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The Market Risk Premium for Unsecured Consumer Credit Risk

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We use the prices of credit card asset-backed securities to study the market risk premium associated with unsecured consumer credit risk. We find that the market incorporates a substantial credit risk premium into the prices of these securities. Furthermore, there has been a major repricing of unsecured consumer credit risk since the 2007–2009 financial crisis. We find evidence that this increase is linked to balance-sheet costs imposed by postcrisis changes in regulations that have placed credit card securitizations back onto issuer balance sheets. These regulatory changes may have added more than 100 basis points to the cost of unsecured household credit. (*JEL* G12, G13, G21, G5)

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Why is the cost of unsecured household borrowing so high? For example, the effective annual rate for consumer credit card debt, which represents one of the largest components of unsecured household debt, has averaged nearly 20% over the past 20 years.[1] The widely held industry view is that these high rates simply

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[1] The effective credit card annual percentage rate (APR) (including both fees and card interest) averaged 19.37% from 2000 to 2020. Recently, however, the APR has been increasing. For example, the effective APR averaged 20.82% in 2018, and 21.75% in 2019. For other examples of the high cost of unsecured household borrowing, see Morse (2011) and Melzer (2011).

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reflect the large potential credit losses associated with unsecured consumer credit.[2] In reality, however, actual credit card charge-off rates averaged less than 6% over the same period. Thus, expected credit losses are unlikely to fully explain the high cost of unsecured consumer debt. Previous academic research has focused on the role that card issuer market power and imperfect competition in the credit card market may play in determining consumer borrowing costs. An important paper by Ausubel (1991) provides evidence consistent with a market-power interpretation, and imperfect competition may well be one of the primary drivers of the high cost of unsecured consumer credit.[3] Recent trends in the secondary market for credit card loan portfolios, however, suggest that other important factors could be affecting the cost of consumer credit.

Given the central role of credit in the market, it is natural to consider whether the pricing of credit risk might be one of these additional factors. Could the high cost of household credit be at least partially due to the presence of a large unsecured consumer credit risk premium? The challenge in answering this question is that relatively little is known about the size and nature of household credit risk premiums. This is because consumer lending typically occurs in private transactions between households and financial institutions. Thus, market prices of consumer debt contracts are generally not directly observable in the secondary capital markets, making it difficult to measure how financial markets value unsecured consumer credit risk.

The key innovation of this paper is the use of market prices of credit card asset-backed securities (ABS) to measure the risk premium for unsecured consumer credit card risk. An important advantage of our approach is that the prices of credit card securitizations are determined purely by the actual credit risk of consumer cash flows faced by secondary market participants. This aspect allows us to directly identify the consumer credit risk premium.[4]

We find that the market incorporates substantial credit risk premiums into the prices of credit card ABS. These risk premiums increased far more during the financial crisis than the risk premiums for corporate bonds with similar ratings. The most-striking aspect of the risk premiums, however, is that there appears to have been a major repricing of unsecured consumer credit risk beginning in 2010. In particular, postcrisis premiums more than triple in size relative to their precrisis values even though consumer credit losses decrease and the distance to default for credit card securitizations increases significantly during the postcrisis period. The results suggest that the repricing of consumer

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[2] See, for example, Thangavelu (2021) and Karp (2021).

[3] Other important papers addressing the role of imperfect competition in the credit card markets include Calem and Mester (1995), Agarwal et al. (2015), and Herkenhoff and Raveendranathan (2021).

[4] In contrast, non-price-based approaches, such as attempting to infer the risk premium from the accounting margin between credit card rates and charge-off rates, can confound the risk premium with other factors, such as the economic rents earned by lenders or asymmetries in the bargaining power of consumers and lenders.

credit risk in the secondary market could have added as much as 100 to 200 basis points (bps) to the direct cost of consumer credit in the primary market.

What explains the significant repricing of unsecured consumer credit risk since 2010? One possibility is the impact of major changes on the regulation of financial intermediaries following the financial crisis. Foremost among these was the requirement for issuers to reconsolidate credit card securitizations back onto their balance sheets at the beginning of 2010. Since most credit card issuers are large financial institutions subject to strict regulatory capital requirements, their securitizations now require regulatory capital. Upon reconsolidation, issuers' capital ratios declined significantly, which suggests that they faced tighter capital constraints and new costs for meeting regulatory requirements ("balance-sheet costs"). Two other major changes were the "skin-in-the-game" risk retention requirement of the Federal Deposit Insurance Corporation (FDIC) Securitization Safe Harbor Rule of 2010 and the Dodd-Frank Act, which required issuers to retain a specific fraction of the credit risk of the assets underlying their securitizations.

To explore the relation between the consumer credit risk premium and the balance-sheet costs and capital constraints faced by financial intermediaries, we conduct a number of analyses. First, we show that there was a massive decline in credit card securitization activity immediately following these regulatory changes. This suggests that regulation majorly affected the costs faced by financial intermediaries from their securitization activities.

Second, we find that consumer credit risk premiums are significantly higher at quarter-ends (when regulatory capital ratios are reported), and are also higher at year-ends after 2010. These results are consistent with those of Du, Tepper, and Verdelhan (2018) and Fleckenstein and Longstaff (2020a), among others, and provide evidence that intermediary balance-sheet effects play a role in the pricing of consumer credit risk.

Third, we test whether consumer credit risk premiums are related to exogenous measures of the costs of intermediary balance-sheet space and capital constraints. In particular, we examine the relation between consumer credit risk premiums and the He, Kelly, and Manela (2017) measure of intermediary leverage, the aggregate Tier 1 capital ratio for broker-dealers, and the Fleckenstein and Longstaff (2020a) turn-of-the-year measure of the cost of intermediary balance-sheet usage. The results show that consumer credit risk premiums are much more related to these measures of intermediary constraints during the postcrisis period than during the precrisis period.

Fourth, we make use of a natural experiment created by a large exogenous shock in the accounting and/or regulatory environment to study the relation between the consumer credit risk premium and intermediary constraints at a more fundamental causal level. As discussed, financial intermediaries were required to reconsolidate their ABS back onto their balance sheets as of January 1, 2010, for both accounting and regulatory capital purposes. Since the credit card ABS issuers in the sample disclosed the financial impact of the reconsolidation event on their retained earnings and capital ratios, we can directly measure the marginal cost of adding an additional dollar of assets onto their balance sheets. Using this measure as an instrument for the relative intensity of balance-sheet usage across issuers, we again find that the risk premiums are much more related to the interaction between the cost and amount of balance-sheet usage that securitization activity requires during the postcrisis period than during the precrisis period.

Taken together, these results make a strong case that postcrisis regulatory reforms may be among the key factors explaining the major repricing of consumer credit risk beginning in 2010. It is important to consider, however, whether other factors could also have played significant roles in this repricing. Accordingly, we consider several other possibilities suggested by the literature. We note that the various factors we consider are not necessarily mutually exclusive: multiple factors may drive the repricing of credit risk.

We begin by exploring whether changes in issuer market power and imperfect competition in the credit card market could help explain the repricing of credit risk during the postcrisis period. Following Ausubel (1991), we collect data on the prices of secondary market sales of credit card receivables portfolios and examine the trend in the premiums. We also examine patterns in card issuer profitability. We find little evidence suggesting a material change in issuer market power during the postcrisis period.

Next, we explore whether the repricing of credit risk could be partially due to increased adverse selection in the securitization process during the postcrisis period. Following Piskorski, Seru, and Vig (2010) and Agarwal et al. (2011), among others, we compare the ex post realizations of delinquencies and charge-offs for securitized and nonsecuritized portfolios of credit card receivables. Again, we find little evidence of a material change in the relative performance of securitized and nonsecuritized portfolios during the postcrisis period.

Finally, we consider whether postcrisis regulatory changes could also have affected credit card behavior, leading to fundamental changes in the systematic risk or nature of unsecured consumer credit. In addition, regulatory changes, such as the CARD Act, could have changed the underlying economics of the credit card industry and made credit cards less profitable to operate. We find little evidence that credit card loans have become riskier or that recovery rates have declined. Furthermore, we find that the credit risk premiums actually become less connected to charge-off rates during the postcrisis period. These results suggest that the repricing of credit risk beginning in 2010 is unlikely to be explained by fundamental changes in the nature of credit card risk.

In summary, this paper has a number of important implications for the pricing of consumer credit risk. The results reveal a substantial risk premium associated with unsecured consumer credit risk. Furthermore, this risk premium has increased significantly during the past decade even while credit card charge-off rates have declined. The results suggest that much of this increase may be due to the additional balance-sheet costs and capital constraints that intermediaries now face in the post-financial-crisis period. In turn, the increase in the risk premiums in the secondary credit card ABS market may have added significantly to the cost of obtaining unsecured consumer credit in the primary credit card market. Finally, these results provide a useful historical perspective about the pricing of unsecured household credit risk.

This paper is related to three important literatures. The first is the literature on the pricing of unsecured consumer credit. Ausubel (1991, 1997) finds that credit card interest rates are much higher than bank funding costs, consistent with issuers earning rents from market power. Ausubel (1999) and Agarwal, Chomsisengphet, and Liu (2010) examine the effects of adverse selection on the cost of consumer credit card debt. Livshits, MacGee, and Tertilt (2007, 2010, 2016), Norden and Weber (2010), Morse (2011), Vissing-Jørgensen (2016), Keys and Wang (2019), and Agarwal et al. (2020) focus on the role that default risk plays in consumer credit markets. We extend this literature by being the first to provide estimates of the risk premium associated with unsecured household borrowing.

The second is the literature on the impact of changes in the regulatory and economic environment on consumer credit markets. Agarwal et al. (2015) and Han, Keys, and Li (2018) study the effects of the CARD Act of 2009 on credit card markets. Other important papers focus on the impact of regulatory changes on the securitization of consumer debt. These include Calomiris and Mason (2004), Ayotte and Gaon (2011), Faltin-Traeger, Johnson, and Mayer (2011), Levitin (2013), Acharya, Schnabl, and Suarez (2013), Tian and Zhang (2018), Flynn, Ghent, and Tchistyi (2020), and Furfine (2020). Our results extend this literature by showing that postcrisis regulations may have affected the cost of unsecured consumer credit by increasing the risk premiums required for credit card securitizations.

The third is the rapidly growing intermediary asset pricing literature focusing on the impact of the frictions and constraints faced by intermediaries on the assets in which they make markets. Key examples include Gromb and Vayanos (2002), Krishnamurthy (2003, 2010), Brunnermeier and Pedersen (2009), Adrian and Shin (2010), Gârleanu and Pedersen (2011), He and Krishnamurthy (2012, 2013), Adrian, Etula, and Muir (2014), He, Kelly, and Manela (2017), Duffie (2018), Kondor and Vayanos (2019), Andersen, Duffie, and Song (2019), Fleckenstein and Longstaff (2020a, 2020b), and Lewis, Longstaff, and Petrasek (2021), among others. We contribute to this literature by providing evidence that intermediary constraints affect the required premium for unsecured consumer credit risk in financial markets.

1. Credit Card Asset-Backed Securities

In this section, we describe some of the key characteristics and properties of credit card ABS and summarize some of the major recent regulatory changes affecting the credit card ABS market.[5]

1.1 Credit card ABS

Credit cards are the primary source of revolving unsecured consumer credit and are extensively used by consumers. As of March 2020, there was over $1 trillion in revolving consumer credit outstanding, with credit card banks holding about 92% ($926 billion of $1.01 trillion).[6] The general-purpose credit card market in the United States is concentrated, with the top-10 issuers holding over 80% of the outstanding credit card balances, and the top-three issuers controlling more than 60% of the market. Cards issued on the Visa and Mastercard networks accounted for nearly 85% of about 544.5 million general-purpose credit cards in 2016. American Express and Discover accounted for another 99 million general-purpose cards in 2016.[7]

The credit card ABS market was created in the late 1980s and has since grown to become a major sector of the ABS market. Total credit card ABS outstanding reached a level of more than $300 billion during the pre-financial-crisis period. Daily trading volume for credit card ABS averaged about $280 million during the 2012 to 2020 period.[8]

The underlying collateral of a credit card ABS consists of receivables generated when consumers make charges on their credit cards to purchase goods and services. From the credit card issuer's perspective, credit card receivables are short-term unsecured loans.[9] The issuer pools the receivables and transfers them to a separate entity (master trust), which issues series of notes to investors. The master trust receivables are not segregated by series. Instead, the pool of receivables supports all outstanding series.

As an illustration, let's imagine an issuer that would transfer, say, a billion dollars of card receivables from a million accounts to a master trust, which then issues a series of notes (or certificates). These notes consist of tranches (sometimes also called classes) that differ in their seniority of receiving cash flows. A typical series includes a senior A tranche, a mezzanine B tranche, and a junior C tranche. Each tranche has an attachment and a detachment

5 The Internet Appendix fully details the credit card ABS market and the securitization process.

6 See the Federal Reserve Board's G.19 Release on consumer credit at https://www.federalreserve.gov/releases/g19/Current.

7 Board of Governors of the Federal Reserve System, Report to the Congress on the Profitability of Credit Card Operations of Depository Institutions, June 2017.

8 See https://www.sifma.org/resources/research/us-asset-backed-securities-statistics/.

9 Consumers repay either the full principal of this unsecured loan or make partial payment. In the latter case, the issuer finances the remaining balance and earns interest (finance charges).

point relative to the total credit card receivables balance. The attachment point represents the percentage of the receivables pool balance that can default before the tranche experiences first losses. The detachment point represents the level of credit card defaults that leads to the total loss of the tranche. The issuer can transfer additional receivables to the master trust as consumers pay off their card balances, and also issue additional series of securities.

The process by which cash flows are allocated to investors has two distinct periods: revolving and controlled amortization (in some cases, controlled accumulation). If there are no losses, the two-period structure mimics a traditional bond in the sense that interest is distributed every month, and the final principal cash flow occurs on the maturity date.

Specifically, upon issuance, a credit card ABS begins the "revolving period," during which investor coupon cash flows are paid from finance charge collections on the credit card accounts, and principal collections are used to purchase new receivables. Any residual cash flow after paying investor interest, servicing fees, and trust expenses, and covering ordinary portfolio charge-offs is referred to as "excess spread" and, depending on the master trust, can serve as credit enhancement or is released to the issuer.

The revolving period continues for a predetermined length of time, and then the controlled amortization (accumulation) period begins during which principal collections are distributed to investors. For instance, a credit card ABS with a 60-month expected maturity might revolve for 48 months and then enter amortization for the final 12 months. In the case of controlled amortization, principal cash flows are distributed in equal installments, for instance, one-twelfth of the invested amount every month for 12 months. In the case of controlled accumulation, principal cash flows are deposited into a collection account (principal funding account) every month and then paid out as a single cash flow at the end of the accumulation period.

