policy in the US

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ABSTRACT

This paper examines the factors driving housing price exuberance in the United States, specifically the influence of expansionary monetary policies and the global saving glut. We employ medium scale Bayesian VAR and time-varying VAR models to estimate the effects of monetary policy and global saving glut shocks on US housing bubbles. We find that, prior to the Global Financial Crisis, the impact of the saving glut shock is more enduring, powerful, and rapid in generating housing bubbles compared to monetary policy shocks. However, the recent housing boom that commenced in 2019 demonstrates a different pattern. Our results suggest that both monetary policy and the global saving glut contribute to the increase in house prices. Counterfactual policy experiments validate this conclusion.

1. Introduction

The rapid increase in US housing prices, both prior to the Great Financial Crisis (GFC) and the more recent housing price boom starting in mid-2019, has been attributed to low interest rates, among other factors. However, the underlying causes of these low interest rates remain a subject of debate. This raises the question of the extent to which housing price exuberance is influenced by domestic or external shocks. Specifically, to what degree is housing price exuberance attributable to US expansionary monetary policies or the global saving glut? Moreover, is it possible that the formation of a housing bubble in the US could negatively impact its current account and further exacerbate global imbalances? Another area of interest is the examination of time variation in the impact of saving glut and monetary policy shocks on house prices. Is there evidence to suggest that these shocks have varying effects over time? We also investigate the drivers behind the two most recent US housing price booms: the first, pre-GFC housing bubble spanning from 2003 to 2006 and the second, post-GFC housing bubble that started in 2019. Were these housing booms primarily fueled by current account deficits, monetary policy measures, or a combination of both factors?

This paper presents novel empirical evidence addressing these questions. Its objective is to establish a set of empirical regularities that can provide guidance to policy economists and researchers involved in constructing macroeconomic models for monetary policy, particularly those focusing on housing booms. In other words, our aim is to extract the insights from the existing literature regarding the relative importance of monetary policy versus the global saving glut in the pre-GFC housing bubble and compare it with the post-GFC housing bubble.

Economists have conjectured different explanations for the low interest rates observed during 2001–2004. One argument suggests that these rates were a consequence of accommodative monetary policy implemented by the Federal Reserve (Fed). On the other hand,

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the "global saving glut" hypothesis proposed by Bernanke (2005, 2007, 2010, and 2011) emphasizes the increased saving behavior of the global economy, particularly emerging economies like China. Figure 1(a) displays the S&P/Case-Shiller US national home price index while Figure 1(b) represents monetary policy through the Fed Funds Rate (FFR). This graph also includes the 10-Year Treasury Note rate that drives housing mortgage rates and demand for housing. It is worth noting that these longer-term interest rates can be influenced by global capital inflows, as depicted by the US current account balance shown in Figure 1(c).

Fig. 1(a) and (c) reveal a simultaneous increase in housing prices and a widening US current account deficit from 2002 to 2006. Another interesting observation that can be inferred from these graphs is that despite the Fed's gradual increase in the FFR (Fig. 1b) starting in 2004, long-term interest rates remained relatively stable. This element can be viewed as supporting evidence for the global saving glut hypothesis, as it suggests that the long-term rate remained low during a period when the US encountered growing current account deficits. In addition, the graph also suggests that the second, most recent house price boom that started in 2019 could be due to both global imbalances and domestic monetary policy. It is noteworthy that following the monetary policy easing implemented by the Fed since early 2019, with the policy rate stabilizing around 2.40% and subsequently declining (as shown by the FFR in Fig. 1b), the 10-year rate experiences a substantial decrease to nearly 0.50%. Concurrently, the US current account deficit exhibits a significant widening. This observation suggests that both hypotheses could have some validity in explaining the recent housing boom. However, based on visual inspection alone, we cannot ascertain the relative significance of these two potential factors driving the two housing booms.

In this paper, we propose an empirical analysis guided by the theoretical model of Ikeda and Phan (2019). Their model highlights the role of financial integration in driving capital flows from emerging economies to the US, which in turn affects long-term interest rates and facilitates the formation of bubbles. Housing bubbles in the US in turn, contribute to increased wealth among agents, leading to relaxed credit constraints and greater borrowing by productive agents. This, in turn, results in higher leverage and a credit boom.

Our empirical analysis begins by establishing a connection between housing bubbles, the global saving glut and monetary policy. To achieve this, we estimate an open-economy, medium scale Bayesian VAR (BVAR) model that incorporates various elements of the theoretical framework by Ikeda and Phan (2019). This includes incorporating indicators of global economic conditions, the US current account, wealth, leverage, and other standard macroeconomic variables. Additionally, we construct a housing bubble index, which will be further explained in the data section. Our empirical specification is designed to allow for the identification of a global saving-glut shock through the application of sign restrictions.

Our BVAR is estimated using data from 1980Q1 to 2020Q3. The global saving glut shock generates a deficit in the US current account, triggers an appreciation of the dollar, and leads to a decrease in the US long-term interest rate. Furthermore, the shock has a

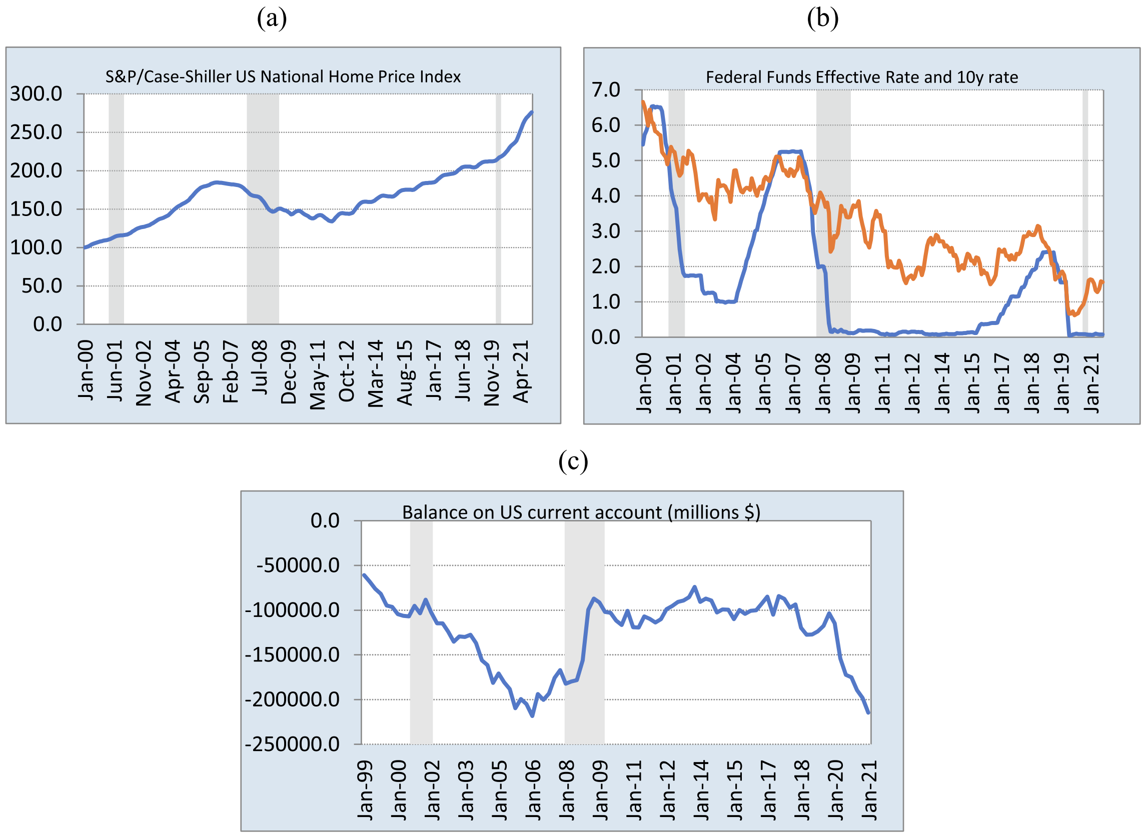

Fig. 1.

significant impact on the domestic bubble. This suggests that capital inflows play a substantial role in driving the development of housing bubbles within the US. Additionally, the global saving glut shock leads to notable increases in wealth, leverage, and investment.

