CONTENTS

Commentaries on the March 6, 1995 draft of this paper by Herbert M. Kaufman and Lawrence J. White and Fannie Mae's review of the draft paper begin on pages 303, 305, and 314, respectively. The authors' response begins on page 333.

Benjamin E. Hermalin and Dwight M. Jaffee are both on the faculty of the University of California at Berkeley, where they are, respectively, Associate Professor in the Walter A. Haas School of Business and the Department of Economics, and Professor of Finance and Real Estate in the Walter A. Haas School of Business.

Mr. Jaffee has received research funding from Fannie Mae in the past. Mr. Hermalin has neither had a prior nor current relationship with Fannie Mae or Freddie Mac.

The Hermalin-Jaffee paper was submitted in draft form on March 6, 1995 and was presented in a seminar at the U.S. Department of Housing and Urban Development on May 1, 1995. The written commentaries by Mr. Kaufman and Mr. White were submitted on May 11, 1995 and June 11, 1995, respectively, and the Fannie Mae Review was submitted on June 30, 1995. Hermalin-Jaffee then slightly revised their paper; they submitted their final manuscript on July 24, 1995 and their Response to Discussants on September 15, 1995.

EXECUTIVE SUMMARY

In this report we analyze the effects of privatizing the Federal National Mortgage Association (Fannie Mae) and the Federal Home Loan Mortgage Corporation (Freddie Mac) with regard to the possible changes it would create in the structure, performance, and welfare benefits of the secondary mortgage markets. The primary tool we use in this analysis is applied industrial organization theory.

We begin with an analysis of the conduit market as it currently exists. We divide the market into three segments: securitization of FHA/VA loans, securitization of conforming loans, and securitization of jumbo loans. Our analysis focuses on the latter two segments only. Our conclusions concerning the current structure are as follows:

(1) There are strong theoretical reasons and reasonable empirical evidence for believing that Fannie Mae and Freddie Mac are tacitly colluding[1] duopolists in the conforming segment of the conduit market.

(2) There are strong theoretical reasons and strong empirical evidence for believing that the jumbo segment of the conduit market (from which Fannie Mae and Freddie Mac are barred) is competitive.

(3) Fannie Mae and Freddie Mac are able to sustain their duopoly in the conforming segment because there are barriers to entry into this segment. Most of these barriers are a consequence of Fannie Mae's and Freddie Mac's status as government-sponsored enterprises (GSEs).

(4) The other "players" in the markets (e.g., the buyers of mortgage-based securities and mortgage originators) have no market power.

(5) The close substitutes for mortgage-based securities (e.g., securities based on FHA/VA loans) limit the spread that Fannie Mae and Freddie Mac can enjoy despite their duopoly.

We next address the competitive advantages and disadvantages of Fannie Mae and Freddie Mac. In addition to the aforementioned barriers to entry, we study whether Fannie Mae and Freddie Mac enjoy economies of scale, whether the lack of effective competition may have made them soft, and whether they would have or could acquire sufficient capital were they privatized. Although the empirical evidence does not allow definitive conclusions, we derive issues that would need to be considered were Fannie Mae and Freddie Mac privatized.

We also consider the issue of vertical integration, that is, mergers in which conduits acquire (or are acquired by) mortgage originators or mortgage servicers or both. Although it is theoretically possible that vertical integration could be anticompetitive, we find that the evidence indicates that it would *not* be anticompetitive in these markets. Rather, there seem to be efficiency gains to be realized from vertical integration. Consequently, we would expect Fannie Mae and Freddie Mac to integrate vertically if privatized, and we expect that such integration would be socially beneficial.

---

[1] The adjective "tacit" is important: There is no evidence that Fannie Mae and Freddie Mac are colluding *directly*, which would be illegal. Rather they are behaving *as if* they were colluding, which is *not* illegal.

Implications for Mortgage Industry Structure   *Page 227*

Finally, we consider the welfare (social) benefits of privatization. We begin by analyzing the welfare benefits inherent in the *current* market structures. To deter entry into their market segment, Fannie Mae and Freddie Mac must price in such a way that they are either securitizing the amount of conforming mortgages that a competitive industry would or they are securitizing *more* than a competitive industry would.[2] Under the first alternative, there is no welfare gain from privatizing Fannie Mae and Freddie Mac except for the gain that would be achieved by eliminating the federal government's implicit liability and, thus, the potential need to raise revenues through distortionary taxation. (Rough calculations indicate that the *annual* welfare cost from the government's implicit liability ranges from $210 million to $1.26 billion.) Under the second alternative, there would be welfare gains from privatizing, as this would restore the market to its welfare-maximizing level. In addition, the welfare gain from eliminating the implicit guarantee would also be realized. It is worth noting, however, that homebuyers could face higher mortgage rates following privatization if the second alternative is the correct one.

A possible problem with the previous analysis is that it is static; that is, it does not account for structural changes in the industry following privatization. There are two possible scenarios. One, the two market segments would come to resemble the current jumbo segment, which would mean that they would both be competitive. Alternatively, both segments would come to be dominated by a few large firms (including, possibly, Fannie Mae and Freddie Mac). Which scenario will occur depends on the extent to which there are economies of scale in the conduit industry. The current evidence from the jumbo segment suggests that there are not, which makes the first scenario more likely. This conclusion needs, however, to be tempered by the realization that Fannie Mae and Freddie Mac currently operate at a scale that is an order of magnitude greater than any private-label (jumbo) conduit. It is possible, therefore, that there are economies of scale but the jumbo market is too small to reveal them. Even if there are significant economies of scale and, therefore, the industry becomes dominated by a few large firms, this need not be welfare reducing vis-à-vis the current situation: The extension of economies of scale to the jumbo segment will lower costs in that segment, which is welfare enhancing, while the number of firms in the conforming segment either will be unchanged or will increase, which is either welfare neutral or welfare enhancing. We conclude, therefore, that this dynamic analysis is complementary with our static analysis, in that both suggest that privatization would be socially beneficial.

The final welfare question we address concerns whether there are market imperfections that would prevent a fully privatized industry from operating efficiently. Our theoretical analysis, coupled with the success of the private jumbo conduit segment, strongly indicates that market imperfections are unlikely to be a problem and that, therefore, we can expect a fully privatized industry to operate efficiently.

---

[2] The "traditional" problem of market power—that producers produce too little—is unlikely because then Fannie Mae and Freddie Mac would be pricing in a way that would encourage entry into the conforming segment of the conduit market.

PART 1. INTRODUCTION

The Federal National Mortgage Association and the Federal Home Loan Mortgage Corporation, hereafter Fannie Mae and Freddie Mac, respectively, have the current status of government-sponsored enterprises (GSEs). As such, they enjoy certain advantages over competitors in the secondary mortgage markets, most importantly the perception of an implicit federal guarantee against default on bonds or securitized mortgage instruments issued by Fannie Mae and Freddie Mac. At the same time, Fannie Mae and Freddie Mac operate under various legal constraints, most importantly that they may hold and securitize only "conforming" residential mortgages (a subset of all mortgages) and that they may not vertically integrate with their suppliers (such as mortgage originators, servicers, and insurers). It has been proposed, however, that Fannie Mae and Freddie Mac be "privatized," meaning (at least in most interpretations) that they would lose the implicit federal guarantee on their liabilities, but also be released from the constraints on their allowed activities.

Privatization of Fannie Mae and Freddie Mac is likely to have important effects on the mortgage industry, given the dominant role they play in the secondary mortgage markets. Most importantly, the industrial organization of the industry may change significantly, with possible ramifications for the degree and nature of competition in the industry. These changes in turn may have critical implications for the welfare of the end users of the secondary mortgage markets, both borrowers and investors.

In this report we analyze the effects of privatizing Fannie Mae and Freddie Mac with particular regard to the possible changes it would create in the structure, performance, and welfare benefits of the secondary mortgage markets. Given the importance of the mortgage market within the U.S. economy and the importance of Fannie Mae and Freddie Mac within the mortgage industry, the privatization of Fannie Mae and Freddie Mac would be without precedent in U.S. financial and economic history. To be sure, the deregulation of the airline industry and the separation of the AT&T operating companies involved industries of perhaps comparable importance, but the firms involved were already fully operating in the private sector. Thus, although we will take advantage of the experience gained from these and other changes in major industries, the privatization of Fannie Mae and Freddie Mac would be unique in many dimensions.

The primary tool we use in analyzing Fannie Mae and Freddie Mac privatization is "applied economic theory." Economic theory refers here to economic models of firm interaction in markets that vary in terms of the degree of concentration, ease of entry and exit, and related structural aspects. *Applied* economic theory refers to the behavioral predictions that may be developed from the economic models on the basis of the structure of the mortgage markets as they currently exist and are likely to (or may possibly) evolve as a result of Fannie Mae and Freddie Mac privatization. In short, we see our task as one of applying the available economic theory to the existing U.S. mortgage markets.

