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180 Years' Evolution of the US Mortgage Banking System: Lessons for Emerging Mortgage Markets*

Man Cho

The KDI School, Seoul, Korea; man_cho@jhu.edu

This study is structured around two objectives: surveying the 180 years' evolution of the US mortgage intermediation system (MIS); and, extracting the lessons to be learned by emerging mortgage markets. To that end, I first discuss three pillars of a well-functioning MIS as a conceptual underpinning - intermediation efficiency, affordability enhancement, and risk management. The historical survey proceeds based on four reasonably distinct time periods – (1) the era of exploration (pre-1930s or pre-Great Depression era), (2) the era of institutionalization (1930s to 1960s), (3) the era of market-making (1970s and 1980s), and (4) the era of expansion and efficiency gain (1990s to Present). Based on the survey done, the lessons for other countries are organized under five topics: developing conforming mortgage product and market; extending the service to non-conforming segments; managing default and prepayment risks; managing systemic risk; and, developing an efficient intermediation process. The concluding remarks in the final section comprise the issue of right sequencing: that is, through what steps an MIS in a given country can be evolved toward a more market-based one that can deliver a higher degree of consumer welfare.

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Keywords

mortgage banking and intermediation; housing affordability; risk management

Introduction

The US Mortgage Intermediation System (henceforth, the USMIS) is one of the largest and most complicated financial systems in the world. It manages an extensive portfolio of \$8.8 trillion mortgage debt outstanding (MDO) as of the end of third quarter 2005, which amounts to nearly 70% of nominal GDP during the period; is highly efficient with the competitive primary market for loan production and servicing and with the liquid secondary market for funding; and, offers consumers with various affordable loan products such as high LTV loans for wealth-constrained households, subprime mortgages for those with impaired credit records, and reverse annuity loans for house-rich cash-poor senior citizens.

In recent years, the system also served as a stabilizer to the macroeconomy, as evidenced by several studies. That is, aided by the strong home price appreciation and the low mortgage interest rates since the late 1990s, the USMIS enabled a large number of households to liquidify their home equities for consumer spending and for capital investment (Case, Quigley, and Shiller (2001) and Leung and Zeng (2005)) The net mortgage equity extraction - the total amount of newly-originated loans minus the total repaid loans - also jumped to \$800 billion in 2004, about 170% increase from \$300 billion in 2000. (Greenspan and Kennedy (2005))

The USMIS experienced a tremendous growth since the early 1990s and achieved further maturity in its key functions of lending, funding, servicing, and risk management. However, the system has a long history of evolution, over 180 years from the first recorded institutional lending in the 1830s. Throughout that evolution, economic shocks often stimulated discrete policy shifts, which in turn led to innovations in product development and risk sharing arrangement. The main objective of this study is two-fold: first, to survey the milestone events that shaped the USMIS over time; and, second, to extract lessons to be learned by emerging mortgage markets from the US experience.

I believe that the historical survey of this sort can shed light as to how a given sector in economy - the mortgage banking industry in our context - started in the first place, and what events, whether they are driven by institutions or by markets, triggered structural changes in the industry. Not

surprisingly, there are a number of good references on the history of the US mortgage market (Jacobides (2001), Lea (1994), Weicher (1988), and Hendershott and Villani (1977)). Building upon these studies, I aim to extend the analysis in several fronts. First, I survey the recent period of 1990-2005 in a greater detail, more so than others, as it represents the era of another big shift in the landscape of the USMIS caused by the advancement of Information Technology (IT) and other innovations. Second, the study also attempts to come up with a set of performance indicators in gauging how well-functioning a given MIS is in terms of serving its promised social and private functions. The lessons for other countries are organized along these performance indicators.

The following list represents main findings from the study.

- As an organizing concept throughout the study, Section 2 elaborates three pillars of a well-functioning MIS – intermediation efficiency, affordability enhancement, and risk management. A set of success factors for each dimension, both qualitative and quantitative, is listed and used in subsequent analyses. The trade-off between risk and affordability in the context of market segmentation and expansion is one of the core issues discussed.
- The historical survey in Section 3 starts with the analysis of long-term trend (1895 to 2004) of the yield spread between residential real estate loans and high-quality corporate bonds in the US. The trend indicates that USMIS has achieved a comparable level of intermediation efficiency over time to that of the corporate debt sector: that is, the spread has been stabilized over time with zero to 50 basis points (bps) premium; and, there are several small peaks in the recent years that correspond to the heightened prepayment risks in holding mortgage portfolio in those periods, which in general does not exist in the corporate sector due to various call protections. The historical survey in Section 3 is done for four distinct time periods – (1) Era of Exploration (Pre-1930s or Pre-Great Depression Era), (2) Era of Institutionalization (1930s to 1960s), (3) Era of Market-Making (1970s and 1980s), and (4) Era of Expansion and Efficiency Gain (1990s to Present).
- The 180 years' evolution of the USMIS has brought about a number of outcomes that enhance the welfare of both consumers and investors:
 - Heightened liquidity with the rise of the secondary market, as evidenced by the increase of MDO from \$1.5 trillion in 1980 to almost \$9 trillion in 2005;

- Well-established conforming market segment, in which the 30-year fixed-rate mortgage (FRM) with no prepayment penalty is used as the “plain vanilla” (or benchmarking) product by industry participants;
 - Growing non-conforming sector, with the rising volume of subprime loans that further enhance the affordability in home purchase for marginal borrowers;
 - Maturing markets for trading the borrowers default risk with key players from both private and public sectors;
 - Active markets for trading the prepayment risk borne by mortgage pools/portfolios, via structured finance products and enabled by various industry-wide norms;
 - Efficient loan production and servicing processes assisted by AUS (Automated Underwriting System) and other IT/model solutions;
 - Rising home ownership rate from 64% in 1995 to 68% in 2004.
- Using the historical survey done, Section 4 discusses the lessons that can be leveraged by emerging mortgage markets. It covers five particular topics: On developing a conforming market; On expanding the service to non-conforming segment; On managing default and prepayment risks; On managing systemic risk; and, On intermediation efficiency. Section 5 provides several concluding remarks.

The target audience of this study includes interested parties from academia, mortgage finance industries, and governments of different countries. In terms of data, I used academic studies on various topics covered as the primary source. Where appropriate, I also tried to inject a practitioner’s view based on my experience as a student of the USMIS during the last fourteen years.

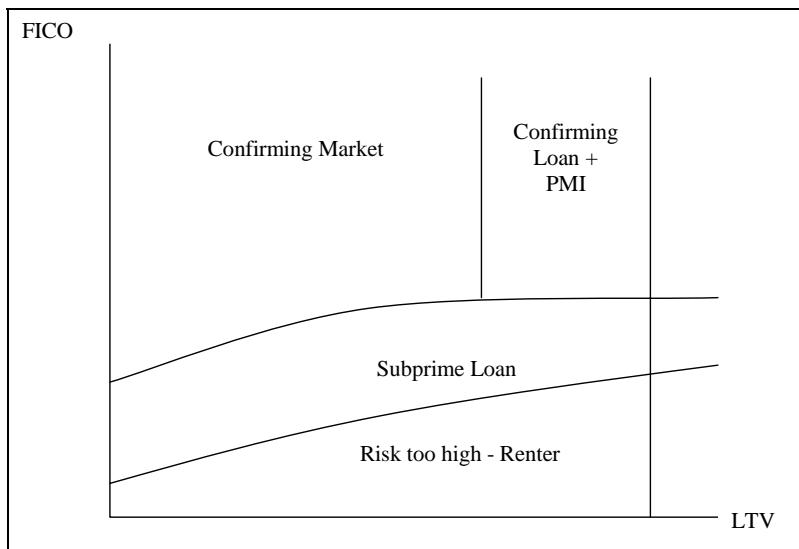
Assessing MIS – A Quest for Criteria

If one is to come up with a scorecard to assess a given MIS, what performance indicators should be therein? Answering this question is non-trivial due to several complicating factors. That is, by the nature of its function, the system is closely linked to multiple markets in an economy with housing, long-term bond, and derivative markets being the major ones; Various public and private institutions operate in the system as intermediaries, insurers, and regulators because the outcome of this sector has important implications both in terms of profit-making and in terms of achieving public policy goals; The system also deals with segmented markets that are differentiated by loan product, default insurer, and other

loan characteristics.

In general, the efficacy of MIS can be assessed by examining three inter-related factors: How efficiently, or cheaply, the system delivers different products, mortgage products to consumers and MBS products to investors; How broadly the lending products penetrate target consumer cohorts, or how affordable the loan products offered are; and, how safely the system as a whole manages various risks embedded in the mortgage and MBS products. As an illustration, the current market segmentation in the USMIS is shown below¹, along two key risk dimensions – the borrowers' idiosyncratic risk summarized in the consumer credit score (FICO) and the cushion in the collaterals' asset values shown by the loan-to-value (LTV) ratios. Each of the three questions will be elaborated below, to serve as a conceptual basis for subsequent analyses.

Figure 1: Market segmentation in USMIS



Intermediation efficiency

Ceteris paribus, the lower the “net” intermediation cost, the more efficient the system is. In particular, Lea and Diamond (1993) specified the excess yield (δ) in mortgage lending as the spread between mortgage lending rate

¹ I owe Tyler Yang for valuable suggestions in coming up with the segmentation picture in Figure 1.

(r^m) and risk-free rate (r^f) net of risk premia, and used that in their comparative study of the OECD countries:

$$\delta_t = r_t^m - r_t^f - \text{Risk premia}_t \quad (1)$$

The excess yield, equivalent to option-adjusted spread (OAS), represents business profit and intermediation cost (or G&A). In a well-functioning MIS, δ should be positive enough to attract for-profit market entities but, at the same time, it should convert toward zero as the system becomes more efficient and more arbitrage-free.

The problem of δ as a performance indicator is the fact that there are various measurement issues in consistently estimating that and using that in comparing the systems in different countries or in different time periods. To name a few such issues, loan characteristics can vary widely both cross-sectionally and inter-temporally; forward-looking measurement of risk premia involves with a number of complicated modeling techniques, for which the best practice is either not known or non-universal; in many emerging markets, a proper benchmarking rate (r^f) does not exist because a well-developed long-term bond market is a rarity; and, systematic risk factors are also hard-to-control consistently given diverse economic and regulatory regimes in different countries/time periods.