Severe defaults or "charge-offs" on the pool of credit card accounts trigger early amortization, independent of whether the credit card ABS is in the revolving period or in controlled amortization. Typical early amortization trigger events include collateral performance deterioration (e.g., the 3-month average excess spread falls below zero, or the collateral balance falls below the investor invested amount), seller/servicer problems (e.g., the seller's interest falls below the required minimum level, the seller fails to transfer new receivables into the trust when necessary), but also legal issues (e.g., breach of representation or warranties by the issuer, or default, bankruptcy, and insolvency of the seller or servicer).[10] Early amortization is in some sense similar to the

[10] Specifically, the "seller's interest" represents an ownership interest in the credit card receivables transferred to the trust that are not pledged to back any securities sold to investors. The minimum required seller's interest for most master trusts tends to be in the 4% to 7% range of outstanding receivables. If the seller's interest falls below this threshold, the seller must add receivables, or early amortization is triggered.

default of the trust, and the credit card ABS immediately starts to amortize with principal balances being paid to investors according to their seniority.

Finally, we note that credit card securitizations differ from conventional securitizations in that not all of the cash flows generated by the underlying portfolio of credit card receivables are pledged to the securitization. In many securitizations, all of the cash flows from the underlying assets are allocated to specific securities in the securitization via a waterfall mechanism. In a credit card securitization, however, the issuer receives any excess spread generated by the receivables portfolio after the master trust pays the promised coupon and principal payments to the A, B, and C tranches issued in the securitization. Thus, the issuer has a claim on the residual cash flows of the receivables portfolio, which is not formally part of the securitization.

It is important to recognize, however, that the issuer's claim is not an "equity" tranche in the usual sense since it does not absorb any of the losses suffered by the securitization in the event of an early amortization. In particular, the issuer receives any excess spread cash flows prior to an early amortization. Once early amortization occurs, however, all cash flows to the issuer cease, and the issuer has no obligation to reimburse A, B, and C tranche investors for any principal losses they may suffer during the liquidation process. Because of this, the existence of the claim does not affect the actual cash flows received by the A, B, and C tranches, either before or after an early amortization, and, therefore, the A, B, and C tranches can be valued on a stand-alone basis. This separation feature has the important advantage of allowing us to identify the unsecured credit risk premium without having to condition on the value of the issuer's claim since the prices of the A, B, and C tranches depend only on promised cash flows and potential credit losses, rather than on the factors such as market power or imperfect competition that may drive the value of the issuer's claim.

As an illustration of this latter point, let R denote the market value of a \$100 notional amount of credit card receivables. Similarly, let A, B, and C denote the market value of the A, B, and C tranches, respectively. Furthermore, let Z denote the market value of the issuer's claim. Since the issuer receives cash flows that are always positive, but bears none of the principal losses suffered by the securitization in the event of an early amortization, the value of Z is positive. Clearly, $R=A+B+C+Z$. This adding-up constraint implies that the total market value $A+B+C$ of the tranches issued in a credit card securitization must be less than the actual market value of the receivables.

How is it then possible to transfer a \$100 notional amount of receivables to a master trust and then issue a securitization consisting of A, B, and C tranches with a combined market value of \$100 (regardless of the value of Z)? The answer is simply that the market value R of a \$100 notional amount of credit card receivables will generally be substantially higher than \$100 because of the high portfolio yields these receivables generate. For example, industry sources estimate that the secondary market sales of credit card receivables portfolios typically occur at premium prices ranging from \$110 to \$120 per

$100 notional amount. Because of this premium, however, an issuer can transfer a $100 notional amount of receivables to the master trust, issue tranches with a total notional amount of $100 and market value of $100 via a securitization, and the issuer's claim can still have substantial value. We will return to this point later, when we discuss the model used to identify the credit risk premium from market tranche prices.

1.2 Recent regulatory changes

In this section, we summarize some of the major changes in the regulatory environment affecting the credit card ABS markets during the sample period.[11]

1.2.1 FAS 166/167. In June 2009, the Financial Accounting Standards Board (FASB) issued FAS 166 and 167 to become effective on January 1, 2010.[12] The effect of FAS 166 and 167 was to narrow significantly the scope of transactions that qualify as off-balance-sheet for accounting purposes. In short, FAS 166/167 essentially meant that credit card ABS that were previously off-balance-sheet for accounting purposes had to be reconsolidated on the balance sheets of credit card issuers.[13] As a result of FAS 166/167, U.S. banks reconsolidated $321.9 billion securitized credit card receivables in the first quarter of 2010.

1.2.2 The FDIC Securitization Safe Harbor Rule. The Federal Deposit Insurance Corporation (FDIC) Safe Harbor Rule enacted in 2000 provided bankruptcy remoteness for assets transferred into securitizations and placed off-balance-sheet for accounting purposes. As a result of Financial Accounting Standards No. 166 and No. 167 (FAS 166/167), however, credit card securitizations became on-balance-sheet assets, which meant bankruptcy remoteness would no longer apply to credit card ABS, and the FDIC would have the authority to reclaim any financial assets from the credit card master trust in bankruptcy proceedings against the credit card bank. Thus, the loss of bankruptcy remoteness implies that securitizing credit card receivables has become more costly for credit card banks, because safe harbor protection now requires stricter disclosure, reporting, and risk retention requirements as well as additional credit enhancement on credit card ABS.[14]

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11 The Internet Appendix discusses the regulatory environment in-depth.

12 Financial Accounting Standards No. 166, Accounting for Transfers of Financial Assets – An Amendment of FASB Statement No. 140, and FASB Statement No. 167, Amendments to FASB Interpretation No. 46(R).

13 *Source*: https://www.fasb.org/cs/ContentServer?c=FASBContent_C&cid=1176155633483&d=&p agename =FASB%2FFASBContent_C%2FNewsPage.

14 Specifically, the amended Safe Harbor Rule from 2010 requires that consolidated securitizations meet new risk retention rules (the issuer is required to retain an unhedged minimum of 5% of the securitized assets) and qualify for off-balance-sheet treatment under generally accepted accounting principles (GAAP). See the Securitization Safe Harbor Rule, 12 C.F.R. § 360.6.1.

1.2.3 The Dodd-Frank Act and Basel III. The Dodd-Frank Wall Street Reform and Consumer Protection Act (Dodd-Frank Act) was enacted in 2010 and significantly increased the regulation of credit card securitizations.[15] The Dodd-Frank Act effectively imposes a 5% minimum seller's interest.[16] The Dodd-Frank Act restricts the interchange fees on credit card transactions, imposes stricter disclosure requirements regarding credit card receivables, and tightens credit rating standards from rating agencies. The Dodd-Frank Act also established the Consumer Financial Protection Bureau to regulate the terms of credit card agreements. In addition, the Dodd-Frank Act increases capital requirements on banks, and contains multiple provisions for mandatory risk-based capital requirements that apply to consolidated on-balance-sheet assets. Specifically, the Dodd-Frank Act increases the minimum required ratio of common equity to risk-weighted assets to 4.5% and introduces mandatory capital buffers, which, when taken together, imply a (risk-based) leverage ratio requirement of at least 7% for many large banks. The Collins Amendment to the Dodd-Frank Act makes bank holding companies (BHCs) subject to the same rules that apply to depository institutions, and effectively raises risk-weighted asset requirements for many banks and BHCs since it limits the use of internal models in reporting regulatory capital ("Collins Floor"). As a result, subordinate ABS tranches, in particular, now have significantly higher risk weights than in the precrisis period.

The Basel III framework, introduced by the Basel Committee in December 2010, redefined regulatory capital, established a global leverage ratio, and increased banks' required risk-weighted capital ratios. In addition to tightening equity and risk-weighted capital requirements, the Basel III standard introduced a non-risk-weighted leverage ratio requirement (supplementary leverage ratio (SLR)), as well as liquidity and funding requirements (liquidity coverage ratio (LCR) and net stable funding ratio (NSFR)). The net effect of the regulations from the Dodd-Frank Act and Basel III is to raise the costs of securitizing credit card receivables, since credit card banks are required to hold regulatory capital against credit card ABS.

1.2.4 The CARD Act. In May of 2009, Congress enacted the Credit Card Accountability Responsibility and Disclosure Act of 2009, commonly referred to as the CARD Act. The CARD Act institutes a number of consumer protection and disclosure requirements for consumer credit cards. Credit card issuers must

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15 H.R. 4173: Dodd-Frank Wall Street Reform and Consumer Protection Act, available at https://www.cftc.gov/sites/default/files/idc/groups/public/swaps/documents/file/hr4173_enrolledbill.pdf.

16 Since the minimum seller's interest is always at least as high as the Dodd-Frank risk retention requirements for the issuers in our sample, we use both terms interchangeably. See Section 941 of the Dodd-Frank Act (Board of Governors of the Federal Reserve System 2011). Risk retention requirements were finalized in 2014 (Regulation RR, Federal Register, 79 Fed. Reg. 77601).

follow various rules with respect to the marketing, underwriting, pricing, and billing of consumer credit cards. For example, the CARD Act sets regulatory limits on certain types of credit card fees, and requires card issuers to provide monthly credit card statements showing the costs of making only the minimum payment. Issuers are prohibited from increasing the interest rate on outstanding balances, except in limited circumstances, and must provide a 45-day advance notice of rate increases or other significant changes to terms. The provisions of the CARD Act took effect in three phases between August 20, 2009, and August 22, 2010.

2. Data and Methodology

2.1 The data

We collect data for the period from January 2000 to January 2020 for the credit card ABS of the 10 largest U.S. credit card issuers from the Bloomberg system.[17] We also collect credit spreads and regulatory capital ratios for all issuers from the Bloomberg system and Capital IQ. Our sample consists of the credit card master trusts set up by American Express, Bank of America, Bank One, Citibank (Citi), J.P. Morgan Chase (Chase), Capital One, Discover Financial (Discover), First National Bank (First National), and World Financial Network/Alliance Data System (World Financial).[18]

For each master trust, we identify all credit card ABS series and tranches in the Bloomberg system. Next, for each credit card ABS, we identify the issue date, the expected maturity date, the principal amount issued, whether the ABS pays fixed or floating coupon cash flows, and in the latter case the floating index (1- or 3-month Libor) plus the basis-point spread. To be consistent throughout the analysis, we swap the floating coupon rates into their fixed coupon rate equivalents and then use these fixed coupon rates in computing the risk premiums. In addition, we manually collect information from prospectus supplements about the required risk retention ratios by the seller (the minimum percentage of portfolio receivables the issuer is required to hold, or minimum seller's interest).[19] We also manually collect information on the subordination for each series and tranche by reading the prospectus documents for the master trusts. These documents are obtained from either the Bloomberg system or

17 We select these 10 issuers for two primary reasons. First, these issuers hold 80% of the outstanding credit card balances (Board of Governors of the Federal Reserve System, Report to the Congress on the Profitability of Credit Card Operations of Depository Institutions, June 2017). Moreover, our data cover more than 80% of the total U.S. credit charge card volume. Second, using these 10 issuers, our data span two decades, allowing us to study the pricing of consumer credit before, during, and after the financial crisis.

18 The Internet Appendix describes the data, defines the variables, lists all of the data sources, illustrates how tranche coupons can be swapped into fixed or floating coupon payments, and provides additional details about the master trusts.

19 This information is unavailable from the prospectus supplements for Capital One. Similarly, this information is unavailable for Citibank prior to the second half of 2002.

regulatory filings with the SEC (Form 424-B).[20] For each credit card ABS, we collect the portfolio yield, the charge-off rate, the excess spread, the monthly payment rate (MPR), as well as month-end prices from the Bloomberg system.

Portfolio yield is defined as the annualized percentage gross return on the credit card receivables portfolio and is calculated as the total monthly (gross) cash flows into the credit card master trust divided by the outstanding principal balance at the beginning of the month.[21]

The charge-off rate measures the rate of defaults on the credit card receivables and is calculated as the (1-month) annualized percentage rate of charge-offs on the portfolio. Credit card receivables are typically charged off after the cardholder has been delinquent in paying the revolving balance for more than 180 days.

Excess spread is the annualized percentage net return on the portfolio and is calculated as the annualized rate of (gross) portfolio yield less servicing fees, coupon cash flows to noteholders, charge-offs, and any other trust expenses. Intuitively, as long as the excess spread is positive, the securitization generates enough cash inflows to cover cash outflows. When the average excess spread is negative (typically calculated over a period of 3 months), many master trusts enter into early amortization.[22]

Finally, the MPR measures the speed at which cardholders pay down the amount owed on their credit card balances. The MPR is computed as the ratio of total cash flows into the trust each month divided by the portfolio receivables balance, expressed as a percentage.

Table 1 presents summary statistics for the characteristics of the portfolios of credit card receivables underlying the securitizations for each of the 10 issuers. For all the issuers, our data cover some portion of the 2000–2006 precrisis period, the 2007–2009 crisis period, and the 2010–2020 postcrisis period. Across all credit card issuers, average portfolio yields are significantly higher than the corresponding average charge-off rates, which is reflected in high excess spreads. In fact, all issuers have average excess spreads of more than 5% over the 2000 to 2020 sample period. Nonetheless, there is cross-sectional variation in these averages. For instance, American Express has an excess spread of 12.317% compared to an average excess spread of 6.267% in the case of First National. Moreover, the data show heterogeneity in the average

[20] Specifically, for each series and each A, B, and C tranche, we identify the attachment and detachment points expressed as a percentage of the total series par amount at which the tranche experiences first losses or a complete loss, respectively.

[21] Gross cash inflows consist of interest on the revolving principal balances (finance charges) plus income from fees on the accounts, such as late charges, card annual fees, cash advance fees, overdraft charges, and card interchange. Cash inflows include recoveries on defaulted receivables, but exclude charge-offs from the current month.

[22] To illustrate how the excess spread is determined, suppose a master trust generates a portfolio yield of 14.80% and experiences charge-offs of 5.50%. The trust has issued tranches paying a coupon of 2.05%. Assuming that the the master trust is paying a servicing fee of 2%, the excess spread is 14.80 − 2.05 − 2.00 − 5.50 = 5.25%. Intuitively, this means that the master trust generates about five cents for each dollar invested each month above what is required to pay investor coupon interest, servicing fees, and other trust expenses.

