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Reassessing the Single-Family Agency CMO Market: Implications for MBS Pool Liquidity

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ABSTRACT

We lay out a transparent data structure designed to produce a clean dataset that serves as a benchmark for the Agency Single-Family Collateralized Mortgage Obligations (CMO) market, restoring visibility into how CMO structures affect the availability and effective supply of Agency MBS pools. Agency CMOs are created by repackaging the cash flows of agency single-class pools into multi-class securities². While there is substantial literature describing the pass-through, or pools market, considerably less has been written about CMOs. This is due in no small part to the underlying market complexities, which until recently impeded analysis but now fall within the reach of digital tools. Prior efforts have largely focused exclusively on mortgage pools, an approach that effectively severs the relationship between CMO assets and liabilities, and which can lead to confusion, such as double-counting. By reconnecting CMO assets and liabilities, our approach restores the structural linkage between underlying mortgage pools and the securities built upon them. We establish the integrity of the new dataset through the application of the simple accounting identity: Assets of Collateral Pools = Liabilities of CMO tranches. This approach is internally consistent and transparent. Furthermore, this effort is timely insofar as the innate complexity of CMOs implies that the market is vulnerable to shocks stemming from the current elevated levels of policy and economic uncertainty. We conclude with two applications of our dataset. First, we examine the relationship between CMO lockup ratios and the market shares of Agency MBS production, illustrating how structuring choices affect the supply of available pools. Second, we discuss mortgage market and security liquidity in the context of the float rates at the Agency, tranche and security levels, providing indicators of effective supply, which will be of great interest to portfolio managers, traders, risk managers, market analysts, researchers, and policymakers.

¹ I would like to thank Li Chang for her many insights and Yang Yang for superb research assistance.

² **Understanding and Measuring Risks In Agency CMOs**, Nicholas Arcidiacono, Larry Cordell, Andrew Davidson and Alex Levin, Federal Reserve Bank of Philadelphia Research Department Working Paper No 13-8, February 2013 (ACDL)

Introduction

Securitization is broadly defined as a method of turning illiquid loans into liquid securities. Another way of looking at this is that “The mortgage-backed securities (MBS) market emerged as a way to decouple mortgage lending from mortgage investing”.³

These are often referred to as “pass-through” securities because the mortgage payments made by borrowers are passed through to investors. The term “Pool” is also often used interchangeably with “pass-through”. The success of this idea can be seen in the growth of the market from the first agency pass-through issuance in 1970, a Ginnie Mae security, to the present time with outstanding balances in excess of \$9.3 trillion.⁴

Given this expanding pool of liquidity, it’s not surprising that enterprising investment bankers figured out that they could structure new products designed to meet the specified requirements of different classes of investors with preferences for distinct performance characteristics, such as prepayment speeds and durations. This was achieved by redistributing the allocation of pass-through cash flows (both interest and principal payments) and re-packaging them into separate tranches to obtain certain desirable traits. These are called Collateralized Mortgage Obligations (CMOs). The first one was issued by Freddie Mac in 1983, supported by two investment banks.⁵

Such entities can be registered in various forms, such as corporations and partnerships. The 1986 Tax Reform Act authorized a particular form of CMO known as a Real Estate Mortgage Investment Conduit (REMIC)⁶. A REMIC is registered as a partnership, which has the advantage of avoiding double taxation for investors in the structure (the REMIC does not pay taxes). Agency CMOs are in the REMIC form, but referring to them as “CMOs” has become standard market usage.⁷ CMOs consisting of Agency MBS receive the same guarantees as the underlying collateral.

As with pass-throughs, the Agencies disclose data on the CMOs they guarantee. This allows us to compare the scales of the complex securitizations (CMOs) to the simpler pass-through MBS structures used in the Agency market. According to ACDL, “From a cash flow standpoint, a CMO can be thought of as a set of rules that split the interest and principal cash flows of the underlying mortgage collateral.” That statement represents the peak of CMO research available at the time of publication (2013), and no other basic research has surpassed this work since then. The market has continued to develop, but our literature search and discussions with market participants have confirmed this. Our hope with this paper is to move the literature forward by building a new benchmark dataset that incorporates both the pool and CMO sides in a consistent way. From this basic work we believe that researchers will be able to better understand the risks associated with this complex structure, while market participants will be in a position to design strategies best in line with their fundamental views.

³ **Mortgage-Backed Securities**, Andreas Fuster, David Lucca, and James Vickery, Federal Reserve Bank of New York Staff Reports, no. 1001 (FLV), February 2022

⁴ Federal Reserve Z.1, as of 2025 Q2

⁵ <https://www.occ.gov/news-issuances/news-releases/2010/nr-occ-2010-39f.pdf>

⁶ <https://capitalmarkets.freddie.mac.com/mbs/products/remics>

⁷ A wrinkle is a class of CMOs called Re-REMICs which are securitized defaulted REMICS. We will discuss this asset class in more detail in future work.



To begin, we start with an example.

An Example

As an illustration, we look at a recent CMO, Fannie Mae REMIC Trust 2025-59.

**Table 1: Summary of Classes of Fannie Mae REMIC Trust 2025-59
(Fannie Mae's Prospectus Supplement)**



**Guaranteed REMIC Pass-Through Certificates
Fannie Mae REMIC Trust 2025-59**

Class	Group	Original Class Balance(\$)	Principal Type(1)	Interest Rate(%)	Interest Type(1)	CUSIP Number	Final Distribution Date
FL	1	212,814,233	PT	(2)	FLT	3136BWM52	August 2055
SL	1	212,814,233(3)	NTL(PT)	(2)	INV/IO	3136BWM60	August 2055
FG	1	50,000,000	PT	(2)	FLT	3136BWM78	August 2055
FD	1	42,668,685	PT	(2)	FLT	3136BWW59	August 2055
DS	1	92,668,685(3)	NTL(PT)	(2)	INV/IO	3136BWM86	August 2055
MS	1	92,668,685(3)	NTL(PT)	(2)	T/IO	3136BWW75	August 2055
LA	1	80,000,000	SEQ	5.0	FIX	3136BWM94	November 2053
LY(4)	1	14,117,647	SEQ	5.0	FIX	3136BWN28	August 2055
LE(4)	1	73,661,929	SEQ	5.0	FIX	3136BWN36	November 2051
LV(4)	1	14,615,046	SEQ/AD	5.0	FIX	3136BWN44	April 2038
LZ(4)	1	16,681,181	SEQ	5.0	FIX/Z	3136BWN51	August 2055
FM	2	100,000,000	PT	(2)	FLT	3136BWN69	August 2055
SM	2	100,000,000(3)	NTL(PT)	(2)	INV/IO	3136BWN77	August 2055
MA	2	32,869,095	SEQ	5.0	FIX	3136BWN85	March 2051
MV	2	7,204,000	SEQ/AD	5.0	FIX	3136BWN93	August 2036
MZ	2	9,926,905	SEQ	5.0	FIX/Z	3136BWP26	August 2055

(Table continued on next page)