Nevertheless, there are several indicators that one can come up with to gauge the level of intermediation efficiency, as I suggest below:

Intermediation efficiency:

- Positive δ , as perceived by market participants, to induce the participation of, and the competition among, for-profit business entities;
- Low transaction cost when underwriting and issuing loans, achieved through IT solutions for different steps of intermediation and through the specialization of key functions (e.g., efficiency gain via unbundling);
- Control mechanisms in place, both at- and post-origination of loans, to check and alleviate the moral hazard problem in the form of document and other types of fraud.

Mortgage affordability vs. risk management

Another problem of δ as a performance indicator is the fact that it is narrow in scope in assessing MIS and leaves out other functions that it is supposed to play. Two such functions include (1) enhancing the affordability in home purchase and in utilizing home equity as a liquid asset, and (2) proper

control of the risk, mainly borrowers' default and prepayment risks, both under normal economic environments and under stress (or tail-side) economic outcomes, that is, systemic risk events.

Each of the above two factors is multi-dimensional in nature and no single measure hardly represents that with a reasonable completeness. For example, the level of affordability is determined by the maximum loan-to-value (LTV) ratio allowed throughout the system and by the maximum debt-to-income ratio (DTI), or by the restrictions in terms of consumer credit ratings in making lending decisions for different products. Each of these, in turn, is also influenced by the existence and the size of the market for mortgage default insurance. There are numerous other factors that impact the affordability as well, such as the maximum loan amount (e.g., the loan limit for the conforming loans market in the US) and other loan characteristics (e.g., amortizing vs. non-amortizing, and fixed-rate vs. floating-rate mortgages).

The important issue to discuss in this context is how we segment the market and through what products and risk-control means we target different consumer cohorts in each market. Several points are worth noting with this regard. First, in any economy, there is a consumer cohort that is beyond the service of MIS, either those who are too highly income/wealth-constrained for the system to serve or those whose credit records are too much impaired to offer any loan type at a particular point in time. The rental market in Figure 1 is such segment.

Second, once a conforming market segment is formed, then it serves a certain segment of population. At the same time, it also sets a corresponding level of risk to manage by that market segment as a whole (in terms of LTV, FICO, PMI, and other risk factors), as illustrated in Figure 1. As the system matures, it can extend the service to a larger segment of population, either by expanding the conforming market or by developing a non-conforming market segment (as labeled by subprime segment in Figure 1).

Third, the evolution of the USMIS is the history of expansion of both the conforming and non-conforming market segments, which makes it possible to transition the risk appetite for the system as a whole to achieve a higher degree of housing affordability. Along that transition path, different risk management techniques to control the heightened risk are also developed, as surveyed in the next section.

In terms of the performance indicators for the affordability (A) and the risk management (R), there are several performance indicators to suggest based on several recent studies (Mercer Oliver Wyman, 2005 and Miles, 2003 and 2004).

Affordability enhancers (A):

- Availability of a long-term fixed-rate mortgage (FRM);
- Existence of a well-defined conforming market segment (via various lending criteria);
- Existence of non-conforming segments to serve marginal borrowers;
- Availability of consumer education and counseling.

Risk Management Infrastructure (R):

- Risk-based pricing, underwriting, and capital allocation;
- Availability of industry-wide norms and data sets to support risk-based transactions:
 - Consumer credit score (and underlying micro data to estimate that);
 - Expected prepayment speed (e.g., the PSA multiples in the US);
 - Benchmarking interest rates ;
 - Home price indexes for granular geographical locations;
- Hedging instruments to control the prepay risk (e.g., interest rate swaps);
- Foreclosure law and other legal infrastructure for managing default/delinquent loans;
- Mortgage insurers and other risk-sharing partners;
- Risk-based capital adequacy rules and appropriate measurement infrastructure, along the same line of three “Pillars” of supervision identified in Basle II.

Historical Survey

Bird's eye view

One long-term historical trend to note (1895 to 2004) is the yield spread between residential real estate loans and high-quality corporate bonds in the US. The spread, as shown in Figure 2², gauges relative intermediation efficiency of the mortgage lending sector vis-à-vis the corporate sector. After the two historical peaks – one around the Great Depression with over 240 basis points (bps) and another during the high-inflationary period in the early 1980s, the spread shows a stabilized trend during the 1990s and 2000s

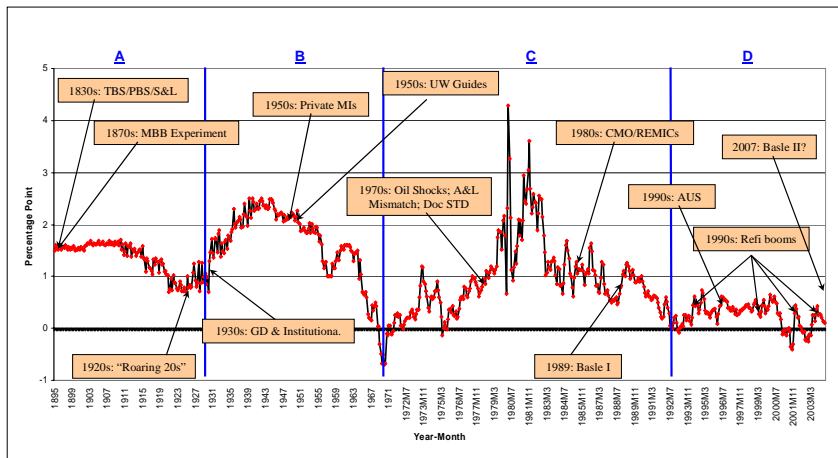
² The chart is from Cho (2006). The data represents a combined series of three sources – (1) annual data between 1895 and 1952 on the difference between mortgage rates in New York and yields on long-term corporate bonds (from Grebler et al. (1956)), (2) monthly data between 1955 and 1971 on the difference between the national average effective mortgage rate and yield on 20-year AA utility bonds (from Hendershott and Villani (1977)), and (3) monthly data between 1971 and 2004 on the spread between the rates on 30-year FRMs and AAA corporate bond.

with the range between 0-50 basis points (bps) and several smaller peaks. These peaks in the recent period correspond to the refinancing booms in the US, implying that those minor upsurges likely reflect the prepayment risk in holding mortgage securities. That risk does not generally exist in corporate bonds due to various call-protections.

The point to make is that the mortgage lending sector in the US has improved its intermediation efficiency over time, and has now gained the confidence from the market place after having gone through several iterations of economic shocks, institutionalization, and innovations in risk management and product design.

The figure also visualizes several distinct patterns over time. That is, it was hovering around 150 basis points (bps) until the turn of the century and gradually declined to about 100 bps during the booming economy of the 1920s (Phase I); rose again since the Great Depression up to 250 bps in the late 1940s but declined to zero or even negative during the Oil Shock period of the 1970s (Phase II); experienced a high degree of volatility in the inflationary periods of the late 1970s and the early 1980s and reverted back to zero in the recessionary period of the early 1990s (Phase III); and, stabilized in the range between zero and 50 bps since then with several smaller peaks during the 1990s and 2000s (Phase IV). The historical survey in this section will proceed based on these four reasonably distinctive time segments. Appendix 1 provides a summary of each time segment in terms of key institutions, prevalent mortgage products, and economic shocks.

Figure 2: Yield spread between mortgage & corporate debts & milestone events



Era of Exploration (Pre-1930s)

The record shows that the first institutional mortgage lending in the US was in 1835. The prevalent institutional arrangement at that time was “Terminating” Building Societies (TBSs), which played a dominant role in the early- to mid-19th century. TBSs, whose origin goes back to 1775 in England, represents a “communal solution” to housing finance: that is, a small number of people from a town pooled savings and provided funds to one another for construction of houses; and, they ceased to exist once all members received the loans. Later on, more formal lending institutions emerged out of TBSs – to “Permanent” Building Societies, to Building and Loans, and eventually to Savings and Loans (S&Ls).

As to the loan characteristics in this era, the maturity for the majority of loans was six to ten years, payments were semi-annual with non- or partially-amortizing principal, interest rates were variable, and the maximum loan-to-value (LTV) ratio was about 50%. The deposit certificates instituted in the 1890s increased the inflow of savings into lending institutions, improving the liquidity of the system.

Under TBS, the risks in lending and funding are completely internalized among participating members. In fact, the first mortgage loan made by the first Building Society, the Oxford Provident, went into default. The members negotiated a transfer of the property to another member who eventually repaid the loan (Lea, 1994).

The first separation between lending and funding occurred during the 1870s. That is, mortgage banks were formed to lend in the expanding Midwestern and Western states, mostly by former agents of insurance companies and other financial institutions in the Northeast. Those institutions originated and serviced loans with the funds raised by selling Mortgage Backed Bonds (MBBs), modeled after the practice in France and Germany at that time. Under this intermediation process, investors took on credit risk of bond issuers (mortgage banks) and were compensated through a premium in the interest rate. Through MBBs, investors also enjoyed the diversification benefit as their portfolios encompassed loans from different regions, which helped their financial stability.

Initially, the MBB market grew significantly, and both issuers and buyers of the security could benefit from scale economies in loan origination, servicing, and funding. However, during the recession in the 1890s, MBBs defaulted in large numbers. The lax risk screening by the agents (mortgage companies) at the time of underwriting caused high defaults during the economic downturn, imposing significant costs to the principals (investors),

a classic example of the principal-agent problem caused by incongruent incentives. The incident also resulted in the demise of the mortgage companies, and this particular 19th Century experiment of liquidity enhancement ended unsuccessfully.

Era of Institutionalization (between 1930s and 1960s)

As the name “Roaring Twenties” implied, the booming economy in the 1920s bolstered both real estate markets and consumer credit markets, and new players such as insurance companies entered into the USMIS. However, the Great Depression, started by the stock market crash in 1929³, caused precipitous declines in economic activity. Two outcomes of this economic shock were particularly adverse to the USMIS: the ramping up unemployment rate that caused liquidity and solvency shocks for a large number of borrowers and led to nonpayment of their mortgage obligations; and, the acute deflation that resulted in an almost 50% drop in the price level and caused insufficient collateral values for bank loans. Due to these factors, large-scale bank runs came about, which caused the insolvency for the whole banking system.