Table 1
Summary statistics for credit card receivables portfolio characteristics

Card issuer	Sample period	Monthly payment rate	Portfolio yield	Excess spread	Charge-off rate	Risk-retention	N
American Express	2000–2019	26.155	21.539	12.317	4.046	7.000	220
Bank of America	2000–2012	15.246	19.540	7.839	7.039	4.000	143
Bank One	2000–2013	19.056	17.498	7.537	5.642	4.162	160
Citibank	2000–2014	19.267	16.558	7.484	5.708	5.000	162
Chase	2000–2015	19.654	16.831	7.630	5.051	4.000	185
Capital One	2000–2015	19.361	20.146	10.577	4.255	5.000	185
Discover	2000–2013	19.580	17.719	8.145	5.536	7.000	159
First National	2002–2011	13.605	17.815	6.267	7.314	7.000	87
MBNA	2000–2013	15.615	19.147	8.107	6.238	4.000	162
World Financial	2000–2020	17.649	30.237	15.338	7.178	4.602	221
All	2000–2020	19.032	20.194	9.597	5.677	5.131	1,684

This table presents summary statistics for the indicated characteristics of the portfolios of credit card receivables underlying the securitizations. The statistics for the individual card issuers are computed by taking averages across all securitizations for each month, and then averaging the monthly averages. The monthly payment rate is the ratio of total cash flows collected each month divided by the portfolio balance and is expressed as a percentage. Portfolio yield is the annualized percentage gross return on the portfolio. Excess spread is the annualized percentage net return on the portfolio. The charge-off rate is the 1-month annualized percentage rate of charge-offs on the portfolio. Risk-retention denotes the minimum percentage of portfolio receivables the issuer is required to hold. N denotes the number of months. The sample period is monthly from January 2000 to January 2020.

charge-off rates. American Express has an average charge-off rate of 4.046%, compared to an average charge-off rate of 7.314% in the case of First National.

Figure 1 plots the average portfolio yield, excess spread, and charge-off rates across all issuers. As shown, all three variables vary significantly over time. Portfolio yields and excess spreads decline substantially during the financial crisis, and charge-off rates take their highest values of around 10% during that period. Both portfolio yields and excess spreads quickly rebound from their lows during the crisis period and increase to much higher levels during the postcrisis period. Similarly, charge-offs decline significantly following the crisis and reach their lowest levels during the postcrisis period.

Table 2 presents summary statistics for the individual A, B, and C tranches of the credit card securitizations in the sample. As shown, credit card ABS typically have average maturities in the range of 2 to 4 years. In terms of credit support, the average attachment and detachment points of the individual tranches show that C tranches absorb roughly the first 8 to 26 cents of losses, whereas A tranches can withstand portfolio charge-offs between roughly 15 and 25 cents before experiencing first losses. That A tranches are relatively well shielded against portfolio charge-offs is also reflected in their prices. As shown, average prices of A tranches are generally closer to par compared to the prices of C tranches. Nonetheless, the minimum and maximum prices suggest substantial variation in the average prices of credit card ABS. For instance, the prices of C tranches decline to less than 50 cents per dollar of notional amount

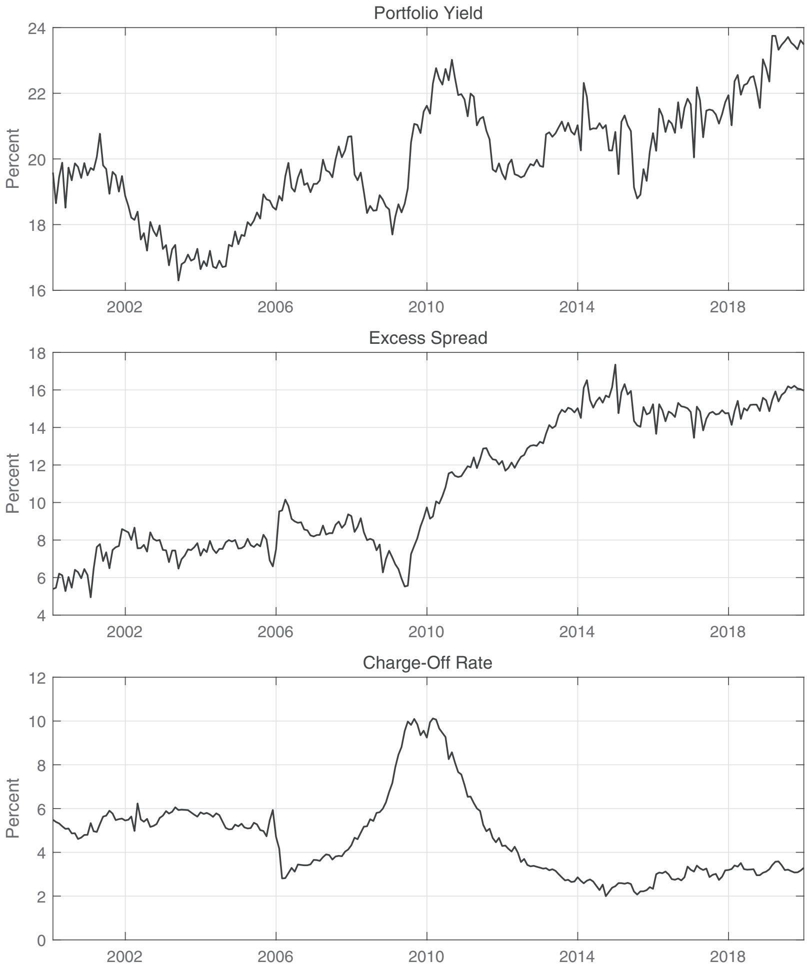

Figure 1
Average portfolio yields, excess spreads, and charge-off rates
This figure shows the average portfolio yield, excess spread, and charge-off rates for the issuers in the sample, where the averages are taken over the average values for each issuer in the sample for a given month.

during the financial crisis for 7 of the 10 issuers, but quickly rebound after the crisis.

2.2 The consumer credit risk model

Next, we present the unsecured consumer credit risk modeling framework used to value credit card ABS tranches.[23] We use a framework that parallels

[23] The Internet Appendix fully details the consumer credit risk model, discusses the empirical methodology, provides a numerical example, and shows how the model can be extended to allow other dynamics for the excess spread.

Table 2
Summary statistics for credit card asset-backed securities

Card issuer	Tranche	Mat	Sprd	Attach	Detach	Min	Mean	Max	*N*
American Express	A	3.21	30.46	15.04	100.00	63.97	99.71	110.98	3790
Bank of America	A	2.75	8.41	18.09	100.00	73.43	98.53	100.86	577
Bank One	A	2.85	12.22	15.82	100.00	95.75	100.05	102.99	427
Citibank	A	3.46	13.34	12.98	100.00	79.52	99.44	112.06	1229
Chase	A	3.07	10.58	16.27	100.00	61.57	99.83	110.29	1815
Capital One	A	3.52	13.71	20.02	100.00	55.39	101.20	114.91	1865
Discover	A	3.09	13.49	12.50	100.00	68.06	99.98	111.58	2596
First National	A	2.00	44.74	20.23	100.00	92.51	99.92	101.12	195
MBNA	A	3.66	14.16	15.28	100.00	78.47	100.79	123.67	4199
World Financial	A	2.94	33.69	24.69	100.00	59.05	100.55	108.64	1387
American Express	B	3.22	82.70	8.46	15.07	34.65	98.42	119.86	3722
Bank of America	B	2.76	64.19	9.54	18.09	40.32	96.16	101.91	584
Bank One	B	2.84	36.18	8.75	15.84	96.43	99.98	101.91	424
Citibank	B	3.43	43.49	7.78	12.98	52.66	97.29	111.14	1224
Chase	B	3.10	33.76	9.05	16.28	24.64	98.53	108.82	1851
Capital One	B	3.58	41.78	11.05	20.09	22.63	97.72	112.16	1803
Discover	B	3.11	35.61	7.50	12.50	38.32	98.42	110.76	2656
First National	B	1.93	24.53	10.69	18.09	79.58	98.02	101.63	111
MBNA	B	3.67	36.70	8.00	15.28	50.12	99.64	123.09	4216
World Financial	B	2.98	119.18	16.51	23.29	49.06	99.48	109.85	852
American Express	C	3.39	42.90	0.00	8.14	20.45	93.43	104.15	1312
Bank of America	C	2.87	152.02	0.00	10.22	41.07	93.29	110.06	395
Bank One	C	3.95	88.93	0.00	8.30	27.81	97.87	107.32	508
Citibank	C	4.01	68.96	0.00	7.76	23.27	97.12	113.54	1282
Chase	C	3.27	81.53	0.00	9.14	15.97	97.87	104.27	1558
Capital One	C	3.43	108.20	0.00	11.34	11.44	97.05	113.89	1590
Discover	C	2.00	32.44	0.00	26.86	61.40	86.44	100.20	25
First National	C	1.99	106.39	0.00	9.50	67.50	97.87	102.41	99
MBNA	C	4.00	107.10	0.00	8.13	27.22	100.38	118.83	3051

This table presents summary statistics for the individual A, B, and C tranches of the credit card securitizations in the sample. Mat denotes the average maturity of the tranches in years. Sprd denotes the average floating spread above Libor of the tranches and is expressed in basis points (fixed coupon rates are swapped into floating coupon rates for the purposes of this table). Attach and Detach denote the average attachment and detachment points for individual tranches and are expressed as percentages of the total notional amount of the securitization. Min, Mean, and Max denote the minimum, mean, and maximum prices for the individual tranches during the sample period. The statistics for the individual card issuers are based on the daily values across all of their outstanding securitizations. The sample is daily from January 1, 2000 to January 31, 2020.

standard approaches for modeling corporate bond default risk. While triggering the early amortization of a credit card trust portfolio differs from the default of a corporate bond along some aspects, it clearly can be interpreted as the primary event initiating financial distress for credit card ABS. Most credit card securitizations include the provision that early amortization of the credit card master trust is triggered by the event of the excess spread becoming zero or negative. Intuitively, this follows since the excess spread only becomes negative when the portfolio of credit card receivables experiences disastrously high levels of charge-offs or defaults by cardholders.

Accordingly, the model assumes that a credit card trust is able to make all promised payments to credit card ABS investors as long as the excess spread X is positive. If charge-offs increase to the point at which the excess spread makes a first passage to zero, however, the credit card trust then suffers an early amortization distress event, and the underlying pool of receivables may experience significant principal losses.[24] This specification parallels that used in the structural corporate bond credit modeling literature in which corporate financial distress is triggered by the value of a firm's assets making a first passage to some critical threshold (see Black and Cox 1976; Longstaff and Schwartz 1995; Collin-Dufresne and Goldstein 2001, among others). As in standard reduced-form corporate credit models, we assume that the credit losses suffered by the portfolio upon early amortization are specified exogenously (see Jarrow and Turnbull 1995; Duffie and Singleton 1999; Duffee 1999, among others). Rather than assuming a specific "loss given default," however, we follow the CDO modeling literature by allowing for a discrete distribution of losses when early amortization is triggered (see Longstaff and Rajan 2008; Bhansali, Gingrich, and Longstaff 2008, among others).

Consider the standard case in which a credit card securitization consists of A, B, and C tranches. Let N denote the percentage detachment point of the C tranche (the most-junior tranche), and $N+M$ the percentage detachment point of the B tranche (the next most-junior tranche). Also, denote the expected maturity date of the credit card securitization by T. Let F denote the risk-neutral probability that the excess spread X makes a first passage to zero by time T. If a first passage does not occur by time T, portfolio losses are zero. If a first passage does occur, however, we assume that there are three different possible outcomes for the total credit losses on the underlying portfolio. Specifically, we assume that conditional on a first passage, the loss is $N\%$ with probability γ, $N\%+M\%$ with probability β, and 100% with probability α. Since the conditional probabilities must sum to one, $\alpha+\beta+\gamma=1$. This specification now implies that there are four possible outcomes for losses on the portfolio. In particular, the portfolio loss is zero with probability $1-F$, $N\%$ with probability γF, $N\%+M\%$ with probability βF, and 100% with probability αF.[25]

Given this portfolio loss distribution, parameterizing the model reduces to a process of solving for the probabilities α, β, and γ, and determining the risk-neutral first passage probability F. Let P_A, P_B, and P_C denote the market prices of the A, B, and C tranches, respectively. Similarly, let T_A, T_B, and T_C denote the prices these tranches would have in the absence of credit risk, given by discounting promised tranche cash flows using riskless Treasury rates. It follows immediately that

$$P_A = (1 - \alpha\ F)\ T_A, \tag{1}$$

[24] Since excess spread is defined as the portfolio yield (Y) minus debt servicing costs (S), servicing fees (R), trust expenses (E), and portfolio charge-offs, the event of the excess spread making a first passage to zero is the same as the charge-off rate making a first passage to $Y-S-R-E$.

[25] Note that this model implies that the issuer's Z tranche claim will be wiped out whenever the C tranche is. Thus, conditioning on the value of the Z tranche would not provide any additional credit information beyond that already reflected in tranche prices and the value of the excess spread.

$$P_B = (1 - (\alpha + \beta)\, F)\, T_B, \tag{2}$$

$$P_C = (1 - (\alpha + \beta + \gamma)\, F)\, T_C. \tag{3}$$

Solving this bilinear system iteratively gives

$$F = (1 - P_C/T_C), \tag{4}$$

$$\alpha = (1 - P_A/T_A)/F, \tag{5}$$

$$\beta = (P_A/T_A - P_B/T_B)/F, \tag{6}$$

$$\gamma = 1 - \alpha - \beta. \tag{7}$$

2.3 Identifying the credit risk premium

The approach described above allows us to use market prices to solve for the risk-neutral probability, F, of the excess spread making a first passage to zero. To identify the credit risk premium, however, we also need to solve for the actual or objective probability H of the excess spread making a first passage to zero and triggering early amortization.

In many asset pricing situations, we only have market prices to work with, and estimating objective probabilities requires making strong assumptions about the functional form of the stochastic discount factor. For example, although we can solve for the risk-neutral probability of default from the price of a corporate bond, the price tells us little about the actual probability of default, and decomposing its credit spread into separate default-risk and risk-premium components requires significant additional assumptions and model structure.

What is different in our setting, however, is that in addition to having tranche prices, we can also literally observe the actual or objective probability of a credit card borrower defaulting. In the same way that actuaries aggregate data from millions of individuals to obtain precise estimates of life expectancy or mortality probabilities, the observed charge-off rate for the underlying pool of receivables from millions of credit card borrowers provides us directly with a precise estimate of the actual or objective default probability without requiring a specific stochastic discount factor or pricing model.[26] We note that without being able to observe the excess spread, the analysis would be limited to only the information contained in tranche prices, and which might not be sufficient to fully characterize the credit risk of the receivables portfolio in states of the world in which an early amortization event does not occur.[27]

[26] This approach parallels that of Chernov, Dunn, and Longstaff (2017), who identify the prepayment risk premium by comparing the risk-neutral prepayment rate implied from the prices of mortgage-backed securities to the actual prepayment rates observed in the market.

