Bank Oversight and the Capital Structure of German Firms

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Abstract

Pecking order theories predict that information asymmetries result in excess costs of, and thus resistence to, outside versus inside finance. Bank relationships should ameliorate information problems, reduce cost differentials, and diminish reliance on internal funds and bank debt. This paper supports the pecking order hypothesis generally but finds little static effect of bank oversight on firms= capital structure or use of bank debt. Furthermore, bank-attached firms actually reduce leverage more than independents in response to cash flow. Thus, the findings cast doubt on the standard perception of interlocking directorates as an important source of information or signals of quality.

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Caroline Fohlin

According to the ›pecking order hypothesis‹ of capital structure, corporations finance out of retained earnings whenever possible. Moreover, when funding needs exceed internal funds, firms may forgo investment but prefer to issue debt rather than equity if they do turn to outsiders.[1] Such behavior arises because of information asymmetries between the sources and uses of external funds generally, and because of the negative signals new equity in particular sends to potential investors.

More recent research has revived the older view that capital structure may vary systematically among corporate firms and over individual firms' lifecycles. Since availability and quality of information vary from firm to firm, optimal capital structure should differ accordingly. Thus, the theoretical literature identifies several firm characteristics and circumstances that should correlate systematically with the relative extent of debt and equity financing used as well as with the choice between bank debt and bonds. Firms with mild information-related problems may face low relative costs of equity finance and may avoid the risk of having to match net operating returns to fixed debt payments.

Optimal capital structure, because it depends on the accessibility and reliability of information, may also vary due to the organization of financial intermediaries. In particular, institutions that facilitate access to information about firms may temper the problems that lead to inefficient financing decisions. The German financial system, for example, is long associated with universal banking and close relationships between banks and firms; and many attribute importance to the practice of bank representation on clients' supervisory boards as a conduit of information. Such bank oversight may lower the relative costs of and increase access to bank finance, so that

bank-attached firms may have higher leverage (with greater reliance on bank debt) than independent

firms on average.

Another way interlocking directorates may be useful, however, is by equalizing information between the operators of firms and those who provide securities-based finance. If bank relationships improve firms= ability to gain positive reputations in capital markets, then such involvement should minimize the cost gap between debt and equity. Firms may then reduce their leverage. The fact that German banks provide both investment banking and brokerage as well as commercial services should further facilitate this adjustment. In short, formal universal banking relations should speed firms movement through the pecking order of financial instruments.

This paper investigates both the role of asymmetric information and the effects of bank oversight in the patterns of German corporate capital structure at the start of the twentieth century. Germany is a useful case to study given that country=s long-standing adherence to universal, relationship-based banking practices and the many hypotheses made about the benefits of such a system. The period prior to World War I is particularly important for a number of reasons: it falls close to the roots of the development of the modern German financial system, it coincides with a period of rapid industrial investment and growth in Germany, and it predates the upheaval that altered German economic and financial relations for much of the remainder of the twentieth century. Moreover, since new historical evidence supplements the already available modern data, such research may expand the empirical testing grounds for theoretical findings on firms= financial decision making.

The results indicate that information-based theories seem to apply to the German industrialization context. In particular, most hypothesized determinants of leverageBsuch as cash flow and firm sizeBare also systematic predictors in the current sample. Controlling for these other factors, leverage also declines significantly over firms= life cycles. The effects of formal bank oversight, however, seem to be minimal. Capital structure changes little with formalized bank relationships. Moreover, controlling for other firm attributes, attachment to a universal bank offers no consistent speeding of firms= progress through the pecking order of financing modes but does heighten firms= response to increasing cash flow. Finally, a comparison of debt maturities reveals no significant variation between bank-attached and independent firms in the relative use of short and

[1] On pecking-order behavior, see the study by Donaldson (1961) and the discussion by Myers (1984).

long-term debt or in factors associated with that choice. Thus, the results generally fall in line with predictions of information-based theories of capital structure but undermine the traditional emphasis on formal bank-firm relationships for ameliorating information problems, increasing access to bank debt, and accelerating reputation-acquisition in capital markets.

