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Government Sponsored Enterprises and Resource Allocation: With Some Implications for Urban Economies

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ABSTRACT

About half of the money that finances housing in the U.S comes from three government-related "Agencies:" two government-sponsored enterprises (GSEs): Fannie Mae and Freddie Mac, and a government owned enterprise, Ginnie Mae, that buy mortgages and securitize them and sell the securities or debt backed by mortgages (or mortgage-backed securities) in the bond markets. The purpose of this paper is to analyze Fannie Mae and Freddie Mac and their role in the mortgage market and effects on resource allocation and urban economies. A central point of the paper is that the problem is essentially a "second best" one because of the presence of multiple guarantees and subsidies in the mortgage market. The two agencies may well lead to too much housing but they may also be the most efficient (relatively to banks, which also have guarantees and subsidies) way of funding mortgages.

I. Introduction and Summary

About half of the money that finances housing in the U.S comes from three government-related "Agencies:" two government-sponsored enterprises (GSEs): Fannie Mae and Freddie Mac, and a government owned enterprise, Ginnie Mae, that buy mortgages and securitize them and sell the securities or debt backed by mortgages (or mortgage-backed securities)[1] in the bond markets. The purpose of this paper is to analyze these three agencies, primarily the GSEs, Fannie and Freddie (FF), their role in the mortgage market and their effects on resource allocation and urban economies. It does not touch on some of the more popular recent aspects of FF, in particular safety and soundness, accounting

[1] Everything that Ginnie Mae buys is securitized. Fannie and Freddie have debt funded around 40% of the mortgages they buy. This is mostly done by repurchasing existing securities and then debt funding. The main reason for this seemingly duplicative process (first creating, then securitizing and then buying them back, rather than debt funding to begin with) is that by buying back the same securities everyone else is trading Fannie and Freddie assure the markets that they are not selecting against them is setting up the securities.

and privatization. These are interesting, albeit not always well-researched, topics that are beyond the scope his paper. Nor does the paper, with one exception, have much to say about policy recommendations.

The analysis focuses on the way GSEs affect resource allocation through their effects on the structure of the mortgage market, in particular in the division of labor in the market between banks, who act primarily as portfolio lenders and the GSEs, primarily as securitizers. The impact of the GSEs on urban economies is mostly indirect, through their effects on mortgage rates and mortgage market liquidity. Most of the discussion in the paper is focused on these effects. However, there are some special programs that come out their charter and more recent legislation that direct the GSEs to lend in central cities and to targeted groups. These are discussed as well. However, the nature of their portfolio restrictions, coupled with similar rules for banks, makes it extremely difficult to sort out the marginal impact of the GSE regulations on targeted lending. A proposal to make their impact easier to understand is discussed below.

Both banks and the GSEs exist simultaneously in the mortgage market, and an accurate description of the structure of the market can be summarized as one of *dueling charters* (see Lea (1986) and Van Order (2000a)). That is, there are two major charters in the industry: one charter is for depositories or "banks" (traditionally thrifts but now mostly commercial banks) who use the deposit market as their primary way of attracting funds, and the other charter is for the GSEs, who use the bond markets. The charters have similarities, particularly in the form of ownership (both are privately owned) and subsidy (mainly in the form of implicit and explicit guarantees). They also have differences, for instance in regulation and market structure (there are thousands of banks and only two GSEs in the mortgage business). Yet both are viable. The ratio GSE purchases to mortgage originations increased sharply in the 1980s; since then it has fluctuated over time, and it has been declining lately. The older distinction between primary markets (banks) and secondary markets (FF) is no longer very important. Now there are simply different ways (e.g., via a bank through deposit markets, or via a GSE through bond markets) of getting money from the financial markets to the mortgage market. In effect,

there are now two sorts of GSEs: explicit ones, Fannie and Freddie, and implicit ones, banks.

A central question in any analysis of financial structure is whether the type of funding and the type of institution doing the funding should matter. One of the basic tools of financial economics, the Modigliani-Miller (1958) (MM) irrelevance theorem, suggests that in competitive markets the nature of the institutions supplying funds does not matter. That is the point of departure. Of course, there are subsidies in the market. GSEs get theirs primarily in the form of implicit guarantees, allowing them to take on risk without fully paying for it; and subsidies can invalidate MM. But that is not enough to explain the rise of securitization and the determinants of market share *relative to banks* because banks also receive subsidies from deposit insurance, and it is not at all clear that (at the margin) banks get smaller subsidies than do GSEs.[2] An alternative candidate for theorem violation is asymmetric information coupled with restrictions on where subsidies can be used (banks have historically been restricted to the deposit market).

The paper suggests that if subsidies are similar, market structure depends on the tradeoff between the advantages GSEs have in spending their subsidy in the bond market, which has been a more efficient market for raising funds (especially for long term lending) relative to deposits vs. the informational advantages that banks have because they originate loans and know more about them. This tradeoff has been favorable for the GSEs and securitization, especially for long term fixed rate mortgages, which have traditionally been difficult for banks to hold without taking interest rate risk. But history does not suggest that the GSEs have a tendency to grow independently of market considerations. Regression analysis suggests no time trend in market share in the 1990s and 2000s and a relationship between GSE market share and ARM and refinance share.

[2] "At the margin" is important. It may well be the case that banks via regulatory and other burdens have less valuable franchises than do FF, but the question for resource allocation is subsidy at the margin/ Banks for the most part do not pay insurance premiums for deposit insurance and borrow at rates comparable to those of FF.

There has been a considerable amount of research on how big a subsidy GSEs get and by how much they lower mortgage rates. A consensus seems to be that they borrow at rates that are 25 to 40 basis points lower than they would absent their implicit guarantee (with a low AA rating), and they lower mortgage rates by something more than 25 basis points. This range is not held unanimously (e.g., Passmore (2005)), but it does seem to be the consensus, and it is consistent with most data. It also likely that GSEs have increased the liquidity of the market, meaning they have led to flatter supply curves and less chance of market collapse. The GSEs probably keep some of their subsidy; it is not all passed through, as evidenced by generally high returns on equity.[3] However, how much they keep is hard to estimate because the range of error in both the benefits received and rate decline is high. More important, the "dueling charter" model suggests that some care has to be taken in interpreting the way subsidies work and how they are likely to effect resource allocation. In particular, much of what either type of institution gets is needed to offset the subsidy the other already gets. This has two implications: First how much is "free" to be passed on is smaller than might be thought, and second, the effect of changing one of the subsidies (and not the other, e.g., by charging banks a risk-based fee for deposit insurance, but not charging a similar fee to GSEs) might have a much bigger effect on market share than on mortgage rate and resource allocation (though it could have a big effect on market liquidity).

Whether or not the impact of GSEs is good, in a welfare-increasing sense, is controversial, and, more importantly, the answer is deeply embedded in the theory of second best because of the existence of two competing subsidies. The GSEs affect welfare in four ways: effects on homeownership, effects on capital allocation (the amount of housing vs other capital uses), effects on market liquidity and effects on targeted groups through requirements to make certain types of loans. Urban economies are affected by all four, but the primary ones are probably through homeownership and the special programs. While it is clear that the GSEs have some affect on homeownership,

[3] For instance, return on equity for Freddie Mac averaged around 23% from 2000 through 2005 (see recent annual reports at Freddiemac.com) . Recent accounting changes involving the use of Generally Accepted Accounting Principles (GAAP) have added some artificial volatility to returns, but that should not affect an average over 5 years.

which has been rising especially rapidly for minority and low income households), and the special programs must have some effect on the targeted groups, there is very little "how much" evidence.

Standard economic analysis of welfare effects of the GSEs on resource allocation (housing vs. other capital uses) is by and large indeterminate. In particular, while in a first best world it is clear that the distortions brought on by the GSE implicit guarantee would be welfare reducing, because of the existence of an already distorted mortgage market via banks with deposit insurance subsidies and the relative inefficiency of deposit markets in raising money for mortgages, it may be that the GSEs, to the extent they spend their subsidy in a more efficient market, are a second best improvement.

The structure of the paper is as follows:

Section II discusses some history of the mortgage market and GSEs and presents some data on the market.

Section III discusses the economics of securitization.

Section IV presents a model of market structure that focuses on the tradeoff between low cost supply from securitization and better information for banks.

Section V discusses welfare implications. It discusses subsidizing homeownership, and it switches gears and uses partial equilibrium demand and supply models to analyze resource allocation efficiency. Because of the presence of "dueling subsidies" the problem is inevitably one of second best, and as discussed above it could be the case that the addition of subsidized GSEs. The model also sheds some light on measuring GSE benefits and their impact on mortgage rates.

Section VI presents some empirical analysis. In particular it tests a simple version of the market share model. It finds that there was indeed a discontinuous shift in market share in

the early 1980s, and after that market share fluctuated without trend, depending largely on the share of the market that was adjustable rate (vs fixed rate) and the extent to which it was a refinancing market (vs loans to purchase houses). Is also discusses work on the extent of the GSE subsidy and the extent to which it is passed on to borrowers.

Section VII presents final comments and a recommendation.

II. Some History[4]

Between the end of World War II and the early 1980s American mortgage markets were dominated by depository institutions (mainly savings and loan associations or, more broadly, thrift institutions), which by both regulation and tax incentive were induced to hold most (about 80%) of their assets in mortgages. For simplicity depository institutions will be referred to as "banks." The mortgages were financed with low-cost, short term, government-insured deposits. The banks provided all the major aspects of mortgage lending, and they held the majority of mortgages. They originated loans, serviced them and were the ultimate investors, both accepting the risk of borrower default and raising money to finance the mortgages. Pricing was relatively simple and probably best expressed as a markup over deposit costs. The banks were also subject to liquidity crunches, or more broadly an inelastic supply of funds, and interest rate risk from funding long term fixed rate mortgages with short term deposits. Interest rate risk was the beginning of the crisis that virtually eliminated the thrift industry in the 1980s.

