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COMPETITIVE EFFECTS OF BASEL II ON U.S. BANK CREDIT CARD LENDING

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Abstract

We analyze the potential competitive effects of the proposed Basel II capital regulations on U.S. bank credit card lending. We find that bank issuers operating under Basel II will face higher regulatory capital minimums than Basel I banks, with differences due to the way the two regulations treat reserves and gain-on-sale of securitized assets. During periods of normal economic conditions, this is not likely to have a competitive effect; however, during periods of substantial stress in credit card portfolios, Basel II banks could face a significant competitive disadvantage relative to Basel I banks and nonbank issuers.

JEL classification: G210, G280, D430

Keywords: Basel Accord, Basel II, capital requirements, bank regulation, competition

Competitive Effects of Basel II on U.S. Bank Credit Card Lending

1. Introduction

This paper analyzes the potential competitive effects of the proposed Basel II capital regulations on U.S. bank credit card lending. Under Basel II, a small number of large U.S. banking organizations would be required to use the advanced internal ratings-based (A-IRB) approach for credit risk and the advanced measurement approach (AMA) for operational risk. In addition to these "mandatory banks," it is expected that a relatively small number of mostly large U.S. banks are likely to "opt-in" to Basel II and use the A-IRB and AMA. However, the vast majority of other U.S. banks would continue to operate under the current Basel I capital rules.[1] The Basel I rules require the same minimum capital charge for all credit card exposures regardless of credit quality. In contrast, the Basel II rules are more risk sensitive with minimum capital requirements based on banks' internal estimates of the probability of default (PD), loss given default (LGD), and exposure at default (EAD).

The Basel II proposal raises questions about the competitive positions of banks adopting Basel II relative to banks remaining under the current capital regime and relative to nonbank rivals. Some bankers, particularly community bankers, have expressed concern that Basel II banks would face lower capital requirements for various products (including credit cards) and therefore have a competitive advantage.[2]

Basel II will generate competitive effects only if the regulatory capital constraint is *binding* (i.e., for a given portfolio, minimum regulatory capital requirements cause banks to hold more capital than they would hold in the absence of the requirement). A central component of our analysis will be to determine

[1] This paper considers the Basel II regulations as stated in the June 2004 Basel Committee Framework Agreement. The U.S. banking agencies have proposed modifications to the current capital standards that would increase the risk sensitivity of those standards. For the purposes of this paper, we assume that banks not adopting Basel II will operate under the current Basel I rules, and we will use the term "Basel II bank" to designate a bank operating under the A-IRB rules of Basel II, and "Basel I bank" to designate a bank not operating under A-IRB.

[2] See "Smaller U.S. Banks Say Basel Accord Unfair," Reuters News, June 22, 2004. This study uses the term "community bank" for banking organizations with assets of less than $1 billion. We use "regional bank" to refer to banking organizations with assets over $1 billion that operate in regions of the U.S. and not nationally or globally. Unless otherwise noted, the term "bank" will mean depository institution more generally.

whether regulatory capital requirements for credit card portfolios are currently binding or are expected to be binding under the proposed Basel II regime.

Three caveats to our analysis are noteworthy. First, the analysis is based on the *current* Basel II proposal, which has not yet been written into U.S. rules and is subject to revision as well as to changes in interpretation. Second, the analysis is based on the *current* Basel I rules, which may be modified before the effective date of Basel II. Third, our analysis focuses solely on the domestic U.S. credit card market. We do not consider the potential competitive effects on international credit card operations.

The remainder of the paper is organized as follows**:** Section 2 provides descriptive background on the most important features of the credit card industry. Section 3 describes the current and proposed regulatory capital framework. Section 4 lays out our analytical framework for assessing changes in regulatory capital standards. Section 5 analyzes whether regulatory capital requirements are currently binding or are expected to be binding under Basel II. Section 6 concludes and presents several likely reactions to the Basel II A-IRB framework that banks could have in response to the bifurcated capital regime.

2. Description of the credit card market

Credit cards are an extremely important asset class to commercial banks. As of June 30, 2004, managed credit card outstandings at U.S. commercial banks totaled $623 billon.[3] In addition, there was $3,085 billion in unused credit card lines in the commercial banking system. Charge-offs on credit cards totaled $3.3 billion or approximately half of all charge-offs in the commercial banking system on a year-to-date basis.

[3] Managed outstandings are defined as the sum of on-balance-sheet credit card loans, outstanding credit card receivables sold and securitized with servicing retained or with recourse or other seller-provided credit enhancements, and seller's interest in credit card securitizations held on balance sheet as securities. About half of credit card receivables are "on balance sheet" in the form of credit card loans, while about half are "off balance sheet." The figures are based on Call Report data as of June 30, 2004 for commercial banks. All figures in this paper are based on this source unless otherwise noted.

2.1. Market concentration

Although 1,982 commercial banks issued credit cards as of June 30, 2004, the top 10 issuing banking organizations (at the top holder level) manage approximately 93 percent of the $623 billion in commercial bank-managed credit card loans outstanding, while the top 20 issuers manage approximately 98 percent.[4] This is a higher level of concentration than for commercial banking overall, where the 10 largest banks in the U.S. held less than half of the U.S. banking industry's assets in 2004. Moreover, concentration of credit card lending is increasing. In 1990, the top 10 issuers held only 55 percent of the commercial bank credit card market; by 1998, this figure had grown to 76 percent.[5] More recently, Citigroup's purchase of the Sears portfolio, Bank of America's merger with Fleet, JP Morgan Chase's merger with Bank One, and Bank of America's purchase of MBNA have increased concentration in the credit card industry. Once these transactions are accounted for, the top 10 issuing banks will control nearly 95 percent of credit card loans managed by commercial banks.

2.2. Credit card specialty banks: independent and affiliated monolines

As of June 2004, there were 23 independent "monoline" credit card banks.[6] While some independent monoline banks (e.g., Capital One) are among the largest credit card issuers, most members of this group are small banks that concentrate almost all of their lending in credit cards (e.g., First National Bank of Marin, Direct Merchants Credit Card Bank, NA). Independent monoline banks account for 42 percent of credit card loans managed within the commercial banking industry.[7]

In addition to the 23 independent monoline banks, large diversified banking organizations typically place their credit card operations in a separate subsidiary with a separate bank charter.

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[4] There is no precise estimate of the amount of credit card lending outside of the banking system. Based on the Board of Governors of the Federal Reserve System G19 report, outstanding revolving consumer credit held at banks and nonbanks equaled $773 billion, as of June 2004. However, while the bulk of the revolving consumer credit number reported in the G19 report represents credit card debt, other types of debt are included. Nevertheless, we can say from the G19 report and the Call Report data that credit card debt managed by commercial banks represents over 80 percent of the credit card market.

[5] Historical data on market shares are based on the *Nilson Report* from various years.

[6] We define a monoline as a bank for which credit cards account for 50 percent or more of its managed loan portfolio. Independent monoline banks are institutions for which this definition holds at the highest holder level.

[7] This share has dropped substantially since 2004 mainly due to Bank of America's acquisition of MBNA, which was the largest independent monoline credit card bank.

Currently, 15 monoline banks that specialize in credit card lending are affiliated with diversified banking organizations (e.g., Citibank South Dakota, Bank of America USA, and BB&T Bankcard Corp). We refer to both the affiliated and independent monoline credit card banks as credit card specialty banks (CCSBs). CCSBs account for 84 percent of all managed credit card loans in the commercial banking system.

2.3. Community and regional banks

Community banks and most regional banks have largely exited the credit card market (BB&T and First National Bank of Omaha are notable exceptions among regional banks). Banks with assets under $1 billion, excluding independent monolines, account for 0.20 percent of managed credit card loans in the commercial banking industry, and most banks have no credit card loans. Of those community banks that have any credit card loans, the median bank in terms of credit card loans managed does not securitize credit card loans, and credit card loans are less than 0.36 percent of the median bank's total loan portfolio. This suggests there are important scale economies in the industry. Likewise, credit cards play a small role for most regional banks. Non-CCSB banks with assets over $1 billion but not meeting the criteria for having to use the A-IRB Basel II approach account for only 1.6 percent of all credit card loans managed by the commercial banking industry.

2.4. Nonbank issuers

Nonbank companies, such as Morgan Stanley, American Express, General Electric, and (until recently) Sears, are substantial competitors in the credit card industry. However, no major nonbank competitor in the credit card-issuing industry operates completely outside the banking system, since they have chosen to operate significant banking subsidiaries (e.g., Discover Bank, American Express Centurion Bank, GE Money Bank, and Sears National Bank, respectively). Furthermore, many private-label store and gas cards are operated within banking subsidiaries.

Two factors seem to be important in the banking industry's dominance of this market. First, Visa and MasterCard bylaws require firms issuing their cards to be depository institutions. Second, there appears to be a net regulatory benefit to issuing credit cards through a depository institution. This benefit is derived from banks' ability to export home-state consumer protection laws on credit card products (particularly usury laws) to customers in other states. But while many nonbanks issue credit cards through a bank affiliate, nonbanks can and do differ substantially from banking organizations in how much of their credit card portfolio is held within the banking system and therefore subject to bank capital regulations. For example, when Sears was in the credit card business, it managed virtually its entire credit card portfolio outside of the banking system, while Morgan Stanley manages approximately 6 percent of its credit card portfolio outside of the banking system.[8]

Banks do not enjoy any obvious informational or maturity-transformational advantages in credit card lending relative to nonbanks. Therefore, if the costs associated with regulatory capital requirements and other regulatory burdens at banks are greater than the benefits, we would expect to see credit card exposures increasingly being held by nonbanks. However, the opposite has occurred: Citigroup's recent acquisition of the Sears credit card portfolio transferred credit card assets from a nonbank to a banking organization.

2.5. Potential Basel II banks

Approximately 70 percent of credit card loans managed by commercial banks are currently managed by banks that are required to use the A-IRB Basel II approach under the proposed rule. Some major CCSBs would not meet mandatory Basel II standards under the current proposal but could choose to "opt in" to the Basel II approach. Smaller, independent CCSBs are expected to continue operating under current Basel I capital guidelines.

2.6. Funding strategies

Much of the funding of credit card operations comes from the wholesale market (uninsured borrowing from sophisticated lenders) rather than traditional deposits. Approximately 60 percent of all credit card loans originated by commercial banks are funded off balance sheet in the form of the investors' interest in credit card asset-backed securities (CC-ABS). Credit card securitization occurs

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[8] Sears National Bank originated MasterCard credit cards – providing the interest rate advantage of banking and the ability to use the MasterCard logo and system – but each night the loan balances were transferred to the parent corporation to avoid bank regulatory burdens. At any given moment, Sears National Bank's credit card balances were negligible, despite the fact that Sears, Roebuck Corporation managed a $30 billion credit card portfolio.

almost exclusively among the largest issuers and some smaller monoline banks.[9] Even among the largest issuers the amount of securitization can vary, as indicated by the figures in column 3 of Table 1 reporting the ratio of off-balance-sheet credit card receivables to total credit card receivables for a sample of large CCSBs used in our regression analysis below.

3. Description of the regulatory capital regimes

Both Basel II and the current Basel I capital regimes prescribe minimum regulatory capital levels for banks as determined by two ratios: the ratio of tier 1 capital to risk-weighted assets and the ratio of total capital (tier 1 + tier 2) to risk-weighted assets. In general, tier 1 capital comprises funds that protect the bank against insolvency (e.g., equity), while tier 2 capital comprises additional funds that protect the FDIC insurance fund from losses (e.g., preferred stock, subordinated debt). Under both regimes, the minimum regulatory standards are 4 percent and 8 percent for the tier 1 and total capital ratios, respectively. However, the two regimes calculate risk-weighted assets and regulatory capital differently.

3.1. Current regulatory framework

3.1.1. Calculation of risk-weighted assets. To calculate risk-weighted assets it is convenient to think of credit cards in three pieces: outstandings held on balance sheet, the differences between the maximum credit line and the outstanding balance (e.g., the ”open to buy” or undrawn credit lines, which are recorded as unused commitments in the Call Reports), and credit cards funded off balance sheet through securitizations. Under current Basel I capital rules, on-balance-sheet credit card loans are assessed a 100 percent risk-weight and, thus, a 4 percent tier 1 and an 8 percent total risk-based capital requirement. Undrawn credit card lines are not assessed a capital charge.

The “investors’ interest” in credit card asset-backed securities (CC-ABS) is treated as a sold asset and, therefore, has zero risk-based capital requirements. However, the “seller’s interest” in CC-ABS – the seller’s share of the receivables in the pool – is typically recorded on the selling bank’s balance sheet. Thus, seller’s interest has the same risk-based capital requirements as other on-balance-sheet loans (i.e., 4 percent tier 1 capital and 8 percent total capital).

[9] Appendix 1 in Lang, Mester, and Vermilyea (forthcoming) provides details on the mechanics of CC-ABS.

3.1.2. Calculation of capital: the treatment of expected losses, reserves, and capital deductions related to CC-ABS. The Basel I regime measures capital held against *all* losses (both expected and unexpected). Thus, the allowance for loan and lease losses (ALLL) is included as a component of tier 2 capital subject to the restriction that the ALLL included as capital not exceed 1.25 percent of a bank's risk-weighted assets. This reserve cap is calculated for the bank's entire portfolio and is not calculated separately for each asset type.

Credit card securitizations typically generate a variety of *residual interests* in the securitization, including the gain-on-sale generated by the sale of credit card receivables to the special-purpose trust, spread accounts, and cash collateral accounts. Almost all residual interests in credit card securitizations are effectively subject to dollar-for-dollar capital deductions, with half of the deductions coming out of tier 1 and half of the deductions coming from tier 2 capital.[10]

3.2. The Basel II A-IRB framework

3.2.1 Calculation of risk-weighted assets. Under Basel II, banks will calculate risk weights using the A-IRB approach. In the A-IRB approach, risk weights for on-balance-sheet credit card exposures are a function of the probability of default (PD), loss given default (LGD), and exposure at default (EAD), all of which the bank provides based on its own internal estimates. To calculate these estimates, a Basel II bank must allocate its credit card portfolio into segments with homogeneous risk characteristics and then estimate the PD, LGD, and EAD associated with each segment. These internally estimated parameters then generate a regulatory capital requirement based on a "risk-weight" function for qualifying revolving retail exposures (QRREs) developed by the Basel Committee. QRREs include most unsecured revolving lines of credit (e.g., credit card and overdraft protection portfolios).[11]

A key regulatory factor entering the risk-weight function is the asset value correlation (AVC), which reflects the correlation of losses among the assets within a given asset class (e.g., QRREs,

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[10] Technically, the current rules require banks to account for residual interests by augmenting their risk-weighted assets rather than through a capital deduction. However, the method for converting residual interests into risk-weighted assets has the same effect on effective minimum capital requirements as a deduction from the capital level.

