

Salomon Smith Barney Guide to Mortgage-Backed and Asset-Backed Securities

LAKHBIR HAYRE, Editor



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**Salomon Smith Barney Guide to
Mortgage-Backed and
Asset-Backed Securities**

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LAKHBIR HAYRE

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Introduction

Lakhbir Hayre

Mortgage-backed securities (MBSs) and asset-backed securities (ABSs)¹ constitute the largest sector of the bond market. They form a core holding of almost all U.S. institutional fixed-income investors, and Wall Street dealers trade billions of dollars of these securities every day. However, the complexity and variety of these securities, along with the dearth of easily available information, means that very few people in the financial industry or in academia have a detailed understanding of their characteristics.

The purpose of this book is to provide a comprehensive, sophisticated, and clear treatment of the MBS and ABS markets. The book brings together recent research conducted by analysts at Salomon Smith Barney (SSB), which (as Salomon Brothers) played a pioneering role in creating the secondary mortgage market in the late 1970s and early 1980s, and which remains the largest trader in the market.

WHAT ARE MORTGAGE- AND ASSET-BACKED SECURITIES?

In essence, MBSs and ABSs are securities entitled to the cash flows from a specified pool of assets. A majority of the market (close to \$3 trillion) consists of securities backed by residential mortgage loans; however, a large variety of other types of assets have been securitized, including commercial

¹In the United States, the term MBS is used to refer to securities backed by residential mortgage loans, while ABS denotes securities collateralized by other types of consumer loans, such as car loans. However, securities backed by home equity loans (HELs) or by manufactured housing loans (MHs) are usually labeled ABSs by convention. Outside the United States, the term ABS is used in a more general sense, with MBSs a subset of ABSs.

mortgage loans, car loans, credit card receivables, and so on. The cash flows from the assets can be channeled to investors in two ways: (1) they can simply be passed through to investors, after administrative or **servicing** fees are subtracted. This method produces a **pass-through security**, which comprises the bulk of MBSs; or (2) the cash flows can be allocated to investors according to specified rules, creating **structured securities**, such as **collateralized mortgage obligations** (CMOs).

Despite the variety of collateral types and cash flow allocation structures, most MBSs and ABSs share certain characteristics:

- In almost all cases, payments, both those received from the pool of assets and those paid to security holders, are monthly.
- The monthly payments from the assets typically consist of principal and interest. The principal can be *scheduled* and *unscheduled*.
- The scheduled principal reflects the **amortizing** nature of most consumer loans; in other words, the principal borrowed is paid back gradually over the term of the loan, rather than in one lump sum at the maturity of the loan.
- Unscheduled payments of principal, or **prepayments**, reflect the fact that most consumer loans can be paid off early, either in whole or in part. For example, most mortgage loans are paid off early because the borrower sells the house or refinances into a new, lower-rate mortgage.

Because we cannot predict with certainty when and how borrowers will make prepayments, there is cash flow uncertainty for MBSs and ABSs. In fact, prepayment uncertainty is key to the investment characteristics of most MBSs. As we discuss next, there is minimal credit risk for most MBSs and ABSs, whereas for traditional bonds, cash flow uncertainty arises from credit risk.²

DEVELOPMENT OF THE MARKET

The U.S. government has played a key role in the development of the secondary mortgage market in the United States, through the creation of three housing finance agencies—Ginnie Mae, Fannie Mae, and Freddie Mac—to

²It has been said that the difference between mortgage securities and corporate bonds is that in the case of corporate bonds investors know when they are supposed to get the principal back, but are not sure if they will, while in the case of MBSs, investors know that they will get the principal back, but are not sure when.

facilitate the flow of mortgage capital and make it easier for potential home buyers to obtain mortgages.³ The agencies support the secondary mortgage market by buying mortgage loans from lenders, ensuring that lenders have funds to make additional loans. The agencies can pay cash for the mortgages and hold them in portfolio (only Fannie Mae and Freddie Mac) or issue an MBS in exchange for pools of mortgages from lenders. MBSs provide lenders with a liquid asset that they can hold or sell to Wall Street dealers who will then trade these MBSs:

- **Ginnie Mae** (formerly known as the **Government National Mortgage Association**, or GNMA) is still a part of the U.S. government, and MBSs guaranteed by Ginnie Mae carry the full faith and credit of the U.S. government. Hence, like U.S. Treasuries, Ginnie Mae MBSs are generally considered to have no credit risk.
- The other two agencies, **Fannie Mae** (formerly the **Federal National Mortgage Association**, or FNMA), and **Freddie Mac** (formerly the **Federal Home Loan Mortgage Corporation**, or FHLMC), are now private entities but maintain close ties to the U.S. government.⁴ Although Fannie Mae and Freddie Mac MBSs do not have explicit U.S. government guarantees, they are not rated by any of the rating agencies, the implicit assumption being that they have negligible credit risk.

The *agency MBS market* refers to mortgage securities guaranteed by Ginnie Mae, Fannie Mae, or Freddie Mac, and at over \$2.5trillion (as of late 2000), it constitutes the majority of the MBS/ABS market. *Private-label MBSs* refer to mortgage-backed securities not guaranteed by Ginnie Mae, Fannie Mae, or Freddie Mac, generally because the underlying mortgage loans do not meet certain necessary criteria for inclusion in agency MBSs (see Chapter 1). Since the mid-1980s, many nonmortgage asset types have been securitized—these securities are collectively referred to as asset-backed securities (ABSs)—as many institutions realized that securitization provided a means for both controlling risk and for efficient balance sheet management (see Chapter 2).

³To be precise, the agencies guarantee the timely payment of interest and principal to investors.

⁴These ties include a line of credit to the U.S. Treasury, a number of board members being appointed by the U.S. president, exemption from having to register publicly issued securities with the U.S. Securities and Exchange Commission (which other private institutions have to do), and an exemption from all state and local taxes (except real property taxes). Fannie Mae, Freddie Mac, and a few other similar entities are now commonly called government-sponsored enterprises, or GSEs.

The rapid growth in the MBS/ABS has been possible because of widespread investor sponsorship of these securities. Several factors are responsible for the rapid acceptance of MBSs and ABSs by institutional investors, with the main ones being their high credit quality and returns that have historically been superior to alternative high quality securities; these factors are discussed in more detail in Chapter 1.

ORGANIZATION OF THIS BOOK

The book is organized into parts, each covering a specific topic or sector of the market.

Part One: *An Overview of the Market* provides an introduction to the market. The three chapters in this section give a concise treatment of topics covered in more detail in the rest of the book. It is intended to provide a self-contained introduction to the market for readers who are not specialists in mortgage- and asset-backed securities, or for use in a brief course on the market in academia.

Part Two: *Prepayment Analysis and Modeling* discusses the modeling of prepayment rates on residential mortgage loans. Prepayment forecasts are critical in estimating security cash flows and investment characteristics. However, since prepayment behavior is influenced by a host of economic and demographic factors, modeling prepayments is as much art as science. Chapter 4 describes a general framework for modeling prepayments that has been applied at Salomon for developing models for many different types of mortgages; these models are used by traders at the firm and by several hundred institutional investors to manage portfolios of mortgage- and asset-backed securities. Chapter 5 discusses the effect of prepayment modeling errors on investment value. Chapter 6 gives a detailed description of the mortgage origination process, a knowledge of which is crucial for the understanding of prepayments, while Chapter 7 discusses how the Internet is changing the process, and the resulting implications for prepayment patterns.

Part Three: *Collateral Sectors* provides a description of several sub-sectors of the agency and non-agency MBS markets. Even within the agency MBS market, there are diverse types of loans, each characterized by specific prepayment and hence investment characteristics. The section describes these prepayment characteristics, and how they can be modeled.

Part Four: *Option-Adjusted Spreads and Durations* discusses the concept of *option-adjusted spreads* (OASs), a valuation methodology pioneered by Salomon Brothers in the mid-1980s, which combines prepayment and term structure models and which is now the standard method for analyzing

MBSs and ABSs. The section also discusses some issues that arise when estimating durations for MBSs.