Our econometric specification is well-suited to explore the competing hypothesis regarding the drivers of the housing bubble. One prominent perspective, advocated by Taylor (2007, 2009, 2012) and supported by studies such as Bracke and Fidora (2012) and Hirano et al. (2017), emphasizes the role of monetary policy in fuelling the first housing bubble. According to this view, the housing bubble was fuelled by monetary policy as the Fed pursued policy rates below those recommended by the Taylor rule, resulting in increased output, wealth, leverage, and asset bubbles. To quantify the specific influence of monetary policy in driving the housing bubble, we estimate a slightly modified specification that is necessary to enable us to identify an expansionary monetary policy shock, using sign restrictions as suggested in Uhlig (2005) and Ahmadi and Uhlig (2015).

We show that an expansionary policy shock leads to a significant build-up in house prices. However, when comparing the magnitude of both shocks, we discover that the saving glut shock exhibits immediate, enduring, stronger, and faster effects in generating housing bubbles compared to US monetary policy shocks.

With this empirical evidence in place, we next shift our focus to exploring the possibility of a reverse causality between global imbalances and housing bubbles. This concept has been investigated by Laibson and Mollerstrom (2010), Fratzscher et al. (2010) and Ikeda and Phan (2019). According to this view, the housing bubble in the US led to an increase in domestic investment, output, and consumption, subsequently resulting in a rise in wealth and a surge in imports, leading to significant trade deficits. To further investigate this mechanism, we employ a separate BVAR specification, where we identify an exogenous housing bubble shock that captures the formation of a housing bubble boom. Our findings support the existence of this mechanism, suggesting a reinforcing relationship between capital flows and house price bubbles.

The evidence presented thus far, examines the average consequences of saving glut and monetary policy shocks over the sample period, but it does not allow us to uncover potential time variations in the strength and impact of these shocks on the build-up of US house prices. Time variation in the effects of these shocks may arise due to changes in financial globalisation, particularly in the case of saving glut shocks. Additionally, time variation could also manifest in the case of monetary policy shocks, where the reaction of house prices may differ depending on whether conventional or unconventional monetary policies are implemented.

In the second part of the paper, we introduce the concept of time variation in the impact of both shocks by employing a time-varying Bayesian VAR (TV-VAR) model. This approach allows us to examine the changing responses of housing prices to two types of shocks: an expansionary US monetary policy, accounting for the effects of both conventional and unconventional monetary policies, and a global saving glut shock. Importantly, the time-varying nature of our model enables us to distinguish the impact of these shocks on the pre-GFC and post-GFC housing bubbles. Our findings confirm that the two housing bubbles exhibit distinct characteristics. The first, pre-GFC housing bubble is primarily driven by the global saving glut, whereas the second, post-GFC housing bubble that started in mid-2019 is influenced by both expansionary monetary policy and the global saving glut.

Finally, we delve deeper into assessing the relative importance of saving glut and monetary policy shocks in driving the pre- GFC and the post-GFC housing bubbles by using our TV-VAR model to construct two counterfactual policy scenarios. The first counterfactual is carried out from 2001Q3 to 2005Q2 capturing the pre-GFC housing bubble, while the second counterfactual is designed from 2019Q1 to 2020Q3, representing the post-GFC housing bubble. The analysis validates our previous findings and provides additional insights. Both the monetary policy easing implemented by the Fed since mid-2019, characterized by a series of interest rate cuts, and the significant deterioration in the current account resulting from the global saving glut, played a role in driving up housing prices. Furthermore, the impact of monetary policy was further amplified by the subsequent introduction of a new round of quantitative easing (QE) in response to the Covid-19 pandemic. Our results demonstrate that the implementation of additional asset purchases in March 2020 had a more substantial effect in fuelling the recent exuberance in house prices compared to the impact of the global saving glut.

Our findings are robust to several perturbations to the benchmark specifications of both the BVAR and the TV-VAR, including an alternative identification scheme, the use of alternative macroeconomic variables, alternative measures of global economic indicators and the addition of extra lags, among others.

Section 2 reviews the relevant literature. Section 3 focuses on the data utilized in our study and presents the methodology employed for our empirical analysis. The empirical results are described in Section 4. Section 5 summarizes the main findings and draws some final conclusions.

2. Related literature

Empirical research on the impact of capital flows on US house prices has received limited attention. Previous empirical and theoretical studies on this issue have primarily focused on the impact of current account imbalances on long term interest rates (Krishnamurthy and Jorgensen, 2007; Caballero et al., 2008; Warnock and Warnock, 2009; Adam et al., 2011; Steinberg, 2019).

Our paper is related to Bracke and Fidora (2012) who investigate the effects of monetary policy shocks, preference shocks, and investment shocks on asset prices. In their study, they estimate separate structural VAR models for the US and emerging Asia. The authors find that US monetary policy shocks account for a significant portion of the variation in global imbalances and financial market prices. However, unlike our paper, their focus is on share prices rather than US housing market variables and housing bubbles. Additionally, Bracke and Fidora (2012) compare the developments between the US and emerging Asia by expressing the variables in cross-country differences. This means that their methodology can only be used to identify relative shocks between the two regions, but it does not capture the origin of these shocks. Consequently, their model cannot identify the impact of an external global saving glut shock on the US economy.

Dokko et al. (2011) provide cross-country evidence to explore potential factors that may have contributed to the global housing bubble of 2000, including the role of current account balances. However, the focus is not on identifying global saving glut shocks. Instead, the primary emphasis of their study lies in conducting bivariate causality tests among the VAR variables. Sa and Wieladek (2015) estimate a two-country Bayesian VAR model to study the effect of capital-inflow shocks on the US housing market. In contrast to their study, our paper focuses on the impact of saving glut and monetary policy shocks on the emergence of US house bubbles. Furthermore, unlike Sa and Wieladek (2015), who derive time-invariant average impulse responses, we enrich our empirical specification by obtaining time-varying responses of house prices to both shocks. Our analysis naturally leads to policy scenarios, as we introduce policy counterfactuals that allow us to explicitly investigate the last two episodes of housing price booms in the US: the 2002–06 housing bubble and the more recent house price increases that began in 2019.

Our paper is also related to the extensive literature that uses structural VARs to examine the transmission of monetary policy shocks. We contribute to this literature by focusing on the impact of monetary policy on housing markets, which has been investigated in numerous studies (Calza et al., 2013; Iacoviello, 2005; Del Negro and Otrok, 2007; Fisher et al., 2019; Huber and Punzi, 2020; Jarociński and Smets, 2008; Lastrapes, 2002; Musso et al., 2011). Our work substantially differs from these contributions. While previous papers primarily concentrate on the effects of monetary policy on housing prices and disregard the effects of capital inflows, our paper focuses on identifying the respective influences of US expansionary monetary policy and the global saving glut on the housing boom. Additionally, we derive time-varying responses of house prices to both shocks. Furthermore, our analysis examines the impact of these shocks on the formation of US house bubbles, rather than solely on housing prices.

Finally, another strand of the literature reverses the causation proposed by Bernanke (2005, 2010). Laibson and Mollerstrom (2010) present evidence from 18 OECD countries plus China to show that home price appreciation in these countries explains half of the variation in their trade deficits. Similarly, Fratzscher et al. (2010), using a Bayesian structural VAR model, show that equity market shocks and housing price shocks have been the major determinants of the US current account prior to the GFC. Ikeda and Phan (2019) suggest a reinforcing relationship between capital flows and asset bubbles. Specifically, the financial integration of the rest of the world (ROW) economies with the US leads capital to flow into the US. Capital inflows facilitate the emergence of bubbles in the US, which in turn deteriorate the trade balance, increase the trade deficit, and further exacerbate global imbalances. Although the focus of our paper is to study the opposite effect, our BVAR allows us in a separate specification to identify an exogenous house bubble shock and test whether the formation of a house bubble could deteriorate the US current account.

3. Data and methodology

3.1. Data

The composition of each BVAR specification is depicted in Table 1. We use quarterly data from 1980Q1 to 2020Q3, of the following variables, which enter our BVAR specifications as endogenous variables. Real GDP, the consumer price index (CPI), real investment (as a percent of GDP), the total credit to private non-financial sector (as a percent of GDP), the US wealth, the ratio of the US current account balance to GDP, the real effective exchange rate (REER) of the dollar, the 10-year long term government bond, and the world industrial production index (WIP) by Baumeister and Hamilton (2019). The inclusion of WIP allows us to identify a global saving glut shock that aligns with the hypothesis proposed by Bernanke (2005), which suggests that the saving glut is the result of many economies outside the US facing a lack of domestic investment opportunities. As a result, the combination of high desired saving and low prospective returns to domestic investment compels ROW economies to run current account surpluses and lend abroad. In the robustness section, we employ two alternative proxies to identify saving glut shocks, namely the index proposed by Baumeister et al. (2022), which encompasses multiple dimensions of the world economy relevant for measuring aggregate fluctuations, and the index of global real economic activity developed by Kilian (2009). Furthermore, our measure of the monetary policy stance is the Federal Funds Rate (FFR). In our extensive robustness checks section, we introduce an alternative version of our baseline model by replacing the FFR with the shadow rate by Wu and Xia (2016), which captures the stance of monetary policy when the FFR was at the zero lower bound. As demonstrated below, our main results remain largely unchanged.

