

# THE MACROECONOMIC EFFECTS OF GOVERNMENT ASSET PURCHASES: EVIDENCE FROM POSTWAR U.S. HOUSING CREDIT POLICY\*

ANDREW J. FIELDHOUSE  
KAREL MERTENS  
MORTEN O. RAVN

We document the portfolio activity of federal housing agencies and provide evidence on its impact on mortgage markets and the economy. Through a narrative analysis, we identify historical policy changes leading to expansions or contractions in agency mortgage holdings. Based on those regulatory events that we classify as unrelated to short-run cyclical or credit market shocks, we find that an increase in mortgage purchases by the agencies boosts mortgage lending, in particular re-financing, and lowers mortgage rates. Agency purchases also influence prices in other asset markets, stimulate residential investment, and expand homeownership. We compare these effects to those of conventional monetary policy shocks, and we provide evidence on the interactions between housing credit and monetary policies. *JEL Codes:* E44, E52, N22, R38, G28.

## I. INTRODUCTION

The residential mortgage market in the United States is one of the largest capital markets in the world and by far the dominant source of credit for U.S. households. The mortgage market finances housing, which is a key component of household wealth and aggregate spending, see for example, [Leamer \(2007\)](#). Many accounts of the causes and propagating factors of the 2007/8 financial crisis assign an important role to a boom and bust in the availability of mortgage credit.<sup>1</sup> The U.S. mortgage market is also subject to

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1. See, for example, [Mian and Sufi \(2009\)](#), [Justiniano, Primiceri, and Tambalotti \(2015\)](#), or [Di Maggio and Kermani \(2017\)](#).

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heavy government involvement through various federal agencies, including the housing government-sponsored enterprises (GSEs). In the decades preceding the 2007/8 crisis, the various agencies collectively accumulated a large share of the total outstanding U.S. mortgage debt on their balance sheets. In this article, we investigate whether agency portfolio purchases of mortgage assets influence the availability and cost of housing credit and whether there are spillovers to other debt markets and economic activity more broadly.

Although the history of agency activity offers a rich source of variation to study the effects of government asset purchases, it also presents a number of challenges. The largest agencies, Fannie Mae and Freddie Mac, have been privately owned for much of their existence and therefore carry responsibilities to stock owners as well as to their public missions of providing “stability” and “ongoing assistance” in mortgage markets. Both profit and public objectives cause these agencies to systematically and rapidly respond to market conditions, such that changes in their mortgage purchasing activity reflect changes in housing credit demand and many other influences. Some of the correlation between agency balance sheets on the one hand and credit growth or mortgage rates on the other is therefore likely to reflect reverse causality.

Our strategy to isolate changes in agency purchasing activity free of confounding influences is to focus on historical credit policy interventions affecting agency mortgage holdings, in the spirit of the approaches in [Romer and Romer \(1989, 2010\)](#) and [Ramey \(2011\)](#) to studying monetary and fiscal policy. Based on a narrative analysis of the regulatory history of the housing agencies, we identify and quantify significant policy events affecting agency purchases. These include adjustments to capital requirements, portfolio caps, or statutory borrowing authority, direct appropriations and capital injections by the Treasury, or changes to the pool of mortgages eligible for agency purchase, such as changes in conforming loan limits or authorizations to enter new mortgage market segments.

Credit policy changes are often reactions to cyclical conditions in mortgage and housing markets, the recent crisis being a prime example. However, many interventions are motivated by other longer-run objectives, such as increasing homeownership. Based on an extensive analysis of historical sources, we classify each significant credit policy change as motivated by either cyclical

considerations or by other noncyclical objectives.<sup>2</sup> This results in a measure summarizing the noncyclically motivated policy events, which we use as an instrumental variable in regressions of a variety of outcome variables on measures of agency purchasing activity. Similar to the approach in [Ramey and Zubairy \(forthcoming\)](#) to estimating government spending multipliers, we estimate the cumulative effects of an increase in agency purchases on mortgage credit and originations, as well as impulse responses to news shocks about future agency purchasing activity.

It is not clear *ex ante* that government purchases of mortgage assets have meaningful effects on the cost and availability of housing credit. If financial market frictions are relatively unimportant, an increase in agency purchases may have little impact on the volume of mortgage credit and simply lead to crowding out of private holdings. If such frictions are instead pervasive, mortgage market policies may be very important for providing credit to residential borrowers. Based on our methodology, we find that agency purchases indeed lead to statistically significant expansions in mortgage credit. Our estimates indicate that each additional \$1 in agency mortgage purchases leads to a \$3 to \$4 cumulative increase in mortgage originations over the course of three to four years, and a net expansion in the stock of mortgage debt of around \$1. The rise in originations is largely driven by an increase in refinancing activity, but is also followed by a greater volume of originations financing home purchases. The expansionary effects on housing credit are accompanied by temporary reductions in mortgage interest rates, which fall by 10 to 15 basis points for more than a year following an increase in agency purchases of 1% of trend originations.

Agency purchases also affect prices in other asset markets. We estimate that the 10-year Treasury rate and the 3-month T-bill rate both decline when the agencies increase their purchases of mortgages. Key policy objectives behind the housing credit policies first introduced in the 1930s included boosting the availability of housing credit, increasing residential investment, and elevating homeownership over the long run, all recurrent motivations for subsequent policy interventions. We find evidence that supports these roles of the agencies in that new housing starts and homeownership rates rise following an increase in agency

2. The full narrative analysis is in a companion background paper, [Fieldhouse and Mertens \(2017\)](#), available at <http://www.nber.org/papers/w23165>.

mortgage purchases. We also find some evidence that agency mortgage purchases increase house prices and stimulate private sector consumption. There is no clear evidence of any significant impact on the unemployment rate or personal income.

Perhaps our most surprising finding concerns the relationship between housing credit and monetary policies. We show that the narratively identified housing credit policy shocks have forecasting power for the residual shock component of the [Romer and Romer \(2004\)](#) decomposition of federal funds rate target changes, while the reverse is not true. Instead, we find that cyclically motivated housing credit policy changes lean against the wind of contractionary monetary disturbances. Housing credit policy shocks have larger effects on refinancing originations than interest rate shocks and influence homeownership independent of short-term interest rates. The quantitative effects of housing credit policy and conventional monetary shocks are very similar along many other dimensions. These findings suggest that both may share similar transmission channels and that the interplay between monetary and credit policy deserves more attention.

In the [Online Appendix](#), we pursue an alternative identification strategy based on instrumenting agency purchases with shocks to Fannie and Freddie excess stock market returns. This approach is analogous to [Fisher and Peters \(2010\)](#), who use excess return innovations in major U.S. defense stocks as a measure of news shocks to military spending. The results validate the findings obtained from the narrative approach.

## II. MORTGAGE PURCHASES AS CREDIT POLICY IN THE UNITED STATES

The U.S. government intervenes in the mortgage market in many ways. We focus attention on the federal involvement in purchasing residential mortgages. The first significant use of this type of policy dates back to the Great Depression. The sharp and sustained downturn in credit markets motivated Congress to create the Home Owners' Loan Corporation in 1933. Financed by bonds, the corporation purchased delinquent mortgages from lenders and refinanced these mortgages into fully amortizing fixed-rate loans with long maturities to lower monthly payments for distressed mortgagors. In 1938, Congress created Fannie Mae to support a secondary market for government-guaranteed mortgages. Fannie's authority to acquire mortgage debt was increased greatly after World War II to support the construction sector and

promote homeownership among veterans. The late 1960s saw the creation of Ginnie Mae to provide continued support for the market for government-guaranteed mortgages. In 1970, Fannie Mae obtained permission to enter the conventional market, that is, the market for loans not directly guaranteed or insured by the government, and the newly created Freddie Mac joined Fannie Mae in developing a nationwide secondary market for conventional mortgages.

Over time, the agencies have played an increasingly active role. The two largest GSEs, Fannie and Freddie, acquire mortgages through advance commitments to buy loans from mortgage lenders, which are delivered once the loans are originated in the primary market.<sup>3</sup> Until the late 1960s, the purchases by Fannie were financed predominantly by borrowing from the Treasury. Afterward, as quasi-private entities, Fannie and Freddie financed these purchases with a mix of private capital and debt issued in capital markets. A third financing option is the issuance of mortgage pools, that is, mortgage-backed securities (MBSs). Securitization was brought to the conventional market by Freddie Mac in the early 1970s and took off in the 1980s when Fannie Mae entered the business. Mortgage securitization has consistently been GSE-dominated, perhaps with the brief exception of the 2004–2006 private-label securitization boom. In the process of packaging whole mortgages into securities, the agencies also assume the credit risk in return for guarantee fees. From the early 1990s onward, the agencies increasingly retained their own and acquired each other's MBSs, as opposed to selling them to private investors.

Figure I illustrates the evolution of agency involvement in the residential mortgage market over time. The upper left panel shows the stock of total residential mortgage debt as a ratio of GDP and as a ratio of total residential wealth. The upper right panel shows the total annualized volume of residential mortgage originations as a ratio of GDP and as a fraction of outstanding mortgage debt. The lower panels of Figure I provide measures of agency market shares, constructed by consolidating data on holdings and net purchases of whole loans and MBSs as reported on the agencies' balance sheets and activity statements. The left panel

3. Another major housing GSE is the Federal Home Loan Bank System, chartered during the Depression to provide wholesale liquidity to member mortgage lending institutions. We use the term GSE to refer to Fannie and Freddie.

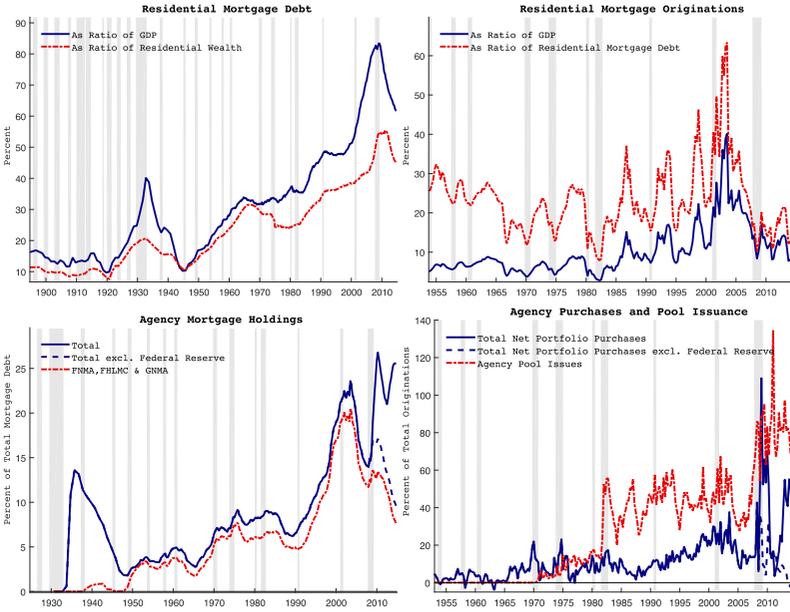


FIGURE I

Mortgage Debt, Annualized Originations, and Agency Market Shares

Residential mortgage debt and originations include home as well as multifamily mortgages. Agency holdings include holdings of both whole loans and pools. Agency purchases are net purchases for portfolio investment, whereas pool issuance approximates purchases backing new mortgage pools (mortgage-backed securities). The gray bars are NBER-dated recessions. See [Online Appendix III](#) for sources.

shows the fraction of mortgage debt owned by Fannie, Freddie, and Ginnie and all other federal agencies with mortgage holdings, such as the Federal Home Loan Banks and the Federal Reserve.<sup>4</sup> The lower right panel show the flows of net mortgage purchases by the agencies as a percentage of total originations. The solid line (blue online) shows the net portfolio purchases. To distinguish these portfolio purchases clearly from those for securitization, the

4. Other agencies include the Home Owners' Loan Corporation, the Treasury, Veterans Administration, Federal Housing Administration, Federal Farmers Home Administration, Resolution Trust Corporation, Federal Deposit Insurance Corporation, and Public Housing Administration. We do not include mortgages in government pension funds. See the [Online Appendix III](#) for sources.

figure also shows as a dot-dashed line (red online) the combined issuance of MBSs by the agencies.<sup>5</sup>

The post–World War II period witnessed a marked expansion in mortgage debt, rising from around 10% of GDP at the end of the war to more than 80% by 2008, before steadily declining in the wake of the 2007/8 financial crisis. Originations of new mortgages are volatile, procyclical, and average around 20% of outstanding debt at an annualized rate.<sup>6</sup> By any measure, the government agencies have become large players in the mortgage market. Between 1980 and 2006, total purchases in the secondary market by Fannie and Freddie alone averaged around 40% to 50% of originations. The majority of these acquisitions were packaged in MBSs and sold off to private investors. The portfolio purchases, comprising whole loans retained for the portfolio as well as net acquisitions of MBSs, have averaged 7% of originations between 1967 and 1990, and about 15% between 1990 and 2006. At the peak in 2004, almost a quarter of all residential mortgage debt resided on the balance sheet of a federal agency, with roughly 20% owned by Fannie and Freddie alone. In early September 2008, Fannie and Freddie were taken into conservatorship and were required to gradually wind down their balance sheets by two-thirds. The Federal Reserve subsequently pursued several rounds of large-scale purchases of agency MBSs under its quantitative easing (QE) programs, and its current holdings amount to roughly 15% of total mortgage debt outstanding. For readers wishing more information about the institutional history of the housing agencies, [Online Appendix I](#) provides more background.

The focus of this article is on the portfolio purchases of the housing agencies, shown as the solid line (blue online) in the lower right panel in [Figure I](#). Prior to the Fed's QE programs, Fannie and Freddie accounted for the bulk of agency mortgage acquisitions. Even as privately owned corporations, Fannie and Freddie have been key agents of federal housing policy and differ from traditional financial intermediaries in a number of important ways. First, they have always maintained authorization to borrow from the Treasury. Although this authorization was

5. Because purchases may include loans originated in prior periods, the market shares may occasionally exceed 100%.

6. Net additions to the stock of mortgage debt are considerably smaller than originations because existing home sales and refinancing transactions typically lead to minor net changes in mortgage debt.

limited and never formally exercised, it sufficed to create the widely held belief that the U.S. government would never allow a GSE to default. This perception, eventually justified by the government takeover of Fannie and Freddie in 2008, meant that interest rates on agency bonds have typically been close to Treasury rates. Second, agency debt is eligible for open market operations by the Fed. In the 1960s and 1970s, the Fed made significant purchases of agency debt (see [Haltum and Sharp 2014](#)) and did so again under the QE programs. Third, the prudential supervision of the GSEs is separate from private banks and, prior to 2008, resided within the Department of Housing and Urban Development (HUD).<sup>7</sup> Regulatory oversight of the GSEs was traditionally light compared with that of private banks, and the GSEs generally enjoyed much less stringent capital and reporting requirements. For instance, despite being publicly listed companies, Fannie and Freddie were exempt from filing with the Securities and Exchange Commission until the early 2000s. Finally, for much of their existence, the GSEs have also benefitted from various preferential tax treatments.