Part Five: *Agency CMOs and Stripped MBSs* describes the many ways that mortgage cash flows have been structured to create bonds with specific maturity and prepayment profiles. The resulting bonds, generally termed *Collateralized Mortgage Obligations* (CMOs), form a large sector of the market, but it is important for investors to understand how the prepayment risk of the underlying pass-through securities is allocated among different types of CMO bonds, as these allocations are not generally equal.

Part Six: *Commercial Mortgage-Backed Securities* provides an introduction to commercial MBSs, or CMBSs, which, as the name implies, are securities backed by commercial mortgage loans. The section provides an introduction to the broad category of loans in CMBSs—on residential apartment buildings, retail stores, nursing homes, hotels, and so on—and describes basic methods of analyzing CMBSs. The section also gives a detailed description of two specific types of CMBSs: *interest-only* (IO) securities, which receive just a strip of the coupon interest payments from the collateral, and agency CMBSs backed by loans on multifamily housing.

Part Seven: *Mortgage-Related Asset-Backed Securities* is the first of two sections on asset-backed securities. By convention, securities backed by two types of mortgage loans—home equity loans and loans on manufactured housing—are classified as ABSs. This section gives a detailed description of these two types of ABSs, focusing on their prepayment characteristics and on the extensive modeling, based on loan level data, that Salomon Smith Barney has conducted in recent years.

Part Eight: *Nonmortgage-Related Asset-Backed Securities* discusses in detail several types of nonmortgage-related ABSs, including some recent innovations in credit card ABSs. There is a large variety of asset types that have been securitized, and it is difficult to provide descriptions of every type without making the book overly long. However, this section, along with the general overview of ABSs in Chapter 2, should provide the reader with an understanding of key asset types and of important structural developments in the market.

Part Nine: *Non-U.S. Markets* discusses important sectors of the MBS and ABS markets outside the United States. Perhaps the most important development in the market in recent years has been the surge of securitization outside the United States, and key growth areas have been Europe (especially the United Kingdom) and Australia. In this section, we describe the MBS and CMBS markets in the United Kingdom, and the rapidly growing MBS market in Australia.

The last part of the book includes a glossary of common terms (the MBS and ABS markets, like every specialized field, has its share of jargon),

and a series of Appendixes, including basic mortgage mathematics; a guide to resources for investors, including useful Web sites; and some information on risk-based capital standards as they apply to MBSs and ABSs.

USING THIS BOOK

The book is designed to both provide a comprehensive and authoritative description of the MBS and ABS markets, and to serve as a reference source for specialists. A major strength of the book is that it is written by specialists with many years of experience in the field, working at a firm that was a pioneer in the market and that still trades the largest volume of MBSs and ABSs. Given the specialized nature of the market, the vast variety of collateral types and cash flow structures, the fact that trading is over-the-counter rather than on public exchanges, and the dearth of generally available information about the securities, this type of “hands-on” experience is critical for a realistic understanding of these complex instruments.

There are no prerequisites for this book, other than a basic knowledge of fixed-income concepts, such as coupon and principal payments, maturity, yield, and duration. We recommend that readers who are not already MBS and ABS specialists start with Part One, which provides an overview of the market. The rest of the book is self-contained and individual chapters can be read as desired. One exception is Part Three, which discusses the prepayment characteristics of various sectors of the market; a prior reading of Chapter 4, on prepayment modeling, will help make Part Three more rewarding.

An encouraging trend in recent years has been the increased attention paid in academia to MBSs and ABSs, as part of real estate finance courses or as courses offered in financial engineering programs. Part One, along with the Appendixes can be used for a brief course on the topic; parts of Chapters 4, 13, and 14 can be added if there is time. The whole book may be suitable for a two-semester course on the market.



PART
one

**An Overview of
the Market**

A Concise Guide to Mortgage-Backed Securities (MBSs)

Lakhbir Hayre

This chapter provides an introduction to mortgage securities and methods of analyzing them. While it lays the groundwork for the more detailed treatment of various topics in the rest of this book, it can also be used as a concise but comprehensive overview of the market for nonspecialists. The chapter is organized as follows:

- Section 1.1 describes the growth of the market.
- Section 1.2 reviews key features of agency mortgage pass-through securities, the most basic and most prevalent type of MBS.
- Section 1.3 discusses the basics of MBS analysis, such as prepayment estimation and modeling, and spreads over Treasuries.
- Section 1.4 describes option-adjusted spread methodology, which has become the standard way of evaluating MBSs.
- Section 1.5 gives an overview of structured MBSs, such as collateralized mortgage obligations and interest-only MBSs.
- Section 1.6 provides an introduction to the various types of non-agency MBSs.
- Section 1.7 gives a brief review of mortgage securitization outside the United States.

