Securitization, the creation and sale of bonds backed by loans, has become an increasingly important method of financial intermediation in the past three decades. This dissertation attempts to further our understanding of the causes and consequences of the rise of securitization. To answer the question of why securitization exists, Chapter 2 explores the history and develops the theory of securitization. Securitization arose in the United States from a confluence of private and public actions. The theory of securitization simply states that the institution, where it exists, provides positive net benefits to market participants. It is unlikely that securitization can persist without some form of public support to overcome the informational costs it imposes.

These costs largely arise due to asymmetric information. Asset-backed securities (ABS) can reflect adverse selection (if issuers securitize relatively risky loans) and moral hazard (if originators shirk due diligence in anticipation of sale and servicers shirk monitoring). Chapter 3 reviews the evidence for asymmetric information in securitization, analyzes commonly proposed solutions, and argues for the formation of public ABS markets. It provides a synthesis of current theory regarding the choice of due diligence effort under securitization.

Chapter 4 examines how credit market dynamics change as an economy shifts from traditional lending institutions to securitization. Models of fractional reserve lending and securitization under a central bank are presented and compared in order to address this question. Fluctuations in the supply of credit are shown to be greater under the securitization regime because of the manifestation of regulatory requirements applied to both types of originators. These regulations manifest in the model as a minimum level of liquid assets each bank type (traditional banks and securitizers) must retain. This level is based on retained loan originations and thus
applies differently to the two regimes, creating disparate credit market and real outcomes after shocks to productivity and monetary policy. The result is due to a definitional tenet of any securitization regime: the practice reduces the amount of time loan originators hold loans on their balance sheets. In contrast to existing research, the results do not depend on issues of perverse incentives or asymmetric information in securitization markets relative to traditional lending.
Essays on Securitization

by
Alexander Gill

A dissertation or thesis submitted to the Graduate Faculty of
North Carolina State University
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

Economics

Raleigh, North Carolina
2019

APPROVED BY:

Douglas K. Pearce
Committee Co-chair

Nora Traum
Committee Co-chair

Lee A. Craig

Karlyn Mitchell

Ronald P. Endicott
Alexander Gill graduated *summa cum laude* with a Bachelor of Science in economics and political economy from Tulane University in 2005. He worked for four years in commercial mortgage-backed securities before attending graduate school in economics in 2009. He was a fellow of the Center for the History of Political Economy at Duke University in 2014, an Adam Smith Fellow at George Mason University in 2015, and has taught at St. Lawrence University for four years.
ACKNOWLEDGMENTS

I wish to thank the members of my committee for their able assistance and patience. All remaining errors are my own.

I am also grateful for funding received from the Pope Foundation for Higher Education.
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CHAPTER 1: Introduction

Securitization is the transformation of non-security assets into securities. Usually the term denotes the transformation of a pool of loans into bonds. Loans are originated directly or purchased from third parties, pooled, and then tranched according to the deal structure and the ratings received on the issue. The bonds are then sold to third parties, and the loans collateralizing the bonds are removed from the issuer's balance sheet. This method of financial intermediation is, in its modern form, not more than 60 years old, which means that it is an exceedingly recent development in credit markets dominated by fractional reserve systems since the Italian Renaissance beginning six centuries ago. Furthermore, securitization did not become a nonnegligible portion of any credit market in the U.S. or Europe other than for mortgages until the 1990s. Research from that decade is therefore focused on understanding the contours of this new system that was and probably still is in the process of supplanting traditional fractional reserve lending systems, under which loans are funded by deposits.

Issuance of securitized assets, or asset-backed securities (ABS), is typically financed with the use of short-term debt and equity supplied by the issuer. Furthermore, these securities (at least those with a “shelf registration” from the Securities and Exchange Commission, or SEC, allowing public marketing and sale of a security in the U.S.) are traded after issuance and also commonly serve as collateral for subsequent issues of ABS derivatives. Hence these securities, once widespread, presented challenges to the financial industry and academia then accustomed to traditional banking methods. How should these securities be priced? How are risks associated with holding ABS, like risk of default or prepayment, exposure to interest rates fluctuations, etc., to be evaluated? What rules should rating agencies and others use to evaluate collateral and the bonds themselves, especially prior to the availability of historical statistics? What are appropriate
underwriting and deal structuring heuristics? How is collateral seizure best accomplished subsequent to default, and to whom and how are those rights recorded and changed?

By 2007 and 2008, it was almost unanimously agreed that extreme volatility in credit markets was traceable to ABS, most specifically MBS backed by subprime mortgages, where “subprime” indicates the credit quality of the mortgagors. Moreover, many construed the unfolding crisis as “systemic” rather than indicating a large shock to credit markets or a temporary and infrequent interruption to an otherwise sound system of financial intermediation. Two themes are common from this period and the literature immediately after it: (1) Moral hazard and adverse selection play important roles in ABS issuance and account for its lack of stability. (2) ABS issuers are able to lever loan issuance to a greater extent than traditional banks, creating more exposure to risk and also leading to “leverage cycles,” whereby the necessity of deleveraging in bad times makes bad times even worse and vice versa. These themes together indicate what could fairly be called the conventional wisdom on securitization, especially among policymakers and researchers. ABS issuance is subject to asymmetric information problems and inadequate regulation, and it is for these reasons that the process contributed to, exacerbated, or even caused the financial crisis of 2007 and 2008.

In order to evaluate these claims, the origin and nature of securitization itself must be properly understood. This is the task of Chapter 2, entitled “The Theory and History of Securitization.” Next, the role of asymmetric information, or more generally the distinct incentives facing loan originators under a system in which they hold originations until maturity versus one in which they sell loans shortly after origination and hence capture some portion of expected returns from the loan prior to repayment, is examined in Chapter 3. “Securitization and Asymmetric Information” begins by reviewing the mixed evidence for asymmetric information problems in
ABS markets, then develops a theoretical account of three commonly proposed revisions to rules governing securitization practices in order to address these perceived problems. The possible informational benefits of public ABS exchanges are also examined. Stable ABS markets require aligning the incentives of loan originators and ultimate lenders that adjustments to the structural implementation of securitization may accomplish.

Chapter 4, “Securitization, Central Banking, and Credit Cycles,” evaluates securitization’s theoretical role in credit market volatility in a modern economy. The primary result of this analysis is that securitization regimes are likely to exhibit increased volatility relative to traditional, fractional reserve banking due to the regulatory arbitrage available to ABS issuers, namely an exemption from liquidity requirements on monies used to fund sold loans. The regulatory advantage to securitizers arises from the fact that the liquidity requirement references loans retained by financial intermediaries. By the definition of securitization, loans are removed from originators’ balance sheets under a securitization banking regime, and the application of the regulatory liquidity requirement only to loans held on balance sheet allows ABS issuers to evade the requirement on a portion of originations. This regulatory arbitrage results in increased lending and increased exposure to negative policy and real shocks relative to a traditional banking system.

There are important differences between the analysis in Chapter 4 and pre-existing studies of this ilk. First, the central bank in the model presented is present throughout the course of decision making each period. This bears mention because typically (e.g. Gorton and Metrick 2012 and 2013, Gertler and Kiyotaki 2010, and Gertler, Kiyotaki, and Queralto 2012), models of financial intermediation are constructed and solved prior to the introduction of the central bank, which is then tasked with fixing whatever problems identified by the modeler in the basic model, usually a straightforward task. But the central bank is always present in the real economy and is
always accounted for by market participants whether or not a crisis is unfolding. This feature of the model allows an analysis of the changed nature of monetary policy transmission as credit markets become more saturated with ABS.

There is also no leverage or information asymmetries in the model presented -- both traditional banks and ABS issuers are equity-less and exist in a moneyless economy. Both bank types are fully owned and controlled by households. So increased volatility is not the result of increased leverage or information asymmetry under securitization regimes but rather solely due to the distinct effects of regulations on the two types of banks' profit-maximizing decisions. The analysis does not rule out leverage cycles or other accounts of volatility in securitization markets, but it does show that an explanation of high volatility in ABS markets does not necessarily have to rely on leverage cycles. This point is important because it indicates that forcing ABS issuers and traditional banks to adhere to the same maximum leverage requirements may not eliminate the observed relatively high volatility of ABS markets.

Before turning directly to the tasks outlined above, a few comments are appropriate to help the reader interpret the results herein. Throughout this work, welfare implications are largely ignored. It is not clear that increased volatility and issuance under securitization is a welfare improvement for savers or firms or banks. Asymmetric information is largely regarded as a necessary evil. To the extent that welfare implications are present in the analysis, the agents considered are savers by tacit implication. More defaults are worse than fewer, implying that we are concerned with the welfare of the agents holding the loans rather than the welfare of a dishonest bank. We similarly refrain from attributing consequences of the development of securitization, whether generally favored or not, to the “market” or to the “state.” As will become clear in the following chapter, neither abstract entity is responsible for the creation of modern securitization.
It was instead a result of the interaction of the two, and neither side of the story can fairly be attributed credit for its ultimate form -- neither the government nor private market participants were able to unilaterally design the market structure. If we adopt a stability norm, under which volatility is welfare decreasing in and of itself, then securitization can plausibly be labeled a retrogressive development from the perspective of all involved. No other approach allows an unambiguous statement of the welfare implications of securitization, even if we limit our analysis to the implications for savers (the ultimate lenders in the models presented in Chapter 4). Would increased ABS issuance that results in both more physical capital formation and higher default rates be a net gain or loss for households? The only conceivable answer to this question is arbitrary, the transformation of a particular assumption about household preferences into particular welfare implications. We refrain from this exercise for that reason.
CHAPTER 2: The Theory and History of Securitization

2.1 -- Introduction

Securitization refers to the creation of bonds from homogenous pools of loans. Loans are originated and/or purchased and pooled, then bonds backed by the cash flows from the loan payments are sold to investors. These bonds are generally referred to as “asset-backed securities” (ABS).¹ In this chapter, “securitization” is defined as (i) pooling loans and (ii) issuing bonds backed by those loans. Recent regulatory changes require ABS issuers to retain at least 5% of the credit risk in ABS they issue, but prior to 2014, issuers were allowed to sell 100% of loan pools and retain no credit risk on sold bonds.²

The use of securitization to fund loans marks a significant shift in banking methods in use since the 15th century. From the Italian Renaissance until the mid-1990s, banks funded loans with deposits and generally held loans on balance sheet until maturity. From the mid-1990s until the Great Recession, U.S. and European credit markets funded increasing shares of mortgages, credit card loans, car loans, and student loans with ABS issuance. The shift is a change not only in the source of credit but in the incentives facing loan originators, who no longer depend on the absence of loan defaults for profit. Proponents of securitization point to perceived reductions of risk to investors (and consequent lower interest rates facing borrowers), tax and regulatory advantages to issuers, increased liquidity, and the ability it grants to government to channel credit to politically favored groups. Detractors point to asymmetric information problems inherent in securitization, the perceived role of ABS in the Great Recession of 2007-09, and increased costs of resolving

² Section 941 of the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 mandated the Securities and Exchange Commission create rules governing minimum risk retention by ABS issuers. These rules were implemented on October 22, 2014 and are accessible online at https://www.sec.gov/rules/final/2014/34-73407.pdf.
defaults due to the opaqueness of ABS markets. These issues, among others, will be discussed in more detail below.

Modern methods of securitization were fully developed about 30 years ago, but many of the “most basic and pressing questions” about securitization remain unanswered (Gorton and Metrick 2013, 58). Perhaps chief among them is the question of why securitization exists. An answer would provide an historical account of securitization's emergence as well as an explanation of the institution's persistence in terms of the positive net benefits it provides market participants and policymakers. To that end, the next section traces the development of securitization and securitization-like institutions in the U.S. and shows that modern securitization is the result of government policies intended to favor certain groups of debtors and the rational responses of market participants to those policies. The subsequent section evaluates the theoretical tradeoffs in securitization for market participants.

2.2 -- History

Most historical descriptions of securitization (e.g., Hu 2011) begin in 1968, when the Government National Mortgage Association (Ginnie Mae or GNMA) first guaranteed a pool of residential mortgages,3 but attempts to create bonds out of collections of mortgages date back at least to the late 19th century in the U.S. and Europe. Snowden (2010) documents the use of covered mortgage bonds (which differ from today's mortgage-backed securities (MBS) in that collateral was held by the seller rather than transferred to investors) for over two centuries in Europe, as well as attempts to copy such institutions in the U.S. as early as the 1880s for farm mortgages. These early European structures were not true securitizations because the bonds were still backed by the credit of the issuing institution. These institutions are best described as public-private partnerships.

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3 Ginnie Mae is a U.S. government corporation created by the Housing and Urban Development Act of 1968. It guarantees qualifying mortgage-backed securities but does not otherwise participate in secondary mortgage markets.
channeling credit to underserved groups of borrowers, namely those without access to urban credit markets.

Similarly, early securitization-like schemes in the U.S. were attempts to bridge geographic distance between Midwestern farms and eastern centers of finance. The Federal Farm Loan Act of 1916 created a semi-private system of joint-stock mortgage banks that had to satisfy federal regulatory requirements but were not formally backed by the credit of the federal government. The resulting Federal Land Banks, modeled on the German Landesbanken, imposed interest rate ceilings on farm mortgages and issued farm mortgage-backed bonds.4 This system accounts for the first securitizations in the U.S. under the definition used in this work in that some mortgage-backed bonds issued were removed from lender balance sheets and became the complete liability of the borrower. The Wilson Administration, like the later FDR Administration for residential mortgages, wanted to allow borrowers (voters) access to the capital available to large corporations in securities markets. Farm mortgage securitization continued in the 1920s but failed to provide stable credit to the underserved agricultural sector, displaying many of the apparent weaknesses of modern securitization, including steadily weakening underwriting standards and frequent defaults. When the Great Depression arrived, the federal government began assuming these failing banks' liabilities (Goetzmann and Newman 2010). These developments led to a federal ban on private securitization in the Securities Act of 1934. Like other bonds, MBS must be registered with the SEC prior to public sale.

The key conclusions of historical studies of securitization schemes are that (i) the history of securitization begins well before 1968, contrary to most accounts and (ii) the informational problems associated with securitization have always been present and misunderstood. Snowden

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4 Currently, the Federal Agricultural Mortgage Corporation (or Farmer Mac) securitizes farm mortgages in the U.S.
(1995, 294), after a painstaking review of securitization's prehistory concludes, “[e]very [securitization-like] structure...that appeared before 1930 failed...There is always some limit to the amount of default risk that can be absorbed in a privately financed securitization structure...[before] the severe informational problems that are inherent in mortgage securitization appear in full force.”

The present form of securitization began to emerge because of the creation of the Federal National Mortgage Association (FNMA or Fannie Mae) in 1938 and the formalization of the use of credit rating agencies in secondary bond markets in 1934. These institutions proved critical to the development of a new market in residential mortgage-backed securities (RMBS). Securitization of other assets (credit card receivables, car loans, student loans, etc.) arose decades after mortgage securitization and does not currently display the high market share held by RMBS. Fannie Mae was created to help current and future homeowners afford mortgages despite the dire economic conditions of the 1930s. FNMA sponsored mortgages directly over the following three decades, but in 1968, Congress split FNMA into two private (the modern-day Fannie-Mae) and the Federal Home Loan Mortgage Corporation (FHLMC or Freddie-Mac) and one public (GNMA) entities, all tasked with increasing liquidity in mortgage markets. GNMA began guaranteeing qualifying mortgages with the full faith and credit of the U.S. Government. FNMA and FHLMC are government-sponsored enterprises (GSEs), chartered by Congress but owned by shareholders,

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5 According to the standard account, the share of ABS in the mortgage market hit 50% in the early 1990s and has been around that level since, and saturation in other ABS markets (student loans, credit cards, auto loans, etc.) never exceeded 25%. The Federal Reserve's Flow of Funds releases, the source of most of the data presented in the literature, show that securitization probably accounted for over 50% of non-mortgage consumer credit at its peak in 2001 (see below on the repeal of key legislation in this market in 2004) then fell to under 5% by 2013. Including issuance by GSEs, the majority of mortgage funding in the U.S. has consistently come from ABS issuers since the early or mid 1990s. See http://www.federalreserve.gov/econresdata/releases/mortoutstand/current.htm and http://www.federalreserve.gov/releases/g19/current/default.htm for the most recent data. More detail on securitization’s share in various credit markets is provided below.
but enjoy the implicit backing of the federal government.⁶ Beyond the credit enhancement derived from government guarantees, packaging the securities into pools and issuing securities backed by the pools would also make the mortgages more salable, especially to institutional investors such as pension funds and insurance companies interested in maintaining diversified portfolios. Over the next decade and a half, nearly all mortgage-backed security issuance was done under implicit (from Fannie Mae or Freddie Mac) or explicit (from Ginnie Mae) government guarantees.