Implications for Mortgage Industry Structure

Page 229

6

FIGURE 1
Tangible Wealth and Real Estate Wealth

$ Trillion

Total Tangible Wealth   Total Real Estate

FIGURE 2
Components of Real Estate Wealth

$ Trillion

Residential Structures   Nonresidential Structures   Land

Page 230

Hermalin and Jaffee
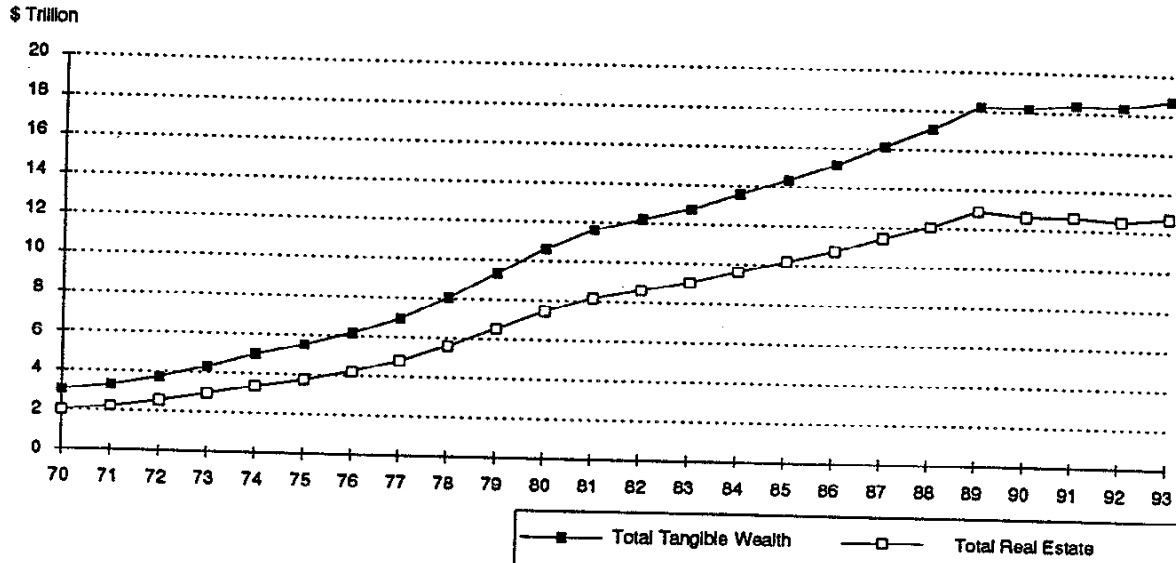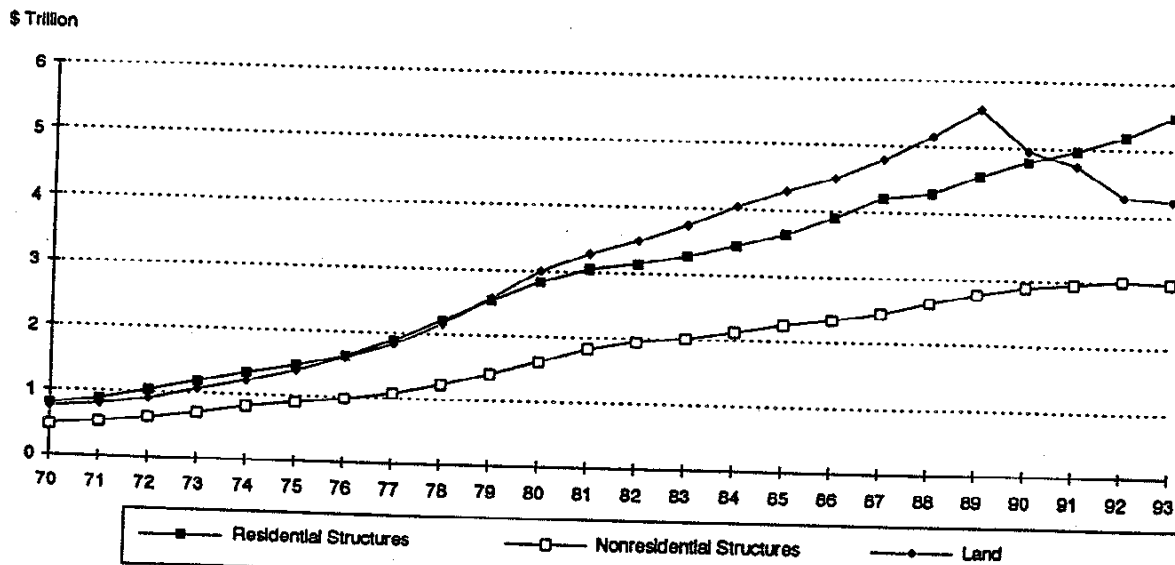
7

To begin, in the remainder of this introduction we present a statistical overview of the importance of residential housing in the U.S. economy, the importance of the mortgage market to the housing market, and the importance of Fannie Mae and Freddie Mac to the mortgage market.

1.1. Real Estate Markets and the U.S. Economy

Real estate constitutes one of the most important sectors of the U.S. economy. This is illustrated in Figure 1, which shows that the value of total real estate in the United States in current dollars at year-end 1993 (the most recent data available) was about $13 trillion.[3] In comparison, the total tangible wealth of the United States at that time was about $19 trillion, so that real estate wealth represents more than two-thirds of total tangible wealth.[4]

On a flow basis, new real estate construction in the United States is generally less than 10% of the total gross national product (GNP). The lesser importance of real estate activity on a flow basis is a result of the highly durable nature of real estate assets. In other words, even if 8% of GNP is allocated to real estate construction each year, the cumulative effect is that real estate represents about two-thirds of the country's tangible assets.

The total real estate wealth can be divided into three components: residential structures, nonresidential structures, and land. As illustrated in Figure 2, residential structures are the largest component, about $5.5 trillion at year-end 1993. Furthermore, if we include land associated with residential structures, the total for residential real estate (that is, residential structures and land) is close to $8 trillion, or almost two-thirds of total real estate wealth.[5] Fannie Mae and Freddie Mac operate only in the residential mortgage market, so residential real estate assets are the proper baseline for their mortgage market activity.
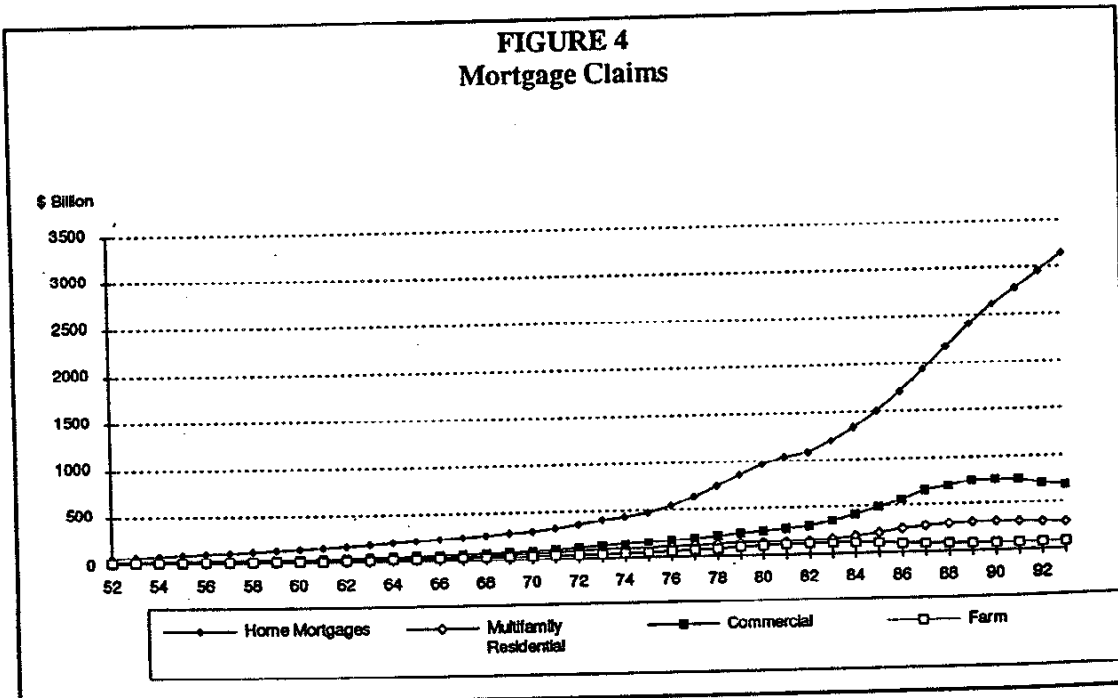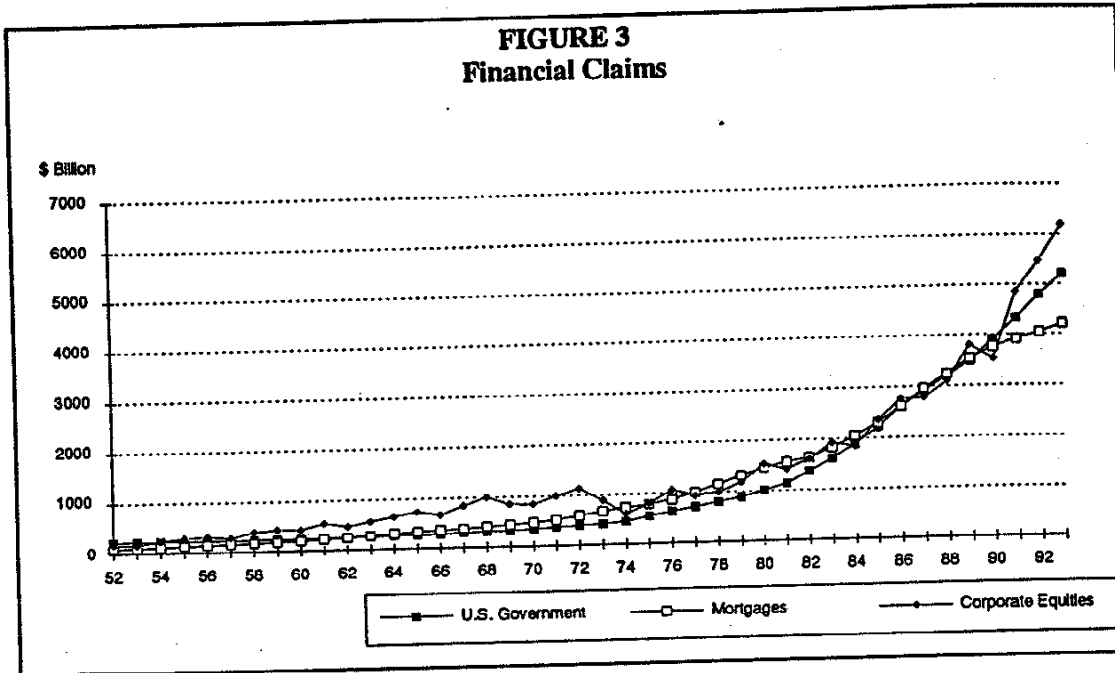
1.2. Mortgage Markets and U.S. Capital Markets