1.1 GROWTH OF THE SECONDARY MORTGAGE MARKET

The mortgage-backed securities (MBSs) market has experienced phenomenal growth over the past 20 years. The total outstanding volume of MBSs

EXHIBIT 1.1 Relative Size of U.S. Debt Sectors (Dollars in Trillions)

All Mortgage Debt	\$6.32
Single-Family Mortgage Debt	4.76
Mortgage-Backed Securities	2.95
Treasury Securities	3.65
Corporate Bonds	2.06
Agency Debt	1.95

Note: Total for Treasuries includes Bills, while the total for Mortgage-Backed Securities includes those backed by nonresidential loans and home equity loans.

Source: *Federal Reserve Bulletin*, pp. A35 and A40, May 2000.

has increased from about \$100 billion in 1980 to about \$3 trillion, and as Exhibit 1.1 shows, mortgage-backed securities form a major component of the U.S. bond market.

Exhibit 1.2 shows a breakdown of Salomon Smith Barney's U.S. Broad Investment Grade (BIG) Index. Note that MBSs are a bigger proportion of the index than suggested by Exhibit 1.1, as almost half of all Treasury securities are Bills with maturities less than one year, and are hence excluded from the index.¹

What accounts for the rapid growth of the MBS market? Increased securitization of mortgages and ready acceptance of MBSs by fixed-income investors are both key reasons. Mortgage originators became much more disposed to sell loans into the secondary market after the high-interest-rate environment of the late 1970s and early 1980s, when the disadvantages of holding fixed-rate long-term loans in their portfolios became apparent. The growing market share of mortgage bankers, who have little interest in holding onto mortgage loans, also has contributed to the increasing securitization of mortgages. In addition, many institutions have increasingly come to view securitization as a means of turning illiquid assets into liquid securities, and hence a tool for efficient balance sheet management.

The federal government has played an equally important role. Three agencies, the Government National Mortgage Association (Ginnie Mae), the Federal National Mortgage Associations (Fannie Mae), and the Federal Home Loan Mortgage Corporation (Freddie Mac) are major players in the

¹Also excluded are various mortgage sectors, such as non-agency MBSs, and various corporate bond issues. See *Salomon Smith Barney Global Index Catalog—1999* edition, February 1999.

EXHIBIT 1.2 Breakdown of Salomon Smith Barney's U.S. Broad Investment Grade (BIG) Index (Dollars in Trillions)

Sector	Par Amount	% of Index
Treasuries	\$1.634	29.1 %
MBSs	1.895	33.8
Corporates	1.408	25.1
Agency Debt	0.627	11.2
BIG Index	\$5.607	100.0 %

Source: Salomon Smith Barney, May 2000.

secondary mortgage market in issuing and guaranteeing MBSs.² These federal housing finance agencies were created to facilitate the flow of mortgage capital and, hence, to ensure that lenders have adequate funds to make new mortgage loans. The three agencies are generally credited with significantly reducing the cost of mortgage borrowing for American home buyers, as well as making mortgages more widely available. On the demand side, MBSs have come to represent a significant portion of fixed-income holdings for many types of investors over the past decade. In Exhibit 1.3 we show a breakdown of holdings of MBSs by investor type.