In exchange for the privileges granted by federal law, the GSEs face a number of restrictions and obligations. Fannie and Freddie cannot originate loans in the primary market and are not allowed to diversify portfolio holdings much beyond mortgage assets. Their purchases are limited to conforming mortgages that must meet certain underwriting standards, and the principal on the loans cannot exceed a maximum amount, known as the conforming loan limit. The authority for adjusting the limit and other loan characteristics that determine what mortgages are conforming has generally lied with Congress and the HUD secretary. In 1980, the conforming loan limit became indexed to a house price index maintained by Freddie Mac. Since then typically around 80% of mortgages have been conforming.<sup>8</sup> Finally, the GSEs are expected to balance stock owner interests with certain public policy objectives, including the stabilization and enhancement of mortgage markets and assistance with the provision of credit to lower-income households.

7. Since 2008, the regulatory authority has lain with the Federal Housing Finance Agency, an independent federal agency.

8. In response to the financial crisis, the limit was increased substantially for the financing of homes in urban areas, which further expanded the pool of mortgage debt eligible for GSE purchase.

## III. RELATED LITERATURE

There are relatively few attempts at identifying the dynamic effects of agency purchases on mortgage credit, residential investment, or homeownership. An early literature estimates reduced form models of credit and housing markets to assess the impact of GSE activity in the 1970s, for example, [Arcelus and Meltzer \(1973\)](#), [Meltzer \(1974\)](#), [Hendershott and Villani \(1977, 1980\)](#), [Jaffee and Rosen \(1978\)](#), and [Kaufman \(1985\)](#). Although no clear consensus emerges from this early work, [Smith, Rosen, and Fallis \(1988\)](#) conclude that an additional dollar in government lending increases mortgage debt by 25 to 35 cents after three to four quarters. [Arcelus and Meltzer \(1973\)](#) and [Meltzer \(1974\)](#), however, argue there is no effect on residential investment or home purchases, while [Jaffee and Rosen \(1978\)](#) and [Hendershott and Villani \(1977, 1980\)](#) find a positive impact of agency activity on home construction.

Starting with [Hendershott and Shilling \(1989\)](#), a number of studies document significant interest rate spreads between conforming and jumbo loans, which suggests that the GSEs affect the cost of mortgage credit. [Hendershott and Shilling \(1989\)](#) attribute this result to a credit supply channel operating through agency securitization. A number of studies investigate the time series relationship between GSE activity and credit costs. [Naranjo and Toevs \(2002\)](#), for instance, find a negative long-run relationship between GSE purchases and mortgage rates, while [González-Rivera \(2001\)](#) finds only a negative short-run relationship.<sup>9</sup> [Lehnert, Passmore, and Sherlund \(2008\)](#) study the impact of GSE activities on primary and secondary market mortgage spreads using both generalized impulse response analysis and causal orderings in VAR models. Based on monthly data from 1993 to 2005, these authors find little evidence that higher GSE purchases affect mortgage spreads, which is consistent with the Meltzer view that credit

9. [Naranjo and Toevs \(2002\)](#), who use vector error-correction (VEC) and GARCH (generalized autoregressive conditional heteroskedastic) models and study monthly time series data from 1986 to 1998, find that GSE purchases and securitization reduce conforming mortgage spreads and volatility, while documenting some spillover to reductions in nonconforming loans, which they attribute to investor substitution effects. [González-Rivera \(2001\)](#), who uses VEC models and monthly data from 1994 to 1999, finds a negative short-run relationship of GSE purchases responding to widening secondary mortgage market spreads, and some evidence of a pass-through from secondary to primary mortgage rates from agency purchases.

market interventions are neutral. In a May 2005 speech, Federal Reserve Chairman Alan Greenspan conveyed a similar view of the role of the GSEs' portfolio activities, stating that "Fannie's and Freddie's purchases... with their market-subsidized debt do not contribute usefully to mortgage market liquidity, to the enhancement of capital markets in the United States, or to the lowering of mortgage rates for homeowners" (Greenspan 2005).

In this article, we contribute new evidence against the Greenspan-Meltzer view that agency mortgage purchase have little effect on the cost and availability of mortgage credit. Our approach is similar in spirit to [Lehnert, Passmore, and Sherlund \(2008\)](#), but adopts novel and arguably better identification strategies to control for the endogeneity of agency purchases. We also study a much longer time frame than any of the earlier papers, and we estimate the effects on both credit aggregates and mortgage rates. Moreover, our analysis allows us to study the dynamic causal impact on many other variables of interest, including housing starts, home prices, homeownership rates, cyclical indicators, and various other interest rates and credit spreads.

Our article is related to the many analyses of the large-scale MBS purchases by the Federal Reserve under the QE programs. To isolate the effects of these purchases, the literature typically restricts attention to high-frequency financial data, and most studies conclude that MBS purchases lowered secondary market mortgage yields on impact; see, for example, [Gagnon et al. \(2011\)](#), [Krishnamurthy and Vissing-Jørgensen \(2011\)](#), [Patrabansh, Doerner, and Asin \(2014\)](#), and [Hancock and Passmore \(2011, 2015\)](#).<sup>10</sup> Exploiting cross-sectional variation, a few recent studies uncover evidence that is suggestive of a positive impact on mortgage lending. [Di Maggio, Kermani, and Palmer \(2016\)](#), for instance, find that after the first QE intervention, originations of mortgages qualifying for inclusion in securities eligible for purchase by the Fed increased substantially more than those of nonqualifying mortgages. No such differential effects are evident after the second QE intervention, which did not include MBS purchases. [Darmouni and Rodnyansky \(2017\)](#) find that banks with larger mortgage positions increased lending relative to banks with smaller positions, and [Chakraborty, Goldstein, and MacKinlay \(2016\)](#) show that banks with MBS exposure increased their mortgage origination

10. [Stroebel and Taylor \(2012\)](#) instead find no effects of the MBS purchases under QE1.

share relative to other banks. By studying a longer history of housing credit policy interventions, we are able to circumvent some key limitations of the event studies of the Fed's large-scale MBS purchases. Our approach permits an analysis beyond the very short-run response of financial variables, and unlike the cross-sectional studies, provides direct evidence on aggregate rather than relative effects.

Our study also fits in a broader empirical literature that aims to identify credit supply shocks and estimate their aggregate effects. [Peek, Rosengren, and Tootell \(2003\)](#), for instance, use bank health indicators as proxies for loan supply shocks and find substantial effects on inventory investment and other aggregates. [Gilchrist and Zakrajšek \(2012\)](#) look at innovations in corporate bond spreads after removing cyclical default premia and demonstrate their strong predictive content for macroeconomic fluctuations. [Bassett et al. \(2014\)](#) study residual variation in survey measures of bank lending standards and find an impact on economic activity. [Mian, Sufi, and Verner \(2017\)](#) use variation in the timing of bank branching deregulation in the 1980s to construct differential state-level credit supply shocks and find that these shocks impact household borrowing and employment. Our narrative policy indicator and the GSE excess return shocks discussed in the [Online Appendix](#) can similarly be viewed as proxies for credit supply shocks in the mortgage market.

Many existing theories of financial frictions can explain the non-neutrality of agency mortgage purchases. [Krishnamurthy and Vissing-Jørgensen \(2011\)](#) and [Di Maggio, Kermani, and Palmer \(2016\)](#), among others, discuss a variety of potential transmission channels associated with the MBS purchases under the QE programs. Many of these channels have similar implications for mortgage purchases by the GSEs. Through the portfolio rebalancing channel, for instance, private investors bid up the price of mortgages when rebalancing assets toward some desired composition of mortgages and agency liabilities. GSE portfolio purchases are not funded with reserves but with debt instruments that closely substitute for Treasuries in terms of liquidity and (perceived) safety.<sup>11</sup> Depending on the level of segmentation in financial markets, rebalancing effects may spill over to other asset

11. This difference may be less important if the Federal Reserve simultaneously acquires agency debt.

markets, in which case yields on mortgage substitutes—particularly other types of long-term debt—may fall as well.

Agency mortgage purchases also matter when private mortgage lenders face capital constraints because of regulations or binding incentive constraints, for instance as in the theoretical models of [Gertler and Kiyotaki \(2010\)](#) or [Cúrdia and Woodford \(2011\)](#). Because the GSEs are more highly leveraged than private lenders, aggregate lending capacity increases with agency market share. Agency purchases that drive up the price of mortgages may improve the net worth position of private mortgage lenders, while the exchange of mortgages for agency debt lowers their risk-weighted leverage ratios. Increased agency activity in the secondary mortgage market may reduce liquidity premia. Our findings support a role for credit supply channels in determining household debt, homeownership, and residential investment, but it is beyond the scope of this article to isolate precisely which of these channels may be more important.

#### IV. IDENTIFYING CAUSAL EFFECTS OF AGENCY MORTGAGE PURCHASES

##### *IV.A. Endogeneity Problems*

To assess the impact of agency portfolio purchases, one might be tempted to simply correlate measures of agency activity, such as those in [Figure I](#), with credit and other macroeconomic aggregates. This would ignore various endogeneity problems. For one, the agencies respond to changes in market conditions. To maintain market share, for instance, the GSEs vary purchases with the supply of mortgages into the secondary market, which in turn depends on fluctuations in the housing market and the economy. The agency response to varying growth in the mortgage market induces a positive relationship between agency balance sheets and overall mortgage lending activity. Failure to correct for this source of reverse causality is likely to lead to an overestimation of the impact of agency activity on credit availability.

A different endogeneity concern operating in the opposite direction is that agency purchases typically expand relative to the mortgage market when credit is tight or conditions in the housing market are deteriorating. This was evidently the case during the latest financial crisis through the actions of the Fed and Treasury, but it is also true of earlier episodes. To illustrate this,

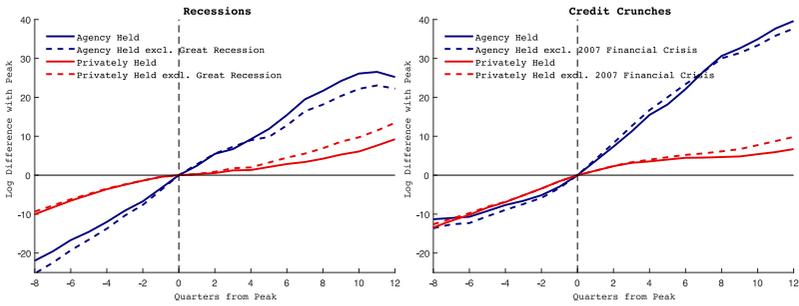


FIGURE II

Real Mortgage Debt by Holder in Recessions and Credit Crunches

Mortgage debt is deflated by the core PCE price index. The left panel shows the average of nine NBER recessions starting 1957Q2, 1960Q1, 1969Q4, 1973Q4, 1980Q1, 1981Q3, 1990Q3, 2001Q1, 2007Q4. The right panel shows the average of credit crunches beginning one quarter after the following dates: 1955Q3, 1959Q1, 1965Q4, 1968Q4, 1972Q4, 1978Q1, 1980Q4, 1990Q1, 1998Q2, 2007Q2. See [Online Appendix III](#) for sources.

**Figure II** shows the average real levels of agency and private holdings of mortgage debt over the course of business and credit cycles since the mid-1950s. The left panel shows the average real levels of agency and privately held mortgage debt centered around National Bureau of Economic Research (NBER) business cycle peaks. On average, growth in agency holdings is high relative to growth in private holdings prior to a business cycle peak. The growth in private mortgage holdings slows down just prior to the peak and remains low for a prolonged period after the start of a recession. The pace of growth of agency holdings, in contrast, remains roughly unchanged for at least two years after the beginning of an economic downturn.

The right panel of **Figure II** shows the average real levels of mortgage holdings centered around the peak of credit cycles, defined as the quarter preceding the start of credit crisis episodes based on the datings in [Eckstein and Sinai \(1986\)](#) and subsequent updates.<sup>12</sup> Agency and private holdings grow at roughly similar rates prior to a credit crunch. Growth in private holdings of

12. The dating of pre-1986 credit crunches is from [Eckstein and Sinai \(1986\)](#). The dating of post-1986 crunches is based on [Owens and Schreft \(1993\)](#) for the 1990 commercial real estate crunch, [Lehnert, Passmore, and Sherlund \(2008\)](#) for the 1998 Russian default/LTCM crisis, and [Bordo and Haubrich \(2010\)](#) for the 2007/8 financial crisis.

mortgage debt slows markedly following the start of a credit crisis. In contrast, growth in agency holdings accelerates at the onset of a credit crunch and remains elevated for about 10 quarters, before flattening toward the precrunch trend.

The evidence thus indicates that agencies tend to increase their share of the market in cyclical downturns and credit crunches. These countercyclical purchase dynamics are robust to omitting the 2007/8 crisis and the Federal Reserve's interventions. There are a number of reasons the agencies maintain or expand purchases during cyclical downturns. A public mission to provide stability to mortgage markets is mandated in the GSEs' statutory charters. Credit crises also offer particularly profitable opportunities for the GSEs because their lending spreads widen relative to private intermediaries because of countercyclical mortgage spreads and the implicit guarantee provided by the U.S. government. Finally, the federal government often undertakes deliberate regulatory or legislative actions to further enable agency expansions during downturns. The fact that agency purchases tend to accelerate when mortgage spreads are elevated or credit is tight induces a negative relationship with mortgage credit aggregates. Failure to account for this negative association is likely to lead to an underestimation of the causal effects of agency mortgage purchases.

#### *IV.B. Narrative Analysis of Policy Changes Affecting Agency Mortgage Holdings*

Our strategy to control for reverse causality in the relationship between agency mortgage purchases and credit conditions is to use a narrative identification approach involving major regulatory events impacting agency mortgage holdings. By focusing on policy interventions by the federal government, we exclude variation in purchase activity resulting from the agencies' regular response to market developments. Because policy makers themselves often respond to conditions in mortgage and housing markets, we exclude interventions with short-run stabilization motives as the primary objective. The end result of our narrative analysis is a record of housing credit policy events that we use as an instrument for agency purchase activity. Here, we summarize the methodology of the narrative analysis and describe the resulting policy indicators. A companion background paper ([Fieldhouse and Mertens 2017](#)), provides the full narrative analysis of credit

policy events, including explanations of relevant findings for each policy event and extensive documentation that allows verification of our analysis.

The development of the narrative instrumental variable follows five steps: identifying significant policy changes affecting agency portfolios, quantifying their ex ante projected impact on agency holdings, pinpointing the timing of when the policies became publicly known, classifying each policy change as either cyclically or noncyclically motivated, and restricting the sample for consistent use as an instrument for agency purchasing activity. Next we describe the procedures used in each of these steps. [Table I](#) provides an overview of the historical primary sources used in the narrative analysis.