All variables, except for the US current account balance, the policy rate, the long-term government rate, and the WIP, are transformed into annual growth rates. The data for all variables are sourced from the Federal Reserve Economic Data (FRED), except for the WIP, which is obtained from the dataset constructed by Baumeister and Hamilton (2019).[1]

The last variable that we add to our model is the house bubble series. We construct this series based on the methods proposed by Borio and Lowe (2002), Detken and Smets (2004), Goodhart and Hofmann (2008), and Evgenidis and Malliaris (2020, 2022). Specifically, we define house price booms as deviations of real house prices above a specified threshold relative to a Hodrick-Prescott filter trend with a high smoothing parameter. In our case, we use a smoothing parameter of 14,400. A house boom is defined as a positive deviation of house prices from this smooth trend of more than 4%. Therefore, if the house price index at a given quarter exceeds its trend by 4%, the bubble index is set equal to the trend plus 4%, and zero otherwise.

We follow the approach of Goodhart and Hofmann (2008) and Evgenidis and Malliaris (2020) in choosing the threshold of 4%. Adalid and Detken (2007) use a higher threshold of 10% to identify asset price booms. However, we opt for a lower threshold to ensure

[1] These data can be downloaded from: https://sites.google.com/site/cjsbaumeister/research.

Table 1
VAR specifications.

Variable name	VAR models				
	Medium scale Bayesian VAR			Time-varying BVAR	
	Global saving glut	Monetary Policy	Bubble	Global saving glut	Monetary Policy (CMP and UMP)
World Ind. Production index	■	■		■	
Bubble series	■	■	■		
Current account (% GDP)	■	■	■	■	■
Real GDP	■	■	■	■	■
CPI		■			■
Real gross investment(%GDP)	■	■	■		
Wealth	■	■	■		
Total Credit to non-fin (%GDP)	■	■	■		
Federal funds rate	■	■			
10 year Government bond	■	■	■	■	■
Real effective exchange rate	■	■			
US National Home Price Index				■	■
Shadow rate					■

Notes: The table lists the variables included in the baseline domestic and open economy VARs. Models correspond to (1) open economy BVAR with a shock on the world industrial production index; (2) and (3) BVARs with focus on US monetary policy expansion and house price bubble shocks respectively, (4) time-varying BVAR with a world industrial production index (5) time-varying BVAR with focus on monetary policy.

an adequate number of housing price boom episodes for estimating our VAR model, as house prices exhibit smaller fluctuations around their trend compared to asset prices. The housing bubble series, along with the identified boom episodes, is presented in Figure 2 (the NBER recessionary dates are indicated by the blue shaded areas). It is important to note that our baseline impulse responses are not sensitive to the use of alternative thresholds, including 3%, 5%, and 6%, for constructing the housing bubble series.[2]

The figure shows that our proposed method, combined with a threshold value of 4%, produces highly reasonable results. The housing bubble series effectively captures the historical surge in house prices in the US from 2003 to 2006. Additionally, it successfully identifies the rapid spread of housing booms across major economies during the late 1980s, encompassing housing, land, and commercial property markets, including the US. The graph also highlights the presence of a brief housing boom in the early 1980s, followed by a subsequent decline in house values. Notably, our index has recently remained at elevated levels, reflecting the current exuberance in the US housing market. In the robustness section, we present the results from an alternative specification where we construct the bubble series by regressing house prices on various economic fundamentals.

3.2. The model

We estimate the following open economy VAR model:

$$Y_t = c + \sum_{j=1}^{p} Y_{t-j} B_j + \nu_t, \tag{1}$$

where Y_t is a vector of n endogenous variables, B_j is the coefficient matrix, c is the vector of n constant terms, and ν_t $N(0, \Sigma)$. The covariance matrix of the residuals, Σ, can be decomposed as $A_0 A_0^{'} = \Sigma$, with A_0 representing the contemporaneous impact of the structural shocks, ε_t, where $\nu_t = A_0 \varepsilon_t$. The lag length of the endogenous variables is set at four, reflecting convention in studies employing similar VAR models to quarterly data (see Christiano et al. 1996; Del Negro and Otrok, 2007; Mumtaz and Surico, 2009; Barakchian and Crowe, 2013). As shown in the sensitivity analysis, the main results are very similar for alternative lag lengths.

We adopt Bayesian techniques to estimate our open economy VAR. In this paper, we follow the approach used by Banbura et al. (2010), who implement a natural conjugate extension of the Minnesota prior popularized by Litterman (1986) through dummy observations. This prior approach has the advantage of easy implementation (Koop, 2013), enabling computationally feasible estimations of large information sets. Furthermore, this approach overcomes the curse of dimensionality by allowing for the estimation of VARs with a larger number of variables, as is the case in our paper, compared to small-scale VAR models that use only key macroeconomic indicators.[3] The latter is achieved by shrinking all VAR coefficients towards zero, except for coefficients on the first lags of the dependent variable in each equation. These coefficients are either shrunk towards one (for variables that exhibit substantial persistence) or zero (for variables that do not). Another advantage is that the Bayesian simulation methods employed in our paper, specifically Gibbs sampling, provide an efficient way to obtain point estimates and to characterize the uncertainty around those point estimates by obtaining confidence bands. The details of the dummy prior are described in the Appendix A.1.

[2] Results are available upon request from the authors.
[3] The 'curse of dimensionality' refers to the fact that coefficients tend to increase exponentially with the number of endogenous variables and the number of lags in the VAR system. This can lead to overfitting with adverse consequences both for structural analysis and for forecasting.

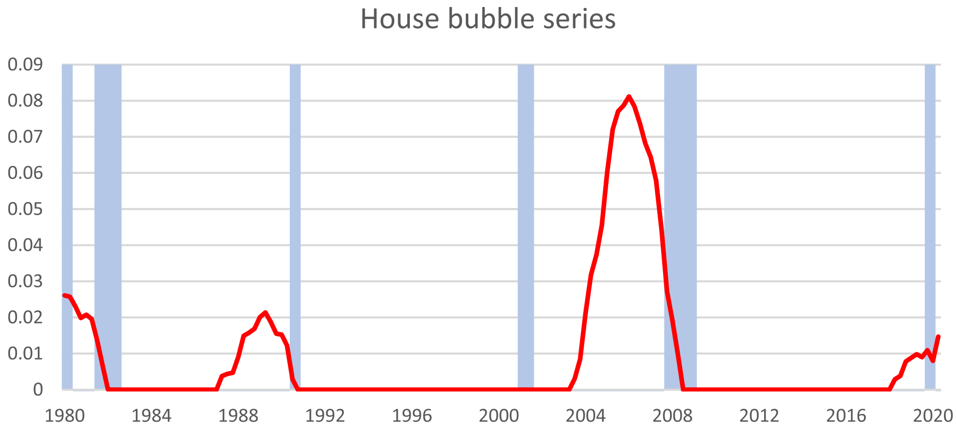

Fig. 2.

3.2.1. *Identification of the shocks*

We follow the methods developed by Canova and De Nicolo (2002) and Uhlig (2005) by imposing sign restrictions to identify the saving glut and the US monetary policy shock. The underlying idea behind sign restrictions is to rely on economic theory to derive reasonable signs for the impulse responses. Following Sa and Wieladek (2015), we identify the saving glut shock in the ROW as a shock that leads to lower levels of world economic activity (as proxied by the WIP), which in turn leads to lower long-term rates in the US, a real appreciation of the dollar, and a deficit in the current account. Regarding the monetary policy shock, we follow the standard practice in the literature (see Uhlig, 2005; Baumeister and Benati, 2013) and assume that a US expansionary monetary policy shock is consistent with a decrease in the FFR, which leads to a rise in GDP and inflation, a depreciation of the dollar, a decrease in the long-term rate, and a deterioration in the US current account balance. Finally, the third type of shock, a house bubble shock, is identified recursively using a Cholesky decomposition. Following Gilchrist et al (2005), the bubble series is ordered first in the vector of variables as we assume that it is the most exogenous variable in the system that affects all the other variables contemporaneously.