[11] To qualify for QRRE treatment under Basel II, credit card portfolios need to demonstrate "low volatility." However, currently there are no concrete criteria for determining low volatility, and so, for the purposes of this paper, we assume that all consumer credit card exposures will be considered under the QRRE risk-weight function.

commercial and industrial loans, mortgage loans). A high AVC indicates that losses among the assets tend to move together, so that losses during a stress period will likely be large relative to the average loss. A low AVC indicates that losses tend not to move together, so that losses during a stress period tend to stay closer to the average loss rate. Since regulatory capital is meant to serve as a buffer in a stress period, a higher AVC indicates higher required capital, other things equal. The AVC for credit card portfolios is set at 4 percent under the current Basel II proposal.[12]

The risk weight for QRREs, RW, is calculated according to the following formula:

$$RW = 12.5 \times \left[\left(LGD \times N\left(\frac{N^{-1}(PD) + \left(\sqrt{AVC} \times N^{-1}(0.999)\right)}{\sqrt{1 - AVC}} \right) \right) - \left(LGD \times PD \right) \right].$$

N(·) and N^{-1}(·) represent the normal cumulative distribution function and its inverse. The value of 0.999 in the term $N^{-1}(0.999)$ reflects the choice of the 99.9th percentile value as the solvency standard for the minimum regulatory capital requirement, which is consistent with a bond rating in the BBB+ to A− range.

To calculate risk-weighted assets (RWA), the bank multiplies the risk weight (RW) by exposure at default (EAD), i.e., RWA = RW × EAD. The total minimum regulatory capital required under Basel II, then, is K = 0.08 × RWA = 0.08 × RW × EAD, and so required capital per dollar of exposure at default is k ≡ K / EAD = 0.08 × RW. [13]

In contrast to the existing Basel I rules, Basel II requires capital for the risks associated with unused credit card commitments – the so-called “open-to-buy.” This charge is introduced through the bank’s internal estimate of EAD. To determine EAD, the bank estimates the level of additional outstanding balances it expects if accounts were to default over the following year. These estimated increases in balances are then included in the bank’s overall estimate of EAD. The ratio of expected

[12] This is small compared to the AVCs for other assets, e.g., 15 percent for residential mortgages and 12 percent or more for large corporate loans.

[13] Note that K/EAD is equal to the term in the square brackets in the RW equation. Because the regulatory capital requirement is intended to cover *unexpected losses*, expected losses (= LGD × PD) are subtracted in the formula.

future drawdowns in the event of default to the amount of the open-to-buy is often referred to as the "loan equivalence" (LEQ) of the open-to-buy.

Thus, Basel II introduces an effective capital requirement for the open-to-buy that depends on the amount of the open-to-buy, the bank's estimate of LEQ, and the other Basel II risk parameters (PD, LGD) associated with the exposures. Because total unused credit card commitments exceed $3 trillion at banks (nearly five times total managed assets), even a small effective capital charge on the open-to-buy can have a significant effect on minimum required regulatory capital.

In contrast to Basel I, Basel II would also subject banks to a potential capital requirement for the investors' interest in CC-ABS. This potential capital requirement includes an amount equal to the product of: (a) the Basel II capital requirement against both the drawn amount and the open-to-buy if the loans were held on balance sheet and (b) a credit conversion factor (CCF) that depends on the trust's three-month average excess spread relative to deal-specific trapping points.[14]

These CCFs are:

Trust's Excess Spread[15]	**Credit Conversion Factor (CCF)**
≥ 133.33 percent of trapping point	0%
< 133.33 to 100 percent of trapping point	5%
< 100 to 75 percent of trapping point	15%
< 75 to 50 percent of trapping point	50%
< 50 percent of trapping point	100%

Note that the CCF is 15 percent or less as long as the excess spread is at least 75 percent of the trapping point. An excess spread as low as 75 percent of the trapping point generally indicates that a card issuer is experiencing serious credit quality problems in the credit card receivables that have been securitized.

[14] Excess spread is the interest payments and other fees received on the assets in the pool of securitized assets less the interest payments made on the asset-backed securities, plus expenses, including the fees paid to service the assets. The trapping point is a predefined level of excess spread below which excess spread is no longer paid to the issuer but is instead held (i.e., "trapped") in escrow as a form of credit enhancement.

[15] These are the credit conversion factors for "noncontrolled" early amortization provisions. Credit conversion factors for controlled early amortizations are considerably lower. A key feature of the definition of a controlled early amortization is that during the early amortization, there are no disproportionate payouts to the investors based on the bank's and investor's relative share of the receivables outstanding at the beginning of each month. In addition, investors must be at risk for a large percentage share of their ownership interest at the start of the early amortization.

3.2.2. Calculation of capital: the treatment of expected losses, reserves and capital deductions related to CC-ABS. There are several important differences between the Basel II rules and Basel I rules with respect to the measurement of regulatory capital. The Basel II regime defines capital as a cushion against *unexpected* losses and not against all losses as in Basel I. Thus, under Basel II, expected losses (calculated as PD × EAD × LGD) are deducted from total capital. This change in the concept of capital is particularly important for credit cards, since expected losses on credit cards are approximately 10 times higher than those on other bank loan products. Thus, a large component of the impact of Basel II on effective capital requirements comes from the deduction of expected loss from total regulatory capital and the treatment of the allowance for loan and lease losses (ALLL), which is meant to offset the bank's expected losses.

The impact on minimum capital requirements of a change to Basel II rules from Basel I rules will differ depending on the organizational form of the issuing bank, namely, whether the issuer is a monoline credit card bank or whether it is part of a diversified banking organization. Under both Basel I and Basel II, the ALLL effectively counts as tier 2 capital up to a limit.[16] Basel I caps eligible ALLL at 1.25 percent of RWA, while Basel II caps eligible ALLL at expected losses plus 0.6 percent of RWA. Since large credit card lenders typically experience expected loss rates of around 5 or 6 percent of outstanding credit card loans, a bank's ALLL allocated to credit card lending is typically well above the Basel I cap. In contrast, the ALLL allocated to credit card activities would be less than the Basel II cap. But the cap on eligible reserves is calculated based on the bank's entire portfolio, not product line by product line, and most diversified banks are able to count all of their reserves as capital under Basel I. Many monoline credit card banks, on the other hand, hold a large amount of reserves that currently do not count as capital under Basel I, but that would count as capital under Basel II. Thus, the reserve cap provision of Basel II provides effective capital relief for those monoline credit card banks that are currently constrained by the cap but less so for issuers within diversified banking organizations. The extent of this benefit will also

[16] Technically, the ALLL is a component of tier 2 capital under Basel I while the ALLL provides a dollar-for-dollar offset to the deduction of expected losses under Basel II. This distinction has no real economic impact, since a marginal dollar in the ALLL increases tier 2 capital by a dollar under both regimes. For simplicity, we will ignore this technical distinction in the text of the paper.

depend on the rate of securitization. Higher levels of securitization, all else equal, will lower this relative benefit of Basel II over Basel I. This is because under Basel I securitized credit cards generate a higher RWA without increasing the ALLL, thus increasing reserves counted as capital under Basel I.

The ALLL and expected losses also affect the definition of tier 1 capital under Basel II but not under Basel I. If eligible reserves are less than expected losses, then half of the reserve shortfall is deducted from tier 1 capital. This shortfall is calculated based on a bank's entire portfolio and not product by product. Whereas bank reserves allocated to credit card loans are typically less than expected losses, reserves often exceed expected losses for many other bank products. Thus, Basel II monoline credit card banks would typically have a substantial tier 1 capital deduction due to the reserve shortfall, while most diversified banking institutions would not have a tier 1 deduction, since the surplus reserves in other portfolios will offset the reserve shortfall in the credit card portfolio. Thus, under Basel II, monolines benefit with respect to total capital because of the reserve cap provision but issuers within diversified banking organizations benefit with respect to tier 1 capital because of the treatment of the reserve shortfall.

The Basel II rules also introduce a new approach to the treatment of the gain-on-sale, which is part of the bank's residual interest generated by CC-ABS. Under Basel II, the gain-on-sale is deducted *solely* from tier 1 capital. Under Basel I, the effective deduction from total capital is the same, but a bank would typically deduct *half* of the gain-on-sale from tier 1 capital and the other half from tier 2 capital. Other residual interests, such as the portion of an interest-only strip that does not represent a gain-on-sale, would continue to be deducted half from tier 1 capital and half from tier 2 capital in both regimes.

4. Analytical framework for assessing minimum regulatory capital standards

Regulatory capital minimums are threshold levels required by regulators to protect against bank insolvency as well as to protect against losses to the deposit insurance fund. Failure to maintain capital above regulatory thresholds leads to penalties and possibly to bank closure. In contrast, *economic capital* refers to the optimal level of capital that maximizes shareholder value in the absence of regulatory capital requirements.[17] This optimal level of capital for a bank operating free of regulatory constraints will incorporate capital's effect on the cost of liquidity, the expected costs of bank financial distress, and the ease of forcing borrower repayment (Diamond and Rajan, 2000).

In the absence of capital regulation, by holding a capital level above economic (i.e., optimal) capital a bank reduces its value by holding "too much" expensive capital financing relative to lower cost debt financing. By holding a capital level below economic capital, a bank reduces its value by raising the market cost of equity and debt finance or by increasing the expected costs of financial distress. Since market prices for equity and debt financing are based on market perceptions of bank risk, our concept of economic capital implicitly incorporates distortions that may occur when markets have imperfect information about the riskiness of a bank's portfolio.

Healthy banks typically hold a substantial buffer of capital over and above regulatory minimums. One possible explanation for this substantial stock of buffer capital is that regulatory constraints are well below economic capital levels and therefore have no effect on capital decisions. In that case, the regulatory constraint would be nonbinding in that the bank would not change its capital level in response to a marginal increase in the minimum regulatory capital requirement.

However, an alternative explanation for the observed buffer stock of capital is that regulatory constraints are binding and that bank managers maintain a buffer to avoid the regulatory penalties associated with breaching the minimums or the higher regulatory costs that a bank may incur if it is believed to be in danger of breaching the minimums. These actual or potential regulatory costs will also be factored into market pricing of the bank's debt and equity. Thus, the value-maximizing level of capital *in the presence of regulatory minimums* may be higher than economic capital even if economic capital exceeds the regulatory minimums.

4.1 The influence of regulatory capital minimums on bank capital: a simple model

To illustrate this analytical framework, we construct a simple model of the demand for capital in the presence of required regulatory minimums. The model assumes that in the absence of bank regulation

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[17] For ease of exposition, we assume that bank managers maximize shareholder value and that there are no agency problems that cause bank managers to take actions to promote their own welfare at the expense of shareholder value.

there exists an optimal capital structure given a bank's set of activities.[18] That is, there exists a unique level of economic capital conditional on a bank's portfolio. This assumption is reasonable, since on the margin a decision to increase capital balances the tradeoff between the higher cost of equity finance versus the benefits of lowering the interest rate on debt and lowering the costs of expected financial distress. Appendix 2 in Lang, Mester, and Vermilyea (forthcoming) gives a full description of the model and proofs of results.

Let k = the level of bank capital, k^* = the level of economic capital, k_m = the regulatory minimum level of capital requirement,[19] and $v(k)$ = bank value as a function of k. By assumption, $v''(k) < 0$, so there is a unique value, k^*, that maximizes $v(k)$. In the absence of regulatory minimums, banks would choose to hold k^*. However, in the presence of regulatory minimums, there are costs associated with holding low levels of capital relative to the regulatory requirements. These costs include the expected costs of falling below the minimum, as well as costs associated with increased regulatory scrutiny, criticism, or constraints imposed by regulators when capital falls to a level close to the regulatory requirement. Assume that the costs imposed by holding a capital level near the regulatory minimum are higher the closer the capital level is to that regulatory minimum and that there are no costs if the capital level is sufficiently above the minimum, i.e., $\exists\gamma$ such that there are no costs if $k > k_m + \gamma$. Let the bank's loss-minimizing choice of capital level be $\hat{k}$. Then as shown in Appendix 2 of Lang, Mester, and Vermilyea (forthcoming), if $k^* > k_m + \gamma$ then $\hat{k} = k^*$ and the minimum capital requirement is nonbinding (i.e., $d\hat{k} / dk_m = 0$), and if $k^* \leq k_m + \gamma$ then $k^* < \hat{k} \leq k_m + \gamma$ and the minimum capital requirement is binding (i.e., $d\hat{k} / dk_m > 0$).

Figure 1 displays graphically the model's results for the relationship between actual bank capital, economic capital, and regulatory capital minimums when holding the bank's portfolio constant. If the capital requirement is sufficiently low (less than k_b in the graph) relative to economic capital, then

[18] While this violates the well-known Modigliani-Miller Theorem that firm value is independent of capital structure, there is now a voluminous literature generating an optimal capital structure based on different violations of the Modigliani-Miller Theorem's assumptions.

marginal changes in the regulatory capital minimum have no effect on actual capital and the capital requirements are nonbinding.[20] For given k^* and γ, this value of the regulatory minimum at which the capital requirement is just binding is given by $k_b = k^* - \gamma$. The capital requirements become binding once capital requirements exceed k_b, but initially the marginal effect of changes in the capital requirements is small. As capital requirements increase, the marginal impact of an increase in capital requirements on actual capital rises.

If the regulatory capital requirement for an individual bank product line is binding, the bank has the incentive to reduce the amount of that product in its portfolio and increase its investment in products for which the regulatory capital requirement is not binding. All else equal, the economic capital ratio for an asset declines as the credit quality of the asset increases. The Basel II approach attempts to reduce regulatory distortions that may discourage banks from holding relatively safe assets when regulatory minimums are high relative to economic capital. Misalignment of regulatory capital with economic capital may also encourage banks to engage in costly "capital arbitrage" activities that reduce regulatory capital requirements without reducing the underlying risk of an activity.

Looking ahead, we will argue that the current Basel I capital requirements are not binding for most credit card portfolios.[21] We will also argue that Basel II requirements generate an increase in regulatory minimum capital requirements. The central issue in the paper then becomes whether the higher Basel II requirements are binding (implying a need for the affected bank to raise additional capital) or nonbinding (in which case competitive effects would not exist). Our empirical results suggest that the Basel II requirements could become a binding constraint, particular in periods of stress in the credit card market. Thus, the switch to Basel II might have a competitive effect, but not the one feared by banks that would remain under the Basel I requirements. That is, credit card lending at Basel II banks might be at a

[19] Note that since the bank's portfolio is given, writing the minimum capital requirement in levels is equivalent to writing it as a percentage of assets or risk-weighted assets.

[20] As discussed above, theoretically it is possible for regulatory capital requirements to be binding for any positive requirement. However, the economic impact of the constraint becomes negligible when economic capital far exceeds regulatory requirements.

competitive *disadvantage* (not at a competitive advantage) relative to credit card lending at Basel I banks.

5. Are regulatory capital requirements a binding constraint?

We now address the question of whether regulatory capital requirements are binding for large credit card portfolios under each of the capital regimes.

