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How and Why Do Small Firms Manage Interest Rate Risk? Evidence from Commercial Loans

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Although small firms are particularly sensitive to interest rates and other external shocks, empirical work on corporate risk management has focused instead on large public companies. This paper studies fixed-rate and adjustable-rate loans to see how small firms manage their exposure to interest rate risk. Credit-constrained firms are found to match significantly more often with fixed-rate loans, consistent with prior research showing that the supply of internal and external finance shrinks during periods of rising interest rates. Banks originate a higher share of adjustable-rate loans than other lender types, ameliorating maturity mismatch and exposure to the lending channel of monetary policy. Time-series patterns in the share of fixed-rate commercial loans are consistent with recent evidence on "debt market timing."

Key words: fixed-rate loan, adjustable-rate loan, corporate risk management, interest rate risk

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1. Introduction

Empirical research on corporate risk management has generally focused on large public companies, most often studying firms' use of financial derivatives.[1] This paper instead examines fixed-rate and adjustable-rate commercial loan contracts to study how *small* firms adjust their exposure to interest rate risk. Small and medium-sized firms are important to the US economy; firms with less than 500 employees generate half of non-farm private GDP[2]. Small firms are often financially constrained, considered a key theoretical rationale why firms engage in risk management (eg. Froot, Scharfstein and Stein, 1993). Moreover, work on the 'credit channel' of monetary policy shows directly that small firms are sensitive to interest rate shocks (eg. Gertler and Gilchrist, 1994; Ehrmann 2000).

Although small and medium sized firms make little use of derivatives, they do borrow extensively from financial institutions. In some cases the interest rate on these loans is fixed, while in other cases it adjusts with market interest rates. I study this variation in 'fixed-versus-adjustable' outcomes as a window into how small firms adjust their exposure to interest rate risk.

I firstly examine the relationship between 'fixed-versus-adjustable' outcomes and firm financial constraints. Theoretically, Froot, Scharfstein and Stein (1993, hereafter FSS) shows that optimal risk management policy should aim to generate cash in states of nature where an additional dollar of internal funds is most valuable. Empirically, research on the 'credit channel' of monetary policy finds that the availability of finance to bank dependent firms becomes scarcer relative to

[1] Cross-industry studies of the determinants of firms' use of derivatives include Covitz and Sharpe (2005), Purnandanam (2004), Lin and Smith (2003), Rogers (2002), Graham and Rogers (2002), Géczy, Minton and Schrand (1997), Mian (1996) and Fenn, Post and Sharpe (1996). Some studies focus on particular types of derivatives eg. Géczy et al focus on foreign currency derivatives, while Covitz and Sharpe study interest rate contracts. Allayanis and Weston (1998) study the relationship between derivatives use and firm value. Guay (1999) examines how derivatives hedging affects firm risk. Guay and Kothari (2003) examine the quantitative relevance of firms' derivatives holdings. Other papers take an industry-specific approach; Faulkender (2005) studies chemicals firms, Haushalter (2001) focuses on oil and gas, and Tufano (1996) studies gold mining firms. The literature is also broadening to consider other dimensions of risk management. For example, Bartram, Brown and Minton (2006) and Pantzalis, Simkins and Laux (2001) present evidence that firms use operational hedging (eg. matching foreign sales to foreign production) to manage exchange rate risk. Petersen and Thiagarajan (2000) study two gold mining firms who achieve a similar reduction in exposure to gold price risk, one using derivatives, the other using a combination of operating, financial and accounting decisions.

[2] Source: SBA. See http://www.sba.gov/advo/research/rs211tot.pdf.

investment opportunities during periods of rising interest rates, causing lower investment and output amongst credit-constrained firms (section 2 reviews this literature in detail). Correspondingly, I test the hypothesis that credit constrained firms match with fixed rate debt, thereby maximizing net cashflows during periods of rising interest rates when the shadow value of internal funds is high.[3]

A related implication of FSS is that risk management outcomes should reflect variation across firms in the correlation between interest rates and pre-interest firm cash flows. In sectors where industry output or cashflows covarys positively with interest rates, firms have a partial or complete 'natural hedge' against interest rate risk, and thus fixed rate debt is less likely to be optimal. I test the hypothesis that the share of adjustable rate loans is higher in such industries, using an estimated index of industry 'interest rate procyclicality'.

Although plausible, there are several reasons why these two FSS 'hedging' hypotheses might fail to hold empirically. One alternative hypothesis is that 'fixed-versus-adjustable' outcomes are set by the firm's banks (eg. perhaps the firm's relationship lender only originates fixed-rate loans or only adjustable-rate loans, so the firm does not have a choice). Another possibility is that small firms prefer to *amplify* volatility in the shadow value of internal funds; Adam, Dasgupta and Titman (2006) presents a model where such behavior may be optimal in an imperfectly competitive industry setting. A third possibility is that small firms are financially unsophisticated or the 'fixed-versus-adjustable' margin is unimportant, so that there are no systematic correlations in the data.

Using data from the Federal Reserve Board's Survey of Small Business Finance (SBF) I do in fact find evidence consistent with the two FSS 'hedging' hypotheses outlined above. First, as predicted, matching with a fixed rate loan is positively correlated with several different proxies for financial constraints. Fixed rate debt is most popular amongst smaller firms, younger firms, firms switching from their primary lender, and firms with low cashflows (measured by current profits) or

[3] In the FSS framework, a non-credit-constrained firm would be simply indifferent between fixed and adjustable rate loans, in line with the Modigliani-Miller theorem. However, I argue in the body of the paper that when *lenders* are also exposed to interest rate risk (consistent with a large body of empirical evidence) unconstrained firms may strictly prefer adjustable-rate debt.

high investment opportunities (measured by sales growth). These results are economically as well as statistically significant; for example young, small firms in the SBF are about twice as likely to match with fixed rate debt as old, large firms (69 per cent compared to 38 per cent). Second, fixed rate debt is less prevalent in 2-digit SIC sectors where industry output comoves most positively with interest rates, and thus where firms have a partial natural hedge against interest rate risk.

Next, I study how lender characteristics influence 'fixed-versus-adjustable' outcomes. Several theoretical papers on loan contract design and bank risk management suggest that the share of interest rate risk in a loan borne by the borrower should depend in part on the *lender's* interest rate risk profile (Arvan and Brueckner, 1986; Edelstein and Urosevic, 2003; Froot and Stein, 1998). These models predict that lenders who are exposed ex-ante to rising interest rates will optimally originate a smaller share of fixed-rate loans, since the present value of such loans declines by comparison to adjustable-rate loans when interest rates rise.

I test this prediction by comparing bank loans to loans from non-bank institutions. Banks are exposed to rising interest rates in two ways that are specifically tied to their reliance on deposit finance. First, banks are affected by the 'lending channel' of monetary policy (Stein, 1998, Kashyap and Stein, 2000, Ashcraft, 2004), in which tight monetary policy reduces the insured deposit base, raising banks' cost of funds. Second, banks are subject to maturity mismatch, where demand deposits and short-term time deposits fund long-duration assets such as mortgages.

Correspondingly, I test the hypothesis that bank loans are more likely to involve an adjustable interest rate than loans from other lender types. This 'lender risk management' hypothesis receives strong support in the data; I find that a loan from a commercial or savings bank is 14 percentage points more likely to involve an adjustable interest rate compared to a loan from a non-bank financial institution.

Since many small bank-dependent enterprises are closely held and owner-managed, it also seems plausible that owner characteristics play a significant role in 'fixed-versus-adjustable' outcomes. Somewhat surprisingly, I find that variables like the owner's age and the concentration of ownership are nearly uncorrelated with the loan type chosen. I do find some evidence that adjustable rate loans are more commom amongst firms with wealthier owners, consistent with the view that risk aversion is declining in wealth.

The last part of the paper studies time-series patterns in the aggregate share of fixed-rate loans. Using data from the Survey of Terms of Business Lending, I construct and study a 28-year quarterly time-series of the fixed rate share for business loans originated by commercial banks. I find that high real interest rates and a steep yield curve are correlated with a lower proportion of fixed rate loans, consistent with previous work on 'debt market timing' by Faulkender (2005) and Baker, Greenwood and Wurgler (2003). To my knowledge, this paper is the first to show these results also extend to small, bank dependent firms. Implications of these findings for theoretical explanations of 'market timing' patterns are discussed.

The rest of this paper proceeds as follows. Section 2 reviews existing literature on the sensitivity of small firms to interest rate shocks. Section 3 describes the Survey of Small Business Finance, and discusses the measures of financial constraints I use. Section 4 presents cross-sectional empirical evidence from the SBF. Section 5 presents time-series evidence on the share of fixed rate commercial loans. Section 6 presents cross-sectional evidence from the STBL. Section 7 concludes.

2. Small firms and interest rate shocks

Research on the 'credit channel' of monetary policy argues that higher interest rates lead to a decline in the availability of internal and external finance relative to investment opportunities, resulting in lower investment and output amongst credit-constrained firms. This channel is considered to be most important for small, informationally opaque, bank dependent firms, who are most likely to be constrained in their access to finance. Consistent with this view, Gertler and Gilchrist (1994) show that small US manufacturing firms are disproportionately affected during periods of rising interest rates. Small firms reduce external borrowing, shed inventories and experience sharp falls in sales growth. Larger firms maintain debt levels, increase inventories, and experience a substantially smaller decline in sales growth. Ehrmann (2000) finds similar evidence using data on German firms.

The broad credit channel can be further decomposed into 'balance sheet' and 'lending' effects. The 'balance sheet' channel is that higher interest rates weaken firm balance sheets, partially by reducing expected future profits, and partially because small firms have long-lived physical assets but mainly short term or adjustable rate liabilities (bank loans, credit lines etc.). This maturity mismatch implies that net current cashflows decline when interest rates increase, and also that the present value of assets declines relative to the present value of liabilities. The latter makes the firm less creditworthy, reducing its ability to raise external finance.

Consistent with the balance sheet channel, Bernanke and Gertler (1995) show that firms' balance sheet strength, proxied by interest coverage, declines during periods of high interest rates. Greenwood (2003) finds firm investment is most sensitive to interest rates when maturity mismatch is high, and that this relationship is most pronounced for financially constrained firms. Ashcraft and Campello (2006) find commercial lending is more sensitive to monetary policy in geographic regions where firm balance sheets are weak.

The 'lending' channel is that contractionary monetary policy reduces the ability of banks to lend by shrinking the supply of bank deposits. Stein (1998) presents a formal model of the lending channel. Kashyap, Stein and Wilcox (1993) show the bank lending as a share of total debt finance falls during periods of contractionary monetary policy. Kashyap and Stein (1995, 2000) present further empirical evidence on the lending channel for the US.