[27] We are grateful to the referee for this insight.

Given the current charge-off rate, or equivalently, the excess spread (since excess spread is just a linear translation of the charge-off rate), we can solve for the objective probability H of an early amortization in the following way.[28] First, we assume that the excess spread X has the following dynamics under the objective measure,

$$dX = \sigma \, dZ, \tag{8}$$

where dZ denotes the increment of a standard Brownian motion, and σ is a constant. Consistent with the properties of excess spreads, these dynamics allow X to take both positive and negative values. Standard results now imply that the actual probability of the excess spread X making a first passage to zero over horizon T is

$$H = 2 \, N\left(\frac{-X}{\sqrt{\sigma^2 T}}\right), \tag{9}$$

where $N(\cdot)$ is the standard normal distribution function.[29]

Given H, we can now solve for the implied tranche values V_A, V_B, and V_C under a scenario in which the market prices in the actual expected credit losses, but does not require a credit risk premium. These implied no-credit-risk-premium tranche values are given by simply subtracting the present value of expected actual credit losses from the riskless tranche values T_A, T_B, and T_C, and can be expressed as

$$V_A = (1 - \alpha \, H) \, T_A, \tag{10}$$

$$V_B = (1 - (\alpha + \beta) \, H) \, T_B, \tag{11}$$

$$V_C = (1 - (\alpha + \beta + \gamma) \, H) \, T_C. \tag{12}$$

Finally, we follow the standard approach in the fixed income literature and define the credit risk premium as the difference between the yield implied by the market price of a tranche and the yield implied by the corresponding no-credit-risk-premium tranche price given in Equation (10), (11), or (12).[30] Key advantages of defining the risk premium in terms of a credit spread are the intuitiveness and direct relation of the definition to the expected return on the tranche over its life.

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[28] While our model allows the risk-neutral probability of an early amortization F to differ from the objective probability H, the model implicitly assumes that the loss parameters α, β, and γ are the same under both the objective and risk-neutral measures. This assumption, however, is a common one in the literature (see Longstaff and Rajan 2008; Chernov, Dunn, and Longstaff 2017).

[29] See Yi (2010).

[30] See, for example, Longstaff et al. (2011).

Table 3
Summary statistics for the consumer credit risk premiums

	All	2000–2006	2007–2009	2010–2020
A. Credit risk premium				
A tranche	55.77	13.65	194.74	41.26
B tranche	130.99	20.43	497.71	92.23
C tranche	213.03	35.89	738.48	173.06
B. Total credit spread				
A tranche	78.60	60.51	222.84	42.24
B tranche	165.80	84.90	555.21	94.29
C tranche	266.44	137.94	820.31	175.90
C. Premium/spread percentage				
A tranche	71.56	34.52	82.19	98.58
B tranche	70.36	31.44	82.10	98.55
C tranche	68.59	27.27	80.55	98.70
D. Premium/charge-off ratio				
A tranche	13.45	3.73	30.50	15.46
B tranche	29.45	5.37	72.48	34.14
C tranche	50.81	8.86	106.51	65.86

This table presents summary statistics for the consumer credit risk premiums for the indicated tranches and time periods. The statistics are computed by taking averages across all securitizations in the sample for each month, and then averaging the monthly averages over the indicated periods. The consumer credit risk premium and the total credit spread are expressed in basis points. Premium/spread percentage denotes the ratio of the credit risk premium to the total credit spread of the tranche and is expressed as a percentage. Premium/charge-off ratio denotes the ratio of the credit risk premium to the percentage charge-off rate. The sample is monthly from January 2000 to January 2020.

3. The Consumer Credit Risk Premium

Table 3 provides summary statistics for the estimated consumer credit risk premiums. To provide a broader perspective, we report results for the full sample period, as well as for the 2000–2006 precrisis period, the 2007–2009 crisis period, and the 2010–2020 postcrisis period. As shown, the average values of the risk premiums are positive for all three tranches and over all time periods.

Figure 2 plots the time series of the premiums for the three tranches.[31] As illustrated, the size of the risk premiums varies widely throughout the sample period. For example, the risk premiums increased dramatically during the financial crisis and reached values in excess of 10% to 20%. To put this increase into perspective, we note that the actual credit spreads for corporate bonds (which can be viewed as upper bounds on the corporate credit risk premiums) with similar ratings to those of the tranches only reached values in the range of 3% to 6% during the crisis.[32] Thus, credit card ABS tranches were clearly much more affected by the financial crisis than were corporate bonds.

31 The small gap in the time series arises since there are almost no tranches during this time period that meet the maturity criteria the estimation algorithm requires.

32 Based on Bloomberg information, 97.81% of the A tranches are rated AAA, 97.80% of the B tranches are rated AA or A, and 95.46% of the C tranches are rated BBB.

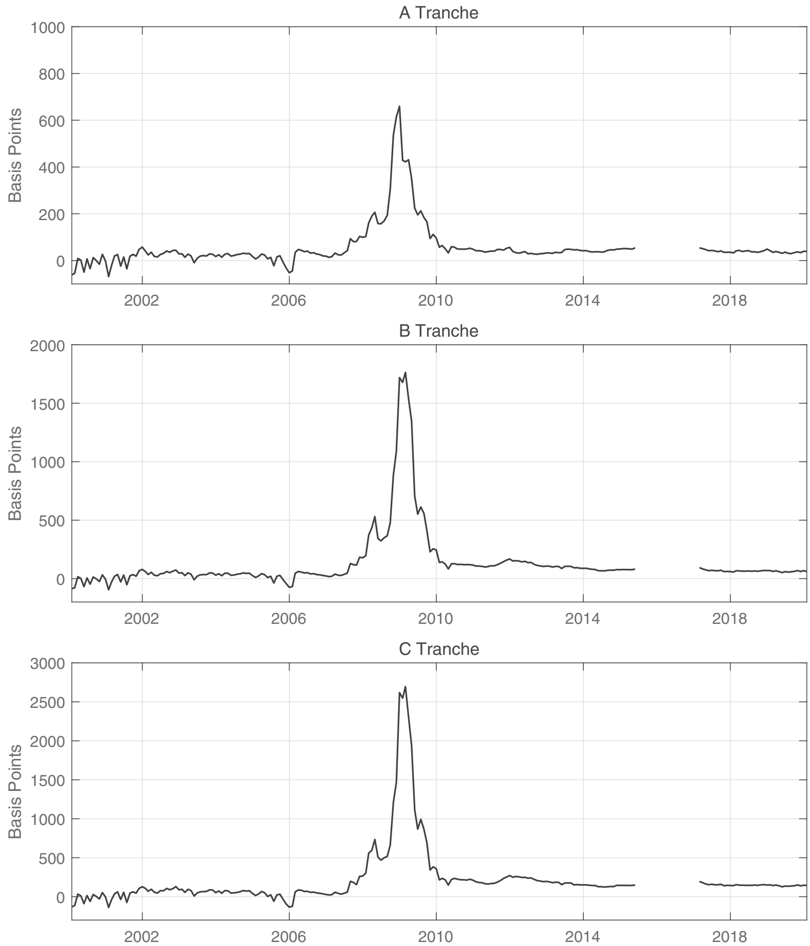

Figure 2
The consumer credit risk premium
These panels plot the average consumer credit risk premium for the A, B, and C tranches, respectively. Averages are taken over all A, B, or C tranches in the sample for each month.

Perhaps the most-striking aspect of the risk premiums, however, is that they are significantly higher during the postcrisis period than the precrisis period, this despite the overall level of credit risk faced by tranche investors being far lower during the postcrisis period. To see this, Figure 3 again plots the credit risk premiums, but with the crisis period omitted. As shown, the risk premiums are substantially higher during the postcrisis period for all three tranches.

To appreciate how puzzling this is, the results reported in Table 3 imply that the average premiums for the A, B, and C tranches during the postcrisis period are, respectively, 3.02, 4.51, and 4.82 times their average values during

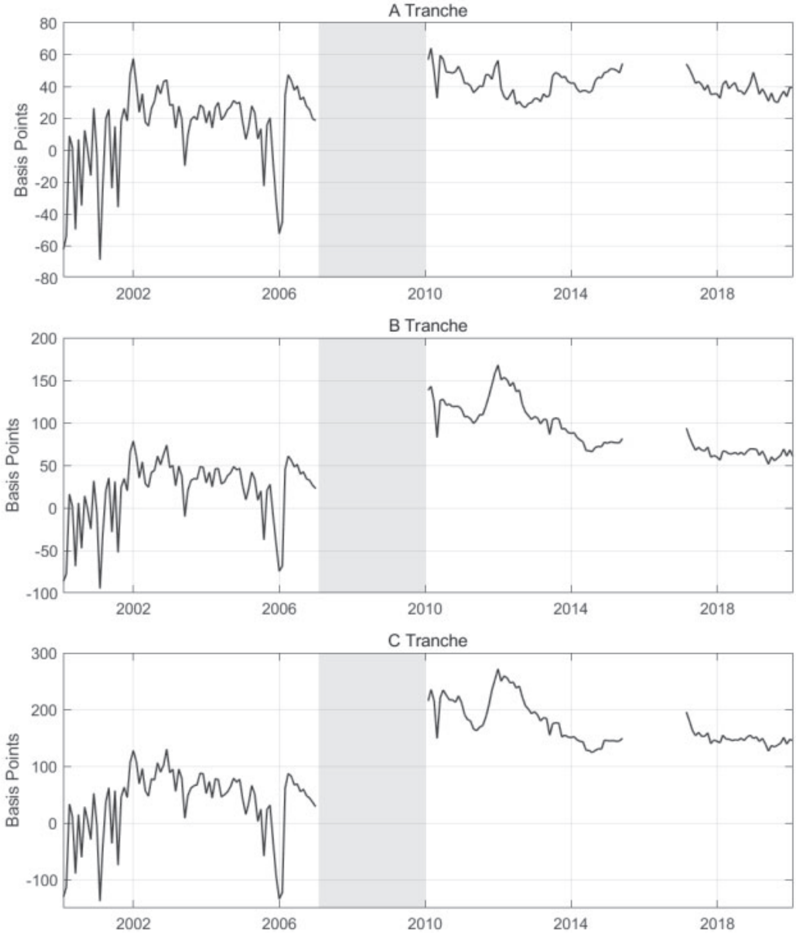

Figure 3
The consumer credit risk premium (crisis period omitted)
These panels plot the average consumer credit risk premium for the A, B, and C tranches, respectively. Averages are taken over all A, B, or C tranches in the sample for each month.

the precrisis period. In contrast, the average values of the excess spread during the precrisis and postcrisis periods are, respectively, 7.54% and 14.10% (see Figure 1). Since early amortization is triggered by the first passage of the excess spread to zero, the net effect of the large postcrisis increase in the excess spread is a dramatic increase in the "distance to default," thereby making the risk of entering into financial distress vanishingly small. Because our primary focus is the pricing of credit risk in the secondary market, we do not attempt to identify all the reasons behind the major increase in the excess spreads, some of which may well be related to changes in card issuer market power, imperfect competition in the credit markets, and/or the large decline in charge-off rates during the postcrisis period (see Figure 1).[33]

Probably the most-objective way to put the increase in risk premiums into perspective, however, is by comparing the actual charge-off rate for the underlying portfolio of credit card receivables to the corresponding risk-neutral charge-off rate. To obtain the implied risk-neutral charge-off rate, we simply substitute F for H in Equation (9) and invert the formula for the implied risk-neutral excess spread. Holding fixed the other components of the excess spread, the difference between the risk-neutral and actual charge-off rates is just the difference between the risk-neutral and actual excess spreads.

The upper panel of Figure 4 plots the difference between the risk-neutral and actual charge-off rates throughout the 2000–2020 sample period. As shown, the difference is on the order of 2% to 3% during the early 2000s, but then increases dramatically beginning in 2010 and reaches a level of about 15%. The lower panel of Figure 4 plots the ratio of the implied charge-off rate to the actual charge-off rate. This ratio provides a useful metric for how the market views consumer credit risk under the risk-neutral measure relative to the objective measure. The graph shows that this ratio is consistently around 1.50 during the precrisis period. Beginning in 2010, however, the ratio increases rapidly and reaches values of roughly six by the end of the sample period.[34] These results make a strong case that a major repricing of unsecured consumer credit risk occurred in the ABS market beginning around 2010.

An extensive literature documents that risk premiums in many other credit markets increased significantly during the financial crisis and remained at elevated levels for an extended period thereafter. Key examples include Beber, Brandt, and Kavajecz (2009), Bao, Pan, and Wang (2011), Gilchrist and Zakrajsek (2012), and Schwarz (2019), among others. These patterns raise the question of how the repricing of consumer credit risk may be related to broader trends in the credit markets. To explore this question, we regress monthly changes in the consumer credit risk premium on changes in a number of corporate credit spreads. Table 4 presents the results from this regression.

The results show little apparent relation between the risk premium and corporate credit spread during the precrisis period for any of the tranches. This aspect, however, changes completely during the postcrisis period. In particular, the premiums for the A, B, and C tranches are now significantly related to many of the corporate spreads. These results are consistent with the interpretation that the market views common factors affecting the pricing of credit risk in other credit markets as driving unsecured consumer credit risk.

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33 As an alternative way of illustrating this puzzling pattern, Table 3 show that the average premium per unit of charge-off losses increases from 4 to 9 bps precrisis to 15 to 66 bps postcrisis.

34 Giesecke et al. (2011) find that the ratio of the risk-neutral to objective credit spread for U.S. corporate bonds averages 2.09 during their 1866–2008 sample period.