The first private mortgage securitization was completed by Bank of America and Salomon Brothers in 1977. Lewis S. Ranieri, an infamous executive at Salomon Brothers at this time (who also coined the word “securitization” and is a major subject of Michael Lewis's 1989 bestseller Liar's Poker), was instrumental in this deal. In a speech 17 years later (and after leaving Salomon Brothers), Ranieri (1996, 33) recalled, “Unfortunately, the victory of creating the [private] first pass-through⁷ mortgage-backed security was followed by a total failure of the issue.” The failure was due to a counterproductive legal environment in which the regulatory and tax statuses of the bonds were not clear. Many potential investors were precluded from buying the securitized mortgages by state-level regulations derived from prior experience with widespread failures of securitized farm mortgages in the Great Depression, despite the attractive yields on government-guaranteed debt. In order for financial intermediaries to take advantage of the government's support of residential mortgages, some adjustments to the legal code were required.

Private mortgage securitization began in earnest after the Tax Reform Act of 1986 (hereafter, the Act). Prior to the Act, an institution invested in MBS was required to pay taxes on

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⁶ Although FNMA and FHLMC are technically GSEs, both have been under the conservatorship of the Federal Home Finance Agency since 2008.

⁷ A pass-through (or “pass-thru”) entity is a type of special purpose vehicle (SPV) that holds assets on investors' behalf and passes income from the assets along to investors. The entity's activities are highly circumscribed legally and are typically allowed to perform only this function.
the income derived from those securities, and savers (institutional clients, e.g. pensioners and annuity holders) were required to pay taxes on income from institutional intermediaries. In other words, income from MBS was double-tax ed before ultimate investors (savers) could spend it. In the same manner, direct mortgages (those made by lender institutions and held on their balance sheets) became subject to double taxation if interest income is not retained by the company but instead distributed to shareholders. The Act created the Real Estate Mortgage Investment Conduit (REMIC), a pass-thru entity restricted to holding mortgages, and exempted it from federal taxation, allowing mortgage originators to securitize mortgages by creating a REMIC to hold a loan pool and issuing regular (debt) interests (i.e., bonds) backed by the pool to investors, usually through large financial intermediaries. Although it was technically possible to securitize loans without incurring double taxation before the Act, ambiguities in tax and corporate law prior to the Act effectively precluded investment in securitized products (Alexander, Ferst, and McCauley 1997, Gorton and Metrick 2012). Ranieri was instrumental in the creation of the Act and other key legislation. In the same 1995 speech, he stated:

In 1981, I realized that we needed to bring to final resolution the two sets of long-term problems that were stunting the mortgage market: the tax problem and the legal investment problem that the agencies had not resolved completely.⁸ I needed to take the legislative route and convince Congress to adopt legislation permitting the capital markets to meet the nation's housing needs more efficiently and effectively. I enlisted some help, Shannon Fairbanks from the White House and Bernie Carl, a respected Washington lawyer. We developed two pieces of proposed legislation: the Secondary Mortgage Market Enhancement Act of 1984 (SMMEA),

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⁸ Ranieri is here referring to state-level lobbying and advising done by the GSEs with the general intent of widening and deepening securitization in mortgage markets over the 1970s.
a doing-business bill that would preempt state laws for rated mortgage securities and make them a legal investment for almost all investors; and a new section of the Tax Code, Trust for Investments in Mortgages (TIMS). We spent two and one-half years lobbying for these sister bills. Finally, SMMEA was passed by Congress. Our Act is cited in the “Investment Section" of every mortgage securities issue as the source of the state law preemption.

Unlike SMMEA, our tax bill was not passed by Congress. It was defeated primarily by Andy Furer, an analyst at Treasury, who opposed the bill because he could not determine our intentions. Given that I do not easily accept defeat, my reaction to the Treasury's opposition was to hire Andy Furer. With the assistance of this brilliant tax analyst, we rewrote the previous bill to meet his objections. The bill was finally passed after two more years of lobbying as part of the Tax Reform Act of 1986. Our legislation created a new tax vehicle called Real Estate Mortgage Investment Conduits, commonly called REMICs.

SMMEA solved our investment problems, and the creation of REMICs gave us our own private provision in the tax code...We won total flexibility.

The Act did not require a REMIC to be of any particular corporate form or to possess any implicit or explicit government guarantee. REMIC provisions were first employed during the savings and loan (S&L) crisis by the Resolution Trust Corporation, a federal agency tasked with taking over failed S&Ls and liquidating their assets. (Lustig 1997) But by the mid-1990s, private originators of commercial and residential mortgages were beginning to securitize loans more frequently, and MBS issuance grew until the onset of the Great Recession.
Figures 1.1 and 1.2 show nominal MBS issuance over 1996-2017 and MBS outstanding for the period 2002-2017, respectively. Private commercial mortgage-backed security (CMBS) issuance began in 1994 after being spearheaded by the Resolution Trust Corporation in the early 1990s, and RMBS grew with mortgage debt and the support of the “agencies” GNMA, FNMA, and FHLMC. Thus both CMBS and RMBS issuance steadily increased until the onset of the Great Recession. Thereafter, private MBS issuance fell precipitously and has yet to recover. Private CMBS issuance peaked in 2007 at $240.5 billion, fell to $17.3 billion in 2008, and was

Figure 2.1: MBS Issuance. Source for Figures 2.1 and 2.2: Securities Industry and Financial Markets Association, U.S. Mortgage-Related Issuance and Outstanding
only $97.7 billion in 2017. Non-agency RMBS issuance peaked in 2006 ($1.3 trillion), fell to $52.7 billion in 2008, and totaled $126.3 billion in 2017. These declines in issuance were sufficient to decrease the outstanding amounts of RMBS and CMBS over 2008-2013 and 2007-2017, respectively. RMBS outstanding has increased since 2013 primarily due to agency issuance, as clearly shown by overlap of total and agency RMBS issuance since 2008 in Figure 2.1, though non-agency issuance increased year-over-year in 2017, and issuance through October 2018 has already exceeded that total by $38 billion.

Figures 2.3 and 2.4 show non-mortgage-related ABS issuance and outstanding nominal amounts, respectively, for various asset classes since 2000. Collateralized debt obligations (CDOs) and collateralized loan obligations (CLOs) are ABS that can include non-mortgage loans in addition to mortgages. CDOs may include existing ABS.\textsuperscript{9} CDOs may include existing ABS.\textsuperscript{10}

\textsuperscript{9} Depending on the content of the asset pool backing a CDO, CDOs are ABS in some cases and derivatives in others.

\textsuperscript{10} The pooling and sale of existing ABS is called “re-securitization.”
There are ABS backed by non-mortgage loans, though none in which securitization plays the role it does in residential mortgage markets. The Financial Asset Securitization Investment Trust (“FASIT”), an entity parallel to a REMIC but applicable to the sale of pools of other types of credit (usually shorter term credit than mortgages), was introduced in the U.S. by the Small Business Job Protection Act of 1996 and repealed in 2004. The lesser (though still substantial) significance of securitization in these other credit markets may be due to the present lack of a securitization vehicle that provides legal and tax certainty to market participants. It may also reflect the higher transactions costs associated with securitizing short-term, volatile credit contracts such as credit card receivables. Issuance of ABS backed by automobile loans, credit card receivables, student loans, and other loans types displays similar behavior over 2000-2017 to that of non-agency MBS discussed above. Issuance of all types declined during and after the Great Recession and has yet to recover. Furthermore, the decline in issuance was sufficient to cause the outstanding amounts of these ABS to decline until 2016 or 2017. Other than in residential mortgages, buttressed by government support, securitization currently funds a smaller portion of major U.S. consumer credit markets than prior to the Great Recession. Figure 2.5 shows the level of saturation of securitization, defined as outstanding ABS divided by total loans outstanding, in selected credit markets.
Securitization saturation for major credit markets other than residential mortgages peaked in 2006 (automobile loans) or 2007 (commercial mortgages and student loans) and declined thereafter. Securitization of credit card receivables peaked in 2002.\textsuperscript{11} None of the markets other than residential mortgages currently display saturation ratios above 20%. RMBS outstanding comprises 72.7\% of total residential mortgage debt in the U.S. These data strongly suggest that securitized credit markets are faltering in the absence of some sort of public support for securitization, in this case in the form of GSE-backed issues of RMBS. CMBS, for instance, enjoys all the tax and regulatory advantages (further discussed below) enjoyed by RMBS, but GSEs do not purchase, originate, guarantee, or issue MBS backed by commercial mortgages. Notably,

\textsuperscript{11} Securitization saturation in revolving consumer credit markets declined sharply in 2009 in the midst of significant deleveraging by consumers. The decline in total credit card debt exceeding the decline in credit card receivables outstanding, suggesting loans that were not securitized were more likely to be paid than those securitized during that period.
agency RMBS are exempt from the 5% retention requirement, another factor that may be supporting RMBS issuance.

The history of securitization indicates that securitization did not arise independently of political motives and that the development of the private market in the U.S. did not occur until after the federal government created a variety of special provisions to make the practice attractive to potential market participants. This experience in the U.S. and Europe does not inspire confidence in the wisdom of using bond issuance to fund loans to individuals and small firms. Attempts to create secondary markets for farm and residential mortgages all failed prior to the creation of Fannie Mae in 1938. GSEs comprised 100% of the U.S. secondary mortgage market until the 1970s. A rapid expansion of private issuance in the 1990s and 2000s ended in

Figure 2.4: ABS Outstanding Excluding MBS. Sources: Securities Industry and Financial Markets Association, U.S. Mortgage-Related Issuance and Outstanding; Board of Governors of the Federal Reserve System releases: “G.19 Consumer Credit” and “Mortgage Debt Outstanding”
the Great Recession and the collapse of securitization for all but residential mortgages. Thus, to date, there is no evidence of a private ABS market able to withstand credit market fluctuations, leaving aside for now the question of whether those fluctuations are due to endogenous or exogenous causes. So the question arises of why anybody would create and participate in ABS markets. The following section identifies the perceived net benefits of securitization to market participants in order to explain the existence and (perhaps unimpressive) persistence of securitization.

Figure 2.5: Securitized Portion of Total Lending in Selected Credit Markets

Sources: Securities Industry and Financial Markets Association, U.S. Mortgage-Related Issuance and Outstanding; Board of Governors of the Federal Reserve System releases: “G.19 Consumer Credit” and “Mortgage Debt Outstanding”
2.3 -- Theory

Why would a bank choose to securitize its loans rather than hold them on its balance sheet? Why would an investor purchase ABS rather than whole loans or bank stock? Ultimately, an economic explanation of securitization must show how the benefits of this form of financial intermediation outweigh the costs for market participants. The history reviewed in the previous section leaves open the question of whether securitization would exist or persist without government intervention, and many of the benefits of securitization discussed below are created by taxes and regulatory structures. There are costs and benefits of securitization however implemented as well as costs and benefits associated with any particular structural implementation.

What are the benefits and costs of securitization for market participants? Borrowers get lower interest rates and better terms via access to bond markets, though they may lose important features of traditional loans like the ability to negotiate with lenders while in delinquency. Policymakers get credit for lowering the cost of credit to large blocks of voters. Investors get the opportunity to invest in a diverse pool of loans in liquid asset form. Issuers of ABS get fees, commissions, and the spread between their short-term cost of credit and the yield on assets held in their securitization pipeline. They also no longer have to raise deposits to fund loans but can use bridge loans and the proceeds from previous sales to fund originations. Finally, securitization also allows financial intermediaries to engage in tax and regulatory arbitrage.

Securitization provides benefits to and imposes costs on all actors involved, and their participation in these markets indicates the perceived positive net benefit of ABS to each group. The subsections below describe the perceived net gains of market participants in terms of risk, public policy, institutions, incentives and information, and macroeconomic stability.
2.3.1 – Risk

Perhaps the most universally cited advantage of securitization is that it diminishes risk borne by investors through increasing diversification.¹² Risk is the chance of loss, and diversification lowers the volatility of a portfolio’s return (as long as the pooled assets do not co-vary perfectly), not the likelihood of negative returns. The mere pooling of loans does nothing to affect the chance of loss to lenders in the aggregate due to the “adding up” constraint. Unless the act of pooling introduces some new factor of correlation between the loans that did not exist prior to pooling, or the selection mechanism for choosing loans for the pool causes the individual loan performances to co-vary, the benefits of investing in ABS are identical to the well-known benefits of investment diversification. The overall risk associated with the asset pool is not changed by securitization, but the risk faced by individual investors is lowered relative to investing in whole loans.

So it is generally uncontroversial to argue that securitization limits risk to investors who otherwise would not have been able to invest in a large pool of similar assets while the performance of each asset is at least partially independent of the performance of other loans in the pool. This logic supported all of the securitization schemes discussed above. There are three reasonable positions on this issue of independence. First, one may make the assumption that all loans are independent and remain so when pooled. Second, one may assume that loans are not independent and that pooling the loans does not affect this covariance. Third, one may assume that loans are independent but that the act of pooling introduces common factors to the pooled loans that cause

them to co-vary in some systematic and significant way.\textsuperscript{13} (The position that they co-vary until pooled is ruled out as unreasonable.) If one adopts either of the first two positions, it is clear that securitization will lower risk evaluations of individual investors. The third position, however, would lead investors to higher risk estimates and offset some of the risk-reduction-through-diversification effects that make securitized assets seem so attractive to investors.

The ability to subordinate payments to certain classes of bondholders is also widely viewed as a distinct advantage of securitization with regard to risk. Specifically, “payment waterfalls” that specify that senior bondholders are paid in full prior to junior bondholders receiving any remuneration shield investment-grade bondholders from losses they would have incurred under a system that allocates delinquencies on a pro rata basis. ABS are divided into different tranches and arranged in a payment queue. Payments received from borrowers are distributed to the (most senior) tranche highest in the payment waterfall, then to the next most senior tranche, until all loan payments have been distributed. Any payment shortfalls thus accrue to the junior tranches at the end of the queue. Subordination shifts but does not reduce risk facing investors in the pool. Investors in lower tranches accept more risk in return for yield, while senior bondholders make the opposite exchange. Recall that loan pools are homogenous mixtures of loans, so the loans backing the different tranches of a given ABS issue are the same. The disparate ratings and yields assigned to the tranches reflect the investor’s place in the payment waterfall, not underlying credit quality.

Assuming diverse risk preferences, the ability to separate expected losses in this manner could improve investor welfare. Securitization also shifts risk from originator to investor as well as among investors in a single ABS issue, which is also welfare-improving to the extent that

\textsuperscript{13} There is some empirical evidence of this. See Ciochetti et al. (2003) and Black et al. (2012). The logic is that loan originators’ preferences and underwriting standards may cause realized returns on loans from one originator to co-vary.
originators and lenders do not coincide. There are numerous other arrangements, conventions, and practices in securitization markets that are viewed as credit enhancing, like letters of credit behind specified bond tranches and escrow provisions in large loans in the pool. REMIC provisions, though strict in requiring only mortgage assets in the pool, are highly flexible (as Ranieri brags above). Issuers can effectively create new credit enhancements as needed to market bond issues. These are all similar to credit enhancements used by balance sheet lenders.

The analysis thus far has focused on default risk, but other categories of risk are thought to be affected by securitization, like prepayment and counterparty risk. Prepayment risk poses a significant issue for RMBS investors. Large institutional investors hold the bulk of outstanding ABS according to Federal Reserve Flow of Funds data. Insurance companies and pension funds are not only concerned with absolute returns but the specific intertemporal character of their investment returns. A loan that pre-pays denies the lender interest income over the period from payoff to originally scheduled maturity and causes an unexpected mismatch between assets and liabilities, like annuity and pension payments, to these investors. It is not surprising, therefore, that prepayment provisions are commonly included in mortgage contracts intended to be securitized. A collateralized mortgage obligation, or CMO, addresses prepayment risk by tranching issues according to prepayment, rather than payment, priority.

Bankruptcy-remoteness, which shields previously securitized assets from becoming part of any subsequent bankruptcy proceedings of the issuer, also allows ABS investors to escape exposure to the risk that issuers default on their other obligations, avoiding giving other creditors claims on ABS previously sold. Loutskina and Strahan (2009) show that the extension of credit is less sensitive to the health of bank balance sheets after the development of securitization markets, implying that securitization helps investors avoid counterparty risk.
2.3.2 – Public Policy

Because of the perceived effect of securitization on risk, an investor would not purchase a whole mortgage while the same investor would deploy that amount of monetary capital to invest in a diversified pool of mortgages. Securitization can therefore be used as a method to intermediate loans across geographic distance and other dimensions of saver/investor heterogeneity. Securitization is also viewed as a way to increase total lending, especially to borrowers in economically disadvantaged or politically favored (i.e. homeowners and farmers) groups. Other types of government support for favored groups of debtors may account for increased lending, but the development and support of securitization by GSEs has at least coincided with a boom in mortgage lending.

