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Computerized Loan Origination Systems: An Industry Case Study of the Electronic Markets Hypothesis

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Abstract

Much has been written in recent years about the changes in corporate strategies and industry structures associated with electronic coordination of market activities. This paper considers the advent of electronic market coordination in the home mortgage industry, focusing on Computerized Loan Origination (CLO) systems. Case studies of five CLOs (First Boston's Shelternet, PRC's LoanExpress, American Financial Network's Rennie Mae, Prudential's CLOS, and Citicorp's Mortgage Power Plus) reveal a range of system functionalities. Predictions from the Electronic Markets Hypothesis (EMH) are tested against the empirical results of the five case studies. As suggested by the EMH, financial intermediaries have been threatened by the introduction of CLOS, and in some cases opposition has been mounted against the systems. On the other hand, despite the availability of the technology and mortgages' seemingly favorable characteristics as an elec-

tronically mediated market product, the industry has not been fundamentally changed by the introduction of these systems, despite more than a decade of experience with them. Of the two case studies that could be characterized as electronic markets, neither continues to exist in that form today. And the system with the largest dollar volume of mortgages of the five is best characterized as an electronic hierarchy. These results suggest that either the full results predicted by the EMH require a longer gestation period or that the underlying hypothesis will require augmentation in order to fully explain the results in the home mortgage market.

Keywords: Computerized loan origination systems, electronic markets, electronic hierarchies, incomplete contracts, Shelternet, mortgages.

ISRL categories: AM02, BA0215, EL0202
GA01, HA0702, HB32

Introduction

William Bolt of Cinnaminson, N.J., knows well the anxieties of buying a new house. In three such transactions, he waited an average of six agonizing weeks for loans to be approved. It was with a certain foreboding, therefore, that Mr. Bolt faced buying another new house last August—this time before the lease on a rented house ran out. "By the time we found the home we wanted, we had to settle in two weeks," he recalls. "Everyone said it was impossible." But everyone was wrong. Mr. Bolt's mortgage banker turned to a nationwide, computerized mortgage-search service to process the Bolt loan application. The mortgage was approved just eight working days later (Lipman, 1984).

Although he may not have been aware of it at the time, Mr. Bolt had happened upon an innovation that many in the early to mid-1980s felt was destined to revolutionize the market for home mortgages. Computerized Loan Origination systems, or CLOs, were heralded as mortgage banking's savior by some and as a dire threat by others. For years, mortgage lenders had benefited from computerizing the "back end" of their operations, where records were archived,

balances were transferred, and bills were sent out. The "front end," where loans were contracted for by a home buyer and a lending officer, was dominated by face-to-face interaction, piles of paperwork, and, as Mr. Bolt experienced in his three previous outings, a lot of waiting.

CLOs promised to change that. Automation first crept into the front end of the mortgage business through the local lending officer's door. Large lenders offered their agents terminals they could use to tap into centralized databases in order to have the latest information about volatile interest rates and to transmit application information back to the corporate underwriters as an aid in the origination process, the creation and delivery of mortgage loans. These early CLOs generally offered loans from only one lender and left the task of picking that lender and traveling to his or her office to the borrower. The critical change that made CLOs the source of hope and controversy occurred when the systems went out the lender's door and set up shop at the local real estate office.

Suddenly, CLOs were much more interesting. The new systems linked the entire loan production value chain from its beginning at the point of home sale to the lenders' back offices where loans were underwritten and approved. In a 1984 *Wall Street Journal* article, the pronouncements and predictions of industry leaders about CLO-induced changes to the fundamental characteristics of the industry came fast and furious:

Financial-services networks will mushroom until real-estate agent and the banker melt into one, providing buyers with one-stop shopping. . . . The transformation has already begun. . . . These national networks will become the rule rather than the exception. . . . Once computerized mortgage searches become more widespread. . . anyone can, and will, originate mortgages (Lipman, 1984).

Against this backdrop of media excitement, the information technology (IT) literature offers a theory upon which to base predictions about the future scope and direction of this market. The theory, developed by Malone, Yates and Benjamin, and referred to as the Electronic Markets Hypothesis, suggests that the introduction of IT will, all other things being equal, generally lead

to greater use of markets rather than hierarchies for economic transactions (Malone, et al., 1987).

Predictions from the Electronic Markets Hypothesis (EMH) are tested in this paper against the empirical results of case studies of five CLOs from the United States (First Boston's Shelternet, PRC's LoanExpress, American Financial Network's Rennie Mae, Prudential's CLOS, and Citicorp's Mortgage Power Plus). As suggested by the EMH, IT has reduced the time and effort required to select and secure a mortgage, and financial intermediaries have been threatened by the introduction of CLOs, with active opposition mounted in some cases against the systems. On the other hand, despite the availability of the technology and mortgages' favorable characteristics as an electronically mediated market product, the industry has not yet been fundamentally changed by the introduction of these systems. Of the two case studies that could be characterized as true electronic markets, neither continue to exist in that form today. And the most successful system, that is, the one with the current largest dollar volume of mortgages, is best characterized as an electronic hierarchy.

These results suggest that either the results predicted by the EMH require a longer gestation period or that the underlying hypothesis will require augmentation in order to fully explain the results in the home mortgage market. Some possible barriers to the advent of full electronic markets in the home mortgage industry are suggested as possible directions for future research to explore in continuing the validation of the EMH.

This paper is organized as follows. The next section presents a very brief introduction to the mortgage banking industry, intended as background for subsequent sections. This is followed by a summary of recent research on the advent and attributes of electronic markets and hierarchies, which focuses on a list of predictions stemming from the EMH. The analysis section develops a three-level categorization of these systems and describes the experience of five CLO systems in light of the predictions of the EMH. These results are discussed in the penultimate section, which also offers suggestions for future research. Concluding remarks are presented in the final section.

Mortgage Banking Industry Background¹

During the late 1980s more than \$400 billion in home mortgages were originated each year (Miller, 1992, p. 91). Every stage in the process by which loans are made depends on the transfer of volumes of information from one party to another. While lenders have made great progress in now offering more than 200 different loan-type choices, the means by which borrowers select their loans has been slower to evolve (Lipman, 1984). Home buyers still scour local newspapers looking for the right rate and terms, and spend hours on the phone with lending officers. Figure 1 shows the relationships, activities, and participants that characterize the traditional home mortgage process.

Lender and loan selection is the first of five steps in the process of home mortgage origination.

Subsequent steps are application, prequalification, underwriting, and closing. In submitting an *application*, the potential mortgagor provides the mortgagee with information about the property in question and his or her present financial situation, including income, current housing costs, job, assets, and debts. During *underwriting*, the lender verifies the claims made on the application and determines if the applicant and the property meet the firm's approval criteria for the loan in question. *Closing* a home mortgage involves the actual transfer of the funds in question and signing of various loan documents. After a loan is closed, the chief task remaining for lenders or their agents is *servicing* the loan, which entails processing the periodic loan payments.

Savings and loan associations and savings banks have traditionally provided the largest portion of mortgage financing. In addition, while demand deposit accounts are the primary focus of *commercial bankers'* attention, mortgages are an im-

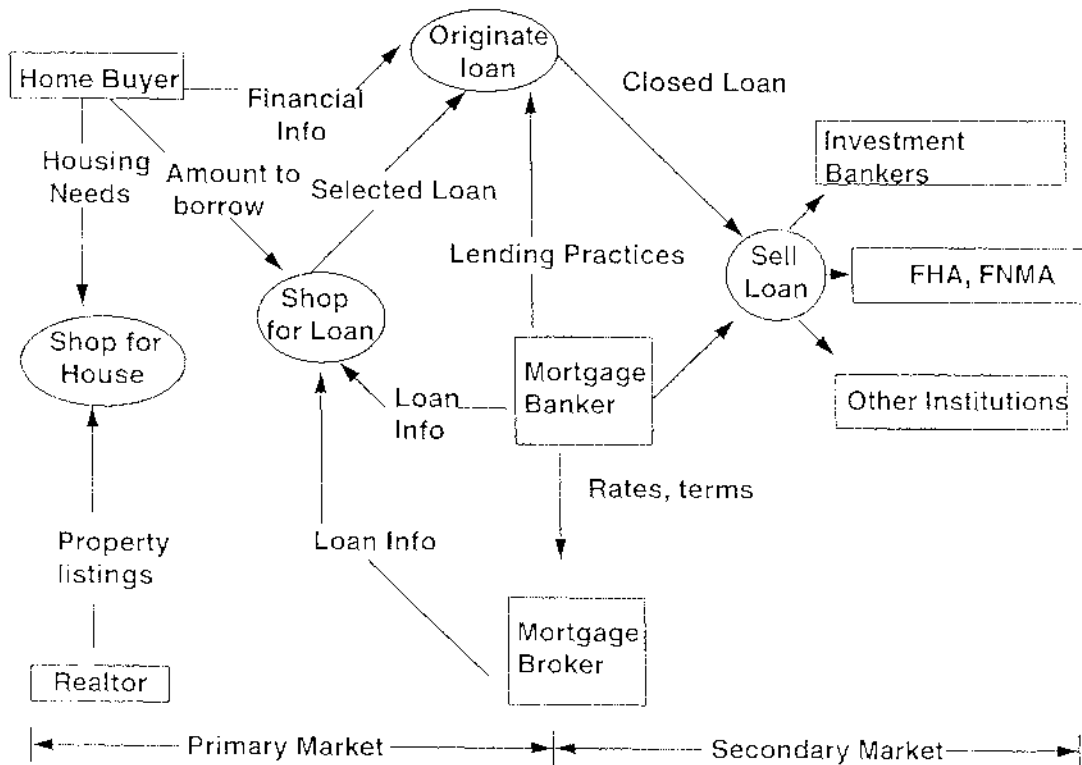


Figure 1. Traditional Mortgage Market

portant secondary activity. *Mortgage bankers* use their own funds or capital from other sources (banks, pension funds, etc.) to originate home mortgages. They often act as middle-men, seeking out borrowers who meet the desired risk profiles of the investors who provide loan capital. In these cases, it is not uncommon for the mortgage banker to retain the servicing of the loan for a fee paid by the investor (Barrett, 1992).