Now most mortgages are sold into secondary markets where they are securitized and they and their derivatives or debt backed by them compete with a wide range of securities in the capital markets. Ginnie Mae securitizes government insured loans, primarily by the Federal Housing Administration (FHA) and the Veteran's Administration (VA). Ginnie Mae's were the first mortgage-backed securities, beginning in 1970. The GSEs operate almost entirely in the "Conventional" (not government-insured) market, and they have a limit on the size of loan they are permitted to buy (currently $417,000 for single family

[4] For some recent analysis of the GSEs and some policy issues see Frame and White (2005) and Quigley (2006)

loans), the "Conforming Loan Limit," which is indexed annually to house prices.[5]There is a "Private label" market tends to operate above the conforming loan limit, though it also has grown rapidly into markets in which the GSEs do not operate.[6]

An effect of the advent of securitization has been to allow banks to avoid interest rate risk, by selling the loans, while allowing borrowers to continue to have long term, fixed rate mortgages. Banks now have a wide range of ways of being in the mortgage business without taking interest rate risk. They can originate fixed rate mortgages (FRMs) and sell them, and make money from servicing them; they can hold adjustable rate mortgages (ARMs) financed with short-term deposits; they can use derivative securities (e.g., options and forward contracts on Treasury securities or interest rate swap and swaptions) to hedge the risks of long-term mortgages; they can hold derivative mortgage securities , which have varying degrees of interest rate risk; or they can hold debt backed by mortgages with varying degrees of duration and call protection.

The rise of securitization in the last twenty five years has involved implicit and explicit government support, but government support has dominated mortgage markets since the 1930s when the Federal Home Loan Bank System, Deposit Insurance and FHA were introduced. Fannie Mae and Freddie Mac do not represent an increase in government support as much as a change in the nature of support from the depository charter to the GSE charter.

Data and Trends

Figure 1 depicts the outstanding stock of mortgages and new originations over time. The basic trend in mortgage markets has been rapid growth in stock of mortgage debt, especially over the past decade as house prices have risen rapidly. Originations are more volatile, primarily because of fluctuations in the amount of refinancing due to declines in interest rates.

[5] Alaska, Hawaii, Guam, and the U.S. Virgin Islands have loan limits that are 50 percent higher. Limits are higher for multiunit properties.

[6] The GSEs have language in their charters that requires that they purchase "investment quality" loans. Investment quality is not defined, but it puts some limits on where and how (e.g., insurance and recourse back to seller can make loans investment quality) they operate.

Figure 1

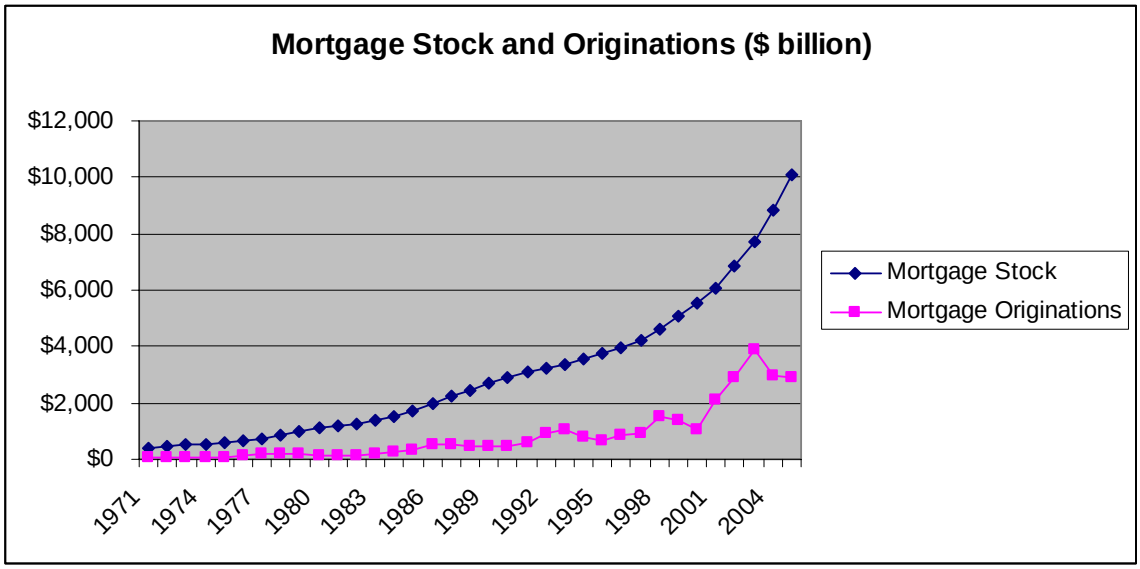
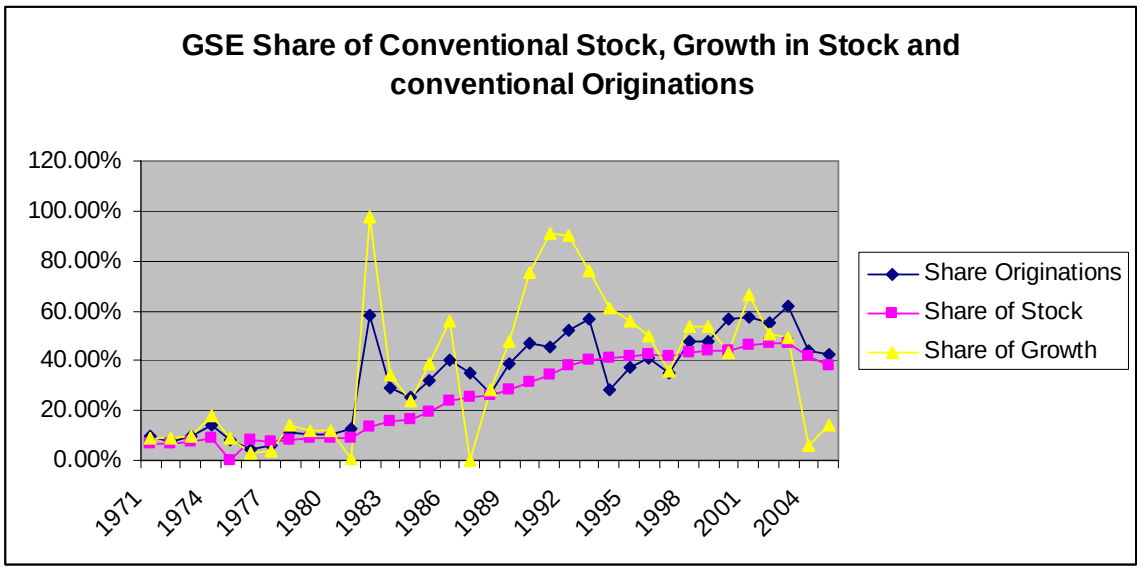


Figure 2 depicts the share of the GSEs (include both loans in securities outstanding and in loans held in portfolio) in the stock of conventional mortgages, the growth in the stock of conventional and in the flow of new conventional mortgage originations.

Figure 2



The GSE share of the conventional stock has risen fairly steadily from around 7% in 1971 to just below 40% at the end of 2005. There have however been some cyclical swings with share recently declining from a peak of around 47% in 2003. Mortgage origination share has been more volatile. The figure suggests that there was a structural break in 1982 when the GSE share suddenly increased to around 60% from around 10% previously. After that there is very little trend in originations.

Abstracting from refinancing,[7] originations can be thought of as the marginal addition to the share in the stock, and the share of the stock can be thought of as the average. Clearly, the secular trend in the stock is mostly the average catching up with the marginal after a break in the marginal in1982. However, originations are not quite the marginal because they do not include payoffs. The more volatile line in the figure depicts the GSE share of growth in the stock, which does correspond to the marginal change in share. While it is more volatile[8] than the origination percentage, it tells a similar story: a break in the early 80s and a recent decline. The difference between marginal and average is important. There is very little trading in used mortgages; mortgages are typically purchased by the GSEs shortly after origination and go into securities. So GSE activity and effect on the market is best viewed in terms of purchases of newly originated loans.

Table 1 shows recent changes in product mix in the mortgage market. The key trend since 2001 has been a sharp decline in share of conventional conforming loans (those which are eligible for GSE purchase) and a sharp increase in the share of riskier subprime, Alt-A (loans between "prime" and subprime) and home equity loans. This has been

[7] It is straightforward to show that GSE share of the outstanding stock will rise or fall depending on whether or not the GSE share of the increase in mortgage stock bigger or smaller than the GSE share of the stock. If GSEs have the same principle pay down rate (akin to depreciation rate) as the market as a whole, then share growth will depend on whether or not the GSE share of new originations is bigger or smaller than the GSE share of the stock. Otherwise there needs to be an adjustment for pay down rate differences. In the short run this adjustment can be important, especially in heavy refinancing booms, in part because the GSEs have relatively more fixed rate mortgages, which have more interest sensitive pay down rates than adjustable rate mortgages.

[8] The changes in MDO or GSE stock are the difference between two numbers, purchases (or originations) and pay downs, which are both subject to measurement error. The ratio of these numbers can be expected to be quite volatile, especially in years when growth is low. Hence, the year to year volatility is artificially large.

accompanied by an increase in non Agency securitization from around 2% of all securitization in the mid 1980s to 20% in the late 1990s and around 50% in 2004 and 2005.[9]

Table 1. RECENT ORIGINATIONS

Year	FHAVA	Conventional Conforming	Jumbo (above conforming loan limit)	Sub prime	Alt-A	Home-Equity	Total
Single-Family Originations ($ Bil)							
2001	165	1,268	430	190	60	102	2,215
2002	186	1,712	576	231	68	112	2,885
2003	230	2,460	655	335	85	180	3,945
2004	135	1,210	515	540	200	320	2,920
2005	84	1,092	570	625	390	359	3,120
Market Share (Percent)							
2001	7.4%	57.2%	19.4%	8.6%	2.7%	4.6%	
2002	6.4%	59.3%	20.0%	8.0%	2.4%	3.9%	
2003	5.8%	62.4%	16.6%	8.5%	2.2%	4.6%	
2004	4.6%	41.4%	17.6%	18.5%	6.8%	11.0%	
2005	2.7%	35.0%	18.3%	20.0%	12.5%	11.5%	

Source: Inside Mortgage Finance, The 2006 Mortgage Market Statistical Annual- Volume 1

Recent trends in the market can be summarized as:

[9] Source: Inside Mortgage Finance, The 2006 Mortgage Market Statistical Annual- Volume 1

1. An increase in growth in mortgage stock.
2. A decline in the GSE share of both mortgage stock and originations.
3. An increase in non traditional loan types.
4. A decline the share of government insured loans (FHA/VA).

III. The Economics of Securitization and the Structure of Mortgage Market: Adverse Selection and Dueling Charters.

Broadly speaking there are two models for funding mortgages: the *portfolio lender model*, which typically involves banks or other intermediaries originating and holding the loans and funding them mainly with debt, most often deposits, and the *securitization model*, which involves tapping bond markets for funds, for instance by pooling loans and selling (perhaps structured[10]) shares in the pools.