Table 1 shows the composition of each BVAR specification. Specifically, the first and second VARs focus on identifying the global glut shock and the US monetary policy shock, respectively. It is worth noting that, as our interest lies in directly comparing the impact of both shocks on the bubble component, these specifications are nearly identical, with the exception that the global saving glut VAR does not include domestic CPI as it is not relevant for identifying the saving glut shock.[4] The third column presents the VAR specification that allows us to identify the impact of a housing bubble shock. Columns 4 and 5 display the TV-VAR specifications that will be discussed in the next section.

4. Results

4.1. *Saving glut shocks, monetary policy shocks and house bubbles*

We begin our empirical exploration by examining the responses to a saving glut shock, with the shock size set at one standard deviation. Figure 3 shows the impulse responses over a span of 10 quarters, which were derived from estimating the BVAR using the aforementioned sign restrictions. The Figure depicts the median and the 68% error bands of the posterior distribution of impulse responses.[5]

The saving glut shock leads to a current account deficit and a dollar appreciation. It is noteworthy that the decrease in the US current account remains significant throughout the entire period, even though the restriction only applies for one period. Additionally, the shock results in a decrease in US long-term interest rates.[6] These findings align with Krishnamurthy and Jorgensen (2007) and Warnock and Warnock (2009) who emphasize the role of the global saving glut in lowering US long-term interest rates. Our results are also consistent with the theoretical predictions of Caballero et al. (2008). The authors develop a model that incorporates two regions, the US and the ROW, and use it to analyze the implications of gradual integration and the emergence of fast-growing economies in the ROW. This phenomenon generates a current account deficit in the US and a decline in long-term interest rates. Furthermore, the dollar experiences an initial appreciation followed by a gradual depreciation until it stabilizes in the long run, which corresponds to the response depicted in Figure 3.

[4] To ensure that our results are not sensitive to the exclusion of US CPI in the saving glut specification, we run a specification with US CPI included. The responses (available upon request), qualitatively and quantitatively are largely unchanged.

[5] Note that in contrast to the frequentist approach, it is standard practice in Bayesian VARs to report 68% error bands (see Sims and Zha, 1999; Banbura et al., 2010; Liu et al., 2014; Inoue and Rossi, 2021).

[6] The short-term rate proxied by the FFR (not depicted here) also falls in response to the saving glut shock, consistent with the theoretical and empirical responses of Sa and Wieladek (2015).

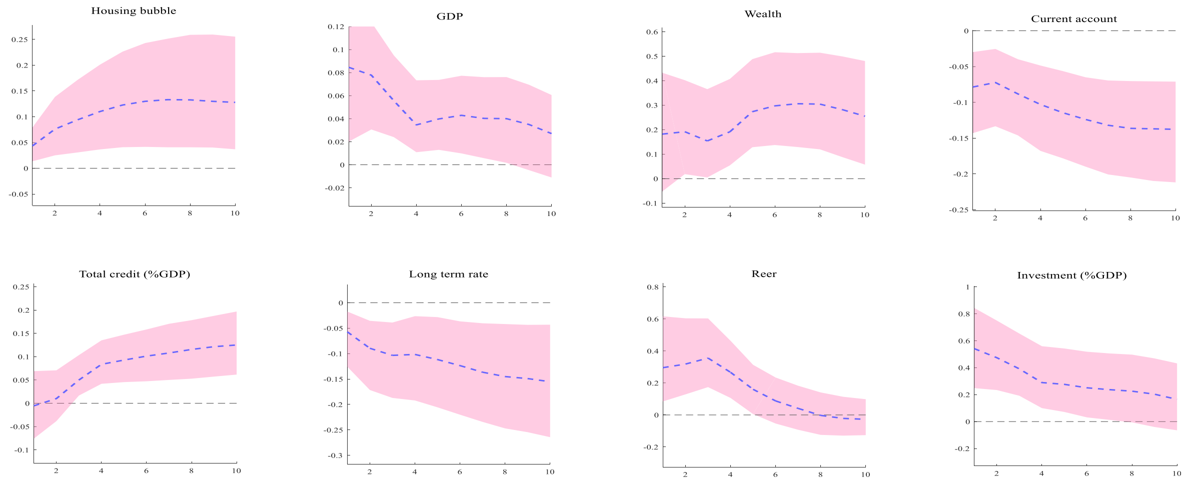

Fig. 3. Responses to a saving glut shock.

Our rich BVAR specification allows us to delve deeper into the underlying effects of the saving glut on the US economy. Figure 3 illustrates that a capital inflow resulting from the saving glut stimulates an increase in consumption, which subsequently leads to a rise in output (as indicated by the positive response of GDP). Furthermore, the influx of a global saving glut into the US contributes to the formation of a domestic housing bubble, as evidenced by the corresponding response. Specifically, our analysis reveals that the saving glut shock leads to a significant increase in the bubble index, with the point estimate indicating a 0.05% rise upon impact. By quarter 10, the bubble index further escalates to 0.13%. The emergence of the house bubble can be attributed to the lower long-term interest rates, which reduce borrowing costs and facilitate an upward trajectory in house prices. Furthermore, the house bubble contributes to an increase in the overall national wealth of the US, as reflected in the respective response. This development aligns with the theoretical predictions of Ikeda and Phan (2019). The rise in wealth, in turn, leads to higher levels of leverage, as evidenced by the positive response of total credit to GDP. Additionally, it stimulates business activity, as indicated by the response of investment to GDP, ultimately resulting in further expansion of GDP.

Figure 4 displays the impact of an expansionary monetary policy shock resulting in a one-standard deviation decrease in the FFR. The monetary expansion induces a significant depreciation of the dollar and exerts a positive effect on investment, credit, wealth, and the housing bubble. The response of the current account is negative and persistently so, aligning with the income absorption effect theory, which posits that an expansionary monetary policy stimulating domestic income also raises domestic import demand, resulting in a deterioration of the current account. Regarding the housing bubble response, while it is positive, there is no robust evidence of a substantial increase in house prices following the monetary policy shock, as the response remains statistically insignificant throughout the entire forecast horizon.

Taken together, the findings presented in Figure 3 and Figure 4 collectively show the effect of the saving glut shock is immediate, longer-lasting, and more potent in generating housing bubbles compared to US monetary policy shocks. This result is consistent with the evidence presented by Bernanke (2010) and Sa and Wieladek (2015) which suggests that US monetary policy played a less significant role in the first housing bubble that occurred prior to the GFC. Two points should be emphasized. First, following the GFC, the Fed implemented unconventional monetary policy measures such as asset purchase programs and open market operations, which are not accounted for in the baseline analysis. We account for the utilization of unconventional monetary policy measures at the zero lower bound as part of our robustness check. Additionally, we examine the robustness of our findings by excluding the Covid-19 period, specifically the last three observations from 2020Q1 to 2020Q3. As we show in the 'robustness analysis' section, the results remain largely unchanged.

Next, we turn our attention to the potential existence of reversed causality between global imbalances and housing bubbles. Figure 5 examines the impact of a housing bubble shock, representing the creation of a housing bubble, on the rest of the variables in the system. Following the shock, we observe a significant and persistent decline in the US current account. This finding is consistent with the theoretical research of Ikeda and Phan (2019) which suggests that bubbles arising from global imbalances facilitate capital flows from the ROW to the US. Specifically, the emergence of a bubble in the US increases investment returns in the country, attracting more capital from the ROW. As a result, the current account deteriorates, further reinforcing global imbalances.

We also observe a positive and significant response of wealth. This finding is consistent with Laibson and Mollerstrom (2010), who suggest that the housing bubble increased US wealth, leading to an investment and consumption boom that, in turn, increased GDP. As illustrated in Figure 5, our model successfully predicts these increases in GDP and investment, as we witness significantly positive and persistent responses of both variables to a housing bubble. Last, note that the response of the 10-year US rate is statistically insignificant. This finding is reasonable when considering our previous discussion of Figures 1(a) – 1(c) which indicated stable longer-term interest rates during the formation of the housing bubble from 2002 to 2006. The non-responsiveness of long-term rates to the appearance of a housing bubble highlights the importance of other mechanisms in explaining fluctuations in long-term rates, such as the global saving glut shocks we demonstrated earlier.