*Realtors*² are important to mortgage lending for a number of reasons. They act as intermediaries between home buyer and seller. They are at the "point of sale" throughout the home-buying process. Realtors' success often depends on their ability to help their clients find attractive financing quickly. One study showed that 60-70 percent of home mortgages result either directly or indirectly from realtor referrals (Lewis, 1991). In a poll conducted by the Mortgage Bankers Association, 90 percent of responding realtors said they made recommendations on financing (Anderson, 1987). Realtors and others may act as *mortgage brokers*, matching borrowers with lenders for a fee. Mortgage brokers can be a significant market participant, and it has been estimated that 45 percent of all mortgages were originated by mortgage brokers (Stark, 1992).

As shown in Figure 1, there are two markets for home mortgages. Most home buyers are familiar with what has been described above, called the *primary market*, where lenders and home buyers meet to finance the purchase of a property. There is also a *secondary market* for mortgage money, where similar loans are bundled and sold to large institutions, either to be held in a loan portfolio or perhaps to be used as the basis for mortgage-backed securities. While the primary market is generally a local one, this secondary market is nationwide. These three players, plus the smaller private firms who compete in the secondary market, provide much of the investment capital for home financing. The secondary market also sets loan standards that originators use to produce mortgages that will be readily accepted into the secondary market. Mortgages meeting such criteria are known as "conforming" loans. The secondary markets make mortgage money much more liquid: loans can be turned into cash with relative ease, the proceeds going to new loans or other applications.

Research Questions

Mortgage banking is an information intensive business, characterized by local markets and financial intermediaries. Considering the immense amounts of money moving through this market, it is not surprising that some firms have tried to capture more of it using information technology. This section presents prevailing theories of electronic market coordination and transformation on which consideration of CLOs in mortgage banking will be based.

The electronic markets hypothesis

Beginning with Malone, et al., some authors have suggested that there are higher-order benefits available to market participants who rethink and recast the nature of their organizations' activities based on the emerging capabilities of IT (Gurbaxani and Whang, 1991; Malone, et al., 1987). The basic argument is that by decreasing many of the coordination costs associated with doing business both within the firm and outside, IT will provide opportunities for cost reduction and revenue expansion that entail either changing the structure of markets or the boundaries separating the firms in those markets. Coordination costs refer to the resources expended processing information in order to select suppliers, enter into contracts, schedule deliveries, and other activities associated with doing business outside the organization. Specifically, two varieties of market transformation have been identified that are made possible by relatively recent improvements in coordination technology: electronic markets and electronic hierarchies both coordinate "the flow of materials through adjacent steps in the value-added chain" (Malone, et al., 1987, p.465). In markets, the basic forces of supply and demand determine how products and services are transferred between multiple firms and customers and in what quantities. Customers compare offerings from many vendors in order to find a good match for their specific needs with regard to product attributes, service, price, and other factors. Comparing more vendor offerings is likely to improve the match, but also adds to the consumer's search costs. In electronic markets, IT facilitates customers' comparison of purchase alternatives. Generally speaking, electronic markets can improve both the amount of information available

to customers and lower their search costs, enabling volumes and speeds that human middle-men could not feasibly accomplish.

In traditional hierarchies, there is ownership and common, centralized managerial control, and this, rather than market forces, dictates how goods and services are transferred between a purchaser and one supplier. Malone, et al. (1987) coin the term "electronic hierarchy" to include the situation where buyers are linked by computers and telecommunications technology to a predetermined source for the product or service in question. Although this arrangement forfeits the access to multiple providers that markets feature, it eliminates all the costs associated with identifying and doing business with more than one firm. For some firms and some industries, this is a worthwhile tradeoff. As customers move from one to many suppliers, the cost of coordinating business rises, and conversely, as the number of competing suppliers falls, production costs tend to rise because of the absence of price competition to encourage firms to carefully manage production costs. From this analysis, it follows that if coordination costs are decreased (by IT or some other factor) customers will naturally tend to favor markets because they will pay lower prices without paying as much in coordination costs. Malone, et al. argue that producers are, in general, motivated to support hierarchies as the coordinating scheme of choice. Producers do not like price competition with other firms, which drives down margins and requires producers to focus more of their resources on advertising and controlling production costs. Most importantly, though, Malone et al. suggest that the benefits to buyers will increasingly outweigh the benefits to suppliers, as IT drives down the costs of coordination through electronic markets. They propose an evolutionary path that industries will follow to electronic markets. Beginning with a single source electronic channel ("electronic hierarchy," e.g., the early versions of the American Hospital Supply/Baxter ASAP system) the first step is the biased electronic market, where suppliers, often the providers of the coordinating technology, use the technology to push customers toward their product or service, while providing access to other firms' offerings as well. The next step is the unbiased electronic market, where all vendors are given equal chance to win customers based on the

merits of their goods and services. A third and final evolutionary step is the personalized electronic market, which provides decision support for customers who may find that they now have more product and vendor information than they can efficiently search.

EMH predictions for mortgage banking

Prior to CLOs, the primary lending activity of mortgage banking could be described as being coordinated by a local market dominated by intermediaries. Generally, prospective home buyers chose among the loan programs of nearby lenders, perhaps with guidance from newspaper advertisements, realtors, or possibly mortgage brokers. In essence, even mortgage bankers could be considered to be intermediaries, channeling investment capital from the secondary market to borrowers. It is not surprising that electronic markets and hierarchies have become an issue in mortgage finance, as the market has been characterized by two critical imperfections. First was the geographic fragmentation of the market. Price competition was intense primarily among neighboring lenders. A particularly low rate offered by a lender in Los Angeles would pose little competitive threat to a lender in Boston. Second, the aforementioned intermediaries were able to be quite profitable, acting as middle men between the huge pools of investment capital in the secondary markets and home buyers. In some cases, two layers of intermediaries, primary lenders and brokers, took a share of the profits generated by loan originations, presumably leading to higher origination costs to borrowers than would be the case if borrowers had more direct access to the capital markets.

Are home mortgages amenable to being handled in electronic markets? In addition to coordination costs, Malone, et al. (1987) argue that lower levels of two factors, asset specificity³ and complexity of description, will favor markets in a given industry. Complexity of description is defined as the amount of information that must be transferred between buyers and sellers of a given good or service in order to describe its attributes in sufficient detail that buyers can make an informed choice between competing suppliers (Malone, et al, 1987). Malone, et al. specifically suggest stocks and bonds as examples of pro-

ducts with low complexity of description and large business computer systems as examples of high complexity of description (p. 486). Applying asset specificity to the market for home mortgages, in theory, a loan for \$100,000 can buy \$100,000 worth of home equally well in any real estate market, and this is the principle behind borrowers "prequalifying" for mortgages.⁴ In terms of the complexity of description many loans, chiefly the traditional fixed-rate, 30-year variety, are easily described such that the average home buyer using an amortization table or financial calculator can readily determine monthly payments, interest charged, and principal paid at any stage in the life of the loan. While other, more complex loans, such as ARMs indexed to volatile standards, require more information to be passed between mortgagee and mortgagor prior to closing the loan, even the descriptions of these more complex products can generally be accommodated in the commonly accepted industry terminology and therefore should not pose a barrier to electronic mediation.

In general, from the beginning of the value-added chain to the end, mortgage banking is concerned with managing only one resource: information. Fund transfers, applications, underwriting, monthly payments—all are, in essence, just transmitting or verifying information. Therefore, based on the information provided by the EMH proposal, it would appear that CLOs would provide an opportunity for an electronic market to arise. Given this, what changes does the EMH predict for the home mortgage market? *As information technology reduces the unit costs of coordination, markets will be substituted for hierarchies.* This happens because relatively lower coordination costs are a traditional source of advantage for hierarchies in environments with no or limited information technology. The benefits of electronic tools in matching buyers and suppliers is referred to as the electronic brokerage effect, and this also contributes to the trend toward electronic markets.

It suggests that coordination technology provides opportunities to lessen or alleviate the market imperfections. This could occur, for example, if lenders from across the country included their loans on CLOs. They could then compete with lenders in any locality where the CLO was available. A related effect of electronic coordina-

tion would be a significant reduction in the search effort required on the part of loan shoppers to compare a larger number of available loans.

It also follows from the general hypothesis that there will be fundamental changes in the market's structure catalyzed by electronic coordination. The hypothesis predicts that financial intermediaries, in this case mortgage brokers and mortgage bankers, are threatened by electronic coordination and should expect to be hurt or even made obsolete by electronic markets. Furthermore, the hypothesis suggests that agents who take advantage of electronic coordination will have some initial competitive edge over their counterparts who do not.

The hypothesis predicts that customers, in this case borrowers, will be driven by their desire for lower interest rates and closing costs to favor electronic markets over electronic hierarchies as forms of industry coordination. If this prediction holds true, there should be a migration away from the traditional loan selection methods mentioned above, presumably through electronic hierarchies and biased electronic markets, to CLOs providing unbiased, efficient national markets for home mortgage financing. This should occur despite producers' (lenders') wishes to establish hierarchies that secure a non-competitive distribution channel for loans. Given consumers' desires, this further suggests that *the predicted evolutionary path toward electronic markets is from electronic hierarchies to biased electronic markets to unbiased electronic markets to personalized electronic markets.*

Alternative views of electronic markets

Recently, a number of authors have suggested alternative views as to how information technology will affect market structures. In particular, they independently argue that the introduction of IT may result in fewer, rather than more, suppliers, despite the reduction in transaction costs.