Mortgage markets are one of the most important parts of U.S. capital markets. As illustrated in Figure 3, mortgage claims totaled more than $4 trillion at year-end 1993. This was exceeded only by the total value of corporate equities (about $6 trillion) and U.S. government debt (about $5 trillion) as components of total capital market claims.[6] Furthermore, as illustrated in Figure 4, home (1–4 family) mortgage claims outstanding at year-end 1993 totaled more than $3 trillion, or about

---

[3] The source of data for Figures 1 and 2 is *Survey of Current Business*, U.S. Department of Commerce, various issues, under the topic "tangible capital wealth of the United States."

[4] Tangible wealth covers all physical assets in a country, including business plants and equipment, consumer durables, residential real estate, and corresponding government assets. It excludes financial assets because, although each financial instrument is an asset for one agent in the economy, it is also a liability for another agent (except for foreign holdings).

[5] The decline in land prices starting in 1989 was no doubt part of the general real estate collapse that took place in the United States at that time.

[6] The data source for Figures 3 to 8 is Flow of Funds Accounts, Board of Governors of the Federal Reserve System.

Implications for Mortgage Industry Structure   *Page 231*

FIGURE 3
Financial Claims

FIGURE 4
Mortgage Claims

Hermalin and Jaffee

9

three-fourths of total mortgage claims. This is the primary market for Fannie Mae and Freddie Mac activity.[7]

1.3. Holdings of Home Mortgages

Figure 5 shows the distribution of 1–4 family home mortgage holdings. By 1994-3 (third quarter of 1994), just under 50% of total home mortgages were backing mortgage pools. Direct mortgage holdings of financial intermediaries (FIs) are currently the next largest share, just over 30%. FI holdings approached 90% of the total during the 1950s but declined sharply beginning in the late 1960s.[8] Direct holdings of individuals and of Fannie Mae, Freddie Mac, and the Government National Mortgage Association (Ginnie Mae) (collectively designated "Agencies" in the figure) round out the total, each with about 10%.

1.4. Agency Activity in Home Mortgages

The Agencies' role in the mortgage market consists of two parts: direct holdings and mortgage pools. Figure 6 shows Fannie Mae's, Freddie Mac's, and Ginnie Mae's positions in the first of these parts, direct holdings. It can be seen that Fannie Mae has the dominant position here, a total of $160 billion as of 1994-3. Freddie Mac's holdings as of 1994-3 are smaller, about $60 billion, although their growth rate has been more rapid in recent years. Ginnie Mae's holdings are now negligible, although they were more important in the early 1970s.

Figure 7 shows 1–4 family mortgage pools by issuer. Fannie Mae, Freddie Mac, and Ginnie Mae each have about $500 billion in pools outstanding by 1994-3, with Fannie Mae currently the largest. Privately issued pools are substantially lower, about $200 billion at 1994-3. The growth rate of the privately issued pools, however, has been the most rapid during the 1990s.

The total mortgage market contribution of Fannie Mae, Freddie Mac, Ginnie Mae, and private pool issuers can be evaluated by combining their direct holdings and their mortgage pool activity. Figure 8 shows that, as of 1994-3, Fannie Mae has the largest contribution to the secondary mortgage market (close to $700 billion), followed by Freddie Mac (more than $500 billion) and Ginnie Mae (close to $450 billion).

1.5. Summary

The above discussion has indicated the key importance of Fannie Mae and Freddie Mac within the residential mortgage market. The value of U.S. residential real estate is almost $8 trillion

---

[7] Fannie Mae and Freddie Mac also operate in the multifamily mortgage market. Their penetration in the multifamily market, however, is quite small, and the multifamily market in turn is a small part of the overall mortgage markets (as shown in Figure 4). Consequently, we focus on the home (or 1–4 family) mortgage markets in this part.

[8] Figure 5, however, exaggerates the decline in financial intermediary participation in the mortgage market, because the intermediaries are the single largest holders of mortgage pool instruments.

Implications for Mortgage Industry Structure   *Page 233*

10

FIGURE 5
1–4 Family Mortgages as a Percentage of Total

FIGURE 6
Agency Mortgages Held

11
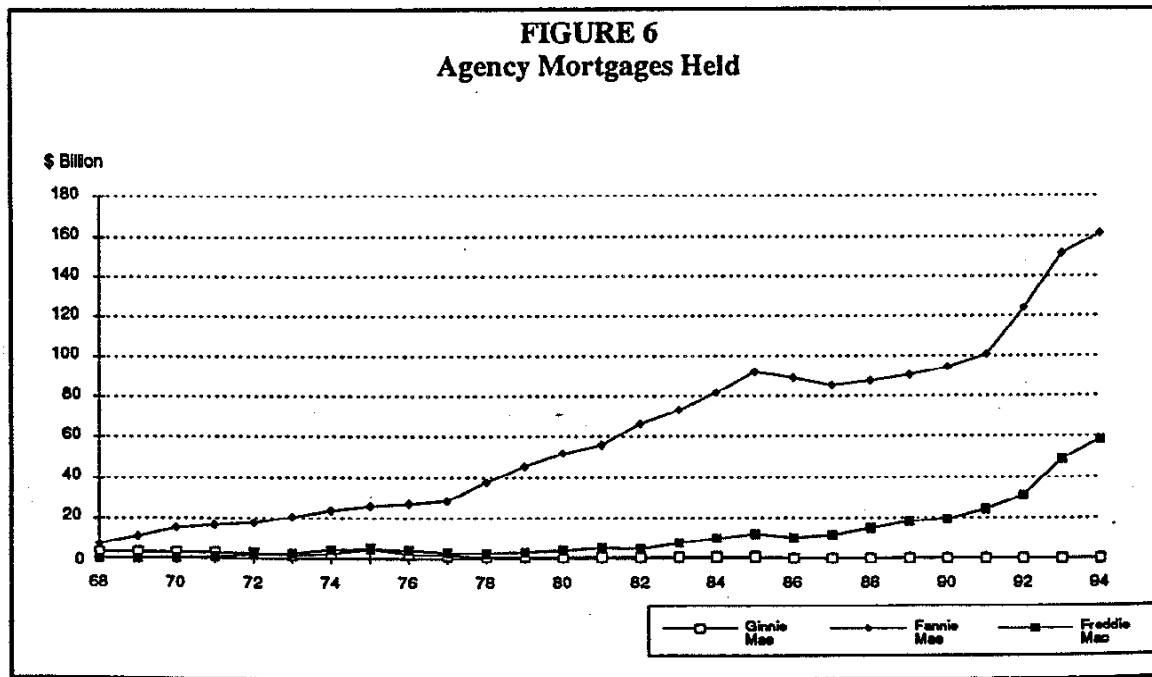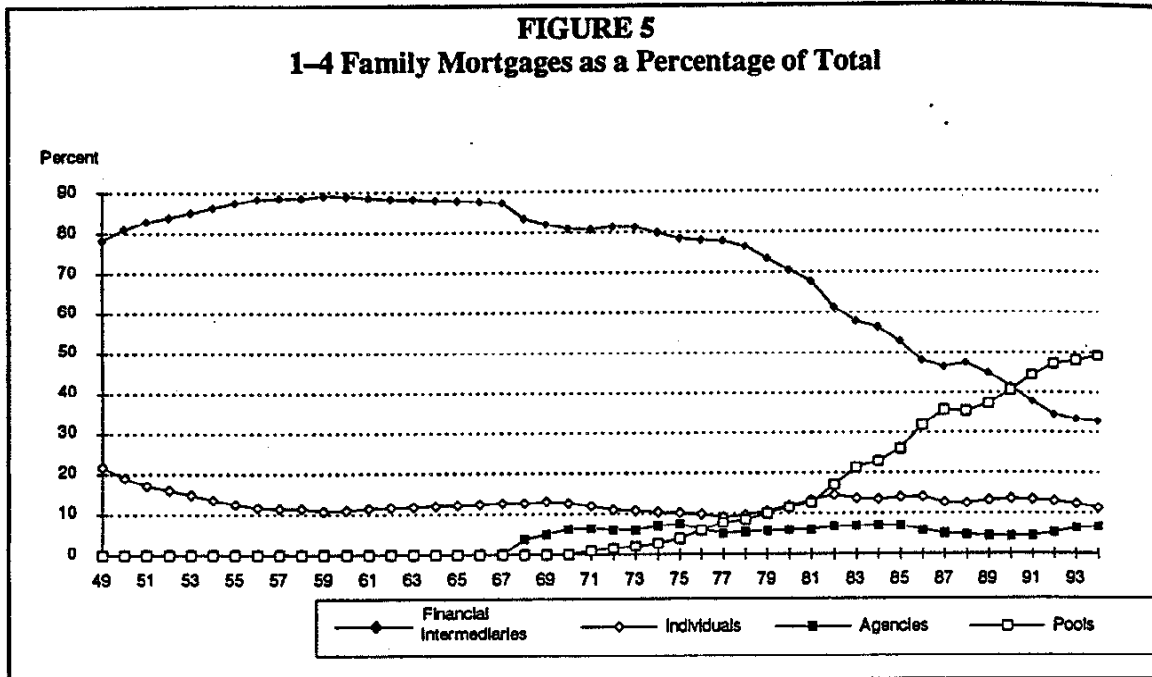
FIGURE 7
1-4 Family Pools Issued
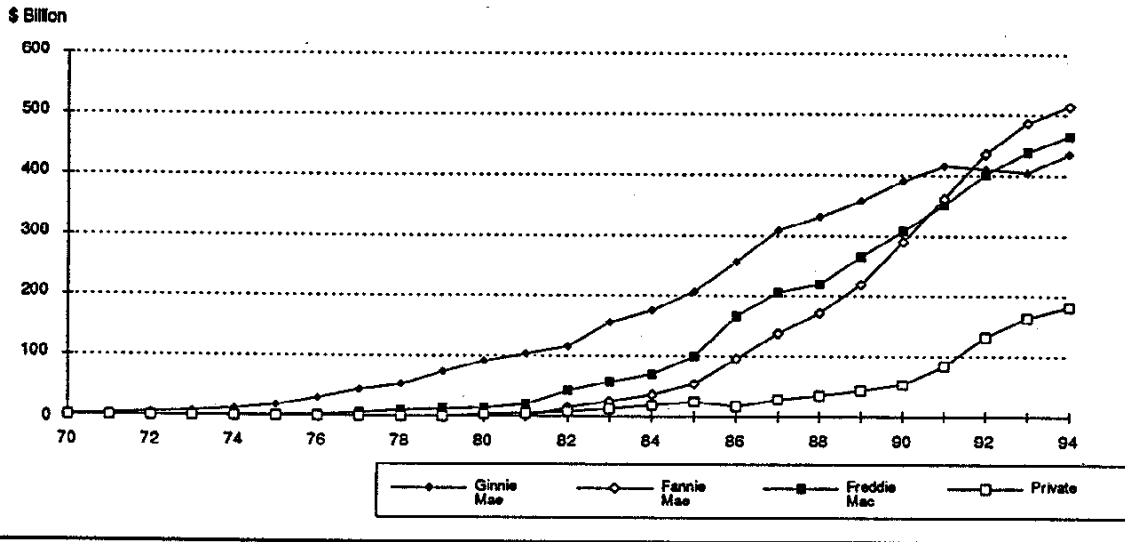
$ Billion