A Framework

A key question in evaluating role of the GSEs in resource allocation is whether they can be expect to matter much. The point of departure is the much celebrated "Modigliani-Miller Irrelevance Theorem" (Henceforth "MM;" see Modigliani and Miller (1958)). Briefly, the theorem is that under a set of assumptions, which mainly involve perfectly competitive markets, no transaction costs and widely agreed on information, the liability structure of the firm is irrelevant in the sense that changing the way the firm finances its assets will not affect its total cost of funds, where total includes the costs of hedging risk differences for different strategies. This is because different liability strategies are simply different ways of rearranging the same cash flows from the firm's assets, and in a well-informed, competitive market (with a perfectly elastic supply of funds) competition and arbitrage will assure that all structures will be priced so that none has an overall advantage; the sum of the parts will equal the whole.

[10] "Structured" means taking the cash flows from the pool of mortgages and selling them in non pro rata ways, for instance selling the earliest principal payments to some investors and later payouts to other classes (these and variants are Collateralized Mortgage Obligations or CMOs), interest payments to one group of investors and the principal payments to another (these are "IO/POs") or prioritizing the impact of default losses by having one group take the first hit ("Senior/Subordinated" structures). Some of these structures, particularly the latter, are discussed below.

Taken literally, the theorem, applied to mortgage markets, implies that while there are lots of possible institutional structures for funding mortgages and lots of liability structures within the institutional structures, which institutions and structures are chosen doesn't affect mortgage rates. A softer version is that advantages of different structures are likely to be small, and because of very elastic supply curves small advantages of one source of funding (e.g., some sort of subsidy or slightly lower transaction costs) the small differences can lead to big effects on how the financing is done (who has the biggest market share) but with small effects on interest rates on the loans and subsequent resource allocation.

The MM Theorem is one of those ideas that when you think about it is obvious, but of course, it is wrong (markets aren't perfect (e.g., some supply curves, in the sort run at least, are not flat); though they're often rather good, asymmetric information is often the rule rather than the exception, and transaction costs matter). But the theorem is not a bad first approximation, and it is a good place to start because it makes us ask the right question: why should we expect one institutional setup to be better than another at financing a particular set of cash flows when they all compete in the same overall financial system? In particular, it suggests that some reasons for particular structures, like "getting assets off balance sheet" or "the high cost of capital relative to debt" or "allowing banks to shed the risk of low downpayment loans" are wrong, or at least suspect, pending analysis of what part of MM is violated.[11] So why might banks or GSEs matter?

Unbundling and the Securitization Process

The traditional portfolio lender performs all aspects of the mortgage bundle: it originates the mortgage, it services it, it takes the risk of default (perhaps along with a private or government insurer), and it raises money in the deposit market to fund it. The secondary market evolved by unbundling this package. A major contribution of the Agencies has been to facilitate the money-raising part of the bundle by taking on residual credit risk

[11] The issue of subsidy via guarantee is not touched on to any extent here. Both sources of funds, deposits and Agency liabilities have implicit or explicit guarantees, and the question of which is more valuable (at the margin) is not clear.

and packaging mortgages, so that mortgages can be sold in pools as relatively homogenous securities or financed with homogenous debt in the capital markets. This has allowed separation of the funding part of the bundle from the other three parts.

All four aspects of the mortgage bundle can now be unbundled. Mortgage securitization typically has four major actors: (1) mortgage originators, who are large in number and sometimes small in scale, who sell the loans themselves or who (mortgage brokers) act as agents for mortgage bankers or depositories, who sell the loans;[12] (2) mortgage servicers who sell the mortgages into the secondary market and either keep the servicing or sell the servicing rights to other mortgage servicers; (3) secondary market institutions and mortgage insurers,[13] who take on credit risk; and (4) investors who buy mortgage-backed securities or GSE debt and take on the interest rate risk, which comes both from the long term of mortgages and the option borrowers have to refinance when rates fall. Indeed, the last function has become further unbundled with the advent of derivative securities, like Collateralized Mortgage Obligations (CMOs), which further segment the cash flows, so that different parts of the investment risk (primarily interest rate risk) can be reallocated to investors who prefer different types of interest rate risk.[14]

Principal/Agent Problems

Unbundling takes advantage of scale economies and division of labor and promotes competition among the suppliers of the various bundles, but it occurs with a cost. The cost is that the players that focus on one part of the bundle depend on players in the other parts of the unbundling to perform services for them as expected (e.g., sell them good loans) when it is not always in their interest to do so. That is, there is an agency problem. For investors, or more broadly those who end up taking the risk, the major agency problem has come from the reliance on originators and servicers to originate good loans

[12] In 2002 over half of the loans originated were done through mortgage brokers.
[13] It is typically the case that loans with down payments of less than 20% have private mortgage insurance. The insurance typically covers the first 20 to 25 cents on the dollar of loss.
[14] CMOs partition cash flows in a variety of ways, but typically the idea is either to: 1. Carve up principal payments so that investors who prefer short term assets get their money back faster and leave term risk to others, or 2. Allocate principle payments to "*tranches*" that take more or less prepayment risk (for instance by guaranteeing a particular repayment schedule as long as prepayments speeds are below some prespecified level, with a residual *tranche* absorbing the bulk of the risk.

and service them well. The major risks are that sellers will select against them or originate loans that are of low quality (occasionally this involves actual fraud, e.g., selling mortgages not associated with houses). This is particularly true for institutions that are in danger of bankruptcy, for which reputation is less valuable. Hence, to control credit risk, whoever is taking the credit risk needs to do things that align the incentives of originators and servicers with their own or get better information on risk.

Securitizing on a large scale, which keeps fund-raising costs low, has historically required that the Agencies not spend a lot of resources monitoring the credit risk of individual loans. Hence, the burden of controlling credit costs historically has fallen on: the ability to foreclose on property, the performance of mortgage insurers, who insure loans with down payments of 20% or less, the ability to monitor servicers, and contracts that provide incentives to induce originators to make good loans. More recently the advent of credit scoring models has provided FF with a low (at the margin) cost way of determining credit cost at least for the lowest risk or "prime" loans.[15]

This is all in contrast with the traditional, bundled bank, which had all the elements of the bundle under its control and was less worried that the part of the firm that originates mortgages would take advantage of the part of the firm that evaluates credit risk[16].

MM

So where does Miller-Modigliani fit into this? In the pre secondary market world in the U.S. where banks (actually savings and loans) did the lending, deadweight losses and asymmetries were more or less the same for everyone. Capital structure was managed by regulation, and debt was primarily deposits, which were often inelastic in supply but subsidized by deposit insurance. In that model MM was violated because of regulation; holding less capital lowered costs to the banks because it allowed better exploitation of the deposit insurance guarantee. A price paid for this was that funding was forced

[15] The credit scoring systems have been able to quantify credit history and use it to model default probability. For relatively low risk loans this works well, but for borrowers with poor credit history it is very difficult to distinguish borrowers with temporarily bad histories fro those who are permanently bad.
[16] That is not to say that there is no risk. Compensation schemes could induce conflicts of interest inside the firm. The point is that conflicts inside the firm are easier to resolve.

through the deposit market, which is not the most efficient vehicle for funding long term fixed rate mortgages.

The advent of GSEs, didn't add much in terms of the existence of guarantees, but it changed the types of guarantees and the possible ways of operating and exploiting the guarantees, by allowing institutions to get access to a new market, the bond market, which has lower transaction costs, a more elastic supply of funds and is a better way of managing interest rate risk. But the GSEs were forced, because they were *secondary* markets, to take on some asymmetric information problems that banks did not have to take on. So MM was still violated, but it was violated in different ways.

So why, again, might banks or GSEs matter? First, both get subsidies, in particular in the form of underpriced implicit and explicit guarantees, and having a subsidy matters. Second, the GSEs can matter because they get to spend their subsidy in the bond market rather than the deposit market, and third, banks can matter because they tend to have an informational advantage over GSEs.[17]

IV. Agency Costs and Competitive Balance: A Model of Market Structure

This section develops a simple version of a model of market share based on the balance between economies of fundraising that the GSEs have and the advantages of control over risks that banks have (see Van Order (2000b and (2006)) for a more formal discussion) as well as on differences in the values of the guarantees received by the two. The appendix develops a formal model, which produces the same results in a more general framework.

A Simple Model

Assume that borrowers take out mortgages to finance house purchases and that there are two types of risk neutral financial institutions (FIs) that buy the mortgages. The FIs are the dueling charter FIs, banks and GSEs, and the total amount of lending is fixed. The

[17] While there is some controversy over exactly what the FF charters imply, it is generally agreed that FF are not allowed to originate loans.

banks have, as their part of the charter structure, higher costs either because of a less valuable subsidy or because their fund raising costs are higher (e.g., because they pay higher underwriting costs or deposit markets are more expensive markets in which to operate than are bond markets). The GSEs are securities market traders, who do not underwrite as much and cannot originate loans, so they are selected against by the banks. They know the distribution of loans but not the details of individual loans. It is assumed that equilibrium occurs when price equals average cost in both.[18] The households that take out the (mortgages know the quality of their loans and sell them to the highest bidder.

The loans are one year discount bonds, which pay $100 at the end of the year. The discount reflects the risk free rate and default plus underwriting costs. There are three types of loans: good, for which the expected present value of default cost is $1, medium, for which default cost is $4, and bad, for which expected cost is $16. Banks' costs are $1, per loan vs. zero for the GSEs. For simplicity it is assumed that the risk free rate is zero. Banks, because of full information, price loan by loan. It is assumed that price equals average cost by product for banks. Then fee charged by banks is $1, $4 or $16, plus underwriting costs of $1. Because GSEs do not know loan by loan detail they charge one fee, which equals their average cost.

Assume that the market consists of 100 bad loans, 200 medium loans and 400 good loans and that GSEs know this distribution. GSEs have a $1 cost advantage, but they will be selected against. By offering just under $17, the GSEs can bid the bad loans away from the banks. At just under $5 GSEs will take both the bad and medium loans away from the banks, but they will lose $1,100 (at $16 minus $5 or $11 per loan) on the bad loans and only make $200 (at $1 per loan) on the two good ones; at just under $2 they will take over the entire market, but they will lose $1400 on the bad loans, lose $400 on the medium loans and only make $400 on the good loans. Hence, zero profit equilibrium is for GSEs to hold only the bad loans, which will have a $16 fee. The good and medium loans will be held by the banks, and their fee will be $5 and $2, respectively.