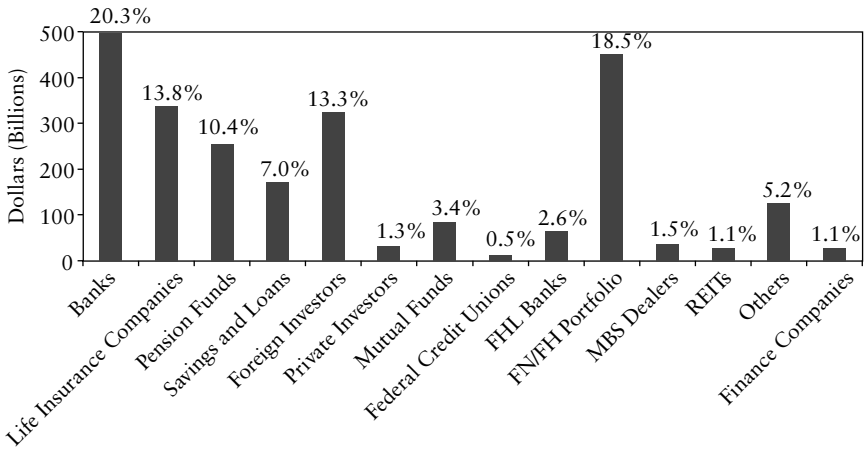
Why Institutional Investors Buy Mortgage Securities

MBSs have quickly become popular fixed-income investments for many reasons, including:

- *Higher returns.* MBSs typically yield 100bp (basis points) or more over Treasuries and offer higher yields than comparable-quality corporate bonds. Although some of this higher yield compensates for their complexity and embedded prepayment options, MBSs still have outperformed comparable Treasuries and other corporate bonds in most years since the early 1980s, as shown in Exhibit 1.4.

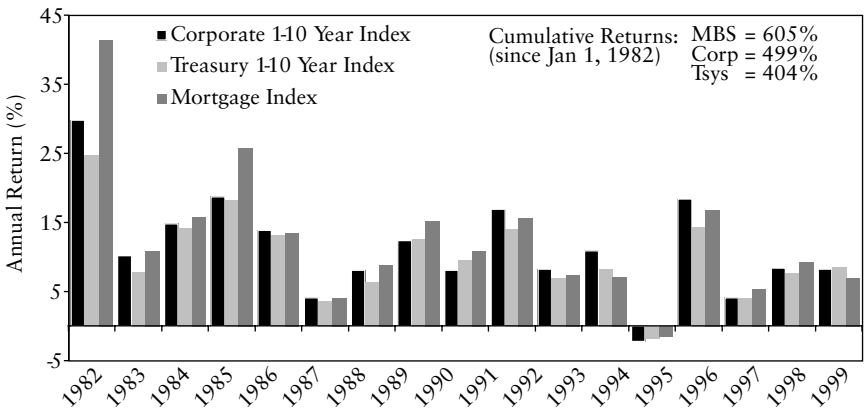
²As discussed in the Introduction, although all three entities are commonly referred to as agencies, only Ginnie Mae is now a true agency. Fannie Mae, which the government established in 1938, and Freddie Mac, which Congress created in 1970, are now private entities, although both have strong ties to the government. The market convention is to refer to all three as agencies (although *Government Sponsored Enterprises* [GSEs] is becoming a more common term for Fannie Mae, Freddie Mac, and other such entities), and we will follow this convention.

EXHIBIT 1.3 Mortgage-Backed Securities—Holdings by Investor Type



Note: Numbers shown at the top of the bars are holdings as a percentage of total outstanding MBSs, as of midyear 1998. Note that the total may not add up to the same as in Exhibit 1 because certain types of MBSs, such as those backed by nonresidential loans, are not included here. Source: *Inside MBS and ABS*, Salomon Smith Barney.

EXHIBIT 1.4 Mortgage, Corporate, and Treasury Securities—Historical Performance, 1982–1999



Source: Salomon Smith Barney Fixed-Income Index Group.

Exhibit 1.4 also shows cumulative returns on various Salomon Smith Barney fixed-income indices; MBSs have outperformed Treasuries and corporate bonds by substantial margins. Even during the 1990s, when conditions were ideal for Treasuries and corporate bonds—falling interest rates and a sustained recovery from the early 1990s recession—and the environment tough for MBSs, with several major refinancing waves, MBSs still did relatively well versus comparable fixed-income instruments.