5.1. Are current (Basel I) rules binding for credit card banks?

Evidence suggests that the Basel I minimum capital standards are probably nonbinding for most credit card banks. First, credit card specialty banks (CCSBs) maintain capital levels far in excess of current minimum regulatory capital requirements. Summing across all CCSBs as of June 30, 2004, the aggregate equity capital-to-assets ratio is 17.7 percent. Similarly, the tier-1-to-total assets ratio for all CCSBs is 15.7 percent. Table 1 shows the capital ratios for the large CCSBs used in our regression analysis described below. These ratios far exceed regulatory minimums, suggesting that regulatory standards might not be a binding constraint for these banks. Figure 2 shows the distribution of the total capital to risk-weighted assets ratios, weighted by managed assets, for the CCSBs in our sample in the top panel and for the non-CCSPs in our sample in the bottom panel. As shown there, the CCSBs' ratios tend to be higher and comfortably above prevailing regulatory requirements. Indeed, this ratio at CCSBs has been rising over time even as the rate of securitization of bank credit card loans has been rising. In contrast, the asset-weighted equity-to-managed-asset ratio has been relatively stable over this period. This is consistent with the view that market participants (e.g., rating agencies) assess the capital position of a bank using managed assets rather than assessing the capital-to-on-balance-sheet asset measures underlying the Basel I regulatory minimums. Indeed, the major U.S. bond rating agencies add all or a substantial portion of assets held in CC-ABS back onto the balance sheet when evaluating the capital position of major issuers.[22]

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[21] For ease of exposition, we will use the term binding or not binding in the rest of the paper. More accurately, we are considering cases where the regulatory constraint has a significant impact versus cases where the regulatory constraint has a zero or negligible impact.

[22] See Moody's Report: "Securitization and Its Effect on the Credit Strength of Companies" (2002); Fitch Report: "Basel II Securitization Proposals: Primer and Observations" (2003); and S&P Credit Week: "Substance, Not Form, of Securitizations Drives Leverage Analysis" (2002).

To investigate this issue more fully, we examine the factors that determine capital holdings at CCSBs using multivariate regression analysis to control for factors affecting the desired capital ratio. The sample used for our empirical analysis is a cross-section comprising commercial and industrial banks with BIF or SAIF insurance (i.e., all institutions that file a Report of Condition and Income, the so-called bank Call Report) that have been in existence since June 1996. Unless specifically stated otherwise, the data are as of June 30, 2004. Since it is unlikely that small banks will opt in to Basel II, we restrict our sample to banks with total managed assets over $1 billion. To create an appropriate peer group for CCSBs, which by definition are primarily lending institutions, we restrict our sample to banks with a managed-loan-to-managed-asset ratio at or above 60 percent. We also delete from our analysis a small number of outliers with very high equity-capital-to-managed-asset ratios (above 25 percent).[23]

These selection criteria produced a final sample of 275 banks. Table 2 shows difference-in-means tests for the relevant variables for the noncredit card banks versus the credit card banks included in the sample. As shown, on average, credit card banks generally have significantly higher capital-to-total-asset ratios than noncredit card banks, and they tend to be larger in size.[24]

We regress several measures of capital adequacy on various controls reflecting the demand for capital using ordinary least squares and use one of the Davidson and MacKinnon (1993) adjustments of the standard errors to account for potential heteroscedasticity in the error term.[25] Table 3 reports the regression results when the dependent variable is equity capital-to-total assets, equity capital-to-risk-weighted assets, or equity capital-to-managed assets (where managed assets are total assets plus

[23] There were four such outliers. Including them in the analysis yields results qualitatively similar to those obtained when the outliers are excluded.

[24] Our results are qualitatively similar when we test for difference-in-medians rather than difference-in-means.

[25] We use the Davidson and MacKinnon (1993) adjustment of the covariance matrix of the estimated parameters, $(X'X)^{-1}(X'\hat{\Omega}X)(X'X)^{-1}$ where $\Omega \equiv$ diagonal matrix with $\frac{n}{n-k}e_t^2$ on the diagonal, where e_t is the estimated regression error, that is, $e_t = y_t - x_t\hat{\beta}$, n = number of observations and k = number of explanatory variables. This adjustment has been shown to have better small-sample properties than the White (1980) heteroscedasticity-consistent covariance estimator.

outstanding credit card assets sold and securitized with servicing retained or with recourse or other seller-provided credit enhancements).[26, 27]

Each of the capital ratios is regressed on several variables that are possible determinants of a bank's desired capital ratio. Since economic capital is increasing in risk, higher volatility of earnings could generate a higher desired capital ratio, other things equal. We measure the volatility of earnings by the coefficient of variation of return on equity (ROE), which is the standard deviation in ROE divided by mean ROE. The mean and standard deviation of ROE were calculated over the period 1992 to 2003 using quarterly data. We also controlled for total asset size (in billions) and total asset growth from December 31, 2000 to December 31, 2003 (we exclude 2004 from our estimates of the coefficient of variation and growth variables to avoid endogeneity problems). To control for potential nonlinear effects of size and growth, we include asset-size squared and asset-growth squared. Finally, we include an indicator variable for CCSBs (as defined above).

The regression results in Model 1 of Table 3, in which the dependent variable is the equity-capital-to-asset ratio, indicate that the coefficients of variation of ROE, asset size, and growth are highly significant predictors of the capital ratio and have the expected sign (although the main explanatory power comes from the constant term and CCSB indicator variables). Variability of ROE and more rapid growth are associated with higher capital ratios, while larger banks have lower capital ratios, all else equal. Model 1 shows that the sharp differential between capital levels held by CCSBs and other banks is not completely attributable to differences in earnings volatility, growth rates, or asset size. Even after

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[26] While equity capital is not used to determine compliance with regulatory standards, we include the equity capital ratio in our analysis, since many market analysts concentrate on equity capital when measuring a firm's capital adequacy. The managed assets denominator in the last ratio is not used for regulatory calculations under the current or proposed risk-based capital rules or under prompt corrective action guidelines. Still, we look at this ratio because the rating agencies and other market participants often state that they analyze the risk of credit card operations based on the managed portfolio. Appendix 3 in Lang, Mester, and Vermilyea (forthcoming) reports results for total capital ratios and for tier 1 capital ratios. The results are similar to the ones discussed here. We also ran regressions for the tier 1 leverage ratio with results similar to the equity-to-assets ratio. These results are available from the authors upon request. The equity-to-assets ratio allows for a more straightforward computation of an equity-to-managed assets ratio for comparison with risk-based ratios.

[27] Flannery and Rangan (2006) study nonfinancial firms and provide evidence that they pursue a target level of capital and that when hit with a shock that takes its capital ratio away from target, the mean firm in the sample acts to close 30 percent of the gap per year. Our empirical work abstracts from the dynamics of changes in banks' capital ratios.

controlling for these factors, CCSB capital ratios are, on average, around 9.6 percentage points higher than the equity capital ratio at other commercial banks.

The results for Model 2, in which the dependent variable is equity-capital-to-managed assets, also show highly significant coefficients with the expected sign for earnings volatility, growth, and size. However, when we replace the equity-capital-to-asset ratio with the equity-capital-to-managed-assets ratio as the dependent variable, the coefficient on the dummy variable for credit card banks is not significantly different from zero. In other words, CCSBs' equity-capital-to-managed-assets ratios are statistically indistinguishable from those of other banks. Taken together, these regression results suggest that actual capital levels at CCSBs are more closely tied to total managed credit card assets than to on-balance-sheet credit card assets (on which the current Basel I capital requirements are based).[28] When we measure the capital ratio with respect to risk-weighted assets in Model 3, we get similar qualitative results with estimated "extra" capital-to-risk-weighted assets held by CCSBs of 6.2 percentage points.[29]

We conducted several robustness checks of our specification. To test whether our results are due to regulatory actions that may have disproportionately affected capital ratios at CCSBs, we estimated our regression models including an indicator variable for whether a bank operated under a regulatory enforcement action at any time from January 2000 through June 2004 (we allowed the coefficient on this variable to differ for credit card and noncredit card banks). To test whether our results were due solely to the subprime CCSBs in our sample, we reestimated our regressions with an indicator variable for CCSBs with an average annual charge-off rate from 2000 to 2003 above 7 percent.[30] We repeated our analysis,

[28] Note that when the dependent variable is the ratio of equity-capital-to-assets, the adjusted R^2 is 0.3944, but it drops to 0.1057 when the dependent variable is the ratio of equity capital to managed assets. This is because CCSBs are large outliers compared with the other banks with respect to the equity-capital-to-assets ratio. Thus, when we include the CCSB dummy variable in the regression (Model 1), we are capturing much of the variation. But CCSBs are not large outliers compared with the other banks with respect to the equity-capital-to-*managed*-assets ratio. The CCSB variable is not of much help and the R^2 falls. To verify this, we regressed the equity-capital-to-assets ratio on all the explanatory variables except the credit card bank indicator and obtained an R^2 of 0.0535, similar to the R^2 of the regression with the equity-capital-to-managed-assets ratio as the dependent variable.

[29] Note that the means shown in Table 2 similarly suggest that the difference between CCSBs' and non-CCSBs' capital-to-risk-weighted-assets ratios is smaller than the difference between their capital-to-total-assets ratios.

[30] The bank's average charge-off rate is calculated as the average from 2000 to 2003 of the ratio of the bank's net charge-offs for the year to the bank's average total loans for the year.

adjusting for mergers that have occurred among the banks in our sample. To avoid potential endogeneity in the coefficient of variation of return on equity, we reran the regressions measuring earnings volatility with the coefficient of variation in return on assets. To test whether anticipation by mandatory A-IRB banks of Basel II led these banks to hold higher capital ratios, we reran the regressions including a dummy variable equal to one for banks in the sample that are currently expected to be mandatory A-IRB banks and zero otherwise. There were 16 mandatory A-IRB banks in the sample, 8 CCSBs and 8 non-CCSBs. (All of these results are available from the authors.) In all cases, our findings on the differences in capital ratios between CCSBs and other banks are very similar to the ones reported here. The A-IRB dummy variable was insignificant in the regressions.

These regression results suggest that *actual* capital ratios at CCSBs far exceed current *minimum* regulatory requirements and far exceed capital ratios at other banks after controlling for risk and growth. CCSBs appear to be responding to market pressures to maintain an adequate capital-to-managed-assets ratio.[31] These regression results combined with Figure 2 suggest that CCSBs are unlikely to respond to marginal changes in regulatory capital However, if Basel II results in a large increase in the regulatory minimum capital requirements, then those regulatory minimums could become a binding constraint with Basel II banks increasing their actual capital levels. We turn to this possibility in the following sections.

5.2. Basel II capital requirements with a zero CCF for the investors' interest in securitized receivables

In this section, we use Call Report data and proprietary data from CCSBs to estimate the quantitative change in capital requirements for credit card activities when a bank shifts from Basel I requirements to Basel II capital requirements, assuming a zero CCF for the investors' interest in CC-ABS. A positive CCF should be a significant factor when the portfolio is under stress, and we discuss the effects of the CCF rule in the next section.

We first discuss our estimates of the change in the minimum regulatory total capital requirement from switching to Basel II from Basel I requirements; we then discuss the tier 1 requirement. As already

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[31] Calomiris and Mason (2003) offer further empirical evidence that the level of capital at CCSBs is driven primarily by total managed assets. They show that credit card banks reduce their capital holdings, on average, only about 0.04 percent for each additional percentage point of their portfolio moved off balance sheet.

discussed, Basel II not only changes the calculation of risk-weighted assets, but it also changes how regulatory capital is defined. The changing definition of capital under Basel II requires determining an appropriate "apples-to-apples" comparison of the Basel II requirements to the Basel I requirements.[32]

5.2.1. Basel II total capital requirements. As discussed above, the Basel II total capital requirement for retail credit card assets comprises five components.

1. The Basel II measure of unexpected loss (UL) for on-balance-sheet outstanding balances (this includes the seller's interest in securitized receivables) and the UL associated with undrawn lines of credit associated with those outstanding balances. UL is based on the Basel II risk parameters (PD, LGD, EAD), and risk-weighted assets is equal to 12.5 times the estimated UL capital requirement;
2. Capital deductions for expected loss (EL), including any EL associated with the seller's interest in securitized receivables and the undrawn lines apportioned to the seller's interest;
3. Capital deductions for residual interests in securitized receivables (e.g., interest-only strips, cash collateral accounts);
4. Adjustment for the changing definition of eligible loan loss reserves to be counted as capital;
5. Potential capital requirements arising from a positive CCF associated with the investors' interest in securitized receivables, including the investors' interest proportionate share of undrawn lines (there is no assessment for this under Basel I rules).

We estimated the UL component of the Basel II capital requirement using proprietary estimates of PDs, LGDs, and EADs from large, nationally diversified credit card lenders for their outstanding balances and undrawn lines of credit.[33] We then calculated Basel II risk-weighted assets, which is 12.5

[32] Appendix 4 in Lang, Mester, and Vermilyea (forthcoming) provides a detailed description of the components of the Basel II requirements and our method for comparing the Basel II requirements to the Basel I requirements.

[33] Banks providing these estimates were aware of the existing proposals for implementing Basel II in the U.S. and the proposed supervisory guidance. Credit card portfolios were primarily segmented using credit score buckets. PDs were based on historical averages of default rates using the regulatory definition of default for credit card exposures, which is chargeoffs plus loans past due 180 days or more. As one would expect for most unsecured credits, LGDs were very high and did not vary much across institutions. EAD estimates included the outstanding balances on credit card exposures plus the expected utilization of undrawn lines of credit for accounts that would default over the next year.

times Basel II UL capital, and calculated the ratio of Basel II risk-weighted assets to the bank's current Basel I risk-weighted assets; for the representative bank, this ratio turned out to be 94.6 percent.[34] Given this 94.6 percent ratio and the value of Basel I risk-weighted assets for each CCSB used in our regression analysis, we estimated each bank's risk-weighted assets under Basel II.[35]

We estimated the capital deductions for EL and for residual interests in credit card securitizations using the CCSBs' Call Report data. EL is estimated by the average lagged charge-off rate from June 2002 to June 2004. The lagged charge-off rate is the current level of charge-offs divided by outstanding balances one year prior, and this measure is commonly used in the industry to measure average loss rates. Data on capital deductions for residual interests in CC-ABS were taken directly from the Call Report. The Call Report contains data on a bank's total capital deductions for residual interest in securitizations.[36] Most CCSBs securitize only credit cards, but some securitize other loans. Where a CCSB securitizes noncredit card loans, deductions for credit cards are apportioned based on the relative amount of residual interest in credit card versus noncredit card securitizations.

The first column of Table 4, Panel A reports the average, the minimum, and the maximum estimates across our sample of credit card specialty banks for the percentage change in total required capital under Basel II vs. Basel I rules, assuming that all of the bank's reserves count as capital under both the Basel I and Basel II rules, i.e., that neither cap is binding.[37] Our calculations indicate a very large average increase in total required capital under the Basel II approach of 44.3 percent. The minimum increase for our sample banks was 19.1 percent, while the maximum was 67.0 percent.[38]

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[34] The bank data are from 2002, a period in which charge-off rates on credit cards were quite high, around 7 percent (compared to an average charge-off rate of 5 percent between 1994 and 2003). Thus, we believe our bank estimates reflect relatively high PDs and relatively high estimates of Basel II risk-weighted assets.

[35] We exclude Providian National Bank from this analysis because it has a very different risk profile from the other CCSBs in our regression model.

[36] Charge-offs and capital deductions for residual interests are reported on an aggregate bank level. For a few CCSBs, it was necessary to estimate the proportion of EL and capital deductions for residual interest that was due to the bank's credit card activities.

[37] The average estimates are unweighted bank averages. Weighting by assets does not make a substantial difference.