For the purposes of this paper, the key implication of both the 'lending' and 'balance sheet' channels is that for the average small firm, the supply of internal finance plus external finance declines relative to investment opportunities during periods of rising interest rates. This fall in credit availability will have no real effects if credit constraints are not binding. For firms that are credit constrained, such a shrinkage in the availability of finance induced by rising interest rates will reduce investment and output and raise the shadow value of internal funds. Correspondingly, I test the hypothesis that credit constrained firms match with fixed rate loans rather than adjustable rate loans, maximizing cash flows during periods of rising interest rates, when internal funds are most valuable.

What about financially unconstrained firms? In FSS, such firms would be indifferent between the two loan types, in line with the Modigliani-Miller theorem. However, a substantial amount of evidence suggests lenders too are exposed to interest rate risk, via the 'bank lending' channel as well as maturity mismatch (Sierra and Yaeger, 2004). In such an environment, the optimal contract will generally involve a financially unconstrained firm bearing the interest rate risk of the loan (Arvan and Brueckner, 1986, Edelstein and Urosevic, 2003, Froot and Stein, 1998). In Section 4.2 I present direct evidence that lender types exposed to rising interest rates originate a higher fraction of adjustable-rate loans, consistent with this view. Alternatively, unconstrained firms may match with adjustable rate debt to signal firm quality, in line with the model of Guedes and Thompson (1995). Even without these effects, it will still hold that unconstrained firms have no explicit incentive to protect cashflows against rising interest rates, unlike constrained firms.

3. Data: Survey of Small Business Finance (SBF)

The SBF is a cross-sectional survey conducted approximately every five years by the Federal Reserve Board, containing detailed microeconomic information on firm characteristics and financing behavior for a representative sample of US small and medium sized enterprises, defined as firms with less than 500 employees at the end of the reference year[4]. The SBF provides particularly detailed information on the firm's most recent loan, including the size of the loan, interest rate and fees paid, category of loan (eg. line of credit, business mortgage etc.), maturity, and collateral posted against the loan. Most importantly for this paper, the SBF also records whether the most recent loan was issued at a fixed or variable interest rate.

[4] For the 1987 survey, the relevant population is US firms with less than 500 full time equivalent employees. For the 1993 and 1998 survey the population is firms with less than 500 full-time plus part-time employees. Other things equal, this implies firms in 1993 and 1998 are smaller on average than those in the 1987 survey.

I pool data from the 1987, 1993 and 1998 SBF surveys, for a total of 11422 firm observations. Of these, 4000 firms had received a loan within three years of the end of the survey reference year. (I use three years as a cutoff because the 1993 and 1998 surveys do not collect information on the most recent loan if it was originated more than three years ago.) I then drop firms where data is missing for one or more key variables: total assets, firm age, profitability, total debt, sales growth, years with primary lender, or the amount, maturity or 'fixed or adjustable' status of the most recent loan. This yields a final sample of 3248 loans matched with firm characteristics. (N.B. the SBF is not a panel dataset, so each of these observations relates to a different firm.)

[INSERT TABLE 1 HERE]

Table 1 presents descriptive statistics for this final sample of 3248 observations. Since the survey oversamples large firms and minority-owned firms, I present weighted averages based on the SBF sampling weights, as well as unweighted statistics for comparison. 70 per cent of unweighted observations are S- or C-corporations. Average assets are $939 000 ($2.7 million on an unweighted basis). Comparing the last two columns of the Table, firms in the final sample are of similar age although substantially larger than the overall SBF sample. There are relatively fewer observations in the final sample from the 1998 survey, partially due to a change in survey design; in 1998 the survey does not consider renewals of existing credit lines to be 'new loans'.

38 per cent of loans are lines of credit (43 per cent on an unweighted basis). The distinction between credit lines and other loan types is important for the 'fixed or adjustable' dimension of the loan contract. A fixed rate credit line in fact create a potential arbitrage opportunity, since any change in market rates will affect the wedge between market rates and the rate on the commitment. For example if interest rates rise sharply, the firm could potentially aggressively draw down the line of credit, investing the proceeds at the higher market rate. For this reason, only 29 per cent of lines of credit in the SBF are fixed rate, compared to 70 per cent for other loan types. Moreover, most fixed rate credit lines are short term, 70 per cent have a maturity of 1 year or less. For these short term

commitments, interest rates are unlikely to shift enough before the credit line is renegotiated for the arbitrage opportunity described above to be profitable after transaction costs. A second point of difference is that the interest rate risk of an adjustable-rate credit line is 'contingent', since the firm only faces risk to the extent that it actually draws down the line in the future. Given these differences, but also taking into consideration the moderate sample size, I always present two sets of empirical estimates, one based on the full sample, the other on a subsample excluding credit lines.

Loans in the sample have an average maturity of 4 years, and the average weighted loan size is $324 thousand (around one-third of average firm assets). Most importantly, there is substantial variation in firms' choices between fixed and adjustable rate loans. 52 per cent of loan observations in the sample were drawn at a fixed rate (59 per cent on a weighted basis), the rest at an adjustable rate. 92 per cent of variable rate loans are indexed to a commercial prime lending rate.

[INSERT TABLE 2 HERE]

Table 2 breaks down the fixed rate share by type and source of loan. Importantly since loan type dummies are included in most regressions, there is a significant share of both fixed- and adjustable-rate contracts within each loan type. At the extremes, credit lines have the lowest fixed rate share (29 per cent), while capital leases and vehicle mortgages are most likely to be fixed (89 per cent and 88 per cent respectively).[5] Bank loans are less likely to involve a fixed rate (46 per cent compared to 78 per cent for non-bank loans).

3.1 Measuring financial constraints

The SBF contains several potential measures of financial constraints. Below I discuss the measures I use, and briefly review the evidence associated with each of them.

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[5] Beyond the earlier discussion of credit lines, this paper does not provide a full explanation for why the fixed rate share varies across loan types. Differences in securitization rates provide a potential explanation, however. For example, a vehicle mortgage, backed by a standardized, easy-to-value asset, may be easier to securitize than a business mortgage secured by assets that are difficult for outsiders to value and monitor. (There is an active secondary market for auto loans in the US, consistent with this argument.) This may in turn explain the high share of fixed-rate vehicle mortgages, analogous to the argument that securitization underpins the popularity of the US fixed rate household mortgage (Green and Wachter, 2005).

Firm size. Small firms are generally thought to face more severe financial constraints than large firms, due to scale economies in monitoring and information aquisition. Within the class of bank dependent firms, the focus of this paper, Petersen and Rajan (1995) show that smaller firms pay higher interest rates and take lesser advantage of attractive early-payment discounts on trade credit, signs that such firms are short of cheap, liquid funds (footnote 6 replicates these findings for my sample). Eisfeldt and Rampini (2004) show that small firms invest more often in used capital, which they argue is due to credit constraints. Evans (1987) finds that small firms have more volatile growth rates. Finally, the 'credit channel' evidence cited earlier suggests that smaller firms are more sensitive to interest rate shocks (Gertler and Gilchrist 1994, Ehrmann 2000). On the theory side, Albercurque and Hopenhayn (2003) present a dynamic limited commitment model of firm growth in which small and young firms are credit rationed until they grow sufficiently. Cabral and Mata (2003) show that a related model captures well the evolution of the size distribution of Portuguese firms.

Firm Age. The actions of a firm over time can help to reveal private information and build a reputation (Diamond, 1991) and develop relationships with financial institutions (Sharpe, 1990; Rajan, 1992; Petersen and Rajan, 1994). Over time, profitable firms also accumulate capital and internal funds to finance investment (Albercurque and Hopenhayn, 2003). Petersen and Rajan (1995) find that young firms are less likely to take advantage of early payment discounts on trade credit, and that loan interest rates decline with firm age.

Banking relationships. A large theoretical literature argues that incumbent banks over time become more efficient monitors or accumulate private information about firms they lend to (Sharpe, 1990; Rajan, 1992; see also Von Thadden, 2004, who highlights an error in Sharpe and provides a corrected analysis). This implies firms with strong relationships will have greater access to finance, and that changing to a new lender involves some switching costs because of a winner's curse effect (since the new lender must have 'outbid' an existing informed lender). Petersen and Rajan (1994) show that firms with long or concentrated banking relationships repay trade credit more quickly.

Consistent with the winner's curse effect discussed above, Degryse and Van Cayseele (2000) show that firms who switch lenders pay higher interest rates after switching.

Cash flows relative to investment opportunities. Financial constraints will be less binding if internal cashflows are high or investment opportunities are low. I use profits scaled by firm size as a measure of current cashflows, and sales growth as a proxy for investment opportunities. Although widely used, these variables are imperfect; for example profits likely contain information about investment opportunities as well as current cashflows, as argued by Kaplan and Zingales (1997). But as some supporting evidence, Petersen and Rajan (1995) find that more profitable firms take greater advantage of early-payment discounts on trade credit, consistent with the view that such firms are less credit rationed (I replicate this result in footnote 6).

4. Evidence from the Survey of Small Business Finance

I begin by estimating a simple probit regression to study the cross-sectional determinants of firms' matching to fixed-rate or adjustable-rate loans. The probit takes the form:

$$P(\text{fixed}) = \Phi(a_0 + a_1 \text{ . fin.constraints} + a_2 \text{ . lender type } + a_3 \text{ . lender controls} + \\ + a_4 \text{ loan controls} + a_5 \text{ other firm controls} + a_5 \text{ . year dummies} + e) \quad [1]$$

The dependent variable is equal to 1 for a fixed-rate loan, and 0 for an adjustable-rate loan. 'Fin.constraints' includes the measures of financial constraints discussed in Section 3: firm size (log (1+assets)), firm age (log(1+age in years)), return on assets (profits / assets), annual sales growth, and three measures of the strength of lending relationships: the number of financial institutions the firm uses, the log of the length (in years) of the firm's relationship with its primary lender, and a dummy for whether the most recent loan was not from the firm's primary lender. This dummy variable (positive for 23 per cent of the sample) captures the 'switching' mechanism discussed in Section 3 that switching lenders conveys negative private information about the firm.