[18] You get the same sort results (e.g., the discrete shifts in market share) if you assume that banks have zero profits and free entry, but GSEs have monopoly power.

More generally, the zero profit condition implies that if GSEs take over the bad and medium loans, they will charge a break even fee of $8 (losing $800 on the bad loans and making $800 on the medium loans), but they will only be able to do this if they can undercut the banks' fee for medium loans, which is $5. Similarly, if they are to take over the entire market and break even, they will charge a fee of $4, and they can only do this if they can undercut banks' fee for good loans, which is $2.[19] Hence, changing market structure requires either a change in bank cost or in the risk structure of the loans

Now suppose bank costs go up to $2. Market structure will not change, but fees charged by banks will go up by $1. At $3 costs it will still not be profitable for the GSEs to take over just the bad and medium markets (banks' $7 fee for medium loans will still undercut GSEs' $8), but they will be just indifferent to taking over the entire market (banks' $4 fee just equals GSEs' $4). However, if banks' costs go up by a penny more, GSEs will take over the entire market, bypassing the intermediate position of taking over only the bad and medium parts, charging a fee of $4 to all borrowers. Hence, there will be a discontinuous change in both market structure and fees. The fee will fall by more (to $4 from $16) for bad loans than it will for good loans, which will remain at $4; medium loan fees will fall from $7 to $4. This, of course, can work in reverse. If banks' costs fall, there will be a discrete shift back to banks holding all but the bad loans, and the bad loan fee will rise sharply. One would get similar results, with bank cost at $3, by adding and then subtracting a small number of good loans (*vice versa* for bad loans) to the market. Hence, small changes in cost advantage and/or risk structure can have big changes in pricing and market structure; i.e., the model exhibits abrupt regime shifts.

Hence, the model generates some expected results: that GSE market share will go up when its cost fall relative to banks' or information increases, but it also produces an extra result that market share can increase discontinuously. Clearly, the example requires two distinct types of lenders, which is implied by the dueling charters model, and a particular

[19] Zero profits for SM, conditional on taking over the whole market, are given by: 0 =100(f-16) + 200(f-4) 400(f-1), where f is SM's fee. This implies that f=4. Note that what matters is the ratio of medium and good loans to bad loans. For taking over the bad and medium parts the condition is: 0= 100(f-16) + 200(f-4), which implies f=8.

type of (convex) risk structure, with a lot more good loans than bad loans. The model in the appendix generalizes the example for a case where the assets are risky because of default risk, which comes from the put option embodied in the collateral; borrowers default if they have negative equity when the loan is due. It then uses the Black-Scholes (1973) model to derive a result like that in the example, in particular that:

1. GSEs' share will increase with its cost advantage and decrease with the range of asymmetric information. .
2. GSEs will have a bigger share in markets in which they have bigger cost advantages and where information is more transparent.
3. Market share can shift discontinuously.

These predictions are given some tests in Section VI.

V. Welfare Economics and the Second Best

The above model has very simple welfare implications: the GSE share is "too low" because it is the low cost provider of funds and adverse selection produces market failure, a standard "Lemons" result. However, that result requires the difference in cost to be "real", i.e., not coming from a bigger subsidy, but rather from the bond market being more efficient, and from the assumption output is fixed. The later is not helpful if the goal is to understand the full welfare effects of the GSEs as they affect resource allocation.

Welfare Effects

From a policy perspective, and from the prospective of effects on urban economies, there are four areas through which the GSEs can have positive effects:

1. *Homeownership.* This is directed to the question of whether homeownership has positive externalities, and if so, whether the GSEs are a good way of promoting it.
2. Housing *Production vs. Other Capital Uses*. This the standard resource allocation issue of whether GSEs increase distortions in resource allocation.
3. *Liquidity of the mortgage market*. This is interpreted as providing an elastic supply of funds in the short run.
4. *Special targeted programs.* Currently, there are portfolio requirements for lending to low income borrowers and for lending in targeted neighborhoods.

All four are questions about GSEs relative to alternatives, and all involve "second best" issues. That is, in a "first best" world where there were no other distortions, whatever benefits the GSEs might provide in these four areas could be better provided by direct transfers and direct incentives to the targeted groups.[20] However, if the world is second best, for instance because the alternative to GSEs subsidizing homeownership is the tax system or because we are stuck with subsidies in the banking system, the GSEs may well be a second best improvement on the existing alternatives.

Homeownership

The question of social benefits of homeownership has been studied more intensively of late, and there is an emerging consensus (e.g., see Di Pasquale and Glaser (2004), Green and White (1997) and Haurin *et al* (2002)) that homeownership causes changes in people's behavior that have positive externalities. The more controversial question is whether or not the GSEs are particularly good at providing the subsidy. To begin with, as is discussed below, the effect of the GSEs on mortgage rates is on the order of 25 basis points, and it is hard to expect that to cause large increases, (see Feldman (2001)). But that is not the most important question. The important question is whether the perhaps small benefit is worth the cost given the alternatives.

There are two ways that GSEs affect homeownership: through price and through availability.

1. *Price Eeffects.* Currently the main device for subsidizing homeownership is the tax system, which like the GSE subsidy lowers the cost of homeownership. While the tax system is much bigger in effect, it also less efficient if the goal is promote homeownership among lower income and minority groups and/or in central city neighborhoods, because the subsidy goes disproportionately to high income, high bracket owners. The GSE subsidy is before tax and has a bigger effect on lower bracket homeowners. For instance, low income borrowers would generally not

[20] The targeted programs, which are discussed more below, are in the spirit of standard welfare models in the first best sense, but in a first best world there would be no reason to fiancé them through the GSEs.

itemize if they did not have a mortgage, so some of the effect of the mortgage interest deduction is lost because the borrowers would have had it anyway, and what is left is not as useful because the borrowers are in lower tax brackets.

2. *Availability*. GSE targeted lending is meant to affect availability directly. These are discussed below. Guercia *et al* (2002) argue that GSEs have a positive effect on homeownership via an availability route because they have had the effect of lowering down payment requirements. Chambers *et al* (2004) attribute much of the change in homeownership since 1995 to innovations in mortgages, particularly lower down payments. Bostic and Surette (2001) analyze the increase in homeownership in the 1990s and find that whereas the increase in homeownership rates for high income households can be explained by past relationships, e.g between homeownership and income and wealth, the increase in low income homeownership is greater than can be explained from past data, suggesting a role for homeownership programs.
3.

This is all suggestive, but not conclusive. There has not been a study that separates the effects of GSE programs from other programs (e.g., the Community Reinvestment Act CRA)) and from general tendencies for downpayments to fall (for instance private insurers making lower downpayments easier).

The broader effects on resource allocation come from effects on housing vs. other uses of capital and on the ability of the market to provide liquidity. In particular, while there may be reasons for GSEs being a lower cost source of funds, to the extent that it's (and banks) costs are subsidized it might provide a distortion in the form of too much housing (houses that are too big). To analyze this it is easiest to use the basic welfare economics tools of supply and demand, partial equilibrium analysis and dead weight loss. To keep things simple this is done buy putting the previous section's model in the background and assuming that GSEs and banks both operate in the same market, but that GSEs have lower costs. The models also provide a convenient framework for analyzing some recent questions about the amount of subsidy.

Modeling dueling charters, the production of housing and the liquidity of the mortgage market

The focus here is on differences in subsidy and costs across charters. Whether (and the extent to which) GSEs get a subsidy has been a source of controversy. That the implicit guarantee allows them to borrow at lower rates than otherwise conveys a subsidy, along with an incentive to take on riskier loans than otherwise. The extent of the subsidy depends on the strength of the incentives to take risk and on the ability of regulators to control risk taking. The size of the subsidy can be measured by how much higher rates would be if there where no charter and regulation. Outside analysis has suggested that "on their own" FF would be rated low AA,[21] but they borrow at better than AAA, which implies a subsidy of 25 to 40 basis points.

Offsetting some of the benefits of the GSE charter are costs of constraints from the charter, which should be netted out. For instance Fannie and Freddie are only allowed into the mortgage market, but there are other advantages such as exemptions from state and local (but not federal or property) income taxes and SEC registration. These are probably worth on the order of a few basis points and are dominated by variations in borrowing spreads.

Similar calculations can, in principle, be made for banks by comparing the cost of their (uninsured) debt with the cost of deposits. The calculations are difficult because the debt of most depositories is unrated, but it is doubtful that much of the industry is close to A or AA. Few banks have ratings of AA or better (none are AAA now); most are in the A to BBB range.

Financial Institutions can be expected to take account of their charter benefits when they make decisions. A value-maximizing firm with a completely unconstrained guarantee will tend to take on as much risk as it can in order to exploit the guarantee. But guarantees are never unconstrained. If it is possible for the institution to be shut down or for management and shareholders to lose control of the company, it will have incentives

[21] Sanders ( ) surveys some of these issues.

to control risk so as to maintain access to future benefits. Hence, while a guarantee might produce incentives to take excessive risk, FIs also have a franchise that induces them to be more conservative than otherwise. The balance between incentive to take risk and to preserve the franchise will be the main factors in rsk management.[22]

For current purposes the point is that the existence of a guarantee provides incentives to do more business at lower cost than otherwise. The details of how this is done and how risks are managed are subsumed by the subsidy measure, the difference between what they actually borrow at and what they would if not for the charter. Hence, we can think of both banks and GSEs as having two supply curves: one without the subsidy (measured by their lower than otherwise borrowing rate) from the guarantee, which as a first approximation (assuming other distortions are not important) represents social costs of the institution supplying funds, and the other supply curve with the subsidy, which is the relevant market supply curve.

Welfare effects of GSEs inevitably involve second best considerations because the rationale for GSEs requires market imperfections in the first place. The criticism by economists of guarantees has generally been that they distort prices and resource allocation by diverting funds toward resources affected by the holder of the guarantee (in this case housing) and away from other types of uses (in this case other investment). This distortion is a part of the model; though of course the distortion may have a good reason. Given the distortions involved, what are the implications the GSEs and various alternatives?