[38] Our estimates are changes in the "all-in" capital requirements for a bank's credit card activities, including capital deductions for securitization residuals. Since the effect of CC-ABS residuals on minimum required capital is roughly unchanged under Basel II compared to Basel I, the rate of increase in the all-in capital requirement under Basel II is smaller than the increase in the capital requirement for on-balance-sheet credit card loans. Our estimates

5.2.2. Calculating "eligible" reserves to be counted in total regulatory capital. Under Basel II, reserves are counted as capital up to the sum of EL plus 0.6 percent of risk-weighted assets. This calculation is done for the bank's entire risk-weighted portfolio rather than a separate calculation for each asset type; thus, the effective marginal regulatory capital requirement for the exact same activity can differ across banks regardless of which capital regime they operate under. As discussed above, in general, monoline credit card banks can count significantly more of their reserves as capital under Basel II than under Basel I; for diversified holding companies with credit card subsidiaries, there is less of a difference under the two capital regimes.[39]

Because of the complexities associated with calculating eligible reserves, we provide bounds on the estimated effect on required capital of a shift from Basel I rules to Basel II's A-IRB rules rather than precise estimates. Our bounds are derived by analyzing polar cases. The first case is where there is little difference in eligible reserves between Basel I and Basel II, i.e., we assume that neither cap is binding. This would more likely apply to the diversified holding company with a credit card bank subsidiary and you will recall that our estimate of the increase in total capital requirements under Basel II assuming no binding cap on reserves equaled 44.3 percent for the managed credit card portfolio (as shown in column 1 of Table 4, Panel A). The second case is where the change from Basel I to Basel II has a large effect on the amount of reserves that can be counted as capital. This would more likely apply to a monoline credit card bank. In this case (as shown in column 2 of Table 4, Panel A) the estimated increase for the average CCSB would be reduced to 23.6 percent.

(which are not reported in the table) indicate that Basel II raises the capital requirements for on-balance-sheet credit card loans by 67.5 percent. While the all-in charge is, in our view, the relevant measure when analyzing competitive effects, our estimates show that the change in the all-in requirement depends importantly on a bank's rate of securitization, and, other things equal, banks that securitize less will see larger increases in required capital. This suggests that incentives to securitize credit card loans may grow with the adoption of Basel II.

[39] But even at the CCSB level, different rates of securitization can generate a wide disparity in the level of ineligible reserves generated by credit card activities. Since on-balance-sheet credit card loans typically generate ineligible reserves when considered in isolation, the effect of the change in the rules for determining eligible reserves is bank-specific and is dependent on the level of securitization and the mix of other products held on the balance sheet. In some cases, the reserve cap might not be binding on a bankwide basis, and consequently, there would be little or no benefit to the bank if Basel II increases the maximum level of reserves that can be included in regulatory capital.

5.2.3. Basel II tier 1 capital requirements. We now turn to estimating the effect on the minimum tier 1 capital requirements of a shift from Basel I to Basel II. The appendix provides a detailed description of the components of the Basel II requirements and how we compare the Basel II requirements to the Basel I requirements.

As described above, the Basel II tier 1 capital requirements for retail credit card assets comprise the following three components:

1. One half the total capital requirement for UL that enters the total capital requirement;
2. Tier 1 capital deductions for residual interests in securitized receivables. Whereas residual interests have roughly the same effect on the total capital requirement under Basel II and BaseI I rules, the Basel II approach applies a higher proportion of these deductions to tier 1 capital;
3. A capital deduction equal to one half of any shortfall in loan loss reserves relative to EL. There is no adjustment to tier 1 capital if reserves equal, or exceed, EL.

We have already discussed the estimation of risk-weighted assets under Basel II in discussing the total capital requirement. We estimated a ratio of Basel II risk-weighted assets to the Basel I measure of risk-weighted assets of 94.6 percent. The main change in the Basel II treatment of credit card securitization residuals is that the after-tax gain-on-sale component of those residuals is deducted entirely from tier 1, whereas typically under Basel I rules, the gain-on-sale is effectively deducted half from tier 1 and half from tier 2. Thus, the Basel II change in the treatment of the after-tax gain-on-sale will effectively increase required tier 1 capital by approximately half of the gain-on-sale while leaving total capital requirements unchanged.

Bank Call Reports do not directly report the gain-on-sale from CC-ABS; however, the gain-on-sale is typically closely tied to the valuation of the interest-only strip (I/O strip) for credit card securitizations reported on the Call Report. For our calculations of the tier 1 requirements under Basel II, we estimate the after-tax gain-on-sale for CCSBs by the after-tax I/O strip (we assume a 35 percent tax rate).

The final component of the Basel II tier 1 capital requirement is the deduction from tier 1 of half of any reserve shortfall that exists. The evidence from Call Report data suggests that large CCSBs hold loan loss reserves that are below EL. However, the Basel II calculation of the reserve shortfall is done on an aggregate portfolio basis. Many of the CCSBs are subsidiaries of bank holding companies that might not have a shortfall on an aggregate basis. Thus, allocation of the reserve shortfall to specific asset classes raises the same types of conceptual issues as the allocation of eligible reserves, because credit card portfolios typically have a reserve shortfall while other loan portfolios do not. However, note that allocating the shortfall at the CCSB level rather than at the parent holding company level likely raises the estimated increase in Basel II tier 1 requirements, whereas estimating eligible reserves at the CCSB level rather than at the parent company level likely reduces the increase in total required capital under the Basel II approach. The intuition for this result is that, compared to other bank portfolios, credit cards produce a high EL relative to risk-weighted assets under Basel I, and credit card portfolios generally hold low reserves relative to EL.

We again address the issue of allocation by reporting the estimates assuming there is no reserve shortfall, which would be more likely for diversified bank holding companies with a credit card subsidiary, and when there is a reserve shortfall, which would be likely for monoline credit card banks.

As shown in Table 4, Panel B, assuming no reserve shortfall, the average percentage increase in tier 1 requirements under the Basel II rules compared to the Basel I rules is only 2.2 percent. But the average increase for the monoline CCSBs in our sample adjusting for the reserve shortfall is 13.2 percent. Table 4 also reports the minimum and maximum estimates, and, as with our results for total regulatory capital, there is a wide dispersion. Note that this dispersion is not due to differences in risk weights for on-balance-sheet credit cards across institutions. Rather, the dispersion occurs principally because of different rates of securitization and different reserving practices.

To summarize, we estimate that a shift from Basel I rules to the Basel II A-IRB rules would imply an average increase in total required capital ranging from 23.6 percent to 44.3 percent and an average increase in required tier 1 capital ranging from 2.2 percent to 13.2 percent. This range between the lower and upper estimates represents different approaches to allocating eligible reserves for the Basel I total capital calculation and allocating the reserve shortfall in the Basel II tier 1 calculation.

5.2.4. Estimated change in actual capital ratios from switch from Basel I to Basel II rules. Next we calculate the change in the actual capital ratio for a CCSB shifting from the Basel I rules to Basel II assuming it maintained its current level of capital.[40] Table 5 shows the results of our calculations of the implied change in the capital ratio for the average CCSB given our estimates for the increase in required capital when moving from Basel I rules to Basel II (shown in Table 4) for a hypothetical average CCSB bank.

This hypothetical bank is based on the average bank in our sample of large CCSBs used in our regression analysis. The current average total risk-based capital ratio for this sample is 18.5 percent, and the average tier 1 risk-based capital ratio is 15.0 percent (see Table 2). As shown in Panel B of Table 5, for this hypothetical average CCSB, our higher estimate of a 44.3 percent increase in the minimum required total capital would imply a reduction in the capital ratio to 12.8 percent, a reduction of 5.7 percentage points.

Our estimates indicate that the new effective total risk-based capital ratio would still be above the 8 percent regulatory requirements and above the 10 percent "well-capitalized" criterion in the prompt corrective action requirements of FDICIA. Moreover, the total risk-based ratio would be slightly higher than the 12.1 percent average total risk-based capital ratio at other commercial banks (see Table 2). Nevertheless, the excess of total risk-based capital held at CCSBs would be substantially reduced, and we

[40] For this purpose, we approximate the change in the actual capital ratio under the assumption that the percentage change in required capital from a switch to Basel II from Basel I rules arises from an equivalent percentage change in the denominator of the regulatory capital ratio rather than any change in the net deductions from capital under Basel II compared to Basel I rules. (Note that this assumption understates the percentage change in required capital to the extent that net deductions as a fraction of risk-weighted assets rise under Basel II compared to Basel I rules. To see this, let $(C_{II} - D_{II})/RWA_{II}$ be the required minimum capital ratio under Basel II and $(C_I - D_I)/RWA_I$ be the required capital ratio under Basel I, where C = minimum regulatory capital, D = net deductions from capital, and RWA = risk-weighted assets. Then, $C_I = 0.08RWA_1 + D_I$ and $C_{II} = 0.08RWA_{II} + D_{II}$. Let γ be the percentage change in required minimum capital that a shift from Basel I to Basel II rules would imply. Then $C_{II} = (1+\gamma)C_I$, which implies $0.08RWA_{II} + D_{II} = (1+\gamma)(0.08RWA_1 + D_1)$, and so $\gamma = [(0.08RWA_{II} + D_{II}) / (0.08RWA_1 + D_1)] - 1$. Note that if deductions were zero, then $\gamma = (RWA_{II} / RWA_1) - 1$, i.e., the percentage increase in capital would equal the percentage increase in risk-weighted assets. If we approximate γ by $(RWA_{II} / RWA_1) - 1$, we will understate γ whenever $\gamma > (RWA_{II} / RWA_1) - 1$. This occurs when $[(0.08RWA_{II} + D_{II}) / (0.08RWA_1 + D_1)] - 1 > (RWA_{II} / RWA_1) - 1$, i.e., $(D_{II}/RWA_{II}) > (D_I/RWA_I)$).

cannot rule out the possibility that Basel II would generate a binding total risk-based capital requirement (i.e., bank management, the market, and the rating agencies might be less comfortable with the actual capital held relative to the new regulatory capital requirements).

Our estimated effect on the tier 1 risk-based capital ratio is more modest. As shown in Panel C of Table 5, our higher side estimate of a 13.2 percent increase in minimum required tier 1 capital after adoption of Basel II would imply a reduction in the average bank's tier 1 capital ratio from 15.0 percent to 13.3 percent, a reduction of 1.7 percentage points. This estimate indicates that the average CCSB tier 1 ratio would still far exceed the 4 percent minimum requirement and would remain substantially higher than the 10.5 percent average tier 1 ratio at other commercial banks.

Although our estimates imply that the capital ratios of the average CCSB would still exceed regulatory minimum requirements, there is no simple test to determine whether a level of buffer capital held by a bank is sufficiently large to make the minimum capital requirement nonbinding. The estimated substantial increase in required capital under Basel II suggests the possibility that Basel II CCSBs would move from a nonbinding total capital requirement under Basel I to a binding capital requirement under Basel II, as their buffer relative to regulatory requirements narrows substantially. However, the case that the tier 1 regulatory requirement will become a binding constraint under Basel II is considerably weaker, since our estimates indicate that the average credit card bank would still have a significantly high buffer over the Basel II regulatory minimum.

What about CCSBs with increases in tier 1 requirements that are higher than the average CCSB? Increases in the tier 1 requirement derive principally from two sources: the shortfall in reserves relative to EL and the full deduction of the gain-on-sale from tier 1 capital. If a CCSB has a larger reserve shortfall than other CCSBs with similar ELs, then it would seem reasonable that that CCSB would receive a relative increase in capital requirements. As for the change in the gain-on-sale treatment, this item increases in importance directly with the rate of securitization. That is, a bank that securitizes more will tend to see a higher increase in required tier 1 capital upon adopting Basel II. However, under both Basel II and Basel I, a higher securitization rate substantially reduces capital requirements relative to the managed portfolio, whereas market capital requirements, which are based on managed assets, are not greatly affected by securitizations. Thus, those CCSBs with a relatively high increase in tier 1 requirements due to the Basel II treatment of gain-on-sale will be banks that receive substantial capital relief from securitization activities. These banks are the least likely to face a binding tier 1 requirement because the divergence between regulatory capital and economic capital is greatest for these banks.

5.3. Basel II capital requirements with a positive credit conversion factor for the investors' interest in securitized receivables

Up to now we have assumed a zero credit conversion factor (CCF). How likely would performance by a CC-ABS trigger a positive credit conversion factor (CCF), and how might this affect required capital under Basel II? Under Basel II, CCFs for the investors' interest in securitized receivables and the share of undrawn lines apportioned to the investors' interest are a function of deal-specific trapping points. Unfortunately, data regarding deal-specific structure for a large cross-section of CC-ABS are not easily obtained. However, CC-ABS deals are somewhat standardized among the larger, higher quality issuers. A common trapping point for excess spread is 4.5 percent, i.e., when the three-month average excess spread falls below 4.5 percent, the excess spread is "trapped" in an escrow account instead of being paid to the issuer. Using 4.5 percent as the presumed relevant trapping point for Basel II banks, CCF thresholds are hit when excess spread reaches 6.0 percent, 4.5 percent, 3.375 percent, and 2.25 percent (resulting in CCFs of 5 percent, 15 percent, 50 percent, and 100 percent, respectively). We analyze historical data on CC-ABS. To assess the frequency with which these thresholds have been reached, we examine data on excess spreads for publicly traded and rated CC-ABS deals from ABSNet, which provides monthly measures of excess spread and its component parts from 1996 to 2004.

Out of 126 floating-rate CC-ABS deals measured over 6,432 deal-month observations,[41] 47.2 percent of all deal-month excess spreads were at the 0 percent CCF, 38.5 percent of all deal-months were at the 5 percent CCF, 13.1 percent of all deal-months were at the 15 percent CCF, 0.96 percent of all deal-months were at the 50 percent CCF, and 0.06 percent of all deal-months were at the 100 percent CCF.

[41] Older CC-ABS were often fixed-rate deals. Some of these deals hit excess spread targets when interest rates rose. We do not include these in our sample for two reasons. First, most new deals are structured as floating- rate deals. Second, since the decline in excess spread for fixed-rate deals was not a credit event, regulators allowed banks to restructure those deals when excess spreads fell without considering the restructuring recourse.

Thus, only about 1 percent of deal-months had a CCF of 50 or 100 percent, suggesting that performance by a CC-ABS triggering a CCF above 15 percent is highly unusual. Looking across all deals, 22 deals reached the 50 percent CCF or higher at some point, but they typically did not stay at that level for long.[42]

Based on past data, reaching the 5 percent and 15 percent CCF will be fairly common. Even though we believe that the probability of hitting a 15 percent CCF might decline substantially in the future, we estimate the effect on Basel II capital requirements relative to Basel I for large CCSBs, assuming that they trigger a 15 percent CCF.