The paper is organized as follows. Section 2 provides a brief background on the theoretical framework and some of the existing evidence. Section 3 describes the data source and sample used. The empirical analysis proceeds in sections 4 and 5. Section four evaluates factors correlated with capital structure among firms in general, while section five assesses the additional impact of bank oversight on corporate financing patterns. Section 6 concludes.

2. BACKGROUND

In a tax-free world with perfect competition, freely-functioning markets, and symmetric information the choice among financial instruments has little consequence for firms. Under such conditions, Modigliani and Miller (1958) proved their now well-known proposition that firms cannot alter the total value of their securities by varying the mix between debt and equity. That is, capital structure is irrelevant. The stringent Modigliani-Miller conditions, however, rarely hold; consequently, optimal methods of corporate finance may vary systematically with firm characteristics.

Many theories of capital structure, most hinging on problems of asymmetric information and agency problems, have appeared in the past several years. In this literature, information and preference gaps between firms (or managers) and potential investors create differences in the desirability of various types of financing. Because such problems are inherent in the use of any outside funds, recourse to external finance may raise financing costs. In the extreme, internally-generated funds may constitute the only viable means of financing new investment. Only in the presence of mechanisms able to transmit credible information and ameliorate conflicts between managers and investors is external finance viable.

Firms seeking outside finance must then decide between debt and equity, and that choice is based largely on the relative costs and benefits of the two instruments. Earnings on debt are bounded

above and thus cannot be improved by extra efforts firms might or might not make. Equity returns, in contrast, depend directly on firm valuation and therefore on the quality of managers, investment opportunities, and the observability of returns. Moreover, firms have the incentive to issue new equity when insiders believe shares to be overpriced. Such information problems theoretically lead to the underpricing of equity and the rejection of worthwhile projects by existing shareholders. Consequently, in cases in which it is difficult to determine firms' worth (either *ex ante* potential or actual outcomes), debt imposes lower information-related costs on firms and is preferred over equity.[2] Likewise, when the potential for managerial perquisites and overinvestment is high, debt can increase managers= relative stake in the company and reduce the availability of funds available for overinvestment.

Debt itself is a heterogenous category involving varying degrees of maturity, liquidity, collateralization, intermediation, and monitoring. As with the debt-equity tradeoff, inability to credibly relay information to securities markets constrains firms' options (see Diamond, 1991, and Chemmanur and Fulghieri, 1994). Bank loans, because they are typically the most closely monitored mode of finance, are usually seen as the first step to gaining a reputation for high quality and efficient disposition of outside funds. Such monitoring is thought to alleviate asset substitution as well as under- and overinvestment (Jensen and Meckling, 1976, Myers, 1977, and Stulz, 1990). Compared to bonds, however, bank debt may impose additional costs that result from monitoring, renegotiation, and the potential for rent-extraction due to the banks' access to proprietary information. Thus, firms may avoid bank financing when bond-issuance is feasible (see Rajan, 1992, and Sharpe, 1990).

The profusion of theoretical models offers a wide array of implications that can be tested empirically. Theoretical models imply potential differences in capital structure among firms: factors that mitigate conflicts of interest and problems of asymmetric information tend to promote greater use of outside finance and of equity in particular. Thus, firm leverage is hypothesized to increase with the extent of information asymmetry, liquidation value, managerial reputation, firm value,

[2] See Myers and Majluf (1984), Diamond (1984), Gale and Hellwig (1985), and Townsend (1979). Related models appear earlier in Ross (1977), Leland and Pyle (1977), and Lee, Thakor, and Vora (1983). Capital structure is relevant due to moral hazard problems in Chaney and Thakor (1985), Hellwig (1981), and Jensen and Meckling (1976). Information asymmetries do not always result in pecking-order behavior; see Brennan and Kraus (1987) and Noe (1988). See Harris and Raviv (1991), Hellwig (1991), and Calomiris (1995) for reviews of related literatur

default probability, and managerial equity ownership but to decrease with growth opportunities, investigation costs, and the interest coverage ratio (see Harris and Raviv, 1991).