The first such objection to the EMH is also rooted in the transaction cost economics literature. While IT may reduce coordination costs, increased coordination can create transaction risks, specifically, increasing one's exposure to

opportunistic behavior on the part of the other party in the cooperative arrangement. *IT can reduce these transaction risks, which, combined with the reduced costs of coordination, suggests a move toward tightly coupled, cooperative relationships.* These relationships are neither transactions in the spot market, nor are they vertical integration within the firm, and therefore, they represent a "middle" position between these two extremes. Clemons and his colleagues argue for an amended version of the EMH, which they term "the move to the middle" (Clemons and Row, 1992; Clemons, et al., 1993). Clemons, et al. further decompose transactions costs into coordination costs, opportunism risk, and operations risks (e.g., uncertainty regarding the quality of the product being supplied), and argue that the use of IT is favorable toward all three dimensions. *Their conclusion is that there will be increased coordination (outsourcing), but via a limited number of long-term suppliers.* Therefore, in this view a true electronic market, as proposed by the original EMH, would be unlikely.

A second objection to the EMH comes from an analytic model to investigate the effects on market structure of the adoption of electronic data interchange (EDI) in the case of a single buyer with multiple competing heterogeneous suppliers (Seidmann and Wang, 1993). A simple analysis of EDI might argue that since EDI reduces transaction costs, all suppliers would agree to participate in the arrangement, assuming that the costs to do so are not prohibitive. However, this is shown to be unlikely to be the case because most of the benefits tend to be captured by the buyer (with some flow-through to the end customer). More importantly, there are declining marginal returns to the suppliers with each subsequent supplier added. *This creates a situation whereby the buyer will encourage early suppliers' adoption (perhaps even providing subsidies for adoption), but where equilibrium may be reached before complete adoption by all current suppliers.* In general, the price offered to non-adopting suppliers will be lower than the price prior to the introduction of EDI, and the resulting cost differentials may result in fewer total suppliers than was originally the case, despite the fact that EDI has reduced transaction costs. Therefore, the introduction of information technology may not unambiguously move industry structures toward a greater amount of

spot market transactions because some firms may choose not to participate.

A third objection to the EMH comes from the economics literature on incomplete contracts, but was motivated by empirical observations in the U.S. and Japan that note a general movement toward fewer, rather than more, suppliers (Bakos and Brynjolfsson, 1993). In particular, Bakos and Brynjolfsson note that in buyer-supplier relationships there are likely to be a set of attributes such as quality, responsiveness, and innovation, that are "non-contractible investments" due to the difficulty in specifying their levels in advance in a contract. *The authors argue that the introduction of IT will increase the importance of these non-contractibles.* Supplying firms will only make such investments based on their ability to capture the benefits *ex post*, which depends on their relative *ex post* bargaining power. Therefore, to the degree to which such non-contractibles are important in the supply relationship, *buyers will find it in their best interests to limit the number of suppliers so as to provide the remaining suppliers with sufficient bargaining power and the resulting incentives to make non-contractible investments.* The net result is a smaller number of suppliers, all of whom have sufficient incentives to invest in those non-contractible investments that will ultimately benefit the buyer. While drawing from different economic theories, the Bakos/Brynjolfsson and Seidmann/Wang models provide complementary explanations for why the resulting equilibrium number of suppliers may be smaller after the introduction of IT.

These alternative views of electronic mediation focus on the repeated nature of the transaction. They note that information technology, while rapidly declining on a per unit basis, still represents a significant investment when employed on the scale required to transform an industry. In applying these models to the market for home mortgages, the buyer is the "retailer" providing the mortgage to the consumer/home buyer, while the suppliers are those firms with the capital to lend.⁵ Therefore, the conclusion of the alternative views is that a limited number of capital lenders (suppliers) are likely to be offered via the CLO because the incentives for both the lenders, and the retailer providing the system will be to constrain membership in the system.

Computerized Loan Origination Systems

Models of electronic mortgage markets

There are a range of design options for electronic coordination of this market. In an "electronic market" for home mortgages, prospective borrowers would be able to use computer technology to search through and compare various loan programs from a wide variety of lenders. In an "electronic hierarchy," these same borrowers could compare all of the loan programs of one lender. Under both schemes, subsequent steps (application, prequalification, and underwriting) in the origination process could be automated as well, saving time for the borrower and lender alike. The user hardware in both cases could be found in a realtor's office, a mortgage broker's office, or in the office of a lender.

Figure 1 presented a view of the traditional mortgage origination process. In order to provide a framework in which to describe the existing CLOs, three new market diagrams that are alternatives to the traditional model are presented in this section. Each represents a step along a continuum, away from hierarchies, middlemen, and localized markets, and toward efficient competition in an electronic market. It is important to understand that these market prototypes are neither discrete nor exclusive possibilities, but rather signposts along a possible evolution. It is clearly possible that some CLOs will exhibit characteristics of more than one model.

CLO1: The Loan Listing Service

In the CLO1 model, only the lender/loan selection process is automated by the CLO system. Application, prequalification, underwriting, and closing all occur just as they did under the traditional scheme: through the time-consuming, personnel-intensive transfer of many paper documents. Figure 2 diagrams the CLO1 process and shows a CLO-equipped realtor brokering the loan. While a traditional mortgage broker could subscribe to a CLO and broker loans via that channel, there are several reasons why Figure 2 shows a realtor performing this function. The first reason is the simplest: most CLOs have thus

far been targeted at realtors. System operators and lenders favor this approach because it moves the CLO as a marketing mechanism to the point of sale of the home purchase that initiates the need to borrow in the first place. This, in theory, gives the CLO an advantage over traditional marketing channels like brokers and newspaper advertisements, because it gets to the prospective buyer first.

A more important reason for diagramming the CLO1 process this way is that it shows that even at this initial step toward an electronic market an intermediary entity's business is hurt or made obsolete. If home buyers can compare many loans from many lenders in their realtor's office, it is less likely that they will expend the money and effort to visit a mortgage broker's office to do exactly the same thing, unless the broker provides some other incentive. A CLO1 speeds up only lender selection and therefore does not offer a significant time savings over the traditional scheme from beginning the mortgage search until closing a loan. The major benefit to consumers is the increased amount of more readily available information, which presumably leads to an ability to choose a less expensive loan.

There are two key benefits to participating lenders. As mentioned above, the marketing of their loan programs now occurs at the point of sale, conveying a competitive advantage over non-participants. Also, CLO1 offers lenders the chance to market their programs more widely without incurring bricks-and-mortar expense for new loan offices. Apart from a shift in their marketing focus, CLO1 does not significantly change the activities of the participating lenders. Once a prospective borrower selects a lender, the process is basically the same as the traditional model.

CLO2: The Application Processor

In the CLO2 model, as shown in Figure 3, much more of the origination process is automated, and information flows both ways between borrower and lender across the CLO. After the prospective borrower selects a lender and loan, he or she then uses the CLO to transmit an application back to the lender. Document requests, necessary to verify the information provided on the application, are also carried over the network.

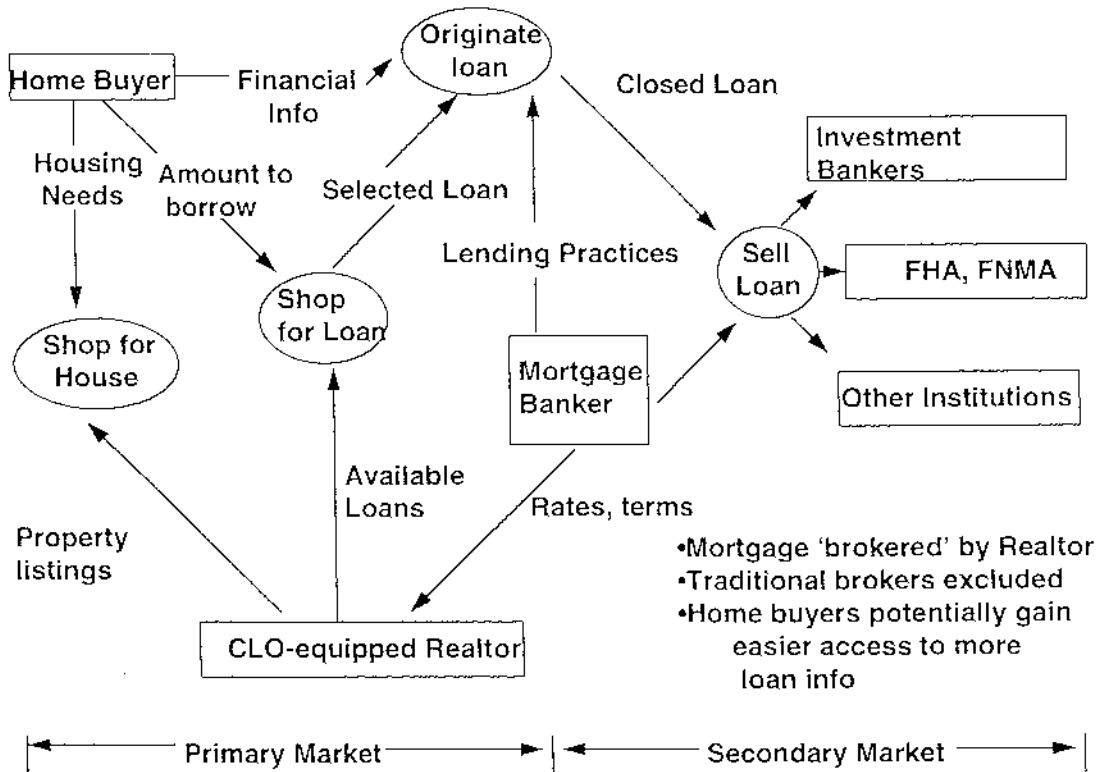


Figure 2. CLO1: Loan Listing Service

Under the CLO2 model, some lenders may pre-qualify borrowers, issuing a legally binding commitment to loan money at a particular rate and under certain terms, provided that the information in the application and the property in question are verified. This prequalification can be a powerful bidding tool for home buyers, serving as proof that their offer on a home is backed by proven borrowing power. Another benefit to mortgagors using CLO2 is that processing time is decreased significantly in comparison to the traditional process.