For the CCSBs in our regression sample, the weighted average rate of securitization was 60.7 percent.[43] With this rate of securitization, a 15 percent CCF produces a 23.2 percent increase in credit card receivables outstanding that would then become subject to regulatory capital requirements under Basel II.[44]

Our previous analysis suggested that for a fixed set of credit card balances outstanding and a CCF of 0 percent, Basel II might generate an increase in both required total risk-based capital and tier 1 risk-based capital. Now we consider these effects along with the effect of triggering a 15 percent CCF for the average large CCSB. The average large CCSB has a total risk-based capital ratio of 18.5 percent. Switching to Basel II might imply an effective 23.6 to 44.3 percent increase in risk-weighted assets for a credit card portfolio using our estimates of the total capital impact of Basel II on our two bank credit card

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[42] This set of deals may not be completely representative of the type of deals that will occur going forward. Deals pre-dating 1999 were disproportionately likely to have excess spreads below the proposed CCF triggers as compared to more recent deals. Moreover, CC-ABS deals may be less likely to hit CCF thresholds going forward than historical data suggest. Deal structure is endogenous and will likely adjust to the new regulatory rules. CC-ABS deals contain many forms of credit enhancement and other protections to bondholders, of which excess spread reserve accounts are only one. Since the Basel II CCFs depend on the relationship of excess spreads to deal-specific trapping points, future deals may be engineered to substitute other forms of credit protection for lower excess spread trapping points while maintaining the same overall level of credit protection for investors.

[43] We define securitized credit card assets as the investors' interest in the securitized receivables, since the seller's interest remains on the bank's balance sheet.

[44] To see this, consider the simple example in Panel A of Table 5. This hypothetical bank has $39.3 million in owned credit card receivables and an investors' interest in securitized credit card receivables of $60.7 million (which corresponds to a securitization rate of 60.7 percent). If a 15 percent CCF is triggered, the bank must then hold capital against 15 percent of its securitized receivables, i.e., against an additional $9.1 million of credit card receivables that move back onto the balance sheet. This represents an increase of 23.2 percent (= $9.1 million/$39.3 million) in outstanding credit card receivables for which the bank must hold capital, and the bank must also hold capital against the exposure from the open-to-buy associated with the additional $9.1 million in outstanding balances.

portfolios. In our example shown in Table 5, a bank with Basel I risk-weighted assets of $39.3 million whose only risk-weighted assets are from credit card loans would see an increase in risk-weighted assets to the range of $48.6 million to $56.7 (and a resulting fall in the total risk-based capital ratio from 18.5 percent to between 12.8 to 14.9 percent). As shown in Panel B of Table 5, if a 15 percent CCF were then triggered, as discussed earlier, this would imply an additional 23.2 percent increase in risk-weighted assets on which capital must be held, which means risk-weighted assets effectively increase to a range of $59.8 million to $69.8 million, and the risk-based capital ratio falls further to between 10.4 and 12.1 percent.

Thus, the shift to Basel II, combined with a triggering of the 15 percent CCF, implies a large estimated decline in the average total risk-based capital ratio for our large CCSBs – by 6.4 to 8.1 percentage points from the original 18.5 percent. The magnitude of this decline suggests that, on average, CCSBs' risk-based capital ratios could end up being lower than the ratios at peer banks should a 15 percent CCF be triggered.

Turning to our tier 1 estimates, Panel C of Table 5 shows that a bank with Basel I risk-weighted assets of $39.3 million whose only risk-weighted assets are from credit card loans would see an increase in risk-weighted assets to the range of $40.2 million to $44.5 million (and a resulting fall in the tier 1 risk-based capital ratio from 15.0 percent to between 13.3 to 14.7 percent). If a 15 percent CCF were then triggered, this implies an additional 23.2 percent increase in risk-weighted assets on which capital must be held, which means risk-weighted assets effectively increase to a range of $49.5 million to $54.8 million, and the risk-based tier 1 capital ratio falls further to between 10.8 and 11.9 percent. Thus, we estimate that the combined effects of a movement from Basel I to Basel II rules plus a 15 percent CCF would lead to a 3.1 to 4.2 percentage point decrease in the tier 1 capital ratio. Our regression analysis (reported in Lang, Mester, and Vermilyea (forthcoming)) indicates that large CCSBs hold, on average, 5.3 percentage points higher tier 1 capital ratios than other banks with similar risk characteristics. Thus, our estimates suggest that the differential in tier 1 capital held by CCSBs and other banks would be largely but not completed eliminated.

In summary, we find:

1. The regulatory capital requirement for total capital under Basel II with a zero CCF would generate capital ratios at CCSBs that are more in line with other commercial banks'. When combined with a 15 percent CCF, some CCSBs would likely be near, or below, the regulatory minimum for total capital and the minimum capital requirement would likely represent a binding constraint for a Basel II bank;
2. The regulatory requirement for tier 1 capital under Basel II would generate reductions in tier 1 capital ratios but, even after those reductions, tier 1 capital ratios at the typical CCSB would be well above regulatory requirements and higher than ratios at other commercial banks. When combined with a 15 percent CCF, most CCSBs would still have tier 1 capital ratios substantially above regulatory requirements; however, CCSB tier 1 capital ratios would fall substantially and would be more in line with other commercial banks'.

Although our results on the effects of triggering a 15 percent CCF suggest that Basel II CCSBs might be disadvantaged relative to CCSBs operating under Basel I rules, these findings cannot be conclusive for several reasons. First, if CCSBs operating under Basel I rules and banks under Basel II have similar losses during periods of stress, the market is likely to assess similarly high capital requirements on both sets of banks. That is, while regulatory capital requirements under Basel II could rise substantially for individual banks (and fall for others), market requirements are likely to also rise during periods of stress, and the market requirement might continue to be well above the regulatory requirement. Second, it is likely that, during periods of poor performance, *any* bank might be constrained by bank supervisors, whether or not it was using Basel II. That is, supervisory oversight might become a binding constraint for any bank demonstrating similarly poor performance in its credit card portfolio. In that case, while the numerical minimum capital requirements during a period of portfolio stress might be much higher under Basel II, the "effective" capital requirements during periods of stress for these portfolios might not be very different. Finally, it is possible that Basel II banks would be able to find ways to structure their securitizations to substantially lower the probability of hitting the performance triggers (i.e., positive CCFs) of the Basel II proposal.[45]

6. Conclusions and implications

This paper has examined the potential competitive effects of Basel II proposals for minimum regulatory capital requirements on credit card exposures.

First, credit cards are not a significant source of revenue or risk for community banks and most regional banks. So changes in regulatory capital costs for Basel II banks are not likely to have any measurable direct or indirect effect on community banks and most regional banks simply because these banks do not compete in this market.

Second, nonbank companies typically issue credit card loans through a CCSB but have the option to hold the credit card assets at the nonbank parent. If the CCSB subsidiary of a nonbank credit card issuer opts in to the Basel II A-IRB approach, a nonbank company can effectively avoid the capital constraint by transferring more of its credit card assets to the nonbank parent. Given the ability of nonbank competitors to shift assets between the parent company and the banking subsidiary, we believe that nonbank competitors will not be harmed by the change in capital requirements and could benefit if bank competitors face a sufficiently large increase in capital requirements.

Finally, regional banks that are involved in credit cards but that do not opt in to the Basel II A-IRB capital approach would face different regulatory capital minimums than the Basel II banks. Our analysis indicated that capital at CCSBs is currently far in excess of current regulatory requirements, as well as far higher than capital ratios at other banks, even after controlling for factors affecting the demand for capital. Indeed, capital positions at CCSBs appear to be driven by market pressures to maintain an adequate capital-to-managed-assets ratio rather than by regulatory requirements. Thus, the current Basel I regulatory capital standards do not appear to be binding at CCSBs.

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[45] Note that our analysis has abstracted from another possible motive for holding capital. Namely, banks may wish to guard against the increased volatility of required capital levels under Basel II as compared to Basel I rules. The *potential* of hitting a positive CCF trigger is a major factor increasing the volatility of required capital levels under Basel II. Also, required regulatory capital could be more volatile under Basel II than under the current Basel I rules, since required regulatory capital under Basel II rules rises and falls with changes in the charge-off rates on credit

In most circumstances, CCSBs will operate with a zero credit conversion factor (CCF) for securitized credit card receivables. Under those circumstances, our estimates indicate that regulatory requirements for total capital would rise much more than the tier 1 requirements. While capital levels at CCSBs would remain above regulatory requirements, the buffer for total risk-based capital would be reduced substantially, and we cannot rule out that the total capital requirement would be binding for Basel II banks. Basel II's effect on tier 1 capital at CCSBs is more modest, and we think it unlikely that under normal economic conditions these banks would be required to raise additional tier 1 capital if they adopted the Basel II A-IRB approach. We believe that in most cases the level of tier 1 capital will remain sufficiently above the regulatory requirements and that market capital requirements will continue to be the primary determinant of the actual level of tier 1 capital. Even CCSBs operating under the Basel II rules that faced pressure to raise their tier 1 ratio would likely satisfy this by raising reserves, thereby reducing their reserve shortfall, which is deducted from Basel II tier 1 capital. Thus, to meet the higher minimum total capital requirement under Basel II rules, it is likely that CCSBs would either raise additional subordinated debt or increase their rate of securitization. Either of these actions has relatively modest cost implications for banks operating under Basel II.

In contrast to periods of normal economic conditions, there is the possibility that credit card operations at Basel II banks would face a significant competitive disadvantage relative to issuers operating under Basel I rules during periods of substantial stress in credit card portfolios. Under those circumstances, the additional required capital generated by a positive CCF for securitized assets would be a substantial increase in the minimum capital requirement. However, we believe that this much larger requirement for credit card portfolios at Basel II banks exaggerates the difference in the "effective" capital requirement at Basel II and Basel I banks. In our view, banks operating under Basel I rules would see supervisory requirements that far exceeded the numerical minimums. In addition, the market capital requirements for credit card portfolios can also be expected to rise in periods when credit performance is poor.

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cards. Thus, Basel II might result in higher actual capital levels of CCSBs, even when the CCF is zero. In other words, banks may desire higher levels of buffer capital under Basel II rules than under the current Basel I rules.

Given these conclusions we believe that banks will react to the changing capital requirements in several ways. First, the increased capital requirements for credit card portfolios under the proposed Basel II framework will deter some opt-in banks from adopting the Basel II capital standards. This effect will be greatest for banks with a large proportion of their assets in credit cards (particularly for opt-in independent monoline credit card banks).

Second, capital-constrained (either tier 1 or total capital) Basel II banks will increase their level of securitization of credit card receivables. Although the proposed Basel II A-IRB framework adds a potential capital charge for the investors' share of CC-ABS, these capital charges are lower than if these assets were held on balance sheet (until the highly unlikely event of hitting the 100 percent CCF threshold, at which time the capital charges are equalized). Banks that are capital-constrained can reduce their risk-weighted assets by shifting assets off of the balance sheet, e.g., via securitization. We note that some banks already securitize a very high proportion of their managed credit card portfolio and so this option may not be available to them.

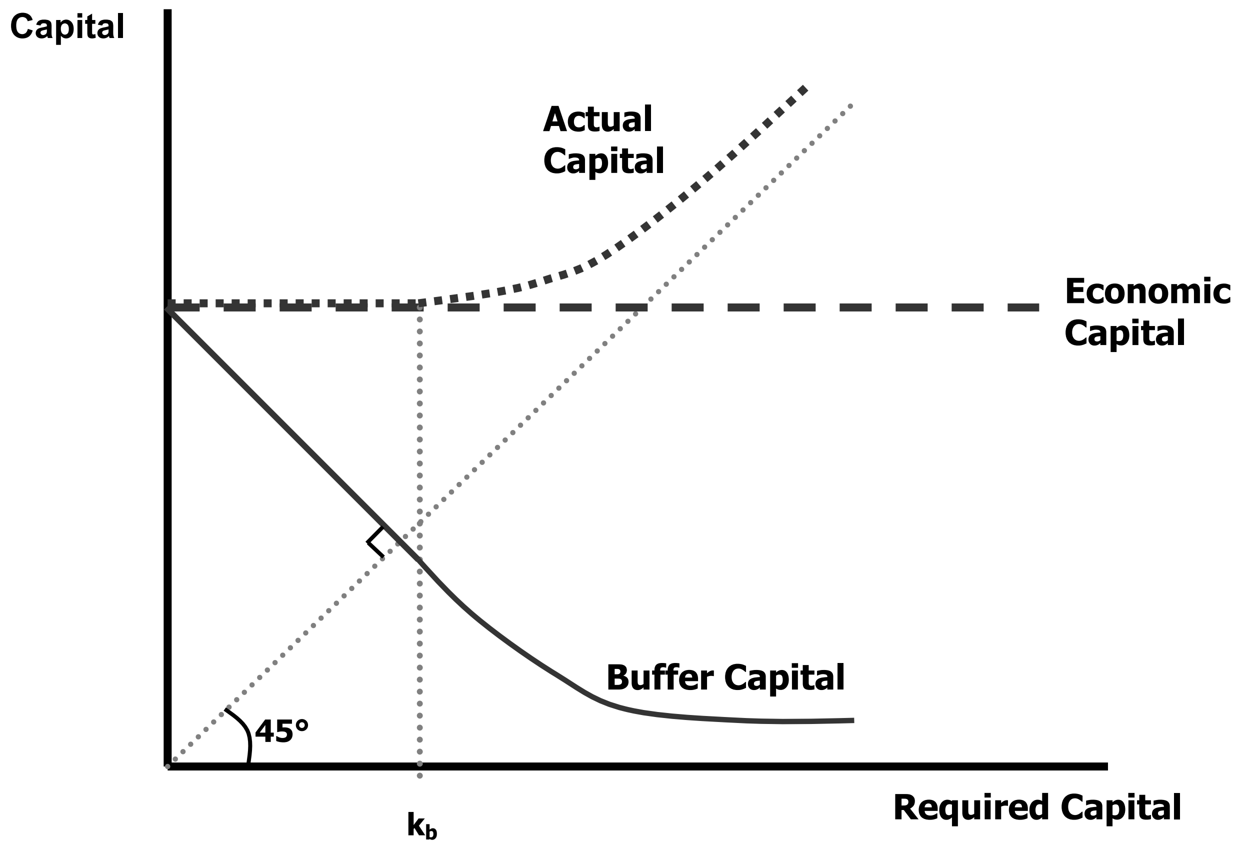
Third, since Basel II banks are more likely to face a binding total regulatory capital requirement than a binding tier 1 regulatory capital requirement, the use of relatively cheap tier 2 capital will increase. Banks that currently hold reserves of less than one year's worth of expected losses will likely increase their reserves. Other banks will likely increase their use of subordinated debt instruments that qualify as tier 2 capital.

Fourth, CC-ABS deal structures will likely be re-engineered to reduce deal-specific excess spread trapping points, thereby reducing potential capital charges associated with CC-ABS. As currently structured, excess-spread performance triggers lead to the funding of cash collateral accounts that provide a form of protection to investors in CC-ABS deals. Hitting these excess-spread performance triggers is unambiguously more expensive for banks under the proposed Basel II framework than under current capital rules, so banks have an incentive to reduce these triggers. Investors in CC-ABS have a stake in ensuring the continued viability of the CC-ABS servicer (typically the bank), so investors may also favor a reduction in these triggers. Furthermore, we believe that it may be possible to substitute another form of credit enhancement or other protection so that investors in CC-ABS are exposed to no additional risk despite lower trapping points relative to current deal structures.

Fifth, under stress, there would be an increased incentive for a Basel II bank to engage in informal recourse to support its CC-ABS than for a bank operating under Basel I rules. The penalty for engaging in informal recourse is that a bank must bring its CC-ABS portfolio back on balance sheet. Under Basel II A-IRB rules, a bank must progressively bring CC-ABS deals back on balance sheet as performance deteriorates. This implies that Basel II banks will face lower de facto penalties for engaging in informal recourse to support their CC-ABS than banks facing Basel I capital rules.