‘Lender type’ consists of 2 dummy variables, respectively equal to 1 if the loan provider was a bank (either a commercial or savings bank), or a non-financial-institution. The omitted category is non-bank financial institution, which includes finance companies, leasing firms, insurance companies, credit unions and so on. ‘Lender controls’ includes other controls relating to the provider of the most recent loan: the log(distance) between this lender and the firm, and two dummy variables reflecting the main type of interaction between the firm and this lender (face to face, telephone, or other). Distance and the form of interaction are widely used to measure the importance of localized ‘soft’ information about the firm for lending decisions (Liberti and Mian, 2006; Degryse and Ongena, 2005; Berger, Miller, Petersen, Rajan and Stein, 2005; Petersen and Rajan, 2002; Stein, 2002). ‘Loan controls’ includes the maturity of the loan, loan size scaled by firm assets, 5 dummy variables for the loan type (e.g. line of credit, business mortgage, vehicle loan etc.), and 7 dummies for types of collateral pledged.

Controls in the ‘lender type’, ‘lender controls’ and ‘loan controls’ categories all reflect different characteristics of the most recent loan. Endogeneity is thus a potential concern, since these features are jointly determined with the ‘fixed or adjustable’ component of the loan contract. Although no convincing instruments are available, as a robustness check I always present empirical results estimated two different ways. The first specification excludes nearly all these potentially endogenous loan characteristics (I control only for the loan type); while the second specification includes all the controls. Although some coefficients are estimated less precisely when these potentially endogenous loan characteristics are included, the main results are quite robust.

‘Other firm controls’ consists of firm leverage (book debt / book assets), a dummy equal to 1 if the local bank Herfindahl index (HHI) is > 1800, industry dummies at the 2-digit SIC level, a dummy for whether the firm had recently been solicited by financial institutions, 2 dummies for whether the firm is an S-corp or C-corp (unincorporated is the omitted category), and 3 dummy variables for the geographic region of the firm. I also include a year dummy for each year a loan is observed in the SBF sample.

As argued earlier, it is important to check that the results are robust to excluding credit lines (because the properties of these loans are quite different), and robust to including or excluding endogenous loan controls like maturity, loan size and lender type. Thus, I estimate four specifications reflecting each combination along these two dimensions. Results are presented in Table 3. Estimates are based on a weighted probit using the SBF sampling weights. Coefficients are normalized to reflect marginal effects, and Huber-White robust standard errors are used.

[INSERT TABLE 3 HERE]

4.1 Financial constraints

As discussed earlier, the first hypothesis I test is that firms identified as credit constrained minimize their exposure to rising interest rates by matching with fixed rate debt. The results in Table 3 provide consistent support for this hypothesis, based on the proxies for financial constraints discussed in Section 3 (firm size, age, lending relationships and cashflows relative to investment opportunities).

First, the estimates show that smaller and younger firms are significantly more likely to match with a fixed rate loan. A doubling of firm size reduces the probability of matching with a fixed rate loan by between 4.7 per cent and 9.2 per cent depending on the specification. Doubling firm age reduces the probability of matching to a fixed rate loan by 4.7 to 5.2 percentage points. The firm size coefficient is always statistically significant at the 1 per cent level, with z-statistics generally above 5. Firm age is statistically significant at the 2 or 3 per cent level depending on the specification.

To illustrate the economic significance of these estimates, I take the original dataset and set firm assets and firm age for all firms equal to their 10th percentile sample values (assets = \$34 200, age = 4.2 years). Under this scenario, the average predicted probability of matching to fixed rate debt is 69 per cent (based on Column 1 coefficients). When firm size and age are replaced with their 90th percentile values (assets = \$695 000, age = 30.4 years), this predicted probability falls to 34 per cent.

In other words, holding other characteristics fixed, small, young firms in the SBF match more than twice as often to fixed rate loans as large, mature firms.

Examining results for the lending relationship variables, 'number of financial institutions' and 'years with primary lender' are statistically uncorrelated with matching to a fixed or adjustable-rate loan. However, the 'switch' dummy, equal to 1 if the loan is not from the firm's primary lender, is positive and significant at the 1 per cent level in columns 1 and 2. Firms switching from their primary lender appear more likely to use fixed rate debt, consistent with the hypothesis modelled in Sharpe (1990) and Thakor (2004) and confirmed empirically in Degryse and Van Cayseele (2000) that switching signals negative private information about firm quality and creditworthiness.

Turning to the accounting variables, firms with lower cashflows (measured by profits / assets) or more growth opportunities (measured by sales growth) are more likely to be financially constrained; I find such firms also match more frequently with fixed rate loan contracts, consistent with previous results. The coefficient on profits is negative and significant at the 5 per cent level in Columns 1 and 2, and close to significant (p-value between 10 and 15 per cent) in Columns 3 and 4. The sales growth coefficient is always positive although significant at the 10 per cent level in Column 1 only.

As an additional check on the proxies for financial constraints used in Table 3, I estimate a linear model of the percentage of early payment trade credit discounts taken by the firm as a function of the explanatory variables from Table 3, following Petersen and Rajan (1995).[6] I find that variables correlated with matching to a fixed rate loan are also correlated with the firm taking fewer early-payment discounts. Specifically, smaller firms, younger firms and less profitable firms are less likely

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[6] To conserve space, I report the results below rather than in a separate table in the text. The dependent variable is the proportion of trade credit early payment discounts taken. The main estimates [standard errors] are:

log(assets)	1.73**	(0.85)	leverage	-3.06	(2.38)
log(firm age)	4.48**	(1.94)	no. lenders	-2.54***	(0.91)
profits/assets	1.65*	(1.00)	log(years prim. lender)	2.96***	(1.47)
sales growth	-1.35	(2.88)	switching dummy	1.92	(3.04)

The sample size is 2087. The sample is smaller than 3248 partially because not all firms use trade credit and partially because not all who do were given the option to use early payment discounts.

to take trade credit discounts, significant at the 5 per cent level for size and age, and the 10 per cent level for profits/assets. Sales growth is correctly signed although not statistically significant. The main difference is the relative impact of different bank relationship variables. Firms with many lenders or a short primary relationship length take fewer trade credit discounts, but the switching dummy (ie. most recent lender is not primary lender) is not statisically significant. In contrast, in Table 3 the switching variable is significant but the other two relationship variables are not. The act of the firm switching from its primary lender appears particularly relevant for 'fixed-versus-adjustable' outcomes, perhaps because switching provides a direct signal to the lender setting the contract terms on the new loan.

Table 3 also presents estimates for two measures of firm indebtedness: leverage (book debt / assets) and loan size (most recent loan size / assets). High firm leverage is correlated with a lower probability of matching with fixed rate debt. Columns 3 and 4 show this result reflects variation in the size of the most recent loan, rather than the stock of previous debt. In other words, larger loans are more likely to be adjustable rate, holding all else equal. These measures are not considered amongst the proxies for financial constraints, since it is unclear whether low debt firms are less constrained (because they have a higher reserve of debt capacity) or more constrained (because their smaller loans reflect difficulty in obtaining credit at an acceptable interest rate). Small and young firms in the sample are less indebted on average, consistent with the latter hypothesis, although leverage is not correlated in either direction with trade credit repayment patterns (see footnote 6).

4.2 Lender characteristics

An interesting feature of the risk management setting considered in this paper is that both lenders and borrowers are potentially exposed to interest rate fluctuations. It therefore seems plausible that the allocation of risk in the loan contract depends in part on the *lender's* interest rate risk profile. In this section, I test the hypothesis that lenders with a greater ex-ante exposure to rising interest rates originate a lower share of fixed-rate loans, ameliorating their ex-ante sensitivity to interest rate shocks. Arvan and Brueckner (1986) and Edelstein and Urosevic (2003) make exactly this prediction in the context of models of optimal mortgage contract design. This hypothesis is also consistent with Froot and Stein (1998), who show that optimal investment by financial institutions should depend on how returns on the investment covary with the institution's existing portfolio risks.

Specifically, I test this hypothesis by comparing bank loans to loans from non-bank financial institutions. Banks are exposed to rising interest rates through two distinct mechanisms that stem directly from their reliance on deposit finance.[7] First, the 'lending channel' literature discussed earlier finds that when interest rates rise, deposits flow out of the banking system; these outflows cannot be costlessly replaced by other sources of finance (Stein, 1998; Kashyap and Stein, 2000; Ashcraft, 2004). Second, banks face 'maturity mismatch' where long-term assets such as household mortgages are funded by short-term demand deposits. Sierra and Yaeger (2004) presents direct evidence that commercial banks are 'liability sensitive' (i.e. the duration of assets exceeds the duration of liabilities). Savings banks face more significant maturity mismatch than commercial banks, because of their focus on residential mortgage lending (Wright and Houpt, 1996).

Thus, I test the hypothesis that bank loans are more likely to involve an adjustable interest rate than loans from non-bank financial institutions. This prediction receives strong support in the data. Columns 3 and 4 includes two lender dummies, for whether the lender is a bank or non-financial institution. Relative to non-bank financial institutions, the omitted category, bank loans are 13.7 percentage points more likely to involve an adjustable interest rate based on Column 3, and 12.2 percentage points based on Column 4, both statistically significant at the 1 per cent level.

Also consistent with the hypothesis, the stylized fact that deposit-taking institutions originate a higher share of adjustable-rate debt does not just hold for small business loans. The table below

[7] Non-bank commercial finance companies are not FDIC members and cannot raise insured deposits. Instead, these firms rely on a combination of commercial paper, medium- and long-term notes and shareholder equity to fund operations, and securitize business loans where possible. A representative example is the balance sheet of CIT, the world's largest publicly held commercial lending firm (balance sheet available online at www.cit.com/main/InvestorRelations/AnnualReports.htm).

compares estimates in Table 3 to Faulkender (2005), who studies debt fundings by a sample of Compustat firms, and Vickery (2006), who analyzes residential mortgages. In both these papers, some debt fundings are originated by banks, while others are funded by an alternative source (the corporate bond market in Faulkender's sample, and mortgage companies in Vickery's sample).

	Table 3 of this paper	**Faulkender (2005)**	**Vickery (2006)**	
Sample	Loans to small and medium sized firms	Debt fundings by public firms	Residential mortgage originations	
Type of banks	Commercial and savings banks	Commercial banks	Commercial and savings banks	
Comparison source of finance	Loan is from non-bank financial institution	Funding is a corporate bond	Loan is from a mortgage company	
Effect of 'funds provided by bank' on probability of fixed rate loan	-0.137 (0.042)***	-0.828 (n/a)	-0.114 (0.037)***	(commercial bank dummy)
			-0.293 (0.020)***	(savings bank dummy)

Coefficients in the table represent the probability that the debt contract involves a fixed interest rate if funds are provided by a bank, relative to the comparison source of finance listed. Estimate in column 2 is from Table 1 of Faulkender (2005). Since this is a table of summary statistics, no standard error is available. Estimates in column 3 are from Table 2 of Vickery (2006).