*1. Identifying Significant Policy Changes.* Policy changes affecting agency purchases and mortgage holdings have historically been directed by a range of policy makers, notably Congress, the president, and the Cabinet, particularly the secretaries of the Treasury and HUD, various regulatory agencies in the executive branch, and the Federal Reserve. The relevant regulatory institutions were disbanded and reinvented several times over the decades, and as a result there is no single consistent source tracking the history of housing credit policy. Instead, a wide range of sources is required for identifying and analyzing policy changes.

Policy actions generally originate from one of three sources: enacted legislative changes, regulatory policy changes published in the *Federal Register* or as other binding agreements with regulators, and macroeconomic stabilization policies managed by the Federal Reserve or Treasury. We restrict attention to significant policy actions, meaning actions that would either be expected to directly affect agencies' permissible volume of net purchases and retained portfolio holdings or else considerably expand the pool of eligible mortgages an agency was authorized or required to purchase. Interventions determined at the legislative level include adjusting statutory leverage ratios, capital requirements, conforming loan limits, provision of working capital, mandatory retirements of public stock, and direct appropriations or borrowing authority for purchases. Regulatory policy actions include setting permissible debt-to-capital ratios, imposing capital surcharges in excess of statutory capital requirements, capping portfolio size or growth, setting affordable housing goals, and authorizing entrance to new segments of the mortgage market. Macroeconomic stabilization actions include the Fannie and

TABLE I  
SOURCES FOR NARRATIVE ANALYSIS

Government publications	
Board of Governors	Annual Report, press releases, <i>Federal Reserve Bulletin</i>
Congressional Budget Office	<i>The Housing Finance System and Federal Policy: Recent Changes and Options for the Future</i> (1983), <i>Controlling Risks of Government-Sponsored Enterprises</i> (1991)
Congressional Quarterly	<i>Congressional Quarterly Almanac</i>
Congressional Research Service	<i>A Chronology of Housing Legislation and Selected Executive Actions, 1892–2003</i> (2004), <i>The Conforming Loan Limit</i> (2008)
Council of Economic Advisers	<i>Economic Report of the President</i>
Department of Housing and Urban Development	HUD news releases, <i>The Secondary Market in Residential Mortgages</i> (1982), <i>1986 Report to Congress on the Federal National Mortgage Association</i> (1987), <i>The National Homeownership Strategy: Partners in the American Dream</i> (1995), <i>Privatization of Fannie Mae and Freddie Mac: Desirability and Feasibility</i> (1996), <i>Profiles of GSE Mortgage Purchases in 2001–2004</i> (2008)
Department of the Treasury	Press releases and statements, <i>Report of the Secretary of the Treasury on Government-Sponsored Enterprises</i> (1990), <i>Government Sponsorship of the FNMA and the FHLMC</i> (1996)
Federal Home Loan Mortgage Corp.	Press releases and statements, Annual Report, Form 10-K
Federal Housing Finance Administration	Press releases and statements, <i>Mortgage Market Notes</i>
Federal National Mortgage Association	Press releases and statements, Annual Report, Form 10-K, <i>Monthly Volume Summary, Information Statement, MBSenger, Offering Circular, Background and History of the Federal National Mortgage Association</i> (1969, 1973)
Financial Crisis Inquiry Commission	<i>Final Report of the Financial Crisis Inquiry Commission</i> (2011)
Government Accountability Office	<i>The Federal National Mortgage Association in a Changing Environment</i> (1985), <i>GSEs: A Framework for Limiting the Government's Exposure to Risk</i> (1991), <i>Housing Enterprises: Potential Impacts of Severing Government Sponsorship</i> (1996), <i>HUD's Mission Oversight Needs to be Strengthened</i> (1998)
U.S. Congress	Hearing transcripts and reports: Committees on Appropriations, Committees on Banking and Currency, Committee on Banking, Finance and Urban Affairs, and Committee on Banking, Housing and Urban Affairs

TABLE I  
CONTINUED

Office of Federal Housing Enterprise Oversight	Press releases and statements, Annual Report, <i>Mortgage Market Notes</i> , <i>Mortgage Markets and the Enterprises</i> , <i>Evaluating the Capital Adequacy of Freddie Mac and Fannie Mae</i> (1998), <i>Special Examination Reports</i> (2003, 2004, 2006)
Office of the <i>Federal Register</i>	<i>Federal Register</i>
Office of Management and Budget	<i>Budget of the United States Government</i>
The President's Commission on Housing	<i>The Report of The President's Commission on Housing</i> (1982)
Press and online sources	<i>ABA Banking Journal</i> , <i>American Banker</i> , <i>American Presidency Project</i> , <i>Bond Buyer</i> , <i>Dow Jones Capital Market Reports</i> , <i>Dow Jones News Service</i> , <i>Dow Jones Newswires</i> , <i>Financial Times</i> , <i>MarketWatch</i> , <i>National Mortgage News</i> , <i>New York Times</i> , <i>Reuters News</i> , <i>Wall Street Journal</i> , <i>Washington Post</i>
Overview books and articles	
Bartke	<i>Fannie Mae and the Secondary Mortgage Market</i> (1971), <i>Home Financing at a Crossroads: A Study of the Federal Home Loan Mortgage Corporation</i> (1972)
Elliot, Feldberg, and Lehnert	<i>The History of Cyclical Macroprudential Policy in the US</i> (2013)
Greenspan	<i>The Age of Turbulence: Adventures in a New World</i> (2007)
Haar	<i>Federal Credit and Private Housing: The Mass Financing Dilemma</i> (1960)
Hagerty	<i>The Fateful History of Fannie Mae: New Deal Birth to Mortgage Crisis Fall</i> (2012)
Hoffman and Cassell	<i>Mission Expansion in the Federal Home Loan Bank System</i> (2010)
Hunter	<i>The FNMA: Its Response to Critical Financing Requirements of Housing</i> (1971)
McLean	<i>Shaky Ground: The Strange Saga of the US Mortgage Giants</i> (2015)

Notes. For detailed bibliographical references, see [Fieldhouse and Mertens \(2017\)](#).

Freddie conservatorship agreements entered in September 2008, subsequent amendments to these agreements, and the large-scale MBS purchase programs conducted by the Federal Reserve and Treasury since 2008.

We use the comprehensive Congressional Research Service report "A Chronology of Housing Legislation and Selected

Executive Actions, 1892–2003” (CRS 2004) as a starting point for identifying significant policy changes, particularly pertinent public laws. This legislative history is cross-referenced with the *Congressional Quarterly Almanac*’s Housing and Development tracker. We additionally search appendixes of the *Budget of the United States Government* for information about policy changes affecting Ginnie Mae during relevant years, cross-referenced with HUD appropriations bills and related reports of the House and Senate Appropriations Committees. After identifying public laws affecting the agencies, we use the ProQuest Congressional Publications Database to collect the legislative text of those enacted laws, related committee reports and congressional hearing transcripts, and any preceding House and Senate versions of the final bill.<sup>13</sup> We analyze relevant sections of these primary sources to confirm these laws’ material impact on mortgage holdings and to better understand the nature of the policy changes.

Legislative actions often set in motion the drafting of new regulatory rules. Identified significant legislative events are the starting point for a directed search of related regulatory changes in HeinOnline’s Federal Register Library. We also obtain information from the GSEs’ annual reports about significant regulatory changes, as well as from 10-K filings in more recent years. We also use sections of the *Economic Report of the President* and *Annual Report of the Board of Governors of the Federal Reserve*, as well as the various reports by regulators to collect information about regulatory rulings. We use newspapers, financial newswires, and mortgage industry newsletters to help direct the search for information about the rulings in the *Federal Register*, particularly the *Wall Street Journal*, *American Banker*, and *National Mortgage News*.<sup>14</sup> Final rules published in the *Federal Register* almost always include a detailed background and overview of the

13. The ProQuest Congressional Publications Database provides a comprehensive compilation of all public laws, committee reports, and hearings. Public laws and related legislative actions since 1973 are available from Congress.gov, a project of the Library of Congress, along with committee reports since 1995. Most older public laws are available through LegisWorks Statutes at Large Project. Most hearing transcripts are digitally available since 1985 from the U.S. Government Publishing Office.

14. This is done by Factiva and LexisNexis Academic searches of key words related to the regulatory policy change in search windows around the vicinity of the event. After roughly pinpointing the publication date of a rule, we search the *Federal Register* for the rule itself, and then work backward to initial rulings.

initial proposed rule, public comments received, and any subsequent modifications.

Using these procedures, we are confident that we have identified the overwhelming majority of significant policy events. The main concern is developing a policy indicator that is correlated with underlying regulatory shocks to agency purchasing activity. The larger the number of significant policy events identified, the higher the relevance of the instrument.

2. *Quantification.* To be included, primary sources must either explicitly cite projections of the policy change's impact or contain information that can be used to quantify the impact on agency mortgage holdings. For each policy change, we use contemporaneous sources to obtain an ex ante estimate of the projected impact on the agencies' capacity to purchase mortgages, measured in annualized billions of dollars within the first year of taking effect. If a baseline is needed for quantifying a policy change, say, for Fannie's regulatory capital when its debt-to-capital ratio is increased, we use the most recent data publicly available prior to the policy change. We use ex ante balance sheet data on regulatory capital, liabilities, or assets in conjunction with standing leverage or capitalization requirements to estimate the impact of related changes, such as increases in permissible leverage ratios. Similarly, public capital injections are quantified as a multiple of one more than the prevailing leverage ratio, to capture the potential increase in assets supported by related debt issues plus the working capital itself. Direct appropriations are straightforward to quantify, at most requiring a pro rata annualization adjustment based on relevant implementation lags. To quantify potential impacts of discretionary conforming loan limit changes, we rely on estimates from congressional committee reports accompanying legislation. Such reports typically cite the extent to which a large conforming loan limit increase would restore a GSE's real purchase activity. We quantify the impact of such adjustments as the difference between annualized purchase volumes immediately preceding the policy change and the home price index-adjusted purchase volume of the benchmark year being restored. For relatively large, open-ended changes, such as leverage ratio increases, potential effects on mortgage holdings are annualized using a two-year rule, which assumes half of the full potential impact would be realized within the first year of taking effect.

For other policies that are inherently harder to quantify, such as authorizations for program expansions into new mortgage

market segments, we search for *ex ante* estimates of projected impacts on purchasing activity from committee reports, market analysts, regulators, or agency executives. We do not include policies that would not have been expected to impose or alleviate binding constraints on agency activity. For instance, when adjustments to leverage ratios or affordable housing goals are viewed as non-binding by most accounts and this appears consistent with the agencies' balance sheet and purchase behavior, we do not consider the policy change significant. We also exclude any laws or regulations that merely extend prior authorizations, and for certain authorizations affecting Ginnie Mae, we use a current policy baseline as opposed to a current law baseline for scoring annual funding changes.

When estimating the quantitative aspects of the policies, we rely on information released by the Congressional Budget Office, Government Accountability Office, Treasury Department, and Congressional Research Service that contain detailed analyses of policy changes, background information, or balance sheet data for the agencies in question; see [Table I](#). We also use information from the annual or periodic reports of the agencies and regulators, particularly regarding balance sheet data, and from appropriations bills and budget appendixes for certain policies affecting Ginnie Mae. Committee report language occasionally cites projected effects of a pending policy change, and we also use the financial press and industry newsletters to search for projections of the impact of policies that are difficult to quantify.

*3. Timing.* At the operational level, the agencies sell commitments to purchase conforming mortgages from primary market lenders, which may then be exercised by the mortgagee up to an expiration date. Consequently, actual agency purchases tend to lag behind the issuance of commitments to purchase mortgages from primary market originators. Together with the usual policy implementation lags, the policy events are therefore best thought of as news shocks about agency mortgage purchases. We date each policy intervention to the month in which we estimate that it became publicly anticipated, rather than the month in which it was formally announced or took effect.

The ProQuest Congressional Publications Database, HeinOnline's Federal Register Library, the *CQ Almanac*, and financial press are the primary sources used for documenting pertinent news surrounding policy changes and the implementation dates. For regulatory changes, we use the month in which proposed rules

were first published in the *Federal Register* or reported in the press. We date legislative changes to when the provision including the policy change was agreed on in the House, Senate, or conference version of a bill, rather than on subsequent enactment. For Fannie and Freddie, we also check the timing by cross-referencing policy announcements with GSE stock price movements and the financial press, because often policy news is priced into GSE shares.

4. *Classification by Motivation.* The classification of the policy events distinguishes between interventions that are guided by prevailing business cycle and financial conditions, and those that are plausibly free of such contemporaneous influences. Our instrument for agency mortgage purchases only includes the latter to avoid bias due to the systematic relaxation of policies during periods of stress in mortgage or housing markets. The classification is based on identifying the primary motivations underlying each of the policy interventions. To make this classification, we parse historical documents, paying particular attention to the rationales invoked by policy makers and the press, the nature of the legislative vehicles or regulatory processes, the relation to known periods of economic and financial stress, and the time horizon of policy objectives.

The principal data sources for identifying policy motives include congressional committee reports and hearings, presidential speeches and signing statements, the *Budget of the US Government*, *Economic Report of the President*, *Federal Reserve Bulletin*, *Annual Report of the Board of Governors of the Federal Reserve*, *CQ Almanac*, and the financial press (see [Table I](#)). For legislated policies, the accompanying reports of the Senate Committee on Banking, Housing and Urban Affairs and the House Financial Services Committee typically detail congressional intent and any pertinent economic context. Major housing policy laws are also usually accompanied by a presidential signing statement explaining the bill's motivation, context, and intended impact. Budget appendixes or committee reports accompanying appropriations bills usually explain the impetus for certain policy changes affecting Ginnie Mae. Final rules published in the *Federal Register* also almost always include a detailed background and history, shedding light on regulators' motives.

Based on these sources, we classify the policy changes as either cyclically motivated or noncyclically motivated. Interventions classified as cyclically motivated tend to emphasize short-term outcomes, such as boosting housing starts in a recession.

Legislative vehicles for such policy actions tend to be quickly drafted and enacted, with a relatively concise legislative history and narrow focus. Policy makers are typically quite explicit about cyclical concerns and objectives, overwhelmingly so when policies are implemented in close proximity to recessions or credit crunches. Language we search for in committee reports and signing statements as strong evidence of cyclical motivations include “emergency, crisis, recession, credit shortage, credit crunch, housing starts, employment, construction, downturn, depressed, stimulus, boost.” Policies enacted during or near a recession or credit crunch are held to a particularly high bar for being classified as noncyclical but are not automatically classified as cyclically motivated.