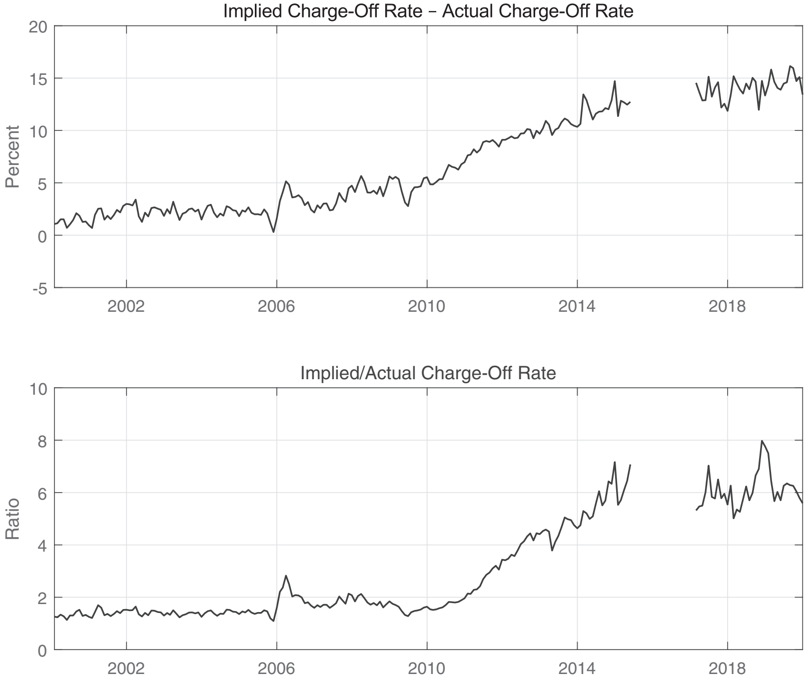

Figure 4
The difference between the implied and actual charge-off rates and the ratio of the implied to actual charge-off rate
The upper panel shows the difference between the implied charge-off rate and the actual charge-off rate. The lower panel shows the ratio of the implied charge-off rate to the actual charge-off rate.

To examine the relation between the pricing of credit risk across different markets in-depth, we focus on returns. Table 5 presents a number of summary statistics for the returns on A, B, and C tranches, as well as for several corporate bond indexes. Panel A shows that while the average excess returns of the tranches over the entire sample period are roughly comparable to those for Aaa, Baa, and high-yield corporate bonds, there is often significant divergence during the subperiods. In particular, the excess returns for the A, B, and C tranches are roughly 100 to 200 bps below those of the corporate indexes during the precrisis period, whereas the opposite is true during the crisis period.

The most-striking differences in excess returns, however, occur during the postcrisis period. For example, the average excess return for the A tranche is roughly 400 to 550 bps below the average excess returns for the corporate bond indexes, and similarly for the other tranches. This large divergence in excess returns between credit card ABS tranches and corporate bonds is consistent with a scenario in which major increases in the required discount rate for consumer credit during the postcrisis period depressed the prices of the tranches relative to those of corporate bonds. We note, however, that despite their lower excess

Table 4
Regressions of changes in consumer credit risk premiums on changes in corporate credit spreads

	All		2000–2006		2007–2009		2010–2020	
	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat
A tranche								
Intercept	0.3047	0.24	1.1299	0.71	0.9682	0.22	−0.4888	−0.85
Δ CP spread	0.1837	1.74*	−0.0527	−0.18	0.2952	2.71**	0.1666	2.64**
Δ Aaa spread	−0.7994	−2.06**	−0.0124	−0.04	−1.7211	−1.48	−0.1162	−1.22
Δ Baa spread	0.8788	2.59**	0.0236	0.09	1.3481	2.00**	0.1662	1.48
Δ HY spread	0.1076	3.26**	0.0636	0.78	0.1477	2.06**	0.0300	1.71*
Adj. R^2	—	.391	—	−.029	—	.622	—	.202
N	—	219	—	83	—	36	—	100
B tranche								
Intercept	0.0420	0.01	1.5083	0.68	2.2434	0.07	−1.9161	−1.42
Δ CP spread	−0.3223	−0.49	−0.0821	−0.21	−0.4165	−0.57	0.3061	2.67**
Δ Aaa spread	−1.5159	−2.89**	−0.0161	−0.04	−1.7129	−0.77	−0.4306	−1.99**
Δ Baa spread	2.0626	2.53**	0.0089	0.02	2.8763	1.77*	0.4875	2.10**
Δ HY spread	0.0647	0.45	0.0777	0.68	0.0102	0.02	−0.0094	−0.33
Adj. R^2	—	.163	—	−.037	—	.150	—	.107
N	—	219	—	83	—	36	—	100
C tranche								
Intercept	0.2435	0.03	2.1925	0.61	4.2947	0.08	−2.5424	−1.43
Δ CP spread	−0.6805	−0.64	−0.1281	−0.23	−0.8331	−0.71	0.4632	2.24**
Δ Aaa spread	−2.1581	−2.71**	−0.0479	−0.08	−2.6553	−0.75	−0.6790	−2.13**
Δ Baa spread	2.8471	2.21**	0.0062	0.01	4.0055	1.34	0.7435	2.03**
Δ HY spread	0.0826	0.29	0.1154	0.67	0.0047	0.01	−0.0205	−0.49
Adj. R^2	—	.122	—	−.039	—	.083	—	.116
N	—	219	—	83	—	36	—	100

This table presents the results from the regressions of changes in the consumer credit risk premium on the indicated changes in corporate credit spreads. CP spread denotes the spread on investment-grade commercial paper relative to the Treasury-bill rate. Aaa and Baa spreads denote the spreads on indexes of corporate bonds with the respective ratings relative to the 10-year Treasury rate. High yield spread denotes the Bloomberg Barclays index of high yield corporate (option adjusted) spreads relative to Treasury rates. The consumer credit risk premiums and all credit spreads are expressed in basis points. Standard errors are based on Newey and West (1987). The sample is monthly from January 2000 to January 2020. * $p < .1$; ** $p < .05$.

returns, the Sharpe ratios for the A, B, and C tranches are substantially higher than those of the corporate bond indexes during the postcrisis period.

Finally, it is useful to consider how increases in the consumer credit risk premium during the postcrisis period could map into the costs faced by credit card borrowers. To study this, we examine the relation between the yield on the underlying portfolio of credit card receivables and the credit risk premiums for the individual tranches. Specifically, we use a panel regression framework to estimate how much of the credit risk premium required by investors in the secondary market flows through to the costs borne by credit card borrowers in the primary market.[35] The panel regression specification is

[35] This analysis parallels other research studying the relation between rates in primary and secondary markets. See, for example, Fuster et al. (2013), Agarwal et al. (2015), and Mukharlyamov and Sarin (2019). We are grateful to the referee for suggesting this analysis.

Table 5
Summary statistics for tranche returns

	All	2000–2006	2007–2009	2010–2020
A: Excess returns				
A tranche	1.947	2.051	2.726	1.581
B tranche	3.099	2.314	6.625	2.482
C tranche	4.529	3.211	10.054	3.634
Aaa corporate	4.247	4.022	1.385	5.465
Baa corporate	5.141	3.863	5.054	6.233
HY corporate	5.743	4.310	5.212	7.123
B: SD				
A tranche	3.188	0.876	7.639	0.874
B tranche	7.902	0.768	19.496	1.384
C tranche	11.502	1.228	28.402	1.861
Aaa corporate	5.753	4.607	8.788	5.267
Baa corporate	5.940	5.425	9.940	4.288
HY corporate	9.237	8.034	17.172	5.491
C: Market beta				
A tranche	0.026	−0.019	0.133	−0.010
B tranche	0.108	−0.015	0.428	−0.011
C tranche	0.147	−0.030	0.592	−0.013
Aaa corporate	−0.036	−0.036	0.094	−0.129
Baa corporate	0.107	0.107	0.308	0.034
HY corporate	0.404	0.404	0.678	0.316
D: Sharpe ratio				
A tranche	0.611	2.341	0.357	1.809
B tranche	0.392	3.014	0.340	1.793
C tranche	0.394	2.615	0.354	1.952
Aaa corporate	0.738	0.873	0.158	1.037
Baa corporate	0.865	0.712	0.508	1.454
HY corporate	0.622	0.537	0.304	1.297

This table presents summary statistics for the indicated tranches and corporate bond indexes for the respective sample periods. Monthly returns are computed by using all securitizations in the sample for each month. Summary statistics are based on the monthly returns for the indicated periods. Returns are expressed as annualized percentages. The sample is monthly from January 2000 to January 2020.

$$\text{Yield}_{it} = \text{FE} + \beta_1\,\text{Prem}_{it} + \beta_2\,\text{Charge-off}_{it} + \beta_3\,\text{MPR}_{it} + \epsilon_{it}, \tag{13}$$

where Yield denotes the portfolio yield, FE denotes the annual fixed effects, Prem denotes the consumer credit risk premium, and Charge-off and MPR denote the charge-off and monthly payment rates for the portfolio. Table 6 reports the results from the panel regression.

As shown, there is roughly a one-to-one relation (transfer coefficient) between the credit risk premium and the portfolio yield during the precrisis period. In particular, an increase of 100 bps in the credit premium for the A, B, and C tranches maps into an increase in the portfolio yield of about 136, 109, and 75 bps, respectively.

The relation between the portfolio yield and the credit premium becomes very different during the postcrisis period beginning in 2010. In particular, the

Table 6
Panel regressions of portfolio yields on credit risk premiums and charge-off rates

	All		2000–2006		2007–2009		2010–2020	
	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat
A tranche								
Premium	0.7050	1.93*	1.3575	4.91**	0.0185	0.12	6.5241	4.08**
Charge-off	0.6657	4.92**	0.4965	3.16**	0.8182	4.17**	0.4620	2.20**
MPR	0.1039	1.39	0.1978	6.23**	0.3960	4.89**	−0.0850	−0.59
Fixed effects	—	Yes	—	Yes	—	Yes	—	Yes
Adj R^2	—	.353	—	.272	—	.188	—	.513
N	—	16,848	—	11,052	—	3,590	—	2,206
B tranche								
Premium	0.1292	0.79	1.0914	6.86**	−0.0559	−1.56	1.6323	7.26**
Charge-off	0.6406	5.49**	0.5305	3.43**	0.7865	4.44**	0.3774	2.39**
MPR	0.0938	1.29	0.1953	6.37**	0.3787	5.82**	−0.1938	−1.40
Fixed effects	—	Yes	—	Yes	—	Yes	—	Yes
Adj R^2	—	.327	—	.291	—	.192	—	.466
N	—	16,848	—	11,052	—	3,590	—	2,206
C tranche								
Premium	0.1057	0.88	0.7539	6.80**	−0.0371	−1.25	1.0612	5.88**
Charge-off	0.6450	5.40**	0.5369	3.39**	0.7897	4.46**	0.3931	2.55**
MPR	0.0947	1.30	0.1909	6.12**	0.3811	6.02**	−0.1861	−1.33
Fixed effects	—	Yes	—	Yes	—	Yes	—	Yes
Adj R^2	—	.330	—	.315	—	.192	—	.472
N	—	16,848	—	11,052	—	3,590	—	2,206

This table reports the results from panel regressions of the portfolio yield on the consumer credit risk premium, the charge-off rate, and the MPR. The portfolio yield, consumer credit risk premium, and charge-off rates are expressed as annual percentages. The MPR is expressed as a monthly percentage of the portfolio balance. Annual fixed effects for the respective sample periods are included in regression. Robust standard errors are clustered by year. The sample is monthly from January 2000 to January 2020. * $p < .1$; ** $p < .05$.

transfer coefficients become significantly larger than before, consistent with a scenario in which an increase in the risk premium has a multiplicative effect on the portfolio yield. For example, the coefficient for the risk premium for the A tranche is about 6.52. This implies that the increase in the A tranche risk premium from 13.65 bps precrisis to 41.26 basis points postcrisis maps into an increase of about 180 bps in the portfolio yield. Similarly, the corresponding increases in the risk premiums for the B and C tranches imply an increase in the portfolio yield of about 117 and 146 bps, respectively. These results suggest that the increase in risk premiums in the secondary credit card ABS markets could potentially have added 100 to 200 bps to the cost of unsecured consumer credit during the postcrisis period.

4. Balance-Sheet Costs and Capital Regulation

The results in the previous section immediately raise the question: What is the reason for the dramatic repricing of unsecured consumer credit risk beginning in 2010? Since the credit card industry also experienced a number of major regulatory changes beginning in 2009–2010, a natural starting point would be to consider whether this repricing could be at least partially attributable to these changes in the regulatory environment. Motivated by the extensive literature on the effects of intermediary balance-sheet costs and capital constraints on security prices, this section examines the relation between the consumer credit risk premium and measures of these costs and constraints.

4.1 Evidence of the impact of regulation

As discussed earlier, a number of major regulatory changes occurred during the 2009/2010 period including the CARD Act, changes in the accounting rules for credit card ABS (FAS 166/167), and new capital requirements from the Dodd-Frank Act and Basel Capital Accords. These postcrisis regulatory reforms fundamentally changed the economics of asset-backed securitizations and made the process of securitizing assets much more capital-intensive by turning securitization from a low-capital-usage, off-balance-sheet activity into one that consumes scarce balance-sheet space.[36] A dramatic reduction in securitization activity accompanied the reconsolidation of credit card ABS onto issuer balance sheets. For example, credit card ABS issuance declined by 87.3% from $50.507 billion in 2009 to $6.536 billion in 2010 and has remained at much lower levels during the past decade.[37] Furthermore, Figure 5 shows that the total amount of credit card ABS outstanding declined by more than 50% from over $300 billion at the end of 2009, to roughly $125 billion at the end of 2013. One reason for this may be that as on-balance-sheet assets, credit card ABS are subject to regulatory capital requirements.[38] As a result of FAS 166/167, credit card ABS previously held off-balance-sheet now occupy "expensive real estate" on credit card banks' balance sheets.[39]

4.2 Quarter-end effects

In their analysis of the covered interest rate parity (CIP) relation, Du, Tepper, and Verdelhan (2018) provide "smoking gun" evidence of the link between CIP violations and intermediary balance-sheet usage. Specifically, they show that the magnitude of the mispricing during the postcrisis period is directly related to the proximity to the end of a quarter (as intermediaries file quarter-end financial reports and disclose their regulatory capital positions). Following Du, Tepper, and Verdelhan (2018), among others, we test for quarter-end and year-end effects in the consumer credit risk premiums.

[36] Credit card banks also face indirect costs because postcrisis regulatory reforms from the Dodd-Frank Act and Basel III impose restrictions on institutional investors to hold ABS and also tighten oversight and rating criteria from credit rating agencies.

[37] *Source*: SIFMA, available at https://www.sifma.org/resources/research/us-asset-backed-securities-statistics/.

[38] 12 CFR Part 567 at https://www.govinfo.gov/content/pkg/FR-2009-09-15/pdf/E9-21497.pdf.

[39] Given the significant economic impact on banks regulatory capital, regulators gave credit card banks the option to delay including consolidated credit card ABS in their risk-based capital ratios for two quarters, followed by an optional additional two-quarter partial implementation of FAS 167. See https://www.federalreserve.gov/newsevents/pressreleases/bcreg20100121a.htm.