Facing this systemic risk, the US federal government implemented four main remedies to prop up the USMIS. First, the Home Owner Loan Corporation (HOLC) and the Reconstruction Finance Corporation (RFC) were created to liquidate non-performing loans in bank portfolios and to bail out those lending institutions that were insolvent. Both the HOLC and the RFC purchased defaulted housing loans and the stock in bankrupt banks and thrifts during the 1930s. Their operation was viewed as successful, although some early examples of the moral hazard problem were revealed in that many borrowers deliberately defaulted on their existing loans to take advantage of the HOLC and RFC bailouts.

Second, the Hoover administration's (1929–1933) remedy was to strengthen the existing lending institutions, S&Ls, by creating the Federal Home Loan Banks (FHLBs) as a special liquidity facility for them. The FHLBs were empowered to charter and regulate federal S&Ls, and put restrictions on both the asset and liability sides; that is, S&Ls' operations were largely restricted to making ten- to twelve-years home mortgage loans, to attracting “small savers” (workers and middle income families), and to lending only in their local markets (within a 50-mile radius from their home office).

Third, the Roosevelt administration's (1933–1945) strategy was quite

³ On Black Tuesday, October 29, 1929, American common stocks lost almost 13% of their value that day. Later on, the Dow Jones lost about 90% of its original value at its trough in 1932, and did not regain its original value until 1954.

different in that their focus was more national than local with a series of new policy measures being implemented. That is, the Federal Housing Administration (FHA) was created to provide insurance against mortgage default for lenders. A new kind of loan – the fixed-rate, self-amortizing mortgage with a low downpayment (as low as 20% of home value) and a longer-term maturity (20 or more years) – was established. Private mortgage associations were authorized as a part of the 1934 National Housing Act, which were empowered to issue bonds and buy mortgages from primary market lenders. The thrust of these remedies was to broaden the base for mortgage funding by encouraging new entrants into the USMIS such as commercial banks. As to the private mortgage associations, none was started until the late 1930s and Fannie Mae (the Federal National Mortgage Association) was established in 1938 as a government-owned agency to provide a secondary market for FHA-insured mortgages. The new institution was expected to borrow in areas where credit was more available (from mutual savings banks in the Northeast) and to lend where capital was in short supply (the Midwest and the West).

Fourth, two deposit insurance companies – the Federal Deposit Insurance Corporation (FDIC) for commercial banks and the Federal Savings and Loan Insurance Corporation (FSLIC) for S&Ls - were established, in large part resulting from a political bargain to win support from S&Ls in creating FHA. Viewing FHA as new competition, S&Ls initially objected to its creation and their federal deposit insurance was to provide them with a level playing field to compete with the banks for mortgage funds. FSLIC was created under the Federal Home Loan Bank Board in 1934, which also regulated the Federal S&Ls.

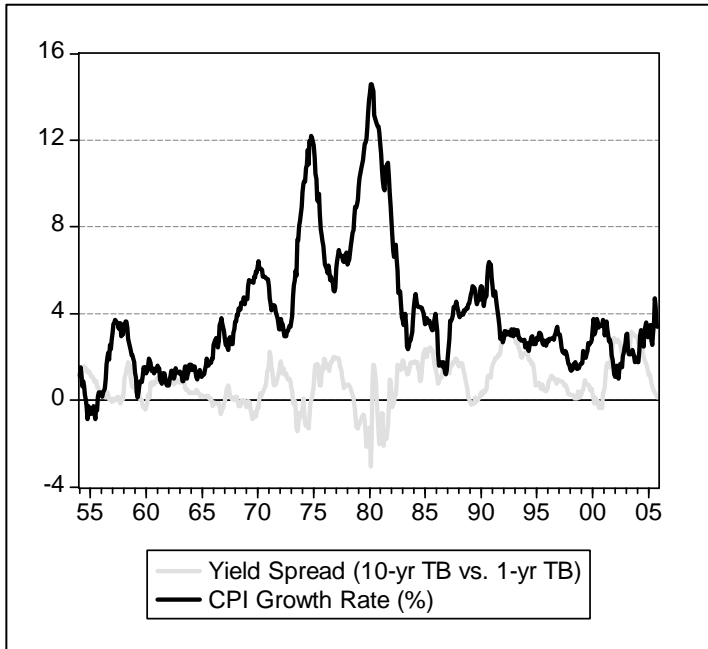
The FHA's operation was successful during the 1940s and 1950s, and produced two demonstrative effects in the industry. First, S&Ls found it profitable to make long-term, self-amortizing mortgage loans without government insurance, resulting in the expansion of the market for the "conventional" mortgage instrument. Second, private firms saw a value proposition in writing mortgage insurance and, between 1957 and 1973, every state passed an enabling statute for private mortgage insurance. This ended the FHA's monopoly in this segment of the USMIS, and its market share declined in the 1960s and 1970s.

Era of Market-Making (1970s to 1980s)

By the mid 1960s, the USMIS faced new challenges – rising inflation and interest rates. As shown in Figure 3, the inflation cycle hit three peaks between mid-1960s and the early 1980s, with the third one being the most severe and recording almost a 15% annualized growth rate in the Consumer

Price Index (CPI). The main reasons quoted by market observers for this rising price level included the Federal government's fight on both the War on Poverty and the Vietnam War without raising taxes in the 1960s, the first and second oil shocks during the 1970s which resulted in the ramping up energy prices, and the change in monetary policy in the mid- to late-1970s that adopted money aggregates instead of interest rates as the policy target.

Figure 3: CPI growth and yield spread in the US (1955-2005)



The unanticipated rise in inflation caused several problems for S&Ls. First, their business model that had relied on short-term deposits to fund long-term fixed-rate mortgages caused a severe drop in their profitability under this volatile interest rate environment. That is, in the face of rising interest rates, this “borrow-short-lend-long” operational mode created a squeeze on their profit margin as the rapidly rising short-term rates created the inverted yield curve in the early 1980s as shown in Figure 3, resulting in the rising negative gap between the lending rates for their long-term mortgages and the short-term rates paid on their deposits. Second, the high interest rates dampened housing demand, having an adverse impact on new business volume for S&Ls. Third, as investors, S&Ls also experienced a worsening duration mismatch caused by the upward shift in interest rates as the effective maturity of existing loans lengthened because prepayments slowed

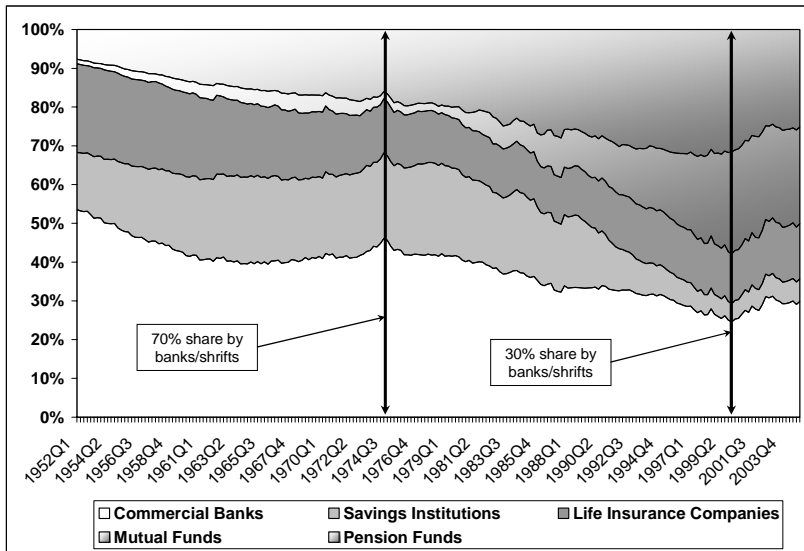
down in the rising rate environment, the extension risk in holding mortgage portfolio.

The S&Ls' market share shrunk between 1979 and 1986 from 43% to 30% in total nonfarm residential mortgages and these adverse market conditions in the early- to mid-1980s eventually resulted in a large number of bankrupt thrifts, known as the "S&L Debacle" in the late 1980s. The federal government created the Resolution Trust Corporation in 1989 to liquidate the assets of the troubled lending institutions.

Another relevant and broader trend occurred since the early 1970s is the shift in funding sources in the US capital market as a whole. As shown in Figure 4, commercial banks and thrifts enjoyed about 70% market share in total financial assets outstanding in the US during the early 1970s. However, the landscape of the credit market gradually shifted such that their market shares were reduced to only about 30% in the next three decades, whereas mutual funds and pension funds more than doubled their shares from less than 20% in 1970 to over 50% in 2000.

This shift in funding source brought about two important changes in the USMIS. First, S&Ls lost a big portion of their traditional deposit base. In particular, Money Market Mutual Funds (MMMFs) came into existence in the early 1970s, opening up a new investment vehicle for small savers. Rates paid by the MMMFs were not regulated, while "Regulation Q" limited the rates banks and thrifts could pay on time deposits (their primary source of funds). While this resulted in a significant drop in deposit inflows to thrifts—called "disintermediation," MMMF assets exploded from \$3.5 billion in 1977 to \$180 billion in 1981, an over 50-fold increase in volume within four years.

Second, the shift in funding sources also triggered changes in the intermediation process. Unlike thrifts, the fund managers' key interest was the asset-liability management by matching effective durations in both sides of their balance sheets, and not about the origination and servicing parts of the intermediation process. This served as a nice stimulus to unbundle the three functions in the USMIS, between thrifts/banks in the primary market who handled the loan production and servicing and the pension/mutual funds who funded by purchasing mortgage pools through the secondary market conduits. In selling mortgage securities to the investors, the conduits also filtered out the idiosyncratic risk of borrower default, to make the cash flow from mortgage pools more predictable.

Figure 4: Share in total financial assets (1952-2005)

The federal government implemented three remedies to bolster the USMIS in the event of macroeconomic shocks occurred during this era. First, Regulation Q was extended to S&Ls in 1966, imposing interest rate ceilings on their time deposits. However, contrary to the original policy intent (enabling S&Ls to control their own cost of funds), the regulation was proven to be ineffective in that the ceilings further accelerated the outflow of deposits, and the restrictions were phased out between 1981 and 1986. Second, S&Ls were allowed to issue new products in both the asset side (Adjustable-Rate Mortgages, or ARMs) and the liability side (money market deposit accounts), to make them competitive with MMMFs. However, these remedies were proven to be too-little-too-late because the share of ARMs in their portfolios was not enough to turn their P&L trends around.

Third, the government realigned and beefed up liquidity-enhancing institutions, by privatizing Fannie Mae in 1968 and allowing them to buy conventional (or non-government-insured) mortgages, by establishing Ginnie Mae in lieu of Fannie Mae to securitize government-insured loans (FHA and VA loans), and by creating Freddie Mac in 1970 as a part of the FHLBs to increase the liquidity for S&Ls.