CLO2 includes the features and implications of CLO1, plus several others. Much of the work associated with originating loans, including taking applications and processing document requests, moves from the lender to the realtor. In exchange for taking on this added responsibility, the realtor receives some portion of the origination fees assessed by the lender to the bor-

rower. An additional bonus to the borrower is that he or she can now make status requests over the CLO. Because the system tracks loan status, the reply can be generated automatically, decreasing labor effort for the lender and providing a quicker response to the borrower. It is also more convenient for the borrower to have the realtor acting as a clearing house for information about the status of both purchase bids and loan requests. Lenders benefit because they can originate mortgages faster and more economically. Much of the approval process is automated by including decision logic in the system. Credit checks are conducted via electronic ties to credit service bureaus. Although the final decision to approve or reject a loan application remains in the hands of a human underwriter, the CLO2 system allows the human participants in the process to spend less time coordinating information, freeing them to spend more time on individual loans or processing a higher volume of applications.

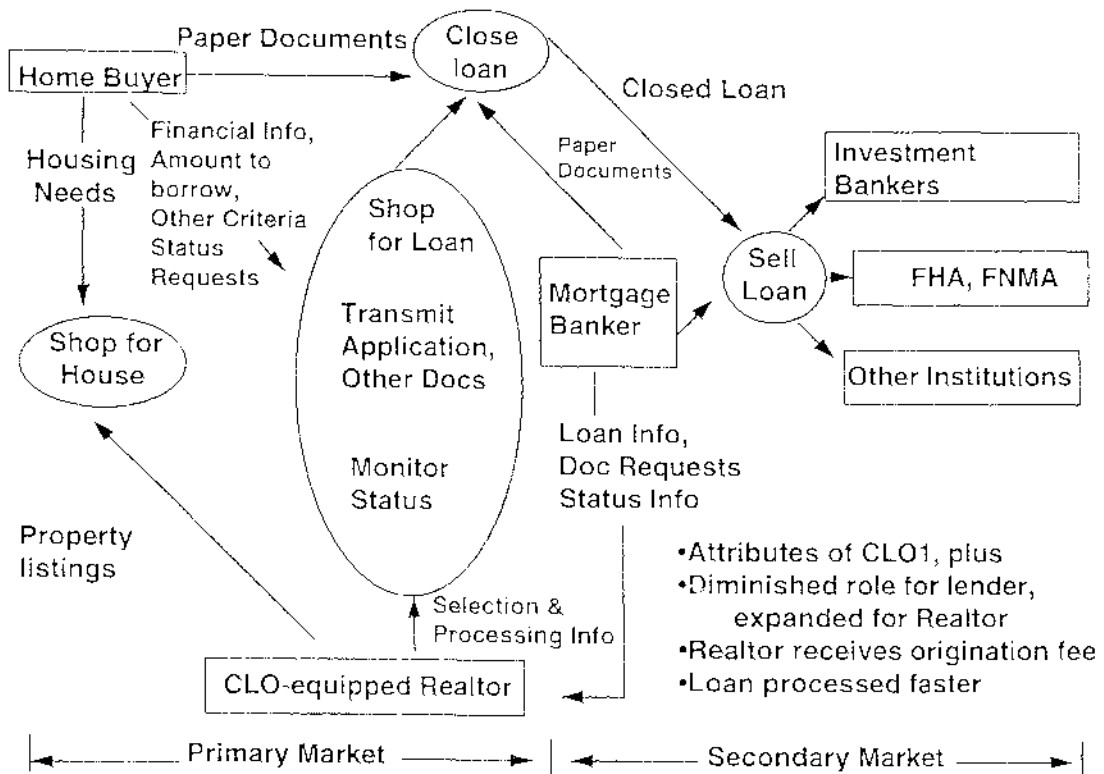


Figure 3. CLO2: Application Processor

CLO3: The Transformed Market

CLO3 represents the ultimate realization of the general electronic market model as applied to home mortgages. The CLO links the realtor's office directly to investment capital available in the secondary market. The realtor performs the entire origination, closing the loan using a credit line made available through the CLO operator. The CLO system, in turn, bundles loans for sale into the secondary market. As shown in Figure 4, both intermediary entities from the traditional model—mortgage brokers and mortgage bankers—are excluded.

As in CLO2, the realtor, now the realtor/lender, is the conduit for information about both the loan and the home purchase. This model offers faster and cheaper loan processing because more of the process is automated, and there are fewer middle-men handling information.

Case studies of CLOs

This section presents an account of the experiences of five leading CLO systems, based primarily on secondary sources.⁶ The five systems are presented in the order in which they were introduced:

- First Boston's Shelternet
- PRC Advanced Systems Inc.'s LoanExpress
- Rennie Mae, developed by the realtors' trade association
- Prudential's CLOS
- Citicorp's Mortgage Power Plus

While there may have been other such systems over the past decade (most of them quite local in scope⁷) these five are believed to represent the most significant initiatives in the decade prior to the amendment of the Real Estate Settlement Procedures Act of 1974 (RESPA) effective in December of 1992.⁸ These "first generation" systems form the basis for the analysis of the

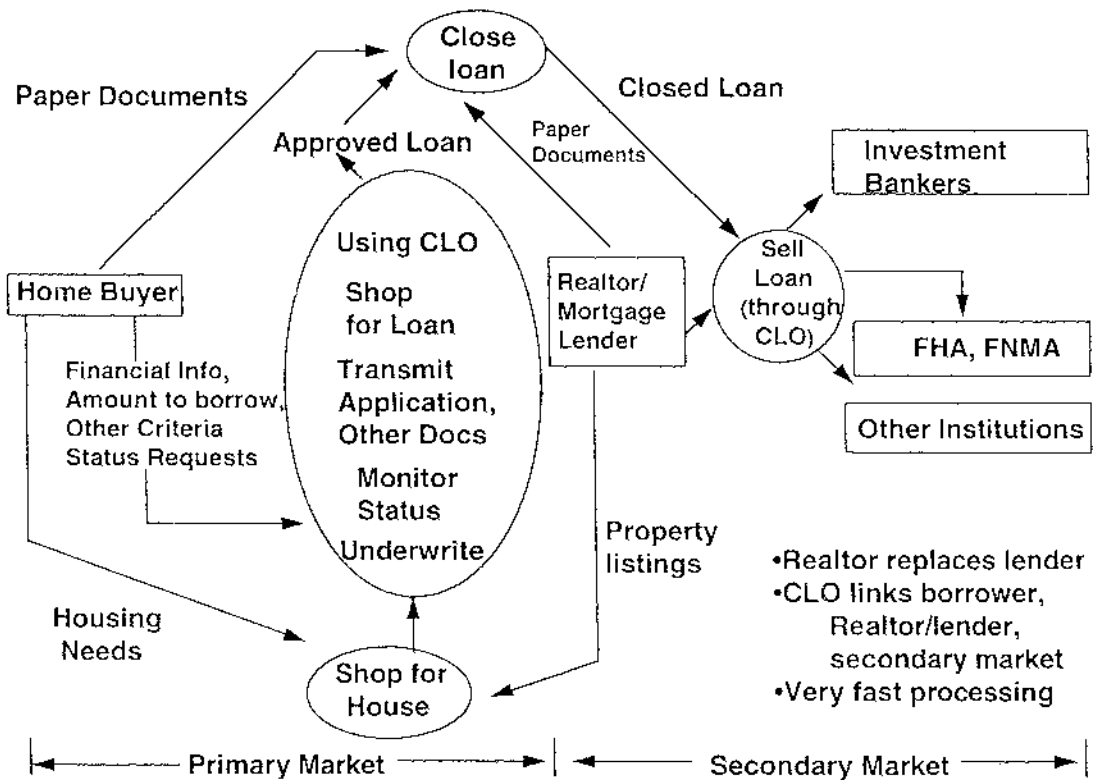


Figure 4. CLO3: Transformed Market

EMH. Table 1 summarizes the basic data about these five systems.

Shelternet (First Boston Capital Group)

Shelternet was developed to be a nationwide automated network offering home buyers access to mortgage financing from a wide variety of originators from across the country. At its peak in 1985, Shelternet processed approximately \$1 billion worth of home mortgages, from 125 originators to borrowers in 44 states, using 140 realtors' offices as the points of contact (Economist, 1986; Runde, 1986). In addition to having the greatest geographical scope, Shelternet was one of the few CLO systems that took borrowers through all five steps of the mortgage process: lender/loan selection, application, prequalification, underwriting, and origination. Shelternet received considerable positive publicity in the literature on strategic information systems (Wiseman, 1985). Only more recently

has there been any follow-up study (Kemerer and Sosa, 1991).