Interventions motivated by social policy, budgetary, or other more ideological objectives are classified as unrelated to the business or financial cycle, provided the various historical sources do not at the same time indicate significant short-term economic or financial market concerns. Political rather than economic context shapes the development of these interventions, such as an administration’s emphasis on expanding affordable homeownership opportunities to lower-income households, concerns regarding the structural budget deficit, or ideological hostility toward the GSEs. It is often hard to establish a single rationale for the noncyclical actions, which can be motivated by a mix of objectives. For our purposes, however, a more precise distinction between these objectives is not essential. Language we search for as indicative of noncyclical motivations include “long-term, far-sighted, comprehensive, low-income, affordable housing, American Dream, homeownership, budget deficit, reduce borrowing, off-budget, privatize.” Legislative actions classified as noncyclical emphasize longer-term outcomes, such as increasing homeownership rates. Legislative vehicles for such interventions tend to be slower-moving bills, particularly deliberate overhauls of housing policy with a lengthy legislative history. The National Housing Acts, Housing and Urban Development Acts, and Housing and Community Development Acts of various years tend to meet this description, being slowly crafted and negotiated between the House, Senate, and White House, and focusing on broad, long-term objectives for housing policy, such as urban revitalization or access to affordable housing for various constituencies. New regulatory rules set in motion by such bills also tend to be classified as noncyclical, such as HUD setting new affordable housing goals

for the GSEs. Occasionally, interventions are prompted by specific events that we view as unrelated to the cycle, such as the regulatory actions taken in the aftermath of accounting scandals at Fannie and Freddie in 2003–2004.

*5. Sample Restrictions.* Occasionally a law or public rule sets in place changes in purchase authorizations or balance sheet restrictions to take effect several years after announcement. To obtain a good indicator for news about pending purchase behavior, we exclude changes with very long implementation delays and focus on interventions taking effect within nine months of their news being made public.<sup>15</sup> We also restrict attention to policy events after January 1967. This choice is made to select a period of relative institutional stability, as it roughly coincides with the creation of Ginnie and Freddie, the emergence of a nationwide secondary market for conventional mortgages, and the beginning of the privatized GSE era. This starting point is also in part determined by the availability of time series used in the empirical analysis. We focus exclusively on the mortgage portfolio activity of Fannie, Freddie, and Ginnie, ignoring less significant government entities for which monthly data are not easily available. We include purchases by the Federal Reserve and Treasury in the recent financial crisis, but in most of the analysis in [Sections V and VI](#) the sample is truncated at December 2006 to deliberately exclude the financial crisis and the Fannie and Freddie conservatorship period. As shown in [Figure I](#), the three housing agencies that we analyze account for the large majority of government agency mortgage holdings between 1967 and 2006.

#### *IV.C. The Narrative Measures of Policy Changes*

[Table II](#) lists the policy events resulting from the narrative analysis. Each intervention is described by the agencies affected, by its annualized projected impact (in billions of U.S. dollars), the timing (arrival of news and effective date), and motivation. The monthly sample contains 45 months with interventions in the post-1967 sample (there are 52 interventions in total, but some occur within the same month). Out of these, 28 are

15. Using a maximum lag of 12 months adds only one relatively minor event in 1968 with virtually no effect on the results. Including all events yields an instrument that is considerably weaker for purchases at shorter horizons. In practice, a larger maximum lag additionally includes only a couple of increases in affordable housing goals announced 18 months ahead of taking effect.

TABLE II  
NARRATIVE MEASURES OF POLICY CHANGES

Policy description	Agency	Impact (\$ billion)	News	Effective	Classification
HUDA 1968: increased debt-to-capital ratio	FNMA	+1.39	Oct. 1968	Oct. 1968	Noncyclical
Increased debt-to-capital ratio	FNMA	+1.13	Dec. 1969	Dec. 1969	Cyclical
HUDA 1969: special assistance	GNMA	+0.75	Dec. 1969	Dec. 1969	Cyclical
Treasury-guaranteed capitalization	FNMA	+2.6	Apr. 1970	Apr. 1970	Cyclical
EHFA 1970: special assistance	GNMA	+0.38	July 1970	July 1970	Cyclical
Conforming mortgage program approval	FNMA	+0.4	Nov. 1971	Feb. 1972	Noncyclical
FHA/VA tandem authorization	GNMA	+1.5	Sep. 1973	Sep. 1973	Cyclical
FHA/VA tandem authorization	GNMA	+3.3	Jan. 1974	Jan. 1974	Cyclical
Subsidized mortgage purchase program	FHLMC	+1.5	May 1974	May 1974	Cyclical
FHA/VA tandem authorization	GNMA	+1.65	May 1974	May 1974	Cyclical
HCDA 1974: conforming loan limit	FNMA	+1.14	Aug. 1974	Aug. 1974	Noncyclical
HCDA 1974: conforming loan limit	FHLMC	+0.46	Aug. 1974	Aug. 1974	Noncyclical
EHPA 1974: tandem program	GNMA	+3.88	Oct. 1974	Oct. 1974	Cyclical
FY1976 approps: tandem program	GNMA	+2.5	Oct. 1975	Oct. 1975	Cyclical
HCDA 1977: conforming loan limit	FNMA	+4.82	Oct. 1977	Oct. 1977	Noncyclical
HCDA 1977: conforming loan limit	FHLMC	+0.21	Oct. 1977	Oct. 1977	Noncyclical
HCDA 1977: tandem program expansion	GNMA	+3.75	Oct. 1977	Oct. 1977	Noncyclical
FY1979 approps: special assistance	GNMA	+1.0	Sep. 1978	Oct. 1978	Noncyclical
HCDA 1978: mortgagee expansion	FHLMC	+2.0	Oct. 1978	May 1979	Noncyclical
FY1980 approps: special assistance	GNMA	+1.0	July 1979	Nov. 1979	Noncyclical
HCDA 1979: Conforming Loan Limit	FHLMC	+0.86	Dec. 1979	Dec. 1979	Cyclical

TABLE II  
CONTINUED

Policy description	Agency	Impact (\$ billion)	News	Effective	Classification
FY1981 approps: special assistance	GNMA	-0.2	Sep. 1980	Dec. 1980	Cyclical
ARM Program Approval	FHLMC	+0.37	May 1981	July 1981	Cyclical
ARM program approval	FNMA	+0.4	June 1981	Aug. 1981	Cyclical
Second mortgage program approval	FNMA	+5.0	Sep. 1981	Nov. 1981	Cyclical
FY1982 approps: special assistance	GNMA	+0.17	Dec. 1981	Dec. 1981	Cyclical
Increased Debt-to-Capital Ratio	FNMA	+6.25	Dec. 1982	Dec. 1982	Noncyclical
FY1983 approps: special assistance	GNMA	-1.47	Dec. 1982	Dec. 1982	Cyclical
FY1984 Supp. Approps: Tandem Repeal	GNMA	-2.92	Nov. 1983	Nov. 1983	Noncyclical
Second mortgage program approval	FHLMC	+1.0	Jan. 1986	Jan. 1986	Noncyclical
Decreased debt-to-capital ratio	FNMA	-2.7	Apr. 1987	Dec. 1987	Noncyclical
Public listing: stock split capitalization	FHLMC	+1.62	Nov. 1988	Nov. 1988	Noncyclical
FHEFSSA 1992: capital requirements	FNMA	-4.25	Mar. 1990	Mar. 1990	Noncyclical
Affordable housing goals of 1995	FHLMC	+0.61	Dec. 1995	Jan. 1996	Noncyclical
Affordable housing goals of 2004	FNMA	+7.6	Apr. 2004	Jan. 2005	Noncyclical
Affordable housing goals of 2004	FHLMC	+7.6	Apr. 2004	Jan. 2005	Noncyclical
Accounting scandal: capital surcharge	FNMA	-141.4	Sep. 2004	Sep. 2004	Noncyclical
Portfolio growth limit imposed	FHLMC	-42.8	June 2006	July 2006	Noncyclical
Portfolio limit increase	FNMA	+17.15	Sep. 2007	Sep. 2007	Cyclical
Portfolio limit increase	FHLMC	+2.14	Sep. 2007	Sep. 2007	Cyclical
ESA 2008: jumbo loan limit	FNMA	+41.57	Feb. 2008	Apr. 2008	Cyclical
ESA 2008: jumbo loan limit	FHLMC	+41.57	Feb. 2008	Apr. 2008	Cyclical
Removal of portfolio limit	FNMA	+9.28	Feb. 2008	Mar. 2008	Noncyclical
Removal of portfolio limit	FHLMC	+9.05	Feb. 2008	Mar. 2008	Noncyclical

TABLE II  
CONTINUED

Policy description	Agency	Impact (\$ billion)	News	Effective	Classification
Reduced capital surcharge	FNMA	+53.33	Mar. 2008	Mar. 2008	Cyclical
Reduced capital surcharge	FHLMC	+43.33	Mar. 2008	Mar. 2008	Cyclical
Reduced capital surcharge	FNMA	+17.75	May 2008	May 2008	Cyclical
HERA 2008: jumbo loan limit	FNMA	-13.34	July 2008	Jan. 2009	Cyclical
HERA 2008: jumbo loan limit	FHLMC	-13.34	July 2008	Jan. 2009	Cyclical
Conservatorship: portfolio limit increase	FNMA	+67.5	Sep. 2008	Sep. 2008	Cyclical
Conservatorship: portfolio limit increase	FHLMC	+66.75	Sep. 2008	Sep. 2008	Cyclical
MBS purchase program launch	Treasury	+80.0	Sep. 2008	Sep. 2008	Cyclical
QE1 launch	Fed	+250.0	Nov. 2008	Dec. 2008	Cyclical
ARRA 2009: jumbo loan limit	FNMA	+13.34	Feb. 2009	Feb. 2009	Cyclical
ARRA 2009: jumbo loan limit	FHLMC	+13.34	Feb. 2009	Feb. 2009	Cyclical
HASP: portfolio limit increase	FNMA	+50.0	Feb. 2009	May 2009	Cyclical
HASP: portfolio limit increase	FHLMC	+50.0	Feb. 2009	May 2009	Cyclical
QE1 expansion	Fed	+750.0	Mar. 2009	Mar. 2009	Cyclical
MBS purchase program sales	Treasury	-120.0	Mar. 2011	Mar. 2011	Cyclical
Agency MBS reinvestment	Fed	+262.0	Sep. 2011	Sep. 2011	Cyclical
Third SPSPA amendment	FNMA	-22.16	Aug. 2012	Aug. 2012	Noncyclical
Third SPSPA amendment	FHLMC	-22.16	Aug. 2012	Aug. 2012	Noncyclical
QE3 launch	Fed	+480.0	Sep. 2012	Sep. 2012	Cyclical
QE3 taper	Fed	-60.0	Dec. 2013	Jan. 2014	Cyclical

*Notes.* Housing and Urban Development Act (HUDA), Emergency Home Finance Act (EHFA), Housing and Community Development Act (HCDA), Emergency Home Purchase Act (EHPA), fiscal year (FY), adjustable-rate mortgage (ARM), Federal Housing Enterprises Financial Safety and Soundness Act (FHEFSSA), Economic Stimulus Act (ESA), mortgage-backed securities (MBS), Housing and Economic Recovery Act (HERA), quantitative easing (QE), American Recovery and Reinvestment Act (ARRA), Home Affordability and Stability Plan (HASP), Senior Preferred Stock Purchase Agreements (SPSPA).

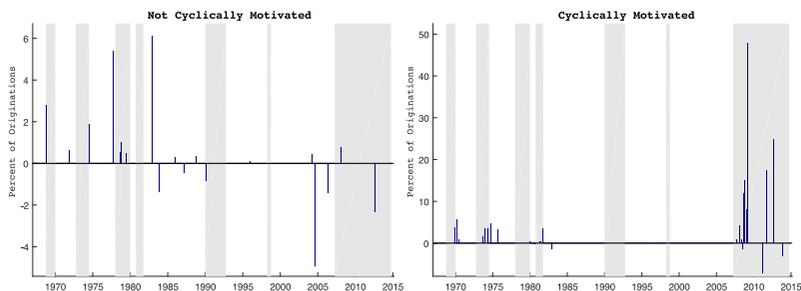


FIGURE III

Measures of Policy Events Affecting Agency Mortgage Holdings: January 1967 to December 2014

The figure shows projected changes in the consolidated agency mortgage portfolio as a percentage of average annualized mortgage originations over the prior 12 months. The left panel shows changes classified as unrelated to the business or financial cycle. The right panel shows changes classified as primarily motivated by cyclical considerations. For sources and classification see [Fieldhouse and Mertens \(2017\)](#). Shaded areas are credit crunch periods; see [Online Appendix III](#) for the chronology.

classified as cyclically motivated, leaving 19 distinct noncyclically motivated policy events. In the sample that excludes interventions after December 2006, there are 15 cyclically and 17 noncyclically motivated policy events after monthly aggregation.

[Figure III](#) depicts the interventions as a percentage of the average annualized level of originations in the preceding 12 months. The left (right) panel shows the noncyclical (cyclical) policy indicator. For reference, each figure also shows credit crisis episodes in grey. The cyclically motivated interventions almost all occur during credit crunches or recessions, whereas those not motivated by cyclical concerns appear unrelated to the cycle. The largest interventions are those introduced since the start of the 2007/8 financial crisis, which are mostly classified as cyclical.<sup>16</sup> The only post-2006 events that we consider noncyclical are the removal of Fannie and Freddie portfolio caps in February 2008, which was contingent on the timely filing of financial reports after the accounting scandals, and a 2012 Treasury decision to accelerate the mandated decline in portfolio caps under the GSE conservatorship agreements. Relative to average originations, the three largest noncyclical changes are the October 1977 combination of

16. These include the Fed and Treasury MBS programs from late 2008 onward, but also the loosening of capital requirements and portfolio caps for Fannie and Freddie and the introduction of jumbo conforming loan limits in 2008.

a conforming loan limit increase and the expansion of the Brooke-Cranston Tandem program, an increase in Fannie's debt-to-capital limit in December 1982, and the tightening of Fannie's capital requirements in September 2004 in the wake of the accounting scandals. We refer to [Fieldhouse and Mertens \(2017\)](#) for a detailed discussion of all policy events.