- *Credit quality.* Ginnie Mae MBSs are backed by the full faith and credit of the U.S. government and, hence, like Treasuries, are considered to carry no credit risk. Fannie Mae and Freddie Mac MBSs do not have U.S. government guarantees, but because of Fannie Mae's and Freddie Mac's close ties to the government, their MBSs are perceived to have minimal credit risk and do not seem to trade at a noticeable credit premium to Ginnie Maes. MBSs from other (private) issuers typically carry AAA or AA ratings from one or more of the credit rating agencies.
- *Choice of investment profiles.* Given the variety of MBSs created, this sector provides a wider range of investment characteristics than most other parts of the fixed-income market. For example, MBSs are available with negative, short, or very long duration. Prepayment sensitivities can range from low to very high. Coupons can be fixed (from 0% to more than 1,000%) or floating (directly or inversely with a range of indices).
- *Liquidity.* The amount of outstanding MBSs, trading volume (second only to U.S. Treasuries), and the involvement of major dealers provide an active, liquid market for most MBSs.
- *Development of analytic tools.* Since the mid-1980s, many major dealers (and some buy-side firms) have devoted considerable resources to developing analytic models for evaluating MBSs. These efforts have led to a better understanding of mortgage cash flows and a higher level of comfort with the characteristics of mortgage securities.

1.2 AGENCY PASS-THROUGH SECURITIES

The basic mortgage-backed security structure is the pass-through. As the name implies, a pass-through passes through the monthly principal and interest payments (less a servicing fee) from a pool of mortgage loans to holders of the security. Thus, investors in the pass-through are, in effect, buying shares of the cash flows from the underlying loans. Structured MBSs, such as collateralized mortgage obligations (CMOs) and interest-only (IO) and principal-only (PO) stripped MBSs (or STRIPs), carve up mortgage cash flows in a variety of ways to create securities with given prepayment and

maturity profiles. In this section we discuss pass-throughs; we describe structured mortgage securities (agency and non-agency) later in this chapter.

Development of the Pass-Through Market

The pass-through is the most common structure for mortgage-backed securities. A pass-through issuer acquires mortgages either by originating them or by purchasing them in the whole-loan market. Many mortgages with similar characteristics are collected into a pool, and undivided ownership interests in the pool are sold as pass-through certificates. The undivided interest entitles the owner of the security to a pro rata share of all interest payments and all scheduled or prepaid principal payments.

The growth of the pass-through market stems in large part from the active role of the U.S. housing finance agencies in the primary and secondary mortgage markets. Ginnie Mae, Freddie Mac, and Fannie Mae account for nearly all of the issuance and outstanding principal amount of mortgage pass-throughs.

The programs of the three major federal housing agencies reflect the historical development of U.S. housing policy. Fannie Mae was created in 1938 as a wholly owned government corporation. Its charter mandated that it purchase Federal Housing Administration (FHA)-insured and, (since 1948), Veterans Administration (VA)-guaranteed mortgages for its portfolio.³ Congress intended to ensure that mortgage lenders would continue to be able to make residential mortgage loans, even in periods of disintermediation (when withdrawals by depositors are high) or when delinquencies and defaults are high. Fannie Mae's purchase activities encouraged the standardization of repayment contracts and credit underwriting procedures for mortgages.

In 1968, the government restructured its role in the housing finance market. Fannie Mae was privatized, although it retained its mandate to buy FHA/VA loans for its own portfolio. **Ginnie Mae** was spun off as a separate agency that would undertake some of Fannie Mae's previous activities; in particular, Ginnie Mae assumed the financing of home loans not ordinarily underwritten in the established mortgage market, such as loans to low-income families. Ginnie Mae's most important activity has been its mortgage pass-through program, which was instituted in 1970. Under this program, Ginnie Mae guarantees the payments of principal and interest on pools of FHA-insured or VA-guaranteed mortgage loans.

³The FHA and the VA are U.S. government entities that provide mortgage insurance intended to serve low and moderate-income home buyers.

The enhanced availability of credit to home owners who qualify for FHA and VA loans led to calls for similar treatment for nongovernment-insured (or *conventional*) mortgages. In 1970, Congress established Freddie Mac to develop an active secondary market for conventional loans, and in 1972, Fannie Mae began to purchase conventional mortgages. Thus, by 1972, lenders could sell their newly originated conventional mortgages to either Fannie Mae or Freddie Mac.