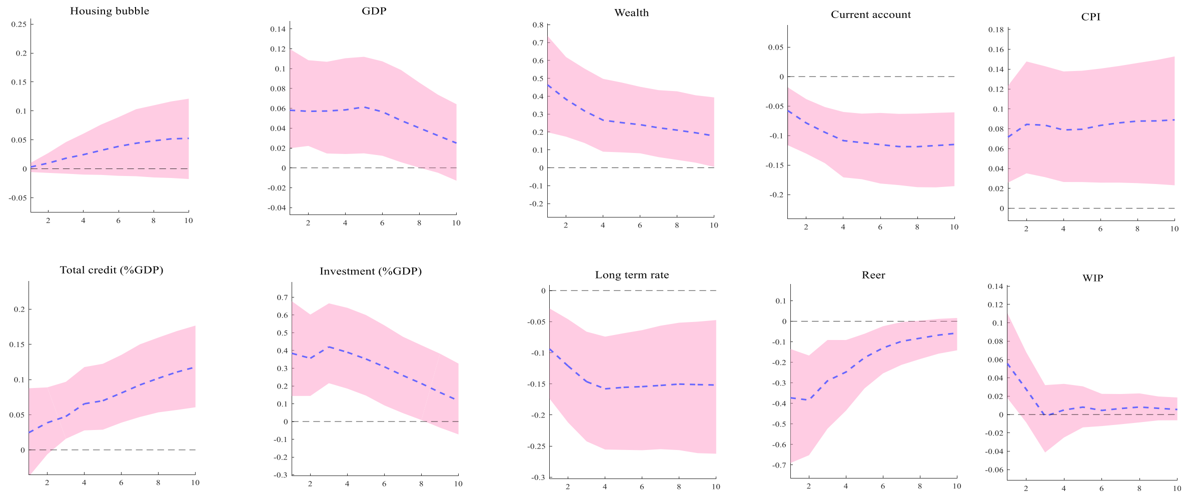

Fig. 4. Responses to a US monetary policy shock.

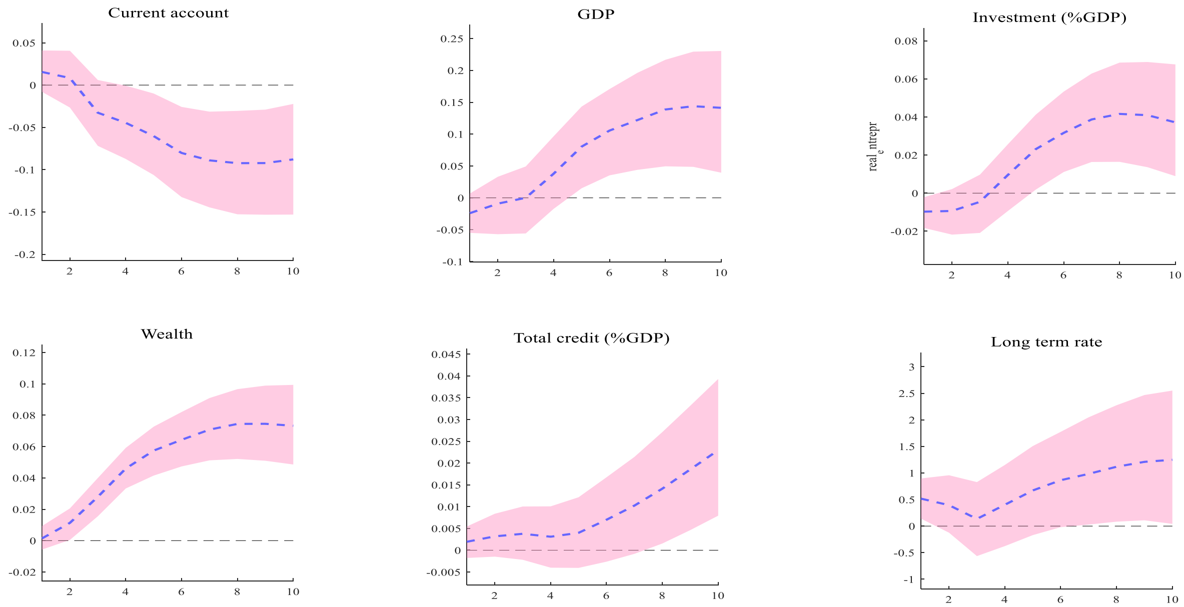

Fig. 5. Responses to a house bubble shock.

Another constructive approach to assessing the relative importance of monetary policy and saving glut shocks in the emergence of housing bubbles in the US is by comparing their respective contributions using forecast error variance decompositions (FEVD). This analysis aims to determine the proportion of variance in the formation of housing bubbles that can be attributed to saving glut shocks and monetary policy shocks.

Table 2
Forecast error variance decompositions (FEVD).

	Shocks	
	Saving Glut	Monetary Policy
House bubble		
1 year	2.1%	1.0%
2 years	8.4%	4.1%
3 years	16.3%	5.9%
4 years	19.1%	5.6%

Table 2 presents the FEVD at various forecast horizons, ranging from one to four years after the shock. From the end of the first year, we observe a significant increase in the impact of both shocks. Saving glut shocks account for a larger proportion of the variance in house bubbles compared to monetary policy shocks. Furthermore, note that both shocks explain a considerable portion of the variation in house prices over longer horizons. Specifically, the combined effect of the saving glut shock and the monetary policy shock explains 12.5% of the variation in housing prices after two years and 22.2% in the third year. This finding supports the hypothesis that saving glut shocks have played a more significant role in driving the increase in house prices compared to US monetary policy. There may be other factors, that we do not study, that may have an impact on developments in the housing market. These shocks may include foreign monetary policy shocks, housing demand shocks such as housing preference shocks, or productivity shocks in construction (Iacoviello and Neri, 2010; Bracke and Fidora, 2012; Sa and Wieladek, 2015).

4.2. Uncovering the time varying impact of monetary policy and the saving glut on house prices

In the previous section, we reported the impulse responses of various variables, including the build-up of housing bubbles, to two structural shocks generated by a BVAR with constant parameters. Although the evidence from our rich-information BVAR is essential as it allows us to relate leverage, housing bubbles, the US current account, and wealth, it is a time-invariant model that depicts the average effect of both shocks over the entire sample period. This feature, does not allow us to uncover potential time variation in the strength and impact of both shocks on the build-up of house prices.

Such time-variation may come about because of changes in financial globalisation, in the case of saving glut shocks. Some properties of financial globalisation may have amplified saving glut shocks, while others may have mitigated the impact of such shocks. Time variation could also appear in the case of monetary policy. If monetary authorities detect a build-up of asset prices, they could react by raising interest rates. However, it is not clear whether and to what extent house prices may respond, even if central banks follow such a contractionary monetary policy. During times of economic euphoria and optimism among agents, do house prices respond differently compared to normal times? Another source of time variation arises from the impact of monetary policy on expectations regarding current and future interest rates, which, in turn, influences house prices. Agents' expectations may respond differently to various monetary policy measures, resulting in different reactions in house prices depending on whether conventional or unconventional monetary policy is implemented.

We address these issues by estimating a Bayesian time-varying VAR (TV-VAR) model with stochastic volatility. Doan et al. (1984) and Sims (1993) were the first to show how estimation of a TVP-VAR with Letterman priors could be conducted by casting the VAR in state space form and using Kalman filtering techniques. Bayesian TV-VARs have become popular in empirical macroeconomics following the work of Cogley and Sargent (2002, 2005) and Primiceri (2005) who provided the foundations for Bayesian inference in these models and used the innovations in MCMC algorithms to improve their computational feasibility. We provide a description of the TV-VAR model and its estimation algorithm in Appendix A.2.

A common choice in the TV-VAR literature is to limit the number of variables to maximum six, due to the computation intensity of the model (Primiceri 2005, Galı and Gambetti 2009, Lubik and Matthes 2015). Thus, there is a trade-off between time-varying shock dynamics and the limited information set, which does not allow us to accommodate the rich underlying tapestry of the economy that was captured by the medium scale BVAR model. We focus on the response of the variable of main interest, housing prices, and we use the minimum required variables to identify both global saving glut and monetary policy shocks. Note that in our analysis, we include the S&P/Case-Shiller home price index instead of the housing bubble series, as the latter is zero for most of the time and therefore does not lend itself nicely to a time varying context. We estimate two different time-varying VAR models since a different set of variables is required to identify US domestic monetary policy and global saving shocks. The TV-VAR for the saving glut shock includes the variables depicted in column 4 of Table 1. Regarding the monetary policy specification, the endogenous variables of our system are depicted in column 5 of Table 1.[7]

Note that, as we are now interested in exploring the effect in each period in the sample, we need to account for the unconventional monetary policy measures that were introduced during and after the GFC, notably the QE interventions, under which the Fed purchased long-term bonds and other risky assets to support the economy. QE would be expected to increase house prices by reducing the total supply of risky long-term bonds to the private sector, which, in equilibrium, induces financial intermediaries to rebalance from risky bonds to housing (te Kaat et al., 2021). In our TV-VAR, we consider the impact of unconventional monetary policy (UMP) on house prices by replacing the policy rate with the shadow short-rate from Wu and Xia (2016) during the zero lower bound period. The advantage of the shadow rate over other proxies for UMP measures is that it uses information from the entire yield curve, including forward guidance, quantitative programs, and their announcements (Wu and Xia, 2016; Lombardi and Zhu, 2018). Consequently, the shadow rate can capture the overall effects of a given measure.