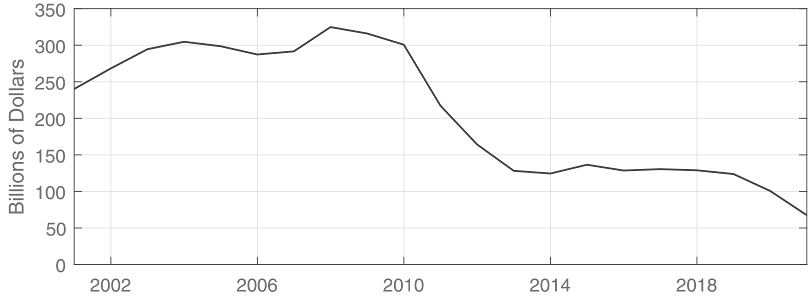

Figure 5
Total notional amount of all credit card ABS outstanding
This figure plots the total notional amount of all credit card ABS outstanding.

To do this, we regress the normalized credit risk premiums for the individual tranches on a quarter-end dummy variable that takes a value of one for the months of March, June, and September, and zero otherwise, and on a year-end dummy variable that takes a value of one for the month of December, and zero otherwise. The credit risk premiums are normalized by subtracting the average value of the credit risk premiums for months $t-1$ and $t+1$ from the value of the credit risk premiums for month t. Table 7 reports the regression results.

The results provide strong support for the hypothesis that intermediary balance-sheet constraints affect the pricing of credit card ABS tranches. In particular, for all three classes of tranches, the results indicate significant quarter-end effects during both the precrisis and postcrisis periods. Table 7 also shows a significant year-end effect on the credit risk premiums during the postcrisis. In contrast, there is no evidence of a year-end effect during the precrisis period. This latter result is consistent with the possibility that post-financial-crisis regulation may have significantly increased intermediary balance-sheet costs. These results complement those of Du, Tepper, and Verdelhan (2018) and provide direct evidence of a link between the consumer credit risk premiums and the costs faced by financial intermediaries in using their balance sheets.

4.3 Capital regulation

As another way of exploring the relation between the risk premiums and the balance-sheet costs and capital constraints faced by intermediaries, we examine whether changes in the risk premiums are correlated with changes in exogenous measures of these costs and constraints. As measures of the constraints faced by intermediaries, we follow Adrian, Etula, and Muir (2014), He, Kelly, and Manela (2017), and Fleckenstein and Longstaff (2020a), among others, in using several aggregate leverage and regulatory capital ratios. In doing this, we focus on ratios that play central roles not only in the current regulatory environment but also in the early 2000s, when Basel I/II and regulation by the FDIC were the

Table 7
Regressions of credit risk premiums on quarter-end and year-end indicators

	All		2000–2006		2007–2009		2010–2020	
	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat
A tranche								
Intercept	−0.0301	−2.80**	−0.0434	−2.33**	−0.0513	−1.12	−0.0110	−2.49**
Quarter-end	0.0775	2.61**	0.1592	3.11**	0.0441	0.37	0.0206	2.32**
Year-end	0.1257	1.58	0.0462	0.92	0.5403	1.37	0.0402	2.66**
Adj. R^2	—	.036	—	.094	—	.084	—	.054
N	—	217	—	83	—	36	—	98
B tranche								
Intercept	−0.0341	−1.57	−0.0621	−2.30**	−0.0130	−0.12	−0.0183	−1.76*
Quarter-end	0.0529	1.01	0.2324	3.16**	−0.3098	−1.68*	0.0327	1.93*
Year-end	0.2497	1.33	0.0488	0.69	1.2542	1.35	0.0494	2.39**
Adj. R^2	—	.012	—	.097	—	.085	—	.020
N	—	217	—	83	—	36	—	98
C tranche								
Intercept	−0.0628	−1.74*	−0.0952	−2.35**	−0.0887	−0.46	−0.0258	−1.63
Quarter-end	0.1071	1.35	0.3616	3.31**	−0.3244	−1.06	0.0481	1.71*
Year-end	0.4296	1.24	0.0615	0.58	2.2678	1.30	0.0634	2.03**
Adj. R^2	—	.016	—	.104	—	.102	–	.013
N	—	217	—	83	—	36	—	98

This table reports the results from the regressions of the normalized credit risk premium on quarter-end and year-end indicators. The credit premium is expressed as a percentage and is normalized by subtracting the average value of the premium for the prior and subsequent month from the value for the current month. The quarter-end indicator takes value one for March, June, and September observations, and zero otherwise. The year-end indicator takes value one for December observations, and zero otherwise. Standard errors are based on Newey and West (1987). The sample is monthly from January 2000 to January 2020. * $p < .1$; ** $p < .05$.

primary capital adequacy standards faced by intermediaries. This set of ratios should measure the impact of regulation on intermediaries more consistently throughout the entire sample than measures enacted after the financial crisis, such as the SLR and the LCR.

As the first measure, we follow Fleckenstein and Longstaff (2020a) in using the aggregate Tier 1 capital ratio for broker-dealers in the financial markets. The Tier 1 capital ratio is defined as total Tier 1 capital as a percentage of total risk-weighted assets and has been a key component of capital regulation starting with the Basel I framework and the Federal Deposit Insurance Corporation Improvement Act in the early 1990s. The aggregate Tier 1 capital ratio is a quarterly average over all broker-dealers and is based on the Z.1 flow of funds data from the Federal Reserve. We acknowledge that in using these ratios, we are relying on the assumption that changes in these ratios reflect changes in either required leverage or capital. This assumption, however, seems plausible since financial intermediaries have strong incentives to leverage their balance sheets. Thus, decreases in leverage or increases in capital ratios are likely driven by tighter regulatory capital requirements. As a second measure, we use the intermediary leverage ratio provided by He, Kelly, and Manela (2017) as a proxy for the funding constraints faced by intermediaries. As a third measure, we follow Du, Tepper, and Verdelhan (2018), Andersen, Duffie, and Song (2019), and Fleckenstein and Longstaff (2020a), among others, in using spreads observed in the market that proxy for the shadow costs of renting intermediary balance-sheet space. In particular, we use the turn-of-the-year premium in Eurodollar futures prices used in Fleckenstein and Longstaff (2020a). Musto (1997) and Griffiths and Winters (2005), among others, show that financing rates, such as 3-month Libor, tend to spike near the end of a year as financial institutions face additional balance-sheet-related pressure to hold cash. Thus, the size of the expected spike in year-end Libor reflected in Eurodollar futures prices provides a measure of the anticipated balance-sheet usage costs financial institutions face.

Table 8 reports the results from regressing monthly changes in the average consumer credit risk premium on contemporaneous and lagged changes in the leverage and capital ratios, as well as on changes in the turn-of-the-year premium.[40] These results provide additional support for the hypothesis that the postcrisis increase in the consumer credit risk premiums is related to the balance-sheet and capital regulation costs faced by financial intermediaries. As shown, there is little to no evidence of any relation between the credit risk premiums and the three measures of intermediary constraints and balance-sheet costs during the precrisis period. In contrast, most of these measures become highly significant in explaining changes in the credit risk premiums during the postcrisis period.

These results suggest that intermediary balance-sheet constraints may be an important determinant of the consumer credit risk premium. If so, then increases in intermediary balance-sheet costs resulting from the extensive changes in capital regulation and other requirements during the postcrisis period could play an important role in explaining the dramatic repricing of unsecured consumer credit risk during the latter part of the sample period. It is important to acknowledge, however, that these regression results simply document correlations between the variables, and should not be interpreted as providing direct causal evidence. We address this issue more directly in the next subsection.

4.4 The 2010 reconsolidation event: A natural experiment

To examine the relation between the risk premium and intermediary balance-sheet costs at a more fundamental causal level, we use the mandatory reconsolidation of credit card master trusts back onto issuer balance sheets that occurred on January 1, 2010, as an exogenous identification vehicle. This reconsolidation event provides us with a natural experiment in which we can measure the impact on each issuer of placing a dollar of securitized consumer credit on its balance sheet.

[40] Table 8 does not report results for the 2007–2009 crisis period since there are too few quarterly observations.

Table 8
Regressions of changes in credit risk premiums on changes in intermediary capital and balance sheet cost measures

	All		2000–2006		2007–2009		2010–2020	
	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat
A tranche								
Intercept	0.1098	1.89*	−0.0286	−0.70	—	—	0.0366	2.56**
Δ Tier 1_t	−0.8678	−2.05**	0.7840	1.25	—	—	−0.4293	−3.28**
Δ Leverage_t	−0.3396	−3.30**	−0.0560	−0.85	—	—	−0.1607	−4.30**
Δ Turn-of-year_t	0.0622	1.41	0.0424	1.45	—	—	−0.0405	−0.74
Δ Tier 1_{t-1}	−1.2889	−2.23**	0.1530	0.31	—	—	−0.2117	−1.93*
Δ Leverage_{t-1}	0.0234	0.25	0.1000	1.17	—	—	−0.0059	−0.20
Δ $\text{Turn-of-year}_{t-1}$	0.1685	1.84*	−0.0759	−1.40	—	—	−0.1232	−2.51**
Adj. R^2	—	.442	—	.219	—	—	—	.562
N	—	66	—	26	—	—	—	28
B tranche								
Intercept	0.2436	1.42	−0.0383	−0.64	—	—	0.0380	1.12
Δ Tier 1_t	−1.2647	−1.42	1.1719	1.35	—	—	−0.7179	−2.06**
Δ Leverage_t	−1.0018	−2.47**	−0.0641	−0.75	—	—	−0.3270	−3.24**
Δ Turn-of-year_t	−0.0571	−0.32	0.0645	1.68	—	—	−0.0402	−0.41
Δ Tier 1_{t-1}	−4.7666	−1.94*	0.1629	0.23	—	—	−0.5251	−1.97*
Δ Leverage_{t-1}	−0.2979	−1.19	0.1288	1.11	—	—	−0.0889	−1.04
Δ $\text{Turn-of-year}_{t-1}$	0.4041	2.05**	−0.0987	−1.34	—	—	−0.3750	−2.24**
Adj. R^2	—	.403	—	.230	—	—	—	.516
N	—	66	—	26	—	—	—	28
C tranche								
Intercept	0.3681	1.39	−0.0706	−0.71	—	—	0.0518	0.99
Δ Tier 1_t	−1.8078	−1.32	1.9894	1.37	—	—	−1.0136	−2.57**
Δ Leverage_t	−1.4530	−2.43**	−0.0886	−0.63	—	—	−0.4382	−3.49**
Δ Turn-of-year_t	−0.1497	−0.54	0.0924	1.46	—	—	−0.1077	−0.77
Δ Tier 1_{t-1}	−7.2831	−1.98*	0.2075	0.18	—	—	−0.6493	−2.37**
Δ Leverage_{t-1}	−0.4936	−1.32	0.1963	1.02	—	—	−0.1469	−1.04
Δ $\text{Turn-of-year}_{t-1}$	0.6446	2.03**	−0.1560	−1.28	—	—	−0.4216	−2.24**
Adj. R^2	–	.413	—	.210	—	—	—	.511
N	–	66	—	26	—	—	—	28

This table reports the results from the regressions of changes in the credit risk premium on the changes in the aggregate Tier 1 capital ratio for broker-dealers (Tier 1), the He, Kelly, and Manela (2017) measure of intermediary leverage (Leverage), and the Fleckenstein and Longstaff (2020a) turn-of-the-year index of balance sheet costs (Turn-of-year). All variables are expressed as percentages. Standard errors are based on Newey and West (1987). The sample is quarterly from April 2000 to December 2019. * $p < .1$; ** $p < .05$.

4.4.1 Intermediary balance-sheet costs. Intermediary asset pricing theory suggests that the costs incurred by intermediaries in placing assets on their balance sheets depend on at least three factors. First, these costs are affected by how binding the capital constraints faced by the intermediary are. Second, the costs also depend on the marginal cost to the intermediary of obtaining additional capital. Third, the costs should also depend on how much capital the acquisition of an asset requires. The first two of these are key elements of models, such as Brunnermeier and Pedersen (2009), and are often expressed in terms of margins/haircuts and other types of leverage and capital constraints, as well as the cost of unsecured debt or equity. The third plays a central role in models such as the debt overhang model of Andersen, Duffie, and Song (2019) in which the cost of acquiring an asset may exceed the value of the asset to an intermediary's current shareholders. Thus, the acquisition of some assets may have the effect of reducing an intermediary's regulatory capital. We designate this third factor as "capital intensity" since it reflects the direct impact on an intermediary's available capital resulting from placing assets on its balance sheet.

4.4.2 Measuring capital intensity. The implementation of FAS 166/167 required intermediaries to reconsolidate many of their securitizations back onto their balance sheets on January 1, 2010. Typically, the decision by an intermediary to acquire assets and place them on its balance sheet is an endogenous one. In contrast, the reconsolidation of credit card securitizations onto issuer balance sheets was a mandatory exogenous event. An important implication of this is that we can use the resultant impact on the issuer's capital as an exogenous instrument to measure capital intensity.

The reconsolidation event resulted in a major revision to the financial statements of all the issuers in the sample and is discussed in detail in their financial disclosures. Table 9 summarizes the impact of the reconsolidation on the total assets, liabilities, loan loss reserves, retained earnings, and Tier 1 capital ratios for each of the issuers in the sample. As shown, the reconsolidation resulted in major changes in the capitalization of the issuers. For example, in the case of Citibank, the reconsolidation resulted in an increase in total assets of \$137.0 billion, an increase in total liabilities of \$146.0 billion, an increase in the loan loss reserve of \$13.4 billion, a decrease in retained earnings of \$8.4 billion, and a decline in the Tier 1 capital ratio of 1.38%. Changes of the magnitude shown in Table 9 clearly had first-order effects on the balance sheets and regulatory capital ratios of the issuers in the sample.

To measure the capital intensity of the individual issuers in placing securitized assets on their balance sheet, we take the ratio of the January 1, 2010, change in the issuer's retained earnings to the total dollar amount of assets reconsolidated. As shown in Table 9, this ratio ranges from a low of 5.13% for Bank One and Chase to a high of 12.21% for First National. We emphasize that the natural experiment provided by the reconsolidation of ABS onto issuer balance sheets that allows us to identify the capital intensity of these transactions from the perspective of the individual issuers.