Despite a general lack of conflict among theoretical predictions, existing models yield opposing results on the relationship of leverage to profitability and free cash flow. In particular, agency models suggest that leverage is positively associated with free cash flow but negatively related to profitability. The converse holds for asymmetric information-based models. Such models suggest that firms prefer to fund investment internally, cash flow permitting, than to resort to external funds. Empirically, however, free cash flow and profitability are often closely related, and the difference often hinges on the commitment of firms to specified dividend payouts. Thus, dividends may also be a significant positive determinant of leverage (Baskin, 1989).

The pecking order hypothesis also suggests that financing decisions may change over the firm=s lifecycle. Often, quality and availability of information grows with the development of the firm so that firms may experience fewer information-related problems as they become older, larger, and have possibly established track records. The fact that reputations take time to establish suggests that mature firms should tend towards more equity in their capital structure relative to immature firms. That is, minimizing information problems reduces the cost gap between internal and external funding and between debt and equity securities and thus alters firms= tradeoffs.

Monitoring is seen as key to many of the theoretical models of firm capital structure, and the German financial system is thought to perform such tasks in a more direct way than its American or British counterparts. In particular, German banks often place their directors or managers on the supervisory boards of client firms, and this representation is thought to improve both the banks= insight into firms= investment opportunities and financial positions and the banks= control in situations of conflict or distress. Such positions may also provide signals of credit worthiness to capital markets. Moreover, German industrial banks, or universal banks, provide the full range of financial services, from short-term lending on lines of credit to underwriting of bonds and equities. The setup of the German financial system, therefore, may promote repeated interaction over the firm=s lifecycle and the development of long-term relationships.

A natural implication of close bank-firm relationships, and a presumed motivation for them,

is the amelioration of asymmetric information problems and accompanying distortions in firms= financing decisions. In general, the banks= superior information about affiliated companies might lead to easier access to debt financing, and to bank debt in particular. The easy observability of bank membership in firms= boards, and the possible positive signal these positions may send, suggests that bank-affiliated companies may also gain faster access to equity financing than independent firms. Such adjustment may be accelerated in the current context, because of regulatory limits on the issuance of bonds. The fact that the universal banks provide underwriting and brokerage of equity shares, in addition to all kinds of debt services, should only speed such seasoning effects.

It must also be acknowledged that bank board membership is probably at least partly determined based on characteristics of the firms involved, and those firm-specific effects may relate to the choice of financing instrument. That is, bank affiliation may be determined simultaneously with capital structure. If bank-affiliated companies would have had unusually poor access to debt financing, then attachment may only raise such companies to the levels of leverage experienced by other firms. By similar reasoning, affiliation may equalize firms= rates of progression through the financial pecking order. Given the universal structure of German banks, however, bank oversight might equally arise because of a firm=s desire to issue equity. Empirical evidence in this, and in other studies, suggests that such selection bias is minimal. For example, Fohlin (1997 and 1998) both suggest that bank-attached German companies perform similarly to independent firms and are, if anything, larger and more liquid. Both types of firms also invest at comparable rates. The current study also shows that distributions of firm leverage and use of short- versus long-term debt are very similar for attached and independent firms.

Not all theoretical predictions are easily tested, but a wide range of empirical work has produced some interesting results. Despite methodological differences, the clear consensus emerges that leverage varies fairly consistently with certain firm characteristics.[3] In particular, most studies find that leverage increases with the tangibility of assets, investment prospects, and firm size and decreases with volatility, likelihood of bankruptcy and profitability. In addition, leverage is associated with past dividend payouts and lagged values of leverage.

Though the empirical work so far tends to support capital structure theories based on

[3] See Baskin (1989), Rajan and Zingales (1995), Harris and Raviv (1991), and included studies.

asymmetric information and conflicts of interest, direct evidence on the existence of a financial pecking order is somewhat mixed. In favor of the theory, leverage does seem to fall with firm profits or cash flow (Baskin, 1989, Chaplinsky and Nichaus, 1993, and Rajan and Zingales, 1995). Using a different methodology, however, Helwege and Liang (1996) find that the probability of choosing external financing is unrelated to internal cash and that greater information asymmetries do not increase the propensity to issue debt. Jung, Kim, and Stulz (1996) find that, in violation of the pecking order, some firms with apparently poor investment prospects issue equity. Their findings support the agency model. The current paper focuses on theories based on information asymmetry, though these issues do not exclude the potential for agency costs as well.