The negative coefficients in each cell show that in each case, the debt funding is more likely to involve an adjustable interest rate if the provider of funds is a bank, rather than the comparison non-depository source of finance listed. The difference is particularly stark for Faulkender's sample; the coefficient of -0.828 essentially summarizes the fact that public corporate debt fundings are nearly all fixed rate, while the largest commercial bank loans are nearly all adjustable rate. These results support the view that originating adjustable rate debt provides a mechanism for depository institutions to minimize their ex-ante exposure to rising interest rates.

A potential alternative interpretation is that these results reflect endogenous matching between banks and firms. Perhaps bank borrowers are less financially constrained, which explains why banks originate a higher share of adjustable rate loans? One piece of evidence that speaks against this view, however, is that the source of finance is not correlated with *observable* measures of credit constraints. I estimate a simple probit regression of the 'lender=bank' dummy on the right-hand-side variables from Table 3; apart from 'primary relationship length', none of the other proxies for credit constraints (size, age, profits, sales growth, number of lenders, or the 'switch' dummy) is statistically significant even at the 10 per cent level (results available on request). This suggests bank loans do not flow to significantly more creditworthy firms on average.

4.3 The 'natural hedge' hypothesis

The credit channel evidence reviewed in Section 2 suggests that on average, bank-dependent firms become more credit constrained during periods of rising interest rates. However, exposure to interest rate risk also likely varies a great deal across firms. For example, in industries where output or cashflows covary positively with interest rates, higher internal cashflows will at least partially offset the effects of interest rates on the supply of credit. In these industries, firms have a 'natural hedge' against rising interest rates, and fixed rate debt is less likely to be optimal. In this section I test the hypothesis that the share of adjustable rate loans is higher in such industries.

This test involves two steps. Firstly, I estimate the correlation between industry output and interest rates using 2-digit SIC industry data for the period 1960-2000. For each industry, log industry output is regressed on the 12-month nominal riskless interest rate r_t (contemporaneous and lagged one period), as well as a constant, time trend and log time trend[8]:

$$\ln(y_{it}) = \alpha_0 + \Sigma_{k=0,1} \beta_{ik} r_{t-k} + \alpha_1 t + \alpha_2 \ln(t) + e_{it} \qquad [2]$$

$\Sigma\beta_{ik}$ provides an empirical estimate of the excess correlation of industry *i* to interest rates. (If output in all industries moved proportionately with interest rates, then $\Sigma\beta_{ik}$ would always equal zero). In the second step, I re-estimate the 'fixed-versus-adjustable' regression [1] after replacing the SIC dummies with the estimated $\Sigma\beta_{ik}$. A negative coefficient on this industry correlation variable would be consistent with the 'natural hedge' hypothesis.

[8] Results are robust to using $\ln(y_{it} / y_t)$ instead of log output as the dependent variable in this regression.

The first step estimates are quite precise: of 52 2-digit industries for which industry output data is available, the β's are jointly significant at the 1 per cent level in 26 cases, and at the 5 per cent level in 33 cases. Coal mining, petroleum refining and oil and gas extraction have high β's, reflecting high interest rates during the energy crisis of the 1970s. Industries with negative β's include non-deposit financial institutions, motor vehicles and personal services.[9]

[INSERT TABLE 4 HERE]

Results from the second step probit are presented in Table 4. Industry interest rate sensitivity has a negative coefficient as predicted, significant at the 5 per cent level in Columns 1, 2 and 4, and the 10 per cent level in Column 3.[10] The estimated coefficient is around 1.2-1.5, implying that a firm in an industry whose share of output increases by 1 per cent when interest rates increase by 1 percentage point (i.e. $\Sigma\beta_{ik} = 0.01$) is 1.2-1.5 percentage points less likely to match with a fixed rate loan compared to an industry whose share of output is uncorrelated with interest rates. Since most industries have $\Sigma\beta_{ik}$ between –0.02 and 0.02, the estimated cross-industry 'natural hedge' effect is fairly weak. This estimated coefficient is probably attenuated however, since $\Sigma\beta_{ik}$ is likely subject to substantial measurement error.

Finally, in Column 5, I test whether the natural hedge effect is more pronounced amongst financially constrained firms. I re-estimate the baseline specification from Column 1 of Table 3 including an additional variable $\Sigma\beta_{ik}$ * ln(firm size). Cross-industry variation in the fixed rate share is absorbed by the 2-digit SIC industry dummies, while the interaction term coefficient just captures the

[9] The five largest and five smallest $\Sigma_{k=0,1}\ \beta_{ik}$ estimates are:

SIC	Industry	$\Sigma_{k=0,1}\ \beta_{ik}$	SIC	Industry	$\Sigma_{k=0,1}\ \beta_{ik}$
61	Non-depository institutions	-0.102	10	Metal mining	0.040
37	Motor vehicles	-0.030	29	Petroleum refining	0.065
72	Personal services	-0.030	12	Coal mining	0.103
82	Education services	-0.029	13	Oil and gas extraction	0.187
45	Transportation by air	-0.029	67	Holding and other investment offices	0.232

[10] The interest sensitivity variable is a generated regressor in the sense of Pagan (1984). The hypothesis test that the interest coefficient is equal to zero is still consistent even without adjusting the standard error to reflect this, however (see Pagan, 1984, p.226).

extent to which the 'natural hedge' mechanism is more pronounced for small firms. Although correctly (positively) signed, the coefficient is not statistically significant.

4.4 Owner characteristics

Since firms in the SBF are generally closely held, it seems likely that the personal characteristics of the firm's owner or managers should influence loan contract outcomes. It is also possible that failing to control for owner variables may bias other estimates. For example, my result that small firms match with fixed rate debt may in fact simply reflect the fact that large firms have wealthier owners, who are perhaps less risk averse or less likely to face personal borrowing constraints.

Fortunately the SBF contains a substantial amount of owner and manager data to test this possibility. First, I re-estimate each specification from Table 3 including five owner characteristics available in the 1993 and 1998 SBF surveys: a dummy for whether the owner is also the firm's primary manager/CEO, the owner's age and years of business experience, the primary owner's ownership share, and a dummy for whether the firm is majority-owned by a single family.[11] In fact, I find these owner characteristics have surprisingly *little* explanatory power. Of 20 coefficients (five variables x four specifications) none are significant at the 5 per cent level, and an f-test of joint significance fails to reject the null in all four specifications. (Given this lack of significance, I do not report these results in a separate table. Results are available on request, however.)

I next include a direct measure of owner wealth, available in the 1998 SBF only. For this survey year, I construct a measure of total wealth by summing the firm owner's personal equity, non-housing personal wealth, and equity stake in the firm (net book equity x the primary owner's ownership share). If 'fixed-versus-adjustable' outcomes covary with firm size only because it is correlated with owner wealth, then if both are included as explanatory variables only the wealth variable should be statistically significant. I estimate three different specifications; in each case

[11] The sample size for these regressions is 2033. It is smaller because the complete set of owner variables is only available for the 1993 and 1998 surveys, and also because not all survey respondents answered the owner questions. This smaller sample is the reason why the owner variables are excluded from the initial regressions.

estimates are presented from a baseline regression that excludes owner wealth, then an otherwise identical model where the natural logarithm of owner wealth is added as a regressor. Results are presented in Table 5.

[INSERT TABLE 5 HERE]

Inferences are somewhat imprecise due to the small 1998 SBF sample. However, the results suggest the conclusion that small firms match with fixed rate loans is quite robust to controlling for owner wealth. The coefficient on log assets drops by about one-fifth when owner wealth is included, but it is still negatively signed and statistically significant at either the 5 per cent or 10 per cent level. The coefficient on log wealth is negative as predicted, and statistically significant at the 10 per cent level in the parsimonious third specification. This constitutes some weak evidence that wealthier owners are in fact less concerned about interest rate volatility, consistent with the model of household interest rate risk management developed by Campbell and Cocco (2003) to study household mortgage choice.

4.6 Robustness checks

'Fixed-versus-adjustable' outcomes are jointly determined with other loan characteristics such as the loan term, size, lender and so on. This raises an important question: do firms actively adjust the 'fixed-versus-adjustable' component of the loan, or is the interest rate exposure just determined passively as a function of other parts of the loan package? For example, perhaps firms actively choose a lender and type of loan, but are then just presented with a standardized 'boilerplate' loan contract by the lender, leaving the firm with no effective decision regarding the interest rate exposure of the loan.

The results presented so far already include several specification checks to help address these concerns. As previously shown, the results are robust to the inclusion or exclusion of an exhaustive set of loan characteristics: loan type dummies, lender type dummies, maturity, loan size, collateral dummies, distance between lender and firm, and dummies for the primary form of lender-firm interaction. Thus, the results still hold even when we only compare firms of different sizes or ages who all have the same type of loan (eg. a business mortgage), all used the same lender type (eg. a commercial bank), and so on. Estimates are also robust to excluding credit lines from the sample.

This section presents some additional robustness checks to help rule out alternative explanations for the empirical results. As a first simple test of the hypothesis that the choice of lender or loan type dictates the 'fixed-versus-adjustable' component of the loan, I visit the small business websites of 10 major US commercial banks, and study online documentation for two types of loans, unsecured term loans and commercial mortgages. In each case I record whether the bank offers firms a choice between a fixed and adjustable loan contract. I find that firms are indeed offered this choice in 12 of 15 cases where this information could be determined from the website. (In the other 3 cases, only a fixed rate contract is offered.)[12] This speaks against the view that firms are shoehorned into a given interest rate exposure once the lender or loan type has been determined.

Further supporting evidence is presented in Section 6, which estimates cross-sectional 'fixed-versus-adjustable' regressions using data from the Survey of Terms of Business Lending (STBL). Unlike the SBF, the STBL uniquely identifies the provider of each loan. I find that loan size, a close proxy for firm size, is significantly negatively correlated with matching to a fixed interest rate, even after controlling for bank fixed effects. This result confirms that individual banks do offer both types of loans, and also demonstrates that small firms match with fixed rate loans even just by comparison to larger firms who borrow from the same bank.