Class	Group	Original Class Balance(\$)	Principal Type(1)	Interest Rate(%)	Interest Type(1)	CUSIP Number	Final Distribution Date
FN	3	10,000,000	PT	(2)	FLT	3136BWP34	August 2055
NS(4)	3	10,000,000(3)	NTL(PT)	(2)	INV/IO	3136BWP42	August 2055
NI	3	500,000(3)	NTL(PT)	(2)	INV/IO	3136BWP59	August 2055
FE	3	148,132,909	PT	(2)	FLT	3136BWP67	August 2055
SE(4)	3	148,132,909(3)	NTL(PT)	(2)	INV/IO	3136BWP75	August 2055
NA(4)	3	59,497,411	SEQ	5.0	FIX	3136BWP83	August 2052
NV(4)	3	9,138,561	SEQ/AD	5.0	FIX	3136BWP91	April 2038
NZ(4)	3	10,430,483	SEQ	5.0	FIX/Z	3136BWPQ25	August 2055

Source: Fannie Mae

Despite the apparent complexity in this structure, the Prospectus Supplement (**Table 1**) makes it clear that the trust consists entirely of UMBS: first lien, fixed-rate, fully amortizing single-family loans. The definitions behind Groups, Principal Types, and Interest Type are extremely complex and are structured in a way to appeal to categories of investors⁸. For our present purposes, it is important to note that this CMO is ultimately decomposed into 24 individual *tranche bonds*, each with its own CUSIP.

⁸ As ACDL importantly note, "This slicing and dicing does not create or reduce aggregate risk but rather redistributes it. If a tranche is created with a low amount of interest rate risk, there are some other pieces that have elevated risks. While CMOs offer the advantage of matching securities with the preferences of a particular class of investors, this occurs at the cost of added complexity." We will examine the risks associated with this complexity in more detail in future research.



The question that arises is: How big is the CMO? Note that in bold print at the top of the prospectus, there is a figure **\$891,758,085**. What is that? Below is a summary of the **Table 1** that produces various subtotals:

Table 2: Summary of Tranches of Fannie Mae REMIC Trust 2025-59 (Recursion)

Group	Tranche	Tranche CUSIP	Tranche Face Amount (\$)	Principal Type	Interest Type	Collateral Type	Principal-Bearing Bond?
1	FNMA.2025-059-FL	3136BWM52	212,814,233	PT	FLT	POOL	YES
	FNMA.2025-059-SL	3136BWM60	212,814,233	PT	IIO	POOL	NO
	FNMA.2025-059-FG	3136BWM78	50,000,000	PT	FLT	POOL	YES
	FNMA.2025-059-FD	3136BWY59	42,668,685	PT	FLT	POOL	YES
	FNMA.2025-059-DS	3136BWM86	92,668,685	PT	IIO	POOL	NO
	FNMA.2025-059-MS	3136BWY75	92,668,685	PT	IO	POOL	NO
	FNMA.2025-059-LA	3136BWM94	80,000,000	SEQ	FIX	POOL	YES
	FNMA.2025-059-LY	3136BWN28	14,117,647	SEQ	FIX	POOL	YES
	FNMA.2025-059-LE	3136BWN36	73,661,929	SEQ	FIX	POOL	YES
	FNMA.2025-059-LV	3136BWN44	14,615,046	SEQ	FIX	POOL	YES
FNMA.2025-059-LZ	3136BWN51	16,681,181	SEQ	Z	POOL	YES	
Principal-Bearing Bonds Subtotal			504,558,721				
2	FNMA.2025-059-FM	3136BWN69	100,000,000	PT	FLT	POOL	YES
	FNMA.2025-059-SM	3136BWN77	100,000,000	PT	IIO	POOL	NO
	FNMA.2025-059-MA	3136BWN85	32,869,095	SEQ	FIX	POOL	YES
	FNMA.2025-059-MV	3136BWN93	7,204,000	SEQ	FIX	POOL	YES
	FNMA.2025-059-MZ	3136BWP26	9,926,905	SEQ	Z	POOL	YES
Principal-Bearing Bonds Subtotal			150,000,000				
3	FNMA.2025-059-FN	3136BWP34	10,000,000	PT	FLT	POOL	YES
	FNMA.2025-059-NS	3136BWP42	10,000,000	PT	IIO	POOL	NO
	FNMA.2025-059-NI	3136BWP59	500,000	PT	IIO	POOL	NO
	FNMA.2025-059-FE	3136BWP67	148,132,909	PT	FLT	POOL	YES
	FNMA.2025-059-SE	3136BWP75	148,132,909	PT	IIO	POOL	NO
	FNMA.2025-059-NA	3136BWP83	59,497,411	SEQ	FIX	POOL	YES
	FNMA.2025-059-NV	3136BWP91	9,138,561	SEQ	FIX	POOL	YES
	FNMA.2025-059-NZ	3136BWQ25	10,430,483	SEQ	Z	POOL	YES
Principal-Bearing Bonds Subtotal			237,199,364				
Total Issuance Amount			891,758,085				

Note: Interest Types include FIX (fixed rate), FLT (floating rate), IO (interest only), IIO (inverse interest only), and Z (Z tranches). Principal Types include PT (Pass-Through) and SEQ (Sequential).

Source: Fannie Mae, Recursion

The important point here is that this number represents the total principal balance of the principal-bearing tranches, not the sum of all tranche balances, which may include interest-only or residual components. In addition, we also need to exclude the recomingables, to avoid double-counting. The size of the CMO is defined by the amount of MBS collateral that backs it—not by simply summing all tranche amounts. Nonetheless, market participants trade individual tranches, not entire CMOs, so we need to understand the underlying structures of each deal. Every time a new CMO is released, we parse the file and break it down into components as above. We have gone back and done this for several thousands of deals.



Next, to study the performance of each CMO over time, we need to track the unpaid principal balances of the underlying pools as the loans contained in them amortize or prepay. The Agencies release data files that report this information at the collateral security level, rather than the tranche level. In our example:

Table 3: Summary of Collateral of Fannie Mae REMIC Trust 2025-59 at Issuance (Recursion, as of July 2025)

Group	Collateral Pool CUSIP	Collateral Pool Number	Collateral Issuance Investor Security UPB (\$)	Weight	Collateral Original Face Amount (\$)	Factor	Collateral Current UPB (\$)	WA Loan Rate (%)	WA Loan Age (Mo.)
1A	3140Y6UD0	FN CC0579	208,703,607	1.00	208,703,607	0.99	205,751,404	6.77	2
1A	3140Y6NY2	FN CC0406	165,473,586	0.70	115,473,586	0.98	113,469,945	6.93	3
1B	3140Y6YU8	FN CC0722	185,481,652	1.00	185,481,652	1.00	185,337,377	6.88	1
Collateral Group Subtotal							504,558,726		
2	31418FDC8	FN MA5498	1,496,455,678	0.03	49,417,995	0.88	43,439,964	6.99	10
	31418FCH8	FN MA5471	5,550,802,144	0.01	62,536,722	0.88	54,885,527	6.99	11
	31418E7B0	FN MA5389	4,055,430,904	0.02	62,355,990	0.83	51,674,513	6.96	14
Collateral Group Subtotal							150,000,005		
3	31418FCH8	FN MA5471	5,550,802,144	0.05	270,265,623	0.88	237,199,371	6.99	11
Collateral Group Subtotal							237,199,371		
Total Asset Amount							891,758,102		