And finally, nonbank competitors with banking subsidiaries that opt in to the Basel II A-IRB framework will be more likely to transfer credit cards from the banking subsidiary to the parent organization to avoid capital requirements. In particular, nonbank competitors will be more likely to issue CC-ABS at the parent level than at the bank level.

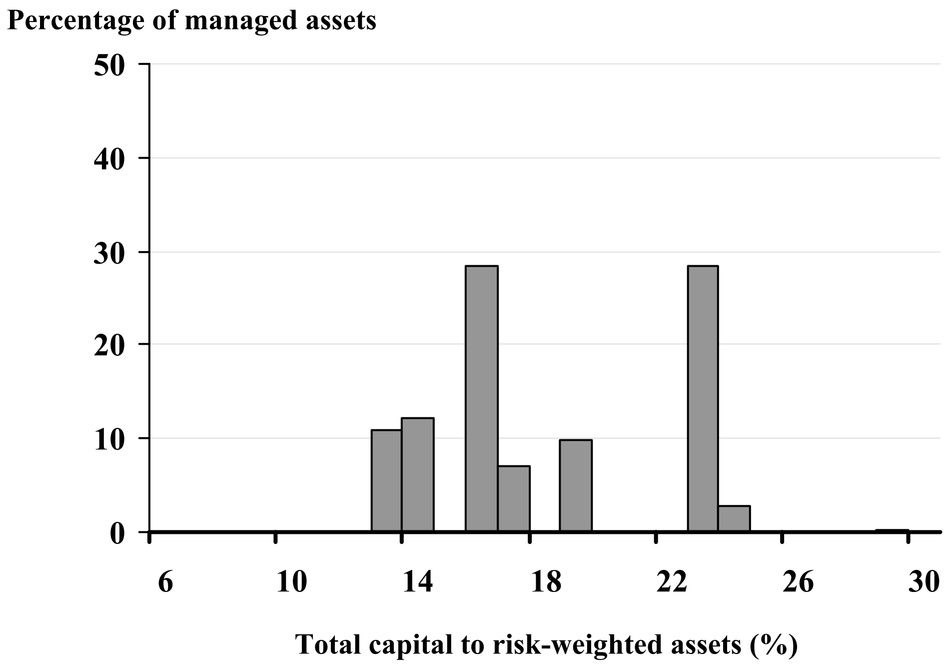
Figure 1. The Relationship between Regulatory Capital Standards and Actual Capital Holdings



k_b is point of binding capital requirement

Figure 2. Distribution of ratio of total capital to risk-weighted assets, weighted by managed assets, for non-credit card banks in the sample, June 2004

Credit card specialty banks



Noncredit card specialty banks

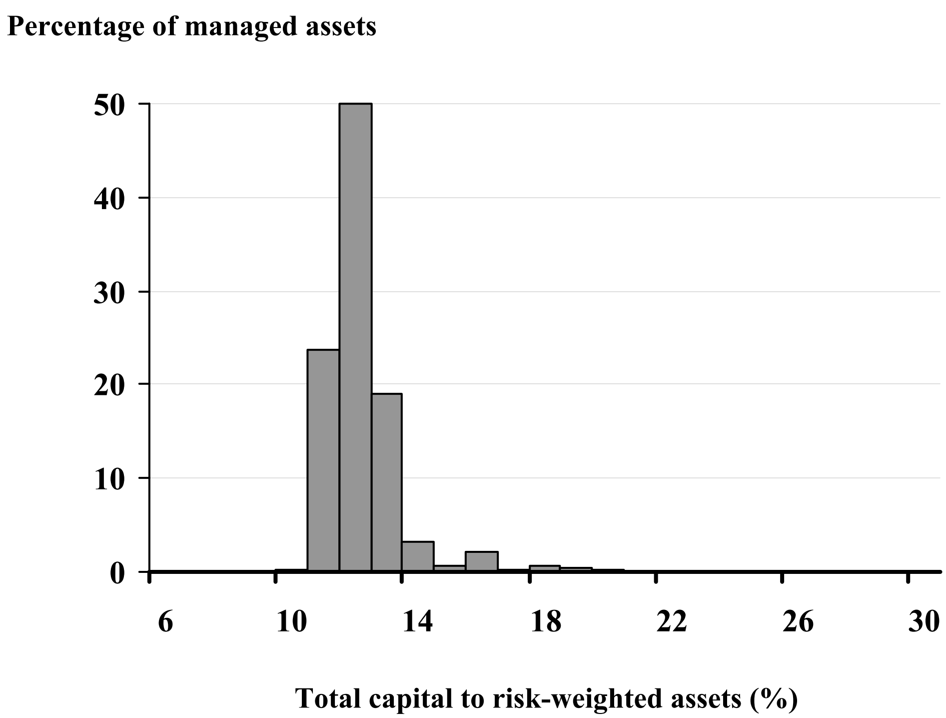


Table 1: Selected Financial Data for Credit Card Specialty Banks (CCSBs), June 2004

Bank (RSSD ID)	Total Managed Assets ($ billions)	Off-Balance-Sheet Credit Card Receivables-to-On- and Off-Balance Sheet Credit Card Receivables Ratio (Percent)	Tier 1 Capital-to-Total-Assets Ratio (Percent)	Equity-Capital-to-Total-Assets Ratio (Percent)	Equity-Capital-to-Managed-Assets Ratio (Percent)	Tier 1 Capital-to-Risk-Weighted Assets Ratio (Percent)	Total Risk-Based Capital-to-Risk-Weighted-Assets Ratio (Percent)
MBNA America Bank NA (1830035)	$ 138.42	81.49	19.12	20.19	8.37	18.69	22.55
Citibank SD NA (486752)	$ 102.84	54.83	11.84	20.63	10.61	11.97	15.79
Chase Manhattan Bank USA NA (489913)	$ 75.52	66.81	12.63	12.75	7.16	9.86	13.65
Capital One Bank (2253891)	$ 61.62	71.02	12.48	12.12	5.18	14.70	18.95
Discover Bank (30810)	$ 45.57	63.39	16.96	16.96	6.53	13.75	15.31
Citibank NV NA (455365)	$ 43.42	61.14	12.47	18.40	8.24	11.71	16.06
Bank of America NA USA (1417557)	$ 39.86	1.32	9.35	9.60	9.48	9.18	12.84
Bank One DE NA (427719)	$ 28.77	47.31	14.85	19.86	11.99	14.16	15.01
American Express Centurion Bank (1394676)	$ 28.04	58.52	11.32	11.30	5.65	11.11	12.51
Providian NB (121709)	$ 22.83	59.41	24.96	24.79	13.85	20.04	22.36
Fleet Bank RI NA (2267991)	$ 17.87	59.20	19.92	33.04	15.84	18.77	23.81
Monogram Credit Card Bank (1212846)	$ 15.05	78.44	18.26	21.50	5.32	21.29	22.57
Wells Fargo Financial Bank (363956)	$ 1.82	0.00	19.63	19.87	19.87	20.28	28.68

These are the credit card specialty banks included in the regression analysis. The RSSD ID is a unique identified issued by the Federal Reserve.

Total managed assets are total on-balance-sheet assets, which include on-balance-sheet credit card loans, plus outstanding credit card assets sold and securitized with servicing retained or with recourse or other seller-provided credit enhancements.

Off-balance-sheet credit card receivables are defined as securitized credit card receivables less the seller's interest.

Note that these data are bank-level data.

Table 2. Difference-in-Means Test for Noncredit Card and Credit Card Specialty Banks (CCSBs)

	Noncredit Card Specialty Banks (No. of Obs. = 262)	Credit Card Specialty Banks (No. of Obs. = 13)			Noncredit Card Specialty Banks (No. of Obs. = 262)	Credit Card Specialty Banks (No. of Obs. = 13)	
	Mean (Standard Deviation)	Mean (Standard Deviation)			Mean (Standard Deviation)	Mean (Standard Deviation)	
Tier 1 Leverage Ratio	0.0827 (0.0175)	0.1613 (0.0477)	***	Assets (unweighted by risk) (in billions $)	10.11 (32.09)	24.12 (18.26)	**
Tier 1 Capital to Assets	0.0801 (0.0173)	0.1568 (0.0451)	***	Managed Assets (in billions $)	10.22 (32.81)	47.82 (38.46)	***
Tier 1 Capital to Managed Assets	0.0800 (0.0174)	0.0847 (0.0418)		Risk-Weighted Assets (in billions $)	7.93 (24.74)	25.59 (19.40)	***
Tier 1 Capital to Risk-Weighted Assets	0.1046 (0.0230)	0.1504 (0.0427)	***	Equity Capital (in billions $)	0.8850 (2.794)	4.12 (3.42)	***
Equity Capital to Assets	0.0929 (0.0253)	0.1854 (0.0631)	***	Tier 1 Capital (in billions $)	0.709 (2.088)	3.47 (2.80)	***
Equity Capital to Managed Assets	0.0928 (0.0254)	0.0985 (0.0448)		Total Capital (=Total Risk-Based Capital = Tier 1 + Tier 2 Capital) (in billions $)	0.918 (2.826)	4.34 (3.52)	***
Equity Capital to Risk-Weighted Assets	0.1217 (0.0351)	0.1784 (0.0621)	***	Coefficient of Variation in ROE	0.4705 (1.904)	0.6704 (0.3658)	
Total Capital (= Total Risk-Based Capital = Tier 1 + Tier 2 Capital) to Assets	0.0926 (0.0174)	0.1923 (0.0517)	***	Coefficient of Variation in ROE (merger-adjusted)	0.7505 (6.967)	0.5963 (0.4684)	
Total Capital to Managed Assets	0.0925 (0.0175)	0.1063 (0.0593)		Coefficient of Variation in ROA	0.6004 (1.201)	0.6586 (0.3634)	
Total Capital to Risk-Weighted Assets	0.1206 (0.0214)	0.1847 (0.0506)	***	Asset Growth	1.691 (13.679)	0.5871 (0.6957)	
				Asset Growth (merger-adjusted)	1.256 (13.643)	0.4645 (0.5359)	

*** Means of the variable for noncredit card specialty banks and for credit card specialty banks are significantly different at the 99% level.
** Means of the variable for noncredit card specialty banks and for credit card specialty banks are significantly different at the 95% level.
* Means of the variable for noncredit card specialty banks and for credit card specialty banks are significantly different at the 90% level.

The hypothesis of equal variances could not be rejected at the 90% or better level for managed assets, risk-weighted assets, equity capital, and total capital. So for these variables the pooled test (which assumes equal variances) was used to test difference in means. The Satterthwaite test (which allows for unequal variances) was used to test the difference in means of all other variables.

Table 3: Equity Capital Ratio Regressions

	Model 1		Model 2		Model 3	
Dependent Variable	Equity Capital to Total Assets		Equity Capital to Managed Assets		Equity Capital to Risk-Weighted Assets	
Independent Variables						
Intercept	0.09041	***	0.09021	***	0.1196	***
	(0.00192)		(0.00190)		(0.00240)	
Coefficient of Variation in ROE	0.00373	***	0.00366	***	0.00506	***
	(0.00103)		(0.00105)		(0.000994)	
Total Assets	−0.000252	**	−0.000231	**	−0.000382	**
	(0.000112)		(0.000109)		(0.000149)	
Total Assets Squared	0.000000667	**	0.000000586	*	0.00000105	*
	(0.000000328)		(0.000000316)		(0.000000444)	
Growth in Total Assets	0.00295306	*	0.00295	*	0.00268	**
	(0.00169)		(0.00169)		(0.00154)	
Growth in Total Assets Squared	−0.0000131	*	−0.0000131	*	−0.0000114	
	(0.00000767)		(0.00000765)		(0.00000697)	
Credit Card Bank Indicator	0.09623	***	0.00917		0.06209	***
	(0.0170)		(0.0127)		(0.0164)	
Adjusted R^2	0.3944		0.1057		0.1741	
Number of Observations	275		275		275	

Standard errors are in parentheses. The standard errors are heteroscedasticity-consistent and calculated using the Davidson and MacKinnon (1993) adjustment of the covariance matrix of the estimated parameters, $(X'X)^{-1}(X'\hat{\Omega}X)(X'X)^{-1}$ where $\hat{\Omega}$ ≡ diagonal matrix with $\frac{n}{n-k}e_t^2$ on the diagonal, where e_t is the estimated regression error, that is, $e_t = y_t - x_t\hat{\beta}$, n = number of observations and k = number of explanatory variables.

*** Significantly different from zero at the 99% level, ** Significantly different from zero at the 95% level, * Significantly different from zero at the 90% level.

Equity capital to assets is equity capital/total assets as of June 2004, where equity capital is RCFD3210 from the Call Report and total assets is RCFD2170 from the Call Report.

Equity capital to managed assets is equity capital/managed assets, where managed assets equals total assets plus outstanding credit card assets sold and securitized with servicing retained or with recourse or other seller-provided credit enhancements as of June 2004.

Equity capital to risk-weighted assets is equity capital/risk-weighted assets (RCFDA223 from the Call Report) as of June 2004.

The coefficient of variation in ROE is the standard deviation of quarterly ROE from 1992-2003 divided by mean ROE from 1992-2003.

Total assets are total assets, unweighted by risk (RCFD2170 from the Call Report), measured in units of $1 billion as of June 2004.

Growth in total assets is measured between year-end 2000 and year-end 2003.

Credit card bank indicator is equal to 1 if the bank is a credit card specialty bank, or 0 otherwise. There are 13 credit card specialty banks in the sample.