4.4.3 The panel regression. In the absence of frictions, we would not expect a "technical" accounting change of the type mandated by FAS 166/167 to have fundamental economic effects on financial intermediaries or security prices. When intermediaries face frictions and binding constraints, however, this may no longer be true. The rapidly growing literature on intermediary asset pricing suggests that balance-sheet costs resulting from funding frictions and regulatory capital constraints can have major effects on the pricing of securities in which these intermediaries make markets. This implies that the 2010 rule change

Table 9
Summary statistics for FAS 166/167 reconsolidations

Card issuer	Elected to defer	Assets consolidated	Change in liabilities	Change in loss reserve	Change in retained earnings	Effect on Tier 1 capital	Effect on Tier 1 capital ratio	Capital intensity ratio
American Express	No	29.00	25.00	2.50	−1.80	−1.60	−1.20	6.21
Bank of America	No	100.40	106.70	10.80	−6.20	−9.70	−0.76	6.18
Bank One	Yes	87.70	92.20	7.80	−4.50	−4.40	−0.34	5.13
Citibank	No	137.00	146.00	13.40	−8.40	−14.20	−1.38	6.13
Chase	Yes	87.70	92.20	7.80	−4.50	−4.40	−0.34	5.13
Capital One	No	41.85	44.87	3.85	−3.02	−6.88	−3.82	7.22
Discover	No	21.10	22.43	2.10	−1.40	−1.41	−2.20	6.64
First National	No	1.31	2.54	0.33	−0.16	−0.39	−0.92	12.21
MBNA	No	100.40	106.70	10.80	−6.20	−9.70	−0.76	6.18
World Financial	No	3.40	3.70	0.50	−0.40	−0.49	−1.49	11.76

This table presents summary statistics for the financial impact on the consolidating entity resulting from the mandatory implementation of FAS 166/167 on January 1, 2010. Assets consolidated, change in liabilities, change in loss reserve, and change in retained earnings are expressed in billions of dollars. The effect on Tier 1 capital is expressed in terms of the change in the percentage Tier 1 capital ratio. The capital intensity ratio is the ratio of the change in retained earnings to the change in assets and is expressed as a percentage.

requiring ABS to be consolidated onto issuers' balance sheets could affect pricing if the change tightened intermediary constraints and increased their balance-sheet costs. In particular, if credit card securitizations are now capital intensive events in the sense that the issuer needs to raise additional capital just to maintain its current regulatory capital ratios, and if the issuer also faces frictions, constraints, and additional costs in raising capital, then this may affect the observed consumer credit risk premium. It is important to note that the impact stems from the interaction between capital constraints and the costs faced by the intermediary and the capital intensity of the securitization.

In light of this, we estimate a panel regression for the credit risk premiums in which the interactions between capital constraints, capital costs, and capital intensity play a central role. In taking the model to the data, however, we first need to map issuer observables into model parameters.

First, recall from earlier discussion that the "skin-in-the-game" risk retention requirement of the FDIC Securitization Safe Harbor Rule of 2010 and the Dodd-Frank Act requires issuers to retain a specific fraction of the pool of credit card receivables underlying the securitization. Thus, the risk retention requirement for issuers can likewise be viewed as imposing margin or haircut requirements on credit card ABS issuers. Including issuer risk retention requirements in the analysis allows us to identify the specific effects of capital requirements on the premiums from the cross-section .

Second, we interpret the Tier 1 capital ratio for an issuer as playing a similar role as margins and haircuts in models such as Brunnermeier and Pedersen (2009) and Gârleanu and Pedersen (2011), among others. This is intuitive since both margins and regulatory capital constraints have the net effect of prohibiting intermediaries from financing assets entirely with debt. As an illustration, consider how an 8% Tier 1 capital requirement can be broadly interpreted as playing a similar role as imposing an 8% margin requirement on an intermediary. Thus, the issuer's capital ratio can be viewed as economically equivalent to the margin constraint in models such as Brunnermeier and Pedersen (2009).

Third, the cost of raising additional capital can be proxied for in a number of ways. A standard approach in the empirical literature is to use the CDS spread or credit spread of the issuer as a proxy for its cost of unsecured debt. We note that this cost plays a central role in models such as Brunnermeier and Pedersen (2009) and Andersen, Duffie, and Song (2019).

To examine the relation between the consumer credit risk premium and the interaction between intermediary capital usage and balance-sheet costs, we estimate the following panel regression specification:

$$\begin{aligned}\text{Prem}_{it} = \text{FE} &+ \beta_1 \text{ Retention Ratio}_i \\ &+ \beta_2 \text{ Cap Ratio}_{it} \\ &+ \beta_3 \text{ CDS}_{it} \\ &+ \beta_4 \text{ Retention Ratio}_i \times \text{Intensity}_i \\ &+ \beta_5 \text{ Cap Ratio}_i \times \text{Intensity}_i \\ &+ \beta_6 \text{ CDS}_i \times \text{Intensity}_i \\ &+ \epsilon_{it}, \end{aligned} \tag{14}$$

where Prem denotes the credit risk premium, FE denotes the annual fixed effects, Retention ratio denotes the risk retention ratio of the issuer, Cap ratio denotes the capital ratio of the issuer, CDS denotes the CDS spread of the issuer, and Intensity denotes the capital intensity measure for the asset-backed securitization. Table 10 reports the regression results.

The results provide strong support for the hypothesis that the consumer credit risk premiums have become much more connected to intermediary balance-sheet costs since the financial crisis. In particular, none of the capital constraint/cost measures or their interactions with the capital intensity measure is significantly related to the risk premium during either the precrisis or crisis period. In contrast, most of these measures and their interactions with the capital intensity measure become significant during the postcrisis period. For example, all three of the interaction terms are significantly related to the risk premiums for the A and B tranches, and two of the interaction terms are significant for the C tranches. These results, which are based on the exogenous instrument for capital intensity, provide evidence that the dramatic increase in the risk premiums during the 2010–2020 period could be at least partially due to corresponding increases in intermediary balance-sheet costs associated with extensive new capital regulation.

Table 10
Panel regressions of credit risk premiums on measures of intermediary balance sheet constraints

	All		2000–2006		2007–2009		2010–2020	
	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat
A tranche								
Risk	−0.0603	−0.11	0.0154	0.03	−7.2163	−0.77	3.3936	2.09**
Cap ratio	−0.0675	−0.28	−0.0599	−0.33	2.7452	0.73	−1.4082	−2.19**
CDS	1.9661	6.94**	0.6718	0.73	1.8779	0.69	−1.1517	−1.55
Risk × Intensity	0.0254	0.31	0.0197	0.29	1.1039	0.77	−0.5230	−2.10**
Cap ratio × Intensity	0.0128	0.35	0.0099	0.35	−0.4161	−0.74	0.2148	2.12**
CDS × Intensity	−0.2534	−5.11**	−0.0857	−0.69	−0.2316	−0.51	0.1977	1.67*
Annual FE	—	Yes	—	Yes	—	Yes	—	Yes
Adj. R^2	—	.593	—	.181	—	.482	—	.211
N	—	7,669	—	4,052	—	2,058	—	1,559
B tranche								
Risk	1.0428	0.59	−0.2295	−0.32	−6.8223	−0.26	7.6035	3.35**
Cap ratio	−0.4066	−0.55	−0.0158	−0.06	2.6038	0.25	−2.8263	−2.88**
CDS	6.8008	5.10**	0.8969	0.73	4.0383	0.54	−1.8070	−2.36**
Risk × Intensity	−0.1303	−0.47	0.0677	0.67	1.0068	0.25	−1.1492	−3.32**
Cap ratio × Intensity	0.0783	0.68	0.0023	0.05	−0.3855	−0.24	0.4434	2.98**
CDS × Intensity	−0.8618	−4.36**	−0.1148	−0.68	−0.3536	−0.28	0.3440	3.00**
Annual FE	—	Yes	—	Yes	—	Yes	—	Yes
Adj. R^2	—	.630	—	.186	—	.542	—	.214
N	—	7,669	—	4,052	—	2,058	—	1,559
C tranche								
Risk	2.3294	0.83	0.1874	0.17	−15.3371	−0.42	4.5115	3.40**
Cap ratio	−0.8822	−0.77	−0.2204	−0.47	5.9377	0.41	−1.5057	−2.09**
CDS	10.1239	5.01**	3.3102	1.31	6.4176	0.58	0.4120	0.33
Risk × Intensity	−0.2952	−0.67	0.0370	0.24	2.3231	0.42	−0.6595	−3.26**
Cap ratio × Intensity	0.1634	0.89	0.0372	0.51	−0.8833	−0.41	0.2568	2.49**
CDS × Intensity	−1.2732	−4.13**	−0.4332	−1.27	−0.5884	−0.31	−0.0247	−0.12
Annual FE	—	Yes	—	Yes	—	Yes	—	Yes
Adj. R^2	—	.644	—	.254	—	.572	—	.165
N	—	7,669	—	4,052	—	2,058	—	1,559

This table reports the results from the panel regressions of the credit risk premium on the indicated variables. All variables are expressed as percentages. Risk denotes the risk-retention requirement for the issuer. Cap Ratio denotes the capital ratio (total equity divided by total assets) for the issuer expressed. CDS denotes the CDS spread for the issuer. Intensity denotes the capital intensity ratio. Annual fixed effects for the respective sample periods are included in the regression. Robust standard errors are clustered by year. The sample is monthly from January 2000 to December 2019. * $p < .1$; ** $p < .05$.

4.5 Potential channels

Finally, it is useful to consider potential channels through which changes in intermediary balance-sheet costs and capital regulation may have affected the pricing of unsecured consumer credit risk. One possibility would be if these changes caused issuers to become less willing to support their securitizations in distressed situations in which the risk of an early amortization being triggered is heightened.

To study this, we first conducted an extensive text-based search of publicly available news sources in an effort to find all references to credit card ABS issuers taking action to support a securitization. Table A5 of the Internet Appendix lists the events identified in the public record. These include actions such as suspending or waiving servicing fees, adding receivables to the trust to increase overcollateralization, or issuing subordinated notes backed by the issuer to increase the credit enhancement of the securitization. Despite numerous examples of issuers providing either implicit or explicit support for securitizations prior to 2009, we were unable to find any instances of this occurring subsequently. We observe, of course, that this is clearly only anecdotal evidence and is far from definitive. For example, we cannot rule out that the apparent complete absence of recourse events in the post-financial-crisis period may simply be the result of higher excess spreads and declining charge-off rates making such interventions less necessary. Despite this caveat, however, these results suggest that this channel is at least plausible. Furthermore, these results are also consistent with the interpretation that the Volcker Rule and the Super 23A provision of the Dodd-Frank Act severely restrict the ability of issuers to support their securitizations (see the discussion in Section A.3.6 in the Internet Appendix).

One way of exploring this potential channel is to examine the relation between the risk premium and the credit risk of credit card ABS issuers. If issuers have incentives to support their credit card securitizations, then there should be a link between the risk premiums and the CDS spread of issuers. On the other hand, if changes in the regulatory environment were to remove those incentives, then this link might disappear. To study this, we regress changes in average risk premiums for the tranches on changes in an index of issuer CDS spreads.[41] Table 11 reports the regression results.

As shown, the results appear to be the reverse of those hypothesized. In particular, there is no significant relation between changes in the risk premiums and changes in average issuer CDS spread during the precrisis period. In contrast, there is a significant positive relation in the postcrisis period, but only for the A tranche. Thus, these results provide little support for the economic mechanism underlying the proposed recourse-based channel. On the other hand, the results are consistent with a broader view that the pricing of credit card ABS has become more connected to issuer capital costs during the postcrisis period.

5. Alternative Channels

The results in the previous section suggest that intermediary balance-sheet costs and capital regulation may be key drivers of the repricing of consumer credit risk during the postcrisis period. It is important to recognize, however, that our results do not preclude the possibility that other factors may also have played central roles: there could be multiple reasons for the dramatic repricing of consumer credit risk. In this section, we consider several alternative possibilities.

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[41] We are grateful to the referee for identifying this potential channel and suggesting this empirical approach.

Table 11
Regressions of changes in consumer credit risk premiums on changes in issuer CDS spreads

	All		2000–2006		2007–2009		2010–2020	
	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat
A tranche								
Intercept	0.0951	0.04	−0.0067	−0.00	1.5580	0.11	−0.5088	−0.85
Δ CDS spread	0.2391	1.56	−0.0361	−0.15	0.2803	1.36	0.1257	2.32**
Adj. R^2	—	.025	—	−.016	—	.007	—	.067
N	—	200	—	64	—	36	—	100
B tranche								
Intercept	0.1030	0.01	−0.0695	−0.03	5.2177	0.11	−1.9376	−1.33
Δ CDS spread	0.3577	0.45	−0.1497	−0.43	0.4516	0.40	0.0764	0.61
Adj. R^2	—	.005	—	−.015	—	−.017	—	−.004
N	—	200	—	64	—	36	—	100
C tranche								
Intercept	0.2570	0.02	−0.3680	−0.10	8.6882	0.12	−2.5883	−1.29
Δ CDS spread	0.2043	0.17	−0.3291	−0.63	0.2516	0.15	0.0732	0.42
Adj. R^2	—	−.004	—	−.013	—	−.028	—	−.007
N	—	200	—	64	—	36	—	100

This table presents the results from the regressions of changes in the credit risk premium on the changes in the index of issuer CDS spreads. The credit risk premium and the issuer CDS spread are expressed in basis points. Standard errors are based on Newey and West (1987). The sample is monthly from January 2000 to January 2020. $^{*}p < .1$; $^{**}p < .05$.

5.1 Imperfect competition

We begin by examining whether changes in the market power of credit card issuers may help explain postcrisis trends in the risk premiums. Recall that the evidence presented by Ausubel (1991, 1997), Bassett and Zakrajsek (2000), Agarwal et al. (2015), and Herkenhoff and Raveendranathan (2021), among others, makes a strong case that imperfect competition in the credit card market allows issuers to extract monopoly rents from consumers. For example, Ausubel (1991, 1997) documents that the return on assets (ROA) from credit card loans were roughly four times the overall ROA in the banking industry between 1983 and 1993. Ausubel (1991) also shows that secondary market resales of credit card receivables portfolios occur at prices roughly 20% higher than the notional amount of the receivables. This implies not only that issuers are able to extract rents from credit card customers but also that investors capitalize these anticipated rents into market prices on an ex ante basis.