FIGURE 8
Mortgage Holdings and Pools Issued

$ Billion

Implications for Mortgage Industry Structure   *Page 235*

12
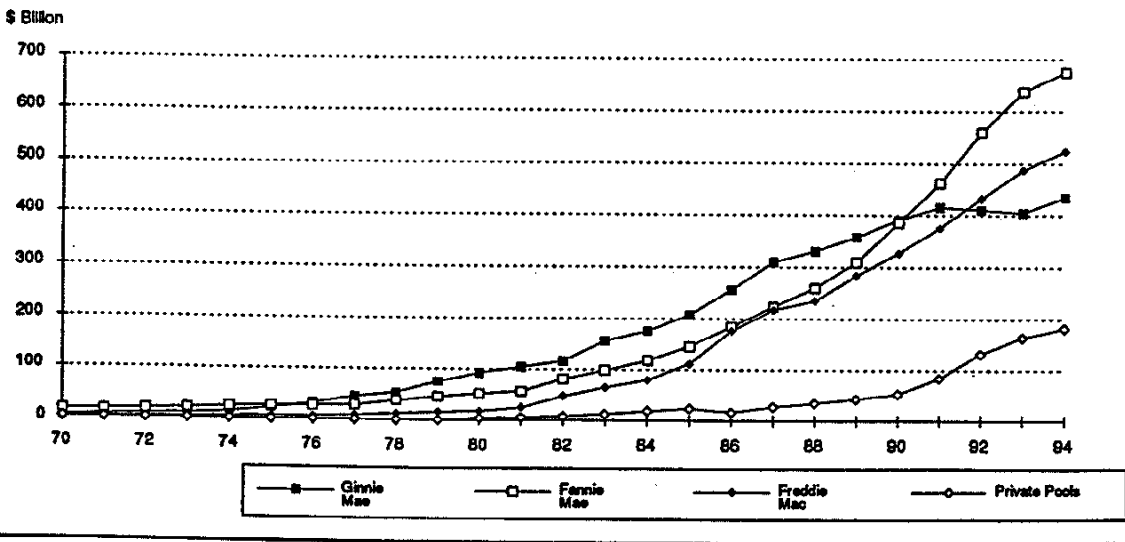
or approximately 40% of the country's tangible capital wealth. Home mortgages total more than $3 trillion, and Fannie Mae and Freddie Mac together participate in well over $1 trillion through direct holdings and mortgage pools. Fannie Mae and Freddie Mac thus participate in about 40% of the total home mortgage market in the United States. Furthermore, Fannie Mae and Freddie Mac are legally restricted to the *conforming* home mortgage market, in which their share is about 50%, as we shall discuss in the next part.

1.6. Agenda for Remainder of Report

The agenda for the remainder of the report is as follows. Part 2 provides a detailed review of the current state of U.S. secondary mortgage markets, focusing on the role of Fannie Mae and Freddie Mac, including their suppliers (originators, servicers, and insurers) and their customers (final investors). Part 3 evaluates the advantages maintained by Fannie Mae and Freddie Mac and the disadvantages imposed on them, given the current structure of U.S. mortgage markets. Part 4 analyzes possible trends in vertical integration of the mortgage markets that might occur following Fannie Mae and Freddie Mac privatization. Part 5 considers the possible structure of the secondary mortgage market after Fannie Mae and Freddie Mac privatization, including changes in the degree of competition and the welfare effects thereof. Part 6 provides a summary of our conclusions.

PART 2: SECONDARY MORTGAGE MARKETS CURRENTLY

To assess the consequences of privatizing Fannie Mae and Freddie Mac, it is necessary to understand first the secondary mortgage markets as they now exist. This involves a careful industrial organization analysis of these markets. This section represents such an analysis. We begin in Section 2.1 with an examination of what the relevant markets are and how they might best be studied. As we discuss in that section, analyzing any market requires dividing up the analysis into six parts: the competitors, their buyers, their suppliers, potential entrants, substitute goods, and government regulation. Sections 2.2 through 2.7 contain these analyses. Section 2.8 concludes and summarizes Part 2 of this report.
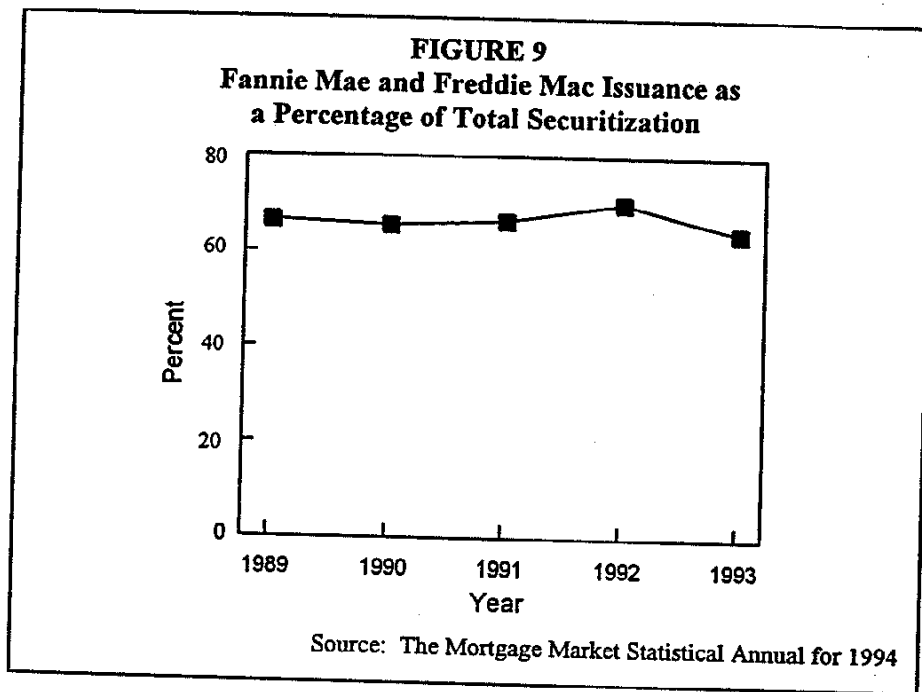
2.1. Market Definitions and Our Approach to Market Analysis

(1) Market Definitions

When Coca-Cola sought to defend its proposed acquisition of Dr. Pepper against antitrust objections, it argued that the relevant market was all beverages, not just carbonated soft drinks. Market definition clearly mattered in this case. If the market is all beverages, then Coca-Cola is a large, but hardly dominant player; if, however, the market is carbonated soft drinks, then Coca-Cola is one of two dominant players that, combined, would have had an 80% market share.[9] An analogous situation exists with secondary mortgage securities. If we look at Fannie Mae and Freddie Mac's

---

[9] This 80% figure also includes Pepsi's then-proposed acquisition of Seven-Up. Both Coca-Cola acquisition of Dr. Pepper and Pepsi's acquisition of Seven-Up were subsequently disallowed on antitrust grounds. See Greer (1993).