The market for Mortgage Backed Securities (MBSs) was formed in the early 1970s and took off in the 1980s. Both Ginnie Mae and Freddie Mac instituted their pass-through security programs in the early 1970s -

Participation Certificates (PCs) by Freddie Mac and the Tandem Plan by Ginnie Mae. Fannie Mae, on the other hand, worked as a portfolio lending institution during the 1970s⁴, and issued its first MBS in 1981. Private-label MBSs by large commercial banks also had a meaningful volume from the mid-1980s.

The expansion of MBS issuances stimulated the integration of the mortgage market with capital markets, and broadened the institutional base for mortgage funding. For example, while two-thirds of Ginnie Mae pass-through securities were sold to S&Ls in 1971, in 1979 about half of them were sold to pension funds and trusts. The introduction of multiple-class MBSs (Collateralized Mortgage Obligations (CMOs) and Real Estate and Mortgage Investment Conduits (REMICs)) further accelerated the integration process, as these securities created “tranches” with varying levels of prepayment risk and/or credit risk, offering the products that are more compatible with the needs of different investors in terms of their asset-liability management needs. Since then, there has been an influx of new investors to the funding side of the USMIS, domestically and internationally.

One significant innovation in this era was the emergence of various hedging tools to control the interest rate risk such as options, swaps, and futures, and that of the intermediaries for those hedging contracts (exchanges and clearinghouses). They allowed market participants to better manage cash flow risk, which also enabled the expansion of the MBS market. During this period, the industry-wide standards to gauge expected prepayment speed from a mortgage pool were also introduced, starting from the FHA survival table in the early 1970s and the simpler and more general measure of the PSA (Public Security Association) multiples in the mid-1980s.

New mortgage products were also introduced to better manage the inflation risk or to increase the affordability in lending, such as the Price Level Adjusted Mortgage (PLAM), the Shared Appreciation Mortgage (SAM), and the Graduated Payment Mortgage (GPM). However, these mortgage types did not become a major part of the USMIS at least as of today.

Era of Expansion and Efficiency Gain (1990s to Present)

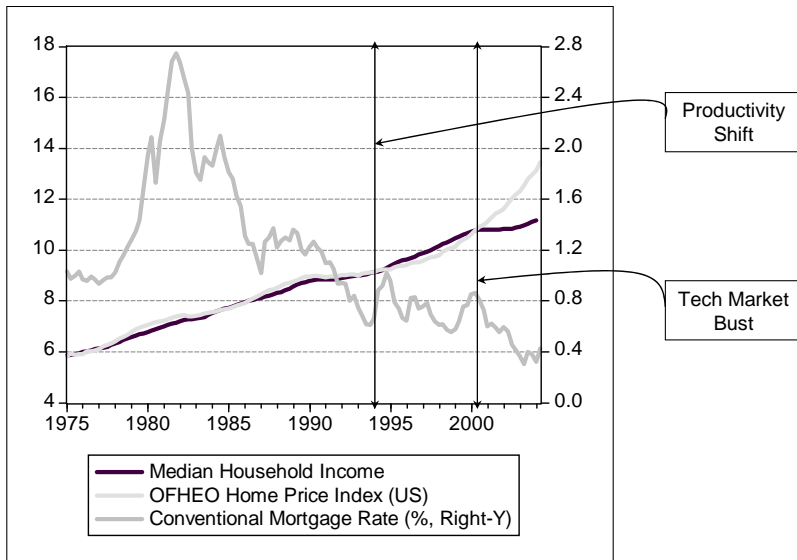
This era represents the period of a high degree of market expansion and efficiency gain in the history of the USMIS, thanks primarily to the two inter-related factors – the Internet based on-line business processes and the

⁴ Since privatized in 1968, Fannie Mae’s portfolio grew from \$15 billion in 1970, to \$25 billion in 1975, to \$50 billion in 1979, and \$78 billion in 1983. By 1981, Fannie Mae’s market value networth became negative with minus \$11 billion, which turned positive by 1986 with a net worth of about 1 billion.

innovations in measuring mortgage credit risk.

As a background, the introduction of the World-Wide Web and the booming IT industries in the early to late 1990s resulted in a big shift in the labor productivity in the US and the corresponding rise in household income. As shown in Figure 5, this was the period when the growth of household income surpassed that of home value appreciation, which continued until the bust of the high-tech industry in 2000.

Figure 5: Income, home price, and mortgage interest rate (1975-2004)



For the USMIS, the Internet and dramatically enhanced data transmission bandwidth (e.g., ISDN line) brought about a couple notable changes. The most important IT-driven innovation was Automatic Underwriting Systems (AUSs). Both Fannie Mae and Freddie Mac implemented their own AUS systems in the mid 1990s - DesktopUnderwriter (DU) and LoanProspector (LP), respectively, and large lenders followed the suit by developing their proprietary systems (e.g., CAPES by Countrywide). Since then, the use of AUSs in mortgage origination and point-of-sale decisions rose sharply: the share of Fannie Mae acquisitions processed through DU increased from less than 10% in 1997 to about 60% in 2002 (Pafenberg, 2004).

AUSs are automated decision-making tools that rank-order loans based on specific risk characteristics of loan product, collateral, and the borrower, with automated B2B connectivity between funding, lending, and servicing

organizations. At the core of the system is a mortgage scoring model, a discriminant statistical method first used in car loan and credit card markets. It measures the level of creditworthiness of borrowers based on historical default/delinquency data and other information specific to loan applications. In addition, most AUSs utilize an Automated Property Valuation Model (APVM or AVM) to streamline or even waive property appraisal requirements in mortgage underwriting, further reducing the transaction cost for borrowers.

The impact of AUSs in the USMIS is already profound and still rising. The first and obvious one is the dramatic reduction in transaction/intermediation costs in originating mortgage loans. That is, the cost of information (on the risk profile of the borrower, the loan, and the collateral) became much cheaper; underwriting decisions (that accept or classify the loan for documentation requirements or interest rate charges) are made much faster (from weeks to minutes); and the amount of training required for underwriting and secondary marketing staff in lending/servicing organizations is also lowered significantly. As to the last point, AUSs essentially replaced Selling and Servicing Guides published by the secondary market conduits, the document containing detailed eligibility rules and business processes for new and existing loan products. In the AUS world, most these provisions are codified inside the computer system and are checked almost instantaneously within the system.

Second, the assessment of credit risk became more scientific, largely thanks to the scoring technique described earlier. The main improvement comes from the fact that, in this model-based world, so-called “compensating risk factors” can be assessed and used more easily and accurately in loan underwriting and product development. That is, some of key risk drivers (e.g., borrower credit history, level of downpayment, payment-to-income ratios, etc.) can be examined in aggregate based on their risk weights from the model. Hence, the overall risk for a given loan product can be examined in a more holistic fashion in underwriting and pricing. In addition, the enhanced (and cheaper) computing power also enabled complex forward-looking risk analysis via simulation techniques to be more feasible.

Third, AUS has been contributing to further specialization in mortgage origination and in servicing, as key market participants achieve economies of scale in various intermediation steps. For example, the volume of loans originated by mortgage brokers has increased since the implementation of AUS because the cost of interfacing with the borrower and making the underwriting decision has been equalized for large and small lenders with the use of the AUS tools. Many large lenders are now focusing more on servicing with specialized AUS and IT solutions both in streamlining its

administrative tasks (e.g., disbursing tax and insurance payments and reporting to investor and borrower) as well as in managing problem loans (deciding which loans present the greatest risk of default and then focusing their collection effort on them). The challenge to this era of automation is the potential increase in fraudulent loan applications, either via identity thefts or incorrect/invalid documentation (on employment, wealth, income, or collateral). This issue is getting more attention in the USMIS, and online identification and authentication tools are being further developed and deployed in the business processes.

Another trend to note regarding the quantification of credit risk is the new capital adequacy rules proposed, or Basle II. The industry observers expect that this new capital regulation will bring about a significant standardization in the quantification of the credit risk borne by mortgage and MBS portfolios. Two particular changes proposed in Basle II that are relevant in that respect include (1) a more refined risk weight based on credit ratings, and (2) three alternative approaches (Standardized, IRB-Foundation, and IRB-Advanced) that a financial institution can take in quantifying the capital ratios. As an illustration, Figure 6 compares the minimum capital requirement under Basle II with those under Basle I and a full-blown risk-based economic capital regime.

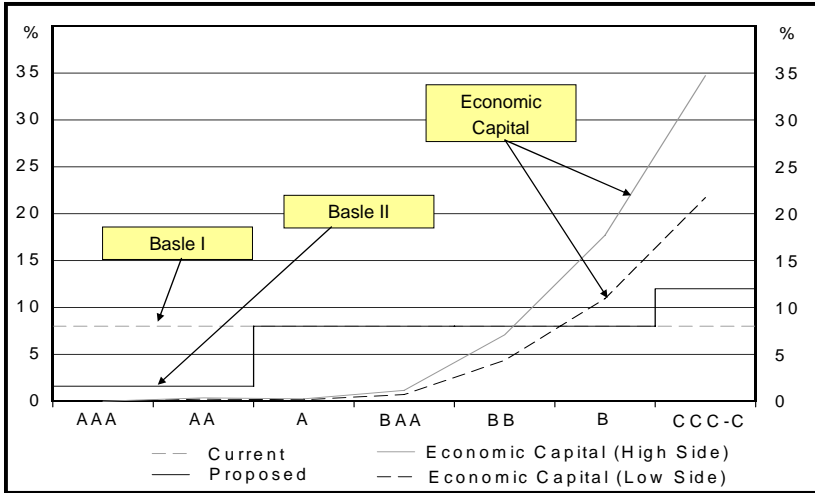
As to the second point above, Basle II will also require the validation of the internal ratings models, for each of the two main components in the credit loss estimation - Probability of Default (PD) and Loss Given Default (LGD). In particular, its directive for validating internal rating systems offers the following guideline:

".... Banks must have a robust system in place to validate the accuracy and consistency of rating systems, processes, and estimation of all relevant risk components. A bank must demonstrate to its supervisor that the internal validation process enables it to assess the performance of internal rating and risk estimation systems consistently and meaningfully." (Basle Committee on Banking Supervision, November 2005).