Model l

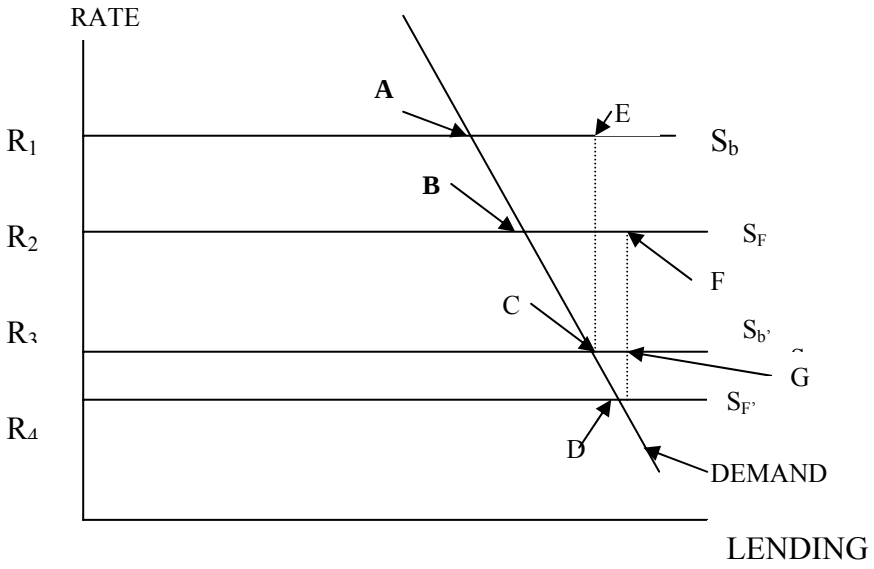
In this model it is assumed that (in the long run) either type of institution can raise as much money as it wants at a fixed rate that covers costs, including "normal" profit. As a result, supply curves are flat, but they vary by institution. There are no externalities; the

[22] For instance, an argument can be made that the difference between the GSEs and the banks is that the GSE charter is relatively unique, only two have it,; whereas the bank charter has very little value. So for instance when the Sand ls got into trouble in the 1980s they had strong incentives to "gamble for resurrection." But GSEs have valuable franchises to preserve.

private demand for mortgage funds fully reflects social benefits of loans and the housing they fund.

The total demand for agricultural loans, which will be supplied by banks and GSEs, is given by "DEMAND" in Figure three. Sb is the supply curve by banks absent a subsidy in the form of deposit insurance, and Sb' is the supply after deposit insurance. Similarly, the curves Sf and Sf' represent supply curves before and after the implicit guarantee for the FCS. Because there are no externalities and we are assuming competitive markets the unsubsidized curves represent marginal social costs for the institutions. As drawn we are assuming that FCS because of its access to the bond market is a lower cost source of funds, but it is not lower than that given by market supply curve for banks.

FIGURE THREE



If there are no subsidies in the system equilibrium is at point B in figure with market rate R2. It is a social optimum because marginal social costs equal marginal social benefits. Now introduce the subsidy to banks form deposit insurance. They now have a borrowing cost advantage from their charter equal to EC, so that the actual supply curve in the market is one with the points C and G on it, while the unsubsidized supply curve, which depicts social costs of depositories, has the points A and E on it. In this model the banks dominate the fully private market because of their lower costs after the subsidy, and market rates are R3. The excess of total social costs above total social benefits, or dead weight loss, from the depositories is the area inside the triangle AEC.

Now introduce the GSEs with the implicit guarantee. This supply curve is the lowest of the curves, with the point D on it. In this case GSEs dominate the market with market rate R4, . The deadweight loss in the market is now the area inside the triangle BFD. This can be either bigger or smaller than the deadweight loss from the entirely depository based system, depending on the size of the subsidy to the GSEs relative to the gross benefit (net of deposit insurance premium premiums) to banks. That is, the introduction of GSEs increases mortgage lending, which absent external benefits form the lending, is a distortion and decreases welfare, but it also redirects lending to the lower cost source of funds, which increases welfare.

Given the subsidy to banks, the subsidy to GSEs may well be welfare improving if demand for funds is relatively inelastic and access to the bond market is relatively more valuable. In the model the first best solution is, not surprisingly, no subsidy. But if there are reasons for under priced deposit insurance, and or political constraints on removing them, then the GSE charter can be welfare improving.

Model 2.

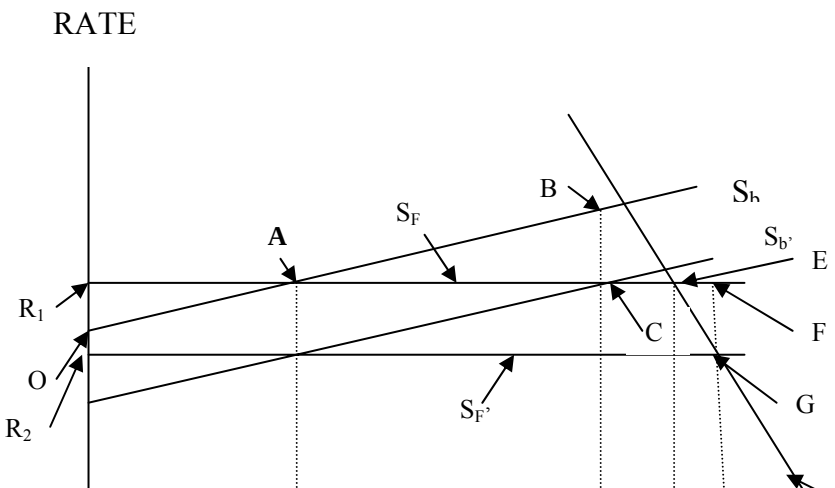
A reason for wanting access to the bond market is that it promises more "liquidity." Liquidity is a difficult concept to define precisely. Here it is assumed that it means that in

the short run supply of funds is elastic. Then banks are assumed to have a low cost source of funds in "core" deposits but that raising money in the deposit market quickly is difficult because the deposit market is illiquid, meaning the supply of deposits is upward sloping, whereas it is much less difficult in the bond market, especially with a conjectured guarantee, which makes the securities issued by the GSEs more homogenous.

The model is developed in Figure four (see Miller and Pierce (2001)). Here we keep the same model except that we assume that banks and GSEs have the same subsidy and banks have an upward sloping supply of funds. Absent subsidy the market supply curve is given by the curve OACE with equilibrium at point E, with banks lending the amount Qb and GSEs supporting a loan amount equal to Qf-Qb. If we introduce the subsidy to banks, as above, it lowers their supply curve to Sb.' As drawn in the figure this has no effect at the margin (the subsidy is not big enough to wipe out the GSEs), and the volume of lending stays the same, but the bank share increases. This involves a distortion because of banks' upward sloping, and sometimes higher, supply curve. The size of the distortion is given by the area inside the triangle ABC.

Now, suppose we subsidize the GSEs by the same amount (e.g., market views the two guarantees the same and nothing else is different). There is now a higher level of production at the new equilibrium G. This is distortionary in the model, and the welfare loss from that distortion is measured by the area of the triangle EFG. However, the welfare loss from too much high cost bank lending has disappeared. In the model as drawn the gain from the latter outweighs the loss from the extra lending.

FIGURE FOUR



Targeted Lending

The GSEs have by regulation obligations to allocate minimal amounts of their loan purchases for targeted activity. There are three areas:

1. Low income borrowers (below median income)
2. Low income and minority neighborhoods.
3. Special targeted programs for lower income borrowers.

For instance it is currently the case that over half (by number, not dollar) of GSE loans have to go to households with below median income. The reuirements are varied from year by the GSE "mission regulator," the Department of Housing and Urban Development.

The implementation of these goals began in the early 1990s, and as discussed above the period since then has been one of increased homeownership, especially among low income and minority borrowers (Bostic and Surette (2001)). However, the effects of the GSEs in particular, are hard to isolate. This is in part because banks via the Community Reinvestment Act have incentives to originate and/or hold similar mortgage types. Furthermore, it is possible that demand for mortgages from these groups increased and banks and GSEs simply responded.

These targets have been studied by An and Bostic (2005), who argue that the goals have indeed been binding; they have caused GSEs to hold more low income and minority loans than other wise. But it is not clear that this has done much to help low the targeted groups increase their mortgage borrowing, because there has been a substitution effect that has caused other lenders, *e.g.,* via FHA, to hold safer loans.

VI. Empirical Analysis

What Determines Market Share?

The data depicted in Figure two suggest a sharp shift in market share of originations in the early 1980s followed by sharp fluctuations in the 1990s and later. The data can be explained by the tradeoff model discussed in Section IV and the Appendix. For instance, the model predicts the possibility of a discontinuous change in market share like the ones in the early 1980s. Before 1982 the origination share averaged .09 with a variance of .0008; from 1982 on the average share was .43 with variance equal to .012. Statistical tests strongly reject both hypotheses that the means and variances are the same. There was a statistically and economically significant regime shift in 1982.

Shifts in market share, whether discontinuous or discrete, are due to changes in changes in information asymmetry or relative costs. We do not have direct data on either. Because the GSEs have dominated the FRM market, it is likely that that is market where costs are lower, for instance because issuing mortgage backed securities or long term debt (perhaps with hedging) is a cheaper way of managing interest rate risks than is available to banks.[23] Hence, we should expect a heavily fixed rate market (relative to ARMs) to favor GSEs. Similarly, heavy refinancing markets should favor the GSEs because refinancing loans are easy to process and have less asymmetric information because the borrowers doing the refinancing have survived and generally increased their equity.

[23] This, of course, is subject to change. Banks can raise money with short term deposits and use derivatives to convert it into debt that looks like mortgage debt, and some do. The argument is that the GSEs get better execution on the hedging (because of volume and because their credit risk is subsidized).

Table 2 present results of regressing GSE share of conventional originations on ARM and Refinancing shares of conventional mortgages and a linear time trend. The results are about as expected; ARM share has a negative (-.60) and significant sign and Refinancing a positive but not very significant sign. The time trend was positive but insignificant. In a similar regression for overall Agency (including Ginnie Mae) share of all originations coefficients were about the same and there was a small negative and insignificant time trend. So there is weak evidence of a time trend of GSEs substituting for Ginnie Mae, but not for the Agencies together growing in share.

Table 2:
Regressing GSE Share of Conventional Originations on Arm Share, Refinance Share and Time

	Coefficients	*Standard Error*	*t Stat*
Intercept	-347.033	739.6418	-0.46919
Arm share	-0.5963	0.252516	-2.36143
Refinance share	0.222508	0.142689	1.55939
Time	0.199018	0.371428	0.535818

Regression Statistics	
R Square	0.607093
Adjusted R Square	0.508866

Because ARM and Refinance share might be endogenous the above was redone with two stage least squares with current and lagged one year and 10 year Treasury rates as

instruments.[24] Results are depicted in Table 3. They are similar to the OLS results, though less significant.