Shelternet used as input a borrower's financial data, the cost of his or her intended home purchase, estimations of homeowner's insurance premiums and property taxes, and the amount of money the borrower had available for a down payment and closing costs. The system applied this information to various loan programs and could immediately generate monthly payments, amortization schedules, closing costs, private mortgage insurance premiums, and even the tax implications to the borrower. Within an hour of taking an application for a selected loan, the system could prequalify the borrower, issuing a loan guarantee good for 60 days. The system then automatically generated and mailed processing documents, such as appraisal requests and salary verification forms, to the underwriter. Loan processing took 15 to 20 days, during which time Verex Corporation, a private mortgage in-

Table 1. Basic Data of Cases

	First Boston's Shelternet	PRC's LoanExpress	AFN's Rennie Mae	Prudential's CLOS	Citicorp's Mortgage Power Plus
Year Started	1981	1983	1985	1988	1989
Approx. Peak Loan Volume	\$1 Billion/year	\$250 Million/year	\$1 Billion/year	\$120 Million/year	\$9 Billion/year
Parent Firm	Investment Bank	System Provider	System Provider	Insurer/Real Estate	Commercial Bank
Peak # of Lenders	125	40	100	Approx. 5 per geog. market.	1

sure under contract with Shelternet, would assess the loan and either approve or reject it for insurance. If the loan closed and was approved for insurance, Shelternet would then buy it from the originator and sell it to an investor. Shelternet typically owned each loan for approximately 15 days.

Shelternet was developed by Andreas Kissal in the late 1970s, while he was working for the mortgage finance subsidiary of a construction company (LaGessee, 1984a). First Boston, the investment banking firm, purchased the system from Kissal in 1981 and subsequently invested roughly \$10 million. First Boston developed the project in secret, presumably to gain competitive advantage and to defer the negative reaction from mortgage bankers who were customers of other First Boston products or services. As late as a year prior to roll-out, First Boston representatives denied the project's existence (Guenther, 1983). The system was rolled out nationally in April of 1983 (Brownstein and Lore, 1984).

Most sources agree that Shelternet was originally marketed to realtors as a conduit to connect them (and their clients) directly to the capital markets, bypassing mortgage lenders in the process (LaGessee, 1984b). Kissal, hired by First Boston to run the network, publicly disputed that the system was designed to exclude traditional mortgage lenders from the loop. What is certain is that First Boston met with enormous resistance from the mortgage banking community, which initiated a boycott of First Boston and Verex's services (Basch, 1985). The roll-out also raised regulatory

issues, regarding the legality of realtors accepting fees for loan originations.

Either to ameliorate the mortgage bankers' concerns or simply to provide more primary mortgage funds for the network, First Boston quickly tempered its revolutionary stance, focusing on providing service to the traditional mortgage lenders and selling the software to other network managers. By 1986, private-label versions of the system were in operation in the realty offices of Coldwell Banker, Century 21, Better Homes and Gardens, Finance Partners and Realty World, who together accounted for 30 percent of the residential market (Nelson, 1986). Shelternet proper originated \$800 million in home mortgages in 1984, \$1 billion in 1985, but only \$650 million in 1986. By 1987, the system's origination rate had dropped 50 percent since the peak, and First Boston cut the Shelternet work force by 20 percent (NMN, 1987). By the end of 1988, the system had been repositioned to deal solely with the secondary market, acting as a conduit between originators and investment banks wishing to sell mortgages to their clients (Miller, 1989; Petramala, 1988).

Shelternet was the first CLO to receive much national attention and was therefore the impetus for many other systems and much of the controversy surrounding CLOs in the 1980s. As originally conceived, Shelternet came as close to a CLO3 system as any has since. First Boston, an investment bank, seemingly intended to build a direct pipeline between its vast pools of investment capital and home buyers, bypassing mortgage

lenders and mortgage brokers in the process (Guenther, 1983). This may account for the high level of secrecy surrounding the project in its early stages, as First Boston may have hoped to defer the negative reaction of traditional mortgage lenders, many of whom were customers of other First Boston services. The mortgage lenders' eventual boycott is just one indication of how serious a threat Shelternet was perceived to be. First Boston had threatened the home mortgage industry with drastic change, and the industry resisted: the middle-men wanted to preserve their positions, the realtors were reluctant to take on additional work to learn and run the system, and the home-buying public did not show a sufficient preference for shopping for mortgages electronically. Shelternet's first repositioning brought the system closer to the CLO2 model: facilitating lender and loan selection and application processing, but keeping traditional mortgage lenders in the loop.

In terms of the EMH, there were aspects of a personalized electronic market evident in Shelternet from the beginning: given a prospective borrower's financial data, the system could generate a list of loans that the user might be interested in and qualify for. However, because Shelternet originally carried only First Boston mortgages, "personalized electronic hierarchy" might be a more accurate descriptor. The system's first repositioning, which expanded the loan programs offered to include other lenders, is very much in keeping with the tenets of the EMH: there was indeed a powerful impetus to move from hierarchy to market. But, it seems to have primarily occurred as a result of pressure applied by competing suppliers who saw their business threatened.

The EMH makes no provisions for looking at the failure or devolution of electronic markets, and as such offers little guidance for assessing the second and final repositioning of Shelternet to a wholesale system dealing solely with customers in the secondary market. However, three case-specific factors seem worth noting. First, Shelternet was expensive to join and use relative to the low or non-existent costs realtors paid to refer clients to local lenders, and as such may not have commanded as much interest on the part of realtors as it might have at a lower price point.⁹ Second, it is important to remember that

mortgage banking is not First Boston's primary business, so that when investment banking profits fell in the late 1980s, the primary mortgage lending operation was one of the first activities to be cut back. Third, First Boston was acquired during this period by Credit Suisse. Shelternet's final repositioning may have been to a large extent the result of a new corporate-level conception of the business unit's function. For these or perhaps other reasons Shelternet represents a failed attempt to establish an electric market for home mortgages.

LoanExpress (PRC Advanced Systems, Inc.)

PRC Advanced Systems, Inc. (PRC) was a successful large vendor of Multiple Listing Services (MLS) to local realty boards. LoanExpress, PRC's mortgage network, was originally developed as a support service for the first four steps of the home financing process: lender/loan selection, application, prequalification, and underwriting. The system was introduced in September of 1983 and by the end of 1984 carried information about 350 loan programs from 40 lenders into more than 2,000 realtors' offices (Mariano, 1984). There, home buyers used the system to select a loan and then had to visit the local LoanExpress office to fill out an application and other processing documents. The system expanded from the Washington D.C./Northern Virginia market into Tacoma, Phoenix, and Memphis.

LoanExpress was developed in-house and ran on the same terminals that PRC had already installed in 12,000 realty offices to run their MLS system. The system was well-received initially partly because for MLS users, there was no cost associated with hardware. Realtors paid \$20/month and borrowers paid \$150/application. Participating lenders paid \$450/month to be listed plus 1 percent of the value (i.e., 1 point) of any loans originated over the system. Borrowers liked the system primarily for the wide range of loans it could access quickly. An interesting, though minor, change in the system came when PRC decided to list loans by lender name rather than anonymously as it had originally. The rationale behind this change was that it would encourage local lenders to participate if they felt that name recognition would give them a marketing advantage over other lenders without a local presence (Naylor, 1985). In September of 1985, PRC an-

nounced a major strategic shift for LoanExpress. Mortgage origination activities were completely abandoned, leaving the network as an automated rate listing service. PRC spokespeople described origination as being outside of their firm's core competence. The refocused network continued to expand into new markets, but positioned as a customer-service enhancement for realtors, as opposed to an origination tool.

In terms of the EMH, PRC's LoanExpress began life as a CLO2 system, supporting loan selection, prequalification, application, and underwriting.¹⁰ LoanExpress carried primarily local loans, so that it effectively automated the existing local markets in which it operated, rather than provided a communication backbone for a national market. PRC's decision to change from listing loans anonymously to listing them by name appears inconsistent with the EMH prediction that markets will evolve from biased to unbiased forums, since the anonymous listings exhibited somewhat less "tilt" than the lender-named listings. On the other hand, despite the widespread perception of mortgages as a commodity, perhaps consumers do place a value on certain "brand name" lending institutions. In this view the lender name may be seen as part of the product description.

After just two years of operation, PRC announced a drastic change in LoanExpress' positioning. All origination activities were dropped, moving the system from being a CLO2 to a new orientation as a CLO1. Under its new definition, LoanExpress became basically just a multiple listing service, which was PRC's business prior to the system's debut. Like Shelternet, this again reflects a failure of an attempt to establish an electronic market.

Realtors National Mortgage Access System (American Financial Network)

The Realtors National Mortgage Access System, nicknamed "Rennie Mae," was developed by the National Association of Realtors (NAR), the U.S.'s largest trade organization, for use by member brokers. As originally conceived, Rennie Mae was to be a non-profit service that would automate the first two stages of the home mortgage process—lender/loan selection and application. The system also allowed loan applicants to track the progress of their applications. Unlike

Shelternet and systems like it, Rennie Mae initially left the processing, underwriting, origination, and securitization tasks to traditional mortgage lenders. Although intended for use by NAR members across the U.S., after three years of operation only a few states had many subscribing realtors. However, despite this limited geographical presence, Rennie Mae processed \$182 million in home mortgages in 1987 (Roosevelt, 1988b). By 1990, the system had expanded to more than 100 lenders, 2,000 loan programs, and over \$1 billion in loan volume (Finkelstein, 1991).

In its initial configuration, Rennie Mae was essentially analogous to the Multiple Listing Service that many local realty boards use. It allowed borrowers to compare rate and fee information, sorting loan programs by type, rate, loan-to-value ratio, or other criteria. Once a loan was selected, an application could be transmitted using a standard form. The system sent Federal Express an electronic order to pick up the original signed documents and deliver them to the lender. From then on, the loan was a matter between the lender and borrower.