Source: Fannie Mae, Recursion

The CMO is backed by seven MBS pools, three in Group 1, three in Group 2, and one in Group 3⁹. As we shall see, it is important to note that the face value of the pool collateral in the CMO is not necessarily the same as the total outstanding principal balance of these pools. The third column labeled “Collateral Issuance Investor Security UPB” reflects each pool’s unpaid principal balance (UPB) at the time of CMO issuance. The column “weight” is the share of the pool’s UPB contribution to the CMO out of the total. A key statistic is the “Factor”, which is the current UPB of the pools as a share of their original face amount used in the CMO. These metrics become important as we move to aggregating the CMOs to get a total view of the market. For now, our main result is to demonstrate that the size of the CMO based on the pool collateral is equal to the sum of the principal-bearing tranches.

To further validate our approach, we turn now to looking at the relationship between the CMO collateral and the tranches on an aggregate basis.

⁹Note that the complexity of the CMO tranching process prevents us from making a straightforward connection between the MBS collateral and that of the tranches.

Assessing the magnitude of the CMO market

Given that an individual CMO can be looked at either from a collateral (portfolio of pools) or tranche perspective, we can assess the quality of our data by creating an aggregate market measure in both ways and comparing the results. **Table 4** and **Table 5** reflect these two approaches based on the categories that are standardized by Recursion.

Table 4: Agency MBS Single-Family CMO Outstanding Balance (Collateral, as of August 2025, in millions of dollars)

Agency	Collateral Type			Grand Total
	POOL	STRIP	REMIC	
FHL	338,146	275	42,883	381,304
FNM	267,415	306	21,152	288,872
GNM	520,919	28	31,172	552,119
Total	1,126,480	608	95,207	1,222,295

Note: Outstanding balances are as of August 1, 2025. Collateral Type classifications are as follows: Pool indicates that the collateral consists of a single MBS pool or a Mega/Super/Giant pool; Strip indicates that the collateral is a stripped mortgage-backed security (MBS); REMIC indicates that the collateral consists of a previously issued CMO.

Source: Fannie Mae, Freddie Mac, Ginnie Mae, Recursion

Table 5: Agency MBS Single-Family CMO Outstanding Balance (Tranches, as of August 2025, in millions of dollars)

Agency	Principal-Bearing Bond Structure Type							Grand Total
	FIX - PT	FIX - PAC/TAC	FIX - SEQ	FIX - SUP	FIX - OTHER	FLT	Other	
FHL	75,528	66,739	76,648	1,307	1,603	105,947	53,259	381,031
FNM	50,938	45,997	62,814	780	1,232	85,031	41,793	288,585
GNM	82,563	90,168	107,738	2,412	2,415	219,631	42,572	547,499
Total	209,029	202,904	247,200	4,498	5,250	410,609	137,624	1,217,115

Note: Only principal-bearing tranches are included. Outstanding balances are as of August 1, 2025. Structure Type is defined by the combination of each tranche's Interest Type and Principal Type. Interest Types include FIX (fixed rate), FLT (floating rate), and Other (e.g., PO and Z tranches). Principal Types include PT (Pass-Through), PAC (Planned Amortization Class), TAC (Targeted Amortization Class), SEQ (Sequential), SUP (Support/Companion), and Other (any remaining types not classified above).¹⁰

Source: Fannie Mae, Freddie Mac, Ginnie Mae, Recursion

¹⁰ For a detailed explanation of each tranche type, see Frank J. Fabozzi, **The Handbook of Fixed Income Securities**, 7th ed. (New York: McGraw-Hill, 2005), 543.



The total quantities are extremely close. Main source of the small differences is due to some CMO deals are overcollateralized. This is particularly the case with Ginnie Mae securities.

To conclude, we propose that the aggregate level of the Agency CMO market at time t be calculated from the collateral side. Let C_k^{orig} be the original face value of collateral security k out of n active pools. Then the aggregate value of the CMO at time t, CMO_t can be expressed:

$$CMO_t = \sum_{k=1}^n C_k^{orig} f_t^k$$

Where f_t^k is the Factor of C_k^{orig} at time t.

It is straightforward to decompose this expression into Agency-specific or other classifications.

Based on this analysis, the integrity of our process has been validated. Accordingly, we propose that our calculation of aggregate CMO unpaid principal balances serves as an industry benchmark. The methodology is transparent and can be divided into components to meet market needs for analysis of specific market segments.

An immediate application is a comparison between the CMO and overall MBS markets:

**Table 6: Outstanding Balance of Agency MBS Single-Family Pools
(as of August 2025, in millions of dollars)**

Agency	Current Remaining Principal Balance (\$M)	No. of Pools	Avg. of Pool Size (\$M)
FHL	3,027,283	342,725	8.8
FNM	3,525,055	501,077	7.0
GNM	2,584,759	338,140	7.6
Total	9,137,096	1,181,942	7.7

Source: Fannie Mae, Freddie Mac, Ginnie Mae, Recursion



**Table 7: Outstanding Balance of Agency MBS Single-Family CMOs
(as of August 2025, in millions of dollars)**

Agency	Current Remaining Principal Balance (\$M)	No. of CMOs	Avg. CMO Size (\$M)	No. of Tranches	Avg. Tranche Size (\$M)
FHL	381,031	3,559	107	26,375	14.4
FNM	288,585	2,970	97	24,194	11.9
GNM	547,499	2,334	235	32,099	17.1
Total	1,217,115	8,863	137	82,668	14.7

Source: Fannie Mae, Freddie Mac, Ginnie Mae, Recursion

Based on this, we can monitor the share¹¹ of Agency MBS that are “locked-up” in CMOs (CMO lockup ratio), which quantifies the portion of Agency MBS collateral that is structured into CMOs, expressed as a share of the total Agency MBS pools by unpaid

$$\text{principal } L_t(\%) = \frac{U_{CMO,t}}{U_{Total,t}} \times 100$$

Where:

L_t = CMO lockup ratio at time t

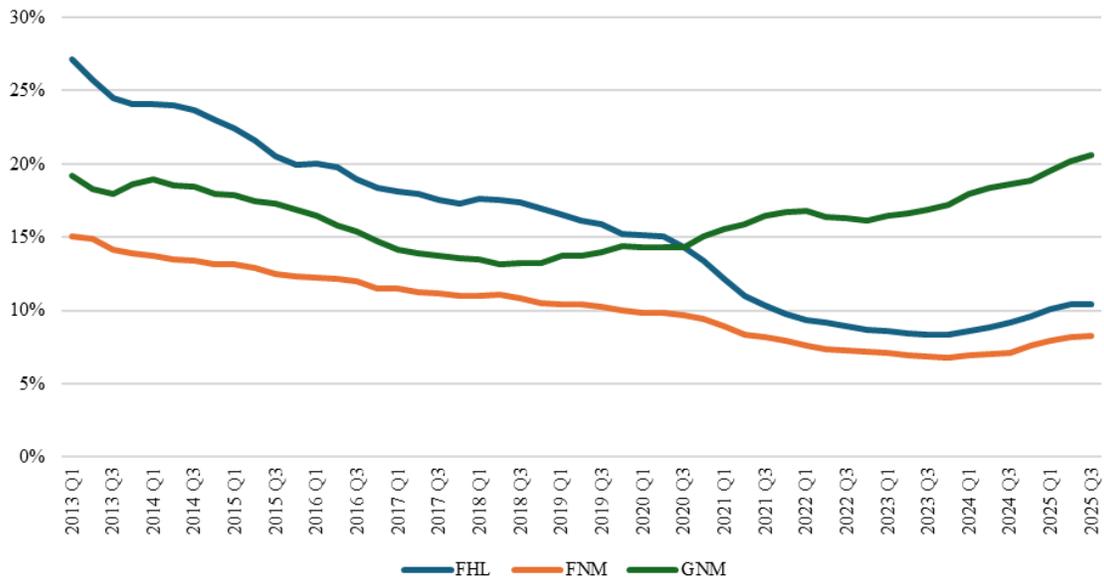
$U_{CMO,t}$ = Unpaid Principal Balance (UPB) of Agency MBS pools used as CMO collateral at time t

$U_{Total,t}$ = Total UPB of outstanding Agency MBS pools at time t

¹¹ <https://www.fhfa.gov/sites/default/files/WPR-2020-001.pdf>



Figure 1: Agency Single-Family MBS CMO Lockup Ratio



Source: Fannie Mae, Freddie Mac, Ginnie Mae, Recursion

Figure 1 leads immediately to the next sections, which discuss the role of CMOs in the liquidity of the underlying MBS market both at the individual security and aggregate levels.

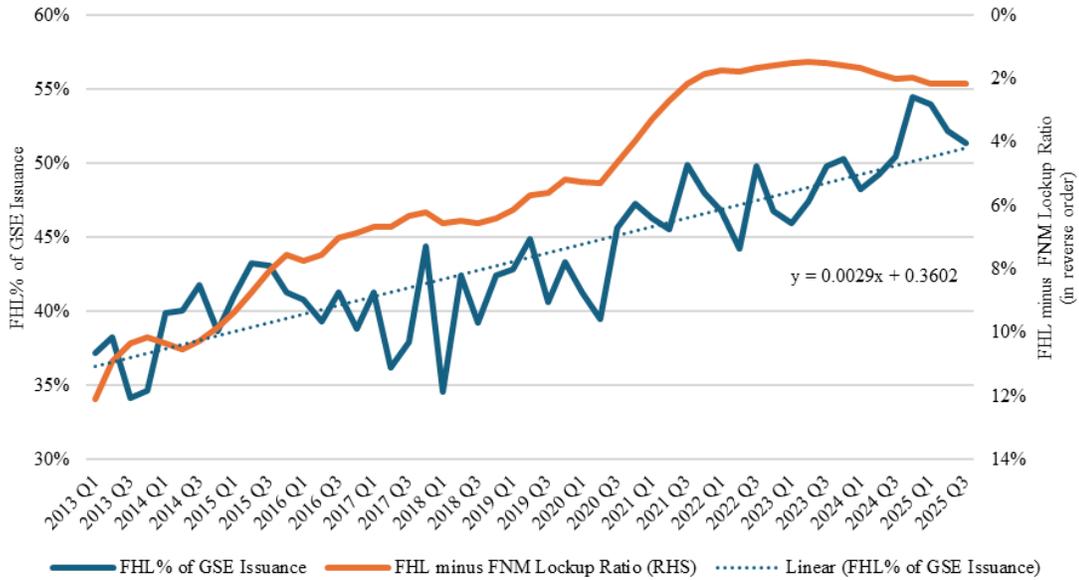
MBS Liquidity and CMOs

In this section, we examine how the CMO market can serve as a lens for viewing the liquidity of the underlying MBS market. In **Figure 1**, we see the CMO lockup shares of the three Agencies. We start by looking at Fannie Mae and Freddie Mac, the two Government-Sponsored Enterprises (GSEs). We can see immediately that the lockup share of Freddie Mac has historically exceeded that of Fannie Mae, but this has narrowed in recent years. What is behind this pattern?

First, in terms of deliveries to the GSEs, historically, Fannie Mae’s market share has exceeded that of Freddie Mac. Part of this is due to the fact that Fannie Mae is older than Freddie Mac (Fannie Mae dates to 1938, Freddie Mac dates to 1970), and part from the differences in the structure of their unique securities. In particular, Freddie Mac’s “GOLD” PCs used a 45-day payment delay compared to a 55-day delay for Fannie Mae’s pass-throughs, giving them a disadvantage regarding delivery preferences. As a result, Freddie Mac would have to lower its fees or issue more CMOs to create an artificial shortage of their pass-through securities to offset the disadvantage. To enhance the liquidity of the overall MBS market, in 2014, the GSE’s regulator, Federal Housing Finance Agency (FHFA), directed the Agencies to build a Common Security Platform (CSP) for the Uniform Mortgage-Backed Securities (UMBS). With UMBS going live in 2019, key characteristics were aligned across the two Agencies.¹² As the new security gained traction, the need for greater production of Freddie Mac CMOs declined, and their market shares converged.

¹² [This effect has come to be referred to as “Mortgage Winter”](#)

Figure 2: Freddie Mac Share of GSE Issuance versus the Difference Between Freddie Mac and Fannie Mae CMO Lockup Ratio



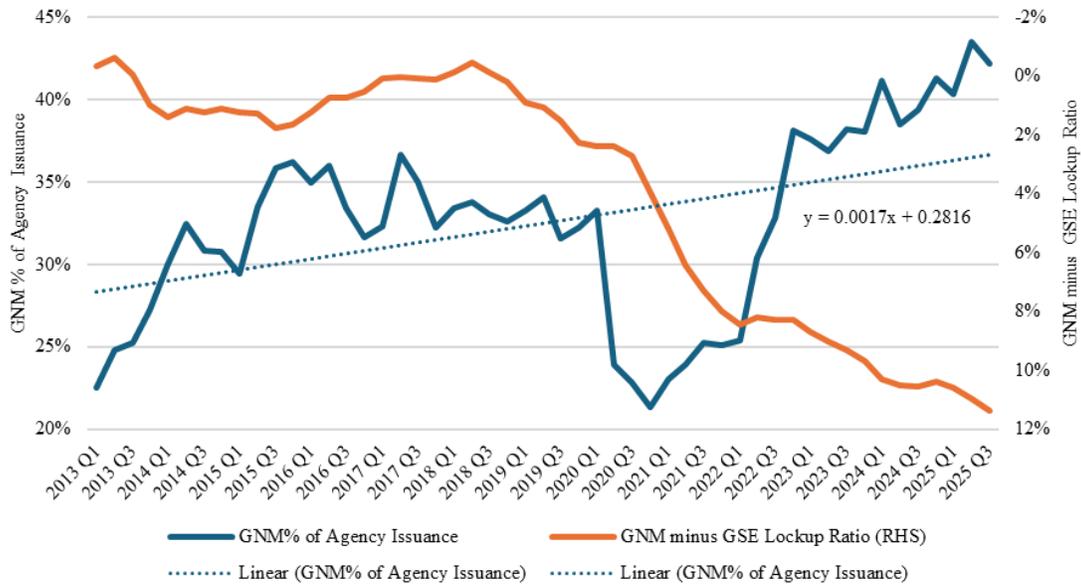
Source: Fannie Mae, Freddie Mac, Recursion