TABLE 3

Two Stage Least Squares Estimates of GSE Share

	Coefficients	Standard Error	t Stat
Intercept	-150.432	816.8266	-0.18417
Arm share	-0.51731	0.328581	-1.57439
Refinance share	0.276405	0.174287	1.585915
Time	0.098636	0.410175	0.240474

Regression Statistics	
R Square	0.530649
Adjusted R Square	0.413312

Table 4 presents results from a similar exercise, but with the GSE change in stock as a share of mortgage stock change. In this model there is a strong *negative* trend in share, and the other coefficients are similar. The negative trend is probably due to extremely

[24] The first stage was as expected: Arm share depends positively on the slope of the yield curve and on the level of rates and refinance share depends negatively on the grwoht in rates.

high levels of the share in the early 1990s, probably having more to do with measurement error than with trend.

Table 4
Regressing GSE Share of Conventional Growth on Arm Share, Refinance Share and Time

	Coefficients	*Standard Error*	*t Stat*
Intercept	9449.672	1272.086	7.428483
Time	-4.70434	0.6383	-7.37011
Arm share	-0.76399	0.404433	-1.88904
Refi share	0.452666	0.229571	1.971794

R Square	0.85
Adjusted R Square	0.81

Overall the results are suggestive:

1. There was a sharp regime shift in the early 1980s.
2. Since then there has been no tendency for GSEs to grow faster than the market.
3. Changes in share in the 1990s and early 2000s were largely cyclical, brought on by changes the refinance and ARM share, which were brought on by cycles in interest rates.

By how much do GSEs lower mortgage rates?

Estimating the effects of FF on mortgage rates is made somewhat easier by the conforming loan limit. That is, there is a maximum loan size, indexed to house prices, that FF are allowed to buy. Virtually every Saturday Real Estate Section in the country publishes listed prices on mortgages, broken down, for FRMs, by "Jumbo" (above the

limit) and non jumbo. The difference between the two fluctuates but tends to be around 25 basis points.

That, of course, is not enough to get to the effect of FF. First it is necessary to control for quality of loan—is it the case that big loans have higher rates generally? Second, it is not clear that holding quality constant, this differential should measure the effect of FF.

There have been a lot of attempts at various controls to compute a constant quality differential. For a recent survey see Sanders (2004). Here I present two charts that capture most of what is important. The central point is that mere size effects can be identified separately from above or below the limit because size is a continuous variable. Figures one and two depict rates (average rates over $25,000 intervals) for fixed rate mortgages in California in 2002 and 2003. The data come from Federal Housing Finance Board data on purchase (no refinancing) mortgages.[25]

The charts show effective rates as deviations from the effective rate just below the loan limit. Clearly rates tend to fall with size and there is a sharp break at the conforming loan

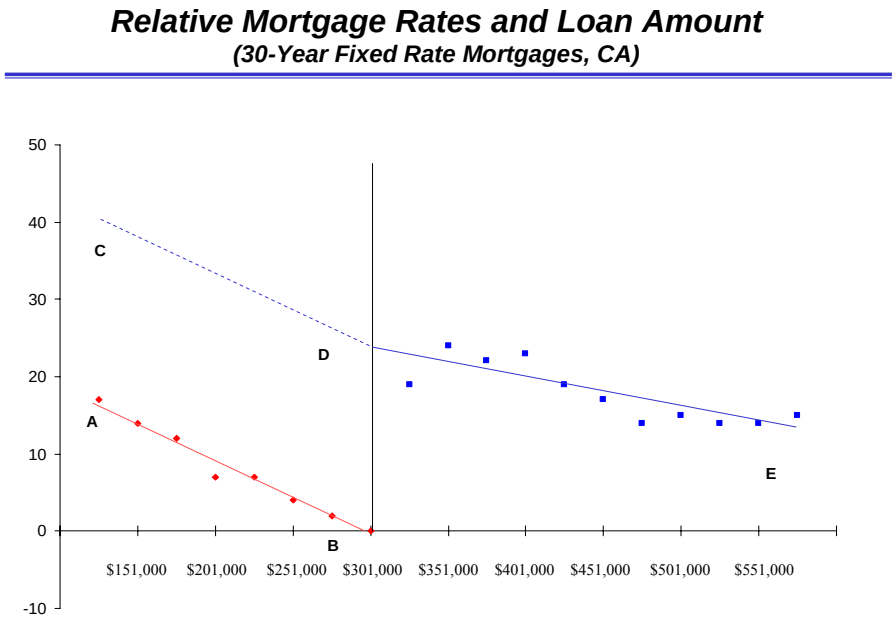
[25] The computations for the chart are based on the 2002 and 2003 Monthly Interest Rate Survey conducted by the Federal Housing Finance Board (FHFB). The FHFB asks thrifts, mortgage companies, and commercial banks to report the terms and conditions on all one-family, fully amortized, purchase money, nonfarm, first mortgage loans closed during the last five working days of the month. The data exclude FHA-insured, VA-guaranteed, and RHS loans, multifamily loans, mobile home loans, and refinancing. The comparison between the jumbo and conforming rates is based on the 30-year effective FRM. For 2002 the plotted points are $25,000 bands and include $301 thousand as the last dot in the conforming segment (1-unit loan limit was $300,700). For 2003 the plotted points are also $25,000 bands and include $323 thousand as the last dot in the conforming segment (1-unit loan limit was $322,700).

In order to account for some errors in the data set the following adjustments to the data were made: Observations with effective rates below the 75th percentile of the effective rates on 30-year ARMs for the month were excluded. Observations with effective rates that were more than 1.1 percentage points above the 30-year PMMS effective FRM rate for the previous month were also excluded..

I am grateful to Frank Nothaft for supplying the data.

limit. Similar results with more controls are found in Miller and Pierce (2001). The spread in both years was around 25 basis points. Recent work by Woodward (2005) with a different cross section of data suggests larger results. Sanders' survey and a recent paper by Vickrey (2006) suggest results mostly in this range and above.

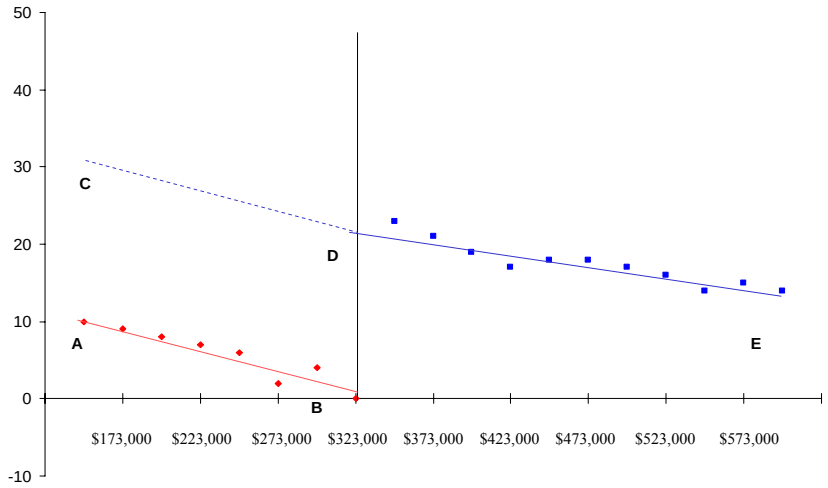
Figure Five: Jumbo-Conforming spread, California 2002



Source: FHFB 2002 MIRS, Freddie Mac PMMS

Figure Six: Jumbo-Conforming spread, California 2003

Relative Mortgage Rates and Loan Amount
(30-Year Fixed Rate Mortgages, CA)



Source: FHFB 2003 MIRS, Freddie Mac PMMS

The estimate of the spread is probably an underestimate of the effect of FF on rates because conforming and jumbo loans are substitutes; banks hold both of them. Hence, one would expect that if FF purchases lowered conforming rates, they would lower jumbo rates as well. One could imagine a world where jumbo and conforming loans were perfect substitutes and FF purchases of conforming loans lowered all rates by 25 basis points but left the spread at zero.

How much of the subsidy is passed through?

There have been several attempts at estimating the amount of the subsidy that is passed through. For instance, CBO (1996) estimated the extent to which the GSEs' benefit is passed through to borrowers. Their measure comes from dividing the extent to which FF lower mortgage rates, measured by the difference between conforming and nonconforming rates, by the extent to which their cost of funds is lowered by their charter, which they measure by the gross benefit defined below. The study estimated that the decline in rates (their estimate was around 35 bp) was only about two thirds of their

measure of the gross benefit to the GSEs (overt 50 bp) and that the retained part constituted about 40% of F and F's income..

First consider methodology. In Model 1 in Section IV the gross benefit to GSEs, the difference between its cost of funds and the purely private market's cost discussed above, is the distance FD. However, the distance FG is not a benefit to the GSEs because it is what is necessary for them to compete with the depositories. The net benefit is only GD. The benefit to depositories (gross and net are the same in this example) is the distance EC, which may or may not be bigger than the net benefit to the GSEs. The guarantee component of the benefit is less than the gross benefit, but by how much cannot be inferred from the picture.

The calculation should use the net benefit, which is the maximum amount that can be passed through. The difference, again, is that some of the gross benefit, FG in the figures, simply cancels out the benefit to depositories, leaving the net benefit at GD. Hence, that methodology does not measure how much of what could be passed through actually is passed through. By construction (because I assumed the supply curves allowed for only normal profits), in both Models 1and 2 all the net benefit is passed through, but both models are also consistent with CBO's calculation that 40% is kept.

The adjustment from gross to net can lead to a GAO type number of around 100% despite GSE profits. One should be agnostic about all of these numbers, but one explanation for passing through a large share, yet apparently keeping a large share is that the GSEs get to spend their subsidy in the bond market, which has been a more efficient place to raise money for fixed rate mortgages than the bond market, so there is a surplus created by the guarantee, which can be passed around..

To the extent the benefit is kept by the GSEs in the form of excess profits, it is unlikely that much goes to current shareholders, because in an efficient market, it will already have been capitalized into stock price. Current shareholders paid for it when they bought the stock and cannot expect to earn more than normal returns. The benefits of the GSE

charter have already been auctioned off. In short, the distributional effects of FF are not very easy to sort out.