3. DATA SOURCES AND SAMPLE DESCRIPTION

The empirical analysis of this paper is based on a randomly-chosen cross-section of 320 German joint-stock companies in 1904. This year is used for a couple of reasons. First, interlocking directorates between banks and industrial companies, though presumed to have played an important role in the German industrialization, only became widespread in the last decade of the nineteenth century. Finding stable bank relationships requires choosing firms at the start of the twentieth century. The economic upheaval of the 1900-01 stock market crash and its aftermath provides further justification for selecting firms slightly later in the industrialization period. The use of a cross section of firms, while forcing the common assumption that different firms represent one firm at various stages of its development, eliminates problems of serial correlation and shocks (such as stock market crashes or sudden inflation) that occur at varying points in different firms= lifecycles.

The data come from the *Handbuch der deutschen Aktiengesellschaften* (HDAG)Ban annual reference manual reporting on every German joint-stock company. The HDAG gives balance sheets, profit and loss statements, lists of supervisory and executive board members, as well as histories of share capital, dividends, and share prices (for listed firms). In most cases, the HDAG also provides details of firms= origins, purposes, and important developments.

The firms are all joint-stock firms, and thus have clearly accessed some equity finance.

However, many firms in this period were transformed into joint-stock companies while remaining largely in the hands of their founders. Thus, there is large variation in the extent of equity in the firms= capital structure and the dispersion of ownership of that equity. In addition, access to equity for expansion and new investments may still depend on seasoning and reputation.

Various measures of leverage as well as tangibility of assets (fixed assets as a share of total assets), investment prospects (typically measured by the ratio of market to book value of equity), firm size (measured by the natural logarithm of sales), dividends, and profits all can be determined from the information reported. Of course, market-to-book value of equity can be calculated only for firms with stock market listings, since they are the only ones to report share prices.

Measures of leverage vary quite a bit in the literature on firm capital structure. This paper uses the ratio of debt to equity, both measured at nominal book values and taken directly from firms= balance sheets. Other definitions yield fundamentally the same results (see Appendix A for other measures). The distinction between debt and equity was clearer in the first part of the twentieth century than it is today. Thus, this paper ignores the question of hybrid securities.

German share companies use a dual system of corporate governance: the supervisory board represents shareholders and appoints an executive board. The latter is responsible for regular company operations, while the former, at least in theory, controls major decisions of strategy and investment. Banks are thought to have gained superior oversight capabilities by placing bank executive board members (managers) on the supervisory boards of firms. Yet membership in supervisory boards was not tied to share ownership; many bankers gained firm board seats without any equity holdings. Measuring formal oversight is fairly simple, since the data source reports the boards of directors of the firms. By matching the names of firm board members with those of the principal universal banks, I create an indicator variable for this form of bank oversight.

Table I summarizes the variables used in the following analysis, broken down by bank oversight category. The last two columns contain the results of probit models, in which a binomial indicator variable for bank oversight is regressed on the remaining variables of interest. The figures given are the change in probability of bank oversight given a one unit increase in the given independent variable. Sectoral fixed effects (included in column four but not in column three) clearly influence the oversight decision, with bank board membership being almost ubiquitous in

some sectors and nearly absent in others.

Leverage, firm age, and listing on the Berlin market provide some useful prediction of bank attachment, though the first two effects are small. An increase in the debt/equity ratio from the overall sample mean of 0.64 to 1.00, for example, raises the estimated probability of bank oversight by less than 5 percent. Similarly, a decrease in firm age by one year (from the overall mean of 15.6 years) increases the estimated likelihood of bank oversight by one half of one percent. The negative prediction of age is due primarily to the existence of a handful of very old firms (over 35 years since founding as a joint-stock company) in the unattached sample. Listing in Berlin, though not in other markets, causes the greatest increase in the estimated probability of attachment: moving from unlisted to listed raises the estimated likelihood of bank attachment by 16 percent. Market-to-face value of shares (not reported) have a very small positive effect on the probability of bank oversight. Thus, while there are certainly some systematic differences between bank-attached and independent firms, industry differences likely carry the greatest effect.