Second, we examine Ginnie Mae’s market share of agency pass-through issuance and the relative lockup rate of its single-class securities compared with those of the GSEs. Ginnie Mae’s programs primarily serve lower-income and first-time homebuyers. As such, the collateral underlying its securities tends to be riskier than that of the GSEs. As an expression of the importance of this cohort to policymakers, Ginnie Mae securities carry the full faith and credit of the U.S. Government, unlike GSE securities, where such support is only implied.

Historically, the Ginnie Mae’s CMO lockup rate was relatively modest. However, with the onset of the COVID-19 pandemic, lenders tended to exhibit more risk-averse behavior in originating conforming loans, and some effort was extended to increase volumes in the Ginnie Mae programs. This trend picked up considerably after the surge in interest rates in 2022, which placed downward pressure on both the demand for housing and the supply, as homeowners who had bought homes or refinanced during the low-rate period became “locked into” their residences.¹³

¹³ Dickey Fuller and Phillips-Perron Unit Root Tests reveal that these first differences are stationary time series across all variables.

Figure 3: Ginnie Mae Share of Agency Issuance versus the Difference Between Ginnie Mae and GSE CMO Lockup Ratio



Source: Fannie Mae, Freddie Mac, Ginnie Mae, Recursion

Note that these stories are quite different. In the first case, Freddie Mac had a long history of locking up its pass-throughs in CMOs to counteract the natural competitive disadvantage in its security structure relative to Fannie Mae. Policy measures were taken to ease this disadvantage, and Freddie Mac no longer had the same incentive to place their securities into CMOs. In the second case, the economic and market environment became highly challenging for mortgage production. Placing more pass-throughs into CMOs became the preferred policy response to boost activity, with a focus on first-time homebuyers.

The question arises as to the causality of the relationship between the lockup ratios and the market shares in the two examples. We take a straightforward XAR approach whereby the first differences in lockup shares are explained by a lag in the first difference of the lockup share and the first difference in the market share with some lag value determined by the best fit¹⁴.

¹⁴ GSE indicates the sum of Fannie Mae and Freddie Mac securities.



A. The Freddie Mac / Fannie Mae Lockup Ratio

Let

$$FHLL_t(\%) = \frac{FHLU_{CMO,t}}{FHLU_{Total,t}} \times 100$$

;and

$$FNML_t(\%) = \frac{FNMU_{CMO,t}}{FNMU_{Total,t}} \times 100$$

Our dependent variable is the “gap” between the two lockup ratios, expressed as a first difference:

$$\Delta_t^{FHLFNMGap} = (FHLL_t - FNML_t) - (FHLL_{t-1} - FNML_{t-1})$$

The independent variable is the change in the market share between Freddie Mac and Fannie Mae:

$$\Delta_t^{FHLFNMS} = \left(\frac{FHLI_t}{FHLI_t + FNMI_t} \right) - \left(\frac{FHLI_{t-1}}{FHLI_{t-1} + FNMI_{t-1}} \right)$$

Where:

$FHLL_t$ = Freddie Mac CMO lockup ratio at time t

$FHLU_{CMO,t}$ = Unpaid Principal Balance (UPB) of Freddie Mac MBS pools used as CMO collateral at time t

$FHLU_{Total,t}$ = Total UPB of outstanding Freddie Mac MBS pools at time t

$FHLI_t$ = Freddie Mac issuance at time t

$FNML_t$ = Fannie Mae CMO lockup ratio at time t

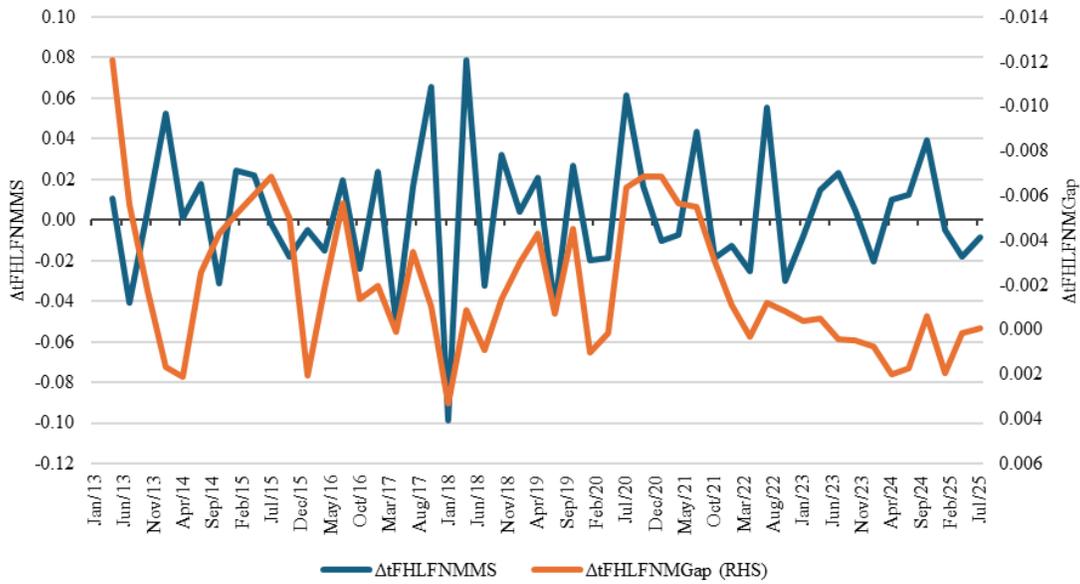
$FNMU_{CMO,t}$ = Unpaid Principal Balance (UPB) of Fannie Mae MBS pools used as CMO collateral at time t

$FNMU_{Total,t}$ = Total UPB of outstanding Fannie Mae MBS pools at time t

$FNMI_t$ = Fannie Mae issuance at time t

Below find a chart of the dependent and independent variables in first difference form:

Figure 4: Change in Difference between FHL and FNM Lockup Rates and Change in FHL/FNM MBS Market Share



Source: Fannie Mae, Freddie Mac, Ginnie Mae, Recursion

Hence, we present Equation 2:

$$\Delta tFHLFNMGap = \alpha FHLFNM \Delta tFHLFNMMS + \beta FHLFNM \Delta t-1FHLFNMGap + \epsilon t$$

Where ϵt is a normally distributed independent error term.