Table 4: Change in Credit Card Specialty Banks' Required Capital from a Shift from Basel I Rules to Basel II A-IRB Rules

Panel A. Percentage Change in Required Total Capital

	Diversified holding co. w/ credit card subsidiary (No difference in reserves counted as capital under Basel II and Basel I since neither cap is binding)	Monoline credit card bank (Increase in reserves counted as capital under Basel II compared to Basel I)
Average	44.3%	23.6%
Min	19.1%	6.7%
Max	67.0%	32.2%

Panel B. Percentage Change in Required Tier 1 Capital

	Diversified holding co. w/ credit card subsidiary (No adjustment for shortfall of reserves from expected losses)	Monoline credit card bank (Deduction of half of shortfall of reserves from expected losses from tier 1 capital)
Average	2.2%	13.2%
Min	− 5.4%	− 1.7%

Table 5: Hypothetical Example of Impact of Basel II Capital Requirement

Panel A. Adjustment for 15 Percent Credit Conversion Factor (CCF) for Hypothetical Bank	
Owned credit card assets	$ 39.3 million
Securitized credit card assets	$ 60.7 million
Addition to credit card assets against which bank must hold capital due to trigger of 15% CCF	$ 9.1 million (= 15% × $ 60.7 million)
Growth in credit card assets against which capital must be held with 15% CCF	23.2% (= $ 9.1 million / $ 39.3 million)

Panel B. Effect of Basel II and 15 Percent Conversion Factor on Total Risk-Based Capital for Hypothetical Average Credit Card Bank					
		Diversified holding co. w/ credit card subsidiary (Using high-side estimate of 44.3% increase in required total capital under Basel II relative to Basel I)		**Monoline credit card bank** (Using high-side estimate of 23.6% increase in required total capital under Basel II relative to Basel I)	
	Capital Level	**Risk-Weighted Assets**	**Total-Capital-to-Risk-Weighted-Asset Ratio**	**Risk-Weighted Assets**	**Total- Capital-to-Risk-Weighted-Asset Ratio**
Basel I[1]	**$ 7.3 million**	**$ 39.3 million**	**18.5%**	**$ 39.3 million**	**18.5%**
Basel II with zero CCF[2]	**$ 7.3 million**	**$ 56.7 million**	**12.8%**	**$ 48.6 million**	**14.9%**
Basel II with 15 percent CCF[3]	**$ 7.3 million**	**$ 69.8 million**	**10.4%**	**$ 59.8 million**	**12.1%**

Panel C. Effect of Basel II and 15 Percent Conversion Factor on Tier 1 Risk-Based Capital for Hypothetical Average Credit Card Bank					
		Diversified holding co. w/ credit card subsidiary (Using low-side estimate of 2.2% increase in required capital under Basel II relative to Basel I)		**Monoline credit card bank** Using high-side estimate of 13.2% increase in required capital under Basel II relative to Basel I)	
	Tier 1 Capital Level	**Risk-Weighted Assets**	**Tier 1 Capital-to-Risk-Weighted-Asset Ratio**	**Risk-Weighted Assets**	**Tier 1 Capital-to-Risk-Weighted-Asset Ratio**
Basel I[1]	**$ 5.9 million**	**$ 39.3 million**	**15.0%**	**$ 39.3 million**	**15.0%**
Basel II with zero CCF[2]	**$ 5.9 million**	**$ 40.2 million**	**14.7%**	**$ 44.5 million**	**13.3%**
Basel II with 15 percent CCF[3]	**$ 5.9 million**	**$ 49.5 million**	**11.9%**	**$ 54.8 million**	**10.8 %**

[1] The average total-capital-to-risk-weighted-asset ratio in our sample of credit card banks is 18.47 percent. Applying this to our hypothetical bank's owned asset level (i.e., on-balance-sheet assets), which is $39.3 million, yields a total capital level of $7.26 million. The average tier 1 capital-to-risk-weighted-asset ratio in our sample of credit card banks is 15.04 percent. Applying this to our hypothetical bank's owned asset level yields a tier 1 capital level of $5.91 million.

[2] Based on our estimates reported in Table 5, depending on whether an adjustment is made for eligible reserves, Basel II might generate as low as a 23.6 percent increase in required total capital relative to Basel I levels and as high as a 44.3 percent increase in required total capital relative to Basel I levels. This can be thought of as a rise of 23.6 percent (or 44.3 percent) in the denominator of the regulatory total capital ratio. Using a 23.6 percent increase in required total capital and applying this to the hypothetical bank yields an increase in assets to $48.6 million, which implies a decrease in the total-capital-to-asset ratio to 14.9 percent. Using a 44.3 percent increase in required total capital and applying this to the hypothetical bank yields an increase in assets to $56.7 million, which implies a decrease in the total-capital-to-asset ratio to 12.8 percent. Similar calculations are done for the tier 1 capital ratios.

[3] As shown in the top panel, a trigger of the 15 percent CCF would imply a 23.2 percent increase in assets against which capital must be held. Applying this to the hypothetical bank and using a 23.6 percent increase in required total capital under Basel II relative to Basel I yields an increase in assets to $59.8 million, which implies a decrease in the capital-to-risk-weighted-asset ratio to 12.1 percent. Applying this to the hypothetical bank and using a 44.3 percent increase in required total capital under Basel II relative to Basel I yields an increase in assets to $69.8 million, which implies a decrease in the capital-to-risk-weighted-asset ratio to 10.4 percent. Similar calculations are done for the tier 1 capital ratios.

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Appendix 1. The Mechanics of CC-ABS[46]

This appendix discusses the mechanics of credit card asset-backed securities (CC-ABS) and their implications for regulatory capital.

CC-ABS begin with a credit card issuer selling a group of receivables from credit card accounts into a bankruptcy-remote trust (a special-purpose entity) that functions as the issuer of securities. The seller (we will use the term "seller" and "bank" interchangeably, although we recognize that not all issuers of CC-ABS are banks) remains the owner of the credit card *accounts* but transfers the outstanding *receivables* from a set of accounts to the trust and pledges to transfer future receivables generated by those accounts.

For CC-ABS, the investor's securities are "over-collateralized" – i.e., the amount of receivables in the trust exceeds the principal amount of the securities issued to the investors. For example, if $100 million of investor securities are issued, the bank might initially sell $120 million in receivables to the trust. In this example, the investor's interest in the pool is $100 million and the seller's interest is $20 million. The seller's interest is typically reported on its balance sheet as loans held by the originating bank with the associated capital requirement, while the investor's interest in the pool is removed from the balance sheet and, under current capital rules, is not subject to minimum regulatory capital requirements.[47]

CC-ABS deals are typically structured so that they have multiple rated classes of bonds. The claims of lower-rated bonds are subordinated to those of higher-rated bonds. Increasing the size of the lower-rated portions enhances the credit quality of the senior classes. The least senior claim in CC-ABS deals is called the residual interest. This piece is typically retained by the bank, and its value fluctuates as the performance of the trust varies.

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[46] This discussion draws on Furletti (2002).

[47] While most banks report the seller's interest as loans, some banks report it as securities. While this will affect the bank's reported on-balance-sheet credit card loans, the regulatory capital requirement is unchanged.

CC-ABS typically have two distinct cash flow periods: the revolving period and the controlled accumulation or principal-amortization period. This structure is designed to generate securities with longer maturities than the 5- to 10-month average life of a credit card receivable. The revolving period typically lasts 18 to 48 months (see Davidson, et al., *Securitization: Structuring and Investment Analysis*, 2003) but has lasted up to 11 years (see Dean, et al., *The ABCs of Credit Card ABS*, Fitch IBCA,1998). During the revolving period, investors receive only interest payments (which come from finance charge payments on the receivables). Principal collections on the receivables are used to purchase new receivables generated on the accounts within the trust or to purchase a portion of the seller's interest if there are no new receivables. This causes the seller's interest to fluctuate. However, the seller is obligated to maintain a certain level of over-collateralization and must place additional accounts in the trust if necessary to maintain an adequate size of the pool.[48]

As the securities near maturity, CC-ABS enter into the controlled accumulation phase wherein principal collections are no longer reinvested but are paid out to the investors in equal payments until the maturity date or collected into an escrow fund and paid to investors in a lump sum at the maturity date. The controlled accumulation period usually lasts 12 months (Dean, et al., Fitch IBCA, 1998).

If the securitization follows the usual path of a revolving period followed by a controlled amortization period, *the seller absorbs all credit losses*. The seller owns the residual interest, which is the residual income earned by the trust in the form of excess spread. Excess spread is the income from receivables after accounting for servicing fees, interest payments to ABS bondholders, and credit losses. If the excess spread is positive, as is the norm, then increases in credit losses reduce the income paid by the trust to the bank.

Not all of the costs of maintaining the receivables pool are borne by the trust. For example, costs associated with replacing terminated or dormant accounts – an activity that is critical to maintaining the required minimum level of receivables in the trust – are absorbed by the issuing bank. In general, a bank

[48] The bank typically has discretion over the timing of these. However, an early amortization would be triggered if

will begin losing money at some excess spread that is above zero even though the trust itself may be showing a profit.

If performance deteriorates substantially and income from the pool is insufficient to make interest payments on the securities, then investors are protected from loss by various forms of credit enhancements provided by the seller. One common form of credit enhancement is the "trapping" of excess spread. When excess spread falls below a deal-specific trapping point, it is held in escrow by the trust and becomes a cash fund available to protect investors from loss. In addition, CC-ABS deals typically require sellers to finance a cash collateral account that can be used to make interest payments on securities if necessary. Credit enhancements can take other forms as well, including credit insurance and increasing the size of the residual interest.

If losses are larger and sustained, then CC-ABS contain early amortization provisions as an additional layer of protection for investors. When credit performance is extremely poor, early amortization accelerates principal payments to investors before investors absorb the losses. The credit enhancements virtually insure investors against losses in the absence of early amortization.

CC-ABS deals typically contain multiple early amortization "trigger events," including an early amortization trigger when excess spread is negative for three consecutive months. In an early amortization, all future principal payments made by the credit card customers on the securitized receivables are allocated *disproportionately* to the investors. In addition, new draws on existing accounts or from newly acquired accounts are funded entirely by the bank. Thus, the seller's relative share in the pool rises, and the seller is exposed to the bulk of the credit risk. The overall effect of this structural feature is that, in economic substance, the seller's interest in the securitized pool is at least partially subordinated to the investor's interest. This is one reason major credit rating agencies generally presume that the seller continues to be exposed to the risk of the securitized credit card receivables, as noted in the main body of this paper.

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the seller failed to maintain adequate over-collateralization of the trust.

In sum, sellers absorb a large share of the credit risk even after securitizing credit card receivables. If there is no early amortization, the seller absorbs all losses in the CC-ABS through reductions in fee income and the payout of credit enhancements when excess spread is negative. In the unlikely event of an early amortization, investor exposure to credit losses is further reduced by accelerating the payment of principal to investors and the continued funding of new draws by the bank.

Finally, we note that CC-ABS transactions are engineered to obtain the accounting standards' "true sale" status required to remove assets from the originating bank's balance sheet. To obtain true sale status, the CC-ABS structure may not contain provisions that make the originating bank responsible for the subsequent performance of the collateral. In other words, the sale must be without explicit recourse. Some analysts have argued that banks have a strong incentive to provide implicit recourse (i.e., provide credit protection beyond contractual obligations) rather than allow investors to absorb losses. (See Calomiris and Mason (2003) and Higgins and Mason (2004).) Gorton and Souleles (2004) present empirical evidence that the price of CC-ABS reflects the market's expectation that banks will provide recourse rather than allow investors in CC-ABS to suffer losses.

Appendix 2. The Influence of Regulatory Capital Minimums on Bank Capital: A Simple Model

To illustrate the analytical framework, we construct a simple model of the demand for capital in the presence of required regulatory minimums. The model assumes that in the absence of bank regulation there exists an optimal capital structure given a bank's set of activities.[49] That is, there exists a unique level of economic capital conditional on a bank's portfolio. This assumption is reasonable, since on the margin a decision to increase capital balances the tradeoff between the higher cost of equity finance versus the benefits of lowering the interest rate on debt and lowering the costs of expected financial distress.

Let:

k = the level of bank capital,

k^* = the level of economic capital,

k_m = the regulatory minimum level of capital requirement,[50] and

$v(k)$ = bank value as a function of k.

By assumption, $v''(k) < 0$, so there is a unique value, k^*, that maximizes $v(k)$.

Let $\ell(k) = v(k^*) - v(k)$ be the lost value associated with departures of k from k^*. Then,

$$\ell(k^*) = 0,\ \ell'(k^*) = 0 \text{ and } \ell''(k) = -v''(k) > 0.\text{[51]} \qquad \text{(A2.1)}$$

In the absence of regulatory minimums, banks would choose to hold k^*. However, in the presence of regulatory minimums, there are costs associated with holding low levels of capital relative to the regulatory requirements. These costs include the expected costs of falling below the minimum, as well as costs associated with increased regulatory scrutiny, criticism, or constraints imposed by regulators when capital falls to a level close to the regulatory requirement. Let $r(k)$ be the costs imposed by holding

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[49] While this violates the well-known Modigliani-Miller Theorem that firm value is independent of capital structure, there is now a voluminous literature generating an optimal capital structure based on different violations of the Modigliani-Miller Theorem's assumptions.

[50] Note that since the bank's portfolio is given, writing the minimum capital requirement in levels is equivalent to writing it as a percentage of assets or risk-weighted assets.

[51] Note that the convexity of $\ell(k)$ follows directly from the assumption of a unique optimal capital level.

a level of capital that is sufficiently near the regulatory minimum, k_m.[52] We assume that the marginal regulatory costs of reducing capital, including the expected costs associated with breaching the regulatory floors, will increase as capital falls closer to the regulatory minimum. We also assume that when the bank's capital level is sufficiently above the regulatory minimum capital requirement, that is, when $k > k_m + \gamma$, there are no regulatory costs associated with meeting the regulatory minimum.[53] Then, regulatory costs are given by:

$$r(k) = \begin{cases} f(k-(k_m+\gamma)), & \text{if } k \le k_m+\gamma \\ 0, & \text{if } k > k_m+\gamma \end{cases} = f(\min(k-(k_m+\gamma),0)) \quad , \tag{A2.2}$$

where $\gamma > 0, f(0) = 0, f'(0) = 0,$ and $f''(k-(k_m+\gamma)) > 0.$

The convexity of $f(\cdot)$ follows from the assumption that the marginal regulatory cost imposed rises as capital falls toward the regulatory minimum. Assuming $f'(0)=0$ allows for differentiability of $r(k)$ at $k = k_m+\gamma$. The existence of a regulatory "satiation" point is necessary to generate a technically "nonbinding" regulatory capital requirement where the elasticity of actual capital with respect to marginal changes in regulatory capital is zero. As we will show, while the distinction between binding and nonbinding is useful in thinking about the role of regulatory capital, there may be little practical economic significance in distinguishing between the case where the losses to the bank from regulatory capital minimums are zero and the case where the costs are positive but very small. For simplicity, we assume that this regulatory "satiation" point is some constant γ above minimum regulatory capital k_m.[54]

Total losses associated with the bank's capital allocation are the sum of the losses associated with departures from economic capital and the losses associated with regulatory costs due to the level of actual capital relative to regulatory capital minimums. Thus, the total loss function is:

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[52] For simplicity, we assume that to stay in operation, the bank's capital level, k, must be above minimum regulatory capital k_m. If k falls below k_m, the bank is closed immediately. The model can be generalized to allow for a positive probability that banks will continue to operate with capital below regulatory minimums.

[53] This does not mean regulatory burden goes to zero, but rather that additional regulatory costs associated with the formal regulatory minimum capital ratios no longer exist.

[54] The model can be generalized to allow the regulatory satiation point to depend on the capital requirement. The model can also be generalized to allow for the possibility that regulators might be concerned that a bank is holding excessive capital to operate profitably.

$$L(k) = \ell(k) + r(k) = v(k^*) - v(k) + f(\min(k - (k_m + \gamma), 0)). \tag{A2.3}$$

Note that $L(k)$ is a convex function of k, since $L''(k) = -v''(k) + f''(k-(k_m+\gamma)) > 0$ for $k \leq k_m + \gamma$ and $L''(k) = -v''(k) > 0$ for $k > k_m + \gamma$. Thus, there exists a unique level of capital, $\hat{k}$, that minimizes total losses $L(k)$. That is, $\hat{k}$ solves the first order condition,

$$\ell'(\hat{k}) + r'(\hat{k}) = 0. \tag{A2.4}$$

When $k^* > k_m + \gamma$, then $\hat{k} = k^*$, since $\hat{k}$ is unique and in this case $\ell'(k^*) + r'(k^*) = 0$. So when $k^* > k_m + \gamma$, there are no losses associated with the regulatory capital requirement, the capital requirement is nonbinding, and total losses are minimized at k^*.