VII. Comments

Central points of the paper are:

1. GSEs lower mortgage rates by around 25 basis points. This comes with a social cost because it might distort resource allocation and because the implicit guarantee may require actual cash payments some time in the future.
2. Because both banks and GSEs have similar subsidies (at the margin) welfare effects of GSEs are deeply embedded in second best considerations, and are ambiguous. There are in principle valid 'second best" reasons for promoting GSEs in mortgage markets.
3. However, there is very little empirical evidence, positive or negative, about the welfare implications of the GSEs, My guess is that the most likely place to look for positive effects is less in targeted lending and stimulating housing (Models 1 and 2 in section V suggest that the accompanying incentive for bigger houses might (or might not) be welfare reducing) than in providing liquidity, an elastic supply of funds, and perhaps as an alternative to the tax system for promoting homeownership. From the stand point of urban issues the targeted lending might be the most important. For instance, it has an explicit central city related component. It is probably impossible to sort out the separate effects of the GSEs under the current overlapping scheme of subsidies and incentives.
4. More generally the effects of the GSEs on urban economies are indirect and not much different from their effects on other parts of the economy. It is the case that their subsidy is disproportionately bigger for lower income borrowers because it comes before tax. To the extent that urban economies benefit from more low downpayment loans and lower before tax rates the GSEs have been a benefit in ways that have also not been quantified.
5. It is possible to model the structure of the mortgage market with a simple model of tradeoff between information and cost, and the model does not fit recent history poorly. GSE share had a discrete shift in early 1980s, but no discernable trend

since then.[26] Rather its share is cyclical and can be explained by type of project dominant in the market. In particular GSE share increases with refinancing share and decreases with ARM share.

6. GSEs pass through some of their subsidy, and they keep some. Recent efforts to quantify this have not been successful and suffer from methodological problems. An important aspect of the discussion is that GSEs get to spend their subsidy in the bond market, which gives them an advantage over banks (especially for fixed rate mortgages) that is independent of the relative values of the guarantees.
7. The difference between what GSEs can do and what banks can do is now small. Banks can hold long term fixed rate mortgages funded with deposits and use hedges like GSEs use to control interest rate risk. MM suggests that in the future market share is likely to be volatile and not very important in terms of resource allocation.

Pricing and Guarantee Fees

Much of the policy discussion regarding GSEs has revolved around questions of risk, safety and soundness and financial issues, beyond scope of this paper. The paper does suggest that there are distortions in the market which raises the question of the use of pricing as a way controlling them. Two issues are addressed here: that banks and GSEs get subsidies and that there is desire to stimulate homeownership especially for low income minority and central city borrowers.

A vehicle for the latter has been special programs. A problem is that the portfolio restriction approach (something in excess of half of the loans are required to be targeted to below median income households) is difficult to evaluate. A better policy would be a "wedge" policy that uses taxes and subsidies to promote change in relative prices, giving targeted groups relatively lower borrowing rates. For instance, if target loans are 20% by volume, charge a 5 basis points tax on non target loans and use the proceeds to pay a 20

[26] As an aside recent concern that the GSE expansion of its debt funding relative to pass through activity has been a vehicle for increasing market share appears to be overrated. The portfolios, especially of Freddie Mac began expanding in the mid 90s and appear to be uncorrelated with market share.

basis point subsidy to target loans. This is revenue neutral, and it gives a 25 basis point advantage to buying target loans, which cannot be substituted away.

A version of this would be a tax or user fee on both banks and GSEs equal to the subsidy to borrowing rates stemming from their guarantees but exempt mortgages from targeted groups. The second best considerations in Models 1 and 2 above suggest that if the fee is not charged to banks then the second best policy would not be to charge the GSEs but to use a wedge policy.

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APPENDIX: A Model of Market Structure

This appendix comes from Van Order (2006), which develops a model of equilibrium in an asymmetric information world like the one described in the text. In particular, there are dueling charters in the two dimensional sense in the text. The first dimension is market operation: the GSEs, or more generally, the secondary market insitutions (SMs) do originate mortgages, so they risk being selected against the banks who originate loans. The second dimension is in cost: it is assumed that either because of differential subsidies or advantages of dealing directly with the bond market SM has lower cost. In the model risk comes from credit risk, which comes from the assumption that borrowers default (exercise a put back to the lender) when the loan is due and equity is negative. The asymmetric information comes from borrowers knowing more about property value than lenders. This allows use of the well known Black Scholes model to price the mortgage, and it adds the "convexity" that was needed to generate the results in the example in the text. Convexity is a standard part of option based models, to the model, which leads to the possibility of discontinuous changes in market share.

Assumptions

Information

There are two types of information for the two financial institutions: that known to everyone at no cost and that which is costly to obtain.

Agents

There are two types of agents: borrowers (homeowners), who finance houses, which are financed with loans secured by the houses, and the two types of financial institutions (FIs), which lend to the borrowers. All agents are assumed to be risk neutral

and maximize expected wealth.[27] All decisions are for one period only, so that intertemporal risks and expectations are not considered. Parameters are known during the period; though they may change over time.

Basics of behavior are:

1. *Borrowers.* There is a continuum of borrowers indexed by i. Borrowers have one period loans. The value of the property securing the loan is a random variable, X. It is assumed that loans take the form of discount bonds that pay \$1 at the end of the period. At the end of the period the borrower maximizes wealth by paying off the loan if $X \geq \$1$ and defaulting otherwise. Borrowers know the distribution function of X at the end of the period.

2. *Financial Institutions*. There are two types of FIs, banks and securities market firms, SMs. There is a continuum of identical banks and identical SMs. As a result of their charters banks have better information, but SMs have lower operating costs.

Banks along with borrowers are assumed to know the distribution function of the terminal value of X, loan by loan. SMs do not know loan by loan details. The portion of the market served by SM is denoted by s, the portion served by the banks by b, and the level of loans originated is N. Then $N = b + s$; N is assumed to be exogenous.

Banks can hold risk free, zero transaction cost bonds or make loans to borrowers. They face two noninterest costs: an upfront operating cost, C^b, which is the cost associated with underwriting the loans and other operating costs, and the expected present value of default costs, which for the ith firm is given by C^i . It is assumed that underwriting costs are paid by borrowers upon application, and are not refunded if the borrower does not choose to sell the loan (bond) to the bank. Default costs are covered in the upfront discount.

Then the opportunity cost to the banks of a \$1 discount bond purchased from the i th firm is given by

[27] This is stronger than is necessary. One could assume that the probabilities assumed below represent equivalent martingale probabilities.

(1) $B^i = 1/(1+r) - (C^b + C^i)$

where r is the interest rate on a one period risk free loan with zero transaction cost. In competitive equilibrium (1) gives the price of the loans if they are held by banks. As in the example, it is assumed that $r = 0$.

SMs have operating costs given by C^s; $C^b > C^s$. They can hold risk free bonds and/or compete with banks in holding the loans.

Financial structure is determined by the balance between the two charters, in the sense of allowing zero profits and nonnegative shares for both FIs. The model is solved by first determining the risk structure of loans, i.e., expected default cost as a function of rank, from worst to best. This determines the order in which loans are sold to the GSEs (SMs) as the latter offers higher prices (or lower interest rates) and bids loans away from banks. Equilibrium comes from assuming free entry and zero profits for both FIs, so that price equals average cost for both. An equilibrium can be either an interior one, where both FIs have positive market shares, or it can be a corner solution, where SM takes over the entire market. The movement back and forth between the two equilibrium types can be discontinuous.

The Risk Structure of Loans

The risk structure comes from transforming C^i, the expected default cost for the loan to the ith borrower, into a function of the rank of the loan, from worst to best, so that default cost can be represented by a function, $C(n)$, $n \in (0, N)$, where $C(n)$ is the default cost of the loan that ranks nth in expected default cost among the loans. The riskiest loan is assigned a rank of 0 and the safest a rank of N.

C^i comes from the option to default and give up the collateral at the end of the period. Hence, it's value depends on the distribution function of $X(1)$, the value of X at the end of the period. This will be conditional on the value, $X(0)$, of X at the beginning of the period, and it is given by

(2) $C^i = \int_{-\infty}^{1} (1 - X(1)) P(X(1) \mid X(0)^i) d(X(1)) \equiv V(X(0)^i)$

where *P( )* is the distribution function of *X(1)*, conditional on *X(0)*.

Let $F(X(0))$ be the distribution function of *X(0)* across firms. Then $F(X(0))$ gives the number of borrowers for whom *n* is less than or equal to *X(0),* and the inverse of *F, G(n*), ranks borrowers from riskiest to safest according to their level of *X(0)*.

Then *C(n*) is given by

(3) $C(n) = V(G(n))$

with

$C' = V'G'$

and

$C'' = V'G'' + G'V''$

A particular version of the model is one in which log*X* follows a random walk, in which case *P( )* is lognormal. Then the value of *V(X(0))* is given by the Black-Scholes formula for a put option on a nondividend paying asset, and expected default costs are given by

$$(4) V(X(0)) = X(0)\Phi(-d+\sigma) - \exp\Phi(-d)$$

where

$$d = \frac{\ln X(0) + \sigma^2/2}{\sigma}$$

and *Φ ( )* is the cumulative normal density function (e.g., see Hull (1997)).[28] Because the Black-Scholes formula is homogenous of degree zero in asset value and strike price, it is clear that the model could also be formulated in terms of different borrowers having different strike prices, e.g., because there are costs of exercising the option that vary across borrowers.[29]

[28] The risk neutral formulation allows use of the Black-Scholes formula without having to appeal to arbitrage models.

[29] It could also be formulated with asymmetric information about volatility.

It is assumed that $F(X(0))$ is the uniform distribution. Then

$F(X(0)) = aX(0)$,

and

$G(n) = n/a$

Then with appropriate choice of units

$$(5) C(n) = n\Phi(-d + \sigma) - \exp\Phi(-d)$$

where

$$d = \frac{\ln n + \sigma^2 / 2}{\sigma}$$

and

$n \in (0, N)$

Because this is the Black-Scholes formula, $C(n)$ is a smooth convex function of n, which approaches zero as n approaches infinity, and (see Hull)

$$(6) \quad C' = \Phi(d(n)) - 1 = -\Phi(-d(n)) < 0$$

and

$$(7) \quad C'' = \Phi'(-d(n))/\sigma n > 0$$

Adverse Selection and the Securities Market

Because banks have asymmetric information the riskiest loans will gravitate to SMs. SMs maximize value subject to their costs, the pricing of banks and the behavior of households, who sell their mortgage to the highest bidder.

Then *C(n)* determines the order in which firms unload loans to the securities market as SMs offer to buy loans at successively higher prices (lower interest rates). Equation (6) implies that marginal costs for SM decline as SM purchases increase. The default cost of the last loan sold to SMs is *C(N-b)*, which in turn equals *C(s)*, and $s = n$.