In the US, there has been a joint effort among regulators, industry practitioners, and academia to come up with the best practice in measuring the amount of risk borne by different loan cohorts and using those quantified information in various business decisions.⁵

⁵ One example of such joint effort for developing the industry best practice in the credit model validation is the recent conference organized by the Office of Comptroller of Currency (OCC), entitled "Validation of Credit Ratings and Scoring Models" (February 2006).

Figure 6: Regularoty capital for corporate debt---IRB approach



Source: Carmichael (2003)

The increased accuracy, and the rising confidence along with that, in the risk-quantification also resulted in the expansion of the USMIS to serve more non-conforming (A Minus and B&C rated) borrowers. As a broader segment, the subprime market has been on the rise in the recent years, which targets not only those with a blemished credit history but also with other risk characteristics. As shown in Table 1 (from Chinloy and MacDonald, 2005), the delinquency rates increase as the credit ratings are down-graded, and lenders accordingly charge higher risk premia to the higher-risk subprime borrowers.

Table 1: Risk premium by consumer credit rating

Consumer risk grade	Share in total Orig. (%)	Delinquency rate (%)	FICO	Risk premium charged (%)
A			>620	
A-	62	3.4	580-620	1.38
B	13	6.7	550-580	2.25
C	10	9.2		3.25
D	15	21.0		4.00

Source: Chinloy and MacDonald (2005). Sub-prime borrowers are able to qualify by paying higher interest rates in exchange for offering more equity or low loan-to-value ratios. Subprime borrowers with Grade B or below are usually liable to pay insurance fees.

As expected, the subprime borrowers are highly correlated with income and other borrower characteristics. As an example, Chinloy and McDonald report that, while subprime loans were 8.5% in total origination in 2001 (\$173 billion out of \$2.03 billion total origination), in minority and/or low-income areas, the share is much higher: 44% in the areas that predominantly have African-American residents and 26% in neighborhoods or among borrowers with less than 80% of annual area-wide median household income.

Lessons for Emerging Mortgage Markets

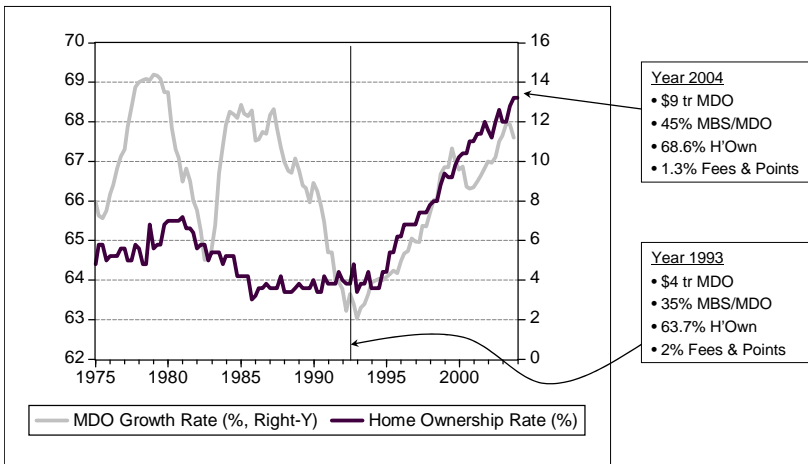
The survey in Section 3 indicates that the 180 years' evolution of the USMIS brought about a number of welfare-enhancing outcomes:

- Enhanced liquidity with the rise of the secondary market, as evidenced by the increase of MDO from \$1.5 trillion in 1980 to almost \$9 trillion in 2005; in the same period, the MBS outstanding as percent to MDO also increased from less than 10% to about 50%;
- Well-established conforming market segment, in which the 30-year fixed-rate mortgage with no prepayment penalty is used as the “plain vanilla” (or benchmarking) product by industry participants;
- Growing non-conforming sector, with the rising volume of subprime loans that further enhance the affordability in home purchase for marginal borrowers;
- Maturing markets for trading the borrower default risk, with key players from both private and public sectors including the private MI companies, FHA and VA, Fannie Mae, Freddie Mac, Ginnie Mae, and the private-label MBS issuers;
- Active markets for trading the prepayment risk borne by mortgage pools/portfolios, via innovative structured finance products (e.g., CMO/REMICs and Stripped MBS) and enabled by various industry-wide norms such as benchmarking interest rates, and the PSA prepayment schedule and its multiples;
- Efficient loan production and servicing process assisted by AUS, AVM and other IT/model solutions, which helps reduce the transaction cost as evidenced by the decrease in average fees and points paid by consumers (from over 200 bps in the early 1990s to the range of 100-130 bps currently);

- All the above outcomes, I argue, contributed to the rise in the home ownership rate in the US, in particular, a four percentage point increase between 1995 and 2004 (64% to 68%).

As to the last point, this increase in the ownership rate in the recent time period is shown to be highly correlated with the rise in MDO (Figure 7). Although a more formal analysis is due, it is fair to say that the outcomes of the USMIS to date contributed to this upswing in the ownership rate since the mid-1990s by making home purchase more affordable for the “stretched” borrower cohorts. As one evidence to this point, Quercia et al. (2003) report that affordable lending products, particularly low downpayment loans, are likely to increase the propensity to own for underserved populations, by 27% for young households, 21% for African Americans, and 15% for central-city residents.

Figure 7: Home ownership rate and MDO growth rate in the US



On Developing Conforming Market

The evolution of the USMIS is the history of transition in loan characteristics to make home purchase by consumers more affordable. That is, the characteristics of the main-stream loan products in the market have changed over time, from 50%-60% max LTV (in the pre-1930s era) to over 100%, from 6-11 year loan term to 30-year, and from non-amortizing ARMs to amortizing FRMs. The expansion of this conforming market segment also enabled the extension of the service to non-conforming borrowers.

Although other countries do not have to follow the exact footsteps of the

USMIS, the US experience shows the importance of establishing a well-defined and well-functioning conforming market segment. Doing so will offer an industry-wide benchmarking loan product to be used for various business decisions, including underwriting, pricing, and capital allocation.

It can also delineate the role of government more clearly. For example, when there is no or very weak market for whole-sale funding in a given country, then government can play an incubator's role in creating the secondary market to increase the liquidity for the defined conforming market segment. Once the segment becomes mature, then the government can reduce or eliminate its role to avoid the possibility of crowding out the private sector participation in the market segment.

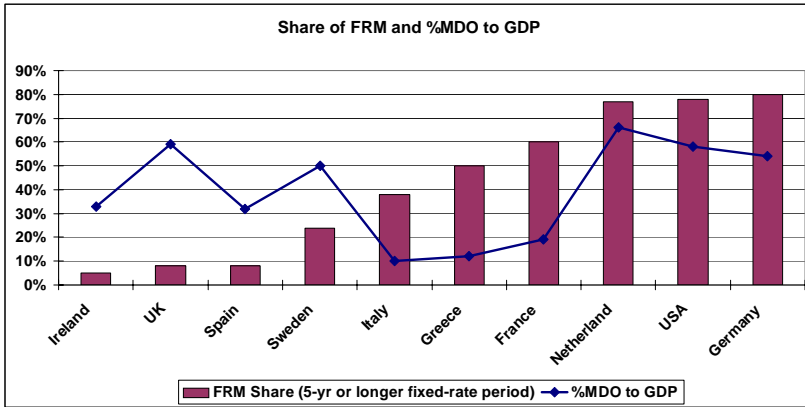
In the USMIS today, the conforming-conventional product (CCP) is defined in terms of several loan characteristics⁶: predominantly long-term FRMs with the maturity up to 30 years, no prepayment penalty, the maximum loan amount \$417,000 (as of 2006), the maximum LTV 80% with no private mortgage insurance and up to 120% with different insurance coverage ratios, the maximum debt service-to-income ratio 33%, "A-rated" borrowers (e.g., those with FICO exceeding a certain threshold such as 620), and fully-documented applications (e.g., those with valid income and employment verifications -- VOI and VOE -- and other required documents).

Each country has its unique market and institutional conditions, and which loan attributes and thresholds to employ in defining its own CCP should be an outcome of public policy debate in a given country. Nonetheless, there are several choice variables that the US experience sheds light on in terms of their economic implications: (1) FRM vs ARM, (2) Maximum LTV, and (3) Loan Maturity and Amortization.

Choice between FRM and ARM

Even in a well-developed economy with a deep mortgage market (such as UK) the share of long-term FRM can be very low. As shown in Figure 8, while the UK mortgage market has a comparable MDO share to GDP as the US and Germany (about 60%), the share of FRM with the fixed-rate period of five years or longer is merely 8% as opposed to about 70% in the latter countries.

⁶ A formal definition of CCP is the loan that fulfills the underwriting criteria of Fannie Mae and Freddie Mac and has no government guarantee for borrower default risk.

Figure 8: Share of FRM and percent of MDO to GDP

Sources: Miles (2004) for the FRM shares, Renaud (2004) for the %MDO to GDP

This low FRM share in the UK mortgage market was the very issue that the two famous reports by Miles along the Bank of England economists examined (the Interim Report in 2003 and the Final Report in 2004). Among others, his main findings point to the high property values in UK (causing a more severe payment affordability problem for UK residents than those in the US), the lack of a centralized mortgage funding organization, and a high share of deposit-based mortgage funding by Building Societies as the underlying factors.

Therefore, it is fair to say that it will be more challenging to establish a long-term FRM market in emerging economies where financial markets tend to be less developed and macroeconomic variables of interest are generally more volatile. But, once developed, the benefits of having a large FRM share in the market are numerous, as argued by a number of studies. (Campbell and Cocco, 2003; Miles, 2003 and 2004; Vanderhoff, 1996; Cho et al., 1996; Brueckner, 1992; Cunningham and Capone, 1990; and Brueckner and Follain, 1988) This list below includes what I view as key relevant findings from these studies:

- Consumers with FRMs will be less sensitive to the course of the interest rate change and business cycle in terms of their consumption patterns,⁷ which facilitates to have a more stable transition mechanism of the

⁷ Case et al. (2001) estimated relative magnitudes of stock wealth and housing wealth in terms of their impact on consumption. Their models largely confirmed a stronger effect of housing wealth on consumption than that of stock wealth.

monetary policy (i.e., changes in short-term interest rates) with a smaller impact on housing market outcomes by the policy action.