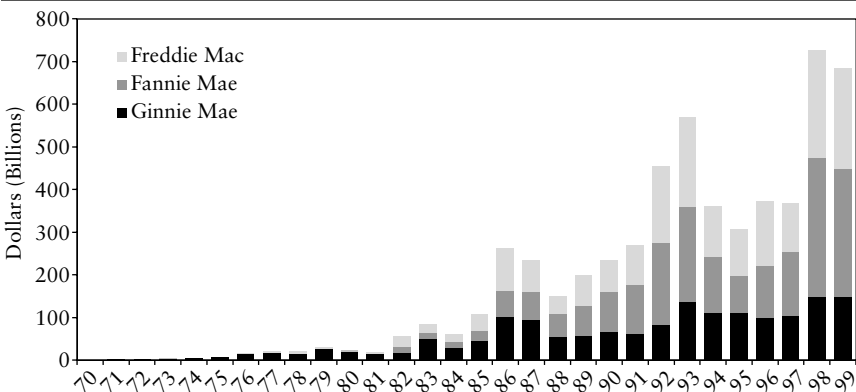
Freddie Mac issued a small volume of pass-throughs in the 1970s, while Fannie Mae began its MBS program in late 1981. As Exhibit 1.5 indicates, issuance volume from all three agencies increased tremendously in the 1980s, hit a peak in the refinancing waves of 1993, and recently hit record levels with the heavy volume of refinancing in 1998.

TERMINOLOGY

Exhibit 1.6. provides a description of a fairly typical mortgage pass-through, or pool, including key current pool characteristics which are updated each month by the agencies (through electronic tapes called *pool factor tapes*) for their pools (for non-agency MBSs, issuers provide updated tapes for their deals each month).

Ginnie Mae guarantees timely principal and interest payments on all of their pools. On Fannie Mae and Freddie Mac pools, the respective agencies guarantee principal and interest payments to investors. Private-label MBSs,

EXHIBIT 1.5 Agency Pass-Through Securities—Issuance, 1970–1999



Source: Inside MBS and ABS.

EXHIBIT 1.6 Ginnie Mae Pool 301100

Issue Date:	03/01/1991	Delay:	45 Days
Collateral:	30-Year Fixed-Rate Loans	Original Balance:	\$3,258,373
Net Coupon:	9.00%	WAC:	9.50%
Current Balance:	\$341,431		
Factor:	0.10478598		
WAM:	20-05 Yrs.		
WALA:	9-04 Yrs.		

WAC: Weighted-average coupon, WALA: Weighted-average loan age, WAM: Weighted-average maturity.

Note: Current balances, Factor, WAM, and WALA as of June 8, 2000.

Sources: Ginnie Mae and Salomon Smith Barney.

which the rating agencies typically rate triple-A, are issued with various forms of credit enhancement, based on rating agency requirements.

Exhibit 1.6 also shows some of the terminology and information used to analyze MBSs:

- **Net coupon and WAC.** The net coupon of 9% is the rate at which interest is paid to investors,⁴ while the weighted-average coupon (WAC) of 9.5% is the weighted-average coupon on the pool of mortgages backing the pass-through. The difference between the WAC and the net coupon is called the **servicing spread**. The majority of Ginnie Mae pools are issued under the so-called **Ginnie Mae I** program, and for such pools, the underlying mortgage loans all have the same note rate (9.50% for the pool in Exhibit 1.6) with a servicing spread of 50bp. Pass-throughs issued under an alternative program called **Ginnie Mae II**⁵ and those issued by Fannie Mae and Freddie Mac allow for variations in the note rates on the underlying loans. In the latter case, the WAC could change

⁴This is the annualized rate. Mortgage cash flows are monthly, so each month investors receive interest at a rate of $\frac{1}{12}\%$; in other words, 0.0075 times the balance outstanding at the beginning of the month.

⁵The Ginnie Mae II program allows for multiple-issuer pools (i.e., loans from a number of different issuers are pooled—in contrast, Ginnie Mae I pools contain loans from a single issuer), as well as for different note rates on the underlying pools. The Ginnie Mae II program has become well established in recent years, with issuance running at about 30% of that of Ginnie Mae I. For a recent update on the Ginnie Mae II program, see *Bond Market Roundup: Strategy*, Salomon Smith Barney, December 12, 1998.