Figure 6 and Figure 7 show the time varying impulse responses of the housing price index to saving glut shocks and monetary policy shocks respectively. Both shocks are identified using the sign restrictions approach that we set out before.

As Figure 6 reveals, housing prices increase in response to a saving glut shock throughout the sample. Most importantly, however, the impact of saving glut shocks is much more pronounced in the post-1995 period, including the 2002–06 housing bubble. This result nicely reflects the global imbalances that started to affect the US from the mid-1990 s onward as a result of the emergence of China and other emerging economies on the world economic stage (see Obstfeld and Rogoff, 2009).

[7] The shadow rate data are available from January 1990 thus the TV-VAR specification with the shadow rate is estimated from 1990Q1-2020Q3.

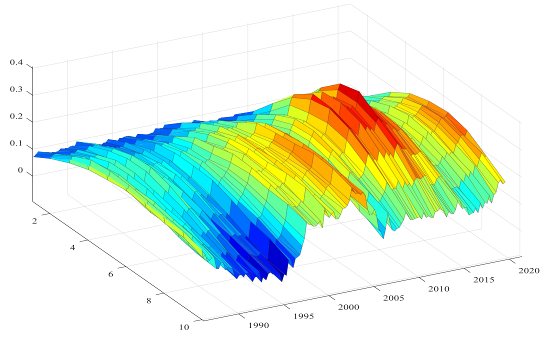

Fig. 6. Time-varying responses of house prices to saving glut shocks.

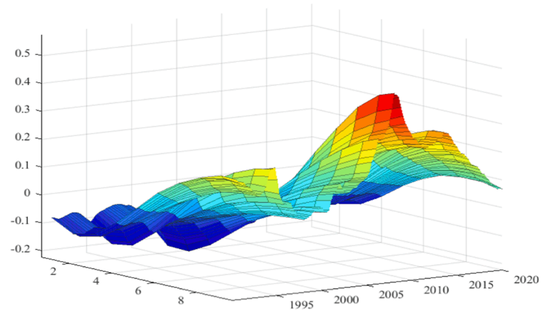

Fig. 7. Time varying responses of house prices to conventional and unconventional MP shocks.

Figure 7 shows the time-varying responses of housing prices to both conventional (pre-GFC period) and unconventional monetary policy shocks (post-GFC period). Housing prices always increase in response to the shocks. Regarding the impact of conventional monetary policy, note that from 2000 to around 2006, the response of housing prices to expansionary monetary policy shocks is weakened and less persistent compared to the pre-2000 period. This suggests that monetary policy has played a decreasing role in explaining housing price fluctuations, including the housing boom in the pre-GFC period. This result plausibly reflects the Great Moderation in inflation that the US economy experienced during the 1990s. The price stability and consumer optimism during that period drove moderate but steady increases in housing prices.

Next, we focus on the post-2007 period, i.e., the zero lower bound period where non-standard measures were implemented. We observe a strong response of housing prices to UMP shocks. Two lessons can be learned by examining Figure 7 and, at the same time, comparing it with Figure 6. First, housing prices respond much more strongly to unconventional monetary policy measures implemented after the GFC, than to standard monetary policy expansions implemented before the crisis. This is because QE increased the origination of home purchase mortgages, which in turn explains the heightened responses of housing prices (Luck and Zimmermann, 2020). Second, we observe that in the most recent period, specifically from 2019 onward, the effects of both monetary policy and saving glut shocks on house prices remain elevated. This finding is an initial indication that, unlike the pre-GFC housing bubble, the recent exuberance in housing markets is driven by both expansionary monetary policy and the global saving glut. We delve deeper into this topic in the next section.

4.3. Saving glut, monetary policy, or both? Scenario analysis

We investigate both housing bubbles by using our TV-VAR to construct two counterfactual policy experiments based on conditional forecasts. Within our context, conditional forecasts can be understood as scenarios that involve projecting a set of variables of interest onto future paths of other variables. In our case, these variables are the FFR (or the shadow rate when UMP is considered) to gauge the stance of monetary policy, and the US current account to simulate the impact of a saving glut shock on the US house prices.[8]

We construct our counterfactuals as follows. The first counterfactual is designed to assess the significance of expansionary (conventional) monetary policy versus the saving glut in the pre-GFC housing bubble. Specifically, we estimate the TV-VAR from 1968Q2 to 2001Q2 and then conduct the counterfactual experiment from 2001Q3 to 2005Q2. The counterfactual experiment involves two conditional forecasts. The first conditional forecast assumes that the Fed never reduced its policy rate; instead, it would have

[8] In the robustness section, we repeat the counterfactual by restricting the world industrial production index (WIP) instead of the US current account.

maintained the FFR in a range of around 3.5% to 4.5%. We refer to this scenario as 'monetary policy tightening'. The second conditional forecast assumes that the US current account did not deteriorate between 2001Q3 and 2005Q2. This scenario implies the absence of a global saving glut.[9] Figure 8 illustrates the counterfactual paths of both the FFR and the US current account.

In terms of the second counterfactual, it is designed to reassess the significance of both shocks in the more recent increases in housing prices that began in mid-2019. Specifically, we aim to explore whether the transition to an accommodative monetary policy stance, characterized by interest rate cuts in early 2019 and the subsequent introduction of additional asset purchases in March 2020, might have contributed to the recent surge in house prices.[10] Additionally, given the significant drop in the US current account deficit during the same period (see Figure 1c), we investigate whether the saving glut could once again be the primary factor driving up house prices.

Similar to the first counterfactual, this one consists of two conditional forecasts as well. We now estimate the TV-VAR from 1968Q2 to 2018Q4 and we carry out the counterfactual experiment from 2019Q1 to the last date of our sample that is 2020Q3. In terms of the counterfactual path of monetary policy, we now use the shadow rate (instead of the FFR), as the policy scenario under investigation takes place in the post 2007–08 period where monetary policy was constrained by the zero lower bound (ZLB). Specifically, the counterfactual path of the shadow rate exhibits a steady increase (orange dotted line), in contrast to the substantial decline observed in the actual shadow rate series (blue line). This counterfactual scenario represents a world where monetary policy was not expansionary, meaning that no interest rate cuts were initiated from 2019 onwards, and no additional round of QE was implemented from March 2020 onward in response to the Covid-19 crisis. In relation to the counterfactual path of the US current account, as before, it reflects a case where the current account balance remained flat, instead of the large deterioration that we observed in reality. Both counterfactual paths can be seen in Figure 9.

Figure 10 and Figure 11 illustrate the results for the pre-GFC housing bubble and the 2019–2020 housing bubble, correspondingly. The blue line shows the actual data for the log of house prices, the brown dotted line shows the median conditional forecast of the house prices under the alternative monetary policy scenario, that is a monetary tightening, and the pink dotted line shows the median conditional forecast under the scenario of 'no saving glut'. Essentially, the difference between the dotted lines and the actual data can be interpreted as the impact of monetary easing and the global saving glut, respectively, in boosting house prices.

Comparing both dotted lines in Figure 10 reveals that the forecast of house prices is clearly much higher in the monetary tightening scenario compared to the 'no saving glut' scenario. This means that house prices would have reached a much lower value if the global saving glut was not present, rather than if US monetary policy was contractionary. This finding corroborates the empirical evidence presented in the previous section, suggesting that the pre-GFC housing boom was primarily driven by the global glut and, to a lesser extent, by US monetary policy. We next turn to Figure 11. Both conditional forecasts show lower trajectories compared to the actual house price series. This suggests that in the absence of expansionary monetary policy or a global saving glut, house prices would not have experienced such substantial increases. It is worth noting that compared to the previous simulation, both effects on house prices are not as sizeable as in the pre-GFC housing bubble.