A proper empirical account of the strength of these effects is difficult to complete. RMBS must be excluded from the analysis because of the government support for that market. Even in the CMBS market, the empirical effect of introducing securitization is not clear. Brian and William (2002), for instance, find evidence that commercial mortgage spreads (over Treasury yields) declined over the first years of CMBS issuance (as CMBS market share was steadily increasing) but spiked during the Russian debt crisis (1998), and the commercial mortgage market nearly tripled in size from 1990 to 2010. Over the same period, nominal GDP increased approximately two-and-one-half times. An et al. (2009) measure gains from securitization on the order of an 11-20 basis point lower yield on commercial mortgage backed securities versus commercial mortgages held on banks' balance sheets. This suggests that securitization increases issuance and

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14 Berrospide, Black, and Keeton (2013) found that residential mortgages were more dispersed after the introduction of widespread securitization and that the practice likely mitigated spillovers from markets more to markets less affected by the financial crisis.
15 Naranjo and Toevs (2002) attribute decreased credit spreads and volatility in residential mortgage markets to GSE participation.
lowers yields but is not conclusive. To date there is no empirical investigation of the effects of securitization on mortgage interest rates that controls for government intervention, known shocks to credit markets in history, and the tax and regulatory advantages of ABS in the United States.

2.3.3 – Institutions

There are also tax, regulatory, and legal benefits to securitization. Current securitization practices allow a wide range of possibilities to change equity investments into debt investments for tax purposes. Additionally, most extant special purpose vehicles, commonly used to hold ABS, are explicitly exempt from federal taxation and provide legal certainty with regard to tax liability. In effect, securitization provides a way for investors to avoid all but personal income taxes (and capital gains and losses if they don't hold the ABS until maturity) on their investments.

Some other legal conventions are also unambiguously favorable to securitization. Sold ABS are not considered legally or financially connected to the issuer in any way after an arms-length sale. Various state and federal laws ensure the “bankruptcy remoteness" of the securitized asset from its original issuer. This fact is crucial to ABS investors. If one purchases a bond which subsequently performs as expected, yet the issuer files bankruptcy, an investor clearly has an interest in keeping his or her bonds out of the bankruptcy proceedings. Current laws and regulations shield investors from “clawback," whereby the creditors of the bankrupt issuer convince the court that previously sold securities should be taken from buyers in order to pay creditors. If clawback is prohibited by law, then ABS investors are not subject to any counterparty risk arising from the financial situation of the issuer.

Most domestic (e.g. state-level regulations in NY, CA, etc.) and international bank capital regulations (e.g. the Third Basel Accord, now binding on Federal Reserve member banks) make recourse to capital tiers and the perceived risk of certain asset classes. Bank capital requirements
generally call for lower leverage on the back of progressively lower quality assets held on a balance sheet. Securitization provides a tool to shift risk with regard to certain held asset classes, allowing more flexibility underneath given regulatory requirements (Acharya, Schnabl, and Suarez 2013). Holding credit-enhanced ABS can allow a financial institution to hold a fraction of the equity on hand that would be required to hold the underlying assets themselves. For example, under the Basel III Accord, the risk weight applied to commercial mortgages is 100% while the weight applied to investment grade commercial mortgage-backed securities (CMBS) is 20 to 50%. In a typical CMBS transaction, 70-90% of the loan pool is rated investment grade. Though specific transactions will differ, a bank can expect to avoid about 25% of the regulatory capital requirement for commercial mortgages by transforming the loans into CMBS (author's calculation from CMBS averages in An and Deng (2007)). Moreover, re-securitization (pooling existing ABS as collateral for new issues of ABS) allows the process described above to be repeated. Re-securitization allows issuers to create investment-grade tranches of CDOs out of junk-rated tranches of existing MBS by creating a new payment waterfall with senior tranches at the head of the new payment queue. Securitization gives market participants the ability to structure their assets in order to minimize capital requirements, and regulatory arbitrage is thought by some researchers to be the driving force of ABS issuance in practice.19

Securitization may increase the cost of seizing collateral if, as it is often accused of doing, it creates an opaque chain of title (Oppenheim and Trask-Kahn 2012, Levintin 2013, Kruger 2018).

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17 In this context the latest rules refer to Basel II (http://www.bis.org/publ/bcbs128.pdf, pp. 126-127 and p. 24).
18 When determining how much Tier-1 capital they are required to hold under the Basel Accords (“regulatory capital”), banks sum exposures to various asset classes based on risk ratings, or weights, set by the regulations. A higher risk weight denotes higher perceived riskiness of an asset (and requires higher equity reserves). Residential mortgages, typically backstopped by sovereigns in various forms, have a risk weight of 35%.
Even if the ownership of the first-loss piece\textsuperscript{20} can be determined, coordination problems are likely to arise if the foreclosure right is shared among multiple investors.\textsuperscript{21} The ability of bond holders to determine whether they have a right of foreclosure has been further undermined by re-securitization as well as the practice of using ABS to collateralize repurchase agreements (repos), which should transfer ownership of the ABS and associated rights to the lender for the duration of the repo.

### 2.3.4 – Incentives and Information

Securitization also spares loan originators and securitizers credit risk relative to balance-sheet lenders. Passing the credit risk directly onto investors may incentivize banks to take advantage of information asymmetries and promote more risk-taking and over-lending. The market structure, moreover, increases the informational distance between savers and borrowers, intensifying any underlying asymmetric information problems and allowing increased opportunity for fraud.\textsuperscript{22} The presence of institutionalized moral hazard\textsuperscript{23} in securitization markets is widely accepted by academics\textsuperscript{24} and practitioners alike.\textsuperscript{25} Because they pay the costs of collateral and loan due diligence prior to marketing the securities, ABS book-runners (financial intermediaries) can manipulate third party due diligence providers, such as appraisers and rating agencies, to report information such that issuer profit is maximized and risks facing investors are possibly

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\textsuperscript{20} A first-loss piece is the lowest-tranche portion of an ABS issue that is “in the money” (can expect at least partial payment given current defaults). It usually carries the right of foreclosure.

\textsuperscript{21} See Piskorski, Seru, and Vig (2010) and the citations in their footnote 7.

\textsuperscript{22} Nadauld and Sherlund (2013), Berndt and Gupta (2009), Keys et al. (2010), and Agarwal, Chang, and Yavas (2012) find some evidence of adverse selection and a decreased incentive to screen in prime mortgage markets. See also Maddaloni and Peydro (2011) and Ivashina (2009).

\textsuperscript{23} Some construe “moral hazard” as applicable to actions taken after a contract is executed and use “adverse selection” to refer to actions prior to contract formation. As used in this chapter, “moral hazard” arises whenever a decision-maker does not face the full costs of his or her decisions, regardless of whether these actions occur before or after a sale of securities. Or one may simply view the relevant contract in some contexts as the origination of the loan rather than the sale of the bond. In other words, there are two relevant contracts.

\textsuperscript{24} See e.g. Chami, Fullenkamp, and Sharma (2010) and Hartman-Glaser, Piskorski, and Tchistyi (2012).

\textsuperscript{25} See for instance Davis (2008) and Solomon and McCluskey (2010).
misleadingly conveyed. Appraisers, environmental and engineering inspectors, and zoning attorneys depend on satisfying intermediaries, not investors, to earn profit. Credit rating agencies (CRAs) are particularly susceptible to manipulation because they rate asset pools prospectively and (because of Securities and Exchange Commission regulations regarding the public marketing of ABS)\(^{26}\) depend on giving one of the most favorable ratings in order to earn fees.\(^{27}\) Book-runners typically “shop” asset pools to at least three CRAs in order to receive the most favorable, rather than the most accurate, credit ratings. Employees at both types of institutions (financial intermediaries and CRAs), including those specifically tasked with ascertaining and controlling risk, are commonly paid on deal volume (Acharya and Naqvi 2012). Furthermore, the interaction of regulations and the issuer-pay model likely leads to inflated credit ratings. There is strong evidence that ratings-based regulations have led to large increases in the volume of highly-rated securities (Opp, Opp, and Harris 2013). Issuers may also expect government bailouts in the event of failure.\(^{28}\)

Fund managers at pension funds, insurance companies, and other institutional buyers of ABS are commonly paid on the basis of a risk-adjusted return. They are given targets for the amount of funds to be allocated, the return to be earned on allocated funds, and the risk profile of investments undertaken. The risk is typically measured and defined in regulations in terms of ratings. The fund managers are incentivized to accept over-rated securities to the detriment of the savers they ultimately represent. Regulators are subject to capture by regulatees because of

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\(^{26}\) Ratings by a nationally recognized (by the Securities and Exchange Commission) statistical rating agency are required in order to obtain a “shelf registration” for the investment-grade portion of a pool. A shelf registration allows public marketing of the securities for three years. Over-the-counter transactions do not require ratings.


\(^{28}\) On the role of expectations of systemic bailouts, see Farhi and Tirole (2012).
discordant payment and talent levels across the institutions.\textsuperscript{29} Borrowers, especially those taking non-recourse loans, are incentivized to overstate metrics that feed into collateral value.\textsuperscript{30} The question of the effect of securitization on underwriting standards is relatively well studied and is further discussed below.

Securitization arguably increases the efficiency of matching savers and borrowers by bringing small loans into public capital markets and because of the flexibility it allows to assign cash flows to different portions of the issue. This is especially true when securitization is completed under the REMIC provisions of the Act. Issuers can offer investors a range of yields, maturities, prepayment provisions, and other bond metrics from the same pool. Through interest rate swaps, issuers may even sell fixed-rate bonds backed by floating rate mortgages and vice versa.

If efficiency is construed in terms of accurate informational transfer between lenders and borrowers, securitization has possibly led to decreases in efficiency.\textsuperscript{31} The most common suggestion for curtailing asymmetric information in securitization markets prior to 2010 was to force book-runners to retain a portion of the asset pool in some form or another and thus subject themselves to risks arising from inappropriate underwriting. Provisions requiring issuers to retain at least 5\% of the risk associated with securitized loan pools (subject to numerous lobbyist-authored caveats) were signed into law as part of the Dodd Frank Wall Street Reform and Consumer Protection Act of 2010 (Title IX, Section D). Forcing issuers to absorb 5\% of a pool will mitigate asymmetric information, but issuers will still not face the full consequences of

\textsuperscript{29} This particular problem could be mitigated by paying individual regulators a portion of fines they are able to impose on market participants.

\textsuperscript{30} Interestingly, Allen and Gale (2000) argue that investor-borrowers misleading bank-lenders about collateral values can lead to bubbles.

\textsuperscript{31} However, Gerardi, Rosen, and Willen (2007) argue that the mortgages post-securitization have become more efficient in terms of reflecting the expected lifetime income of borrowers and that this increase in efficiency does not seem attributable to GSEs.
originating loans that subsequently default under this system. Except for agency MBS, issuers are no longer able to completely remove loan pools from their balance sheet. This regulation reflects a widespread belief that pure securitization schemes whereby issuers relieve themselves of all credit risk after issue result in excessive risk-taking.

There are other proposals to limit asymmetric information problems in ABS markets. Hartman-Glaser, Piskorski, and Tchistyi (2012) propose a system of remuneration to ABS issuers that uses the fact that most ABS that default do so within two years of issuance. Thus ABS issuers, they recommend, should be compensated on a two-year delay. Berndt and Gupta (2009) call for the creation of a public ABS exchange that would strengthen transaction tracking and the accuracy and intensity of reputation effects. Cohen et al. (2017) propose the use of blockchain technology to administer and track ABS transactions. Although an exchange or blockchain will help decrease the legal costs of collateral seizure and publicly expose issuers with below-average performance histories, the moral hazard facing ABS issuers will remain. Ultimately, any securitization structure must feature some moral hazard facing issuers, but this fact does not exclude the possibility of mature and relatively stable securitized credit markets.

There is no strong evidence for the presence of widespread fraud in ABS markets, though casual observation of recent events has led many commentators to decry the high levels of perceived fraud among various market participants, including but not limited to mortgage underwriters and rating agencies. The implicit presumption is securitization provides opportunities for fraud beyond those available to traditional lenders. Since securitization removes

32 This policy might suffer from the ease with which ABS issuers can use special loan provisions, like prefunded escrows for loan servicing, to ensure that loans default after ABS issuers are paid.
33 Perhaps self-governing associations of market participants, discussed in Chapter 3, would work. For examples of associations of market participants overcoming substantial difficulties in rule enforcement, see Benson (1989), Leeson (2007), and Skarbek (2010).
the pooled assets from the issuer's balance sheet, it relieves the issuer of credit risk and the buyer of counterparty risk. It is therefore plausible that the nature of securitization itself incentivizes fraud more than traditional banking practices. It is not clear, however, with the possible exception of residential mortgage-backed securities (RMBS), that outright fraud is or was widespread or critical to observed market outcomes.

2.3.5 – Macroeconomic Risk

ABS markets have frequently been blamed for causing and/or exacerbating the recent credit crisis. Taking as given that fluctuations in credit markets affect the real economy,\textsuperscript{35} there are strong reasons to believe that this blame is well deserved. Many economists blame a decline in housing prices for the crisis and argue that securitization exacerbated fluctuations in mortgage markets in various ways.\textsuperscript{36} Others propose that the asymmetric information inherent in securitization accounts for a decline in underwriting standards that subsequently caused a spike in mortgage defaults.\textsuperscript{37} Another prominent strand of thought argues that securitization, by allowing banks to increase leverage, intensifies and creates “leverage cycles,” previously studied in slightly different contexts.\textsuperscript{38} Those debates are addressed in subsequent chapters.

Some ABS collateral, like commercial mortgages, do not fully amortize at maturity, meaning that borrowers frequently require a new loan to pay off an existing one. If credit conditions are bad when the “balloon payment” (the unamortized principal balance at maturity) is

\textsuperscript{35} See Bordo and Haubrich (2010) for an outstanding historical account of the real effects of credit cycles. For an account of the real effects of credit market fluctuations over the past three major cycles in the U.S., see Jermann and Quadrini (2009). Schlarisk and Taylor (2009) provide the best historical narrative of credit expansions preceding large busts in modern economies.

\textsuperscript{36} See e.g. Feldstein (2007), Brunnermeier (2009), and Rosengren (2010).

\textsuperscript{37} See Nadauld and Sherlund (2013), Keys et al. (2010), Berndt and Gupta (2009), Benmelech, Dlugosz, and Ivashina (2012), Agarwal, Chang, and Yavas (2012), An, Deng, and Garbiel (2009), and Gertler, Kiyotaki, and Queralto (2012).

due, the ABS will typically default, potentially triggering a widespread credit crisis. Acharya, Gale, and Yorulmazer (2011) show how the rollover risk associated with non-amortizing ABS collateral can give rise to market freezes or “sudden stops.” ABS issuers also commonly use “bridge loans,” short term loans that provide a bridge from the time of origination to the time of sale, to finance originations of ABS collateral rather than relatively expensive equity or deposits. Gorton and Metrick (2012) trace the transmission of the crisis from subprime ABS to other ABS products linked to subprime products through short-term repos used by bookrunners for bridge financing, arguing that the reliance on short term debt to fund loans turned a subprime crisis into a wider credit crisis. Ivashina and Sharfstein (2010) provide empirical evidence that banks decreased lending during the crisis to a greater extent the more they relied on short-term financing, rather than deposits, to fund loans. Furthermore, the moral hazard arising from bailout expectations can lead profit maximizing banks to rely more heavily on short term debt than they otherwise would (Gertler, Kiyotaki, and Queralto 2012). Recent empirical research has presented evidence that lenders’ financial condition has less of an effect on credit supply after the advent of securitization (Loutskina and Strahan 2009, Uzun and Webb, 2007).