A final set of robustness checks are presented in Table 6. The first of these considers the hypothesis that the lender dictates the interest rate exposure of the loan. One implication of this hypothesis is that we would expect results to look different for 'captive' firms, who have no viable choice between lenders, and non-captive firms, who can easily switch if the terms of the loan are not

[12] I collect data for the commercial banking arm of the 10 largest US bank holding companies by deposits: Bank of America, Citigroup, JP Morgan Chase, Wachovia, Wells Fargo, HSBC, US Bancorp, SunTrust, Citizens Financial and National City. The three cases where firms are not offered an adjustable rate option are Bank of America (term loan), Bank of America (commercial mortgage), and Wells Fargo (term loan).

as desired. I consider three different proxies for firm captivity: (i) the firm has not recently been solicited by financial institutions (ii) the firm has only a single lending relationship (iii) the firm is located in a concentrated local banking market (HHI > 1800). I then re-estimate the baseline model from Column 1 of Table 3, interacting each ‘captivity’ proxy in turn with the measures of credit constraints used earlier. I then test the significance of each of the interaction terms. Results from this exercise are presented in the first three columns of Table 6.

[INSERT TABLE 6 HERE]

As the Table shows, the interaction terms are almost never statistically significant; in 21 hypothesis tests, the interaction term is significant at the 5 per cent level only twice. Thus, credit constraints are correlated with use of fixed rate debt for both captive and non-captive firms, suggesting previous results are not simply driven by lenders ‘forcing’ firms to use a particular contract type.

In similar vein, the fourth column of Table 6 adds to the baseline model interactions between each measure of financial constraints and two lender type dummies (14 interaction terms in all). I then test the joint significance of each set of lender type interaction terms. Column 5 repeats the same exercise except the financial constraints variables are instead interacted with five loan type dummies. Results presented in Columns 4 and 5 show that none of the sets of interaction terms are statistically significant at the 5 per cent level. Thus, even though lender type and loan type dummies are themselves statistically significant, the *relationship* between firm credit constraints and the matching to fixed or adjustable rate debt is independent of loan type or lender type. In other words, the results are broadly based, rather than being driven by a single loan category or lender type.

4.7 Comparison to existing literature

How do these results compare to existing research on large, public firms? Chava and Purnandanam (2006) study the floating-to-fixed ratio of the debt of around 1800 public companies. They find firms close to financial distress use a higher share of fixed rate debt, consistent with the results from this paper that credit-constrained firms match with fixed rate loans. A notable point of difference, however, is that Chava and Purnandanam find managerial and corporate governance variables, particularly the incentives facing the firm's CFO, to be key determinants of a firm's floating-to-fixed ratio. Related research finds that managerial characteristics also play an important role in the decision to hedge using derivatives (eg. Rogers 2002, Tufano 1996). In contrast, this paper finds that owner and manager variables are relatively unimportant in determining the interest rate exposures of small firms. A plausible reconciliation of these differences is that small firms have simple organizational structures, where the incentives of owners and managers (often the same person or family) are well-aligned. Thus, managerial agency problems are are likely to be relatively less important for risk management outcomes. In contrast, credit constraints are likely to be *more* important, since financial frictions are most likely to bind for small, bank-dependent firms.

Also closely related is Faulkender (2005), who studies incremental fixed-versus-adjustable outcomes for debt fundings by a panel of publicly traded firms from the chemicals industry. Unlike this paper, Faulkender finds quite weak evidence for 'hedging' theories of risk management, consistent with the notion that hedging motivations are most important for small, private firms. Faulkender's main result is that firms engage in 'market timing', they switch between fixed and adjustable rate debt exposures depending on the shape of the yield curve. In the next section, I show that these patterns also extend to small firms, by analyzing a long (26-year) time-series of the share of fixed-rate business loans.

Regarding the source of capital, Faulkender and Chava and Purnandanam both note that bank loans are significantly more likely to involve an adjustable interest rate than public debt fundings.[13] Neither paper suggests an explanation for this stylized fact, however. This paper presents evidence that bank loans are more likely involve an adjustable rate even compared to other, private sources of finance; it also proposes a unified explanation for these facts, arguing that depository

[13] Chava and Purnandanam find that firms with a public debt rating (a proxy for greater reliance on public debt rather than bank loans) have a 36 per cent higher fixed rate share. Faulkender finds a positive relationship between firm size and fixed rate exposures, which he argues reflects the fact that large firms originate more of their debt in public markets.

institutions originate a higher share of adjustable rate debt as a way of ameliorating exposure to maturity mismatch and the 'bank lending channel' of monetary policy.

A final question: how important quantitatively is the 'fixed-versus-adjustable' decision as a margin for risk management? Appendix A presents simple calculations of how much 'fixed-versus-adjustable' outcomes affect small firms' cashflow sensitivity to interest rate movements. I then compare these to corresponding calculations for the use of interest rate derivatives by large firms, given that derivatives are the margin of risk management most often studied in the literature. (These derivatives calcuations are based on data from Guay and Kothari, 2003.) Scaled by firm size, I find the 'fixed-versus-adjustable' margin has a significantly greater effect on firm interest rate sensitivity than the use of derivatives, often larger by an order of magnitude or more depending on assumptions. This finding is consistent with other recent papers that emphasize the importance of operational hedging and other non-derivatives decisions for firm risk management outcomes (eg. Bartram, Brown and Minton, 2006; Chava and Purnandanam, 2006; Petersen and Thiagarajan, 2000).

5. Time-series Patterns in Fixed and Adjustable Rate Lending

Recent work by Baker, Greenwood and Wurgler (2003) and Faulkender (2005) shows that the interest rate exposure of firms' new debt fundings fluctuates over time in response to changes in debt market conditions like the level of interest rates and the shape of the yield curve, a phenomenon they dub 'debt market timing'. For example, both these papers find firms are more likely to borrow short term or at a floating interest rate when the yield curve is steep. Baker et al study time-series variation in aggregate debt maturity, while Faulkender examines the 'final' interest rate exposure of debt fundings by a sample of Compustat firms; this exposure takes into account whether the funding was initially fixed or floating plus whether an interest rate swap was used.

In this section, I extend previous research by testing whether these time-series patterns also apply to the share of fixed-rate commercial loans. I use two data sources, the SBF data employed earlier, and the Survey of Terms of Business Lending, a quarterly survey of banks conducted by the Federal Reserve Board. To preview the results, I find similar time-series patterns to previous research, even when restricting the sample to loans to small firms or loans made only by commercial banks. I discuss implications of these findings for theories of 'debt market timing'.

5.1 *Evidence from the Survey of Terms of Business Lending (STBL)*

The STBL is a quarterly survey of around 200 US commercial banks, who report on all business loans greater than $1000 extended during a given reference week. Banks report information on the loan size, maturity, interest rate, fees charged, commitment status, whether or not collateral was posted against the loan, and where available the bank's internal credit rating of the borrower.

From the initial STBL sample, I drop loans with maturity under one year (or with no stated maturity), since the distinction between fixed and adjustable rates is negligible for very short-term debt. I also exclude loans made under commitment, because of the issues associated with fixed rate lines of credit discussed in Section 3.[14] Using the remaining term loans, I construct value and volume-weighted quarterly time-series of the proportion of fixed-rate loans for the period 1977–2004. These are presented in Figure 1 below.

[INSERT FIGURE 1 HERE]

The thick line in the upper panel of the Figure is the volume of fixed rate loans as a fraction of the total sample. The thin line is the dollar value of fixed rate loans as a proportion of the value of all loans. In both time-series, the proportion of fixed rate loans fluctuates substantially over time. For example the volume-weighted share falls from 0.8 in 1977 to around 0.3 by 1985, then drifts upwards on average over the rest of the sample. The lower panel shows how the federal funds rate and 10-1 year yield spread evolved over the same period.

I now estimate how the aggregate share of fixed rate loans is correlated with three measures of debt market conditions, using a similar approach to Baker et al (2003). Namely, I regress the fixed

[14] Commitments are also reported differently in the STBL than in the SBF. The STBL does not report commitments made, only amounts drawn down on the credit line.

rate loan share on the real interest rate, quarterly inflation rate, the 10-1 year Treasury yield spread, as well as a time trend and the average log real loan size and log maturity of loans extended in the quarter. I also include a lagged dependent variable to soak up any residual autocorrelation in the fixed rate share. Results are presented in Table 7. The estimates in the Table reflect the long-run effect of changes in the right hand side variables on the fixed rate share (this differs from the short-run coefficients due to the presence of a lagged dependent variable).

[INSERT TABLE 7 ABOUT HERE]

Baker et al (2003) find the share of long term debt relative to short term debt is lower when inflation, the real interest rate or the slope of the yield curve are high. Table 7 demonstrates that these variables also in general predict a lower share of fixed rate loans, consistent with Baker et al's findings.

Results in Column 1 are based on the proportion of fixed rate loans, while Column 2 uses the value-weighted series. In Column 1, a one percentage point increase in the real interest rate is estimated to reduce the fixed rate share by 4.8 percentage points, while a one percentage point increase in the 10 year – 1 year interest rate spread reduces the fixed rate share by 7.4 percentage points. Both estimates are significant at the 1 per cent level. The inflation rate coefficient is close to zero and not statistically significant. In Column 2, the yield spread variable is somewhat smaller and now significant only at the 10 per cent level.[15] However, the inflation coefficient becomes negative and statistically significant at the 10 per cent level, consistent with its sign in Baker et al (2003).

Columns 3 and 4 use the same specifications, except that the two time-series are constructed only from smaller loans (a cutoff of $250 000 in terms of year 2000 dollars is used). The results are similar.[16] The results in these two columns suggest that debt-market timing is prevalent amongst small firms, who make up a disproportionate share of small loans studied in Columns 3 and 4.

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[15] The overall R^2 also drops substantially, from 0.84 to 0.23. The value-weighted series is noisier probably because it can be easily skewed by a few very large loans in any given quarter.

[16] As a sensitivity check of whether the results are driven by the large decline in the fixed rate share in the early part of the sample, I generate a dummy equal to 1 in the second half of the sample, and re-estimate all four

5.2 Evidence from the SBF

As additional evidence specifically relating to small firms, I re-estimate the four baseline SBF regressions from Table 3 after replacing the year dummies with the three debt market variables used above (i.e. the real Federal Funds rate, 10-1 year yield spread and inflation rate). Although it is a cross-sectional survey, the SBF does contain a substantial time-series dimension, because I consider data from three survey vintages, where loans in each survey are originated in a window between the survey date (normally 6-12 months after the end of the survey reference year) and three years prior to the end of the survey reference year. The SBF reports the year and month on which the loan was originated, so each loan is then matched against debt market conditions at the time of origination.