In addition, we observe that, unlike the pre-GFC housing bubble, there is no systematic difference between the two conditional forecasts until early 2020. Specifically, we note a negligible gap between the two forecasts, indicating that both the monetary policy easing implemented by the Fed in 2019 and the global saving glut played a role in driving up asset prices. However, the gap between the forecasts begins to emerge in early 2020. Although the size of the gap is modest compared to the previous simulation, the effect is still non-negligible, with the counterfactual forecast of a tightening monetary policy falling below the counterfactual forecast under the 'no saving glut' scenario. This result suggests that the second phase of the Fed's actions in early 2020, when additional asset purchases were launched, had a more pronounced effect in fuelling the recent exuberance in house prices compared to the effect of the global saving glut.

The validity of the counterfactuals depends on the characteristics of the shocks. In particular, if these shocks are exceptionally large, agents may update their beliefs about the policy regime and the structure of the economy, as described by the Lucas critique. To assess the plausibility of our counterfactual simulations, we follow the approach of Leeper and Zha (2003) in determining if they can be regarded as 'modest'. This implies that economic agents do not revise their expectations, making the counterfactual simulations plausible. Following Antolin-Diaz et al. (2020), we examine whether the distribution of the conditional forecast of house prices under the counterfactual scenario deviates significantly from its unconditional distribution. If there is a significant deviation, it suggests that the counterfactual policy scenario should be deemed improbable, indicating a change in the VAR. The conditional forecasts are constructed by tracing the paths of the policy rate (or shadow rate) and the current account, as described above (refer to Figure 8 and Figure 9). Other shocks in the model are perturbed without any constraint.

We compute four conditional and unconditional forecasts, consisting of a pair for each of the counterfactual scenarios discussed above. These forecasts are computed over a horizon of $h = 34$ quarters for the pre-GFC counterfactual experiment and $h = 24$ quarters for the post-GFC counterfactual experiment. The initial conditions for the forecasts are based on the data up to the starting date of each counterfactual experiment. Unlike the counterfactuals presented in Figure 10 and Figure 11, these conditional and unconditional

[9] The counterfactual path of the current account is generated by an AR (1) process for the current account estimated over the same sample period.

[10] Specifically, in early 2019, the Federal Reserve stabilized the policy rate at around 2.40% and subsequently initiated a series of interest rate cuts, eventually leading to near-zero levels by March 2020. The situation was further amplified by the introduction of a new QE round in response to the Covid-19 pandemic. In March 2020, following the lowering of the FFR to a range of 0% to 0.25%, the Fed resumed substantial purchases of debt securities. This involved the announcement on March 15, 2020, of plans to purchase at least $500 billion in Treasury securities and $200 billion in government-guaranteed mortgage-backed securities over the forthcoming months.

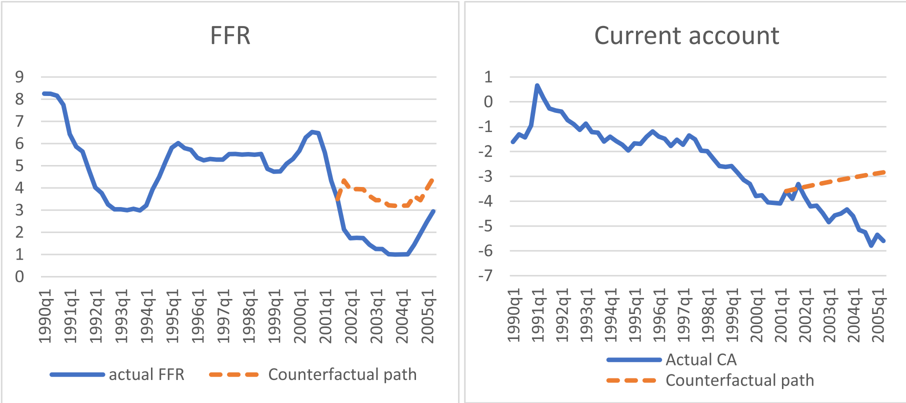

Fig. 8. pre-GFC Housing Bubble /Actual and counterfactual paths.

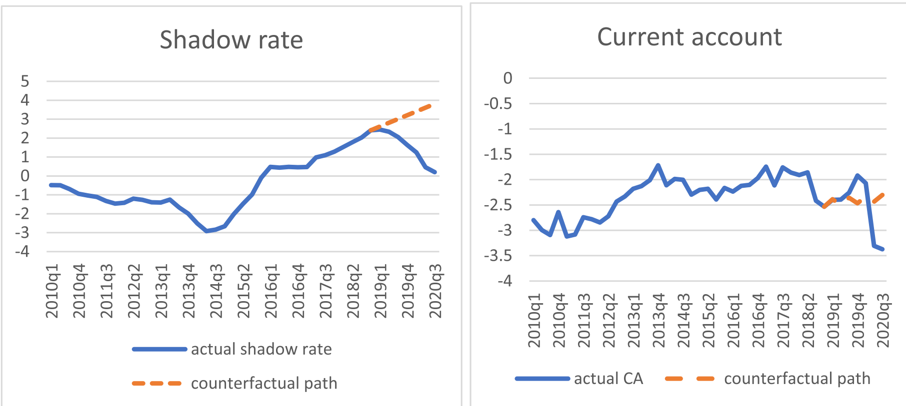

Fig. 9. post-GFC housing bubble of 2019–2020/Actual and counterfactual paths.

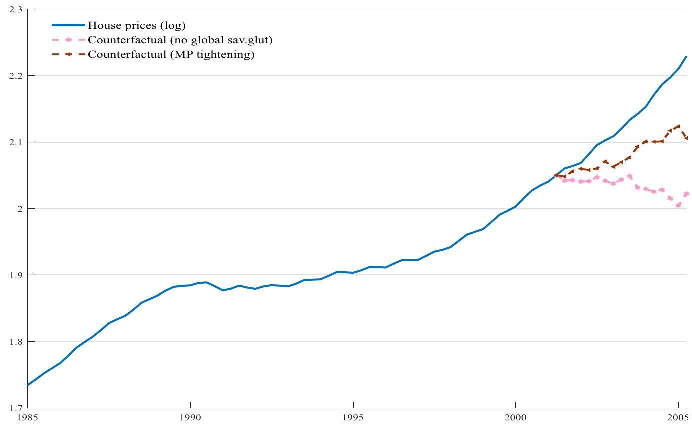

Fig. 10. Counterfactual pre-2007: Monetary policy vs global saving glut.

forecasts are based on the VAR estimated over the entire sample period (in sample forecasts). This is because we require a longer sample to produce reliable estimates and avoid more dispersed posterior distributions. The conditional and unconditional forecasts for each counterfactual scenarios can be found in Figures S22, S23, S24, and S25 in the Appendix. The median of the conditional forecasts is reported in solid blue line, with 68% error bands depicted in blue areas. The median of the unconditional forecasts is shown by a solid red line, along with 68% error bands represented by red dotted lines.

In all cases, we observe virtually no significance difference, as the median of the unconditional forecast distribution of house prices

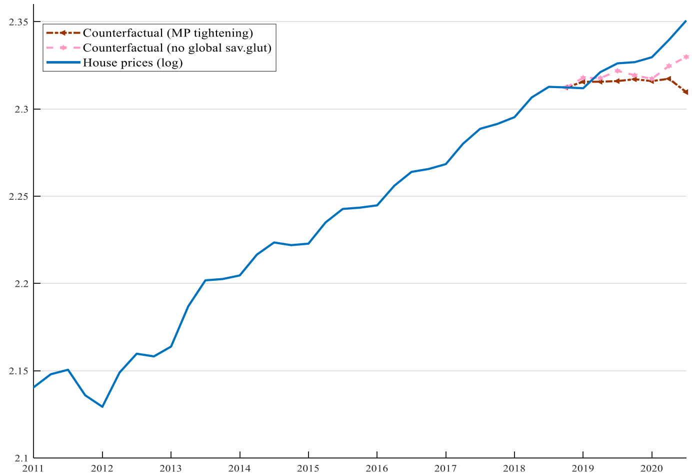

Fig. 11. Counterfactual 2019–2020: Monetary policy (both conventional and unconventional) vs global saving glut.

lies within the blue shaded area and remains very close to its conditional forecast distribution. The only exemption is the counterfactual scenario involving the alternative current account path in A.23, where a deviation is observed. However, even in this case, the unconditional forecast largely falls within the blue shaded area, and the forecast bands overlap. Therefore, we can conclude that all of our counterfactual experiments are plausible.