- When there is a significant positive correlation between inflation shocks and real interest rates, then long-term FRM tends to result in a substantial welfare gain for income-constrained households.
- However, ARMs are more attractive contracts for certain households: that is, when borrowers buy houses that are small relative to income, have a low risk aversion (i.e., those who feel more comfortable in taking the interest rate risk), and have a higher probability of moving.
- Consumer myopia play an important role in mortgage choice: that is, borrowers' understanding of interest rate risk and risk profiles for different mortgage products are poor; the initial teaser rates in ARM contracts tend to lock-in borrowers to ARMs, which later on increase the likelihood of payment shock and, hence, default risk substantially.
- It is also shown in the consumer survey by Miles (2004) that great many households attach overwhelming weight to the initial monthly payment on mortgages and too little weight to the likely overall cost of borrowing and the extent of the risk over the life of the loan.

In summary, mortgages with the interest rate fixed for substantially long time period are expected to be superior products, especially for borrowing constrained households. The question is how to create a sustainable market for FRM in emerging economies. Several observations are made to that end.

First, as suggested by Miles (2004), expanding FRM with a reasonably long duration requires a credible institution that can provide a stable and low-cost funding and, at the same time, can demonstrate its capability to manage risks involved with the product effectively. Without such organization, the markets tend to resort to ARMs to deal with the interest rate risk, more so in a volatile rate environment, as evidenced by the US experience in different time periods.

Second, the distinction between ARM and FRM is not always clear-cut these days in that there are various hybrid loan products. There are also floor-and-cap ARMs that are essentially FRM with a band of allowable interest changes during loan life. Therefore, in designing CCP a country can consider various hybrid products as a substitute to the straight FRM product. Examples include the ARMs with a cap structure, such as 5/2/2 (fixed-rate for first five years and 2% as both initial rate reset cap and as the life-time

adjustment cap).

Third, there are various compensating risk factors and risk-sharing arrangements that can be used in designing the long-term FRM product in a given country. They can work as risk mitigating factors for both credit risk and interest rate risk, and several such variables are discussed below:

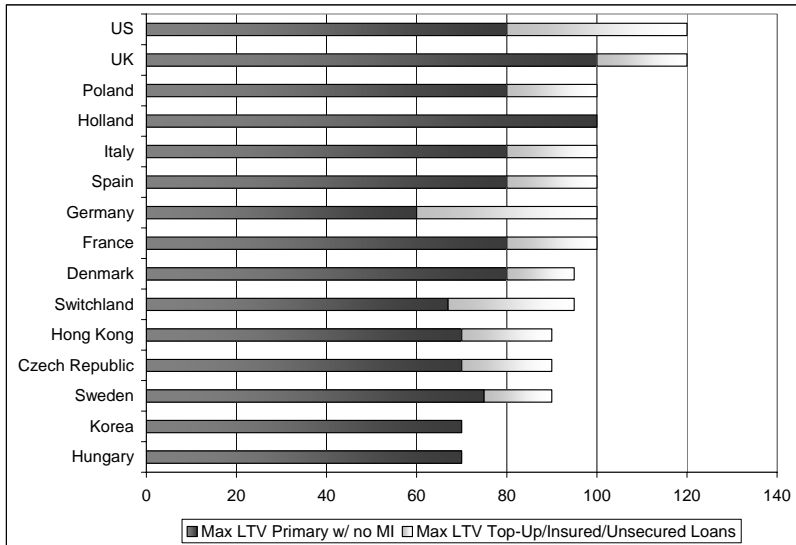
Compensating risk factors - maximum LTV, maturity, and amortization

For many emerging markets, a high mortgage payment burden (for a given level of LTV, loan maturity, and amortization schedule) is the problem in creating a FRM market, partly caused by high real estate prices. For example, the average home price-to-income ratios are eight to eleven in Poland (depending on the region) and about five in Korea, whereas it is hovering around three in the US over time.

To get around this problem, the mortgage finance industry in an emerging market sometime resorts to the product that is much riskier. As an example, the prevalent loan product in the Korean mortgage market, which has been on the steep rise in the 2000s, is the short-term (3-5 years) interest-only ARMs (or IO-ARMs with a short maturity) with no cap structure. As of the end of 2003, about 90% of outstanding loans took these characteristics. Due to the short maturity, a huge amount of principle is due every year for refinancing and almost automatically rolled over to another loan term. In particular, the total principle refinanced was estimated to be 42 trillion Korean won in 2004, over 5% of GDP, and was expected to be even higher in 2005 (Kim, 2004). Although the record low interest rates in Korea in recent years have been propping this lending practice, it poses a significant systemic risk to the whole system if and when the rates rise again.

One factor that can boost the market for FRM is the existence of default insurance, whether from private entities or from government. As shown in Figure 9, most countries surveyed by Mercer Oliver Wyman (2005) require MI for higher LTV segments, which has been the vehicle for expanding the conforming market.

Figure 9: Maximum LTV-primary mortgage and top-up/guaranteed/loans



Max LTV: Source: Mercer Oliver Wyman (2005), except for Korea and Hong Kong (from HKMC's annual reports)

Consumer protection and education

As pointed out by Miles (2004), mortgage choice decision is a complex one for consumers, and borrowers tend to make myopic decisions in that the future interest rate risk and payment shocks are not properly weighed when originating new loans. Therefore, having a proper consumer protection and education is also critical. Some examples of such mechanism suggested by Miles (2004) include:

- Pre-sale disclosure materials that are transparent and clearly-explained about available products along with the features of each – the rate reset period (if ARM), underlying index, the margin, initial discounts (if existing), rate cap (if existing), late fees, and other contractual provisions;
- Evolution of mortgage repayments under different interest rate scenarios (for each major product offered);
- Personalized “what if” questions to consumers, such as:

- What if your income drops? How will that affect your ability to meet the interest and loan repayments on your mortgage?
- What if you choose to get out of your present mortgage? What costs do you have to incur and with what loan product do you expect to replace it?
- What if market interest rates rise by 1%, 3%, and 5%? What consequences it will bring to your monthly mortgage payments?
- Loan pricing disclosure – What factors can affect your mortgage interest rate? How and when is your rate determined? Is there any way to obtain a lower price?

The quality of the consultation and advice also commensurates with the product and market knowledge of those who provide such service to consumers. Hence, it is desirable that regulatory authority and industry participants develop appropriate programs to train professional staff to handle this function.

On expanding to non-conforming segment

Once the conforming segment/product establishes itself as a mature and profitable market, then MIS can extend its service to more borrowing-constrained households. In so doing, one issue to be considered is how to do a “risk-based” consumer targeting. That is, more often than not, the policy debate in developing countries when deciding which consumer segments to target focuses solely on economic (e.g., deciles of income distribution) or demographic (first-time home buyers) conditions. A superior approach is the one that considers not only those socio-economic variables but also risk factors in mortgage lending. Modifying the categorization of borrower segments from Mercer Oliver Wyman (2005), I list the following five consumer cohorts along with their characteristics and mortgage product types to use, as example target groups.

In serving the non-conforming cohorts (B through E), the mortgage product design plays an important role. For example, the non-amortizing products such as IO-ARMs will increase the propensity to own for the income-constrained households (Cohort C), while high LTV loans (say, above 90%) will be an affordability-enhancing tool for the wealth-constrained households (Cohort D).

Table 2: Consumer cohort and lending strategy consumer cohort

Consumer cohort	Characteristics	Lending strategy
A. "All-conforming" ("A-rated") borrowers	<ul style="list-style-type: none"> Meeting all lending requirements, in particular loan-to-value (LTV) ratio, debt-to-income (DTI) ratio, credit-worthiness, and documentation as key conditions to meet 	<ul style="list-style-type: none"> All conforming products; Product variations within the conforming market lending requirements (which can be numerous given various dimensions of product differentiation)
B. Income-stretched borrowers	<ul style="list-style-type: none"> DTI moderately exceeding the conforming limit, either due to high collateral value or due to low income of borrower 	<ul style="list-style-type: none"> Screening them out (as the last resort); Lending w/ appropriate risk premium and/or credit enhancement (CE); Risk-sorting & lending to those w/ "compensating factors" (low LTV and/or good credit history); Providing affordable, but risky, products (e.g., IO ARM)
C. Wealth-stretched borrowers	<ul style="list-style-type: none"> LTV moderately exceeding the conforming limit, due to the lack of reserve for downpayment 	<ul style="list-style-type: none"> Screening them out (as the last resort); Lending w/ appropriate risk premium and/or credit enhancement; Risk-sorting & lending to those w/ "compensating factors" (low DTI and/or good credit history)
D. Credit-impaired borrowers	<ul style="list-style-type: none"> Record of bankruptcy, default or delinquency on consumer loan obligations including the mortgage 	<ul style="list-style-type: none"> Screening them out (as the last resort); Lending w/ appropriate risk premium and/or credit enhancement; Risk-sorting based on more refined credit risk buckets (e.g., A Minus and B-to- D subprime borrowers in the US)
E. Borrowers w/ special needs	<ul style="list-style-type: none"> House-rich but cash-poor senior citizens; Any other underserved consumer segment or geo-areas? 	<ul style="list-style-type: none"> Reverse annuity mortgage (RAM)

Another related point to make is the public-private partnership. That is, the existence of the mortgage insurance (MI) industry, whether it is private or public, is an important element to expand the coverage of MIS to more borrowing-constrained household cohorts (via increased max LTV level). The same logic applies here in that appropriate risk-sharing arrangements such as different MI coverage ratios can also increase the coverage of the MIS in serving more borrowing-constrained households.

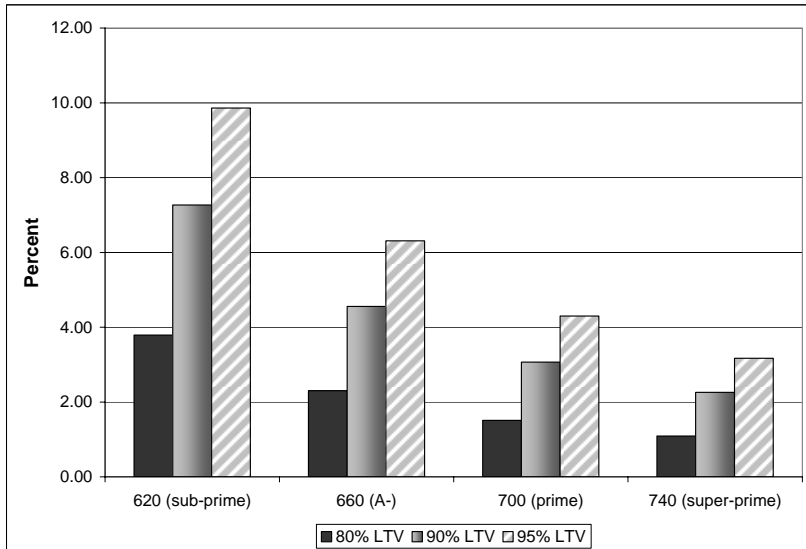
The US experience also shows that private-sector participants will require a period of learning and confidence building before jumping into new products or risk-sharing arrangements. Uncertainties surrounding new products (e.g., the 30-year fixed rate mortgage without the government mortgage insurance before the 1950s) are usually the reason for keeping private-sector intermediaries from trading such products. In such instance, government can jump-start the market by introducing its own program.