Motivated by the results in Ausubel (1991), we use the premiums for secondary market sales of receivables portfolios as an instrument for imperfect competition and/or lenders' market power in the credit card market. A major challenge in doing this, however, is that secondary market transactions are generally private and, consequently, prices are difficult to observe. Fortunately, we were able to find annual averages of the estimated premiums associated with secondary market resales from industry sources through an extensive online search. It is important to add the caveat, however, that since we do not have

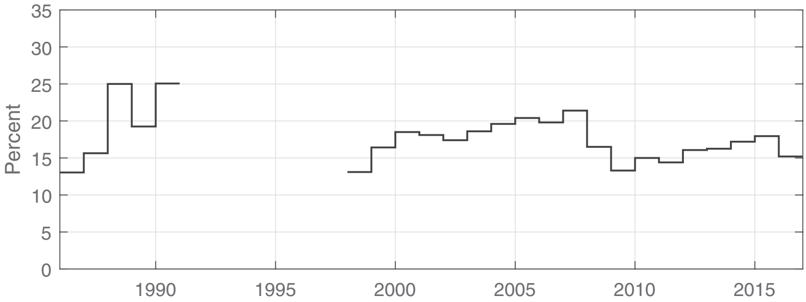

Figure 6
Average premiums for secondary market sales of credit card receivables portfolios
This figure plots the annual estimates of the average premiums for secondary market sales of credit card receivables portfolios.

the original data on which these industry estimates are based, these estimates should be viewed primarily as anecdotal in nature. Figure 6 plots the annual time series of average premiums from secondary market transactions from 1998 to 2016. For completeness, we also include averages from 1986 to 1990 based on the transactions data reported in table 9 of Ausubel (1991).

As shown, the estimated premiums provide little evidence that the market power of credit card issuers has increased meaningfully since 2010. To the contrary, the results suggest that the market power of credit card issuers may actually have declined during this period, potentially as a result of regulatory changes, such as the CARD Act. In particular, the average value of the premiums during the 2010–2016 period is 16.01%, which is substantially less than the average value of 18.30% for the 1986–2009 period, or the average value of 17.76% for the 1998–2009 period.[42] Viewing the premiums for secondary market transactions as an instrument for the market power of credit card issuers, the downward trend during the latter part of the sample suggests that the sharp increase in the consumer credit risk premium beginning in 2010 is unlikely to be due to an increase in the ability of issuers to extract monopoly rents from consumers.

As a robustness check, we also collect data on the profitability of large U.S. credit card banks from the Federal Reserve Board. Figure 7 plots the annual time series of the ROA for these banks. As shown, there is no evidence of an increasing trend in credit card issuer profitability after 2009. The average ROA for these banks is 4.26% prior to 2010 and 4.24% for the subsequent period. This again suggests that the increase in the risk premium is probably not solely the result of a corresponding increase in issuer market power in the credit card market.

42 The difference in means just misses being significant at the 10% level.

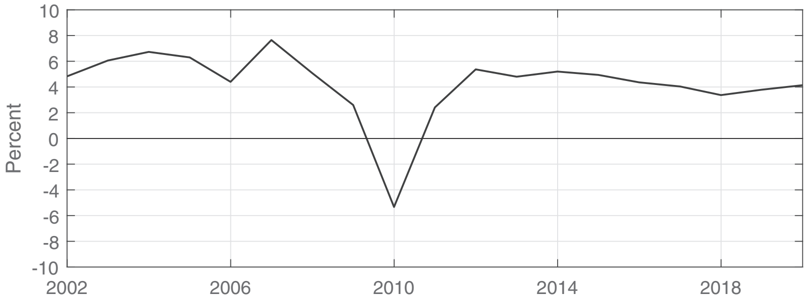

Figure 7
Credit card issuer profitability ratios
This figure plots the annual estimates of the return on assets for large U.S. credit card banks reported by the Federal Reserve Board.

5.2 Adverse selection

An extensive literature documents the role that adverse selection plays in securitization markets.[43] Papers focusing specifically on adverse selection in credit card markets include Ausubel (1999), Agarwal, Chomsisengphet, and Liu (2010), Agarwal et al. (2018), Agarwal et al. (2018), and Agarwal et al. (2020). Motivated by this literature, we next examine whether adverse selection effects could help explain the repricing of unsecured consumer credit card risk. Adverse selection effects could occur, for example, if credit card ABS issuers responded to regulatory changes by retaining higher-quality assets in their portfolios, while securitizing lower-quality assets.[44]

To explore this possibility, we follow Piskorski, Seru, and Vig (2010) and Agarwal et al. (2011), among others, by comparing the ex post realizations for securitized and nonsecuritized assets. Specifically, we collect data on delinquency and charge-off rates for securitized and nonsecuritized loans from the Federal Reserve Board. Figure 8 plots the average 30-day delinquency and charge-off rates for both securitized and nonsecuritized credit card loans.

As shown, the results provide little evidence that the quality of the receivables underlying the credit card ABS securitizations in our sample declined in the period beginning in 2010. To the contrary, both the delinquency and charge-off rates for the securitized receivables are lower than those for nonsecuritized receivables during the latter part of the sample period. In particular, the average values of the delinquency and charge-off rates from 2010 to 2020 are 2.09% and 3.83% for the securitized receivables, and 2.80% and 4.27% for the nonsecuritized receivables. The difference between the delinquency rates is statistically significant at the 1% level.

[43] Important recent examples include Downing, Jaffee, and Wallace (2009), Keys et al. (2009, 2010), Piskorski, Seru, and Vig (2010), Agarwal et al. (2011), An, Deng, and Gabriel (2011), and Agarwal, Chang, and Yavas (2012).

[44] We are grateful to the referee for suggesting this possibility.

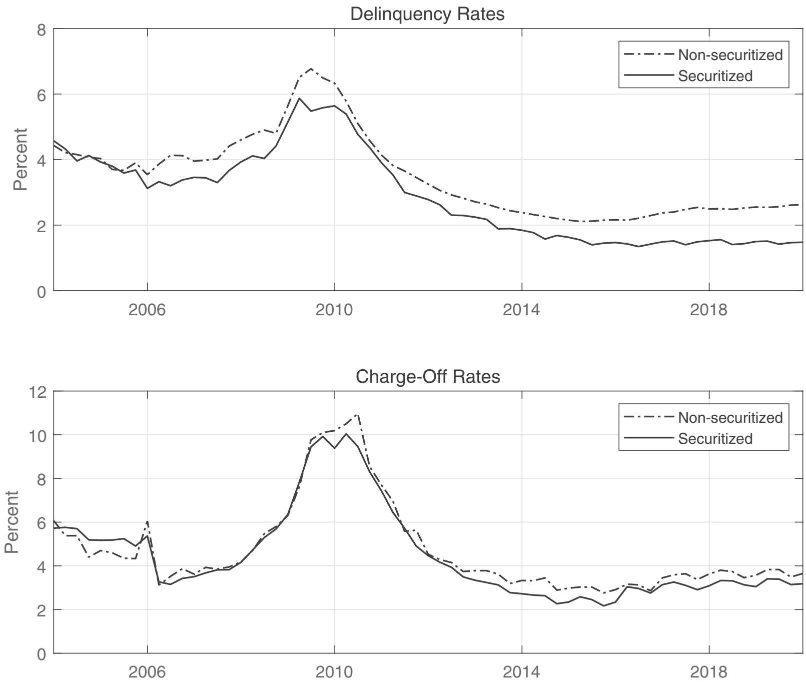

Figure 8
Delinquency and charge-off rates for securitized and nonsecuritized credit card receivables portfolios
The upper panel plots the delinquency rates for securitized and nonsecuritized credit card receivables portfolios. The lower panel plots the charge-off rates for securitized and nonsecuritized credit card receivables portfolios. The delinquency and charge-off rate data are reported by the Federal Reserve Board.

As an alternative approach, we hand-collected data on the FICO scores of borrowers whose balances are included in the master trusts for American Express, Citibank, and Chase. These three master trusts jointly account for 53.12% of all U.S credit card transaction volume during 2019. The data indicate that the average credit quality of borrowers has actually increased significantly during the postcrisis period. In particular, the percentages of borrowers with FICO scores greater than or equal to 660 during the 2007–2009 crisis period were 83.26, 72.98, and 83.18 for American Express, Citibank, and Chase, respectively. In contrast, the same percentages during the 2010–2020 postcrisis period were 90.52, 87.75, and 88.43, respectively. The trends for the FICO scores for borrowers in these master trusts appear to be consistent with the general trends for the average FICO scores for all consumers that have increased from 686 in October 2009 to 711 in July 2020.[45]

In summary, we find little evidence that the quality of securitized credit card receivables declined relative to that of nonsecuritized receivables after 2009, on

45 See, for example, Dornhelm (2020).

either an ex ante or ex post basis. This suggests that the repricing of consumer credit card risk beginning in 2010 is also unlikely to be fully explained by adverse selection effects.

5.3 Changes in credit card risk

Another risk-related possibility is whether postcrisis regulatory changes could have affected credit card behavior, leading to fundamental changes in the systematic risk or nature of unsecured consumer credit. To study this, we first examine the patterns of charge-offs over time. Recall from Figure 1 that charge-off rates reached a maximum of roughly 10% during the financial crisis, but have since declined significantly. Furthermore, Figure 1 shows that charge-off rates are actually lower on average during the postcrisis period than during the precrisis period. Although not shown, we find a similar pattern in the charge-off rates for the individual master trusts in the sample.

Second, we collect data on the recovery rates for charged-off credit card receivables from the FDIC. Figure A1 in the Internet Appendix graphs the annual time series of average recovery rates. As shown, the recovery rate has actually trended upward in the postcrisis period. In particular, the average recovery rate was 14.17% for the 2000–2009 period and 17.31% for the 2010–2020 period.

Third, as a proxy for recovery expenses, we collect data on the noninterest non-credit-related expenses incurred by the credit card issuers in our sample.[46] Figure A2 in the Internet Appendix graphs the average ratio of these expenses to total assets. As shown, the expense ratio follows a very similar pattern during the 2010–2020 period as it does during the earlier period.

Finally, we use the information in the cross-section of the risk premiums to provide a broader perspective about whether the nature of credit risk has changed since 2010.[47] Specifically, Table 12 reports the results from the following panel regression specification:

$$\text{Prem}_{it} = \text{FE} + \beta_1 \text{ Charge-off}_{it} + \beta_2 \text{ Charge-off Trend}_{it} + \epsilon_{it}, \qquad (15)$$

where Prem denotes the credit risk premium, Charge-off denotes the current charge-off rate, and Charge-off trend denotes the trend in the charge-off rate and is measured as the difference between the current charge-off rate and the charge-off rate over the previous 3 months. The intuition behind using the trend is that it allows the time-series behavior of credit risk to inform the cross-section about the pricing of credit risk.

As shown, the current charge-off rate shows little sign of being related to the risk premiums during the precrisis and crisis periods. The current charge-off rate is positively and significantly related to the risk premiums during the

[46] These data are not available for First National and World Financial.

[47] We are again grateful to the referee for suggesting this approach.

Table 12
Panel regressions of credit risk premiums on measures of credit losses

	All		2000–2006		2007–2009		2010–2020	
	Coef	*t*-stat	Coef	*t*-stat	Coef	*t*-stat	Coef	*t*-stat
A tranche								
Charge-off rate	0.0314	0.46	−0.0446	−1.47	0.0728	0.22	0.0280	3.31**
Charge-off trend	0.0881	0.52	−0.0712	−4.49**	0.9517	4.83**	−0.0138	−1.55
Annual FE	—	Yes	—	Yes	—	Yes	—	Yes
Adj. R^2	—	.537	—	.068	—	.394	—	.108
N	—	8,166	—	3,626	—	2,528	—	2,012
B tranche								
Charge-off rate	−0.0633	−0.31	−0.0552	−1.39	−0.3001	−0.34	0.0057	0.23
Charge-off trend	0.6878	0.94	−0.0937	−4.43**	4.4915	4.08**	−0.0008	−0.02
Annual FE	—	Yes	—	Yes	—	Yes	—	Yes
Adj. R^2	—	.555	—	.063	—	.474	—	.123
N	—	8,166	—	3,626	—	2,528	—	2,012
C tranche								
Charge-off rate	−0.0841	−0.27	−0.0295	−0.42	−0.4425	−0.34	0.0087	0.18
Charge-off trend	1.0270	0.91	−0.2054	−4.79**	6.9201	4.15**	−0.0708	−1.49
Annual FE	—	Yes	—	Yes	—	Yes	—	Yes
Adj. R^2	—	.550	—	.066	—	.487	—	.079
N	—	8,166	—	3,626	—	2,528	—	2,012

This table reports the results from the panel regressions of the credit risk premium on the current charge-off rate and the trend in the charge-off rate. All variables are expressed as percentages. The trend in the charge-off rate is the difference between the charge-off rate for the current month and the average charge-off rate over the past 3 months. Annual fixed effects for the respective sample periods are included in the regression. Robust standard errors are clustered by year. The sample is monthly from January 2000 to January 2020. * $p < .1$; ** $p < .05$.

postcrisis period, but only for the A tranche. In contrast, the trend in the charge-off rate is significant for all tranches during the precrisis and crisis periods, but is not significant for any of the tranches during the postcrisis period. These results suggest that the pricing of credit risk actually becomes less connected to the level of credit risk during the latter part of the sample period.

6. Conclusion

We use the secondary market prices of credit card ABS tranches to study how the market values unsecured consumer credit risk. The results reveal a substantial risk premium associated with unsecured household debt. We uncover a major repricing of unsecured consumer credit risk beginning in 2010 that may have added 100 bps or more to the effective rates consumers pay on their credit cards.

We examine potential explanations for this dramatic increase in the consumer credit risk premium. We find that the consumer credit risk premium is directly related to other credit spreads, but also appears to be driven by other factors unique to the credit card securitization market. In particular, we find strong evidence that the consumer credit risk premium is related to the balance-sheet costs and capital constraints faced by financial intermediaries. Using the natural experiment provided by the mandatory reconsolidation of credit card ABS back onto issuers' balance sheets on January 1, 2010, as a way to identify the marginal cost of placing assets on-balance-sheet, we find that a major portion of the increase in the consumer credit risk premium during the past decade may be due to the impact of capital regulation. These results are consistent with other recent evidence about the relation between intermediary balance-sheet costs, constraints from regulatory capital requirements, and asset pricing. We also explore whether the repricing of consumer credit risk could also be related to changes in credit card issuer market power, adverse selection effects, or fundamental changes in the nature of consumer credit risk resulting from postcrisis regulation.

In conclusion, our results point toward the need for further research to understand the role that market credit risk premiums play in determining both the cost and availability of credit to the household sector. Especially, understanding the extent to which regulation aimed at taming risk-taking on "Wall Street" could have real effects on the availability and terms of credit to "Main Street" should be a key priority for academics, policy makers and regulators.

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