Page 236   *Hermalin and Jaffee*

share of *total* securitization, it is 65% of all securitizations of home mortgages, an amount, more-over, that has been declining somewhat in recent years—see Figure 9.[10] As a point of comparison, this concentration ratio is slightly smaller than the two-firm concentration ratio for the beer industry.[11] On the other hand, if we define the market as the securitization of conventional (i.e., non-FHA/VA),[12] conforming mortgages, then Fannie Mae and Freddie Mac together represent virtually 100% of that market. Unfortunately, unlike the case of Coca-Cola, the appropriate market definition in this context is less clear cut.

FIGURE 9
Fannie Mae and Freddie Mac Issuance as
a Percentage of Total Securitization

Source: The Mortgage Market Statistical Annual for 1994

There are at least two reasons why we might be wary about defining the market to be the securitization of all home mortgages. First, the legal distinction between conforming and jumbo (nonconforming) mortgages has effectively divided the market, in the sense that there is essentially no overlap in the firms competing in each division. Second, the federal guarantees on FHA and VA mortgages can be seen as making them distinct products vis-à-vis conventional mortgages. Conse-quently, when we want to analyze the secondary markets as they exist *today*, the best approach is to consider the three types of mortgages—FHA/VA, conventional conforming, and conventional jumbo—separately.

---

[10] Source: *The Mortgage Market Statistical Annual for 1994*, Inside Mortgage Finance Publications, Inc. Washington: 1994.
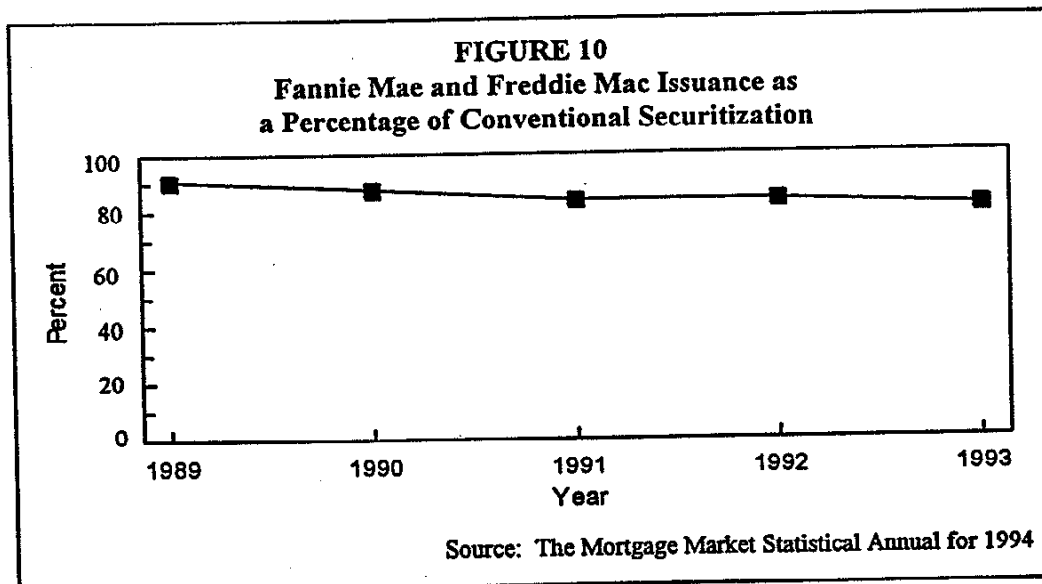
[11] The two-firm (Anheuser-Busch and Miller) concentration ratio for the beer industry was 67.3% in 1990. See Greer (1993).

[12] FHA: Federal Housing Administration. VA: Department of Veterans Affairs.

Implications for Mortgage Industry Structure

Page 237

14

On the other hand, when we want to analyze the secondary markets *after* privatization, the distinction between conforming and jumbo mortgages is less pertinent: Presumably one consequence of privatization would be that Fannie Mae and Freddie Mac could securitize jumbo mortgages. Moreover, there is evidence that they might wish to do so if permitted: Fannie Mae and Freddie Mac securitize mortgages right up to the conforming mortgage limit and continue to do so as the conforming mortgage limit increases over time.[13] That is, their behavior strongly suggests that the conforming mortgage limit is a binding constraint for them; hence, absent that constraint, they would securitize mortgages that are currently over the limit. In addition, elimination of Fannie Mae's and Freddie Mac's GSE status could make credible the entry of private-label conduits into the securitization of conforming mortgages. For these reasons we will tend to treat the conventional market as one when considering the secondary markets in the *future* (post-privatization).

Although, as we have argued, treating the jumbo and conforming conduit markets as a single market is not sensible *today*, it is nevertheless instructive to consider Fannie Mae and Freddie Mac's share of this market in recent years. As Figure 10 shows, the GSEs' share of this market has been falling steadily over the past 5 years, from 91% in 1989 to 82% in 1993.[14] Eighty-two percent is still, however, a high concentration ratio. (As a point of comparison, a slightly lower concentration ratio was grounds for the Federal Trade Commission's decision to block two mergers in the carbonated soft drink market—see Footnote 9.)

Given (1) that the scope of this report does *not* include potential changes to Ginnie Mae's status and (2) Ginnie Mae's current and likely future near-monopolization of the FHA/VA market,

FIGURE 10
Fannie Mae and Freddie Mac Issuance as
a Percentage of Conventional Securitization

Source: The Mortgage Market Statistical Annual for 1994

[13] See, e.g., Woodward (1987) for evidence.

[14] Source: *The Mortgage Market Statistical Annual for 1994*, Inside Mortgage Finance Publications, Inc. Washington: 1994.

Page 238   *Hermalin and Jaffee*

15

there seems to be little point to analyzing the FHA/VA market *directly*. We, therefore, do not include such an analysis. This is not to say, however, that we will ignore this market. We will need, for instance, to consider it when we consider substitute securities in our analyses of the conventional mortgage markets.

It is important to stress that this market definition covers *securitized* conventional mortgages, not all *originated* conventional mortgages. All originated conventional mortgages are only the *input* that the conduits use to create security outputs, and a market is properly defined by its outputs, not its inputs. An example can illustrate why it is not proper to include nonsecuritized mortgages in our market definition. Consider the business that stamps auto bodies out of steel. Suppose the steel industry (all products) is competitive, but the auto body stamping industry is monopolized. Surely one would not call the body stamping industry competitive because it buys the raw material from a competitive industry. To the contrary, a competitive steel industry reinforces the profitability of monopolizing the auto body stamping industry.

In our analysis we will not generally differentiate among the types of securities being offered by the conduits. The securities coming out of Ginnie Mae, Fannie Mae, Freddie Mac, and the private labels are virtually identical, to any reasonable approximation. The same is true for the *derivatives* that are based on these securities (e.g., REMICs, CMOs, interest-only and principal-only securities). Admittedly, Fannie Mae and Freddie Mac also purchase mortgages to hold in portfolio and then issue debt against these mortgages, but this, too, is a form of securitization. For the purposes of our analysis, the distinctions among these mortgage-*based* securities are not critical.

In summary, we will take the following approach to defining secondary markets:

(1) The basis for defining a market will be the type of mortgage being securitized.

(2) The FHA/VA market will not be dealt with directly; such an analysis lies outside the scope of this report.

(3) The conventional market will be divided into two markets, conforming and jumbo, when considering the current state of the secondary markets, but will be considered to be a single market when considering the future, post-privatization state of the secondary markets.

(2) Our Approach to Market Analysis

Our approach to analyzing markets is based on Porter's "five-forces model," which we will sketch in greater detail below.[15] Figure 11 illustrates our variant model for the conforming, conventional secondary market. The picture would be identical for the jumbo secondary market, except the conduits would be just the private-label firms. The picture would also be identical if we were considering the post-privatization conventional market, except the private-label firms would be *added* to

---

[15] For a more comprehensive introduction to this model, the reader may wish to consult Oster (1994, pp. 31–48).

Implications for Mortgage Industry Structure   *Page 239*

16

Fannie Mae and Freddie Mac in our list of conduits. The details on each box are discussed in the following six sections.

Our aims in this analysis are the following:

(1) To understand the structure of the markets as they *currently* exist and determine the extent to which they approach the ideal of perfect competition.

(2) To the extent these markets are not perfectly competitive, to identify both what kind of industrial structure (e.g., oligopoly or monopolistic competition) they have and what the welfare loss might be from their departure from perfect competition.

(3) To determine what current structure suggests about future structure, particularly a future structure in which Fannie Mae and Freddie Mac are privatized.

(4) To evaluate the welfare consequences of these future structures.