## V. THE CUMULATIVE EFFECTS OF AGENCY MORTGAGE PURCHASES ON MORTGAGE CREDIT

To assess whether agency purchases influence mortgage lending activity, in this section we present estimates of the cumulative impact on various mortgage credit aggregates. We obtain these estimates by [Jordà \(2005\)](#) local projections estimated by two-stage least squares (2SLS), similar to the methodology proposed in [Ramey and Zubairy \(forthcoming\)](#) to estimate cumulative government spending multipliers, using the noncyclically motivated policy changes as an instrument for agency purchasing activity. This approach yields easily interpretable results in terms of dollar changes in credit variables and is well suited to handle the news aspect of policy announcements.<sup>17</sup>

The first stage in the 2SLS procedure consists of regressions of cumulative agency purchases on the narrative instrument. Recall that agencies typically make advance commitments to buy loans from mortgage providers and subsequently effectuate these as loans are delivered to the secondary market. Because of potential time delays, we consider monthly data on the advance net purchase commitments made by the agencies and the effective net portfolio purchases as indicators of agency purchasing activity. Specifically, we estimate the following regressions for different horizons  $h$ :

$$(1) \quad \frac{\sum_{j=0}^h p_{t+j}}{X_t} = \tilde{\alpha}_h + \tilde{\gamma}_h \frac{m_t}{X_t} + \tilde{\varphi}_h(L)Z_{t-1} + \tilde{u}_{t+h},$$

where  $p_t$  is either the volume of net commitments or actual purchases by the agencies in month  $t$ , expressed in constant dollars

17. Expressing the impact in terms of elasticities is not feasible since net purchases and net purchase commitments take on negative values in the sample and is also potentially misleading given the differential growth trends in income, mortgage debt, and agency mortgage holdings.

using the core PCE price index, and  $\sum_{j=0}^h p_{t+j}$  is the cumulative sum of purchases or commitments made over the next  $h$ -month period. The variable  $m_t$  on the right-hand side is the noncyclical narrative policy indicator from [Table II](#), expressed in constant dollars. We express both as ratios of  $X_t$ , a deterministic trend in real personal income obtained by fitting a third-degree polynomial of time to the log of personal income deflated by the core PCE price index.<sup>18</sup> The first-stage regressions also include lagged controls,  $Z_{t-1}$ , which are defined below.

The cumulative impact on a credit aggregate  $y_t$  over a given horizon  $h$  is estimated by local projections of the form

$$(2) \quad \frac{y_{t+h} - y_{t-1}}{X_t} = \alpha_h + \gamma_h \frac{\sum_{j=0}^h p_{t+j}}{X_t} + \varphi_h(L)Z_{t-1} + u_{t+h},$$

where  $y_t$  is expressed in constant dollars using the core PCE price index, and as a ratio of  $X_t$ . For stock variables, the dependent variable is the change in the stock between  $t-1$  and period  $t+h$ , scaled by  $X_t$ . For credit flow measures, we construct  $y_t$  by cumulating the flows  $f_t$  such that  $y_{t+h} - y_{t-1} = \sum_{j=0}^h f_{t+j}$ . The coefficient  $\gamma_h$  in [equation \(2\)](#) measures the multiplier associated with an additional dollar in commitments or purchases made between period  $t-1$  and  $t+h$ . This multiplier is the total cumulative dollar change in  $y_t$  over the same horizon. We estimate  $\gamma_h$  by 2SLS, that is, by replacing  $\sum_{j=0}^h \frac{p_{t+j}}{X_t}$  with predicted values from the first stage in [equation \(1\)](#). The baseline estimates reported in the rest of this section use an effective sample of 480 monthly observations, starting in January 1967.<sup>19</sup> In [Online Appendix IV](#), we present results for different sample periods.

Each of the regressions in [equations \(1\)](#) and [\(2\)](#) include a full year of monthly lags of a number of control variables  $Z_t$ , such that  $\varphi_h(L)$  is a lag polynomial of order 11. The controls include variables with predictive content for the dependent variables, and always include lagged values of  $\frac{y_t}{X_t}$  (or  $\frac{f_t}{X_t}$  for flow variables), as

18. The results do not differ meaningfully when we use polynomials of different order. In [Online Appendix IV](#), we show that the results are robust to using a trend in mortgage originations instead of personal income.

19. With local projections, every successive horizon  $h = 0, 1, 2, \dots$  requires a separate regression with  $h$  leads of observations beyond the end point of the sample; see [Jordà \(2005\)](#) for a discussion. For  $h > 0$ , we add the required observations beyond December 2006 such that the number of observations remains constant at  $T = 480$  for every  $h$ .

well as lags of agency net purchases and commitments as a ratio of  $X_t$ . In addition,  $Z_t$  contains lagged growth rates of the core PCE price index, a nominal house price index, total mortgage debt, the log level of real mortgage originations, housing starts, and lags of several interest rate variables: the 3-month T-bill rate, the 10-year Treasury rate, the conventional mortgage interest rate, and the BAA-AAA corporate bond spread. Finally, we add lags of two cyclical indicators: the unemployment rate and the growth rate of real personal income. All growth rates are quarter-over-quarter. [Online Appendix III](#) provides full details on the sources and construction of the time series. In [Online Appendix IV](#), we discuss results for a number of alternative control (sub)sets.

The central identifying restriction is exogeneity of the instrument, which requires that the residuals in [equation \(2\)](#) and the narrative measure are uncorrelated. To the extent that the lagged controls are informationally equivalent to all relevant impulses to the dependent variables occurring prior to time  $t$ , the regression residuals correspond to their horizon  $h$  forecast errors. The latter depend only on unpredictable shocks occurring between period  $t$  and  $t + h$ . Our instrument is based on the projected impact of policy events constructed from ex ante information. These estimates should therefore be uncorrelated with shocks occurring after time  $t$ . The identifying restriction then boils down to the assumption of contemporaneous exogeneity, that is, orthogonality between the instrument and all shocks in month  $t$  other than the one associated with the policy event itself (see [Stock and Watson forthcoming](#)). If the control set does not fully capture all impulses prior to date  $t$ , then the exogeneity requirement is stricter and the instrument must be uncorrelated with the history of relevant impulses to the left-hand-side variables. The omission of the cyclically motivated events aims at dropping policy actions that may be correlated with all other time  $t$  shocks. Our narrative classification retains the noncyclically motivated events for which correlation with contemporaneous shocks is unlikely, while the lagged controls provide additional insurance that the confounding effects of any remaining correlations with prior shocks are eliminated, see also [Ramey \(2016\)](#) and [Stock and Watson forthcoming](#).

#### V.A. First-Stage Results

We first investigate whether the narrative policy changes indeed lead to significant changes in agency purchasing activity by assessing the strength of our narrative instrument. The left panel

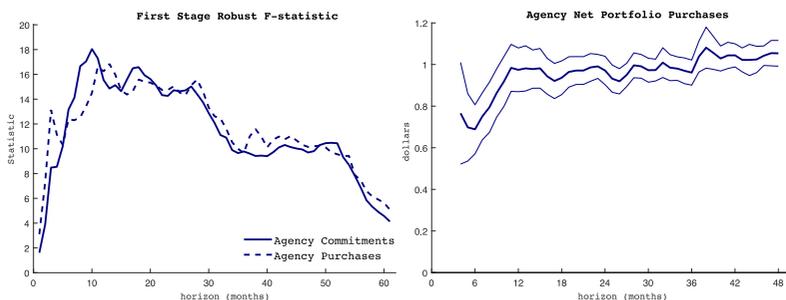


FIGURE IV

## First-Stage Diagnostics

The left panel shows [Newey and West \(1987\)](#) robust  $F$ -statistics of the first-stage regressions of cumulative agency commitments and purchases, respectively, on the narrative instrument; see [equation \(1\)](#). The right panel shows the estimated dollar increase in agency purchases per dollar increase in commitments. Finer lines in the right panel are 95% [Newey and West \(1987\)](#) confidence bands. Sample: January 1967 to December 2006.

of [Figure IV](#) shows the [Newey and West \(1987\)](#) robust  $F$ -statistics on the excluded instrument in each of the first-stage regressions [\(1\)](#) for horizons  $h = 0$  to  $h = 60$ . The figure shows the  $F$ -statistics both when we use cumulative commitments or purchases as the measure of agency activity  $p_t$ .

The results indicate that the narrative measure is a reasonably strong instrument for agency purchasing activity for horizons between 4 to 48 months after the policy events, with robust  $F$ -test statistics exceeding or close to 10. The  $F$ -statistics are low for very short horizons. This is natural given the presence of implementation lags and our timing of the policy changes according to the first arrival of news about impending regulatory changes. Beyond horizons of 48 months, the  $F$ -statistics fall to lower levels, which is also not surprising because other influences on agency purchases accumulate with the forecast horizon. Given these results we re-strict attention to the 4–48-month horizon.

The left panel of [Figure IV](#) shows that the  $F$ -statistics are very similar when we instrument for either purchases or commitments. The right panel of [Figure IV](#) depicts estimates of the dollar change in agency purchases for every dollar of commitments issued over the various time horizons, based on the regressions in [equation \(2\)](#) using cumulative agency purchases as the outcome variable and cumulative commitments as the independent variable. The fine lines denote 95% [Newey and West \(1987\)](#) confidence

intervals. Because of the time delays associated with secondary market transactions, the pass-through from commitments to purchases is high but smaller than unity for shorter horizons. After about one year the relationship becomes one-for-one with very narrow confidence intervals. The interpretation of the credit multiplier estimates presented next therefore depends somewhat on the denominator used, but only for horizons of less than one year. At longer horizons, there is essentially no difference between using commitments or purchases as the agency action measure.

### *V.B. Cumulative Credit Multipliers*

According to the Meltzer-Greenspan view, the portfolio activities of the agencies have no meaningful impact on housing or household debt. Without credit market imperfections, the ownership of mortgage debt is irrelevant. Any change in agency mortgage holdings has no impact on total mortgage debt, but leads instead to perfect crowding out of private holdings. If, on the other hand, there are frictions impeding the private flow of credit to residential borrowers, agency activity may not be neutral for the volume of mortgage lending. We now examine whether agency mortgage purchases indeed impact housing credit, and test the neutrality hypothesis using the local projections in [equation \(2\)](#) and the narrative policy instrument.

[Figure V](#) shows the impact of an increase in either agency commitments or purchases on mortgage credit aggregates, together with the 95% [Newey and West \(1987\)](#) confidence bands. There is a marked difference between the short- and long-run effects. In the short run, the results are consistent with neutrality: the upper left panel shows that a dollar purchased increases agency mortgage holdings initially by almost a dollar. The short-run effect of \$1 increase in commitments on agency holdings is lower at around 60 cents, which is expected given the time delay between commitments and purchases. The upper right panel shows that private holdings decline initially by roughly the same amount as the increase in agency holdings, although the confidence bands are wide.<sup>20</sup> The middle panels in [Figure V](#) show that

20. This almost certainly reflects the fact that our measure of private holdings is partially based on interpolation of quarterly data. Private holdings are measured by subtracting agency holdings from total mortgage debt. Total mortgage debt is constructed using monthly data on originations and an interpolation of implied quarterly repayment rates. See [Online Appendix III](#) for more detail.

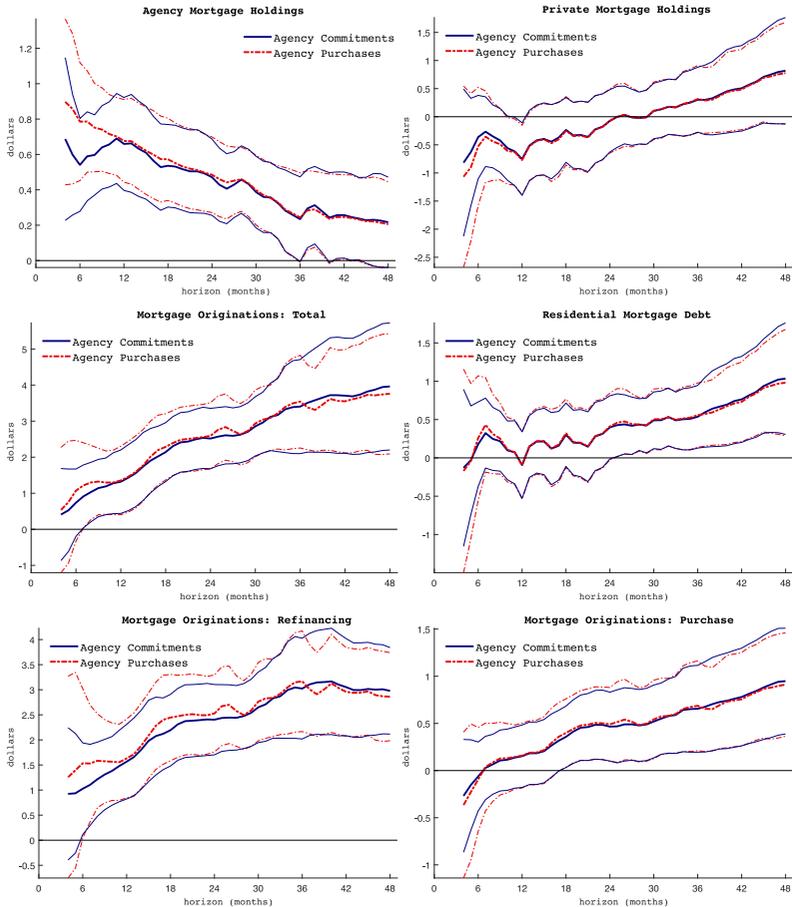


FIGURE V

Estimated Balance Sheet Adjustments and Mortgage Credit Multipliers Associated with Agency Mortgage Purchases

The figure shows dollar changes in the variable listed per dollar increase in agency net portfolio purchases or commitments to purchase cumulated over the reported horizon in months. Estimates are from local projections-IV regressions, see equation (2). Finer lines are 95% Newey and West (1987) confidence bands. Sample: January 1967 to December 2006. In the bottom row panels, the sample excludes May 1985 to December 1986 because of missing data on refinance shares; see Online Appendix III.

as \$1 in mortgage debt changes from private to agency ownership, there are initially no significant changes in originations or mortgage debt.

Over longer horizons, however, there is clear evidence against the notion that agency purchases are neutral for mortgage credit. The cumulative impact on total mortgage originations increases with the horizon and becomes statistically significant after six months. Over the course of three years and beyond, there is a cumulative increase in originations of \$3 or more for every \$1 purchased by the agencies. The estimated long-run multipliers for total originations are highly statistically significant and nearly identical for commitments and purchases. The point estimates for the impact on the stock of mortgage debt at shorter horizons are roughly in line with the range reported in [Smith, Rosen, and Fallis \(1988\)](#). The increase in mortgage debt becomes statistically significant after three to four years and in the longer run reaches a level of around \$1. As the time horizon grows, the increase in agency holdings slowly dissipates toward levels expected before the expansion. Similarly, the negative impact on the level of private mortgage holdings vanishes over time and eventually turns into an increase, although not one that is statistically significant.

The results in the middle row of [Figure V](#) imply that agency portfolio expansions lead to a substantial rise in mortgage lending activity. Originations take place when borrowers refinance, purchase an existing home, or purchase a new home. Unless there are changes in house prices or homeownership, the first two transactions typically lead only to small net changes in mortgage debt because a similar amount of mortgage debt is repaid. Since the increase in originations is a multiple of the net change in debt, it is likely driven mostly by a rise in transactions of the first two types, with new home purchases playing a more important role beyond horizons of two years. The bottom row of [Figure V](#) distinguishes between refinancing originations in the left panel, and home purchase originations in the right.<sup>21</sup> Refinancing originations indeed respond faster and by a substantially larger amount than purchase originations. Refinancing originations see a statistically significant increase beyond six months, and within three years are higher by roughly \$3 per \$1 of agency purchases.