4.4. *Robustness analysis*

We test the robustness of our main findings by implementing an extensive sensitivity analysis.

4.4.1. *Alternative identification*

We estimate an alternative version of our baseline monetary policy specification following Boeckx et al. (2017) and Burriel & Galesi (2018), who assume that monetary policy shocks have no contemporaneous impact on output and inflation. Figure S1 displays the responses to a monetary policy shock. The specification yields responses that are very similar to our baseline model.

4.4.2. *Alternative macroeconomic variables*

We estimate multiple versions of our three baseline specifications: the saving glut shock, the monetary policy shock, and the house bubble shock. We examine whether the impulse responses are sensitive to the use of alternative macroeconomic measures. Specifically, we re-estimate the benchmark models by replacing GDP with alternative proxies for economic activity. One version includes the index of industrial production (IP), and another version includes the unemployment rate. The results are presented in Figures S2, S3, S4, S5, S6 and S7, respectively. All specifications yield responses that are largely unchanged. Furthermore, when we re-estimate our main specification of monetary policy shocks by including the producer price index (PPI) as an alternative measure of prices (instead of CPI), the obtained responses do not differ from the baseline ones (see Figure S8).

4.4.3. *Alternative measures of global economic conditions*

We examine the potential sensitivity of our results by considering two different measures of global indicators. The first measure, proposed by Baumeister et al. (BKL, 2022), is the global economic conditions indicator. This comprehensive index incorporates a diverse dataset that encompasses various dimensions of the world economy, relevant for capturing aggregate fluctuations. The index combines 16 variables, including broad measures of real economic activity, commodity prices, financial indicators, uncertainty measures, weather-related variables, transportation demand indicators, expectations measures, and energy-related indicators.

The second measure we utilize is the index of global real economic activity, developed by Kilian (2009). This index is based on international shipping costs and relies on the rationale that raw industrial materials must be transported before they can be used in production. Thus, an upswing in the global economy leads to increased demand for industrial commodities and shipping services. Consequently, shipping costs rise, given that the supply of ships remains fixed in the short run.

By incorporating these alternative measures of global indicators, we aim to assess the robustness of our findings and provide a more comprehensive analysis of the factors influencing the housing market dynamics.

Figures S9 and S10 display the responses to a saving glut shock, utilizing the BKL index and Kilian's index as proxies, respectively. Comparing both figures with the baseline model reveals a consistent pattern, indicating a decrease in the long-term interest rate, a deterioration of the US current account, an increase in wealth, leverage, investment, and a build-up of house prices, as indicated by the positive reaction in the house bubble response. Our results, not shown here, remain robust when employing an index of household consumption expenditure in the ROW to identify the saving glut shock (following Sa and Wieladek, 2015).

4.4.4. *Lag selection*

Our results remain largely unchanged when we consider alternative lag lengths. Figures S11 and S12 display the responses to a monetary policy shock and a global saving glut shock, respectively, when we estimate a VAR with six lags. The responses in both figures exhibit the same qualitative patterns and are quantitatively very similar to our baseline BVARs. Additionally, we also re-estimate our baseline specifications with a smaller number of lags, specifically a lag order of three. Once again, our results remain largely unaffected (not reported here but available upon request).

4.4.5. *Alternative monetary policy instrument*

The FFR has historically been the Fed's primary monetary policy instrument. However, after December 2008, the FFR was constrained by the ZLB, and the Fed utilized other unconventional policy tools in place of the policy rate. Since the period of the ZLB is relatively short compared to the overall sample period we consider, we do not expect this period to significantly impact the average responses of our baseline model. To verify this, we conduct an alternative specification where, during the ZLB period, we substitute the FFR with the shadow interest rate constructed by Wu and Xia (2016) to capture the monetary policy stance when the FFR was zero. As depicted in Figure S13, our main results exhibit minimal variation.

4.4.6. *Sample period ends in 2019Q4*

We also re-estimate our baseline VARs by excluding the data from the pandemic period in 2020. Since this period consists of only three observations at the end of our sample, we do not expect it to 'contaminate' our sample which could potentially lead to unreliable results. As depicted in Figures S14 and S15, the responses to a monetary policy shock and a global saving glut shock respectively exhibit minimal changes, reaffirming the robustness of our findings.

4.4.7. *Alternative measure of the bubble*

We follow Shi (2017), Shi et al. (2020) and Shi and Phillips (2023) and use the residuals obtained from the following regression as a proxy for the non-fundamental component of the housing bubble. The regression model includes the log house price/income ratio as the dependent variable, while the independent variables consist of the real interest rate (computed as the nominal 30-year mortgage rate minus the University of Michigan inflation expectations index), log employment, log population, and log housing supply (proxied by new housing completions). All data is obtained from FRED. The constructed index is depicted in the upper panel of Figure S16, while the bottom panel displays the responses to the shock using the alternative bubble proxy. Notably, the responses are largely unchanged from the baseline results.

4.4.8. *TV-VAR: Alternative measure of global economic conditions*

We re-estimate our TV-VAR specification by substituting the world industrial production index with the global economic conditions index, BKL, as previously described. Similar to the baseline specification, Figure S17 illustrates that the influence of saving glut shocks is notably more significant in the post-1995 period. It is worth mentioning that we also conducted experiments using Kilian's index, and our findings align with these specifications (results not included here but can be provided upon request).

4.4.9. *TV-VAR: Alternative measure of unconventional monetary policy*

We use an alternative measure of unconventional monetary policy, namely the shadow rate proposed in Claus et al. (2018) and Krippner (2020). As Figure S18 shows, this alternative specification yields similar time-varying responses.

4.4.10. *Counterfactuals: Alternative restricted variable*

We replicate the two counterfactual scenarios by constraining the world industrial production index (WIP) instead of the US current account. Figure S19 shows the counterfactual paths of this indicator. The left figure corresponds to the path that informs our analysis of the pre-GFC housing bubble, while the right figure depicts the path used in the analysis of the 2019–2020 housing boom. Note that in both cases, the counterfactuals are constructed to ensure that the WIP index never experiences a decline. This represents a hypothetical world without a global saving glut. Figures S20 and S21 present the forecast of house prices under both scenarios. Similar to the previous analysis, the results remain largely unchanged, underscoring the significant impact of the global saving glut on the housing boom prior to the GFC, as well as acknowledging the combined influence of monetary policy and the global saving glut on the recent surge in house prices.

5. Conclusion

The GFC of 2007–09 was the worst economic and financial debacle in the US since the Great Depression of the 1930 s. It originated in the US and quickly spread across the world, affecting financial markets, banking institutions, and real estate markets. This led to high levels of unemployment, GDP contractions, and significant wealth losses. Extensive research has been conducted to understand the events, identify the causes, and evaluate the effectiveness of policies implemented to mitigate the catastrophic consequences. Over time, a consensus has emerged that attributes the triggering of the GFC to the bursting of the US housing bubble.

The pre-GFC period witnessed rapid increases in US housing prices, and a similar housing price boom emerged in 2019. These trends were driven by various factors, including low interest rates. However, the specific cause of these low interest rates remains a topic of debate. Was it the result of expansionary monetary policies in the US or the presence of a global saving glut?

The results of this paper suggest that global saving glut shocks have played a significant role in driving housing bubbles in the US.

Additionally, it indicates a reinforcing relationship between capital inflows and housing bubbles. The development of a housing bubble in the US leads to increased wealth, consumer spending, and a deterioration in current account deficits, exacerbating global imbalances. We also find that in the pre-GFC housing bubble, conventional monetary policies played a relatively minor role compared to the impact of saving glut shocks. In more recent times, the monetary policy easing, implemented by the Fed in 2019, and the global saving glut both contributed to the recent house price exuberance.

The findings of our study underscore a strong call for the development of policies that actively address housing bubbles stemming from external shocks. The focus should be on implementing measures that insulate the economy against the accumulation of substantial current account deficits. Additionally, policymakers should prioritize raising awareness among central bankers regarding the potential unintended consequences associated with implementing unconventional monetary policy interventions, particularly in relation to the risks posed to financial stability.

CRediT authorship contribution statement

Anastasios Evgenidis: Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Data curation, Writing – original draft, Writing – review & editing, Visualization. **Anastasios Malliaris:** Conceptualization, Investigation, Data curation, Writing – original draft, Writing – review & editing, Visualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jimonfin.2023.102919.

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