NAR developed the system in cooperation with Solomon Brothers at a cost of approximately \$3 million (Guenther, 1986). Rennie Mae was first tested in San Diego, with 40 realtors and 25 lenders participating. The response was favorable, and a limited national roll-out into five or six key markets was planned. The fees associated with Rennie Mae were initially quite modest, in keeping with the system's positioning as a "public utility" focused primarily on supporting NAR members. Shortly after the San Diego pilot, in late 1985, NAR signed an exclusive licensing agreement with American Financial Network (AFN), a Dallas-based firm, to market and manage the system. The licensing arrangement represented a major shift of focus for Rennie Mae, from non-profit to for-profit and from listing service to origination system. A complex, unorthodox fee structure was adopted to insure profitability for AFN and circumnavigate regulations regarding origination fees collected by agents not approved by federal licensing boards. Lenders agreed to take 70 basis points (.7%) off their origination fees, which would instead be paid to AFN, which in turn would distribute up to 50 basis points to the originating realtor. So,

on a loan of \$100,000 originated through Rennie Mae, AFN would get \$700, \$500 of which it would pay the realtor.

A unique aspect of Rennie Mae was its repositioning from non-profit to for-profit and from listing service to full-blown origination system at a time when other CLO systems were retreating from origination activities. Rennie Mae's strategic shift came at a time when other networks, such as PRC's LoanExpress and Shelternet, were backing away from direct participation in the origination process. AFN felt that Rennie Mae would be less susceptible to resistance from the traditional mortgage lending community because the parent company, unlike, for example, Shelternet's sponsor, First Boston, was not in the business of originating loans. Initially, Rennie Mae was slightly less than a full CLO2. It facilitated loan selection and transmitted applications, but went no farther into the origination process. Perhaps seeing Shelternet's chilly reception deterred NAR from initially choosing a more aggressive posture.

As the system that appears closest to offering something akin to an electronic market, it is interesting to note that Rennie Mae was developed by the realtors association, a financial intermediary. It seems clear from the pricing of the system that it was not initially intended to make money solely through loan originations (Bender, 1985).¹¹ The NAR's adoption also makes sense in the context of their goal of selling properties. Providing ready access to financing is a key way that realtors can encourage the sale of more properties, thereby generating more sales commission revenue. Via Rennie Mae, realtors can be seen as trying to usurp the role of the mortgage intermediary in order to promote their core business.

Computerized Loan Origination System (Prudential Real Estate Affiliates)

In 1987, the Prudential Insurance Company (Pru) announced it was going into the real estate franchise business and that by 1993 it would sell 3,000 franchises, placing it between Century 21 and Coldwell Banker in number of member offices (Sichelman, 1987). One component of Pru's franchise strategy was a comprehensive computerized broker support system that franchisees would be required to install and use. One of its subsystems was CLOS, an electronic mortgage

network that gave the prospective home buyer access to loan programs from different lenders. CLOS supported the first three steps of the home financing process: lender/loan selection, application, and prequalification. In January of 1988, Prudential Real Estate Affiliates (PREA) had 180 members, and CLOS went into operation, carrying six national lenders (Roosevelt, 1988a). By 1992, PREA had installed CLOS in 700 local realty offices and had expanded the lenders carried to include regional players, so that in any given office a home buyer might have access to loan programs offered by three to five lenders (Thompson, 1992). It currently offers just two national lenders, Prudential and Countrywide Funding (Quinn, 1993).

CLOS's loan selection function allowed borrowers to enter selection criteria such as a preference for an adjustable rate mortgage, for the lowest closing costs, or for the lowest monthly payments. The system would then display anonymously the loans that best matched the specific criteria. Once a loan program was selected, the borrower could then transmit an application electronically. Approval came in two to four days and closing in 20. Many loan documents were not transmitted electronically. Underwriting and closing documents were handled by the selected lender. PREA spent \$3.5 million developing the system. CLOS is perhaps a prototypical example of the CLO2 model, implemented with a small number of participating lenders by a non-lender firm. CLOS is unique among electronic mortgage networks in that it was developed as a tool to help its parent get into the real estate business, rather than the mortgage lending or brokering business. Pru was a latecomer to the franchise market, and as such, can be seen as needing a product or service like CLOS to lure top franchisees into its stable. The network was included in the franchise purchase price, which was "in the low \$20Ks." (Sichelman, 1987). There were no transaction or monthly fees to the realtors. Lenders paid PREA \$450 for each application transmitted, and PREA forwarded \$100 of that to the originating franchisee, thereby attracting negative attention from the same mortgage bankers, regulators, and citizen's groups that had been criticizing CLOs since 1981 (especially Citicorp, see below). PREA obtained a letter from HUD stating that their fee structure was not in violation of RESPA, but the system

remained controversial. The Pru system contrasts with the earlier systems in that it seems to have changed little, except for scale, since its inception.

In terms of the EMH, like some of the others, the CLOS system offered some features associated with a personalized electronic market. Borrowers could use the system to screen loans based on their personal selection criteria. The system's designers were committed to providing an unbiased market and to that end built CLOS as a vendor-blind system, where loans were displayed anonymously until one was selected. However, the small number of loan suppliers offered is most consistent with alternative theories that argue that successful electronic markets will inherently offer a limited number of suppliers, in order to maintain the appropriate levels of incentives.

Mortgage Power Plus (Citicorp Mortgage)

Among the five CLOs examined, the newest, Mortgage Power Plus, is also the most biased toward one particular lender: Citicorp Mortgage, the only lender carried on the system. By 1990, it was also the fastest, returning a legally binding loan agreement to the realtors' offices in 15 minutes and closing many loans in three days (Lewis, 1991). Citicorp Mortgage's Mortgage Power program, minus the "Plus," was started in 1981 as an automated system to originate low documentation jumbo loans¹² at an accelerated pace to back the Citicorp parent's private mortgage-backed securities. By 1989, Mortgage Power had 4,000 member realtors in 37 states who processed approximately 75 percent of Citicorp's \$11.9 billion home mortgage business. Loan closing took from 12 to 15 days (Miller, 1989). In 1989, Citicorp initiated a pilot program called Mortgage Power Plus, designed to shorten the time required to close loans even further. The idea behind the enhanced functionality was an electronic linkage between the Mort Power mainframe and credit verification firms. Immediately upon receiving an electronically transmitted application, the system automatically pulled the applicant's credit history from several sources. If the credit and financial information were verified and met the loan requirements, the system sent a binding loan guarantee, conditional on further verification of all information provided. Three days later, the loan was closed through the mail.

The 30-40 percent of applications that were not immediately guaranteed by the system's approval routine were passed to human analysts for further scrutiny. After the pilot, Mortgage Power Plus became available in Pennsylvania, Massachusetts, and Florida.

Mortgage Power and the enhanced Plus system may be the CLO that has provoked the most opposition from industry players and regulators. Perhaps because the network was (a) very successful and (b) limited to loans offered by the parent, citizen's groups and other lenders labeled it "anti-competitive," and accused Citicorp of price-gouging, especially on loans for lower income buyers (BNA, 1990). Mortgage Power also became the focal point for the regulatory dispute over brokers receiving fees for selling properties and directing buyers to loans, a problem of dual agency, meaning that they represented two parties with conflicting goals. In the press, one group, Citizen's Action, called Mortgage Power "an elaborate kickback scheme." Citicorp withdrew from the Mortgage Bankers Association, apparently over the CLO dispute. Despite the external resistance, Mortgage Power was very successful, originating more loans than any other network. In 1991, Citicorp underwent a massive restructuring, and Citicorp Mortgage was dissolved. Home financing came under the aegis of the regional Citicorp consumer banking operations. Citicorp publicly announced that the network would not be abandoned in the changeover (Sichelman, 1991).

Mortgage Power Plus (MPP) is unique among the CLO systems examined in this paper because it was conceived as and remained an electronic hierarchy rather than an electronic market, carrying only Citicorp loans. Because it was created to produce loans primarily to provide raw material for Citicorp's mortgage-backed securities, MPP is essentially a hierarchical version of the CLO3 model, providing almost direct access to the capital markets and excluding other lenders from the loop. Because it was perceived to be so completely anti-competitive, MPP met with strong opposition from government regulators, citizens groups, and competing lenders. However, one group that did not seem to offer much resistance was the borrowing public, who made MPP the most successful CLO in existence. This is interesting since from the EMH it would be ex-

pected that borrowers would avoid a biased system. Under the current scenario it is hard to imagine that Citicorp would ever seriously consider moving to an electronic market by including other lenders on the system, following the prediction of the general hypothesis, unless drastic changes in the system's performance or the regulatory climate took place.

Discussion

Analysis of results

Given these case studies in computerized loan origination systems, what can be said about the applicability of the EMH? Table 2 summarizes the history of five case studies.

In all five cases information technology reduced the time and effort required on the part of prospective borrowers to select and secure a loan, as required by the EMH. In terms of reducing market imperfections, there is some evidence for this to the degree that consumers who use such systems compare more alternatives than they would have without such systems. However, despite the estimated 30 percent of the market's sales force having access to CLOs, as recently

as 1991 computerized originations represented "only a tiny portion" of all originations, and therefore no strong effect can be said to have been observed (Lewis, 1991). There is, however strong positive evidence for the prediction that the electronic market will be a potent threat to intermediaries, most clearly in the cases of Shelternet and Mortgage Power Plus. Interestingly, none of the five systems was developed by a mortgage broker. This is somewhat surprising since (a) they are most obviously threatened by the CLO development, and (b) this group's current primary expertise is searching through the existing market of mortgage offerings and it might therefore be expected that at least one group of brokers would have elected to offer such a system as a way to avoid being squeezed out of the process. Instead, what has happened is either forward integration (realtors have offered a CLO to their home-buying clients) or backward integration (the mortgage lenders themselves have offered systems).