21. Data prior to 1990 is approximated using the refinancing share of S&Ls, see [Online Appendix III](#). Unfortunately, we were unable to find data distinguishing between originations for new and existing home sales with a sufficient time span.

Home purchase originations rise more slowly and are statistically significantly higher after 18 months, increasing by nearly \$1 within 4 years. The rise in purchase originations occurs somewhat faster than the rise in total mortgage debt, suggesting that existing home sales respond before new home sales. The longer-run cumulative change in purchase originations is comparable to the increase in mortgage debt, which suggests a positive impact on residential construction. In the impulse response analysis below, we indeed find evidence for an increase in housing starts. We also document positive effects on homeownership rates and, less clearly, home prices, both of which contribute to the rise in mortgage debt. The bulk of the effect on originations is nevertheless due to refinancing.<sup>22</sup>

A comparison of the 2SLS and OLS estimates of the credit multipliers is informative about which of the sources of endogeneity bias discussed in [Section IV.A](#) dominates in practice. A priori the direction of the bias in the OLS estimates is ambiguous. Systematic GSE expansions during times of high primary market mortgage demand or high private sector credit supply are likely to bias the OLS estimates upward relative to the true effects. The systematic stabilizing actions of the agencies or their regulators, on the other hand, instead lead to a downward bias. By using only the predicted variation in agency purchases resulting from GSE regulatory changes, the 2SLS estimates aim to eliminate the upward or downward biases resulting from any systematic patterns in regular GSE purchasing behavior. The restriction to noncyclically motivated regulatory changes further eliminates the additional potential downward OLS bias due to systematic countercyclical actions by policy makers in response to economic and financial conditions. Recall also that the inclusion of the lagged financial and cyclical controls generally weakens the exogeneity requirement on the instrument, up to the point where the noncyclical policy interventions need only be contemporaneously uncorrelated with other determinants of the credit aggregates, see [Stock and Watson \(forthcoming\)](#).

[Figure VI](#) compares the OLS and 2SLS estimates of the cumulative impact on total mortgage originations. Given the strong procyclicality of originations, the large and consistently positive

22. This is consistent with [Di Maggio, Kermani, and Palmer \(2016\)](#), who document an increase in refinancing activity by 170% during the Fed's first QE program.

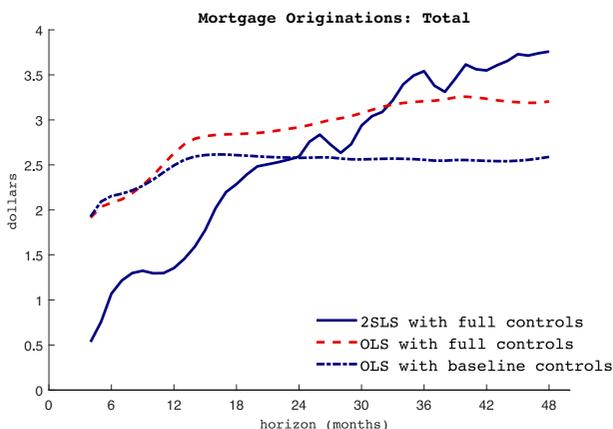


FIGURE VI

## The Role of Instrumentation

The figure shows dollar changes per dollar increase in agency net portfolio purchases cumulated over the reported horizon in months. The benchmark estimates are from local projections as in [equation \(2\)](#), comparing OLS and 2SLS estimates. The specification with baseline controls excludes the interest rate and cyclical controls.

OLS and 2SLS estimates make it unlikely that either estimates are severely contaminated by the countercyclical actions of the agencies over the sample. However, [Figure VI](#) also shows that, regardless of whether the baseline or full set of controls is included, the OLS estimates exceed the 2SLS estimates for horizons up to two years. Moreover, the OLS estimates are roughly independent of the horizon, implying that the bulk of the increase in originations occurs within a few months. The 2SLS estimates instead show a delayed and more gradual increase in originations. This pattern suggests that the dominant source of bias in the OLS estimates is the systematic process of private lenders passing on loans to the agencies very shortly after origination. A GSE policy of maintaining market share, for instance, would be consistent with originations rising before or roughly simultaneously with agency purchases, and without a decline in private holdings. The delayed and more gradual effect on originations that emerges after instrumentation, together with a short-run decrease in private holdings, suggests that the 2SLS estimates are not picking up increased supply of mortgages to the secondary market. Given the decision lags and time delays associated with making new

mortgage loans, the delayed and gradual rise in originations after instrumenting seems instead much more consistent with a causal interpretation.

In [Online Appendix IV](#), we elaborate on the role of instrumenting, and we discuss additional results on agency securitization. We verify robustness in several dimensions, such as the choice of scaling variable  $X_t$ , the sample choice, the set of controls, and the exclusion of specific policy events in the narrative instrument. The expansionary effects of agency purchases on mortgage credit are shown to be robust to many details of the analysis.

## VI. IMPULSE RESPONSE ANALYSIS OF NEWS SHOCKS TO AGENCY PURCHASES

To evaluate the effects of agency purchases on residential investment and homeownership and analyze the response of interest rates and other macro aggregates, we conduct an impulse response analysis of shocks to agency mortgage purchases. Given the gradual and anticipated nature of agency balance sheet expansions, our goal is to identify the response to shocks to expectations of future agency purchasing activity. We adopt a local projections approach and use the narrative instrument for identification.

### VI.A. Empirical Specification

For a given monthly outcome variable  $y_t$ , we estimate the response at horizon  $h$  based on

$$(3) \quad y_{t+h} - y_{t-1} = \alpha_h + \delta_h \left( \frac{12}{8} \times \frac{\sum_{j=0}^7 P_{t+j}}{\tilde{X}_t} \right) + \varphi_h(L)Z_{t-1} + u_{t+h}.$$

The right-hand-side variable of interest measures annualized agency commitments made over an eight-month period, expressed as a ratio of  $\tilde{X}_t$ , a long-run trend in annualized originations. The latter is obtained by fitting a third-degree polynomial of time to the log of real originations obtained using the core PCE price index as the deflator. The control variables  $Z_{t-1}$  are the same as in [equation \(2\)](#) estimating dollar cumulative effects. The first-stage regression is the same as in [equation \(1\)](#), but with  $\frac{12}{8} \frac{\sum_{j=0}^7 P_{t+j}}{\tilde{X}_t}$  as the dependent variable and  $\frac{m_t}{\tilde{X}_t}$  as the regressor. When an outcome variable is not included in the benchmark control set, we always add 12 monthly lags of that variable as additional controls

(in growth rates for trending variables and in levels for other variables).

The regression in [equation \(3\)](#) estimates the month  $h \geq 0$  response to a time 0 news shock to agency purchases. Expected agency purchases are proxied by agency commitments made over the next eight months. We choose an eight-month horizon to measure expected future commitments because at this horizon the robust  $F$ -statistic associated with the narrative instrument in the first-stage regression is the largest, and equals 11.68. The results are very similar for somewhat shorter or longer horizons. To address endogeneity, we use the indicator of noncyclical policy events, deflated by the core PCE price index and scaled by trend originations,  $\tilde{X}_t$ , as the instrument. The IV estimates of  $\delta_h$  in [equation \(3\)](#) can be interpreted as the response associated with a one percentage point increase in the agency flow market share that becomes anticipated  $h$  periods before. For perspective, the average market share in terms of portfolio purchases was approximately 7% between 1967 and 1990, and about 15% between 1990 and 2006; see [Figure I](#).

### VI.B. *Effects on Mortgage Credit and Interest Rates*

[Figure VII](#) displays the responses of mortgage credit and interest rates to news about higher future purchases. Each of the panels shows the point estimates and 68% and 95% confidence bands for the first 24 months after an increase in anticipated agency purchases by one percentage point of trend originations.

The first row in [Figure VII](#) displays the responses of real originations and mortgage debt to the agency purchase shock. Mortgage originations start rising after a few months and reach peak increases of 4% to 5% between 12 and 18 months after the shock. With a slightly longer delay, the stock of mortgage debt also gradually rises to levels that are about 0.3% higher after two years. The expansions in both the stock and gross flow of mortgage credit following a positive shock to agency purchases are statistically significant for multiple periods. The results again indicate that agency purchases stimulate mortgage lending significantly. [Online Appendix IV](#) shows that the impulse response analysis confirms that refinancing accounts for a large share of the increase in originations.

The second row in [Figure VII](#) shows the impact on interest rates on 30-year fixed-rate mortgages in the primary market. The

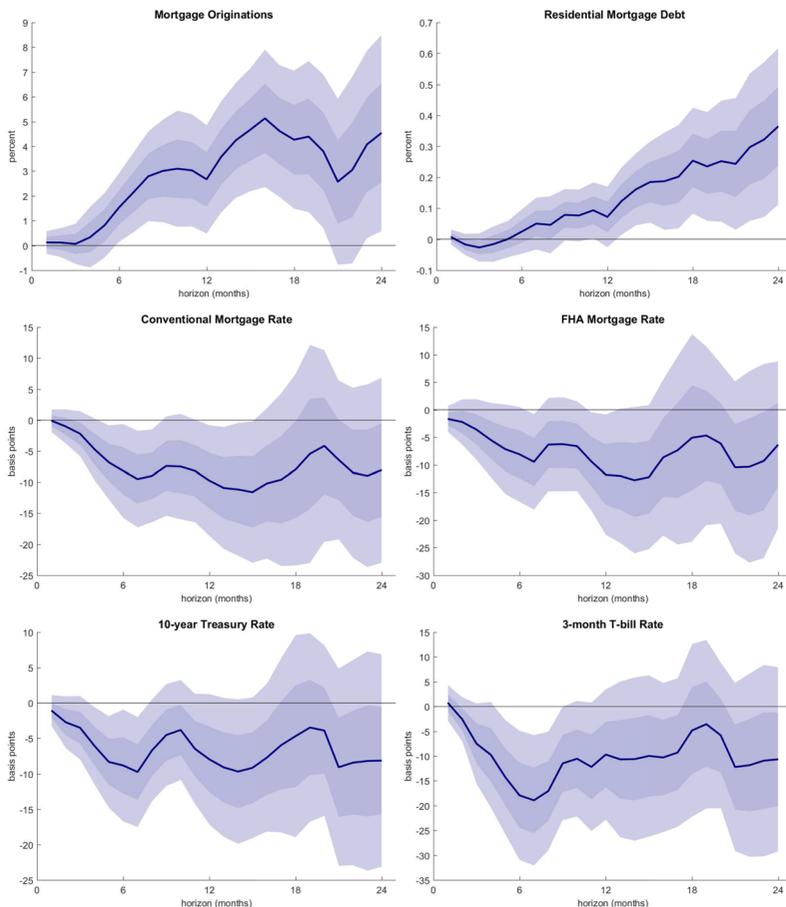


FIGURE VII

Impulse Responses to a Shock to Anticipated Agency Purchases

The figure shows responses to a one percentage point increase in the expected future agency market share measured by agency commitments as a ratio of trend originations. Estimates are from local projections-IV regressions instrumented with the narrative policy indicator, see [equation \(3\)](#). Shaded areas are 68% and 95% [Newey and West \(1987\)](#) confidence bands. Sample: January 1967 to December 2006.

left panel illustrates the interest rate effect on newly originated conventional/conforming mortgages, whereas the right panel contains the impact on interest rates of mortgages guaranteed by the Federal Housing Administration. The mortgage rates in the primary market are largely unaffected in the initial months after

the increase in agency mortgage purchase commitments. As the agencies' purchasing activity picks up, however, mortgage rates gradually decline and are lower by around 10 basis points after six months. The declines in mortgage rates appear quite persistent, are statistically significant for multiple periods, and help explain the increase in refinancing activity. A decrease in mortgage cost is consistent with agency purchases affecting the aggregate supply of housing credit, for instance, because of portfolio rebalancing effects or because private mortgage lenders are capital constrained. Agency purchases also alleviate any constraints faced by private intermediaries, for instance, because the higher prices of mortgage assets improve their net worth or because the sale of mortgages in exchange for agency debt lowers their risk-weighted leverage.

Issuing agency debt to finance the mortgage purchases potentially puts upward pressure on interest rates on other debt instruments. Such pressure may be limited if significant amounts of agency debt are purchased by foreign investors, as has been the case since the mid-1980s, or by the Federal Reserve, as was the case in the early years of our sample. Depending on the level of segmentation in financial markets, the rebalancing and other effects may also spill over to other asset markets and cause the yields on substitutes to mortgages to fall. These include other high-duration instruments, such as long-term Treasuries and corporate bonds. In addition, lower mortgage rates lead to more prepayments, which do not carry any penalty in the United States. There is considerable evidence that lower effective durations cause mortgage investors to bid up the price of higher-duration instruments, see for instance [Boudoukh et al. \(1997\)](#), [Perli and Sack \(2003\)](#), [Hanson \(2014\)](#), and [Malkhozov et al. \(2016\)](#). The broader impact on long-term yields is therefore *ex ante* not clear.

The left panel of the bottom row in [Figure VII](#) shows the estimated response of the 10-year Treasury rate. The results are very similar to those for the long-term mortgage rates just discussed: the 10-year Treasury rate responds little during the first couple of months, but as the agency mortgage purchases commence, it declines in a gradual and persistent manner by up to 5 to 10 basis points. The drop is significant at the 95% level between three and six months after the shock. The right panel in the bottom row of [Figure VII](#) reports the impact on the three-month T-bill rate. The results are qualitatively similar to those for the long-term rates discussed above. Quantitatively, we find some indication of a larger drop in short-term rates than in the

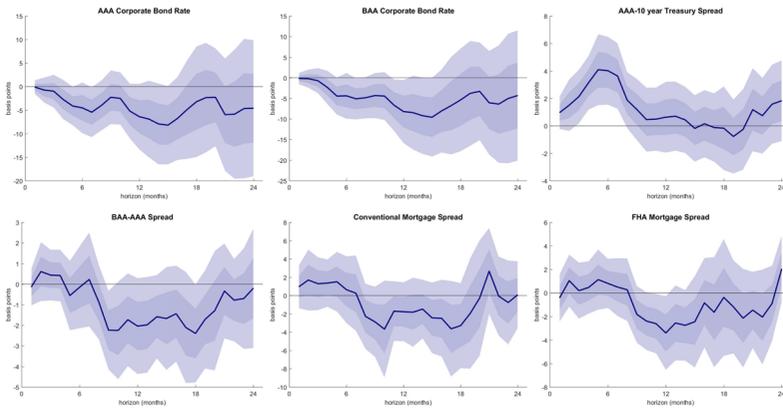


FIGURE VIII

## Impulse Responses to a Shock to Anticipated Agency Purchases

The figure shows responses to a one percentage point increase in the expected future agency market share measured by agency commitments as a ratio of trend originations. Estimates are from local projections-IV regressions instrumented with the narrative policy indicator, see [equation \(3\)](#). Shaded areas are 68% and 95% [Newey and West \(1987\)](#) confidence bands. Sample: January 1967 to December 2006.

longer-term rates. With a delay of a few months, the T-bill rate drops persistently by 15 to 20 basis points with a partial reversion taking place at longer forecast horizons. The negative response of short-term interest rates indicates that a potentially important explanation for the expansion in mortgage lending and the decline in mortgage rates is a more accommodative stance of monetary policy. In [Section VII](#), we investigate the role of monetary policy and its interactions with housing credit policy in greater detail.