4. THE DETERMINANTS OF FIRM LEVERAGE

In line with the theoretical literature, and given the data available for the current sample of firms, the first set of models estimates leverage as a function of fixed relative to total assets, the natural log of income, net profits as a share of total assets, market-to-face value of common equity shares, the age of the firm (since becoming a joint-stock company), and the existence of a listing on the Berlin or other German stock exchange. Fourteen sectoral indicator variables, also included, control for industry fixed effects. Since only roughly one third of the sampled firms had listings on any stock exchange, the model is reported with and without the share price variable.

Because the dependent variable, leverage, is bounded below at zero, one might normally opt for Tobit regression in this case. In the current sample, however, a few firms have extreme values of leverage, and it is difficult to deal with them in a Tobit regression, short of discarding them. Thus, I use robust regression, in which extreme values are downweighted using a variant of the Huber limited influence estimator. In the current sample, approximately six percent of the observations are equal to zero; this fact reduces the potential for bias in OLS regression. As a check on the sensitivity

of the coefficients to the estimator used, however, I also estimate the models using Tobit and OLS regression with extreme outliers removed. Coefficient estimates and t-statistics for all three models are very similar.[4]

The results for this sample (Table II) largely fall in line with those predicted by theory and found in other empirical studies. Tangibility of assets, as expected, relates positively to leverage, though the coefficient estimates are statistically weak for all models. Such findings suggest that, to a small extent, the availability of collateralizable assets makes banks more willing to issue debt. The German system, because it is supposed to provide banks with superior knowledge of firms= quality and potential, may reduce dependence on collateralBthus, predicting a weaker positive relationship between tangibility and leverage. Tangibility, however, is a strong positive indicator of leverage in Germany in the 1980s (see Rajan and Zingales, 1995).

Because larger firms tend to be more highly diversified and therefore present lower risks of bankruptcy than small ones, firm size (natural log of income) is often hypothesized to relate positively to leverage. However, to the extent that size proxies for the availability of information about the firm or the company=s reputation in equity marketsBand thus the firm=s ability to access equity financingBleverage should relate negatively to size. In the current context, size may be less connected to the availability of information than it is to diversification. Indeed, though statistically weak in the base model, size coefficient estimates are positive and highly significant in all other specifications; thus supporting the diversification explanation.

Different types of theories also make varying predictions about the relationship of leverage to firm profits. Pecking order models suggest that high-profit firms prefer to fund investment out of retained earnings and therefore predict a negative correlation. Banks= preference for lending to profitable firms may induce a positive relationship; though if the resistence to debt is strong enough, supply conditions may make little difference in equilibrium. Agency models also indicate a positive relationship between leverage and profitability, since managers may feel compelled to pay out large dividends in order to placate shareholders. This argument, however, hinges on the presence of effective markets for corporate control, and that assumption is likely to fail in the German

[4] I use the Hadi selection method for determining multivariate outliers and find 8 such observations at the five percent level of confidence. Robust regression and Hadi outlier selection were implemented in Stata; both methods are discussed in the Stata manual. A comparison of results using robust regression, Tobit, and OLS are reported in

contextBespecially in the pre-World War I period. The results here, consistently negative and highly statistically significant coefficients of profits, strongly support asymmetric information theories (such as the pecking-order hypothesis).

Equity share price is often used to measure the quality of investment prospects, but it may also relate to a firm=s reputation in equity markets. Since a strong past performance may encourage share issuing rather than debt financing, market-to-book value of equity might actually be expected to correlate negatively to leverage and may, therefore, fail to properly represent investment prospects. In the current sample, market-to-book value of equity relates negatively, but insignificantly, to firm leverage. Since the relationship is too weak to draw any conclusions, and since its exclusion increases the available sample to 310 firms, the remaining regressions drop market-to-book value of equity.