The EMH's prediction that customer needs would be a key factor driving the evolution toward electronic markets appears inconsistent with the fact that the system with the current largest dollar volume is an electronic hierarchy, because it

Table 2. History of Cases

	First Boston's Shelternet	PRC's LoanExpress	AFN's Rennie Mae	Prudential's CLOS	Citicorp's Mortgage Power Plus
System Type	Began as near-CLO3, devolved to CLO2, then secondary market only	Began as CLO2, devolved to CLO1	CLO2	CLO2	Electronic hierarchy
Strategic History	Originally designed to circumnavigate other lenders, who boycotted parent firm in response. Repositioned to include other lenders. Abandoned originations in 1986, focusing on wholesaling in secondary market.	PRC tried to leverage experience with Multiple Listing Service terminals. Began as comprehensive origination tool. After two years, refocused as simple interest rate listing service.	Developed by National Association of Realtors as a non-profit loan listing service to members. Sold to AFN after pilot program, shifted to comprehensive for-profit origination network.	Developed to attract franchisees to the newly formed Pru Real Estate Subsidiary. Supports first three stages of origination process.	Conceived of and operated as a one lender system, facilitating complete origination process for Citicorp loans. Met with much regulatory and citizen's group resistance, but successful nonetheless.

might be argued that this hierarchy actually promotes and enables higher prices whereas an electronic market enables consumers to have ready access to the prices of many vendors (Bakos, 1991). And neither of the most aggressive systems that ventured into the realm of CLO3s—the form closest to a pure electronic market—continues to exist in that form. However, it should be pointed out that in none of the five cases did a market evolve into a hierarchy. When change occurred, it was in the other direction, as per the EMH.

In contrast to the mixed support for the EMH, the alternative versions of the effects of electronic mediation on market structure *do* seem largely consistent with the history of the CLO market. These approaches suggest that a large-scale (in terms of number of suppliers) electronic market for mortgages would not emerge, as has been the case despite more than 10 years of experience with this concept. The alternative theories' emphasis on the need for a limited number of suppliers to maintain incentives is quite consistent with the retreat of ShelterNet and LoanExpress and the recent experience of CLOS and Mortgage Power Plus. However, it is less clear how these alternative views explain the large size of Rennie Mae.

The Bakos and Byrnfjolfsson (1993) description of the role of non-contractible investments is a possible explanation for the failure of a full electronic market to develop in the home mortgage market, especially if this market is compared with the much more successful advent of an electronic market in the secondary market. Mortgage suppliers need to make considerable investments in gathering and analyzing borrower data, such as sources of income, assets and liabilities, previous credit history, preferences in loan terms, etc. In addition, they need to make similar types of investments in gathering information about the property, i.e., conducting an assessment.¹³ To the extent that there are many suppliers competing to provide the mortgage, the incentives for any one supplier to make these investments is reduced. The EMH is much more consistent with events in the secondary market (witness ShelterNet's transformation) where these investments need not be made, because loans are simply categorized as "conforming" and are then bought and sold as commodities. Therefore, the

original EMH may prove to be a much more powerful explanatory model in the secondary market than in the primary market. Table 3 provides a summary of these results.

Why doesn't the EMH predict well for CLOs?

As Table 3 summarizes, the EMH has limited utility in explaining the CLO phenomenon. In order to better understand the forces at work in the CLO electronic market, it seems useful to contrast it with the situation where the EMH has been of greater descriptive accuracy. Malone, et al. make clear reference to the well-known history of the airline reservation systems, and these systems provide the prime example of the evolution from biased to unbiased to personalized markets. How might the market for home mortgages be contrasted with this more successful example?

At the level of the market, airline tickets are sold through a relatively simple transaction, often directly to the end consumer from the supplier (the airline), or, at most, through one additional layer, the travel agent, who is compensated by the supplier for his or her services. The transaction therefore appears costless to the end consumer. The dominant systems (e.g., SABRE, APOLLO) were developed by the supplier and represented an additional source of revenue. The market for airline tickets was already national in scope, by definition of the travel business, even prior to the electronic systems. The product is relatively simple, is purchased with relative frequency, and typically does not represent a significant fraction of a consumer's disposable income.

In contrast, purchase of a home mortgage represents a relatively complex transaction because, in part, the purchase of a home mortgage is often one half of a composite transaction, and the other half is the purchase of a home. This separate but related transaction is typically conducted through the aid of another third party, the realtor. Other intermediaries also play important roles, as diagrammed in Figure 1, and the mortgage transaction is only the "front end" (the primary market) for the entire economic process, which includes the sale of the mortgage in the secondary market. Some systems were developed by parties other than the mortgage supplier,

Table 3. Summary of EMH Results

Major Proposal	Results to Date (1981-1993)
Use of information technology will result in the development of electronic markets for home mortgages.	Limited, with even some contradictory evidence of the two case studies that could reasonably be characterized as true electronic markets, neither continues to exist in that form today.
Use of information technology will result in fundamental changes in market structure; financial intermediaries will be threatened.	While no fundamental changes in market structure are apparent, financial intermediaries, in the form of mortgage brokers and mortgage bankers, have felt threatened.
Customers will drive the movement toward electronic markets over electronic hierarchies.	No support. The most successful system (the one with the current largest dollar volume of mortgages) is best characterized as an electronic hierarchy.
Markets will evolve from electronic hierarchies to biased electronic markets to unbiased electronic markets to personalized electronic markets.	No support.

such as realtors, who were initially prohibited from charging a fee for the system. The primary market for mortgages was local in scope prior to the introduction of electronic systems. Finally, the product is complex, is purchased infrequently,¹⁴ and represents a significant financial commitment.

How might these factors affect the advent of electronic markets? The mortgage product itself may be relatively hard for suppliers to differentiate. Given the structure of the two markets for mortgages, the presence of the large and well-organized secondary market may end up exerting a considerable amount of discipline on the primary market. While at one level this might appear to work in favor of the creation of electronic markets, further analysis may suggest otherwise. If it is difficult to differentiate the product on a dimension like "unique features," then competition will tend to settle around price. Naturally, sellers find it in their best interest to resist such trends. And, in the mortgage industry, the existing financial intermediaries may have been relatively successful in resisting a change to a more open market structure, owing to their pro-

portionately large and well-organized market power relative to that of the consumer. Bakos (1991) argues that electronic marketplaces usually favor the buyers by lowering buyers' search costs, thus reducing the market power and profit of the sellers. Sellers will be reluctant to develop such systems, and in markets such as consumer markets, where the sellers are highly concentrated relative to the buyers, they may be able to slow or even halt their development.

The aspect of market power seems to fit well with the home mortgage cases. Much of the evolution toward electronic markets appears to depend upon the end consumer, who ultimately will be the primary beneficiary, exerting sufficient pressure to provoke the evolution. In home mortgages, the home buyers are fairly unorganized and powerless compared to airline passengers, where it is quite common to witness, for example, large corporations negotiating favorable rates with air carriers for ticket prices.¹⁵ Not only are buyers fragmented, but mortgage transactions happen infrequently, and therefore there may be insufficient motivation or opportunity for buyers to organize. Another interesting contrast is that

in the airline example, it was the supplier of the goods who provided the electronic market. Of the five systems studied in the mortgage industry, the most successful in terms of dollar volume was also provided by a supplier of mortgages—Citicorp. It seems to have been designed to capture additional product sales rather than generate fee income. It is, of course, possible that this system will evolve into offering other suppliers' products, presumably for a fee. However, it is easy to imagine that Citicorp could easily duplicate another vendor's offering, since the ultimate product is simply money offered under a particular contract. In contrast, different airlines own the rights to specific routes and airport landing slots, and therefore a certain amount of cooperation is required. All of these differences suggest obstacles to the creation of electronic markets that were not present in the initial airline reservation system example.

As one might expect, the most adamant detractor of CLO systems continued to be smaller players in the mortgage banking community, whose middle-man niche is squeezed by automated vertical integration. With a few exceptions, the CLO technology is being explored most aggressively by firms interested in building electronic hierarchies rather than markets. These firms fall into two groups: realtors hoping to speed loan approvals and capture additional revenue from the financing process and lenders hoping to position their loan products closer to the point of home sales. An additional explanation for the early slow adoption of an electronic market for mortgages may be the consumers' inability or unwillingness to engage in it given the product's relative complexity. They may prefer to have an intermediary lead them through the transaction. This might suggest that more sophisticated systems that allow greater ease of interaction by the consumer are needed. This possibility may provide a market niche for a new competitor in the development of an electronic market.¹⁶

More recent developments—the role of government in incentives

However, one recent development that may encourage further development of CLOs is a

regulatory change by HUD to RESPA.¹⁷ Prior to an amendment of RESPA effective in December of 1992, receipt of fees by realtors for matching buyers and mortgage providers was prohibited. Now a fee can be charged so long as a service is provided, although "kickbacks" for pure referrals are still prohibited. This is believed by some to lower a barrier to CLOs in real estate offices, because it is now quite clear that the realtor can charge the buyer a fee to use a CLO (NMN, 1992). The Mortgage Bankers Association (MBA) vigorously fought this change and failed in their attempts to get HUD to either (a) cap the fees that could be charged, or (b) require that the systems provide access to multiple lenders. The MBA has filed a lawsuit to reverse HUD's decision (Lehman, 1992). The MBA, although publicly arguing that it is attempting to protect consumers, is assumed to be motivated by loss of service fees by its members if mortgage loans are originated in realtors' offices (Lubinger, 1993). Another outcome of the amendment was to lower barriers to vertical integration, for example, the merging of real estate brokerages and title insurance companies.