[INSERT TABLE 8]

Estimates for the three debt market variables are presented in Table 8 (other coefficient estimates are very similar to Table 3). Similar to the STBL results, the Table shows that SBF firms, which by definition are all small and medium sized enterprises, match more often with fixed rate debt when the yield curve is flat or real interest rates are low. The yield curve coefficient is significant at the 1 per cent level in three of four specifications, and at the 5 per cent level in the other. The real federal funds rate coefficient is less precisely estimated, but is significant at the 10 per cent level in two of the four specifications. Finally, in unreported regressions, I interact the debt market conditions variables with firm size, to see whether market timing patterns are more or less pronounced amongst the smallest, potentially most credit constrained firms. These interaction terms are not statistically significant (results available on request).

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specifications including the dummy as well as its interaction with the variables of interest (yield spread, inflation rate and real interest rate). Out of twelve cases (three interaction terms x four regressions) the interaction term is significant at the 5 percent level twice, the inflation coefficient in Columns 1 and 3. In both cases the interaction term is negatively signed, suggesting in fact a *stronger* relationship in the second half of the sample.

5.3 Discussion

The two sets of estimates presented above provide a consistent picture: firms are more likely to borrow at an adjustable interest rate when the yield curve is steep or the real federal funds rate is high. These results still apply even if we consider a sample of only small firms or small loans, or an alternative sample of loans originated only by commercial banks.

What do we learn from these findings? Firstly, we have learned that that previous results on ‘debt market timing’ patterns are not simply an artifact of firms substituting between public and private debt over the business cycle. Most directly, the results hold even using STBL data which reflects only a single source of finance, term loans from commercial banks. This is significant, because Baker et al and Faulkender’s samples include a mix of different types of debt, and, as shown earlier, the source of finance is highly correlated with the debt contract’s final interest rate exposure.

Secondly, the results show that ‘debt market timing’ patterns extend to small, privately-held firms. This is to my knowledge a new result, and is not obviously implied by previous research. For example, Baker et al. (2003) find that within the Compustat universe, debt market timing patterns are most pronounced amongst the largest, most mature firms. The fact that these patterns extend to small firms sheds some light on the underlying economic explanations for ‘market timing’ patterns. In a recent paper Chernenko, Faulkender and Milbourn (2006) argue that Faulkender’s (2005) result that firms use adjustable rate debt when the yield curve is steep is driven by firms’ attempts to meet consensus earnings forecasts, and by the compensation structure of the firm’s management, especially the CFO. The results presented above suggest this cannot be a complete explanation, since these patterns are also prevalent amongst small firms, where owner and manager incentives are generally well-aligned.

Baker et al. (2003) present a different interpretation of their results. They suggest firms are successfully ‘timing’ the debt market by issuing short-term debt during periods when excess bond returns are high. Although it seems unlikely that the small firms in the SBF are financially sophisticated enough to be able to successfully forecast future bond returns, it is perhaps possible that firms follow 'rules of thumb', such as borrowing short-term whenever short rates are significantly below long rates, that historically have been associated with systematic excess returns.

To summarize, understanding the sources of 'market timing' patterns remains an active area of research. Although not the main focus of this paper, the results presented here suggest that any unified explanation of 'debt market timing' patterns must be able to rationalize why such patterns are prevalent among both large, public companies as well as small closely-held firms.

6. Cross-sectional evidence from the STBL

As a final robustness exercise, I use the STBL microdata to analyze cross-sectional patterns in 'fixed-versus-adjustable' outcomes. An attractive feature of the STBL is that it identifies the commercial bank which provided each loan, enabling controls for bank characteristics or bank fixed effects. Hence, I am able to check whether previous results are robust to the inclusion of these additional lender controls, which are not available in the SBF. Since the STBL does not report any of the proxies for firm credit constraints used earlier (size, age, bank relationships etc.), I focus on the coefficient on loan size, viewing loan size as a proxy for firm assets. In the SBF, the correlation between loan size and firm assets is $\rho=0.75$, suggesting the proxy is quite good.

The regression sample period is Q1:1997 to Q3:2004. (STBL data on loan risk ratings begin only in 1997). The total sample size is 40658. 45 per cent of these loans are fixed rate, and about 80 per cent are collateralized. The average loan size is \$764 thousand, larger than the SBF, which only samples small firms. Average loan maturity is 4 years. The data includes banks' internal risk rating of the loan, which are classified on a 1-5 scale (1 is the safest, 5 refers to a workout loan). 77 per cent of sample loans are assigned a risk rating, and 94 per cent of rated loans are assigned a middle rating of 2, 3 or 4. Analogous to the SBF regressions, I estimate the following linear probability model:

$$P(\text{fixed}) = \Phi(a_0 + a_1 \, . \, \log(\text{loan size}) + a_2 \, . \, \text{loan controls} + a_3 \, . \, \text{loan risk rating} +$$

$$+ a_4 \text{ bank controls} + a_5 \,.\, \text{time-series controls} + e) \qquad [3]$$

'Loan controls' includes log(loan maturity) and a dummy for whether the loan is collateralized. 'Loan risk rating' includes dummies for each value of the rating, a dummy for whether the bank branch uses risk ratings, and a dummy equal to one if the branch uses ratings for some loans but not the loan in question. Column 1 includes bank fixed effects (533 institutions in total). In Column 2 these fixed effects are replaced by two bank characteristics: bank size (the log of bank assets) and liquidity (liquid assets / total assets, where liquid assets is the sum of cash and Treasury securities as in Kashyap and Stein, 2000). Standard errors in both columns are clustered by bank.

[INSERT TABLE 9 HERE]

Results are presented in Table 9. Column 1 includes bank fixed effects, while in Column 2, these fixed effects are replaced with two bank characteristics drawn from bank Call Reports data: log(bank assets) and (liquid assets / total assets).[17]

The first row of results shows that small *loans* are significantly more likely to involve a fixed interest rate. The coefficient on log(loansize) is –0.034 and –0.055 in Columns 1 and 2 respectively, significant at the 1 per cent level. Interpreting loan size as a proxy for firm size, this result therefore is consistent with previous findings from the SBF that small *firms* match with fixed rate debt. Since we obtain this result even after controlling for bank fixed effects (i.e. comparing loans of different sizes all originated by the same bank), this suggests the earlier result is not somehow an artifact of failing to control adequately for lender characteristics. Estimated coefficients are somewhat smaller than the log assets coefficient from the SBF regressions in Table 3; this likely in part reflects attenuation bias, given that loan size is a noisy proxy for firm size.

[17] The coefficient on bank size is negative and significant at the 1 per cent level. Given the lack of firm controls, this likely reflects the fact that small banks disproportionately lend to small firms, who are also more likely to take out fixed rate debt. The liquid assets variable is not statistically significant.

Results for two measures of loan default risk, collateral and loan risk rating, are somewhat inconsistent. On one hand, collateralized loans are estimated to be 6.0 and 10.2 percentage points more likely to involve a fixed interest rate. Berger and Udell (1990) show that loan collateral is associated with riskier borrowers (those more likely to default), as well as riskier loans, so this positive coefficient is evidence that high-risk firms match with fixed rate debt. However, the risk rating estimates suggest if anything an opposite result. In both columns, the middle three risk rating categories are not distinguishable statistically, since the coefficients on risk=2 and risk=4 are not significant. However, in Column 1 firms in the lowest risk bucket are found to be more likely to match with fixed rate loans (significant at the 5 per cent level), while loans in the 'workout loan' risk bucket are less likely to be fixed rate (significant at the 10 per cent level).[18]

It is difficult to clearly disentangle these findings given the lack of detailed firm controls. The risk-rating results apply only in the tails, which make up only a small percentage of loans (risk=5 loans are 3.8 per cent of rated loans, and risk=1 loans 2.2 per cent). Interpretations should also be tempered by the fact that STBL internal risk ratings have been found to be essentially uncorrelated with ex-post measures of performance such as charge-offs or delinquency (Ashcraft and Morgan 2003, English and Nelson 1998).

To summarize, cross-sectional evidence from the STBL shows that small loans are significantly more likely to involve a fixed interest rate, even after controlling for bank fixed effects or bank characteristics. Since loan size and firm size are closely correlated, this provides further evidence that small firms match with fixed rate debt.

[18] Also, STBL risk ratings reflect the rating of the loan itself, rather than an ex-ante assessment of the firm's creditworthiness (English and Nelson, 1998). Thus, reverse causality may be an issue; if banks view adjustable rate loans as riskier, they will apply less favorable risk ratings to such loans, leading to a positive correlation between adjustable rates and risk ex post, even if loans and firms are randomly assigned ex-ante.

7. Conclusions

This paper finds evidence that small, bank-dependent firms use loan contracts to systematically adjust their exposure to interest rate risk. Credit constrained firms are more likely to match with fixed rate debt, consistent with evidence on the 'credit channel' of monetary policy that suggests such firms are most sensitive to rising interest rates. Fixed rate debt is also less prevalent in sectors where industry output moves procyclically with interest rates, consistent with the idea that firms in these industries have a partial 'natural hedge' against rising interest rates. Both these results match with a credit-constraints model of risk management like Froot, Scharfstein and Stein (1993).

In the time-series, correlations previously identified in the 'debt market timing' literature amongst large public companies are shown to also apply to bank loans extended to small firms; namely, fixed rates are most popular when the yield curve is flat or real interest rates are high. These findings suggest 'market-timing' patterns are not just due to earnings management or managerial agency problems, since these concerns are likely much less important for small firms, where the incentives of owners and managers (often the same person) are generally well-aligned.

Finally, this paper finds evidence that suggests loan contracts reflect the interest rate risk exposures of lenders as well as borrowers. Savings banks and commercial banks, who are sensitive to rising interest rates due to their reliance on deposit finance, originate a significantly higher proportion of adjustable rate loans, ameliorating their own ex-ante exposure to interest rate risk.

This last finding has potentially interesting implications for the evolution of the credit channel of monetary policy. Monetary shocks affect firm balance sheets (the 'balance sheet channel') as well as the ability of banks to lend (the 'lending channel'); Cecchetti (1995) notes [in discussing these two channels] that '*with the introduction of interstate banking and the development of more sophisticated pools of loans, it is only the balance sheet effects that will remain*'. The results in this paper, however, suggest that interest rate exposure decisions of firms and lenders are linked. Thus, improved risk management by lenders may also weaken the balance sheet channel, as banks smooth risk once borne by firms or households. The recent proliferation of flexible ‘exotic’ household mortgages and business loans is perhaps evidence of this ‘risk sharing’ effect in action.

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Appendix A. Quantitative exercise

This Appendix presents details of calculations to estimate the quantitative effect of 'fixed rate versus adjustable rate' outcomes on the exposure of small firms to interest rate risk. The point of comparison is the magnitude of interest rate derivatives hedging by large public firms, since derivatives are the margin of risk management most often studied in the literature.