Including firm age, though absent from most empirical studies, addresses the question of changes in capital structure over the life of the firm and offers further evidence on the validity of information-based theories of capital structure. When connected to theories of firm lifecycles, the pecking order hypothesis suggests that firm leverage should decline as firms gain greater access to and reputations in equity markets. It is important to note that age in this context is the number of years since formation as a joint-stock company. Thus, this variable truly measures the time during which the public has had at least some access to information about the firms in question. Though disclosure rules were weaker then than now, all joint-stock companies were required to publish an annual balance sheet and were also included in such publicly available sources as the one used in this study. The current findings, consistently significant negative relationships between leverage and firm age, support the information-based arguments.

The final two specifications in this group include a binary variable indicating whether a firm had a listing on the Berlin stock exchange or a listing on another German exchange (and not in Berlin). Such a variable is absent from the existing literature, mainly because modern studies include only listed companies. The omission may stem in part from the lack of data on unlisted companiesBa problem that also exists for Germany both before 1895 and more recently. The variable provides another test of the proposition that information, or lack thereof, affects firms=

Appendix B.

financial structure.

Firms with stock market listing are more likely to have had a broad and active market for their securities and also distributed more information to potential investors. These factors can be expected to reduce information-related problems and increase firms= access to securities markets. In addition, gaining listing may increase ownership dispersion, and higher dispersion may reduce shareholders= concerns about dilution from issuing new equity. Thus, for a number of reasons, stock market listing should be negatively associated with leverage. In the current sample, a negative relationship does emerge, and the finding can be interpreted as further indication of the importance of information problems in choosing funding sources. Interestingly, the coefficient estimate for the ›Berlin-only= indicator is larger and much more highly significant than the corresponding figures for the ›other-exchange= variable. The difference in both coefficients and significance suggests that the Berlin market offered greater access to equity capital than did the provincial exchanges.

In general, then, the current evidence lends further credence to the idea that asymmetric information between borrowers and lenders and between potential owners and managers has a marked influence on the financing decisions of corporate firms.

5. THE EFFECTS OF BANK OVERSIGHT

The foregoing analysis offers only cursory insights into the impact of financial institutions on firms= capital structure. The question remains whether formalized relationships between banks and firms plays an additional part in determining leverage. Before evaluating more complex models of capital structure, this part investigates absolute differences in leverage among firms with various types of bank relationships. Tables III and IV compare the debt-equity ratio for firms with and without bank board representation. Table III, showing several percentiles of the ratio as well as a number of statistical tests for equality, indicates that companies with attachment to a universal bank maintained somewhat higher leverage than those with no bank affiliation or attachment only to a private bank. The differences, however, are quite small over much of the distribution, and the statistical tests of sample differences vary in their results.

A simple t-test of the difference of means between firms with and without any bank director

on their boards, as well as a one-way ANOVA test of means differences among the four attachment categories, suggests that average leverage does vary somewhat. Examination of broader evidence, however, provides less convincing proof of such differences. For all categories except provincial bank attachment, approximately half of the firms had leverage of 0.5 or greater, and 20 to 25 percent of firms had debt exceeding equity. Firms with provincial bank attachments, though, fall into these two categories at slightly higher rates (62 and 35 percent, respectively).

Further comparisons of distributions offers confirmation of this rudimentary test. The Kruskal-Wallis (KW) test, a chi-squared statistic that tests the hypothesis that multiple samples come from the same population, cannot reject the equality of the leverage distributions of attached and unattached firms (p=0.19). The Kolmogorov-Smirnov (KS) statistic provides an additional test of the equality of two distributions (Table IV).[5] These tests reveal that firms with provincial-bank attachments are largely responsible for apparent differences in capital structure, and that the significance derives mainly from a relatively small number of firms with moderately high leverage. In contrast, the KS statistic indicates that the leverage distributions of firms with great-bank attachments are not significantly different from those of all other firms (p=0.57). The results of these tests show that debt-equity ratios are distributed similarly, though not identically, for bank-attached and independent firms. Thus, in the absence of controls for other firm characteristics, bank affiliation seems to have little generalized impact on firms' capital structure.