By December of 1993 these new RESPA rules supporting increased realtor participation in the mortgage origination process had been in effect almost a year, and the debate among various members of the lending and realty communities over the new rules showed no signs of quieting down. Some new CLO systems were being initiated by a variety of players: on the real estate side, interest in CLOs seems to be growing. The National Association of Realtors was considering a system for inclusion in the Multiple Listing Service package available to member realtors that would eventually include "hundreds" of lenders and feature on-the-spot qualification (Sichelman, 1993). Master Mortgage LP, a consortium of 23 large real estate firms, had a single lender system in the design stage (Saft, 1993). Large lenders showed interest in CLOs as well. GE Capital (Cornwell, 1993) and Sears Mortgage (Harney, 1993) both initiated systems; Sears forged ahead with a new CLO despite a \$700K settlement of a lawsuit alleging that Sears realty offices unfairly steered borrowers to Sears Mortgage loans using a discontinued CLO system (Downey Grimsley, 1993).

Suggestions for future practice and research

What, then, are some of the most generally applicable lessons for practice inherent in this case study of the electronic market for home mortgages? Some of the aspects of the EMH appear to be validated by these examples, in particular the danger to current market intermediaries of information technology. Therefore, anyone in the role of a market intermediary should carefully examine the likelihood of their continued economic existence under the intervention of information technology. More proactively, they might examine whether to be the first to provide the structure for the electronic market, and thereby secure their place in the transaction.

On the other hand, the failure to achieve a full electronic market, despite a significant amount of effort, suggests that significant barriers can exist to this change, barriers that must be acknowledged and accommodated by any party who wishes to create an electronic market. One clear lesson from the alternative views of the EMH, and one that appears consistent with the case of home mortgages, is the need for appropriately aligning the incentives in the market. Suppliers only have incentives to participate in electronic markets where they can either differentiate their products or directly compete with a relatively small number of other suppliers. Choosing the participants to be included in the market may be the most critical decision in establishing such an electronic market.

This is clearly related to the role of market power, a notion that is under-emphasized in both the original EMH and the alternative views. Few real world markets exhibit the perfect characteristics of markets described in neo-classical economics. If such theory is to be directly applied to a specific market, then that market's local imperfections must be taken into account. In the home mortgage market the mortgage lenders and the realtors exhibit a tremendous degree of market power. In addition, this market is strongly affected by government regulation, as witnessed by the impact of the HUD regulatory changes and the high degree of political lobbying that preceded such changes (Markus, 1983). The writings on the effect of information technology on market structure to date have largely ignored the role of government regulation. Table 4 lists some of

these possible factors to consider in predicting the likelihood of the development of an electronic market.

Table 4. Possible Electronic Market Factors

- | |
|---|
| <ul style="list-style-type: none"> • Complexity of the transaction.* • Frequency of transaction • Relation of goods/services supplier and system supplier • Current market structure • Relative power of buyers and suppliers • Possibility of transaction fees • Ability of suppliers to match competitors' product offerings |
|---|

* This is in addition to the EMH's proposed complexity of product description.

Finally, this analysis of the electronic market for home mortgages raises some additional questions for future research. One is the identity of the provider of the market. In the case of the dominant airline reservation systems, the provider was also the supplier of the goods. In the largest dollar volume CLO, this was also the case. Is there an important relationship here, or is this a simple coincidence? After all, the fact that the airline systems were developed by the airlines could be argued to be an historical accident, stemming from the airlines' early familiarity with the then exotic technology of computers as a function of their operational needs to manage their highly perishable inventory of seats. Hypothetically, if airline reservations systems did not exist today, could they be successfully created by a travel agency, serving as an electronic market provider, or would such a system be successfully resisted by the airline suppliers who would be necessary participants in such a system? If airline reservations systems were to fail to arise, then the identity of the market provider might be construed to be an important factor. Further research in other markets may shed light on this issue.

Concluding Remarks

From the analysis in the previous section it appears that at the present time CLOs provide limited support for the Electronic Markets

Hypothesis. Is this an appropriate test? Malone, et al. (1987) suggest the need for such tests: "... our forecasts are based on a simple conceptual analysis rather than on systematic empirical studies. A conclusive test of our model and our predictions will, therefore, require further empirical and analytical work" (p. 484). Home mortgages are a financial product like stocks and bonds that have previously been suggested as good examples of electronic markets at work. The technology necessary for CLOs has been in place for over a decade and, therefore, arguably has had time for the forces to work. At least five major economic agents have offered CLOs, yet none exists today as a pure electronic market as suggested by the hypothesis. Of course, this area continues to evolve, and such a market may yet emerge. The EMH does not give guidelines on how long it will take for an electronic market to emerge in an area like home mortgages. What the current analysis points out is that such an evolution is by no means quick nor is it as straightforward as might be imagined from a casual interpretation of the EMH.

However, it should not pass unnoticed that Malone, et al. caution the reader: "In addition to the changes in information technology that we discuss here, there are, of course, other important forces—such as changes in stock prices, antitrust regulations, and interest rates—that might affect firm and market structures" (p. 484). Clearly, no single variable-based theory, even if intuitively appealing, will successfully predict all events in a phenomenon as complex as the structure of markets. And the EMH has been successful in informing people about the significant potential impacts of information technology. What is needed is further empirical study leading to augmentation of our understanding of the impact of information technology on market structure in order that future events may be forecast with increasingly greater accuracy.

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Endnotes

¹This section may be skipped by readers familiar with the home mortgage industry. Alternatively, readers interested in greater background detail than is provided here are referred to Hess (1992).

²The term "realtor" is a designation for a set of real estate brokers who have met the requirements for this professional certification. While not all real estate brokers are realtors, the term realtor will be used in this paper so as to avoid any confusion with the term "broker" between real estate brokers and mortgage brokers.

³Asset specificity refers to the degree to which an asset can be redeployed to alternative uses and by alternative users without sacrifice of productive value (Williamson, 1989). Williamson's examples of asset specificity include site specificity, e.g., the physical location of an asset chosen to economize transportation costs for a particular customer, and physical asset specificity, e.g., specialized capital equipment designed to optimally produce a very specific product or line of products. Other types of asset specificity include human asset specificity (specialized knowledge arising from learning by doing), dedicated assets (discrete investments in general purpose assets at the behest of a specific customer), and brand name capital, which may not be easily transferred to another product.

⁴However, it should be noted that once the actual mortgage is finally approved, the general funds are transformed into a contract with a single buyer for a single property and are non-transferable.

⁵Note that this generic description is purposeful; while in the traditional market the "retailer" is most often the mortgage banker (see Figure 1), with electronic mediation the retailer could be a different party, such as a realtor.

⁶Data collection approaches are described in the Appendix.

⁷E.g., Coldwell-Banker offers a service called "Borrower's Choice" in some offices in parts of New Jersey (Quinn, 1993).

⁸See the discussion section below for examples of post-RESPA amendment systems.

⁹The fee structure to member realtors was as follows: \$16,000 initiation, which included the hardware, software, and marketing materials, \$100 per hour usage fee, \$500 staff training fee, \$100 per month maintenance. Offsetting these fees were the origination fees from the borrowers, which in the traditional lending process would go to a hometown lender or mortgage banker (Guenther, 1983).

¹⁰The system did not, however, alleviate as much borrower effort as other CLOs, because it required borrowers to visit a PRC office to apply for a loan after selecting one through a terminal in a realtor's office.

¹¹The fee to connect to the network was \$50, and there was a \$10 per month use fee. Status check requests cost \$5 each, as a small disincentive to apply for multiple loans (Bender, 1985).

¹²Jumbo describes mortgages that do not conform with Freddie Mac or Fannie Mae guidelines because their balances exceed the limits established by the quasi-public secondary market makers.

¹³In addition, it might be expected that local firms will have access to better information, and therefore face less risk, than non-local firms.

¹⁴ Although the recent low levels of interest rates have prompted a flurry of refinancing that has made this transaction a more frequent event for many consumers.

¹⁵ Although it should be pointed out that one exception to this is the case of corporate re-location services, which can, due to their large volume, sometimes negotiate relatively more favorable rates.

¹⁶ Personal communication, G. Hurst, January 1994.

¹⁷ For a useful history of RESPA, see Bernstein (1993).

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Appendix

Empirical data for this research were collected primarily through investigation of secondary sources, particularly industry trade journals such as *Mortgage Banking*, *American Banker*, *BNA's Banking Report*, *National Mortgage News*, *Mortgage Commentary*, and *U.S. Banker*. The primary tools in this investigation were the online search services ABI/Inform and Mead's Lexis/Nexis. These databases were initially searched in December 1991 under the main topic headings "computerized loan origination systems" and "automation of mortgage banking operations," resulting in 51 sources that were then examined for relevance to the research topic.

After this initial evaluation, a small number of unstructured interviews with primary sources in the mortgage industry were conducted in order to either investigate issues that were incompletely described in the secondary sources, or to corroborate particularly significant insights gleaned from single secondary sources. Additional online searches were conducted in April and November of 1993 in order to update the data where necessary. During the course of this research initial drafts of this paper were reviewed by knowledgeable sources to avoid egregious errors.

However, despite the careful nature of the investigation, this approach to data collection remains non-traditional. Therefore, the data have been treated conservatively. In particular, attributions of the motivations of specific parties involved in the systems are presented in the text only circumspectly, given the public nature of the data. In all cases direct citations to the source of specific relevant background material have been provided, resulting in a somewhat longer than normal *Application* section bibliography.