We perform an XAR analysis and determine that the contemporaneous variable has the best fit.

Table 8: FHL – FNM Lockup Rate Model Parameter Estimates

Equation	Parameter	Estimate	Standard Error	t Value	Pr > t	Variable
$\Delta tFHLFNMGap$	α^{FHLFNM}	-0.03683	0.00969	-3.8	0.0004	FHLFNMMS(t)
	β^{FHLFNM}	0.65508	0.08446	7.76	0.0001	FHLFNMGap (t-1)



The model is statistically significant, and parameters have the expected signs.

The application of a Granger Causality Wald test¹⁵ indicates that Freddie Mac increases its lockup share when its market share decreases. This increase in lockup share does not immediately translate into a recovery in its market share.

The Ginnie Mae / GSE Lockup Ratio

Let

$$GNML_t(\%) = \frac{GNMU_{CMO,t}}{GNMU_{Total,t}} \times 100$$

; and

$$GSEL_t(\%) = \frac{GSEU_{CMO,t}}{GSEU_{Total,t}} \times 100$$

Our dependent variable is the “gap” between the two lockup ratios, expressed as a first difference:

$$\Delta_t GNMFNMGap = (GNML_t - GSEL_t) - (GNML_{t-1} - GSEL_{t-1})$$

The independent variable is the change in the market share between the Ginnie Mae and GSE lockup ratios expressed as a first difference:

$$\Delta_t GNMGSEMS = \left(\frac{GNMI_t}{GNMI_t + GSEI_t} \right) - \left(\frac{GNMI_{t-1}}{GNMI_{t-1} + GSEI_{t-1}} \right)$$

Where:

$GNML_t$ = Freddie Mac CMO lockup ratio at time t

$GNMU_{CMO,t}$ = Unpaid Principal Balance (UPB) of Ginnie Mae MBS pools used as CMO collateral at time t

$GNMU_{Total,t}$ = Total UPB of outstanding Ginnie Mae MBS pools at time t

$GNMI_t$ = Ginnie Mae issuance at time t

$GSEL_t$ = GSE¹⁶ CMO lockup ratio at time t

$GSEU_{CMO,t}$ = Unpaid Principal Balance (UPB) of GSE MBS pools used as CMO collateral at time t

$GSEU_{Total,t}$ = Total UPB of outstanding GSE MBS pools at time t

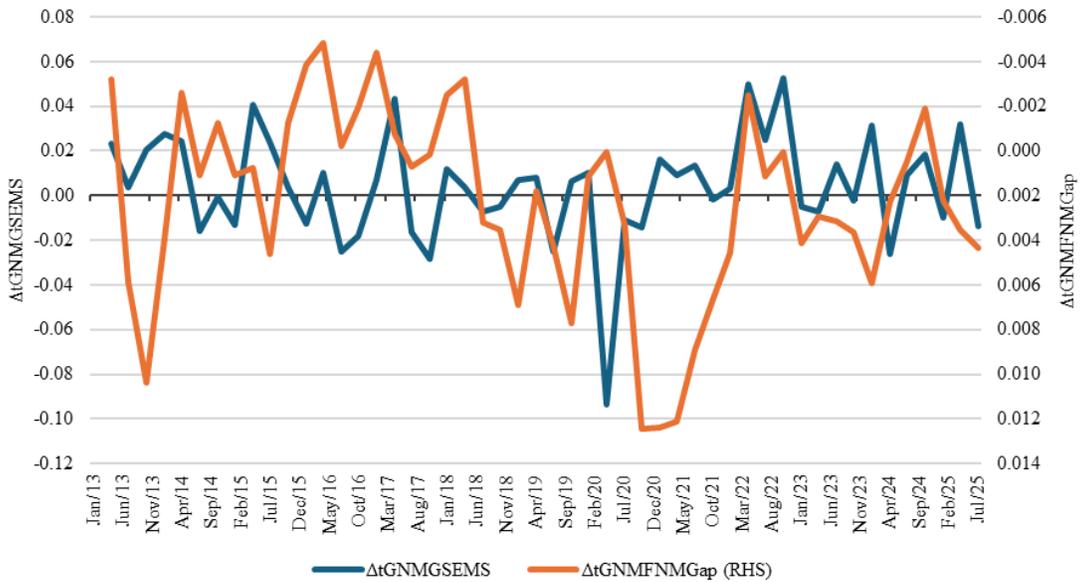
$GSEI_t$ = GSE issuance at time t

Below find a chart of the dependent and independent variables in first difference form:

¹⁵ “Granger causality is a valuable method for investigating predictive relationships in time series data, providing insights into how variables interact over time without asserting direct causation.” from [Granger Causality: A Review and Recent Advances](#), Ali Shojaie and Emily B. Fox, University of Washington, 2021

¹⁶ See <https://www.federalreserve.gov/monetarypolicy/policy-normalization.html>

Figure 5: Change in Difference between GNM and GSE Lockup Rates and Change in GNM/GSE MBS Market Share



Hence, we present Equation 3:

$$\Delta_t \text{GNMFNMGap} = \alpha^{\text{GNMGSE}} \Delta_{t-2} \text{GNMGSEMS} + \beta^{\text{GNMGSE}} \Delta_{t-1} \text{GNMFNMGap} + \epsilon_t$$

Table 9: GNM – GSE Lockup Rate Model Parameter Estimates

Equation	Parameter	Estimate	Standard Error	t Value	Pr > t	Variable
$\Delta_t \text{GNMFNMGap}$	α^{GNMGSE}	-0.02948	0.01992	-1.48	0.1458	GNMGSEMS(t-2)
	β^{GNMGSE}	0.73404	0.09861	7.44	0.0001	GNMFNMGap(t-1)

In this case the formal XAR procedure indicates that the second lag of the exogenous variable demonstrates the best fit. The regressions display the expected sign, but the relationship is not statistically significant. We believe that the exogenous increase in the lockup ratio after 2021 is maybe driving the increase in the market share. But there is too short time period that we require to rigorously demonstrate this.