The place of credit rating agencies in ABS market fluctuations has also received sustained attention. For instance, Coval, Jurek, and Stafford (2009) agree that increased cyclicality in credit markets is attributable to securitization but focus on the role of rating agencies in forming inaccurate perceptions of the risk involved in mortgage-backed securities. Along similar lines, some economists (e.g. White 2010) argue that the present structure of the due diligence process should be expected to aggravate information asymmetries between borrower and ultimate lenders, leading to increased volatility. Brunnermeier (2009) provides a general overview of the role of securitization in the credit crunch of 2007/08 as presently understood.
There is evidence that securitization has allowed banks to skirt regulations and capital requirements and that this feature was a major cause of the financial crisis. Acharya and Richardson (2011), Acharya, Schnabl, and Suarez (2013), Han, Park, and Pennacchi (2014), and Ambrose, Lacour-Little, and Sanders (2005) all argue that regulatory arbitrage, as opposed to risk transfer, is the primary driver of non-agency ABS issuance. These asset movements provided regulatory cover but did not, in fact, shift risk away from the financial sector, as regulators presumably intended (Acharya, Schnabl, and Suarez 2013). Ratings-based regulations have preceded large increases in the volume of highly-rated securities, which can incentivize investors to be uninformed and can subject credit markets to periodic collapse. Opp, Opp, and Harris (2013), Hanson and Sunderem (2013), and Anderson, Capozza, and Van Order (2011) present evidence that underwriting standards declined steadily and suggest that moral hazard facing issuers was not adequately priced. Ratings quality is countercyclical (Bar-Isaac and Shapiro 2013), but it is difficult to distinguish whether declining rating quality leads to cycles or whether cycles influence ratings quality. If there is a steady decline in ratings due to shopping over booms, subsequent default rates above expectations may be due to inflated ratings, an exogenous (to credit markets) shock, or both. Large issuers are granted more favorable ratings, possibly suggesting the importance of rating shopping (He, Qian, and Strahan 2011).

Despite the problems posed by asymmetric information, there is increasing evidence that the credit quality of ABS is no worse (Krainer and Laderman 2014) or better than loans retained on balance sheet (Albertazzi et al. 2015, Elul 2015, Bubb and Kaufman 2014, Ambrose et al. 2005). These researchers find empirical evidence to support advantageous selection in ABS markets, where the reputational effects on issuers and the gains from regulatory arbitrage suffice to keep ABS credit quality high. For non-agency ABS, investors might rationally choose to fund
high-quality credit with securitization while funding low-quality credit with deposits, which are insured (Greenbaum and Thakor 1987).

2.4 -- Conclusion

The initial justification for securitization schemes in the U.S. has always been to channel credit to mortgagors. The existence and magnitude of net benefits of securitization are still debatable and ultimately depend on the regulatory structure of ABS. Issuers and originators are relieved of credit risk and the necessity of raising deposits to fund originations. They also benefit from the regulatory arbitrage opportunity afforded by ABS. Risk is transferred from originators to investors and allocated among investors. Policymakers are able to use securitization systems to subsidize credit to chosen groups of borrowers. These benefits are offset by higher legal administrative costs when underlying loans default, worsening informational asymmetries between originators and investors (the subject of Chapter 3), and a possible contribution of ABS to credit cycles (the subject of Chapter 4). From the perspective of investors, the gains from (i) avoiding counterparty risk, (ii) increasing diversification, and (iii) improving efficiency outweigh the costs in the form of (i) credit risk arising from moral hazard on the “originate-to-distribute” lending model and (ii) difficulty of ABS collateral seizure upon default.

Long-lasting securitization markets have never been observed absent intervention by government, usually in the form of credit guarantees. Even the most successful examples of private securitization markets in history were susceptible to collapse. Nearly 43% of RMBS was nonagency backed in 2005 and 2006. In 2013, well over 99% of RMBS was issued by government-sponsored or backed enterprises,39 which are exempt from the 5% retention requirement. This fact implies that ad hoc policy innovations have been necessary to sustain ABS markets. Policymakers

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provide this support when the votes and money gained from doing so outweigh the votes lost from increased volatility and perceptions of corruption. Profit-maximizing banks and cost-minimizing borrowers will participate in ABS markets as long as policymakers ensure willing buyers of the debt exist.
CHAPTER 3: Securitization and Asymmetric Information

3.1 - Introduction

Asset-backed securities (ABS) markets pose asymmetric information problems. Loan originators may adversely select loans for sale and may shirk screening and monitoring (due diligence) efforts on loans originated for sale. Though issuers may take reputational effects into account, the lack of a central exchange means ABS typically lack a clear market price and all of the information it entails, and collateral lacks a clear chain of title. Unless mechanisms are in place to fully transmit the costs of defaults to issuers, due diligence performed on loans originated to hold and those originated for sale will differ.

Each stage of the securitization process presents an asymmetric information problem. Borrowers can embellish credit and collateral quality in order to garner more favorable loan terms. Originators and issuers can overstate the quality of loans and pools for sale. Third-party due diligence providers, including ratings agencies, are paid by issuers (the so-called “issuer-pay” model), so they are also incentivized to optimistically appraise ABS credit quality. Fund managers at pension funds, insurance companies, and other institutional buyers of ABS are typically compensated on the basis of risk-adjusted expected returns, not realized returns, so they, like issuers, are shielded from the costs of future defaults (except in their capacity as taxpayers). Executives at large firms may expect bailouts in the event of failure. Credit market participants face these incentives in the absence of securitization, though. The asymmetric information problem introduced by securitization is the separation of the originator from the ultimate lender.

40 Borrowers may also prepay residential mortgages to the detriment of residential mortgage-backed securities. This particular information asymmetry is not clearly and closely related to originator’s due diligence effort and is hence beyond the scope of this chapter.

41 Fund managers may suffer reputational damage after their investments fail, which would impose some costs on fund managers for poor investment decisions.
The asymmetric information problem created by securitization is the same as that created by any loan sale. The loan originator may increase profits by shirking due diligence or monitoring. Theoretically, if the ABS seller is able to shed any credit risk via securitization, the returns to screening and monitoring loans originated for sale will be lower than on loans originated to hold. Empirical analyses reviewed below compare the performance of securitized and retained loans and find a negative relationship between the originator’s choice to sell and credit quality, although some studies have found the reverse. Those researchers finding higher credit quality among sold loans account for their results by pointing to reputation effects and the regulatory arbitrage opportunity ABS provides issuers. Despite the mixed empirical evidence, the analysis in Sections 3.3 and 3.4 presume asymmetric information is present and important in securitization markets.

This chapter proceeds as follows. Section 3.2 reviews the empirical evidence for asymmetric information in ABS and syndicated loan markets and shows that the evidence is mixed but generally indicative of the presence of adverse selection and moral hazard. Section 3.3 summarizes various existing approaches with a simple model, concisely reproduces their results, and clarifies the conclusions drawn from existing research. The model allows us to explore the relationship between risk transfer through securitization and the choice of the optimal amount of due diligence to perform prior to origination. The unifying theory offered here illustrates the problems described in Section 3.2 and demonstrates the need for a public ABS exchange, analyzed in section 3.4. Section 3.5 concludes.

3.2 - Asymmetric Information in Securitization – Evidence

Most comparisons of the performance of securitized and non-securitized loans point to the presence of asymmetric information problems in ABS markets. Two influential studies, Keys et al (2010) and Nadauld and Sherlund (2013), found evidence that lender screening in subprime
mortgage markets decreased as securitization became more prevalent. Agency RMBS must be backed solely by qualifying residential mortgages (QRMs), which require mortgagors to have a minimum FICO score of 620. Keys et al. (2010) exploited this QRM criterion and looked at the performance of residential mortgages with borrower credit scores just above and below the threshold. Those mortgages that barely qualify are much easier to securitize than those that narrowly miss the threshold, but the credit quality of the loans is essentially the same, so differences in performance should be indicative of differential screening on loans originators expect to securitize. Surprisingly, they found that loans originated just below the threshold significantly outperformed those that did qualify for agency support, strongly suggesting that originators apply less due diligence effort to loans they expect to sell. Bubb and Kaufman (2014) point out that this approach cannot distinguish between the effect on originators of the expectation of securitization from the effect of the expectation of agency support. Although this objection is technically correct, almost all QRMs are securitized, and private (i.e. non-agency) RMBS issuance is negligible, so Keys et al. (2010) can plausibly conflate QRM status and securitizability. Nadauld and Sherlund (2013) investigated subprime mortgage originations over 2003-2005 and found a significant relationship between the extent of securitization and the origination of subprime mortgages, implying that originators’ expectation of loan sales influences their willingness to extend credit to risky borrowers.

The evidence for asymmetric information in prime RMBS markets is less clear but still strongly suggestive of the existence of asymmetric information problems. Agarwal, Chang, and Yavas (2012) analyzed prime mortgage origination over 2004-2007 and found some evidence of adverse selection in prime mortgage markets in that sellers typically securitize loans with larger prepayment risks than those they retain. However, retained loans exhibit higher default risk. A
final claim on whether adverse selection applies would require an evaluation of which risk poses greater losses to issuers. Contrary to other studies, the authors find no evidence of adverse selection in subprime mortgage markets. The authors argue that, since GSEs control default risk but not prepayment risk, lenders channel relatively lower quality mortgages into the unsupported portion of the market. On the contrary, Elul (2016) looks at prime mortgage origination in 2005 and 2006 and does find that securitized loans become delinquent 30% more frequently than non-securitized loans, however.

Not all studies find evidence for adverse selection in ABS markets, however. Krainer and Laderman (2014) examined mortgages originated over 2000-2007 and found that securitized loans were *ex ante* riskier (in terms of measurable characteristics like loan-to-value ratios and borrower income) than retained loans but *ex post* performance was the same. Over the same period, Albertazzi et al. (2015) find that securitized mortgages in Italy, where RMBS markets are newer than in the U.S. but similarly structured, outperformed non-securitized loans and hypothesized that reputation effects explained the observation, but these effects dissipate once issuers establish their reputations (over 5-7 years). Ambrose, Lacour-Little, and Sanders (2005) find that securitized loans originated in the U.S. in the late 1990s outperformed non-securitized loans. Like Agarwal, Chang, and Yavas (2012), they do find evidence of adverse selection in prepayment risk, but not in default risk. Since loans with lower default risk are more likely to be QRMs, they recognize that their results may depend on the relationship between QRM status and the likelihood of being securitized. Among those loans securitized, non-agency MBS did default at a higher rate than agency MBS.

In addition to looking at default and prepayment rates, researchers have analyzed credit spreads between retained and sold loans. If default and prepayment rates are higher on sold loans,
then a risk premium on securitized loans should be observable. An, Deng, and Gabriel (2011) compare the market yields of conduit (originated solely to be securitized) and portfolio (originated to be held on balance sheet but later securitized) commercial mortgage loans in the 1990s and early 2000s and find that conduit lenders get a premium, suggesting adverse selection of securitized loans among those firms that do hold some loans on balance sheet. Since conduit lenders are assumed to gather less private information about loans than portfolio lenders, market prices appear to account for asymmetric information. Benmelech, Dlugosz, and Ivashina (2012) argue that adverse selection is less pronounced among securitized corporate loans and that this fact is due to originators' typical practice of retaining a portion of each loan in this market, lending credence to the rationale of retention requirements provided for by the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 that requires issuers to retain 5% of each issue, further explained below. Similarly, Ivashina (2009) shows that interest rate spreads on syndicated loans vary inversely with the lead originator’s retained share. Berndt and Gupta (2009) compare default rates on syndicated loans sold in secondary markets to those retained by originators and found a 9% higher default rate on sold loans. As discussed further in the next section, the share of loan pools retained by the issuer should be directly related to the credit quality of the loans being sold if the originator’s due diligence effort affects the chances of default. The lower the lead originator’s retained share in a syndicated loan, the higher the credit spread is above comparable rates.

Publicly marketed ABS must obtain a shelf registration from the Securities and Exchange Commission (SEC), which requires ratings from at least two nationally-recognized statistical rating organizations, also known as credit rating agencies (CRAs). This requirement casts CRAs in a central role in mitigating or exacerbating asymmetric information problems in ABS markets.
The Great Recession featured the first defaults of AAA-rated ABS in history. Many researchers have investigated whether CRAs, like originators, failed to perform appropriate due diligence on ABS. The logic of the registration requirement is that CRAs will provide a check on bond issuers’ incentives to misreport information and due diligence effort, but under the issuer-pay model, there is no mechanism to impose costs on CRAs for overrating securities. In fact, since CRAs rate ABS prospectively, issuers typically go “ratings shopping” by sending new issues to at least three CRAs and selecting the most favorable two. CRAs therefore expect to increase revenue, rather than incur costs from reputational damage, by embellishing credit quality (White 2010). Moreover, the NRSRO designation is a barrier to entry, so CRAs are partially shielded from competition from more scrupulous potential competitors (White 2013). The theoretical implications of ratings shopping are well established.42

Competition among CRAs under the present regulatory structure should lead to inflated ratings and an increase in the volume of highly rated securities. Regulations protect CRAs from reputational consequences, assure the most aggressive two CRAs earn the business of ABS issuers, and also provides issuers a “trusting clientele” (Bolton, Freixas, and Shapiro (2012), p. 87). ABS investors (or rather their agents, investment fund managers) are commonly required to take ratings into account in their investment decisions. Minimum capital requirements facing financial institutions and state-level regulations governing the risk management of pension and insurance funds, the largest buyers of ABS, measure risk according to ratings, possibly increasing the prevalence of uninformed investors (Opp, Opp, and Harris 2013, Hanson and Sunderam 2013).

Originally, the two largest rating agencies, Moody’s Investors Services (Moody’s) and Standard and Poor’s Financial Services (S&P), who maintained an effective duopoly in securities

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ratings until the first decade of this century, depended on investors to subscribe to their ratings to earn revenue. The proliferation of technology to copy and disseminate information increased free-ridership and forced both Moody’s (in 1970) and S&P (in 1974) to transition to issuer-pay systems. Jiang, Stanford, and Xie (2012) show that Moody’s ratings are higher than S&P’s over 1970-1974, and S&P’s ratings rise to match Moody’s ratings after 1974. The increase in S&P’s ratings was most significant precisely “for bonds with greater potential conflicts of interest under the new revenue model, i.e., for bonds that likely pay higher fees or have greater incentives to attain a higher rating.” (p. 620)

In the first decade of this century, the market share of Fitch Ratings (“Fitch”) increased significantly. Multiple researchers have exploited this shift in market concentration to investigate the effects of ratings competition in ABS markets. Becker and Milbourne (2011) find that Fitch’s increased market share decreased the accuracy of ratings (measured relative to realized yields and defaults) of issuers of corporate debt. Subordination ratios (the percentage of the ABS that are rated below investment-grade and hence “subordinate” to investment-grade tranches) for commercial mortgage-backed securities issued from 2002-2007 fell as Fitch’s market share increased (Cohen and Manuszak 2013). This result suggests that CRAs relaxed their standards in response to the increase in competition. Subsequent performance of these CMBS precludes the possibility that the shift in subordination ratios reflected improved credit quality. 43 If CRAs did competitively embellish credit quality to earn revenue from issuers over this period, then we should find a negative relationship between issuer market share and subordination ratios for similar

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43 The relationship between ABS ratings and underlying credit quality is often misunderstood. It is not the presence but the size of investment-grade tranches that informs investors of underlying credit quality. Consider two loan pools of the same size, one composed of loans likely to default (pool A) and another composed of high-quality loans (pool B). ABS backed by either pool will feature some investment-grade tranches, those at the front of the line to receive payments from borrowers. ABS backed by the pool B, however, will feature more investment-grade debt than ABS backed by pool A. The subordination ratio reflects the CRAs’ evaluation of how much of the total principal backing the ABS is very likely to be repaid, so better credit quality results in a lower subordination ratio.
securitizations. He, Qian, and Strahan (2011) analyzed non-agency MBS issuance over 2000-2006 and found that large issuers were indeed granted more favorable ratings (lower subordination ratios) than small issuers. Issuers are particularly sensitive to issuer size in RMBS, as two issuers in the U.S. (J.P. Morgan Chase and Wells Fargo) currently account for over 65% of issuance.

There are also studies that find increased competition improves rating quality. In a particularly illuminating study of a credit market that Fitch has not infiltrated, Kraft (2015) exploits the fact that some corporate borrowers face an explicit relationship between their rating and cost of borrowing through their participation in “rating-based performance pricing” loan contracts. (p. 264) Kraft finds evidence that Moody’s and S&P give better ratings to firms subject to these contracts than similar firms with borrowing costs less sensitive to ratings. The extent of this “catering” to issuers actually diminishes when Fitch does provide a rating for these firms, suggesting that Moody’s and S&P are sensitive to reputational effects in this context. The rating-dependent loan contracts studied, however, only reference ratings from Moody’s and S&P, so they are not incentivized to embellish credit quality in order to out-compete Fitch. CRAs are more sensitive to their reputations when it does not cost them business. Doherty et al. (2012) found that the late-1980s entry of S&P into the insurer rating business, previously monopolized by A.M. Best, led to increased ratings quality overall, though this effect was due to S&P’s ratings only. A.M. Best rated all of the firms in the sample both before and after S&P’s entry, however, and the authors conclude that S&P provided more stringent ratings in order to entice higher-quality firms to obtain a second rating in order to signal their strong credit quality to lenders and customers. Insurers are regulated at the state level and (unlike ABS) are not required to be rated, though many potential clients and lenders must satisfy institutional and regulatory requirements setting minimum counterparty credit ratings. The effect of the issuer-pay model on ratings quality seemingly
depends on the nature of the competition CRAs face. In these instances, Moody’s, S&P, and A.M. Best do not lose business to competitors due to differential underwriting standards as they would competing to rate ABS, so reputation effects more easily overcome the incentive to satisfy issuer preferences.