Estimates of the magnitude of interest rate derivatives hedging are taken from Guay and Kothari (2003). These authors estimate how much cash would be generated by the derivatives portfolios of a sample of top 1000 US public companies following a 3.6 percentage point shock to short term interest rates. Using the 1998 SBF, I then produce comparable estimates for the 'fixed rate versus adjustable rate' decision. That is, I estimate the additional interest expense incurred by an average SBF firm on its most recent loan following this same 3.6 percentage point change in interest rates, assuming the firm chose an adjustable-rate rather than a fixed-rate loan. These two sensitivity estimates are compared side-by-side below. Column 1 is based on the average derivatives positions of Guay and Kothari's entire sample. (Less than half of these firms use interest rate derivatives, which is why the median sensitivities are equal to zero.) Column 2 summarizes just the subsample of 243 derivatives users[19]. Column 3 presents SBF estimates.

	Interest rate derivatives, sample of top 1000 public firms		**Most recent loan, 1998 SBF**
	All firms	Users only	
Mean sensitivity of cash flows to shock, as proportion of:			
Mean interest expense	< 0.039	< 0.069	0.205
Mean assets x10^{-2}	< 0.091	< 0.161	0.956
Mean cash flows from operations	< 0.009	< 0.016	0.029
Median sensitivity of cash flows to shock, as proportion of:			
Median interest expense	0.0	< 0.046	0.235
Median assets x10^{-2}	0.0	< 0.112	0.876
Median cash flows from operations	0.0	< 0.013	0.030

As the Table shows, the 'fixed-versus-adjustable' margin has a significantly larger effect on the firm's cashflow sensitivity to interest rates. For example, the mean sensitivities are greater by a factor of between 2 and 8 compared to the subsample of users (Column 2), and between 3 and 11 compared to the whole sample (Column 1). Moreover, these calculations understate the true difference, for two reasons. One, we consider only the firm's most recent loan, not the entire stock of debt. Two, Guay and Kothari err on the side of overestimating the sensitivity of firm's cashflows to derivatives (their aim is to provide a conservative upper bound).

[19] NB: Only 143 of the 243 derivatives users had positions in interest rate derivatives (35 per cent of the total sample of 413 firms). Guay and Kothari provide no summary statistics for the subsample of 143 firms, which is why I focus on the 243 firms that used some kind of derivatives instrument.

Figure 1
Time-series data: fixed and adjustable rate loans

The upper panel shows the proportion of fixed rate loans over time. The thick black line is the number of fixed rate loans as a proportion of all loans (fixed and adjustable). The thin black line is the value of fixed rate loans as a proportion of the value of all loans (fixed and adjustable). Data comes from the Survey of Terms of Business Lending, and is based on all non-commitment term loans with maturities of 12 months or more.

The lower panel shows the Federal funds rate (thin line) and 10 year – 1 year Treasury yield spread (thick line) over the same sample period.

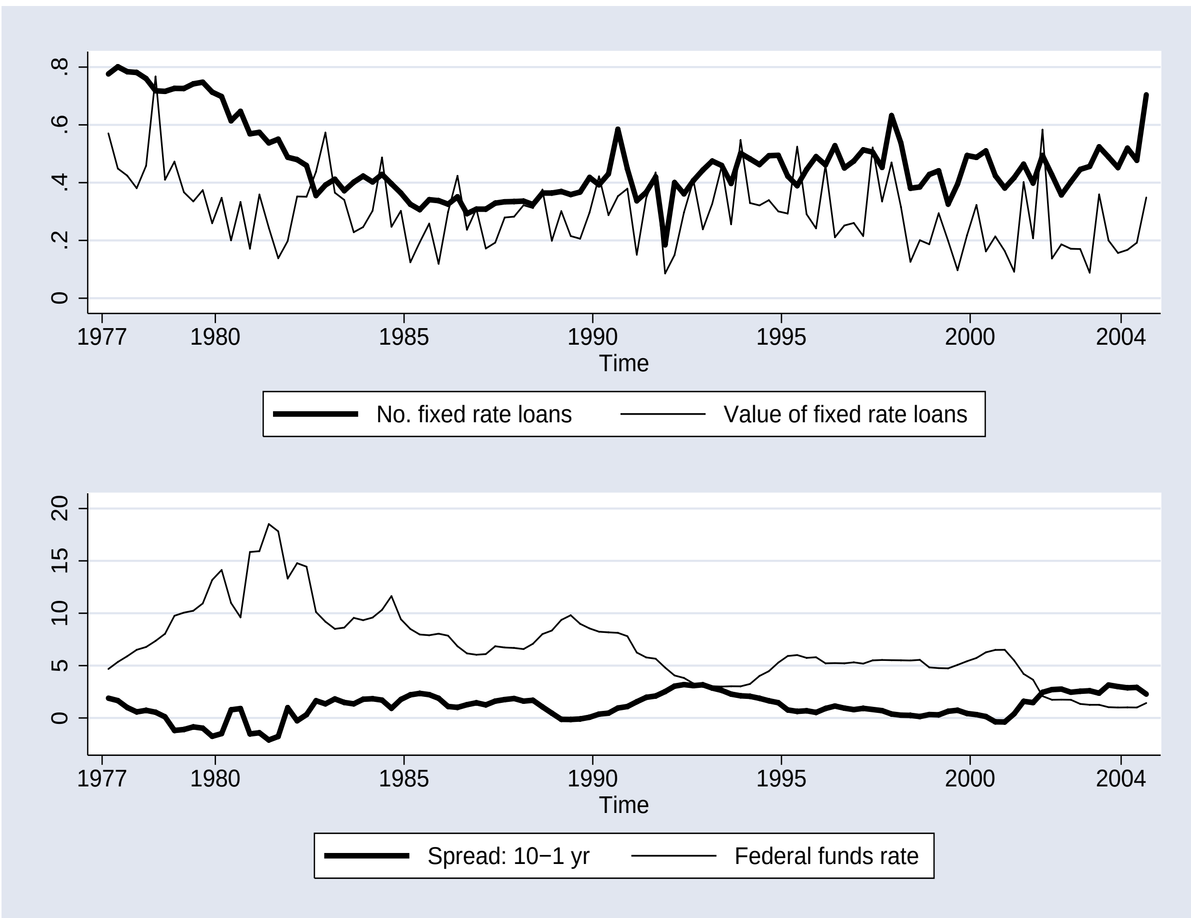

Table 1: Descriptive Statistics, Survey of Small Business Finance (SBF)

The first five columns present summary statistics for the subsample of 3248 firm-loan observations used for regressions. The sixth column presents weighted summary statistics for all firms in the original SBF sample (including those who had not taken out a recent loan and thus not part of the regression subsample). Weighted statistics calculated using sampling weights provided with the SBF.

	Firms in final sample					All SBF firms, (weighted)
	Individual surveys (not weighted)			All years		
	1987	1993	1998	not weighted	weighted	
Number of firms	1215	1335	698	3248	3248	11422
Assets (mean, $000s)	1732	3728	2473	2712	939	468
Assets (median, $000s)	250	720	372	414	177	72
Assets (std. dev., $000s)	4151	10874	6514	8057	3699	2497
Employment (mean, #)	36.5	57.5	39.0	45.6	15.0	8.8
Firm age (mean, years)	13.5	17.6	14.8	15.5	13.6	13.7
Balance sheet:						
Profits / assets	0.36	0.40	0.81	0.47	0.58	0.92
Book debt / book assets	0.59	0.65	0.86	0.67	0.67	0.61
Sales growth	0.22	0.11	0.25	0.18	0.18	0.17
Corporate form (%):						
Sole proprietorship	29	18	25	23	33	45
Partnership	7	7	6	7	8	8
S-Corporation	17	29	34	25	22	20
C-Corporation	47	47	35	45	37	28
Characteristics of most recent loan:						
Loan is fixed rate (%)	56	41	68	52	59	n/a
Maturity of loan (years)	3.80	3.23	4.88	3.80	3.87	n/a
Loan is line of credit (%)	31	60	29	43	38	n/a
Size of loan ($000s)	380.8	350.0	174.0	944.0	324.3	n/a
Provider of most recent loan is a (%):						
Commercial Bank	74	84	71	77	75	n/a
Savings Bank	5	3	4	4	5	n/a
Non-bank fin. institution	16	11	21	15	16	n/a
Non financial institution	5	2	4	4	4	n/a

Table 2: Fixed rate loans by category -- Survey of Small Business Finance (SBF)

The first part of the table presents information on the number of 'most recent loans' of different types as well as the source of those loans (bank or non-bank). 'Non-bank' includes non bank intermediaries such as finance companies, leasing firms, credit unions etc. as well as lenders who are not financial institutions. The second part of the table presents (by source) the proportion of each type of loan for which the interest rate on the loan was fixed, rather than adjustable.

	Number of observations, by lender type			**Proportion of fixed rate loans, by lender type**		
	Bank	Non-bank	All	Bank	Non-bank	All
New line of credit	1259	122	1381	0.28	0.39	0.29
Capital lease	22	48	70	0.64	1.00	0.89
Business mortgage	284	54	338	0.48	0.59	0.49
Vehicle mortgage	359	227	586	0.84	0.96	0.88
Equipment Loan	333	143	476	0.60	0.87	0.68
Other	324	73	397	0.57	0.67	0.59
All loans	**2581**	**667**	**3248**	**0.46**	**0.78**	**0.52**

Table 3: Which firms match to fixed rate loans?

Dependent variable = 1 if firm's most recent loan is fixed rate loan, = 0 if adjustable rate loan. Weighted probit; coefficients normalized to display marginal effects. Standard errors in parentheses are adjusted for heteroskedasticity. Amongst controls not listed, **"Endogenous loan characteristics"** includes maturity of the loan and 7 collateral dummies. **"Other lender controls"** for most recent lender includes log(distance between lender and firm) and 2 dummies for main type of lender-firm interaction (ie. face to face, telephone or other). **"Other controls"** includes: 5 dummies for purpose of loan (ie. credit line, capital lease, business mortgage, vehicle mortgage, equipment loan or other), 3 dummies for location of the firm, industry dummies at 2-digit SIC level, 2 incorporation dummies (ie. C-corp, S-corp or unincorporated), dummy for whether local bank HHI > 1800, and dummy for whether firm solicited by financial institutions.