[Figure VIII](#) shows additional results on the effects on other interest rates and credit spreads. The first two panels show the responses of the AAA-rated and BAA-rated long-term corporate bond yields. Taken together, the results suggest that agency purchases exert a downward pressure on corporate yields with a timing that coincides with the actual purchasing of mortgage assets by the agencies. The response of the corporate yields is qualitatively similar to those of mortgage and Treasury rates, showing initially no effect, and subsequently a gradual decline. The 95% confidence bands around the responses are relatively wide, and the responses are only marginally significant. The

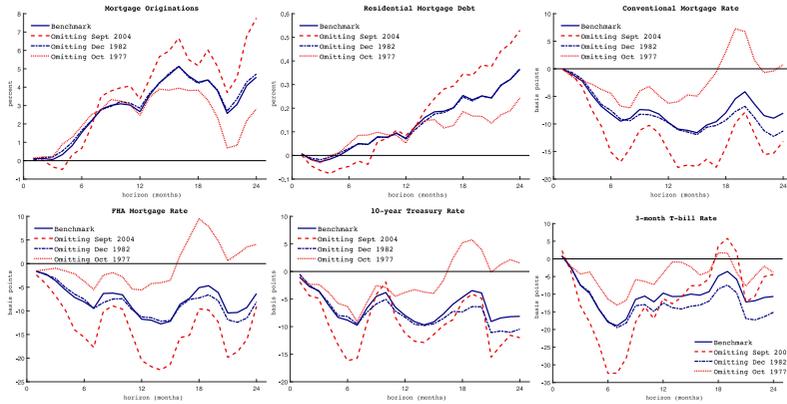


FIGURE IX

## Impulse Responses when Omitting Largest Policy Events

The figure shows responses to a one percentage point increase in the expected future agency market share measured by agency commitments as a ratio of trend originations. Estimates are from local projections-IV regressions instrumented with different subsets of the narrative policy indicator, see [equation \(3\)](#). Sample: January 1967 to December 2006.

declines in corporate bond yields are also quantitatively smaller than mortgage and Treasury rates. The third panel in the first row of [Figure VIII](#) shows statistically significant short-run increases in the spread between AAA-rated corporate bonds and 10-year Treasuries. Agency purchases appear therefore to induce the greatest spillovers on the demand for the relative liquidity and safety of Treasuries, which do not have prepayment risk. The increases are relatively short-lived, with the effects disappearing after seven or eight months. The next panel shows evidence for a drop in the spread between BAA- and AAA-rated corporate bonds after seven or eight months, suggesting some positive spillover effects on the demand for riskier long-term bonds. The final two panels of [Figure VIII](#) show declines in the spreads of mortgage rates over the 10-year Treasury rates of a few basis points after about six months. The declines are only marginally significant at best, indicating that agency purchases have important positive spillover effects on the demand for long-term Treasuries.

The finding that increases in agency mortgage purchases produce a boom in mortgage lending and declining interest rates is robust. [Figure IX](#) shows the response to a shock to anticipated

agency purchases for the benchmark specification along with those when we omit in turn each of the three largest policy interventions from the narrative instrument: the October 1977 conforming loan limit increase and expansion of the Brooke-Cranston Tandem program, the December 1982 increase in Fannie Mae's debt-to-capital limit, and the September 2004 tightening of capital requirements following the accounting scandals. In each case we add the omitted event as a separate dummy variable, including both the contemporaneous value and 12 lags to the control variables. Although there is some variation in the size of the responses, the results remain qualitatively similar to the benchmark narrative estimates. In all cases, there are increases in originations and mortgage debt, and declines in short- and long-term interest rates. We also obtained similar results for samples that omit the Volcker years, or for the subsample starting in October 1982, the end of the period of nonborrowed reserve targeting by the Federal Reserve.<sup>23</sup> Thus, the results are not driven by differences in Federal Reserve operating procedures in the 1970s or by the inclusion of the Volcker period. There is narrative evidence that political pressure to support the GSEs was exerted with some success in the late 1960s and 1970s, for instance leading the Federal Reserve to purchase significant amounts of agency debt, see [Haltum and Sharp \(2014\)](#). In the post-1982 sample, however, it seems less likely that political pressure to support government housing policies can explain an accommodative monetary policy response.

Finally, in the [Online Appendix](#) we report additional results based on using shocks to GSE excess stock returns as an alternative instrument for agency purchasing activity. This different approach is inspired by [Fisher and Peters \(2010\)](#), who use innovations in defense stocks to identify the effects of news shocks about military spending. The special GSE status is likely to account for the bulk of Fannie's and Freddie's market value and portfolio size (see e.g., [Passmore 2005](#)). We can therefore expect that idiosyncratic movements in GSE stock prices reflect unanticipated changes in the value of their GSE status and expected purchasing activity. Controlling for market-wide and real estate sector returns, as well as a wide range of other macroeconomic and financial factors, we find that residual variation in Fannie and Freddie excess stock returns predicts agency mortgage

23. The results are available in the [Online Appendix](#).

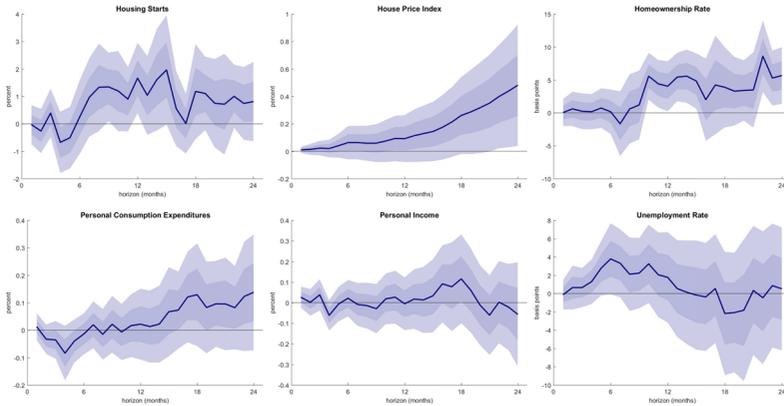


FIGURE X

#### Impulse Responses to a Shock to Anticipated Agency Purchases

The figure shows responses to a one percentage point increase in the expected future agency market share measured by agency commitments as a ratio of trend originations. Estimates are from local projections-IV regressions instrumented with the narrative policy indicator, see [equation \(3\)](#). Shaded areas are 68% and 95% [Newey and West \(1987\)](#) confidence bands. Sample: January 1967 to December 2006.

purchases. This motivates us to use this residual variation as an alternative instrumental variable to estimate the response of credit aggregates to shocks to agency mortgage purchases. The resulting impulse response estimates, which are discussed in the [Online Appendix](#), lead to very similar conclusions as those based on the narrative instrument.

#### VI.C. Effects on Housing and Other Macro Aggregates

Next we assess the evidence for the broader macroeconomic effects of government asset purchases. [Figure X](#) shows the responses of a range of monthly macro aggregates to an agency purchase shock. As in [Figure VII](#), the responses are to an anticipated increase in purchases by one percentage point of trend originations, estimated by the regression in [equation \(3\)](#) and using the narrative instrument. We consider the following additional outcome variables at the monthly frequency: housing starts, real house prices, the homeownership rate, real personal

consumption expenditures, real personal income, and the unemployment rate.<sup>24</sup>

The first panel in [Figure X](#) shows the effects on residential investment, as measured by monthly housing starts. Based on the narrative instrument, the number of new housing starts rises to levels that are roughly 1–2% percent higher after about six months. Housing starts remain elevated for about a year and drop off to prior levels afterwards. We thus find evidence that the expansion in the stock of mortgage debt following a shock to agency purchases is associated with higher levels of residential investment.<sup>25</sup> The top middle panel in [Figure X](#) plots the impact on real house prices, as measured by the Freddie Mac house price index deflated by the core PCE price index. We find that real house prices rise gradually but very persistently over time, with a point estimate that becomes significantly positive at longer forecast horizons only. The increase in house prices is quantitatively relatively small and imprecisely estimated. Thus, we have no clearcut evidence of any strong impact of agency mortgage purchases on house prices. The size of the point estimates imply that only some of the dollar increase in gross mortgage credit flows can be explained by increases in house prices.

The top right panel in [Figure X](#) shows the response of the homeownership rate, as measured by the Census Bureau, which is often cited as one of the primary motivations for housing credit policy. There is a sustained increase in homeownership by around 5 basis points beyond a horizon of 10 months. Although there is considerable uncertainty in the estimates, the responses are statistically significant at the 95% level for multiple months, indicating that agency activity indeed has an effect on homeownership. This also implies that the expansion in the stock of mortgage debt is in part driven by an increase in homeownership.

24. All these variables, except the unemployment and the homeownership rate, are included in logs and all nominal variables are deflated by the core PCE price index. The homeownership rate is only available at a quarterly frequency, and the monthly series in this case simply consists of the quarterly values. See [Online Appendix III](#) for precise definitions and sources.

25. The more immediate effects on residential construction are consistent with the more delayed impact on mortgage debt in [Figure VII](#). This is because financing in the building phase is typically through a short-term construction loan converted into a residential mortgage loan only after the borrower takes up occupancy of the house.

The remaining panels in [Figure X](#) show the responses of consumption expenditures, personal income, and the unemployment rate. Using the narrative instrument, we find that an increase in agency mortgage purchases stimulates consumption very modestly and with a delay of more than a year. Personal sector income and the unemployment rate are roughly unchanged over the entire forecast horizon. The increase in consumption is imprecisely estimated, and none of the impulse responses are significantly different from 0 at the 95% level. There is an initial rise and a subsequent decline in the unemployment rate around a year after the shock, but the magnitudes of these changes are small and not statistically significant.

The alternative GSE excess returns identification strategy discussed in [Online Appendix II](#) yields overall comparable results, including a statistically significant rise in housing starts, and a significant and persistent rise in homeownership.<sup>26</sup> Our overall conclusion, therefore, is that there is evidence that agency mortgage purchases stimulate residential investment and homeownership, and some indication of a positive effect on personal consumption expenditures. The confidence bands in [Figure X](#) are relatively wide, and the power of our instruments to detect a macroeconomic impact of agency mortgage purchases beyond the housing sector is limited.

## VII. HOUSING CREDIT POLICY VERSUS CONVENTIONAL MONETARY POLICY

In the previous section, we found that increases in agency mortgage purchases lead to an expansion in mortgage credit and to declines in short- and long-term interest rates. A natural question to ask is to what extent these effects reflect conventional monetary policy actions and how monetary and credit policies interact more broadly. The left panel in [Figure XI](#) reports the estimated response of the federal funds rate to an agency purchase shock obtained using the methods of the previous section. Based on the narrative instrument, there is a delayed and transitory decline in the funds rate by up to 30 basis points after six months. This decrease is statistically significant at conventional levels after 4 to 12 months.

26. The main exception is that the GSE excess returns instrument yields no evidence for any significant rise in house prices.

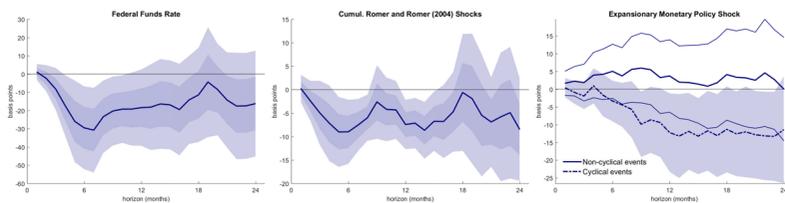


FIGURE XI

## Interactions between Monetary and Credit Policies

The left and middle panels show responses to a one percentage point increase in the expected future agency market share measured by agency commitments as a ratio of trend originations. Estimates are from local projections-IV regressions instrumented with the narrative policy indicator, see [equation \(3\)](#). Shaded areas are 68% and 95% [Newey and West \(1987\)](#) confidence bands. The right panel shows responses to a monetary shock obtained by local projections-IV regressions on the three-month T-bill rate and instrumenting with the [Romer and Romer \(2004\)](#) monetary policy shock measure. Finer lines and shaded areas in the right panel are 95% [Newey and West \(1987\)](#) confidence bands. Sample: January 1967 to December 2006.

We obtain similar declines in short-term interest rates for the post-1982 subsample, after excluding the nonborrowed reserves targeting period, or after omitting larger policy events from the narrative instrument (see [Online Appendix IV](#)). We conclude that there is evidence that agency mortgage purchases are accompanied by accommodative monetary policy. A possible alternative interpretation is that our identification scheme erroneously picks up the influence of recessionary shocks causing downward adjustments in the Federal Reserve's interest rate target. However, if this were the case, we would not expect to find increases in strongly procyclical variables, such as mortgage originations or housing starts. To gain more insight into the nature of the funds rate response, we make use of the decomposition by [Romer and Romer \(2004\)](#) of changes in the intended funds rate at FOMC meetings into a systematic and a residual shock component.<sup>27</sup> The systematic component is measured by the explained variation in a regression of target changes on changes in Green Book forecasts of inflation, output growth, and unemployment. Monetary policy shocks are measured by the residuals in the regression, and

27. We use the updates by [Wieland and Yang \(2016\)](#) to extend the sample of the original series.

capture the remaining variation in target changes not explained by changes in the Green Book forecasts.

The middle panel in [Figure XI](#) depicts the estimated response of the cumulative [Romer and Romer \(2004\)](#) shocks to an agency purchase shock using the regressions in [equation \(3\)](#). With a few months' delay, the narrative instrument yields a significant and persistent decline by up to 10 basis points. The funds rate decline is therefore not explained by inflation and output considerations alone, and possibly reflects an independent reaction to credit market conditions or credit policies.