Overall, the weight of the evidence favors the conclusion that ABS markets display clear features of asymmetric information between originators/issuers and investors and that CRAs do not effectively mitigate the problem. ABS default and/or prepay more often than comparable debt retained on originators’ balance sheets, and issuers’ influence over CRAs allows them to inflate investors’ perceptions of underlying credit quality. Among policymakers in the U.S and Europe, at least, the presence of asymmetric information in securitization markets was uncontroversial enough to pass retention requirements for ABS issuers. Retention requirements in both the U.S. and Europe dictate that issuers retain 5% of ABS they issue. Specifically, issuers can retain 5% of each tranche (a “vertical slice”), the most junior tranche(s) totaling 5% of the pool (a “horizontal slice”), or some combination of horizontal and vertical slices comprising 5% of the principal amount of the underlying loan pool. The optimal retention rate varies with credit quality, so a fixed retention rate is inefficient (Hartman-Glaser, Piskorski, and Tchistyi 2012, Dionne and Malekan 2017, Malekan and Dionne 2014). The next section develops the theory on structural approaches to addressing asymmetric information under securitization, beginning with regulatory retention requirements.

3.3 - Asymmetric Information in Securitization – Theory

This section examines three categories of mechanisms identified in the literature that can limit adverse selection and moral hazard in securitization: retention requirements, reputation effects (the only market mechanism of the three), and insurance requirements. It shows that each
mechanism gives the same result – the costs imposed on issuers from post-sale defaults via these mechanisms must equal the losses the issuer would have incurred from retaining the loan pool in order to induce optimal due diligence effort. Unless the issuer maintains a 100% net long position in the ABS, whether by retaining it, insuring it against default, or suffering reputational damage from defaults that affects future profitability, economic theory predicts that originators and issuers will perform less screening and monitoring on loans they expect to sell than on loans they expect to retain.

We begin the analysis by distinguishing between two banking systems defined by the source of funds for originations, the deposit funding mode (DFM) and the securitization funding mode (SFM).44 With (i) symmetry of information between banks and investors and (ii) the absence of any legal or structural differences (such as disparate taxes, capital requirements, etc.) between the two modes, any general or partial equilibrium model comparing the two funding modes results in the equivalence of DFM and SFM (Greenbaum and Thakor 1987, Gorton and Metrick 2013, Gertler and Kiyotaki 2010, Malekan and Dionne 2014, Dionne and Malekan 2017).

The logic of this result is straightforward. In a general equilibrium model, banks are ultimately owned by households (investors), hence information is symmetric by construction, and banks originate loans and perform due diligence to maximize profit. Whether households hold loans in ABS or on the balance sheet of banks is irrelevant unless structural differences are introduced that lead banks to favor one mode over the other. In Greenbaum and Thakor (1987), deposits are insured and ABS are not, leading investors to favor funding risky loans with deposits and high-quality loans with securitization. Without deposit insurance or other structural differences between the funding modes, banks and investors are indifferent between DFM and

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44 Terminology borrowed from Greenbaum and Thakor (1987).
SFM. Similarly, Gorton and Metrick (2013) and Gertler and Kiyotaki (2010) must introduce regulatory arbitrage opportunities to induce securitization in their models. Gorton and Metrick (2013) model the SFM with lower taxes and bankruptcy costs, while Gertler and Kiyotaki (2010) assume that the SFM lowers capital requirements.

In a partial equilibrium model, considering only a bank’s profit-maximizing choice of funding loans with DFM or SFM, knowledge asymmetries may be introduced. Again, with symmetric information (such that investors can perfectly observe banks’ due diligence effort), we obtain the equivalence of DFM and SFM. Investors demand that banks perform due diligence until the marginal benefit of the marginal unit of effort, $e$, is equal to its marginal cost, and this maximizing level of effort, $e^*$, is invariant under SFM and DFM (Malekan and Dionne 2014, Dionne and Malekan 2017). If the SFM involves any transfer of credit risk from issuers to investors and $e$ is not perfectly observable by investors, then $e^{**}$, banks’ profit-maximizing choice of $e$ under the SFM, is necessarily less than $e^*$.

To clarify these results and allow further analysis, consider the following partial equilibrium model, based on a model developed by Malekan and Dionne (2014). Let $p(e)$ be the probability of default of loans paying a net interest rate of $R$. A default on a loan normalized to size 1 results in losses to the lender of $L(1+R)$, where $L$ is the loss ratio on defaults. The originator can exert effort performing due diligence (encompassing both screening and monitoring) in order to lower $p$, and this effort gives diminishing returns:

$$p'(e) < 0; p''(e) > 0$$

The cost of due diligence, $c(e)$, is increasing with $e$ ($c'(e)>0$) at an increasing rate ($c''(e)>0$). Under the DFM, bank profit is

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45 The originator may be able to influence $L$ in addition to $p$, but the results of the analysis are the same whether $L$ is endogenous or exogenous, so $L$ is assumed to be exogenous here for simplicity.
\[(1 - p(e))R - p(e)(L(1 + R)) - c(e) \quad [1]\]

The bank earns R on loans that do not default \((1-p(e))\), loses \(L(1+R)\) on loans that default \((p(e))\), and incurs due diligence costs that are a function of effort expended, \(c(e)\).

The bank chooses \(e\) to satisfy the first order condition

\[-p'(e)(R + L(1 + R)) = c'(e) \quad [2]\]

The solution to [2] is \(e^*\), the optimal or efficient level of effort.

To introduce securitization, let \(\alpha\) denote the percentage of the loan or pool of loans originated that are retained by the issuer. Hence \(\alpha=0\) denotes full securitization and \(\alpha=1\) denotes full retention. We assume that originators sell loans at a yield of \(R-S\), where \(S\) represents a risk premium demanded by investors. Bank profit becomes

\[\alpha\big[(1 - p(e))R - p(e)(L(1 + R))\big] + (1 - \alpha)(R - S) - c(e) \quad [3]\]

The profit-maximizing choice of \(e\) satisfies

\[-\alpha p'(e)(R + L(1 + R)) = c'(e) \quad [4]\]

The solution to [4] is \(e^{**}\). Equations [2] and [4] together imply that \(e^{**}=e^*\) iff \(\alpha=1\). That is, originators will only expend \(e^*\) under SFM if issuers must retain all credit risk. Since the only return to \(e\) captured by originators is through the retained portion \(\alpha\), \(e=0\) when \(\alpha=0\) – the profit-maximizing level of effort for a pure securitizer is nil.

The optimal contract under securitization, that which induces the securitizer to expend \(e^*\), depends on the issuer retaining 100\% of the \textit{ex ante} credit risk (Hartman-Glaser, Piskorski, and Tchisty 2012, Dionne and Malekan 2017, Malekan and Dionne 2014). Retention schemes result

\[\text{[4]}\text{Malekon and Dionne (2014)}\text{obtain an identical result but conceive of }\alpha\text{ as representing the bottom }\alpha\%\text{ of the issue (a “horizontal slice”) rather than a pro rata percentage of the issue (a “vertical slice”). They induce }e^*\text{ by requiring the issuer to retain }\alpha^*,\text{ the percentage of defaults obtained assuming }e^*\text{ was performed. Retaining an }\alpha^*\text{ sized first-loss piece and retaining all of the issue (}\alpha=1\text{) both represent the issuer carrying all of the credit risk, so the results are equivalent.}\]
in a 100% net long position of the issuer as a solution, and the other two mechanisms we consider below, reputation effects and insurance, have the same result – securitizers will not expend \( e^* \) unless they have a 100% net long position after issue.

In addition to retention requirements, researchers have pointed to reputation effects as a disciplining force on issuers. Assume that a pure securitizer (\( \alpha = 0 \)) suffers reputational damage from defaults equal to \( \nu > 0 \), expressed as a percentage of \( R \). This issuer’s profit function is

\[
R - p(e)(\nu R) - c(e) \quad [5]
\]

\( R \) is earned on all loans at sale, but the issuer suffers losses from subsequent defaults via reputation effects captured by the second term in [5]. The issuer chooses \( e \) to satisfy the first-order condition

\[
-\nu R p'(e) = c'(e) \quad [6]
\]

Let \( \tilde{e} \) be the solution to [6]. Then \( \tilde{e} = e^* \) iff \( \nu = 1 + L + \left( \frac{L}{R} \right) \). \( (L+(L/R)) \) is equal to the loss from defaults as a percentage of \( R \), and the first term, 1, accounts for opportunity cost, the foregone earnings of \( R \) on a non-defaulted loan. Thus, in order for reputation effects to induce \( e^* \) under 100% securitization, they must exactly equal the costs of default that accrue to a loan holder. Again, with securitization under asymmetric information, the only way to obtain \( e^* \) is to force issuers to maintain a position in the ABS that amount to a 100% long position, equivalent to retaining the loans on balance sheet. Interestingly, there is no a priori limit to the magnitude of \( \nu \), so reputational effects could result in \( \tilde{e} > e^* \), and some empirical research (reviewed above) finds evidence that reputational effects may impose larger costs on issuers for due diligence shirking than the cost of defaults. If that were truly the case, however, the DFM would dominate as banks would rationally choose to perform \( e^* \) and hold originations than perform extra due diligence to create the same returns. In terms of the model, if \( \nu > 1 + L + \left( \frac{L}{R} \right) \), then

\[
(1-p(e^*))R-p(e^*)(L(1+R)-c(e) > R-p(\tilde{e})(\nu R)-c(e)
\]
The DFM is more profitable for issuers than the SFM.

Beyond retention requirements and reputational effects, various forms of insurance requirements can induce issuers to perform $e^*$. Issuers can be required to insure investors by selling credit default swaps, promising to buy back defaulted securities, or maintaining (by paying fees) membership in an exchange that reimburses investors for losses. These membership fees are equivalent to insurance premiums that issuers must pay to insure ABS buyers against losses from default. Any of these schemes can be implemented in the general model by requiring issuers to pay $\psi > 0$, expressed as a portion of returns $R$, on their sales that suffer defaults. Bank profit for a pure securitizer ($\alpha = 0$) becomes

$$R (1 - \psi(p(e)) - c(e)) [7]$$

Banks choose $e$ to satisfy the first order condition

$$-(\psi)(p'(e))R = c'(e) [8]$$

Let $\bar{e}$ denote the level of due diligence effort that satisfies [8]. Then $\bar{e} = e^*$ iff $\psi = 1 + L + \left(\frac{L}{R}\right)$. This result simply states that insurance premium/membership fee/buyback guarantee must impose the same costs on a SFM lender as defaults do on a DFM lender. In other words, insurance requirements can only induce $e^*$ by imposing the equivalent of a 100% net long position on issues, just as in the cases of retention requirements and reputation effects.

From the perspective of the investor, $e^*$ is optimal. Under the SFM, issuers choose $e^*$ only when the costs of defaults to issuers are identical under the DFM and the SFM. These costs can be imposed under the SFM through retention and insurance requirements and reputational effects, or some combination of the three, calibrated to match the DFM. Combining the three effects gives a general result: With asymmetric information, the DFM and SFM give identical outcomes only
when the marginal benefit to loan originators of due diligence effort is exactly equal under both modes (when $\alpha + \nu + \psi = (R + L(1 + R))$).

When this condition is satisfied, both issuers and investors are indifferent between the two modes, and securitization can only be induced by introducing structural differences between the two modes. The slope of the marginal benefit curve for a DFM lender is $(1 + L + \frac{L}{R})p'(e)$, while the slope of the marginal benefit curve under the SFM is $(\alpha + \nu + \psi)p'(e)$. Unless the two marginal benefit curves are the same, the two regimes give different equilibrium levels of due diligence effort. Furthermore, in the absence of regulatory structural differences between the two, the mode that requires a lower due diligence expenditure will dominate.

With asymmetric information, lenders cannot be induced to perform $e^*$ without holding a slice of the issue that results in an ex ante net 100% long position. This is equivalent to lenders’ position under DFM or transforming ABS into covered bonds, implying securitization is informationally inefficient. Banks that choose to securitize, and investors that purchase ABS, appear to do so for tax and regulatory arbitrage reasons, not for gains in economic efficiency. If there is a possible net gain in efficiency from securitization, then it behooves researchers and policymakers to attempt to restructure the ABS market in ways that limit moral hazard and adverse selection. The optimal structure of retention and insurance requirements varies with credit quality, issuer characteristics, and myriad other variables, making the regulatory approach extremely unlikely to give efficient outcomes. Furthermore, the efficient regulation may not result in requiring issuers to maintain 100% net long positions if there are offsetting gains from securitization. The only way to know for sure is to observe a public ABS exchange and the eligibility requirements it imposes on its members.
3.4 – The Benefits of a Public ABS Exchange

Regulation can induce $e^*$ in theory, but the complex and dynamic nature of ABS markets coupled with incentives facing regulators make it unlikely that anything but the flexible and self-enforcing mechanisms provided by a market will produce stable securitized credit markets. A public ABS exchange that ABS buyers and sellers must join, though, will possess the information necessary to efficiently regulate issuers. A public ABS exchange will increase the information about issuers and their issues available to investors and thus strengthen reputational effects (Berndt and Gupta 2009). It also provides an environment for the endogenous determination of optimal retention and/or insurance rates through pricing mechanisms. It would make a return to the investor-pay model for credit ratings more feasible, since it can directly address the free rider problem by charging bond buyers for ratings and compensating CRAs on a delay or by paying for ratings with membership fees.

Bisin and Gottardi (1999) provide an analysis of the existence of competitive equilibria under asymmetric information and prove that trading restrictions limiting agents' ability to gain from private information are necessary to guarantee the existence of an equilibrium in such an environment. They also note, seemingly without fully realizing the point's import, that “the introduction of entry fees, which agents are required to pay to be able to trade in markets for...securities, and are endogenously determined at equilibrium, allows to [sic] prove the existence of competitive equilibria...” An entry fee to gain access to the ABS market “operates as a mechanism...to redistribute the losses arising from the presence of asymmetric information so as to ensure feasibility.” (p. 39) The necessity of maintaining eligibility for membership in the proposed exchange imposes costs on an unscrupulous ABS issuer that they do not face in the absence of a central exchange. The exact nature of those costs is best determined by the group
itself. If ABS provides benefits to investors that partially offset asymmetric information costs, then optimal retention and insurance rates may fall such that issuers are not required to retain 100% of their issues, as the theory reviewed above suggests.

The role of rating agencies in securitization markets would likely be greatly limited or eliminated altogether by the formation of a public exchange. If they are not made redundant, a shift to investor-pay ratings made possible by the exchange will align CRA and investor incentives to obtain the most accurate information possible. Investment fund managers guided by ratings-based regulations will therefore be less likely to purchase over-rated securities purposely or mistakenly.

In the case of nonrecourse loans (typically, commercial mortgages), there may still be borrowers incentivized to overstate collateral value in order to obtain a cash amount in excess of the value foregone in default (i.e. the value of the collateral). Banks specialize in evaluating collateral value, however, and have no incentive to let borrowers embellish collateral value under the proposed exchange. While currently both the borrower and proximate lender/ABS issuer can essentially steal from savers (ultimate lenders) by selling partially unsecured loans to them while assuring savers the loans are in fact adequately collateralized, the central exchange would deny issuers the benefit of such a scheme through reputation effects and any retention or insurance requirements the exchange imposes on members. Hence issuers, just like traditional balance-sheet lenders, will rarely if ever fund a loan with a loan-to-value (LTV) ratio above 1 or even above .8 (the historical threshold most originators use as a heuristic when negotiating loans with borrowers). In effect, the exchange will preclude borrower misrepresentation to the greatest extent possible while not changing the incentives facing borrowers.
An exchange, real or cyber, can solve the opaque chain of title created by ABS (Levitin 2013, Cohen et al. 2017, Oppenheim and Trask-Rahn 2012). Securitized loans are more likely to be foreclosed than modified (Kruger 2018) or renegotiated (Piskorski, Seru, and Vig 2010) because of the complexities created by securitization. ABS typically assigns the rights and responsibilities to work out defaulted loans to the owner of the most junior tranche that is still in the money, so ABS investors require up-to-date information on defaults in the pool (to identify the first loss piece) and the identities of the owners of each tranche in order to process defaults. The junior bondholder must pay off more senior tranches after seizing collateral, so they must also be able to identify the owners of other tranches. A central exchange will inform market participants on a daily basis of who holds foreclosure rights on collateral backing bonds traded on the exchange. That will greatly improve results for owners of ABS backed by loans in default.