	(1)	(2)	(3)	(4)
Sample	All loans	No commitments	All loans	No commitments
Firm size and age variables				
Log(assets)	-0.065	-0.047	-0.092	-0.064
	(0.009)***	(0.010)***	(0.010)***	(0.011)***
Log(firm age + 1)	-0.051	-0.047	-0.052	-0.046
	(0.021)**	(0.021)**	(0.021)**	(0.020)**
Cash flows relative to investment opportunities				
Profits/assets	-0.024	-0.021	-0.015	-0.015
	(0.010)**	(0.009)**	(0.010)	(0.010)
Sales growth	0.057	0.021	0.042	0.011
	(0.030)*	(0.030)	(0.030)	(0.030)
Lending relationship variables				
Switch	0.105	0.100	0.046	0.029
	(0.032)***	(0.029)***	(0.037)	(0.036)
Log(years prim. lender + 1)	0.020	-0.002	0.021	0.001
	(0.016)	(0.017)	(0.016)	(0.017)
No. fin.institutions	0.003	0.002	-0.005	-0.006
	(0.010)	(0.010)	(0.010)	(0.010)
Provider of loan (baseline: lender is non-bank financial institution)				
Lender is a bank			-0.137	-0.122
			(0.042)***	(0.037)***
Lender not financial institution			-0.010	-0.104
			(0.096)	(0.097)
Debt				
Loan size / total assets			-0.168	-0.111
			(0.027)***	(0.029)***
Book debt / Book assets	-0.076	-0.063	-0.029	-0.036
	(0.022)***	(0.023)***	(0.025)	(0.026)
Other controls				
Endogenous loan characteristics?	no	no	yes	yes
Other lender controls?	no	no	yes	yes
Other controls?	yes	yes	yes	yes
Year dummies?	yes	yes	yes	yes
pseudo R^2	0.25	0.20	0.28	0.25
No. observations	3248	1867	3248	1867

***, ** and * represents significance at 1%, 5% and 10% levels respectively.

Table 4: Industry interest rate sensitivity

Dependent variable = 1 if firm's most recent loan is fixed rate loan, = 0 if adjustable rate loan. Weighted probit; coefficients normalized to display marginal effects. Standard errors in parentheses are adjusted for heteroskedasticity. Other covariates are the same as the relevant columns of Table 3 as listed below (coefficients very similar to Table 3 results and thus omitted to conserve space). Note that Column 5 includes 2-digit SIC industry dummies; the industry interest rate sensitivity variable is thus excluded, since it is perfectly collinear with the industry dummies.

	(1)	(2)	(3)	(4)	(5)
Sample	All loans	No commitments	All loans	No commitments	All loans
Include endogenous loan/ lender characteristics?	No	No	Yes	Yes	No
2 digit SIC industry dummies	No	No	No	No	Yes
Industry interest rate sensitivity (2-digit SIC)	-1.455 (0.623)**	-1.251 (0.548)**	-1.212 (0.665)*	-1.204 (0.573)**	
Log(assets) * sensitivity					0.036 (0.357)
Other covariates	As Column 1 of Table 3	As Column 2 of Table 3	As Column 3 of Table 3	As Column 4 of Table 3	As Column 1 of Table 3
pseudo R^2	0.22	0.16	0.26	0.21	0.25
No. observations	3248	1867	3248	1867	3248

***, ** and * represents significance at 1%, 5% and 10% levels respectively.

Table 5: Owner wealth (1998 SBF Survey only)

Dependent variable = 1 if firm's most recent loan is fixed rate loan, = 0 if adjustable rate loan. Weighted probit; coefficients normalized to display marginal effects. Standard errors in parentheses are adjusted for heteroskedasticity. Other covariates are the same as the relevant columns of Table 3 as listed below (coefficients very similar to Table 3 results and thus omitted to conserve space).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Include endogenous loan/ lender characteristics?	No		Yes		No (parsimonious model)		
Owner wealth?	Excluded	Included	Excluded	Included	Excluded	Included	Included
Firm size and owner wealth							
Log(book value of assets)	-0.033	-0.027	-0.049	-0.043	-0.040	-0.032	-0.030
	(0.013)**	(0.014)*	(0.015)***	(0.016)***	(0.011)***	(0.013)**	(0.013)**
Log(total owner wealth)		-0.019		-0.015		-0.027	-0.029
		(0.015)		(0.016)		(0.015)*	(0.016)*
Owner equity / total wealth							0.005
							(0.004)
Other controls	As Column 1 of Table 3		As Column 3 of Table 3		Log(firm age + 1) Book debt / book assets Dummies for loan type 1-digit SIC dummies		
pseudo R^2	0.23	0.24	0.29	0.29	0.21	0.21	0.22
No. observations	698	698	698	698	698	698	698

***, ** and * represents significance at 1%, 5% and 10% levels respectively.

Table 6: Robustness checks

The table shows p-values from hypothesis tests after adding new variables to the probit model from Column 1 of Table 3. The new variables are constructed by interacting the measures of credit constraints with various dummy variable(s) as listed below. Contents of the cell are p-values from hypothesis test that the coefficients on the new interaction variable(s) are equal to zero.

	Interact measures of credit constraints with:				
	Proxies that lender has 'captured' firm			Lender type dummies (lender is bank, lender not fin. institution)	Loan type dummies (credit line, vehicle loan etc.)
	Dummy: Firm not solicited by other financial institutions	Dummy for single lending relationship	Dummy for HHI>1800		
p-value; F-test for interaction term on:					
Log(assets)	0.493	0.341	0.025**	0.589	0.151
Log(firm age + 1)	0.179	0.243	0.870	0.675	0.447
Switch	0.269	0.871	0.054*	0.404	0.574
Log(years prim. lender + 1)	0.415	0.880	0.398	0.615	0.373
No. fin.institutions	0.859	0.297	0.111	0.819	0.897
Profits/assets	0.516	0.594	0.514	0.943	0.368
Sales growth	0.023**	0.968	0.866	0.327	0.082*

Table 7: Time-series Evidence
Survey of Terms of Business Lending (STBL)

Quarterly time-series data between 1997Q1-2004Q3. Results are the long-run coefficients from a linear regression that includes a lagged dependent variable (ie. the regression is of the form $y_t = a.x_t + by_{t-1} + e_t$, thus the long run coefficient on x_t is a/(1-b)). Standard errors on the long run coefficients are calculated using the procedure suggested in Bewley (1979), and are also adjusted for heteroskedasticity.

	(1)	(2)	(3)	(4)
Dependent variable	no.fixed loans/ total no. loans	value fixed loans/ total value of loans	no.fixed loans/ total no. loans	value fixed loans/ total value of loans
Sample	All	All	loansize < $250k	loansize < $250k
Debt market variables				
Real federal funds rate	-0.048	-0.023	-0.049	-0.052
	(0.005)***	(0.008)***	(0.005)***	(0.005)***
10-1 year interest rate spread	-0.074	-0.026	-0.044	-0.062
	(0.018)***	(0.014)*	(0.015)***	(0.014)***
Inflation rate	0.004	-0.018	0.012	-0.004
	(0.010)	(0.010)*	(0.010)	(0.010)
Controls				
log(real loan size)	-0.470	-0.001	-0.598	-0.768
	(0.184)**	(0.019)	(0.216)***	(0.186)***
log(maturity)	0.321	0.083	0.849	0.208
	(0.241)	(0.076)	(0.264)***	(0.158)
	0.002	-0.009	-0.009	-0.003
Time trend (measured in quarters)	(0.004)	(0.003)***	(0.003)***	(0.003)
Lagged dependent variable	0.589	0.056	0.537	0.525
	(0.087)***	(0.077)	(0.080)***	(0.071)***
No. of observations	**110**	**110**	**110**	**110**
R^2	**0.838**	**0.211**	**0.841**	**0.836**
Autocorrelation test (p>chi-sq)	**0.980**	**0.337**	**0.944**	**0.867**

***, ** and * represents significance at 1%, 5% and 10% levels respectively.

Table 8: Time-series Evidence
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Dependent variable = 1 if firm's most recent loan has fixed interest rate, = 0 if adjustable rate loan. Weighted probit; coefficients normalized to display marginal effects. Standard errors in parentheses are adjusted for heteroskedasticity. The four columns of the table are based on the four specifications of Table 3, after replacing year dummies with the three debt market variables listed.

	(1)	(2)	(3)	(4)
Sample	All loans	No commitments	All loans	No commitments
Include endogenous loan/ lender characteristics?	No	No	Yes	Yes
Real federal funds rate	-0.023	-0.016	-0.022	-0.014
	(0.012)**	(0.012)	(0.012)*	(0.014)
10-1 year yield spread	-0.049	-0.061	-0.046	-0.059
	(0.018)***	(0.019)***	(0.019)**	(0.019)***
Inflation rate	-0.011	0.017	-0.007	0.020
	(0.016)	(0.016)	(0.017)	(0.017)
Other variables	As Column 1 of Table 3	As Column 2 of Table 3	As Column 3 of Table 3	As Column 4 of Table 3
pseudo R^2	0.24	0.18	0.27	0.22
No. observations	3248	1867	3248	1867

Table 9: Panel Data Results, STBL

Dependent variable = 1 if firm's most recent loan is fixed rate loan, = 0 if adjustable rate loan. Linear probability model, results estimated by least squares. Standard errors in parentheses. Bank fixed effects are included in column 1. Standard errors for both columns of results are clustered at the bank level, and adjusted for heteroskedasticity. Regressions also include 28 dummy variables for each calendar quarter during the period 1997-2003.

Dependent variable	(1) Dummy =1 if loan does not reprice	(2) Dummy =1 if loan does not reprice
Bank fixed effects	yes	no
log(1 + loansize)	-0.034	-0.055
	(0.007)***	(0.012)***
Loan collateralized (1-yes, 0-no)	0.060	0.102
	(0.023)**	(0.041)**
Maturity	0.047	0.049
	(0.021)**	(0.039)
Risk rating - relative to rating = 3 (average risk):		
=1 (lowest risk)	0.100	0.093
	(0.043)**	(0.065)
=2 (low risk)	0.007	-0.012
	(0.020)	(0.062)
=4 (high risk)	-0.011	-0.090
	(0.020)	(0.069)
=5 (highest risk)	-0.049	-0.110
	(0.026)*	(0.069)
Borrower not classified	0.058	0.144
	(0.044)	(0.052)***
Branch doesn't use risk ratings	0.078	-0.010
	(0.042)*	(0.091)
Bank controls		
log(1+bank assets)		-0.037
		(0.014)***
Liquid assets / total bank assets		0.343
		(0.328)
No. of observations	40658	40657
R^2 : Within	0.031	
R^2 : Between	0.125	
R^2 : Overall	0.096	0.156
'Within' error std. dev.	0.33	
'Between' error std. dev	0.37	

***, ** and * represents significance at 1%, 5% and 10% levels respectively.