The findings so far indicate that firms generally behave in line with pecking order theories of capital structure, and that formal bank oversight seems to alter static financing choices only slightly. A second set of models evaluates the impact of bank affiliations on firms' capital structure while controlling for other determinants (Table V). In particular, the new specifications include an indicator for bank attachment and the interaction of that variable with the original independent variables. As in the initial models, firm size and tangibility of assets are both positively associated with leverage, while profits, Berlin stock market listing, and age are negatively so. Tangibility of assets and listing outside of Berlin, as before, do not enter the regressions significantly.

Including bank affiliation variables yields some interesting results. First, the new regressions

[5] The KS and KW tests were implemented in Stata; the manual provides full details of the tests.

produce slightly stronger findings than the foregoing comparisons of firm leverage. That is, controlling for tangibility, size, profitability, and industry sector, bank attachment exerts a significant, positive effect on leverage. These results, however, are substantially diminished by the inclusion of controls for firm age and fall below the 10 percent significance level with the inclusion of the stock market listing variables. Moreover, the reported specifications represent the strongest results on the bank-attachment variable; coefficients and significance are only moderately robust to changes in leverage definition or model specification.

Surprisingly, further division of the bank-attachment variable into separate categories for the three types of banks (private, provincial, and great), indicates that only the great-bank variable, if any, enters the regressions significantly.[6] Thus, despite the slightly higher average leverage of provincial-bank firms, such attachment seems not to correspond to higher debt-equity ratios once other factors are considered.

Two interaction effects offer potentially important insight into the question of bank influence on capital structure. First, the results show that profits is a much stronger negative correlate of leverage for bank-attached companies than for unattached firms. This finding suggests that, though all firms decrease their debt or increase their equity in response to higher profits, those with banker board members react more vigorously. The negative relationship between profitability and leverage is seen as evidence of asymmetric information between suppliers and demanders of capital. A more negative relationship might then imply poorer information availability, but bank-attachment is usually assumed to ameliorate such problems not exacerbate them. Whether attached firms' behavior results from constraints placed by bankers, or indicates a desire of managers to extricate themselves from bank-controlled debt, is a question that requires further research.

Second, the new findings show that, though leverage declines with number of years as a joint-stock company, bank attachment fails to accelerate this process. Thus, if age represents the seasoning of firms as well as increasing availability and accuracy of information, then these results undermine the idea that banks' formal oversight speeds firms' progression through the pecking order of financial instruments. Indeed, since the coefficient of age interacted with bank attachment is positive and larger than the negative coefficient for unattached firms, the findings actually suggest

[6] Additional regression results using a four-choice bank-attachment indicator are available from the author.

that bank-affiliated firms may move toward debt as they age.

The results clearly support pecking-order theories of finance, but show that bank attachment may distort this effect. The findings might be argued to support both positive and negative interpretations of formal bank oversight. While the results suggest that bank representation on firm boards offers slightly greater access to debt, the results may also indicate that formal relationships do not improve information flows outside of banksBthat is, in capital markets.

An examination of debt composition throws a slightly different light on the issue of firms= access to debt. Though the HDAG reports only the type of securities issued, and not the funding source, some inferences can be made about the prevalence of bank debt from maturities. Long-term obligations tend to consist of bonds and mortgages, while short-term debt includes bank advances and credits from other companies. Thus, the ratio of short-term debt to total offers insight into the extent of bank lending in proportion to other forms of debt. Short-term debt is particularly important in the present context, since universal banks are thought to have used rolled-over current account credits as a primary means of financing new investment during the German industrialization. Such loans, particularly when made on little collateral, can pose substantial risk to banks; board seats are thought to offset part of that risk.

The results indicate a remarkable similarity in the use of short- versus long-term debt among the sampled firms, regardless of attachment to a bank (Table VI). Though the means and various percentiles show a higher ratio of short-term debt among the great-bank firms than the other types, several statistical tests indicate that such differences are highly insignificant. Even a one-sided t-test comparing the means of great-bank debt maturity with all others yields a p-value of 24 percent. Clearly then, bank-attached firms may use slightly more debt relative to equity, but they structure that debt in much the same way as independent firms.