Securitization, like insurance, necessarily creates the possibility of adverse selection and moral hazard. Just as deductibles limit but do not eliminate moral hazard in insurance markets, an open exchange is expected to limit private gains from due diligence manipulation to a great enough extent to discourage the behavior observed in ABS markets over the past two decades. If securitization markets have the potential to increase intermediative efficiency and provide society a net benefit, then it may be worthwhile to improve the institutions supporting them. We should expect the most robust securitization system possible to emerge from the maturation of the public exchange, as we have seen in the maturation of insurance markets with a variety of mechanisms to limit moral hazard and adverse selection. Certainly, if such an exchange fails, the long term viability of any securitization scheme is open to doubt.

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47 If the ABS was pledged as collateral for a loan to the ABS investor, then the lender obtains the rights and responsibilities associated with the ABS, adding another layer of confusion when a loan backing ABS defaults.
3.5 – Conclusion

In theory and evidence, asymmetric information is endemic to securitization, and the current institutional structure of these markets fails to deal with it effectively. Any claim to the contrary is inevitably based on misunderstanding. Bubb and Kaufman (2014) argue:

There are…conceptual problems with the theory that a moral hazard problem caused by securitization was a significant contributor to the recent financial crisis. Information economics provides a well-developed theory for the incentive problems posed by information asymmetry. The main implication of this theory is that, in equilibrium, incentive problems inhibit trade. If moral hazard were a major problem in the securitization market, then, the standard incentive theory would predict that relatively few mortgages would be securitized. Investors would require a higher interest rate to compensate them for the increased credit risk of mortgages caused by securitization, and this would result in less trade in mortgages. In fact, the vast majority of mortgages were securitized in the run-up to the financial crisis. So the basic stylized facts of the crisis are inconsistent with the standard moral hazard theory.

Relatively few loans of any type are presently securitized except residential mortgages, which enjoy agency support. With the exception of agency MBS, ABS markets have not recovered from the Great Recession. So the predictions of standard theory are in fact observed. A central exchange may be the only viable alternative to government support that will facilitate the resurgence of ABS
markets. It is possible that one or many self-governing ABS exchanges could simultaneously address the instances of moral hazard in securitization markets and also simplify the resolution of loans in default. In a public exchange, savers can trust that the incentives of their investment managers, the rating agencies, and ABS issuers are aligned with their own. It is in everyone's best interest to perform optimal due diligence.

The problem writ large in securitization markets is not asymmetric information but asymmetric information coupled with an opportunity to use it for profit. Widespread defaults, losses on investment-grade debt, and the (informal) collapse of pension funds across the world during the Great Recession were all symptoms of the overarching information-recourse problem. The central exchange mitigates all of the numerous undesirable symptoms in ABS markets by reinforcing reputation effects and creating a mechanism for market determination of efficient retention and insurance practices. It does not eliminate asymmetric information but simply rearranges the burden of shirking due diligence such that the informationally advantaged party is denied profits derived from that position. In theory, the SFM will result in inefficient outcomes unless mechanisms are in place that force issuers to remain 100% long their ABS issues. It is possible that the proposed exchange would not impose 100% net long positions on sellers if there are offsetting benefits of securitization to investors.
CHAPTER 4: Securitization, Central Banking, and Credit Cycles

4.1 – Introduction

Securitization, the pooling of loans and the sale of bonds backed by the loan pool to investors, became a popular method of financial intermediation in the U.S. and Europe in the 1990s, especially in mortgage markets. Much of the early scholarship on the subject was focused on pricing, structuring, and regulatory issues.\(^{48}\) The advent of widespread securitization saw little academic recognition of the moral hazard and adverse selection problems presented by the “originate-to-distribute” model, but post-2008 analyses of securitization focus on its perceived propensity to succumb to asymmetric information problems and increase bank leverage and risk-taking.\(^{49}\) These arguments have added to the chorus of voices blaming securitized products for causing or significantly contributing to the 2007-2008 financial crisis in the U.S. and Europe.\(^{50}\)

This chapter investigates the implications of a shift from fractional-reserve banking to securitization on economic volatility and the transmission of monetary policy in the absence of special asymmetric information problems under securitization. Parallel models of fractional reserve lending and securitization are presented and compared, and a number of interesting new results are obtained. The change in banking regimes alters impulse responses to productivity and monetary policy shocks. The steady state of the economy under securitization features a lower


\(^{50}\) E.g. Brunnermeier (2009) and Feldstein (2007).
real interest rate and higher investment, output, and consumption. Finally, the level of the neutral policy rate is invariant to the banking regime considered.

The model presented here is a simplified version of Gertler and Kiyotaki’s (2010) “canonical” model of financial intermediation augmented to feature two types of banks, balance sheet lenders and securitizers, both subject to liquidity requirements equal to a fraction of retained loans. Balance sheet lenders retain all originations, while securitizers retain only a portion of originated loans. The liquidity requirements apply to a bank’s balance sheet only, so balance-sheet lenders must hold more liquid assets than securitizers against an identical level of originations. This feature captures the regulatory arbitrage opportunity afforded by securitization, widely believed to be the primary motivation in financial intermediaries’ choice to securitize. Savers partially avoid the costs imposed by regulations by moving assets from (bank) balance sheets subject to liquidity requirements to (household) balance sheets not subject to liquidity requirements. Households own banks, so the resulting gains from partially avoiding liquidity requirements accrue to households in the model.

The application of the same liquidity requirement to the two banking regimes gives disparate reactions to productivity and monetary policy shocks because the liquidity requirement only applies to loans held (rather than originated) by both types of intermediary. The shift from the traditional, fractional-reserve banking regime (hereafter, TR) to a securitization regime (SR) results in a steady state with more investment than the TR due to the higher regulatory costs imposed under the TR. To demonstrate these results, the two model versions are presented and solved below, then simulated by taking advantage of Guerrieri and Iocaviello’s (2015) contribution of a “toolkit” to solve models with “occasionally binding constraints” using Matlab and Dynare, a

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supplemental program designed for solving DSGE models in Matlab. Occbin allows the introduction of the liquidity requirement as a constraint on the decisions of both bank types.

The model solution is used to answer a fundamental question about securitization: What is its effect on credit market fluctuations and monetary policy transmission? It stands to reason that a structural shift in financial intermediation affects the reaction of capital markets to shocks. Under both regimes, however, real investment is ultimately determined by the tradeoff facing households between the marginal cost of real investment and the marginal benefit of consumption. The shift from one regime to the other only affects this tradeoff via regulatory requirements. Higher effective liquidity requirements on traditional banks increases the marginal cost of investment relative to securitization, so steady-state investment is lower under traditional banking, and the reaction of the TR to shocks is muted relative to the SR. Thus securitization may decrease financial stability even in the absence of asymmetric information. Regulatory avoidance under the SR results in less idle assets held against potential losses than in the TR.

The paper proceeds as follows. The next section presents the model and model analysis, Section 4.3 presents simulation results, and a discussion of the results is provided in Section 4.4. Section 4.5 concludes.

4.2 – Model

4.2.1 -- Overview

Consider an economy, as in Gertler and Kiyotaki (2010), including output-producing firms, households, financial intermediaries (or banks), and a central bank. Banks convert household savings and loans from the central bank into physical capital. Output-producing firms (hereafter, firms) use physical capital and labor supplied by households to produce a homogeneous consumption good that can be consumed by households immediately or saved by banks to form
new physical capital next period. Existing capital depreciates but cannot be consumed by households. The central bank lends at a policy rate that is subject to stochastic shocks. Banks and firms are owned by households which receive residual profits from both types of firms, supply labor to firms, and supply savings to banks.

Each period, current total factor productivity and the interest rate on loans from the central bank (the policy rate) are observed, and households choose expected utility-maximizing labor supply. Firms then produce homogeneous output, returns on loans (from households and the central bank) are determined, and loans from the central bank last period are repaid. Households then allocate current output to present and future consumption, and banks fund loans to create new physical capital next period. Banks are subject to a liquidity requirement based on loans held on balance sheet. They satisfy this requirement by holding liquid assets (in the form of the homogeneous consumption good) equal to the regulatory minimum. Since banks in the SR retain a lower portion of originated loans than in the SR by definition, one unit of saving under the SR results in more lending (and hence a higher rate of capital accumulation) than one unit of saving in the TR. This difference results in a larger steady-state capital stock and greater volatility of real variables under the SR relative to the TR.

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52 There is no population growth in the model, but households may vary the capital/labor ratio to maximize utility, as further explained below.
4.2.2 -- Firms

Firms produce homogeneous output in period $t$, $Y_t$, according to a Cobb-Douglas production function of physical capital, $K_t$, and labor, $L_t$:

$$Y_t = \psi_t K_t^\alpha L_t^{1-\alpha} \quad [1]$$

where $0 < \alpha < 1$ is capital’s share in production. $\psi_t$ is total factor productivity in period $t$, determined by an AR(1) process, $\psi_{t+1} = \rho \psi_t + \iota_t$, where $\iota_t$ is a stochastic shock to productivity with distribution $N(0, \sigma_t)$, and $0 < \rho < 1$. Firms and other agents in the model learn the value of $\psi_t$ at the beginning of each period. Let $\delta$ be the rate of physical capital depreciation. Physical capital accumulates according to the rule:

$$K_{t+1} = I_t + (1 - \delta)K_t \quad [2]$$
Gross investment, $I_t$, is determined by financial intermediaries and realized total factor productivity in a process described below. Firms can invest in new and replacement capital only by borrowing from households and the central bank via financial intermediaries.

Since investment in new physical capital is only possible via financial intermediation, banks can be thought of as capital-producing firms. For simplicity and without loss of generality, we assume all loans have terms of one period. Firms borrow at a gross contractual interest rate $R_t^C$ and repay $R_{t+1}$ next period, even if $R_t^C = E_t[R_{t+1}] \neq R_{t+1}$. Firm profit, $\pi_t^F$, is distributed to households equally, as is bank profit ($\pi_t^B$), so it is irrelevant whether we assume that excess returns to capital $(R_t - R_t^C)$ accrue to firms or banks, since both are owned by households. Another implication of households’ ownership of firms is that the firms’ demand for labor and payment of wages can be suppressed in the firm’s problem – households earn the same returns from supplying labor whether the firms pay households the marginal product of labor as wages or distributions of profit. Firm profit is therefore production minus the cost of investment last period.

$$\pi_t^F = Y_t - R_t I_{t-1} \quad [3]$$

Firms choose $I_t$ to maximize the present value of profit,

$$\text{Max } E_t \left[ \sum_{t=0}^{\infty} \beta^t \pi_t^F \right]$$

subject to the capital accumulation equation [2]. $\beta$ is a discount rate between zero and one common to all agents in the model. The first order condition of this maximization problem is

$$E_t[R_{t+1}] = E_t[\alpha \psi_{t+1} K_{t+1}^\alpha L_{t+1}^{1-\alpha}] \quad [4]$$

Using the facts that $E_t(R_{t+1}) = R_t^C$ and $E_t(\psi_{t+1}) = 1 + \rho(\psi_t - 1)$, we can rearrange equation [4] and use [2] to solve for the demand for capital next period:

$$E_t[k_{t+1}] = R_t^C / [\alpha (1 + \rho(\psi_t - 1))] \quad [5]$$
where \( k_t \equiv K_t / L_t \). Production and the payment of investment returns occurs at the beginning of each period. Subsequently, the credit and capital market outcomes are determined.

### 4.2.3 -- Financial Intermediaries

There are two banking regimes considered: one featuring securitization (SR) and one featuring traditional fractional reserve lending (TR). The two regimes are considered separately and the resulting two versions of the model are then compared. Both types of banks cannot exist simultaneously in the model. As explained in detail below, the TR imposes higher regulatory costs, thus transforming a smaller portion of savings into physical capital than the SR. If banks (and by extension their owners, households) were allowed to choose between the regimes, then the SR would dominate. In order to obtain a separating equilibrium in which both SR and TR financial intermediaries exist, as we presently observe in credit markets, additional costs of the SR (e.g. those arising from asymmetric information) and/or additional benefits of the TR (e.g. payment of interest on reserves) would have to be introduced.\(^{53}\) We are interested here in the effect of the regulatory arbitrage opportunity afforded by the SR through the removal of assets from bank balance sheets in the absence of asymmetric information or differential treatment by policymakers. Hence we model the SR and TR as identical in all respects except for the portion of originations retained.

Securitizers issue asset backed securities \( (S_t) \) to households and borrow from the central bank, described below, to fund loan originations equal to \( I_t \). They must retain a fraction \( \chi \) of originations and hold idle assets (in the form of the homogeneous consumption good obtained via loan sales) equal to \( \omega \% \) \((0<\omega<1)\) of assets. “Traditional” fractional reserve banks fund loans with deposits \( (D_t) \) from households and borrowing from the central bank \( (CB_t) \). They retain all

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\(^{53}\) Firm and/or household heterogeneity could also cause a separating equilibrium.
originations and, like securitizers, are required to hold idle \( \omega \% \) of assets, \( 0 < \omega < 1 \). Both types of bank costlessly intermediate savings and investment. Households own these banks, which can be thought of as physical capital-producing firms, as well as the output-producing firms.

This regulatory structure mirrors that in place in the U.S. and Europe. ABS issuers must retain 5% of issues and face minimum requirements for liquid assets held against potential losses. Traditional balance-sheet lenders must also hold “high-quality liquid assets” against risky assets held on balance sheet, and these minimum liquidity requirements are currently closer to binding than reserve requirements (Potter 2018). For this reason, the model does not impose a reserve requirement on traditional banks and only applies a regulatory liquidity requirement to both bank types.

When households create capital through the SR, they pay \( S_t \) to financial intermediaries. Without access to loans from a central bank, financial intermediaries then create \( I_t = S_t / (1 + \chi \omega) \), the maximum amount of gross investment possible while satisfying liquidity requirements. Payments from households to banks fund loan originations (\( I_t \)) and provide the resources necessary to abide by liquidity requirements (\( \chi \omega I_t \)). When households create capital through the TR, they pay \( D_t \) to financial intermediaries, who then create \( I_t = D_t / (1 + \omega) \). The SR creates more capital from savings by avoiding liquidity requirements on \((1 - \chi)I_t\).

Both bank types can borrow from the central bank at the gross policy rate, \( r_t \), but the SR will again produce higher gross investment because any retained originations funded with loans from the central bank must be backed by non-lent savings and/or loans from the central bank, and the SR features a lower retention rate by definition. The gross policy rate, \( r_t \), is set exogenously according to the AR(1) process \( r_t = \rho r_{t+1} + \nu_t \), where the persistence parameter \( \rho \) is the same as

\[ \text{originations} \quad \text{and, like securitizers, are required to hold idle } \omega \% \text{ of assets, } 0 < \omega < 1 \text{. Both types of bank costlessly intermediate savings and investment. Households own these banks, which can be thought of as physical capital-producing firms, as well as the output-producing firms.} \]

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\[ \text{Thus the two regimes are equivalent if } \chi = 1. \]
that in the equation for \( \psi_t \) above, \( R \) is the steady-state return to capital (described below), and \( \nu_t \) is a random variable with distribution \( N(0, \sigma_\nu) \). Like loans funded by savings, loans from the central bank (denoted \( CB_t \)) are repaid in the following period at the rate determined in the previous period. To clarify the structure of both bank types, balance sheets for each are presented in Tables 4.1 and 4.2 below.

Table 4.1: Traditional Bank’s Balance Sheet

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment, ( I_t = (D_t + CB_t)/(1 + \omega) )</td>
<td>Deposits, ( D_t )</td>
</tr>
<tr>
<td>Liquid Assets, ( \omega(I_t) )</td>
<td>Loans from Central Bank, ( CB_t )</td>
</tr>
<tr>
<td>Equity = Assets - Liabilities = 0</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.2: Securitizer’s Balance Sheet

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retained Investment, ( \chi I_t = \chi(S_t + CB_t)/(1 + \omega \chi) )</td>
<td>Retained loans funded with savings plus retained savings owed to savers: ( \frac{\chi + \chi \omega}{1 + \chi \omega} S_t )</td>
</tr>
<tr>
<td>Liquid Assets, ( \chi \omega(I_t) )</td>
<td>Retained loans funded by the central bank plus retained loans from the central bank, ( \frac{\chi + \chi \omega}{1 + \chi \omega} CB_t )</td>
</tr>
<tr>
<td>Equity = Assets - Liabilities = 0</td>
<td></td>
</tr>
</tbody>
</table>

Banks in the SR use household savings and loans from the central bank to fund originations and meet liquidity requirements, and loans equal to \( \frac{1 - \chi}{1 + \chi \omega} (S_t + CB_t) \) are removed to household
balance sheets. Financial intermediaries retain \( \frac{\chi}{1 + \chi \omega} (S_t + CB_t) \) loans and use the remaining savings and central bank loans to meet liquidity requirements totaling \( \frac{\chi \omega}{1 + \chi \omega} (S_t + CB_t) \). Reserves not used to offset losses from default are returned to households and the central bank at the end of each period. Households hold \( (1 - \chi)I_t \) on balance sheet under the securitization regime, exempting it from the minimum liquid asset regulation.