FIGURE 11

Hermalin and Jaffee
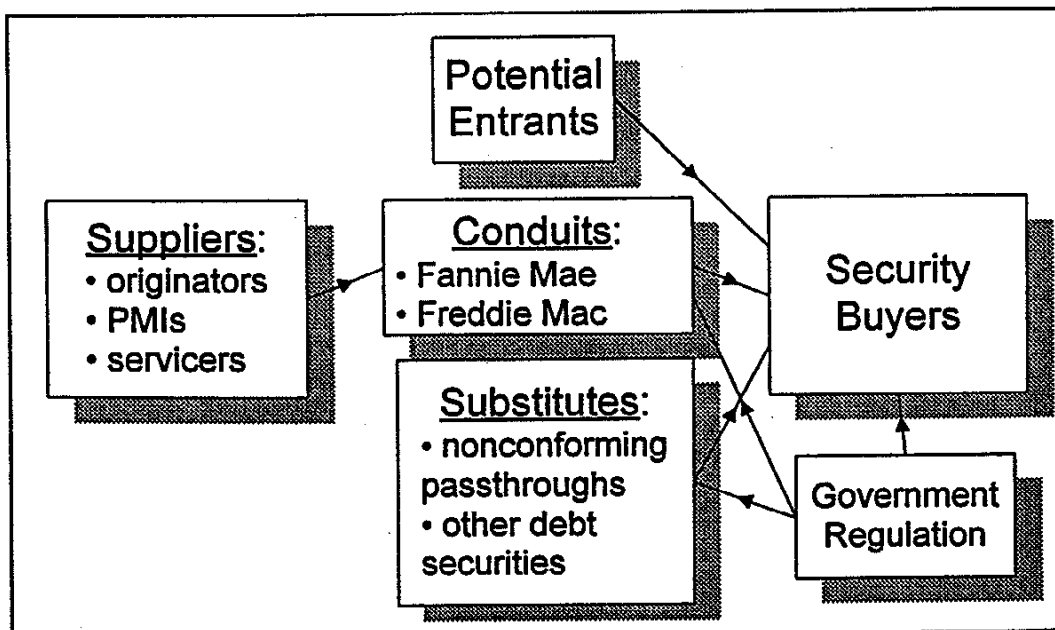
2.2. The Conduits

(1) The Basic Issues

Analysis of the central box in the Porter framework means examining the rivalry among existing firms. The focus of this examination is to discern the intensity of competition among the rivals or, conversely, the degree to which they may avoid competition.

Before going into the details of this analysis, it is important to define some general terms and concepts. Competition can have many dimensions, of which price, advertising, and research and development are typically the most important. In terms of the conduits, however, neither advertising nor research and development are likely to be important dimensions for competition: Security buyers are sophisticated and therefore unlikely to be influenced by brand image or brand loyalty; that is, advertising is unlikely to affect their decisionmaking. Although research and development is important to the industry as a whole (consider, for example, the innovation of mortgage-backed securities in the 1970s and 1980s or current efforts to streamline mortgage origination), we do not believe that research and development provides significant competitive advantages, because it is difficult to prevent rivals from mimicking product innovations in this market (i.e., the effectiveness of laws protecting intellectual property seems limited).[16] Consequently, when we discuss competition, we will typically be referring to price competition.

The traditional model of price competition is the *Bertrand model*.[17] In the simplest version of this model, rival firms sell a completely homogenous product, have identical and constant marginal cost, have sufficient capacity to serve the entire market, and play myopically (i.e., they do not consider their future competition when setting price today). Moreover, consumers are assumed to have no brand loyalty and consequently will buy from whichever firm charges the lowest price. (If more than one firm is charging the lowest price, consumers randomly choose from which of these firms to buy.) Because they play myopically, firms care only about today's profit. Moreover, because they can capture the entire market by undercutting the price of all their rivals, there is strong downward pressure on price. Indeed, in the unique equilibrium of this game, all firms charge a price equal to marginal cost; that is, the price is driven to the perfectly competitive level. Correspondingly, firms earn zero economic profits. The Bertrand model or variants of this model that yield price at or near marginal cost can be considered to be models of intense price competition.

An objection to the Bertrand model is its assumption that the firms play myopically. A more reasonable assumption is that the firms are concerned about the future as well as the present. The degree to which they care about the future is captured by their *discount factors*: The smaller their

---

[16] Admittedly the ability to mimic does not imply the desire to mimic; in particular, smaller firms may not find it cost effective to automate as much as large firms. This, however, is better seen as an economies of scale issue, which we address below in Sections 2.3 and 3.1.

[17] For a comprehensive presentation of the Bertrand model, the reader may wish to consult Chapter 5 of Tirole (1988), although any good intermediate microeconomics text should be adequate.

discount factors, the less they care about the future.[18] Provided the number of firms is not too great and the discount factor is high enough, the firms will be able to escape the Bertrand equilibrium as follows: Each firm, when considering whether to undercut its rivals, will recognize that its rivals can retaliate (i.e., punish) the firm in subsequent periods. Hence, the gain realized today from undercutting rivals and stealing market share must be weighed against the reduction in profits in the future due to retaliation. If the reduction in profits, appropriately discounted, outweighs today's gain, the firm will not undercut. In this way firms can sustain prices above marginal cost in equilibrium. In particular, they can often sustain a price equal to the price that they would have agreed to charge had they been able to collude directly among themselves. For this reason an equilibrium in which firms are able to sustain a price above marginal cost is typically referred to as *tacit collusion*.[19] The adjective "tacit" is important: The firms are not colluding directly—which would be illegal under the Sherman Antitrust Act—they are simply behaving *as if* they were colluding directly. Because they are not colluding directly, there is nothing illegal about tacit collusion.[20] Tacit collusion can thus be seen as the avoidance of competition.

Formally, let π_C be per-period profit from tacitly colluding. Let π_D be the one-period profit from undercutting. Let π_N be the per-period profit from not colluding. Although these quantities should be derived from the underlying model of product-market competition, it is readily apparent that $\pi_D > \pi_C > \pi_N$. Finally, let δ be the discount factor (i.e., $\delta = 1/(1+r)$, where r is the interest rate). The firms can sustain tacit collusion if the present discounted value of π_C exceeds π_D plus the present discounted value of receiving π_N for ever after; that is,

$$\sum_{t=0}^{\infty} \delta^t \pi_C \geq \pi_D + \sum_{t=1}^{\infty} \delta^t \pi_N \,.^{21}$$

Collusion is possible, therefore, if

$$\delta \geq \frac{\pi_D - \pi_C}{\pi_D - \pi_N} \quad \text{(delta condition)}.$$

The greater is this ratio, the more firms must care more about the future (alternatively, the lower the interest rate must be) if tacit collusion is to be sustained; that is, the greater this ratio, the more difficult it is to sustain tacit collusion. Therefore, the greater the profit from colluding, the easier tacit

---

[18] Typically, discount factors are modeled as $1/(1+r)$, where r is the relevant single-period interest rate; that is, firms discount the future in a manner consistent with finance theory.

[19] For a more comprehensive discussion of tacit collusion see Chapter 6 of Tirole (1988).

[20] To be precise, if the firms undertake certain actions whose purpose is largely to facilitate tacit collusion (e.g., creating a trade association to share price information), then these actions will be held to be illegal. If, however, the firms can sustain their tacit collusion without these actions, then they face no legal sanctions whatsoever.

[21] Note this formulation assumes that once collusion breaks down, there is a price war (or non-collusion) forever after. Collusion can, however, also be supported by a finite-length price war if the discount factor is great enough (there is an inverse relation between the discount factor and the minimum length of the *threatened* price war). For more on this see Chapter 6 of Tirole (1988).

Page 242   *Hermalin and Jaffee*

collusion is to sustain, but the greater the profit from undercutting or not colluding in the first place, the more difficult tacit collusion is to sustain.

(2) The Conforming Conduit Market: The Theoretical Case for Tacit Collusion

In determining the intensity of competition (or, conversely, the ability of firms to collude tacitly), it is helpful to divide the analysis into seven parts:

(1) Number of competitors.

(2) Size distribution of market participants.

(3) Commitment to the market.

(4) Homogeneity of outputs.

(5) Capacity.

(6) Changing conditions of demand and supply.

(7) Intensity of competition, or, conversely, the scope for tacit collusion.

The seventh part of the analysis is primarily a synthesis of the implications generated by the first six parts of the analysis.

For all intents and purposes, there are only two firms in the market for securitizing conventional conforming mortgages: Fannie Mae and Freddie Mac.[22] Almost all current models of oligopoly behavior would argue that a duopoly should be able to collude tacitly.[23] Indeed, this factor alone is nearly enough to build a prima facie case for tacit collusion.
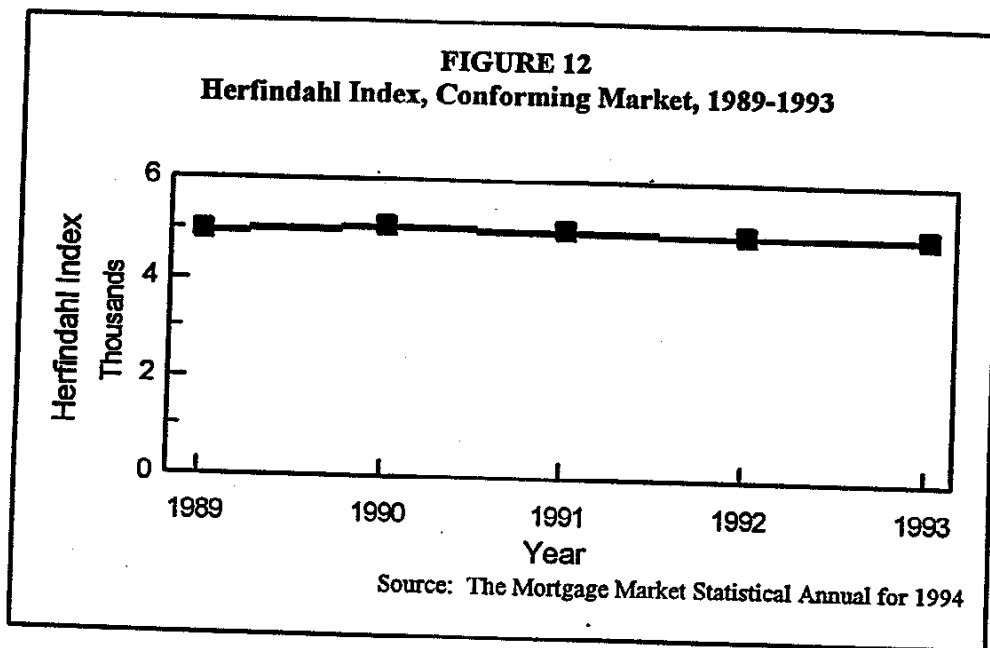
These two firms have approximately the same market share: The Herfindahl index is 5004.37, which is almost the theoretical minimum for a duopoly (5000).[24] This equality has been fairly stable over the past 5 years, as shown in Figure 12.[25] This stability in market shares suggests that neither firm has made a serious attempt to steal market share from its rival. Such behavior is consistent with

---

[22] To be precise, there is some securitization of "low-quality" (B, C, and limited-documentation) conforming mortgages by other firms. Muolo (1993) suggests that the total amount of low-quality conforming mortgage securitization was less than $1 billion in 1993, or 0.2% of the total Fannie Mae and Freddie Mac securitizations for that year.