On controlling default and prepayment risks

Setting “market-clearing” risk premia for borrower default and prepayment is another important market-maker. Conceptually, these two mortgage termination events are competing to each (or mutually exclusive), and the state-of-the-art risk modeling needs to reflect such substitution relationship between the two (Deng et al., 2001 and Calhoun and Deng, 2003). In reality, however, managing these two embedded risks involves with different sets of measurement and management issues.

Managing default risk

It is empirically shown that the default risk varies widely across loan- and borrower-cohorts, and not properly controlling that in product design and in pricing will result in a cross-subsidization from low-risk to high-risk borrowers. As shown in Figure 10, Calem and LaCour-Little (2003) report that the expected cumulative failure and short sale rates (with 10-year forward-looking time horizon) for loans with 95 LTV and Sub-Prime FICO is more than six times than that of loans with 80 LTV and Prime FICO (700 to 740). For a given LTV level, the default rate also rises more than three times depending on the FICO buckets.

Figure 10: Expected cumulative failure and short sale rates

Source: Calem and LaCour-Little (2003)

Two enabling factors in controlling the default risk that are critical in the emerging market context include the availability of data (or industry norms) and information sharing. As to the first, one premise in having a risk-based trade is the availability and the symmetry (between trading parties), of risk information. Some of the critical information elements in the context of managing mortgage credit risk include consumer credit score (which works similar to the bond ratings in the corporate lending sector), loan performance data that is sufficient in volume and quality to quantify the risk (either owned individually by intermediaries or collectively through data coops), and home price indices⁸. As the conforming market matures, the data will become more available and the risk premia will be quantified more accurately, which will, in turn, increase the confidence on the part of intermediaries in making their business decisions in a risk-based fashion.

As to the information sharing, the credit risk premia for different loan types are to a large extent public information in the US. For example, Table 3 shows the risk premia published by one MI company in the US through their

⁸ As to the home price indexes, it is worth noting the data swap between Fannie Mae and Freddie Mace since the mid 1990s, for the sole purpose of creating reliable home price indexes for different geographical areas. That was the beginning of having a credible public data base for this important risk factor in mortgage lending. Since 1998, OFHEO has been publishing the historical home price indexes (HPI) based on the repeat sales model put forth by Case and Shiller (1989), for four different levels of geography – the national, census division, state, and metro area HPIs.

website,⁹ which illustrates several implications about the way the default risk premia are set by the company. In this example, their pricing schedule varies across five dimensions – (1) LTV bucket; (2) MI coverage rate (the amount of loss insured by MI as a percent of unpaid balance at the time of default); (3) documentation/borrower risk level (Full Doc, Low/No Doc, Subprime); (4) FRM vs ARM; and (5) maturity (25 years or less versus longer than 25 years). *Ceteris paribus*, the average risk premia are 11 bps for the longer maturity (30 years as opposed to 25 years), 9 bps for ARM (over FRM), 30 bps for Low/No Doc loans (over Full Doc loans), and 24 bps for subprime borrowers (over prime borrowers).

Another outcome to note is that the risk premia for the last three attributes – ARM, Doc level, and subprime borrowers - also vary across LTV and MI coverage buckets (over 20 bps for ARM with 95%-103% LTV versus less than 10 bps if LTV is under 85%), implying that the company's view of these risk attributes is such that those three factors will have interactive effects with other risk factors such as the LTV level. On the other hand, the maturity risk premia are non-varying (almost) across LTV-MI buckets, implying that it is largely determined by the bond market's expectation on future inflation and loan maturity risk.

The above example shows the importance of the benchmarking rate (e.g., 10-year Constant Maturity Treasury (CMT) rate for 30-year FRM in the US). Not having such rate with a comparable maturity is a prevalent problem in emerging markets where long-term bond markets either do not exist or are very shallow and non-liquid.

Finally, to a large degree, credit risk management is a process management in that the loan default usually involves with prior steps leading to that status – a bad underwriting decision (e.g., improper documentation or fraud), different levels of delinquency, or loan modification (or workout) decisions. Therefore, setting a proper internal procedure for managing nonperforming loans, along with an enabling legal infrastructure for expedient execution of the foreclosure process, is a must in the credit risk management.

⁹ RMIC (or Republic Mortgage Insurance Company). (See their website, <http://www.rmic.com/rates/>, for the premiums on various loan types that they insure.)

Table 3: Credit risk premiums by product type

LTV Bucket	MI Coverage	Premium	Premium	Premium	Premium
		Maturity 30-yr FRM vs 25-yr FRM	ARM 30-yr FRM vs 30-yr ARM	Doc No/Low Doc vs 30-yr FRM	Subprime A Minus vs 30-yr FRM
95.01 - 103	40%	11	21		49
	35%	11	21		46
	30%	11	21		40
	25%	11	22		
90.01 - 95	35%	11	15	36	24
	30%	11	10	36	22
	25%	11	6	36	23
	22%	11	6		
	20%	11	5	36	
	18%	13	5	36	
85.01 - 90	35%	11	15	30	
	30%	11	13	30	16
	25%	11	9	30	16
	22%	11	8		
	20%	11	6	30	
	17%	11	5	30	
	12%	11	1	30	10
85 and under	30%	11	9		
	25%	11	6	22	
	20%	11	5		
	17%	11	1	22	
	12%	11	1	22	9
	6%	8	2	22	8
Mean		11	9	30	24

Source: RMIC (Republic Mortgage Insurance Company; websit - <http://www.rmic.com/rates/>)

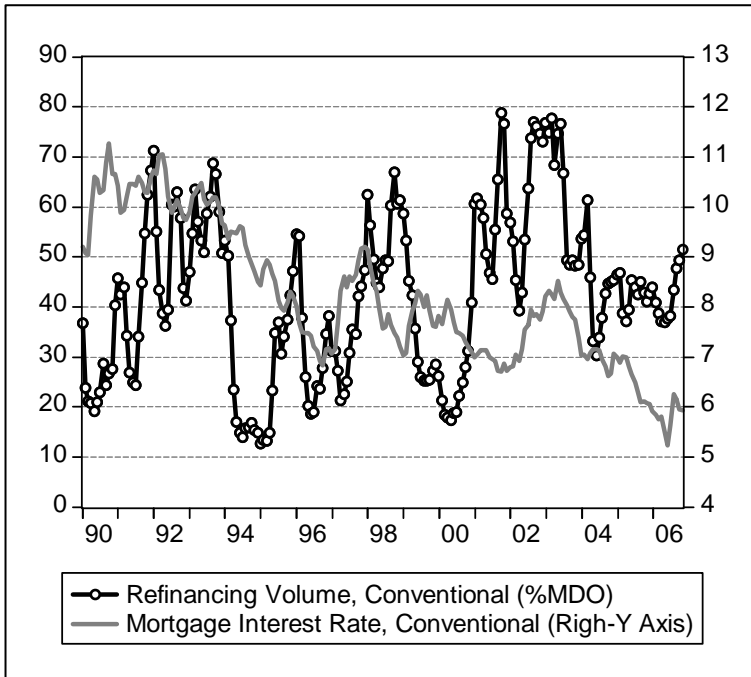
Managing prepayment risk

Mortgage prepayment is largely caused by the difference between the note rate and market interest rate: the lower the market rate relative to the note rate, the more likely consumers prepay, and the higher the chance that investors incur a reinvestment risk.¹⁰ Unlike other fixed-income securities, the mortgage loans and the MBS have the price risk in both directions of interest rate movement - the extension risk when it goes up fast and the contraction (and reinvestment) risk when it comes down fast, both caused by the embedded option to refinance. This prepayment risk can be substantial as seen in the refinancing booms in the US during the 1990s, in which 70-80%

¹⁰ Rothberg, Nothaft, and Gabriel (1989) report that these prepayment-related risk factors were the primary determinants of changes in yield spreads on Ginnie Mae and Freddie Mac pass-through securities. Borrower- and collateral-specific factors are shown to influence the rate of prepayment, including borrower income and demographic factors (Chinloy and Megbolugbe, 1995), home price decline that can cause a "collateral damage" (Caplin et al., 1996), the burnout (an indicator of non-exercise of the call option even though the economic incentive exists), and the curtailment (overpayment of principle by borrower in each payment period).

of MDO was prepaid and refinanced (see Figure 11).

Figure 11: Refinancing volume (%MDO) and mortgage interest rate



The public policy issue to consider in the context of expanding the market in a given country is how to allocate this prepayment risk among borrowers, investors, and hedging counterparts. One mechanism of such risk allocation widely used in both developing and developed countries is the prepayment penalty. In particular, Miles (2004) discusses different methods for charging for the prepayment penalty, listed below for consideration by emerging markets:

- (1) fixed penalty at the point of pre-payment;
- (2) higher interest rate over the life of the mortgage (the excess spread);
- (3) charge a lump-sum fee up front to consumer;
- (4) mark-to-market charge at the time of prepayment (similar to the yield maintenance provision in other fixed-income securities);
- (5) some combination of all these.

Charging the penalty based on any of the above methods, however, would only be the second-best solution, at least in terms of the consumer welfare

point of view and probably in the social welfare viewpoint as well. As long as mortgage investors in a country have an appetite for taking the prepayment risk with a fair compensation, then using a pass-through or other MBS structures (that are transparent to the investors) will be a welfare-enhancing way to control the prepayment risk. That will also help expand the funding base for the mortgage market. As stressed earlier, and establishing an industry norm for the information needed (e.g., expected prepayment speed from a mortgage pool of given characteristics) is an important element to that end.