Expected bank profit on an infinite horizon is

\[
E_t \left[ \sum_{t=0}^{\infty} [\beta^t [R_t \ast \chi I_{t-1} - r_t \ast \chi CB_{t-1}]] \right] \quad [6]
\]

under the SR and

\[
E_t \left[ \sum_{t=0}^{\infty} [\beta^t [R_t \ast I_{t-1} - r_t \ast CB_{t-1}]] \right] \quad [7]
\]

under the TR. The first term of [6] is the realized return on retained loans originated last period, and the second term is the repayment of central bank loans from last period held on balance sheet. Loans funded by the central bank but sold to households are assumed to be repaid from the proceeds of loans held by households and so are omitted from [6]. Similarly, the first term of [7] is the return on loans originated by traditional banks and the second term is the cost of repayment of loans from the central bank.

The profit maximization problem for each type of financial intermediary is to choose loan originations, equal to \( I_t \), each period such that liquidity requirements are satisfied. Both types of bank are assumed to operate in a perfectly competitive market and must balance the expected return of the marginal origination against the expected carrying cost of the loan until maturity if the profit-maximizing origination decision is above the amount households will fund directly. If returns next period are below expectations, or if the policy rate is above expectations, both bank
types can suffer losses on loans held on their balance sheets. Before solving for equilibrium in the credit market and the rest of the model, it is necessary to introduce the final agent in the model, households.

4.2.4 -- Households

A representative household maximizes the net present value of log utility over an infinite lifetime

\[ \text{Max } E_t \left[ \sum_{t=0}^{\infty} \beta^t \left[ \ln(C_t) - \frac{\mu}{1 + \eta} L_t^{1+\eta} \right] \right] \]  

subject to a budget constraint

\[ C_t = \Pi_t + R_t D_{t-1} (1 + \omega)^{-1} - D_t \]  \[ 9a \]

under the TR and

\[ C_t = \Pi_t + R_t S_{t-1} (1 + \chi \omega)^{-1} - S_t \]  \[ 9b \]

under securitization. \( C_t, \Pi_t, L_t, \) and \( R_t \) are consumption, the sum of firm and bank profit, labor supply, and the realized yield on debt held by consumers maturing in period \( t \), respectively. The household sector owns firms and financial intermediaries (banks), and firm and bank profits are available for consumption. Existing capital held by households via firms cannot be liquidated and consumed. The population of consumer/workers is constant. All loans in the economy mature one period after origination and pay a gross return of \( R_{t+1} \). \( \mu \) and \( \eta \) are fixed parameters reflecting the disutility of labor and the elasticity of labor supply. A summary of all the model’s variables and parameters is provided in Table 4.3 below.

The first-order conditions of households’ maximization problem equate the marginal utility of the marginal product of labor to the marginal disutility of labor:
\[(1 - \alpha)\psi_t K_t^\alpha L_t^{-\alpha} \lambda_t = \mu L_t^\eta\]  \[10\]

where \(\lambda_t\) is the marginal utility of consumption in period \(t\), \(C_t^{-1}\), and also equate the marginal utilities of present and future consumption,

\[E_t \left[ \beta \frac{\lambda_{t+1}}{\lambda_t} R_{t+1}(1 + \omega)^{-1} \right] = 1 \quad [11a]\]

under the TR and

\[E_t \left[ \beta \frac{\lambda_{t+1}}{\lambda_t} R_{t+1}(1 + \chi\omega)^{-1} \right] = 1 \quad [11b]\]

under the SR to guide the consumption/saving decision. A model timeline (Figure 1) is provided below to clarify the timing of decisions and the receipt of information each period.

4.2.5 – Central Bank

Before turning to the simulation, some further clarification of the structure and role of the central bank in the model is in order. There is no money in the model, so loans from the central bank are in the form of the homogenous consumption good, which the central bank cannot create. The central bank is assumed to begin in period 0 with an arbitrary stock of the consumption good, and the model economy must satisfy the transversality condition

\[\lim_{t \to \infty} \sum_{\tau} [CB_t] - r_t(CB_{t-1}) \leq 0\]

The central bank cannot permanently inject capital from its beginning stock into the economy. Although this condition means the central bank’s assets cannot decline over time, the central bank can be net expansionary or contractionary over a finite horizon. The central bank is also restricted by the zero lower bound: \(r_t - 1 \geq 0\).

Capital can enter the model in the short run via borrowing from the central bank stock, assumed to be some arbitrary constant in the starting period, subject to the zero lower bound. In the long run, production must pay for all consumption and investment. All loans from the central
Table 4.3: Summary of Variables and Parameters

<table>
<thead>
<tr>
<th>Variable/Parameter</th>
<th>Description</th>
<th>Variable/Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\psi_t$</td>
<td>Factor productivity</td>
<td>$\pi_t$</td>
<td>Total profit</td>
</tr>
<tr>
<td>$R_t$</td>
<td>Realized yield</td>
<td>$CB_t$</td>
<td>Central bank lending</td>
</tr>
<tr>
<td>$r_t$</td>
<td>Policy rate</td>
<td>$\alpha$</td>
<td>Capital share in output</td>
</tr>
<tr>
<td>$R^C_t$</td>
<td>Contract interest rate</td>
<td>$\eta$</td>
<td>Labor elasticity</td>
</tr>
<tr>
<td>$L_t$</td>
<td>Labor</td>
<td>$\mu$</td>
<td>Labor disutility weight</td>
</tr>
<tr>
<td>$K_t$</td>
<td>Capital</td>
<td>$\rho$</td>
<td>Shock persistence</td>
</tr>
<tr>
<td>$Y_t$</td>
<td>Output</td>
<td>$\delta$</td>
<td>Depreciation rate</td>
</tr>
<tr>
<td>$I_r$</td>
<td>Investment</td>
<td>$\beta$</td>
<td>Discount rate</td>
</tr>
<tr>
<td>$S_t$</td>
<td>Loan sales (SR)</td>
<td>$\chi$</td>
<td>Liquidity requirement</td>
</tr>
<tr>
<td>$D_t$</td>
<td>Deposits (TR)</td>
<td>$\omega$</td>
<td>Retention requirement</td>
</tr>
<tr>
<td>$\pi^F_t$</td>
<td>Firm profit</td>
<td>$\sigma_t$</td>
<td>S.D. productivity shock</td>
</tr>
<tr>
<td>$\pi^B_t$</td>
<td>Bank Profit</td>
<td>$\sigma_v$</td>
<td>S.D. policy shock</td>
</tr>
</tbody>
</table>

bank must be repaid, and here the central bank provides capital for only one period. Below, the default conditions for both regimes are derived and clarified.
4.2.6 – Constraints and Equilibrium Conditions

We can now state the aggregate resource constraint under both regimes to complete the model description. Both traditional banks and securitizers fund loans with savings and loans from the central banks and use those loans to fund investment. Under the TR, the aggregate resource constraint is

\[ Y_t + CB_t = C_t + D_t + rCB_{t-1} \]

The aggregate resource constraint under the SR is

\[ Y_t + CB_t = C_t + S_t + rCB_{t-1} \]

Output and loans from the central bank each period fund consumption, repayment of loans from the central bank last period, and saving (which in turn fund investment). Physical capital cannot be consumed or liquidated to pay debt, so firms must repay loans from last period from current output. Since households own both firms and banks, loan repayment amounts to one hand paying the other, and households ultimately have access to current output and loans from the central bank to fund current consumption, repay central bank loans, and save. The liquid assets held on bank balance sheets are refunded to households at the end of each period in the absence of defaults. The only net change in resources in the economy derives from central bank lending. And the only difference between the two regimes is what amount of resources is not productively lent each period.

In equilibrium, households choose consumption (and thus saving) and labor supply by satisfying [11] and [5], respectively. Once the goods, labor, and credit markets clear, the capital market must clear by Walras’ law. Assuming \( \psi_t \) is fixed at one (i.e. there are no shocks to
productivity) and the policy rate is at or below the neutral rate, the steady state is characterized by:

\[ Y = C + D \left( 1 - R \left( \frac{1}{1 + \omega} \right) \right) \quad [12a] \]

\[ Y = C + S \left( 1 - R \left( \frac{1}{1 + \chi \omega} \right) \right) \quad [12b] \]

\[ L = \left[ \frac{(1 - \alpha)K^\alpha}{\mu C} \right]^{\frac{1}{\alpha + \eta}} \quad [13] \]

\[ R^C = R = \beta^{-1}(1 + \omega) = \alpha \left( \frac{L}{K} \right)^{1 - \alpha} = \alpha k^{\alpha - 1} \quad [14a] \]

\[ I = \delta K = \frac{D}{1 + \omega} \quad [15a] \]

\[ R^C = R = \beta^{-1}(1 + \chi \omega) = \alpha \left( \frac{L}{K} \right)^{1 - \alpha} = \alpha k^{\alpha - 1} \quad [14b] \]

\[ I = \delta K = \frac{S}{1 + \chi \omega} \quad [15b] \]

The difference between the steady states is due to the application of liquidity requirements under both regimes (in the model as well as in the real world). With given liquidity requirements, securitizers can originate more credit than traditional banks. While security issuers must account for risk only on those loans they did not sell, traditional banks must account for risk on all originations. Combining [14a] and [14b], we can conclude that the steady-state interest rate under the TR is larger than in the SR. Specifically, the interest rate in the TR steady state \( R^{Trad} \) is greater than \( R^{Sec} \) by a factor of \( \frac{1 + \omega}{1 + \chi \omega} \equiv X \), which is greater than one for \( \chi < 1 \). This causes the capital/labor ratio under the SR to exceed the capital/labor ratio under the TR by a factor of

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55 The neutral rate is derived below.
From [10], $\partial L / \partial K > 0$. Given an initial stock of capital, both regimes will approach the steady-state capital ratio by increasing or decreasing capital and labor together. The resulting higher capital stock and labor supply in the SR imply higher steady-state production under that regime.

Equilibrium in the SR thus features a lower interest rate and higher output, investment, saving, consumption, capital, and labor supply than in the TR. Furthermore, the lower effective liquidity requirement on the SR makes it more sensitive to productivity and policy shocks, as shown in the next section. A shift from one regime to the other will alter the steady state as well as impulse responses but will not affect the neutral policy rate, defined here as the minimum policy rate that will induce borrowing from the central bank. In order to meet capital requirements, banks in the SR will not borrow from the central bank unless $r_t \leq E_t \left[ \frac{R^\text{Sec}_{t+1}}{1+\chi_{t}} \right]$, and banks in the TR will not borrow from the central bank unless $r_t \leq E_t \left[ \frac{R^\text{Trad}_{t+1}}{1+\chi_{t}} \right]$. Since $R^\text{Sec}_{t+1} = X R^\text{Trad}_{t+1}$, these two conditions are the same. The neutral policy rate $r^* = E_t \left[ \frac{R^\text{Sec}_{t+1}}{1+\chi_{t}} \right] = E_t \left[ \frac{R^\text{Trad}_{t+1}}{1+\chi_{t}} \right]$. Although the neutral rate is the same in both regimes, when the policy rate falls below $r^*$, banks in the SR will borrow more than banks in the TR, as shown in the next section.

4.3 – Simulation

There are two sources of exogenous variation in the model: $\psi_t$, the parameter affecting total factor productivity, and $r_t$, the policy rate. Having established equilibrium and the main results of the model, we now complete the analysis by comparing the responses of the two banking

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56 The neutral rate is usually defined as neither expansionary or contractionary, yet it is defined simply as non-expansionary here because the model cannot account for contractionary policy – monetary policy is irrelevant above the neutral rate as financial intermediaries are not forced to borrow from the central bank and money (and hence reserves held at the central bank) are absent.
regimes to unexpected shocks to $\psi_t$ and $r_t$. The model is simulated using Dynare and OccBin. Dynare log linearizes the model and shows the responses of the model’s variables to stochastic shocks. OccBin applies constraints to the models (traditional and securitization) in Dynare and allows us to compare the two modeled regimes. The two constraints OccBin applies are the liquidity constraint, which is always binding in equilibrium in both regimes, and the zero lower bound, which is rarely binding in the model. The solution procedure is a first-order Taylor approximation of impulse responses around the steady state given above. The simulation results presented below use the parameter values given in Table 4.4 below.

Table 4.4: Calibration

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\mu$, disutility of labor</td>
<td>.25</td>
<td>$\eta$, labor elasticity</td>
<td>.33</td>
</tr>
<tr>
<td>$\alpha$, capital share</td>
<td>.33</td>
<td>$\delta$, depreciation</td>
<td>.025</td>
</tr>
<tr>
<td>$\rho$, shock persistence</td>
<td>.9</td>
<td>$\beta$, discount rate</td>
<td>.99</td>
</tr>
<tr>
<td>$\chi$, retention req.</td>
<td>.05</td>
<td>$\sigma_t$, S.D. prod. shock</td>
<td>.1</td>
</tr>
<tr>
<td>$\omega$, capital req.</td>
<td>.1</td>
<td>$\sigma_\nu$, S.D. policy shock</td>
<td>.1</td>
</tr>
</tbody>
</table>

$\beta, \mu, \eta, \alpha, \text{ and } \delta$ match Gertler and Kiyotaki’s (2010) calibration, which is “reasonably conventional.” (p. 575) $\rho$ is chosen to match the persistence of the technology shock in Guerrieri and Iocaviello (2015), on which this simulation is based. Increasing $\rho$ will lengthen the time it takes the model to return to the steady state after shocks. $\chi$ is set to 5% to reflect current regulatory requirements, and $\omega$ is set to approximate overall current liquidity requirements on financial

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57 The log-linearized model is provided in the Appendix.
intermediaries. The chosen variances $\sigma_t$ and $\sigma_v$ give the standard deviation of shocks to monetary policy and productivity of .1. This level is large enough to show differences between the regimes clearly but small enough to avoid defaults on loans from the central bank in the simulations. Defaults are technically precluded in the model. Central bank loans must be repaid, and private credit can be repaid at a rate lower than the contract rate. The analysis of default is limited to showing under what conditions defaults would occur in each model (see below). As long as these last four variables are in the ranges needed to make the mechanisms of the model operative, they may be adjusted without affecting the qualitative results of the model. In the simulations that follow, both the TR and SR are solved and simulated separately, then OccBin is utilized to show differences between the models in impulse responses given shocks to productivity and monetary policy.

4.3.1 -- Changes in Productivity

Figures 4.2 and 4.3 show percentage changes in the endogenous variables over 40 periods subsequent to a one standard deviation (or 10%) positive shock to productivity in the SR and TR, respectively, when monetary policy is ineffective. The responses of both models are slightly different due to the effect of $\chi$, which allows securitizers more flexibility (i.e. the liquidity requirement is less onerous) when adjusting to changes in productivity.

Figure 4.4 shows the differential effects of the same 10% productivity shock shown in the previous two figures. The lines shown are the differences between the percentage changes in the simulated endogenous variables in the two banking regimes: $\frac{(R_t^{Sec} - R_{t-1}^{Sec})}{R_{t-1}^{Sec}} - \frac{(R_t^{Trad} - R_{t-1}^{Trad})}{R_{t-1}^{Trad}}$, $\frac{(Y_t^{Sec} - Y_{t-1}^{Sec})}{Y_{t-1}^{Sec}} - \frac{(Y_t^{Trad} - Y_{t-1}^{Trad})}{Y_{t-1}^{Trad}}$, and so on for

58 The “Liquidity Coverage Ratio” requirements under Basel III require banks to retain cash or cash equivalents equal to 30 days of gross cash outflows, which typically exceed 10% of banks’ assets. So $\omega$ may be realistically set higher, but doing so will not affect the results of the model because $\frac{\partial X}{\partial \omega} > 1$ unless X is very close to 1.
Figure 4.2: Productivity shock to SR, ineffective MP

Figure 4.3: Productivity shock to TR, ineffective MP

Figure 4.4: Difference between responses, productivity shock, ineffective MP (%Change in SR - %Change in TR)
each period \( t \), where the “Trad” and “Sec” superscripts denote the TR and SR, respectively. Any variation from the horizontal axis indicates a difference between the two systems. The shock occurs in period 9.