[23] See, e.g., Chapter 6 of Tirole (1988) for a discussion.

[24] Source: *The Mortgage Market Statistical Annual for 1994*, Inside Mortgage Finance Publications, Inc. Washington: 1994. The Herfindahl index, HI, is given by the formula $HI = 10,000 \times \Sigma_i s_i^2$, where s_i is the market share of the ith firm. The greater is HI, the less competitive the industry is considered to be. Note that the Herfindahl index measures a reduction in competitiveness due both to fewer firms and more unequal size distribution: For example, a four-firm industry in which each firm has 25% of the market has a Herfindahl index of 2500, while a four-firm industry in which two firms have 40%, while the other two have 10%, has a higher Herfindahl index of 3400. Note that equal shares minimize the Herfindahl index.

[25] Source: Ibid.

Implications for Mortgage Industry Structure *Page 243*

20

FIGURE 12
Herfindahl Index, Conforming Market, 1989-1993

Source: The Mortgage Market Statistical Annual for 1994

an equilibrium in which the firms are successfully colluding tacitly.[26] Additional evidence of stability is the fairly constant net interest margins enjoyed by the two firms.[27]
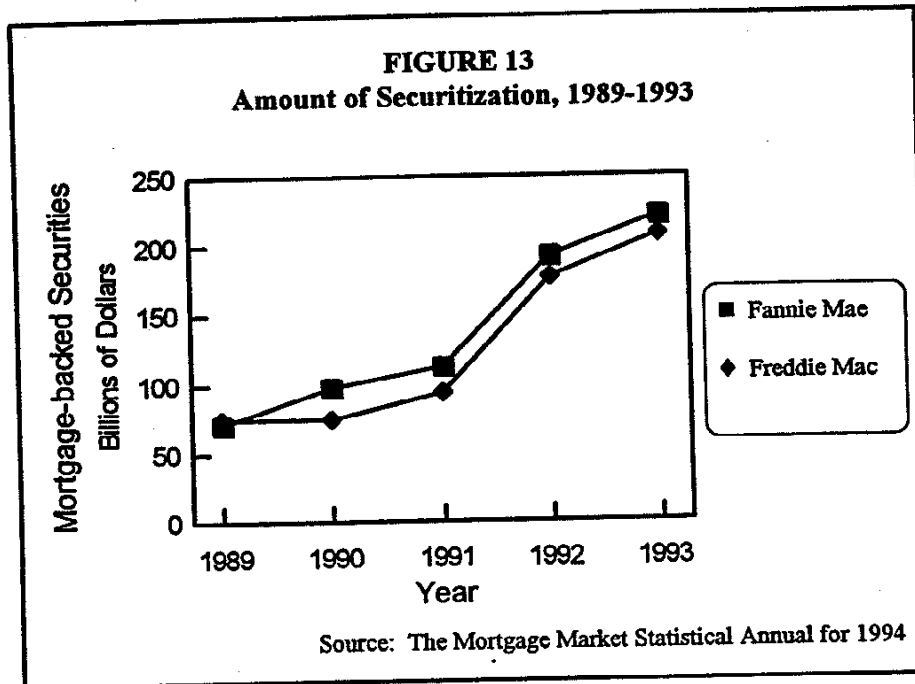
Current law commits Fannie Mae and Freddie Mac to the secondary market. That is, they cannot invest their assets in other lines of business. Consequently, they face a serious barrier to exit. We suspect that this facilitates tacit collusion because driving a rival from the market is not a viable alternative. That is, since they are committed not to exit, they are more likely to find tacitly colluding to be their best strategy.

The homogeneity of mortgage-based securities (within their classes of such securities) would tend to make price competition fiercer *when it exists* but could, paradoxically, make tacit collusion easier to sustain when it exists. The more similar the products become, the more intense is the competition, because price becomes increasingly the only dimension on which to attract customers.[28] More relevant for Fannie Mae and Freddie Mac, however, is that greater homogeneity can make it

---

[26] Admittedly, such behavior is also consistent with a Bertrand equilibrium (firms price at their common marginal cost) in which the firms earn zero economic profit. We find this conclusion implausible for many reasons, which we detail below, not least of which is that we feel that these firms are making positive economic profits.

[27] Sources: *Freddie Mac Investor/Analyst Report* and *Fannie Mae Investor/Analyst Report* for the fourth quarter 1993.

[28] A well-known result in industrial organization is that if firms are engaged in head-to-head price competition, such as Bertrand competition, then they can increase their profits by differentiating their products. See, e.g., Tirole (1988, pp. 277–282).

Page 244

Hermalin and Jaffee

FIGURE 13
Amount of Securitization, 1989-1993

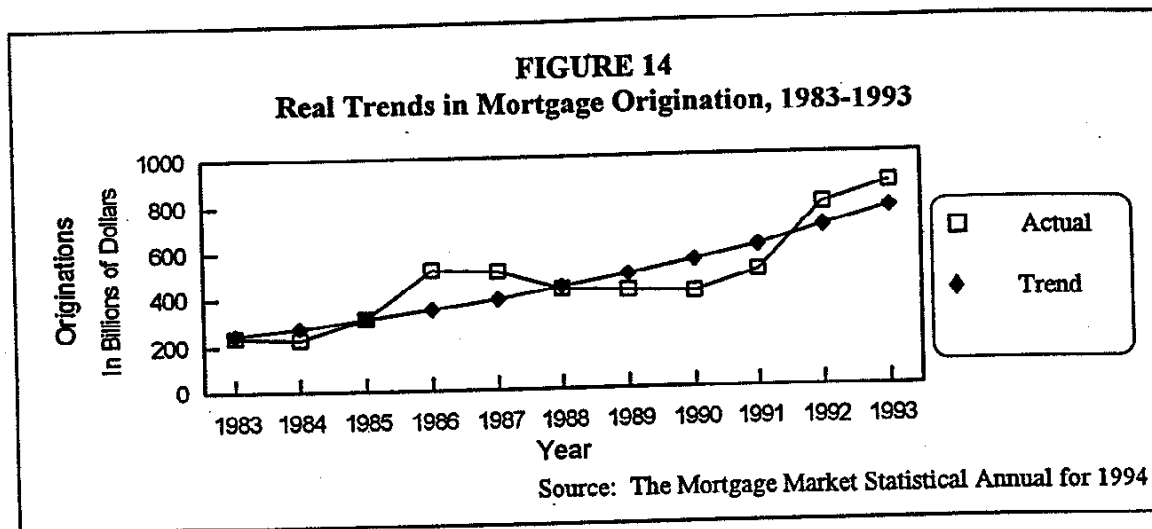Source: The Mortgage Market Statistical Annual for 1994

easier to support tacit collusion. From the delta condition, three factors affect the ability of firms to collude tacitly: the payoff to colluding; the payoff to deviating (undercutting); and the payoff to not colluding. Although differentiated products cannot lower the first payoff, they need not raise it by much, if at all. Differentiating products greatly raises the payoff to not colluding and lowers the payoff to deviating. These changes in the payoffs have an ambiguous theoretical effect on the ease of sustaining collusion; that is, it is possible—although not always true—that product differentiation can make tacit collusion *harder* to sustain. Consequently, in our context homogeneity may facilitate collusion.[29]

The rapid increase in the amount of securitization carried out by Fannie Mae and Freddie Mac over the 5-year period 1989–93 (a 217% increase for Fannie Mae and a 184% increase for Freddie Mac),[30] particularly their rapid response to the refinancing boom of 1992 (see Figure 13), suggests that neither Fannie Mae nor Freddie Mac are operating at capacity. Moreover, both firms seem able to increase their business rapidly in response to changing market conditions. This facilitates tacit collusion, which is sustained by the threat of price wars should any firm deviate from the collusive price (i.e., lowering π_N in the delta condition).

---

[29] A second way in which homogeneity can aid tacit collusion is that the more homogenous the products, the easier it is to detect whether a rival firm is undercutting the collusive price. The easier it is to detect undercutting, the swifter can be the punishment, which lessens the payoff to undercutting.

[30] Source: *The Mortgage Market Statistical Annual for 1994*, Inside Mortgage Finance Publications, Inc. Washington: 1994.