There are two related points to make. First, MBS-financing is sound and efficient, but it is not the only method of wholesale funding to increase liquidity. As discussed in Section 3, the liquidity enhancement in the US has also been done through the issuance of debentures by those institutions that have good market acceptability, which may be a more feasible way in many emerging markets where other critical market-makers for MBS are not in place. Second, the existence of hedging market, the swap market in particular, is also important in controlling the interest rate risk. As it is generally rare to observe such hedging market in emerging economies, having a cross-border hedging contract can be considered given the expansion of the international derivative markets during the last decade.

On Managing Systemic Risk

Managing “systemic” risk, the one that intermediaries cannot diversify away even if they have a well-diversified portfolio, can be differentiated from the risk management under normal economic conditions. One reason for that is the high likelihood that, in a catastrophic risk event such as Great Depression or the Asian financial crisis, correlations assumed across different risk factors (e.g., the compensating risk factors included in a mortgage scoring model) can no longer be invalid.

The amount of “systematic” (rather than idiosyncratic) risk embedded in mortgage contracts is dependent upon the dynamics of economic variables of relevancy in a given country.¹¹ To illustrate this point, Table 4 shows the parameters of home price trends from three countries – Korea, US, and UK. The table shows that the HP volatility in Korea is higher than other countries: although the standard deviation from UK is higher than that in Korea, the downturn in Korea is deeper than UK and California in the US (see the minimum and 5th percentile annual growth rates) and the volatility per unit

¹¹ As to the effects of economic risk factors, Cho (2002) reports that the period of inverted yield curve, the volatility of FRM rate, and that of the US home trend all show a positive and significant effects on the mortgage yield spread (over 10-year CMT rate).

of mean growth (the compensating variation, CV) is also the highest in Korea. Those tail events are the ones that matter most in determining the extent of systemic risk.

Table 4: Home price dynamics—International comparison (annual growth rate)

Country, State	Mean (A/%)	STD (B/%)	CV (B/A)	Minimum (%)	5 th percentile (%)	95 th percentile (%)	Maximum (%)
US	5.1	2.6	0.52	0.2	0.8	8.4	13.3
UK	8.4	9.3	1.11	-7.9	-4.2	25.7	34.2
US, California	7.0	7.7	1.10	-6.3	-4.1	20.2	28.0
US, Ohio	4.4	1.2	0.28	1.1	2.2	6.8	7.5
Korea	4.0	8.3	2.07	-12.9	-8.7	17.5	20.8

Sources: Office of Federal Housing Enterprise Oversight (US), Bank of England (UK) (for 1984-2004), Kookmin Bank (Korea, for 1987-2004)

The critical element in managing this risk is an accurate measurement of the forward-looking distributions of state variables, home price and interest rates in particular. From them, one can estimate both expected and unexpected losses from a given loan cohort, from a particular mortgage portfolio, or even from a whole mortgage stock in a given country. Those expected loss multiples are, in turn, key credit risk indicators used for different business/policy decisions.

As mentioned in Section 3, it is expected that the capital adequacy requirements under Basle II will help standardize the measure of such expected and unexpected risks borne by different loan products.¹² However, a sufficient discretion on the part of regulatory authorities in a given country would be needed in coming up with its own capital adequacy rules that reflect intrinsic economic, institutional, and loan product conditions in a given country. Another point to make is that the Basle II-like capital requirement regime is still an intermediate step toward a more full-blown risk-based capital regulation, to the OFHEO's (Office of Housing Enterprise Oversight) stress test-based capital rules for Fannie Mae and Freddie Mac.

¹² There are growing number of studies on Basle II. Selecting a few relevant ones, Goordy (2000) compares two widely used commercial credit risk models CreditMetrics and CreditRisk+; Peura and Jokiova (2004) provide a model that simultaneously estimates actual bank capital (based on income and default losses), and regulatory capital under Basle II, and optimal capital cushion (difference between regulatory capital and economic capital); Calem and LaCour-Little (2003) test Basle II RBC requirements for mortgage loans and report that substantial variations in capital charges across different loan characteristics and geo-concentration levels exist; Calem and Follain (2003) test the asset correlation assumption for mortgage loans under Basle II and conclude that 15% asset correlation in Basle II falls w/in the range of their estimates.

On Enhancing Intermediation Efficiency

As discussed in Section 2, one necessary condition for a market-based MIS to flourish in a given country is that the net intermediation spread (δ in Equation (1)) to be non-negative such that for-profit entities choose to operate as intermediaries. This condition is in fact non-holding in many emerging markets, either because government mortgage programs with subsidized lending rates hinder the creation of a more efficient whole-sale funding through the secondary market or because a high degree of uncertainty in measuring the risk premia prohibits an accurate estimation of the net spread. This issue is another critical element in creating an efficient intermediation process in a given country, more so than other hurdles discussed such as the lack of data.

The survey of the evolution of the USMIS also shows the importance of the IT solutions for enhancing the processing efficiency. The internet and computer technologies are now universal, and developing AUS, AVM, and B2B or B2C connectivity in other countries are also feasible as long as the data required and technical expertise are in place. Even if some of those building blocks are not available, outsourcing to the data and modeling consultants from other countries is another option that can be considered.

One last issue to comment on is the unbundled (or specialized) intermediation process, as seen in the USMIS today. As discussed, this business model will help enhance the efficiency in the intermediation process. However, the problem of this unbundled intermediation process is the heightened likelihood of the principal-agent problem. That is, the unbundling and the automation of the origination, funding, and servicing processes can raise the issue of moral hazard in data and document verification, adverse selection of good quality loans (by originators) instead of passing them along to secondary market outlets, and even outright fraud. (Van Order, 2001) As shown in the Mortgage Backed Bond experiment in the late 1800s, this principle-agent risk can be toxic, leading to a demise of an entire class of intermediary, and calls for proper due diligence by both public and private institutions.

Concluding Remarks

This study examined the evolution and the current state of the USMIS, for the purpose of providing a benchmark for emerging mortgage markets in extending the service to a larger consumer segment in their countries. In the case of the USMIS, it took 180 years of evolution in shaping itself as an efficient financial intermediation system and, in consequence, has been

delivering welfare-enhancing products both to consumers and to investors. As discussed in Section 4, there are a number of lessons to be learned from this evolution process, and each of those topics covered represents the area of more in-depth future research.

There are also various issues that are important but are left out in this study, including the cross-border issuance of MBS or international funding for mortgage loans, more technical issues of risk quantification and best practice modeling and applications, mortgage choice and further innovations in the product development, derivative accounting, and so on. I hope that this survey promotes in any way future policy debates and research activities on these topics in emerging mortgage markets around the world.

One particular question that I like to pose as a closing is the issue of “right sequencing”: that is, how a country can arrive at a more efficient and more market-based MIS from where it is today. As surveyed in this study, the USMIS started as a communal solution in financing homes about 180 years ago; experienced various discrete and incremental changes in terms of institutions, products, and business processes; came up with various innovations that enabled not only to overcome those challenges but also to jump up to the next plateau; and, eventually grew to be able to deliver various welfare-enhancing outcomes. That is, the system development is likely to be path-dependent, and a right policy question to ask for most emerging markets would be not only how to define the best possible state for its own MIS but also how to define a logical next phase and through what sequence, or via filling in what missing links to get there.

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Appendix 1: Evolution of the USMIS

	Institutions	Products	Risk/Shocks
Pre 1930s: “Era of Exploration”	<ul style="list-style-type: none"> • “Terminating” Building Societies (since 1775) • “Permanent” Building Societies (1850s) • Mortgage companies (1870s) • Life insurance companies (active in the early 1900s) 	<ul style="list-style-type: none"> • Non-amortizing; variable rate; semi-annual payment • 6-11 year loan term, and 50 to 60% maximum LTV • Mortgage backed bonds by mortgage companies (1870s to 1890s) • Deposit/investment certificates (1890s) 	<ul style="list-style-type: none"> • Peer enforcement, and deposit-based funding • Localized risk management (e.g., 50-Mile Radius Rule) • Recession in 1890s – Demise of mortgage companies; agency problem in pooling • Significant growth in 1920s, & stock market clash in 1929
1930s to 1960s: “Era of Institutionalization”	<ul style="list-style-type: none"> • Creation of HOLC and RFC to liquidate bad loans/banks (1933) • Creation of FHLBs (1934) and Fannie Mae (1938) to increase liquidity • Creation of FHA, FDIC, FSLIC, and MI companies (1934) for credit enhancement • Privatization of Fannie Mae and creation of Ginnie Mae (1968) 	<ul style="list-style-type: none"> • Fully-amortizing loans with leveled monthly payments • Fixed interest rate, and 20+ year loan term • Maximum LTV up to 80% • Underwriting guidelines set by Fannie Mae (1954) 	<ul style="list-style-type: none"> • Great Depression (1930s) • National Housing Act (1934), and Housing Act (1949) • Regulation Q (1966) • Rising interest rates and inflation (1960s)
1970s to 1980s: “Era of Securitization”	<ul style="list-style-type: none"> • Creation of Freddie Mac (1970) • New investors into the market: mutual funds, pensions, foreign investors (1980s) • S&L Debacle (1980s), and creation of RTC (1989) 	<ul style="list-style-type: none"> • Introduction of ARMs (1981) • MBS issuance: 1st PC by Freddie Mac (1971), Ginnie Mae tandem (1974-1976), 1st private MBS by B of A (1977) • 1st CMO issuance (1984), and a big increase in MBS issuance (1982-1986) • Market for interest rate swaps (1980s) 	<ul style="list-style-type: none"> • 1st and 2nd Oil Shocks (1970s) • Interest rate hike and mismatch of asset/liability duration of S&Ls (1980s); Removal of interest rate ceilings (1980s) • Oil patch default ramp up (1980s) • FIRREA (1989) and Basle I (1980s)
1990s to Current: “Era of Automation/Computerization”	<ul style="list-style-type: none"> • Creation of OFHEO (1992) – Minimum & Risk-Based Capital Rules for GSEs • HUD Housing Goals for GSEs (1992) • Globalization of MBS markets (On-going) 	<ul style="list-style-type: none"> • IT Revolution – AUS, Mortgage Score, AVM (since mid 1990s) • Refi Booms (mid 1990s to early 2000s) • HELOC, Seconds, & other affordable products (1990s to current) 	<ul style="list-style-type: none"> • California default ramp up (early to mid 1990s) • Expansion of credit derivatives markets (since mid-1990s) • House-price index based hedging market – Being experimented