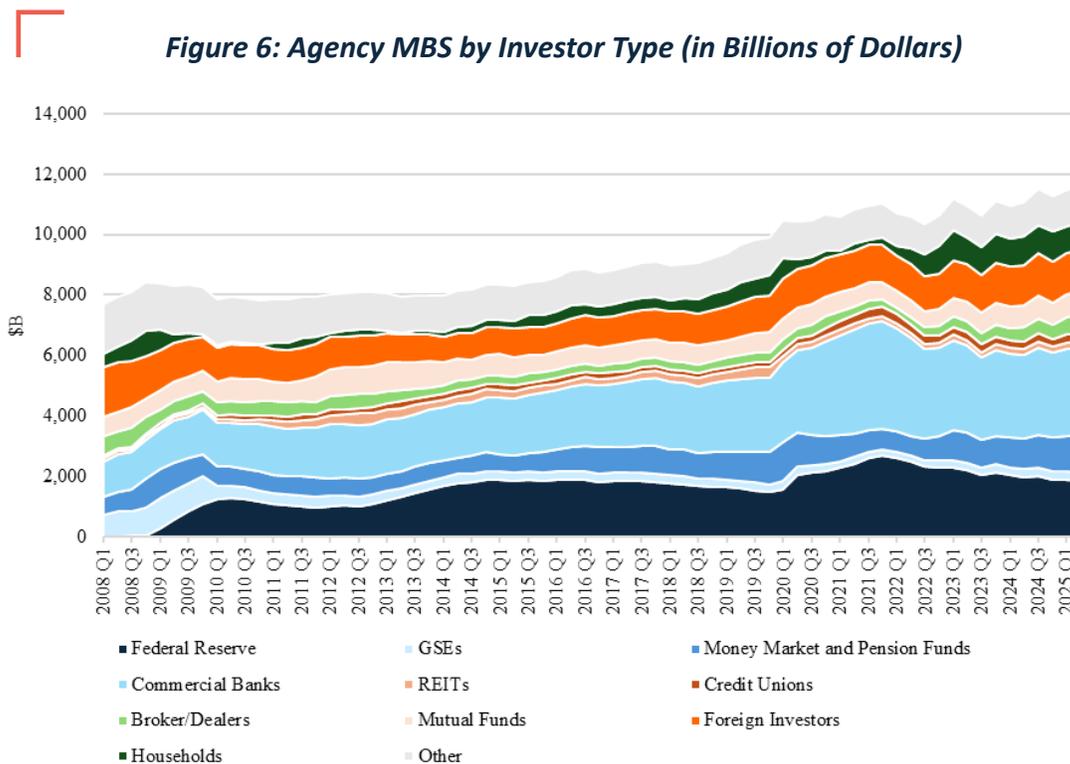


The application of Granger Causality Wald tests does not significantly indicate that Freddie Mac increases its lockup share when its market share decreases. This increase in lockup share does not immediately translate into a recovery in its market share.

The Role of Monetary Policy

A complete picture of “lockup”, however, requires more than a view on CMO’s. The role of monetary policy in the U.S. changed fundamentally during the Global Financial Crisis (GFC) of 2007-2010. As the Federal Reserve lowered its short-term interest rate target to zero in late 2008, it was clear that additional stimulus was needed. The Fed therefore began to purchase U.S. Treasury bonds and Agency MBS in an attempt to drive interest rates lower across the yield curve.

There was another factor in play in this decision regarding the MBS market: the natural selling of MBS going on as the GSEs, following their placement into federal conservatorship, were required to pare back their sizable portfolio holdings of MBS. **Figure 6** illustrates the evolution of agency MBS holdings by major investment groupings since 2008:



Note: “Other” includes primarily life insurance companies, state and local governments, and nonprofit entities.

Source: Federal Reserve Flow of Funds, Recursion



There are many conclusions to be drawn from this chart, but for our purposes, the main observation is that the Federal Reserve's share of holdings went from zero in 2008 to a peak of 24.3% at the end of 2021, before declining to 15.9% by mid-2025. This increase in share came largely from an 8.5% decline in GSE portfolio holdings and a 4.9% decline in foreign investor holdings. The key inference is that besides the change in the identity of the holders over time, the nature of the holdings also changed. The GSEs and international investors who hold MBS could turn around and sell them at any time. To date, however, the Federal Reserve has not sold its holdings but rather reduced this component of its balance sheet by not replacing maturing holdings. There has been some discussion of changing the policy to allow for direct sales¹⁷, but for now we believe that these holdings should be counted in the lockup ratios.

There is an additional point to be made. The Federal Reserve's MBS holdings consist of MBS pools backed by mortgage loans, and pools backed by other pools, that we have not discussed yet: the "Super Pool" (or "Supers"). Super Pools are "single class, pass-through, TBA-eligible securities in which the underlying collateral is groups of existing UMBS® and/or Supers. The securities that back Supers may be issued and guaranteed by either Fannie Mae or Freddie Mac." Supers are similar to plain MBS except that the collateral may be commingled between the two agencies. They were launched in 2019 concurrently with the launch of the UMBS¹⁸.

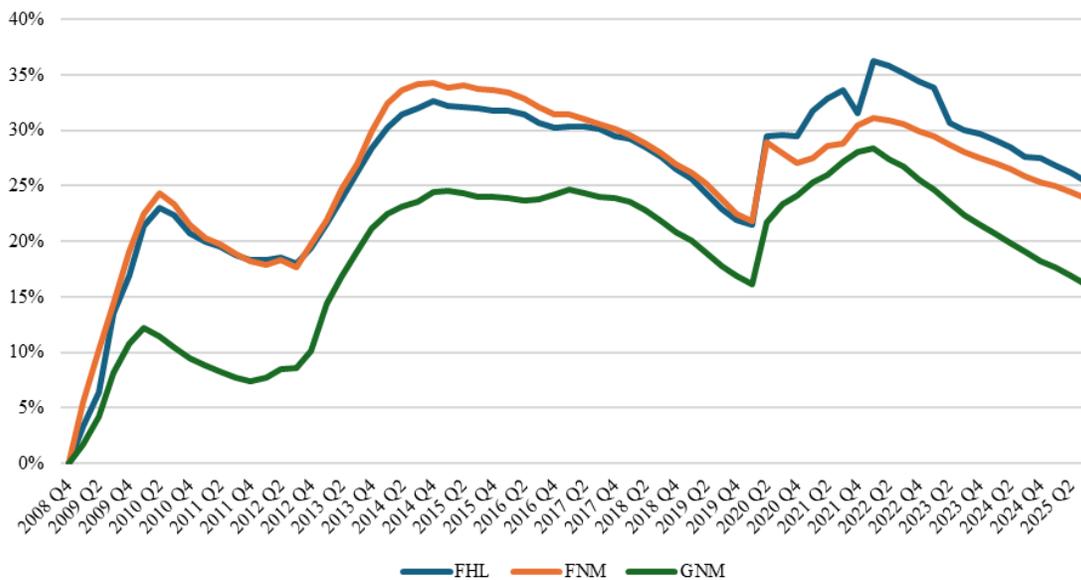
This product was introduced in order to incentivize the GSEs to maintain production standards and to align prepayment performance across agencies. For our purposes, this class is important as the Federal Reserve buys Supers as part of its investment program.

An important part of the Fed's mandate in its purchases of mortgage pass-throughs is to ensure that the quantities purchased are in line with the prevailing market shares of the three Agencies. However, because Supers may commingle collateral from both GSEs, it cannot directly identify the agency composition of pools directly from the pool level. Fortunately, the Fed's portfolio is made available on its website, allowing us to use this data with the Agency disclosure files to produce market shares at the loan level. By "exploding" the Super Pools into their bottom-level collateral, we discover that there has indeed been a higher proportion of Freddie collateral in Fannie-issued Supers than vice versa. Moreover, further analysis revealed that, although the Fed bought pools in line with prevailing market weights between the two GSEs at the security level, on an "exploded" basis, Freddie Mac was modestly over-represented in the Fed's portfolio.