Average cost to banks is given by

(8) $AR(s) = C(s) + C^b$

Then *AR(s)* can be thought of as the equilibrium (zero profit) fee, $f_b(s)$, charged by banks for loan *s*. Because SMs do not know the quality of particular loans, they offer only one price for loans regardless of quality, and *AR(s)* is an offer (demand or average revenue) curve faced by SMs. Their corresponding fee is f_s, and we can think of SMs as offering successively lower fees (or lower interest rates) as they bid loans away from the banks. The loans that SMs get are the loans for which $f_b(s) \geq f_s$.

The expected marginal cost of adding a loan to the portfolio of an SM is the default cost of the next best loan plus the SM's costs, or

(9) $MC(s) = C^s + C(s) \equiv AR(s) - \Delta$

where $\Delta \equiv C^b - C^s$ is the cost advantage for SMs.

Expected total revenue for SMs is given by

(10) $TR(s) = C^b s + C(s)s$,

Expected total cost is

(11) $TC(s) = C_s s + \int_0^s C(\theta)d\theta$.

Expected profits for SMs are

(12) $\Pi(s) = \Delta s + C(s)s - \int_0^s C(\theta)d\theta$.

Expected marginal revenue is

(13) $MR(s) = C^b + C(s) + C'(s)s$

and expected average cost is

(14) $AC(s) = C^s + \int_0^s C(\theta)d\theta / s$

Equilibrium

Equilibrium is characterized by zero profits for both banks and SMs[30] (that they are on the AC curve if they hold any loans) and maximum profits and nonnegative levels of business for both. The zero profit condition for banks is already incorporated into the offer curve, equation (8), which gives the break-even fee charged by banks. Given that, market equilibrium is determined by the zero profit condition for SM.

The equilibrium is constrained by the condition that

(15) $s \leq N$

If there is an interior solution ($s < N$), zero profit for SM requires that

(16) $f_s = AR(s) = AC(s)$

Otherwise

[30] Similar results hold if, for instance, it is assumed that SM is a monopoly.

(17) $s=N$

and

$f_s = AC(N)$

Consider the first condition, (16), which comes from equations (8) and (14). Let average minus marginal default cost be given by

(18) $D(s) = \int_0^s C(\theta)d\theta / s - C(s)$

$s \in (0, N)$

Then (equating AR in (8) with AC in (14)) the zero profit condition can be written as

(19) $\Pi /s = D(s) - \Delta = 0$.[31]

It is straightforward to show that

(20) $D'(s) = -D(s)/s - C''(s)$

and

(21) $D''(s) = -D'(s)/s + D/s^2 - C'')$

From the properties of the Black-Scholes model it can be shown that[32]

(22) $D(0) = 0$

$D'(0) > 0$ *at* $s=0$

[31] Note that SM's lower costs guarantee that s is always positive.

[32] Black-Scholes implies that *C(s),* marginal cost, is convex and approaches the horizontal axis. The rest of the properties follow from well known properties of average and marginal cost.

$D(s) \geq 0$ *for* $s \geq 0$

and

$D(s) \rightarrow 0$ *as* $s \rightarrow \infty$

Figure A-1 depicts *D(s)*. Continuity of *D(s)* and the properties in (22) assure that *D(s)* has a maximum, and it can be shown (see Van Order (2006) that this maximum is unique and that there is no local minimum beyond the maximum. Hence, *D(s)* is shaped as in the Figure, and we can let the level of *s* corresponding to the maximum level of *D(s)* be given by s^* and

$$(23) \quad \Delta^* = D(s^*) \equiv D(N^*)$$

where N^* is the market size that corresponds to the maximum level of *D(s)*.

Equilibrium must either be at an intersection of Δ and *D(s)* or at the intersection of Δ and *N,* with price equal to *AC*. The key property of *D(s)* is that it has a maximum, which implies that Δ can intersect *D(s)* more than once, which is what introduces the possibility of fragility. Because *D(s)* is average cost minus marginal cost we should, from well known properties of average and marginal cost, expect it to have a maximum for a wide range of convex marginal cost functions.[33]

From (19) it can be seen that combinations of Δ and *s* above *D(s)* in Figure one correspond to positive profit, π, for SMs, and points below *D(s*) correspond to negative profit. Consider first the small market case where $N \leq N^*$ (at N' in the figure). For $\Delta \leq \Delta'$, equilibrium will be at an intersection of Δ and *D(s)*. At any position to the left of *D(s)* SMs will have positive profits, which will be competed away by new entrants; similarly, to the right of *D(s)* profits will be negative. For $\Delta \geq \Delta'$, equilibrium will be

[33] In particular, average and marginal cost are always equal at s equal zero (if they are defined at zero); if marginal is falling near zero then average must exceed marginal; and if marginal is constant over some range or approaches some constant level, then average must equal or approach that same level. Hence, in a "strongly convex" situation where marginal cost approaches some level asymptotically, the difference between average and marginal approaches zero. In that case the difference is zero at zero, near zero for large values of s and positive at least somewhere in between, so by continuity it must have a maximum.

the intersection of the horizontal line at Δ with N', and the equilibrium fee for SM will be given by average cost at $s = N'$. Depending on the size of Δ, equilibrium can be anywhere along OGJL.

Next consider the more interesting (large market) case where $N^* \leq N$ (and N is given by $\overline{N}$ in the figure). Equilibrium in this case is complicated by the ability of SMs to move discretely (or new SMs to enter) to a position where they take over the entire market. In particular, along the segment GM, which is determined by $\bar{\Delta}$ and Δ^*, SM profits are zero, but SMs do not maximize profits by staying there because they can make positive profit by moving to the market area between *D(s)* and HI and undercutting the prices of the SMs on GM. The solution that is consistent with both profit maximization and zero profits is along HI, with SM taking over the entire market and profitable undercutting not possible. For $\Delta < \bar{\Delta}$ only points along OG are possible equilibria (taking over the market has negative profits). For $\Delta > \Delta^*$ SM profits are positive at any level of s less than $\overline{N}$, so the boundary, $\overline{N}$ (along IK), with fee equal average cost, is the equilibrium.

Only points on the bold-faced lines OG and HIK can be equilibria. There are two types of equilibrium. The first one, along OG, can be characterized as a "loan shark" equilibrium, because SM takes the worst of the loans, as is typical of lemons models, and interest rates and default costs are high. The second is a corner solution, along HIK, where SM dominates the market. As shown in the picture there is always a switch point where equilibrium and market share change discontinuously (see Van order (2006).

The case where SM's advantage is in having an elastic source of funds, with banks having an inelastic source, can be represented in the model. Figure A-1 then looks the same except that Δ increases with N and may initially be negative.

In this model when there is a discrete jump it is from a position of SM holding some of the market to SM holding all of it. This is an artifact of the assumption that the distribution of property values is uniform. For instance, if the distribution of property value *F( )* is S shaped, there can still be discrete shifts in market share, but not necessarily to 100% of the market (see Van Order (2006).

Major predictions of the model are:

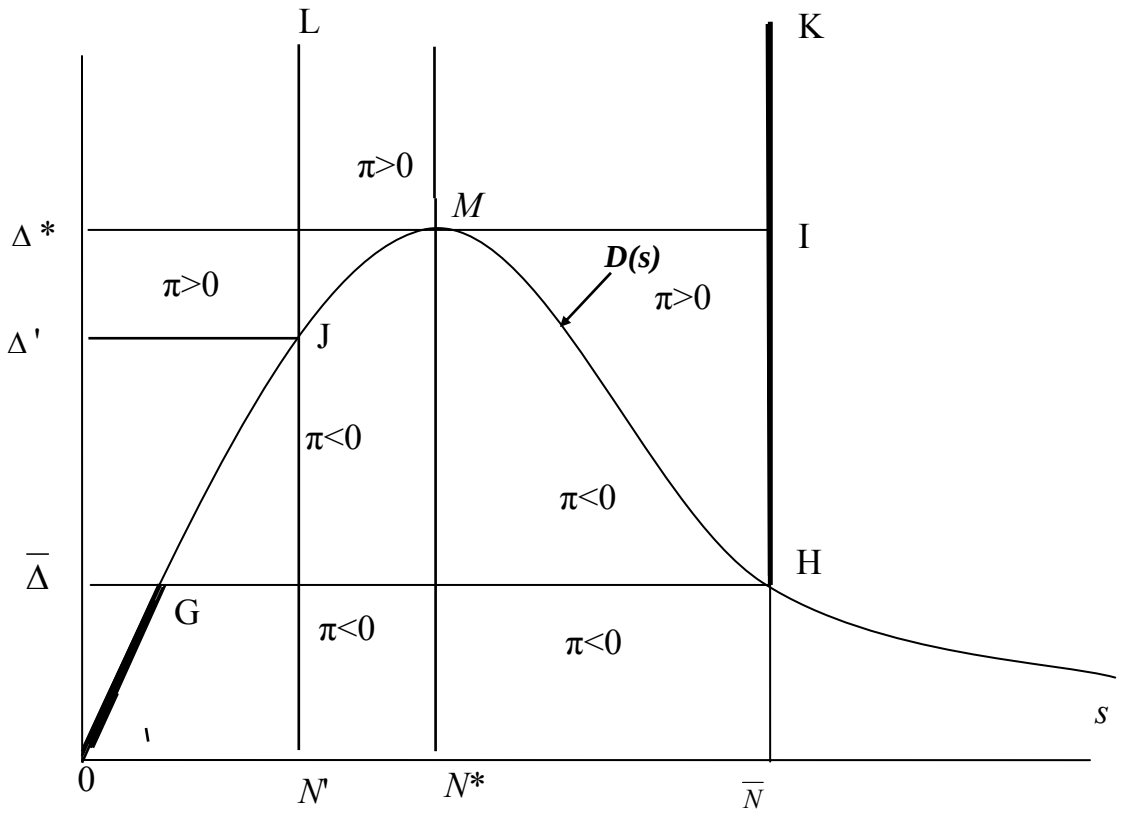
1. Within a market segment SM's share will increase with it's cost advantage and decrease with the range of asymmetric information, as measured by the slope of *C(N)*.

2. Similarly, SM will have a bigger share in markets in which it has bigger cost advantages and where information is more transparent.

3. Market share can shift discontinuously. For instance as SM's cost advantage increases or it is better able to control information, for instance by technological changes that flatten *C(N*).

FIGURE A-1:

MARKET SHARE WITH UNIFORM DISTRIBUTION OF PROPERTY VALUES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