When $k^* \leq k_m + \gamma$, then $k^* < \hat{k} \leq k_m + \gamma$. (To see this, note that for any $\tilde{k} < k^*$, $\ell'(\tilde{k}) = -v'(\tilde{k}) < 0$, and $r'(\tilde{k}) = f'(\tilde{k} - (k_m + \gamma)) < 0$ for $\tilde{k} < k_m + \gamma$ and $r'(\tilde{k}) = 0$ for $\tilde{k} \geq k_m + \gamma$, so that such a $\tilde{k}$ cannot solve the first order condition, (A2.4). For any $\tilde{k}$ such that $k^* \leq k_m + \gamma \leq \tilde{k}$, $\ell'(\tilde{k}) = -v'(\tilde{k}) > 0$, and $r'(\tilde{k}) = 0$, so such a $\tilde{k}$ cannot solve the first order condition, (A2.4).) Thus, when $k^* \leq k_m + \gamma$, there is a binding capital requirement, since $\hat{k}$ is higher than the economic capital level k^*. The loss-minimizing capital level, $\hat{k}$, equates the marginal cost of lost economic value from holding capital higher than economic capital, $-v'(\hat{k})$, with the marginal benefit of holding capital higher than the regulatory minimum, $-f'(\hat{k} - (k_m + \gamma))$.

The effect of changes in regulatory minimums can be examined by substituting the loss-minimizing value of capital, $\hat{k} = \hat{k}(k_m)$ into equation (A2.3):

$$L(\hat{k}(k_m); k_m) = \ell(\hat{k}(k_m); k_m) + r(\hat{k}(k_m); k_m). \tag{A2.5}$$

By the envelope theorem,

$$\frac{dL(\hat{k}(k_m); k_m)}{dk_m} = \frac{\partial L(\hat{k}(k_m); k_m)}{\partial k_m} = \frac{\partial f(\min(\hat{k}(k_m) - (k_m + \gamma), 0); k_m)}{\partial k_m}$$

$$= -f'(\min(\hat{k}(k_m) - (k_m + \gamma), 0)) \geq 0 \tag{A2.6}$$

and

$$\frac{d\hat{k}}{dk_m} = \frac{-\dfrac{\partial^2 L(\hat{k};k_m)}{\partial k \partial k_m}}{\dfrac{\partial^2 L(\hat{k};k_m)}{\partial k^2}} = \begin{cases} \dfrac{f''(\hat{k}-(k_m+\gamma))}{-v''(\hat{k})+f''(\hat{k}-(k_m+\gamma))} \in (0,1), & \text{if } k^* \le k_m + \gamma \\ 0, & \text{if } k^* > k_m + \gamma \end{cases} . \tag{A2.7}$$

For low values of k_m with $k^* > k_m + \gamma$, the capital requirements are nonbinding with $\hat{k} = k^*$ and $L(\hat{k}) = 0$. As k_m increases, the capital requirement eventually becomes binding, the cost imposed by the regulatory capital requirement increases from zero, and the loss-minimizing level of capital, $\hat{k}$, increases.

Appendix 3.

Table A3.1: Total Capital Ratio Regressions

	Model 1		Model 2		Model 3	
Dependent Variable	Total Capital to Total Assets		Total Capital to Managed Assets		Total Capital to Risk-Weighted Assets	
Independent Variables						
Intercept	0.09251	***	0.09236	***	0.1218	***
	(0.00169)		(0.00172)		(0.00192)	
Coefficient of Variation in ROE	0.000818		0.000786		0.00152	
	(0.000801)		(0.000803)		(0.00110)	
Total Assets	−0.0000789		−0.0000815		−0.000222	***
	(0.000092)		(0.000108)		(0.000082)	
Total Assets Squared	0.000000174		0.000000162		0.000000610	**
	(0.000000283)		(0.000000329)		(0.000000262)	
Growth in Total Assets	0.000412		0.000499		−0.000550	
	(0.00170)		(0.00168)		(0.00148)	
Growth in Total Assets Squared	−0.00000202		−0.00000241		0.00000280	
	(0.00000771)		(0.00000764)		(0.00000673)	
Credit Card Bank Indicator	0.1008	***	0.01498		0.06694	***
	(0.0143)		(0.0171)		(0.0137)	
Adjusted R^2	0.5218		0.0097		0.2586	
Number of Observations	275		275		275	

Standard errors are in parentheses. The standard errors are heteroscedasticity-consistent and calculated using the Davidson and MacKinnon (1993) adjustment of the covariance matrix of the estimated parameters, $(X'X)^{-1}(X'\hat{\Omega}X)(X'X)^{-1}$ where $\hat{\Omega}$ ≡ diagonal matrix with $\frac{n}{n-k}e_t^2$ on the diagonal, where e_t is the estimated regression error, that is, $e_t = y_t - x_t\hat{\beta}$, n = number of observations and k = number of explanatory variables.

*** Significantly different from zero at the 99% level, ** Significantly different from zero at the 95% level, * Significantly different from zero at the 90% level.

Total capital to assets is total risk-based capital/total assets as of June 2004, where total risk-based capital is RCFD3792 from the Call Report and total assets is RCFD2170 from the Call Report.

Total capital to managed assets is total capital/managed assets, where managed assets equals total assets plus outstanding credit card assets sold and securitized with servicing retained or with recourse or other seller-provided credit enhancements as of June 2004.

Total capital to risk-weighted assets is total capital/risk-weighted assets (RCFDA223 from the Call Report) as of June 2004.

The coefficient of variation in ROE is the standard deviation of quarterly ROE from 1992-2003 divided by mean ROE from 1992-2003.

Total assets are total assets, unweighted by risk (RCFD2170 from the Call Report), measured in units of $1 billion as of June 2004.

Growth in total assets is measured between year-end 2000 and year-end 2003.

Credit card bank indicator is equal to 1 if the bank is a credit card specialty bank, or 0 otherwise. There are 13 credit card specialty banks in the sample.

Table A3.2: Tier 1 Capital Ratio Regressions

	Model 1		Model 2		Model 3	
Dependent Variable	Tier 1 Capital to Total Assets		Tier 1 Capital to Managed Assets		Tier 1 Capital to Risk-Weighted Assets	
Independent Variables						
Intercept	0.08169	***	0.08146	***	0.1077	***
	(0.00163)		(0.00163)		(0.00194)	
Coefficient of Variation in ROE	0.000684		0.000639		0.00133	
	(0.000786)		(0.000786)		(0.00107)	
Total Assets	−0.000354	***	−0.000340	***	−0.000521	***
	(0.000079)		(0.000081)		(0.000091)	
Total Assets Squared	0.000000912	***	0.000000857	***	0.00000139	***
	(0.000000254)		(0.000000253)		(0.000000299)	
Growth in Total Assets	0.000677		0.000764		−0.000193	
	(0.00163)		(0.000161)		(0.00146)	
Growth in Total Assets Squared	−0.00000289		−0.00000330		0.00000157	
	(0.00000740)		(0.00000732)		(0.00000662)	
Credit Card Bank Indicator	0.08195	***	0.00978		0.05327	***
	(0.0117)		(0.0117)		(0.0107)	
Adjusted R^2	0.4467		0.0537		0.2056	
Number of Observations	275		275		275	

Standard errors are in parentheses. The standard errors are heteroscedasticity-consistent and calculated using the Davidson and MacKinnon (1993) adjustment of the covariance matrix of the estimated parameters, $(X'X)^{-1}(X'\hat{\Omega}X)(X'X)^{-1}$ where $\hat{\Omega}$ ≡ diagonal matrix with $\frac{n}{n-k}e_t^2$ on the diagonal, where e_t is the estimated regression error, that is, $e_t = y_t - x_t\hat{\beta}$, n = number of observations and k = number of explanatory variables.

*** Significantly different from zero at the 99% level, ** Significantly different from zero at the 95% level, * Significantly different from zero at the 90% level.

Tier 1 capital to assets is tier 1 capital/total assets as of June 2004, where tier 1 capital is RCFD8274 from the Call Report and total assets is RCFD2170 from the Call Report.

Tier 1 capital to managed assets is tier 1 capital/managed assets, where managed assets equals total assets plus outstanding credit card assets sold and securitized with servicing retained or with recourse or other seller-provided credit enhancements as of June 2004.

Tier 1 capital to risk-weighted assets is tier 1 capital/risk-weighted assets (RCFDA223 from the Call Report) as of June 2004.

The coefficient of variation in ROE is the standard deviation of quarterly ROE from 1992-2003 divided by mean ROE from 1992-2003.

Total assets are total assets, unweighted by risk (RCFD2170 from the Call Report), measured in units of $1 billion as of June 2004.

Growth in total assets is measured between year-end 2000 and year-end 2003.

Credit card bank indicator is equal to 1 if the bank is a credit card specialty bank, or 0 otherwise. There are 13 credit card specialty banks in the sample.

Appendix 4. Calculating the Change in Minimum Capital Requirements from a Shift from Basel I to Basel II

Total Capital Requirements

Let $k_I = T_I - D_I + R_{IE} = 0.08 \times RWA_I$ = Basel I total risk-based capital requirement, and

$k_{II} = T_{II} - D_{II} + [R_{IIE} - EL] = 0.08 \times RWA_{II}$ = Basel II total risk-based capital requirement,

where subscripts I and II refer to Basel I and Basel II, respectively, and

T_i = total regulatory capital excluding reserves,
D_i = deductions from capital for residual interests in CC-ABS,[55]
R_{iE} = reserves (i.e., allowance for loan and lease losses),
RWA_i = risk-weighted assets,
EL = estimated expected losses under Basel II.

Rearranging the Basel I and Basel II capital equations and solving for $(T_I + R_{IE})$ and $(T_{II} + R_{IIE})$, respectively, yields:

$$T_I + R_{IE} = (0.08 \times RWA_I) + D_I \quad \text{(A4.1)}$$
$$T_{II} + R_{IIE} = (0.08 \times RWA_{II}) + EL + D_{II.} \quad \text{(A4.2)}$$

These equations allow us to compare the regulatory capital and reserves under Basel I and Basel II. Note that these are requirements gross of deductions and for both unexpected and expected losses. Thus, they put the Basel I and Basel II requirements on a comparable basis.

Equation (A4.2) allows us to analyze the components of the Basel II total capital requirement discussed in Section 5.2.1 of the paper.

If the credit conversion factor (CCF) for the investors' interest in securitized credit card receivables is zero, then the Basel II capital requirement comprises:

$0.08 \times RWA_{II}$ = estimated UL from on-balance-sheet outstanding balances and the UL associated with undrawn lines of credit from those balances,

EL = capital deductions for expected losses from on-balance-sheet outstanding balances and the EL associated with undrawn lines of credit from those balances,

D_{II} = other capital deductions, which for credit card portfolios are principally residual interests associated with securitizations

The effective capital requirement depends on how much of a bank's actual reserves are credited against capital (R_{IIE}).[56]

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[55] We treat residual interests in securitizations as deductions from total capital when calculating Basel I and Basel II capital requirements, even though these assets are technically included in risk-weighted assets for Basel I and deducted from capital under Basel II. This is appropriate since the minimum capital requirement under Basel I increases dollar-for-dollar with the amount of these residual interests.

[56] For this purpose, we assume that actual reserves are maintained at the same levels under Basel II as under the Basel I rules.

If the CCF for the investors' interest in CC-ABS is positive, then there are additions to both RWA_{II} and EL under the Basel II minimum capital requirement.

The dollar change in required capital minimums resulting from a shift from Basel I to Basel II rules is measured as, $(T_{II} + R_{IIE}) - (T_I + R_{IE})$, which by equations A4.1 and A4.2 is:

$$(T_{II} + R_{IIE}) - (T_I + R_{IE}) = (T_{II} - T_I) + (R_{IIE} - R_{IE}) = [0.08 \times (RWA_{II} - RWA_I)] + EL + (D_{II} - D_I).$$

Thus, the percentage change in required capital minimums resulting from a shift from Basel I to Basel II rules is:

$$\left[\frac{\text{Change in required capital minimum resulting from a shift from Basel I to Basel II rules}}{\text{Basel I capital requirement gross of deductions}} - 1\right] \times 100$$

$$= \left[\frac{[0.08 \times (RWA_{II} - RWA_I)] + EL + (D_{II} - D_I)}{T_I + R_{IE}} - 1\right] \times 100.$$

Tier 1 Capital Requirements

Let $k_I^1 = T_I^1 - D_I^1 = 0.04 \times RWA_I =$ Basel I tier 1 risk-based capital requirement, and

$k_{II}^1 = T_{II}^1 - D_{II}^1 - (0.5 \times \min[0, EL - R_{IIE}]) = 0.04 \times RWA_{II} =$ Basel II tier 1 risk-based capital requirement,

where the variables are the same as in the section above, with the superscript 1 referring to the tier 1 value of the variable.

Rearranging the Basel I and Basel II equations and solving for T_I and T_{II}, respectively, yields:

$$T_I^1 = (0.04 \times RWA_I) + D_I^1 \quad (A4.3)$$
$$T_{II}^1 = (0.04 \times RWA_{II}) + D_{II}^1 + (0.5 \times \min[0, EL - R_{IIE}]). \quad (A4.4)$$

The three terms on the right-hand side of equation (A4.4) are the components of the Basel II tier 1 capital requirement discussed in section 5.2.3 of the paper.

If the CCF for the investors' interest in CC-ABS is zero, then the tier 1 requirement comprises:

$0.04 \times RWA_{II}$ = estimated UL from on-balance-sheet outstanding balances and the UL associated with undrawn lines of credit from those balances,

D_{II}^1 = tier 1 deductions for gain-on-sale associated with CC-ABS,[57]

$0.5 \times \min[0, EL - R_{IIE}]$ = Basel II 50 percent deduction from tier 1 for any excess of EL over eligible reserves.

[57] Under Basel I this deduction would typically be taken half from tier 1 and half from tier 2 capital.

The effective tier 1 capital requirement under Basel II depends on how much of a bank's actual reserves are credited against capital (R_{IIE}).

If the CCF for the investors' interest in CC-ABS is positive, then there are additions to both RWA_{II} and EL under the Basel II minimum capital requirement.

The dollar change in tier 1 required capital minimums resulting from a shift from Basel I to Basel II rules is measured as $T_{II}^1 - T_I^1$, which by equations A4.3 and A4.4 is:

$$(T_{II}^1 - T_I^1) = [0.04 \times (RWA_{II} - RWA_I)] + (D_{II}^1 - D_I^1) + (0.5 \times \min[0, EL - R_{IIE}]).$$

Thus, the percentage change in tier 1 required capital minimum resulting from a shift from Basel I to Basel II rules is:

$$\left[\frac{\text{Change in tier 1 required capital minimum resulting from a shift from Basel I to Basel II rules}}{\text{Basel I tier 1capital requirement gross of deductions}} - 1\right] \times 100$$

$$= \left[\frac{[0.04 \times (RWA_{II} - RWA_I)] + (D_{II}^1 - D_I^1) + (0.5 \times \min[0, EL - R_{IIE}])}{(0.04 \times RWA_I) + D_I^1} - 1\right] \times 100.$$

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