The analysis of productivity shocks thus far has assumed the central bank is absent or, equivalently, the policy rate is above the neutral rate both before and after the shock. “Ineffective” monetary policy refers to a policy rate that induces no borrowing from the central bank. When a productivity shock causes the policy rate to become effective (with no change in the policy rate), [6] and [7] require that banks under both regimes choose investment to drive the market rate, adjusted for liquidity requirements, to the policy rate. Both types of banks respond to a change in monetary policy by adjusting the offered yield \( (R^c_t) \) on securities or deposits. Just as with ineffective monetary policy (as shown in Figure 4), productivity shocks will produce larger responses in the SR when the policy rate is effective after the productivity shock, as shown in Figure 4.5 below. When productivity is increased by ten percent, the SR results in larger changes in all variables because \( \chi < 1 \).

Regardless of the level of the policy rate, the SR features larger fluctuations in the endogenous variables when shocks to productivity occur. A similar result is obtained for shocks to monetary policy.
4.3.2 Changes in the Policy Rate

Figures 4.6 and 4.7 show the impulse responses to a 10% (one standard deviation) downward shock to the policy rate.

Figure 4.6: Policy Shock to SR
Figure 4.7: Policy Shock to TR

Figure 4.8 combines the results shown in figures 4.6 and 4.7 and shows the differences in the impulse responses between the regimes, just as in Figures 4.4 and 4.5. Again, the percentage change in all endogenous variables is greater for the SR than the TR. For each variable that increases with a decline in the policy rate (e.g. investment), the difference between the regimes is positive. For each variable that varies positively with the policy rate (e.g. realized yield), the difference between the regimes is negative. Thus, the magnitude of the impulse response is larger under the SR for all of the endogenous variables.

Figure 4.8: Differences between responses, policy shock
4.4 – Discussion

The model implies that shocks to productivity and monetary policy will have different effects under the two banking regimes considered. These differences derive from the particular forms of regulatory requirements to which these types of banks are subject. Macroeconomic fluctuations can differ between the two banking regimes even when asymmetric information problems of the “originate-to-distribute” securitization model of financial intermediation stressed elsewhere are absent. Securitization leads to more volatility than traditional banking in terms of all real variables. The model also features equity-less banks and hence does not rely on securitization allowing increased bank leverage in order to amplify cycles as others, as Shin (2009) has argued. In fact, if we define overall leverage in the model economy as the ratio of total investment to idle bank assets, both regimes result in identical leverage ratios equal to $1/\omega$.

The SR achieves higher output, consumption, etc. at the expense of increased volatility and risk. Although default is precluded in the model, it is possible to derive conditions under which banks will default on loans from the central bank. Default occurs when retained liquid assets are insufficient to cover losses on loans from the central bank -- in the SR when $\frac{R_{t+1} - r_{t+1}}{1 + \chi \omega} \cdot CB_t + \chi \omega I_t < 0$ and in the TR when $\frac{R_{t+1} - r_{t+1}}{1 + \omega} \cdot CB_t + \omega I_t < 0$. Both investment and borrowing from the central bank are larger under the SR, and the liquidity buffer is smaller under the SR, so it necessarily follows that the TR can sustain larger negative productivity shocks than the SR while avoiding default. This conclusion stands to reason since securitization evades part of the liquidity requirement in exchange for increased exposure to exogenous shocks.

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59 As long as $\chi X > 1$, which obtains as long as $\chi$ is not close to 1.
To date, there has not been much research on the theoretical changes to productivity and the policy rate as credit markets shift from traditional banking to securitization. The approach closest in spirit to mine must be Shleifer and Vishny’s (2010), who also analyze securitization without making the common assumptions of increased conflict of interest and leverage levels but still find that the profit-maximizing actions of asset-backed security issuers can lead to increased volatility.\textsuperscript{60} Their model, however, relies on fluctuations in investor sentiment to precipitate crises rather than shocks to productivity or monetary policy. Estrella (2002) also investigates the change in monetary policy transmission as credit markets evolve and finds that, although mortgage interest rates are more sensitive to monetary policy shocks after the rise of securitization, the effect of policy on real variables has decreased. The efficacy of monetary policy has diminished over the period of securitization’s rise due to, Estrella speculates, “noninterest rate effects, such as the liquidity and credit channels.” (p. 11) In other words, securitization has narrowed the gap between ultimate lenders and borrowers by making the loans more liquid, allowing less room for monetary policy to affect real outcomes. This comports with the results of Loutskina and Strahan (2009), who show that the extension of credit is less sensitive to the health of bank balance sheets after the development of securitization markets. The model presented here indicates that interest rates are more sensitive to monetary policy under securitization due to the partial evasion of regulatory liquidity requirements, and loan origination under securitization is also more sensitive to monetary policy when the central bank can affect the stock of physical capital.

\textsuperscript{60} “Relative to direct lending, securitization raises the level of investment but also its cyclicality, as well as that of balance sheets and profits.” (p. 312)
This larger effect derives from the application of the liquidity requirement and leads to larger real fluctuations by construction.\(^{61}\) There is empirical support for the modeling approach used here, which assumes that a key difference between the two financial intermediation systems has to do with the existing structure of regulations as currently applied. Acharya and Richardson (2009) provide an account of how securitization has allowed banks to skirt regulations and liquidity requirements and argue that this effect was a major cause of the financial crisis. The acceleration of conduit lending in the U.S. over the late 1980s and early 1990s coincided with the introduction of formal capital requirements on financial institutions in response to the savings & loan crisis (see Burhouse and Ligon 2003). Acharya, Schnabl, and Suarez (2013) argue that these asset movements provided regulatory cover but did not in fact shift risk away from the financial sector, as regulators presumably intended, and Angeloni and Faia (2013) explain how (non-cyclical) risk-based capital requirements in general can amplify shocks and prolong their effects.

Excused from liquidity requirements on sold loans, securitizers in the model rely on funding from the central bank to a greater extent (as a percentage of loans originated) than traditional banks do. They also only need to finance originations that are later sold for the period between origination and sale rather than for the entire loan term, possibly increasing the importance of short-term interest rates to securitizers relative to balance sheet lenders. Other research indicates that this attribute of securitization, when considered outside the context of the narrow model here, can itself exacerbate credit cycles and their real effects. Gorton and Metrick (2012) trace the transmission of the crisis from subprime ABS to other ABS products linked to subprime products through short-term repurchase agreements used by asset-backed security

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\(^{61}\) The assumption that credit fluctuations have real effects is well supported. See Bordo and Haubrich (2010) for an historical account of the real effects of credit cycles. On the real effects of credit market fluctuations over the past three major cycles in the U.S., see Jermann and Quadrini (2009).
bookrunners for short term financing, strongly indicating that the reliance on short term debt to fund loans could be to blame for turning the subprime crisis into a wider credit crisis. Ivashina and Scharfstein (2010a) provide further empirical evidence that banks decreased lending during the crisis to a greater extent the more they relied on short-term financing, rather than deposits, to fund loans. The banks in the model here, though, borrow from the central bank rather than the commercial paper or federal funds markets. To the extent that the central banks can manipulate real rates in private short term credit markets, a prerequisite assumption of activist monetary policy, the model’s conclusions about the exaggerated effect of monetary policy in securitized credit markets should apply.

In the absence of asymmetric information, securitization allows the economy to devote fewer resources to self-insurance against unexpected shocks. Both models’ outcomes are the result of households balancing the marginal cost of forgoing consumption and the marginal benefit of increased production next period in both regimes, but the application of liquidity requirements to bank balance sheets changes this tradeoff and thus household decisions.

4.5 – Conclusion

This research focuses specifically on the macroeconomic effects of the practice of banks selling originations rather than holding them on their balance sheets. Credit markets may exhibit underlying cyclicality for a variety of reasons such as asymmetric information (i.e. Stiglitz and Weiss 1981) or shocks to the value of existing assets, time preferences, or expectations. With the partial exception of Estrella (2002), this paper gives the only theoretical account of productivity shock and monetary policy transmission in the two banking systems to account for increased risk-taking in securitization markets.
The particular structure of financial intermediation in an economy can alter the economic effects of those problems and shocks. It is shown here that securitization, even in the absence of increased information asymmetry, can exacerbate cycles in credit markets and their real effects. This effect is most pronounced when banks have access to financing from a central bank. The role of central banking in existing research is either ignored or considered only in the context of evaluating potential policy responses. The model presented in this paper is the first to consider the role of central banks in loan securitization throughout the credit cycle rather than just during recessions. Lower liquidity requirements by themselves will induce more borrowing from the central bank by securitizers than balance-sheet lenders, and the further effect of the shorter-term funding needs of securitizers on the power of monetary policy to affect credit market outcomes is an important subject of future research.
CHAPTER 5: Conclusion

From a review of the history and an evaluation and development of the theory of securitization, this work has provided answers to some of the most intriguing post-crisis questions about securitization. Why and how did securitization develop? What was it intended to accomplish, and did it do so? Were there unintended consequences of this development? Chapter 2 tells us that securitization was conceived in the political sphere for political purposes, namely, the purchase of votes from current and aspiring homeowners. In the late 1970s and early 1980s, the RMBS market was partially privatized, meaning private parties began issuing mortgage-backed securities, and concerted lobbying efforts on the part of these bankers led to a restructuring of the tax and regulatory code in the U.S. to allow these deals to continue and proliferate. Once the Resolution Trust Corporation standardized the same type of securitization in the realm of commercial mortgages in the early 1990s, private banks in the U.S. and Europe were routinely using securitization to fund mortgages, and by the late 1990s would be using it to fund other types of debt, including but not limited to credit cards, automobile loans, and student loans.

The evolution of credit markets from traditional, fractional reserve banking to securitized credit markets imposes additional asymmetric information problems. Although there are many examples discussed in Chapter 3, the primary issue is created by loan sales via securitization. Lenders are not incentivized to make the same loan to hold as to sell. The only way to induce an originate-to-distribute lender to perform the same due diligence as a balance sheet lender is to force the securitizer into a fully net long position.

We will also observe disparate lending under securitization and traditional banking regimes unless rules and regulations are specifically formulated to achieve such an outcome. Presently, since capital and liquidity requirements reference bank balance sheets and expected outflows,
respectively, regulations intended to keep financial intermediaries solvent will apply more stringently to balance sheet lenders. The resulting increase in lending under a securitization regime exposes the economy to more risk from stochastic shocks than under a traditional banking regime.

Crucially, the shift in the banking system has affected monetary policy transmission. Though transmission mechanisms are poorly understood and require further research, the analysis in Chapter 4 indicates that securitizers will be more sensitive to monetary policy shocks (because they can borrow more than a traditional bank while still satisfying regulations). In real credit markets, this result is likely even stronger than implied by the model because of ABS issuers’ typical reliance on short-term debt to finance the purchase (and/or origination) of loans to securitize. If there is a stronger connection post-securitization between monetary policy and lending, a complete and correct account of the Great Recession and the wise conduct of future monetary policy depend on understanding this connection. This topic was largely unaddressed prior to the credit crisis. The Russian debt/Long Term Capital Management crisis of 1998 and the recession following 9/11/2001 saw declines in ABS returns and were preludes to the credit collapse of 2007-08, but the role of ABS in credit market fluctuations did not get the attention of researchers and policymakers until the information asymmetries and macroeconomic effects of these markets were too obvious to ignore.

Securitization is an example of financial agglomeration that has both costs and benefits. The cost of asymmetric information, or rather the method the system uses to deal with that problem, are of fundamental importance to that industry. If financial intermediaries exist to overcome problems of asymmetric information, evolved traits of credit markets that directly exacerbate that very problem should be viewed skeptically. There is no reason to believe that credit markets could or should be stuck in the “community banker” culture, knowing all borrowers
intimately. But there is also no reason to believe that a program designed by the Federal
government to subsidize homeowners is a good foundation for a credit market. There are many
changes, including and most likely the formation of a public exchange with self-enforcing
membership requirements and rule-breaking penalties, that can potentially ameliorate the systemic
problems in Western credit markets dominated by ABS today.

This work furthers our collective understanding of the nature of securitization and opens
new avenues of exploration of this fascinating arena of financial intermediation. Unanswered
questions include many about the design of appropriate institutions surrounding the practice, a
subject only grazed by the Chapter 3. But these answers require further experimentation,
experience, and study. Forcing issuers to retain all or a significant portion of the risk alters the
basic idea of securitization and raises the question anew whether securitization structured as such
would make any sense -- can we imagine a situation where an originator wishes to retain all risk
on a pool of loans yet not capture the full return from that pool? Why absorb all defaults and not
all returns? What other aspects of ABS issuance could and should be regulated or better regulated?
Should the tax code be amended since it favors debt over equity and directly contributes to the
advantages of structuring mortgage investments as ABS rather than as equity in mortgage lender
firms? The answers to these questions embraced by regulators and market participants will shape
credit market outcomes. This and future research, it is hoped, will help them decide wisely.
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Appendix

Equation numbers in the appendix are the same as in the body of Chapter 4 with the prefix “A”. The log-linearized production function is

\[ Y_t = \phi_t + \alpha K_t + (1 - \alpha)L_t \quad [A1] \]

\( \phi_t \) is determined by an AR(1) process, \( \phi_{t+1} = \rho \phi_t + \iota_t \), where \( \iota_t \) is a stochastic shock to productivity with distribution \( N(0, \sigma_t) \), and \( 0 < \rho < 1 \). The log-linearized capital accumulation equation is

\[ \hat{K}_{t+1} = \left( \frac{I}{K} \right) \hat{I}_t + (1 - \delta) \hat{K}_t \quad [A2] \]

where \( I \) and \( K \) are the steady-state levels of investment and physical capital, respectively. The first order condition of the firm’s maximization problem is

\[ E_t[\hat{R}_{t+1}] = E_t[\hat{\psi}_{t+1} + (\alpha - 1)K_{t+1} + (1 - \alpha)L_{t+1}] \quad [A4] \]

Using the facts that \( E(R_{t+1}) = R^C \) and \( E(\hat{\psi}_{t+1}) = 1 + \rho(\phi_t - 1) \), we can rearrange equation [4] and use [2] to solve for the demand for capital next period:

\[ E_t[\hat{K}_{t+1}] = \frac{1}{\alpha - 1} [E_t(\hat{R}_{t+1} - \hat{\psi}_{t+1})] + E_t(\hat{L}_{t+1}) \quad [A5] \]

The gross policy rate, \( r_t \), is set exogenously according to the AR(1) process \( \hat{r}_t = \rho \hat{r}_{t+1} + \nu_t \), where the persistence parameter \( \rho \) is the same as that in the equation for \( \phi_t \) above, \( R \) is the steady-state return to capital (described below), and \( \nu_t \) is a random variable with distribution \( N(0, \sigma_v) \).

The first-order conditions of households’ maximization problem are:

\[ \hat{\psi}_t + \alpha \hat{K}_t - \hat{C}_t = (\alpha + \eta) \hat{L}_t \quad [A10] \]

and

\[ E_t \left[ (1 + \hat{R}_{t+1}) \frac{1 + \hat{C}_t}{1 + \hat{C}_{t+1}} \right] = 1 \quad [A11a \text{ and } A11b] \]
The first order conditions are the same under both banking regimes because of equations [A14a] and [A14b] below [A14b].

The aggregate resource constraint log linearized around the steady state is

$$\bar{Y}_t = \frac{C}{Y} \bar{C}_t + \frac{D}{Y} \bar{D}_t$$

For the traditional regime and

$$\bar{Y}_t = \frac{C}{Y} \bar{C}_t + \frac{D}{Y} \bar{D}_t$$

for the securitization regime since steady state lending from the central bank is zero.

In equilibrium, households choose consumption (and thus savings) and labor supply by satisfying [A11] and [A5], respectively. Equilibrium is characterized by:

$$\bar{Y}_t = \frac{C}{Y} \bar{C}_t + \frac{D}{Y} [\beta - 1] \bar{D}_t - \bar{R}_t \quad [A12a]$$

$$\bar{Y}_t = \frac{C}{Y} \bar{C}_t + \frac{S}{Y} [\beta - 1] \bar{S}_t - \bar{R}_t \quad [A12b]$$

$$\bar{C}_t = \alpha \bar{K}_t - (\alpha + \eta) \bar{L}_t \quad [A13]$$

$$\bar{R}_t = \bar{\psi}_t + (\alpha - 1) \bar{K}_t + (1 - \alpha) \bar{L}_t \quad [A14a and A14b]$$

$$\bar{I}_t = \frac{K}{I} [\bar{K}_{t+1} + (\delta - 1) \bar{K}_t] = \bar{D}_t \quad [A15a]$$

$$\bar{I}_t = \frac{K}{I} [\bar{K}_{t+1} + (\delta - 1) \bar{K}_t] = \bar{S}_t \quad [A15b]$$