To investigate whether monetary policy affects housing credit policy, the right panel in [Figure XI](#) reports the response of the cumulated narrative measures of credit policy changes in [Table II](#), deflated by the core PCE price index and expressed as a percentage of trend originations, to a monetary shock. The response to a monetary shock is obtained by similar regressions as in [equation \(3\)](#), but replacing the agency market share on the right-hand side with the contemporaneous level of the three-month T-bill rate and using the [Romer and Romer \(2004\)](#) shock measure as an instrument.<sup>28</sup> The results indicate there is no evidence for monetary policy shocks affecting the noncyclical measure of agency purchase shocks, as our narratively identified housing credit policy instrument is not itself predictable by the [Romer and Romer \(2004\)](#) residuals. This provides assurance that our narrative instrument does not erroneously pick up the effects of monetary policy shocks. Similarly, adding the current and lagged values of the [Romer and Romer \(2004\)](#) shocks as additional control variables in [equation \(3\)](#) also has very little effect on the results, see [Online Appendix IV](#). The cyclical housing policy measure (dot-dashed line), on the other hand, does show a statistically significant decline following an expansionary monetary policy shock, which illustrates the importance of accounting for the endogeneity of credit policies. Consistent with an objective of stabilizing credit flows, we thus find that housing credit policies on average act to offset the effects of monetary policy disturbances.

28. Conditional on including an informationally sufficient set of lagged variables as controls, valid identification under this approach requires only contemporaneous exogeneity of the [Romer and Romer \(2004\)](#) shocks. The predictability of the [Romer and Romer \(2004\)](#) shocks by agency purchase shock therefore does not necessarily invalidate the identification of the response to monetary shocks.

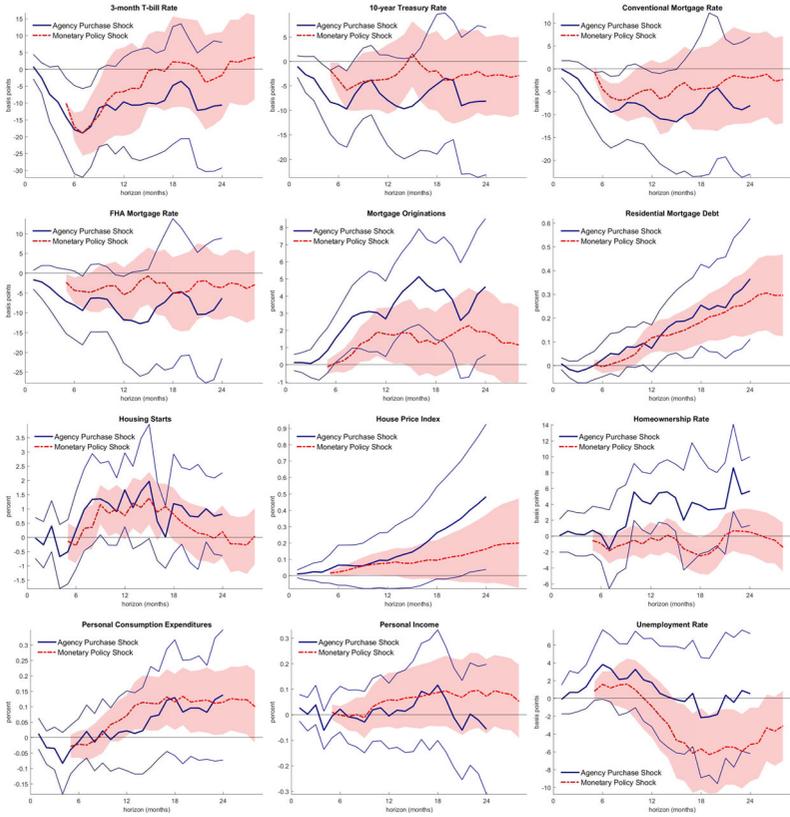


FIGURE XII

Responses to a Shock to Anticipated Agency Purchases versus a Monetary Policy Shock

The figure shows responses to a one percentage point increase in the expected future agency market share as well as the response to a monetary policy shock. Estimates are from local projections-IV regressions instrumenting agency commitments with the narrative policy indicator, see equation (3), and instrumenting the three-month T-bill rate with the Romer and Romer (2004) monetary policy shock measure. Finer lines and shaded areas are 95% Newey and West (1987) confidence bands. Sample: January 1967 to December 2006.

To further judge the extent to which agency purchase shocks operate through more conventional monetary transmission channels, Figure XII compares the impact of a traditional monetary policy shock (dot-dashed line; in red online) with the response to the agency purchase shock identified using the narrative instrument (solid line; in blue online). These responses are again

obtained by local projections as in [equation \(3\)](#), but with the contemporaneous three-month T-bill rate as the right-hand-side variable and the [Romer and Romer \(2004\)](#) residuals as the instrument. In the figure, the impact of the interest rate shock is scaled such that the maximum decline in the three-month T-bill rate is the same as for the agency purchase shock identified with the narrative instrument. For easier comparison, the responses to the monetary policy shock in [Figure XII](#) are shifted forward by four months such that the maximum interest declines for each of the policy shocks coincide. The bands shown are the 95% [Newey and West \(1987\)](#) confidence intervals.

[Figure XII](#) reveals that conventional monetary policy shocks and credit policy shocks have qualitatively similar effects on many of the variables shown. Although each of the policies involves purchases of different types of assets with different sources of financing, both generate a decline in long-term interest rates, a rise in originations and mortgage debt, and an increase in housing starts. Consistent with most of the existing empirical literature, an expansionary monetary shock leads to increases in consumption and income and a decline in the unemployment rate.<sup>29</sup> The monetary shock responses provide a familiar reference point for judging the quantitative impact of agency purchase shocks. After scaling the estimates to imply the same decline in the short-term interest rate and accounting for the more immediate effects of a funds rate target shock on short-term interest rates, many responses to each of the policy shocks are similar in terms of magnitude and timing.

There are, however, also some notable differences between the responses in [Figure XII](#). The first is that agency purchases lead to a rise in originations that is roughly twice as large as that of the interest rate shock. There is little indication that a conventional monetary policy shock causes a significant rise in real house prices, while the decline in long-term interest rates is slightly more pronounced and persistent after an agency purchase shock. Both the rise in housing starts and mortgage debt, on the other hand, are very similar for both policy shocks. Taken together, the results indicate that agency purchases have a larger effect on mortgage repayments than conventional interest rate

29. The response to both shocks also feature a similar price puzzle, that is, a decline in the price level as measured by the PCE price index. Results are available on request.

policy. In [Online Appendix IV](#), we compare the responses of refinancing and purchase originations. Whereas purchase originations respond very similarly to both shocks, refinancing originations react more strongly to the agency purchase shock, and account for the entire difference in the effect on total originations.

Another notable difference between credit policy and traditional interest rate shocks is the effect on the homeownership rate (right panel, third row in [Figure XII](#)). Unlike the response to an agency purchase shock, there is no indication that a conventional interest rate shock has any positive effect on homeownership. In most months, the estimated effect on homeownership instead is negative, though small and generally not statistically significant. Apart from the different response of originations and homeownership, however, it does appear as if credit policy operates through similar transmission channels as conventional monetary policy.

In [Online Appendix IV](#), we compare agency activity and conventional monetary shocks in terms of their contribution to fluctuations in credit aggregates and interest rates. Because our local projections approach is not well suited for this purpose, we assess the variance contributions in a proxy SVAR setting ([Mertens and Ravn 2013](#)) using the GSE excess returns identification strategy and the [Romer and Romer \(2004\)](#) residuals as a proxy for monetary shocks. The main finding is that GSE excess returns shocks explain up to 15% and 10% of the medium-run forecast error variance of mortgage originations and housing starts, respectively, which is roughly comparable to the contribution of monetary policy shocks. In addition, although shocks to monetary policy are substantially more important for the variance of interest rates in the short run, the role of GSE excess returns shocks for long-term interest rates exceeds the role of monetary policy shocks at longer horizons. The SVAR-based analysis overall indicates that the contribution of credit policy shocks to fluctuations in housing and credit markets is nonnegligible.

To explore the potential effects of agency mortgage purchases when conventional interest rate policy does not respond, for instance because it is constrained by the zero lower bound, [Figure XIII](#) reports the results from a counterfactual experiment in which the short-term interest rate is assumed to remain constant. As before, the responses are to an increase in anticipated agency purchases by one percentage point of trend originations, as in [equation \(3\)](#). However, we now additionally assume the

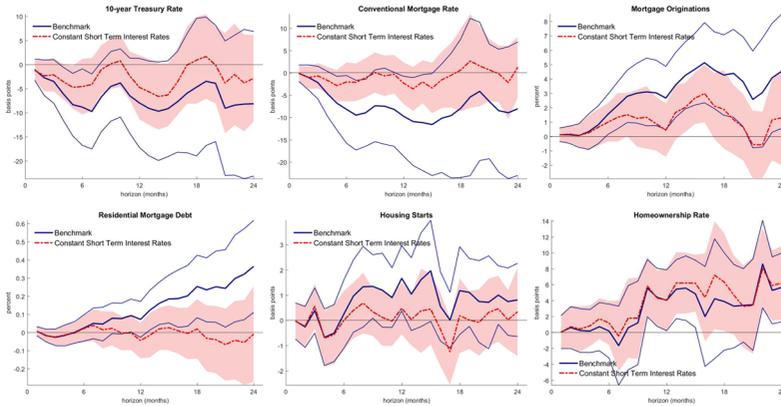


FIGURE XIII

#### Shock to Anticipated Agency Purchases: Counterfactual with Constant Short-Term Rate

The figure shows responses to a one percentage point increase in the expected future agency market share as in the benchmark of [equation \(3\)](#), as well as those augmented with a sequence of monetary shocks such that the three-month T-bill rate remains constant. Estimates are from local projections-IV regressions instrumenting agency commitments with the narrative policy indicator, and the three-month T-bill rate with the [Romer and Romer \(2004\)](#) monetary policy shock measure, respectively. Finer lines and shaded areas are 95% [Newey and West \(1987\)](#) confidence bands. Sample: January 1967 to December 2006.

realization of a sequence of monetary shocks such that the three-month T-bill rate remains unchanged at every horizon.<sup>30</sup> An important caveat with this experiment is that the short-term rate remains constant because of successive monetary surprises rather than an anticipated policy response. As such, the results are clearly subject to the Lucas critique. [Figure XIII](#) shows the counterfactual responses (dot-dashed lines; in red online) and the earlier baseline estimates (solid lines; in blue online), in both cases with 95% [Newey and West \(1987\)](#) bands.

The results from the counterfactual experiment in [Figure XIII](#) suggests that conventional monetary policy plays an important role in explaining the effects of agency purchase shocks. The rise in originations is only about half as large when short-term interest rates remain constant, and there is no longer any sign of

30. The impact of monetary shocks on the outcome variables is obtained as in [Figure XII](#), that is, by using the [Romer and Romer \(2004\)](#) shocks as an instrument in local projections on the three-month T-bill rate and the control variables.

an increase in the stock of mortgage debt. The drop in long-term interest rates is much reduced, and the positive effect on housing starts disappears entirely. The combination of expansionary monetary and credit policy therefore seems particularly important for stimulating residential investment. Even with constant interest rates, however, purchases of mortgage assets continue to have statistically significant effects on mortgage lending. In addition, the path of short-term interest rates appears largely irrelevant for the increase in the homeownership rate that follows an expansion in agency purchases. In the [Online Appendix](#), we report results for the same counterfactual experiment when we use GSE excess returns shocks for identifying responses to anticipated agency purchases. The results indicate a smaller role for conventional monetary policy in explaining the drop in long-term interest rates or the positive effect on housing starts. Otherwise, the findings are comparable to those obtained using the narrative instrument in [Figure XIII](#).

## VIII. CONCLUDING REMARKS

The postwar period witnessed a remarkable expansion in residential mortgage debt. During the same period, an increasing share has come to reside on what is ultimately the balance sheet of the federal government. In this article, we provide evidence that government mortgage purchases influence the volume and cost of mortgage lending. To tackle reverse causality, we make use of a number of policy changes that have affected the ability of government agencies to acquire mortgage debt. Using policy interventions that we classify as noncyclically motivated to construct an instrumental variable for (news about) agency mortgage purchases, we find that an increase in these purchases stimulates mortgage originations and debt and temporarily lowers mortgage rates. Consistent with the evidence in [Di Maggio, Kermani, and Palmer \(2016\)](#) regarding the effects of the QE interventions, we find that agency purchases have particularly large effects on refinancing activity. We also find a positive impact on housing starts and homeownership, and some indications of positive effects on house prices and consumption expenditures. An alternative identification strategy (discussed in the [Online Appendix](#)) based on GSE excess returns innovations as an instrument for purchasing activity yields overall very similar results.

One important aspect of our findings is the apparent similarity and interaction between housing credit policies and conventional interest rate policy. We find that greater agency mortgage purchases lead to broad declines in short- and long-term interest rates. Our measure of noncyclically motivated credit policy changes predicts the [Romer and Romer \(2004\)](#) monetary policy shock measure, and expansionary credit policy appears to be accommodated by monetary policy. In contrast, we find that credit policy adjusts to offset the effects of monetary disturbances. It may therefore be necessary to account for credit policy to understand the effects of monetary policy. Agency purchase shocks have relatively larger effects on mortgage originations and refinancing activity than interest rate shocks, and influence home-ownership regardless of the path of short-term interest rates. The quantitative effects of credit and monetary policy shocks on many other variables, including residential investment, are otherwise remarkably similar.

There are several interesting avenues for future research: unlike theoretical or multivariate statistical models, our approach does not easily allow an assessment of the historical contribution of structural shocks without further assumptions. Future work can verify whether credit policy shocks are important causal factors in past housing or credit cycles, in particular during the most recent housing boom and bust.<sup>31</sup> Another interesting avenue for future research is to verify whether the macroeconomic impact of agency mortgage purchases has grown with the rise in the stock of mortgage debt, and whether it varies importantly with the broader financial conditions. Our results can be used to help evaluate the credit policy interventions in the recent financial crisis, the possible impact of unwinding the Fed's current mortgage holdings, or the various proposals for GSE reform. We have made no attempt at understanding more precisely the nature or implications of the credit frictions and transmission channels through which housing credit policies operate. Future work may apply similar cross-sectional identification strategies as [Di Maggio, Kermani, and Palmer \(2016\)](#), [Darmouni and Rodnyansky \(2017\)](#), or [Chakraborty, Goldstein, and MacKinlay \(2016\)](#)

31. The expansion of the GSEs' market share from the early 1990s to mid-2004 was dramatic but came to a grinding halt when, following revelations of accounting fraud, regulators imposed capital surcharges on Fannie and Freddie in fall 2004 and eventually portfolio caps in mid-2006.

to other housing credit policy events documented in our narrative analysis. Finally, it is possible to apply a similar analysis to assess the impact of government mortgage guarantees and securitization.

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#### SUPPLEMENTARY MATERIAL

An [Online Appendix](#) for this article can be found at *The Quarterly Journal of Economics* online. Data and code replicating the tables and figures in this article can be found in [Fieldhouse, Mertens, and Ravn \(2018\)](#) in the Harvard Data-verse, doi:10.7910/DVN/Y954OM. The companion narrative analysis background paper, [Fieldhouse and Mertens \(2017\)](#), can be found at the [National Bureau of Economic Research](#) online.

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