¹⁷ <https://capitalmarkets.fanniemae.com/mortgage-backed-securities/structured-transactions-products/supers-and-megas>



Figure 7: Agency Single-Family MBS Fed Lockup Ratio



Source: Fannie Mae, Freddie Mac, Ginnie Mae, Recursion

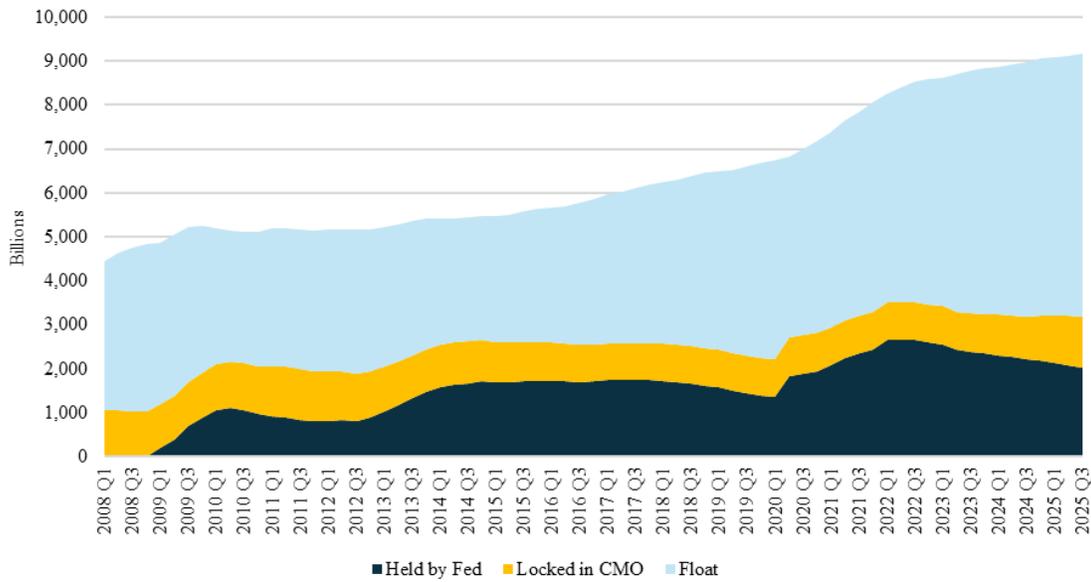
Figure 7 presents the Agency Single-Family MBS Fed Lockup Ratio, where the Fed Lockup Rate is defined as the ratio of the UPB of the Federal Reserve’s holdings to the total outstanding UPB for each Agency.

As shown previously in **Figure 2**, the jump in Freddie’s market share in 2020 corresponds precisely with the start of the over-purchases of its securities by the Federal Reserve as part of their QE program.

Conclusion

We draw two major conclusions from our analysis. First, we find that the analysis of CMOs does not just bear on the product itself but also sheds light on the dynamics of their underlying collateral. Along these lines, **Figure 8** breaks the agency pass-through MBS market into three components: (1) MBS locked in CMOs, (2) MBS held by the Federal Reserve, and (3) a residual category representing the portion of pools that trade freely in the secondary market. We suggest that this category constitutes a benchmark for a liquid pass-through market.

Figure 8: Agency Single-Family Pass-Through Outstanding Balance Held by Federal Reserve, Locked in CMOs and the Residual (Float)



Source: Federal Reserve, Fannie Mae, Freddie Mac, Ginnie Mae, Recursion

Given the innate flexibility of our data structure, these datasets can be broken down by agency, cohort, CMO deals, and even individual security, enabling a more granular study of market behavior. For multi-asset portfolio managers, our approach offers guidance regarding optimal asset allocation decisions based on a market size determined by the float calculation. For traders, the same concept can be used for security selection at the pool level. Market participants should understand and take into consideration policy changes from both the Federal Reserve and the Housing Agencies that impact market float.

For policymakers, a holistic view is called for. From the standpoint of housing policy, the leading question at the moment is the state of the Government Sponsored Enterprises, Fannie Mae and Freddie Mac. A move towards changing their market structure could have an impact on the magnitude of MBS holdings on their balance sheets, which in turn can affect the structure of the overall market in a way that influences the effectiveness of its quantitative policies. For the Federal Reserve, besides the immediate market impact, as long as the no-sale policy is in effect, additions to holdings can have long-term consequences through decreasing float. Changes in the GSE's structure or policies that influence the incentives to own MBS (e.g. Dodd Frank) will have fallout effects on the impact of monetary policy. The episode regarding "super" pools stands as a cautionary episode regarding the need for careful consideration while taking actions in a complex market.

The datasets we have built are intended to provide the infrastructure that users can access for their own analysis. The work on liquidity in this paper is meant to be indicative of the directions in which more rigorous analysis can be conducted across a wide range of issues within the Agency mortgage market. We hope this leads to improved market performance and policy making overtime.



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Appendix: Glossary

Principal Type: A data field standardized and designated by Recursion based on the description of a tranche/class in the CMO prospectus document and other disclosures. It denotes the principal type of a CMO tranche/class. The possible values include:

- **Pass-Through (PT):** It allows investors to receive proportional shares of principal and interest directly from the underlying mortgage pool.
- **Planned Amortization Class (PAC):** It provides stable, predictable principal payments by adhering to a predefined amortization schedule.
- **Targeted Amortization Class (TAC):** It aims to maintain a specified principal payment pattern based on a single assumed prepayment rate.
- **Sequential Pay (SEQ):** A Sequential Pay tranche allocates principal payments in a fixed order. Each tranche begins receiving principal only after the prior tranche has been fully retired.
- **Support (SUP):** A support (SUP) tranche receives the residual or variable portion of principal payments not required to satisfy the amortization schedules of PAC or TAC tranches.

Interest Type: A data field standardized and designated by Recursion based on the description of a tranche/class in the CMO prospectus document and other disclosures. It denotes the interest type of a CMO tranche/class. The possible values include:

- **Floating-Rate (FLT):** It pays interest based on a variable rate indexed to a benchmark, such as SOFR, plus a fixed spread. The interest rates reset periodically, aligning coupon payments with prevailing short-term market rates.
- **Fixed-Rate (FIX):** A Fixed-Rate (FIX) tranche pays a constant coupon rate throughout its life, regardless of changes in market interest rates.
- **Interest-Only (IO):** It receives only the interest portion of payments from the underlying mortgage collateral, with no entitlement to principal.
- **Inverse Interest-Only (IIO):** An IIO tranche pays interest that moves inversely to a benchmark rate. As market rates rise, the coupon rate on the tranche declines, and vice versa.
- **Accrual (Z) Tranche:** A Z Tranche defers interest payments during its accrual phase. Instead of paying interest currently, the interest is added to the tranche's outstanding principal balance until earlier tranches in the CMO are fully retired. Afterward, the Z tranche begins to receive both principal and interest payments



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