Implications for Mortgage Industry Structure   *Page 245*

FIGURE 14
Real Trends in Mortgage Origination, 1983-1993

Source: The Mortgage Market Statistical Annual for 1994

Stability in demand matters because the more unstable a market is, the harder it is for rivals to collude tacitly. First, if demand is quite unpredictable, then firms can have difficulty determining whether changes in their demand are due to movement in the demand curve or price undercutting by their rivals. The harder it is to detect undercutting, the harder it is to punish undercutting, thus increasing the temptation to undercut. Second, if demand is predictable but cyclical, then sustaining collusion may be difficult because the temptation to undercut during a boom is great, while the deterrence effect of later punishment during the ensuing bust phase is limited.

It is difficult to measure the stability of demand for mortgage-based securities over time for many reasons. First there is some degree of heterogeneity in the securities themselves, making it difficult to define a price. Moreover, many securities are initially created through negotiated swaps, making obtaining price data impossible for outsiders, such as ourselves. Finally, there are econometric difficulties in estimating demand curves given the short history of this market. We therefore cannot say much *directly* about the stability in demand over time.

On the other hand, Goodman and Passmore (1992) show that indirect techniques may offer insight into whether demand volatility affects Fannie Mae and Freddie Mac's ability to collude tacitly. Their findings suggest that Fannie Mae and Freddie Mac are able to collude tacitly despite demand volatility. In our view Goodman and Passmore's analysis—although perhaps the best possible given the paucity of data one faces—cannot be seen as conclusive on this point. Nevertheless, we see theoretical reasons to accept their conclusion:

(1) To insiders, demand shocks are sufficiently transparent in this market that we doubt either firm could hide secret price cuts from its rival for long enough to gain more from the price cuts than it stands to lose by triggering a price war.

(2) As noted earlier, sustaining collusion may be difficult in cyclical markets because the temptation to undercut during a boom is great, while the deterrence effect of later punishment during the

Page 246   *Hermalin and Jaffee*

23

ensuing bust phase is limited. But this general insight is much less applicable here because this is a growing market (see Figure 7 above). Consequently the trough of the next bust will not be much lower than the peak of the preceding boom. In other words, because this is a growing market, the deterrence effect of later punishment is greater than it would otherwise be, which means the firms will have an easier time engaging in tacit collusion.

Supply (i.e., mortgage origination) is also somewhat cyclical (see Figure 14).[31] On the other hand, the deviation around the trend is not particularly pronounced: 75% of the variation in actual mortgage originations is explained by the trend line. The residual unpredictability of supply strikes us as too small to have much of an impact on the firms' ability to collude tacitly.

Table 1 summarizes our analysis of the conforming market.

TABLE 1

Scope for Tacit Collusion in the Conforming Conduit Market

Feature	Conclusion for Tacit Collusion
Two competitors	Strongly facilitates tacit collusion.
Roughly equal market share	The stability of market share over the past 5 years suggests successful tacit collusion.
Heterogeneity in other dimensions; homogeneity of product	Unlikely to impede tacit collusion completely.
High exit barriers (strong commitment to the market)	In this context likely to make tacit collusion a more attractive strategy.
Adequate capacity	Facilitates tacit collusion.
Cyclicality in demand and supply	Nature of cycles, combined with growth in the industry, suggest that this is not an impediment here. Econometric results of Goodman and Passmore are consistent with this conclusion.

---

[31] The actual curve is the real value of mortgage originations (Source: *The Mortgage Market Statistical Annual for 1994*, Inside Mortgage Finance Publications, Inc. Washington: 1994). The trend curve was found by estimating the regression $\ln(m_t) = \alpha + \beta t + \varepsilon_t$, where m_t is the real value of mortgage originations, α and β are the coefficients to be estimated, and ε_t is the error term.

Implications for Mortgage Industry Structure   *Page 247*

24

Our conclusion, therefore, is that tacit collusion should be expected in the conforming market. The next subsection considers other empirical evidence that supports this conclusion.

(3) The Conforming Conduit Market: Other Evidence for Tacit Collusion

The Goodman and Passmore paper offers one direct attempt to determine whether Fannie Mae and Freddie Mac are engaged in tacit collusion. They conclude that Fannie Mae and Freddie Mac are tacitly colluding. As we noted previously, however, their results cannot be seen as conclusive because of data difficulties. In particular, whereas they would like to use price as their dependent variable in their regression analysis, price is not observable. Instead, they proxy for price using the ratio of mortgages securitized by both Fannie Mae and Freddie Mac to the total amount of mortgages available for securitization. As they detail in their Appendix II, a model can be constructed with the following features:

(1) If Fannie Mae and Freddie Mac are *not* tacitly colluding (i.e., are engaged in Bertrand competition), then this securitization rate will be positively correlated over time with the amount of mortgages available for securitization.

(2) If Fannie Mae and Freddie Mac are tacitly colluding, then this securitization rate will be negatively correlated over time with the amount of mortgages available for securitization.[32]

It is the finding of a negative correlation (i.e., prediction (2)) that leads Goodman and Passmore to conclude that Fannie Mae and Freddie Mac are tacitly colluding. Unfortunately, the model that leads to prediction (2) is dependent on assumptions about the demand curves for mortgage-backed securities (MBSs) that cannot be independently verified. If these assumptions are different, then (2) can cease to be a prediction of the model. Moreover, other models—that have little to do with collusion—exist that also lead to prediction (2). For instance, suppose that the firms add capacity to handle the *expected* increase in mortgages available for securitization. If the actual amount of mortgages available is greater than expected, then the securitization rate drops because the firms have not added the needed capacity. If, however, the actual amount is less than expected and the firms shed capacity slowly, then the securitization rate rises because of excess capacity. This would also lead to a negative correlation between the securitization rate and the amount of mortgages available for securitization.

Since the Goodman and Passmore results are not conclusive support for our hypothesis that Fannie Mae and Freddie Mac are tacitly colluding, we need to consider other evidence. One possible avenue for collecting evidence is to consider the profits of Fannie Mae and Freddie Mac. If they are unable to collude tacitly, and were thus playing the Bertrand equilibrium, their *economic* profits

---

[32] To be precise, this prediction holds only if the discount factor is high enough. If the discount factor is lower (but not so low that tacit collusion is impossible), then there will be tacit collusion but pricing will be countercyclical. In this the correlation would, again, be positive. Because, however, Goodman and Passmore find evidence to support a procyclical collusion model, we will not discuss this possibility further.

Page 248   *Hermalin and Jaffee*

would be zero.[33] If, in contrast, they are earning positive *economic* profits, then this would strongly suggest tacit collusion. The problem with this test is that it is formulated in terms of *economic* profits, whereas we can only observe accounting profits. It is well known that accounting profits and economic profits need not agree for a number of possible reasons. Consequently, the large *accounting* profits earned by Fannie Mae and Freddie Mac, although suggestive, do not offer conclusive evidence that they were tacitly colluding. (Fannie Mae's profit in 1993 was $1.87 billion and Freddie Mac's was $786 million; their 1994 profits were $2.13 billion and $983 million, respectively.)[34]

One way in which accounting profits and economic profits differ is that accounting profits do not reflect the opportunity cost of capital. For example, consider a fictional firm with capital worth $100 at the start of the year. Suppose that this firm earns an accounting profit of $5 in that year. Has this firm earned an economic profit? The answer depends on what return the firm's owners could have received had they sold the capital and invested the $100 in something else with the same risk as their firm. If this something else is less than $5, then they have made a positive economic profit; otherwise they have not. That is, to make a positive economic profit, their return must exceed the return they could have received from their next best use of their capital.

Fannie Mae's and Freddie Mac's return on their capital, measured as their return on equity (ROE), is quite high: Fannie Mae's was 25.3% in 1993 and Freddie Mac's was 22.2%.[35] This is well in excess of the average ROE (15.5%) of investment and brokerage firms.[36] Historically, Fannie Mae's and Freddie Mac's ROEs have also compared favorably to the ROEs of mortgage originators and commercial banks, as well as the Standard and Poor's (S&P) 500—see Table 2. These high ROEs for Fannie Mae and Freddie Mac are certainly consistent with positive economic profits.

Unfortunately, although consistent with positive economic profits, these ROEs are not absolutely conclusive either. The reason is that there is a tradeoff between risk and return; that is, for investors to be willing to accept greater risks, they must be compensated with higher returns. Consequently, the high ROEs enjoyed by Fannie Mae and Freddie Mac could possibly just be fair return for risk. That is, were investors to invest in other investments with similar risk, they would have received the same (or possibly greater) returns. If this were the case, then Fannie Mae's and Freddie Mac's economic profits would be zero (or possibly negative). Although a plausible case could be made that the risks faced by Fannie Mae and Freddie Mac are comparable to those faced by

---

[33] To be precise, this conclusion presumes (i) that Fannie Mae and Freddie Mac's marginal cost curves be relatively flat over the relevant range of output; and (ii) that they have the same marginal cost curves over the relevant range. Point (ii) is fairly innocuous in this context: If they were not colluding tacitly and one firm had a cost advantage, it would drive the other out of business. Since both firms are currently operating, (ii) cannot be an issue here. Although we have no data (nor can we acquire it) on point (i), the nature of securitization suggests that local returns to scale would be fairly constant. We, therefore, see both presumptions as reasonable in this context.

[34] Sources: *Freddie Mac 1993 Annual Report*, *Fannie Mae Investor/Analyst Report* for the fourth quarter 1993, and private communication from John Gardner.

[35] Sources: *Freddie Mac 1993 Annual Report* and *Fannie Mae Investor/Analyst Report* for the fourth quarter 1993.

[36] Source: Value Line.

Implications for Mortgage Industry Structure *Page 249*