Rerunning the leverage regressions using only short-term debt confirms these findings (Table VII). In particular, short-term debt is statistically invariant to the presence of a banker in the firm supervisory board. Equations 2 through 4 in Table VII use three alternative definitions of debt maturity and compare the results to those found for leverage overall (column 1 of Table VII repeats column 3 of Table V). The first two definitions of debt maturity, because they take short- term debt as a ratio of either long-term debt plus equity or equity only, are the most comparable to the

definition of leverage used in Table V.

The hypothesized determinants of capital structure enter similarly, but not the same, for short- and long-term debt. Size is still a significant positive indicator of short-term debt ratios, but the effect appears to be smaller. Likewise, both net profits and age are negatively associated with short-term debt ratios, but the relationships are mostly much weaker than for the long-term ratio. Coefficients of both variables drop about two thirds in magnitude. Thus, while the pecking order seems to describe the choice between debt and equity, it appears to do less well in explaining the choice between types of debt. This relative lack of differentiation, however, may result from the organization of German industrial banks. Universal banks may have more information about firms than would a specialized underwriter, since the bank likely also provides lending. Thus, bonds and bank debt may have greater complementarity in the universal system.

Interestingly, Berlin market listing remains a strong negative indicator of short-term debt ratios, and listing on the provincial exchanges is also significantly negatively associated with short-term debt. This finding provides further evidence that listing does provide access to information, though it is probable that firms wishing to issue securities are more likely to become listed in the first place. Causality, however, is not important, since the point is simply that there is a strong connection between listing and securities issue. Since provincial exchange listing is significant for short-term but not overall leverage, the results also suggests that the provincial exchanges may have been more important for bonds than they were for equity securities.

Of particular interest, bank oversight causes no significant changes in any of the determinants of short-term debt ratios. Thus, lack of bank board representation seems not to limit firms= access to short-term debt. This finding casts further doubt on the idea that bank board memberships provided important monitoring of potentially risky short-term debt or systematically altered firms= financing decisions. It remains to be determined whether bank relationships simply increased access to all kinds of financing, but the available evidence on investment patterns suggests not.[7]

It is still possible that the sources of short-term debt vary systematically with formal bank oversight and that bank-affiliated companies gained priority access to funding from the banks placed

[7] Fohlin (1998) shows that, in the first decade of this century, bank affiliated firms invested at similar rates as independent firms and that bank board membership, controlling for selection bias, was not associated with lower liquidity sensitivity of investmentBa common measure of firms= liquidity constraints. See Edwards and Fischer

on their boards. The origin of funding should not matter, however, unless it affects the cost of financing. Such data are difficult to assemble for most firms, though the effects of higher financing costs should appear in the quantity of financing used, the dependence of firms' investments on internal funding, or the profits or rates of return of firms.

6. CONCLUSIONS

This paper offers a number of insights into the capital structure puzzle. By demonstrating that debt-equity ratios decline significantly with both age and profitability and increase with firm size, the findings bolster recent theoretical work that emphasizes the importance of information quality and availability in determining the mix of financial instruments.

At the same time, the paper also shows that formalized bank relationships yield little static effect on debt-equity ratios overall and especially on the use of short-term debt. The fact that bank-attached firms use short-term debt in similar proportions as do unattached firms and that bank oversight alters none of the other determinants of short-term debt ratios suggests that affiliations are not directly related to bank lending on rolled-over, and perhaps unsecured, lines of credit.

On the contrary, this paper suggests that formal bank relationships, rather than speeding firms through the financial pecking order as they age, may retard firms' progression from debt to equity financing or even lead to slightly increased leverage over firms' lifecycles. At the same time, relative to independent firms, bank-attached companies move more rapidly away from debt in response to increased cash flow. Though appearances are suggestive, the inability to identify the source of debt for most of the firms in the sample makes it difficult to determine whether this behavior on the part of attached firms reflects a desire to extricate themselves from bank lending whenever profits allow. The fact that increased cash flow does not prompt attached firms to move

away from short-term debt (under which category bank debt would fall) tends to undermine such an hypothesis.

Thus, the findings cast doubt on the standard perception of bank board representation as an

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(1994) on modern Germany.

important source of information or market signals about firms= investment prospects. The findings here underscore the need for further investigation of firm investment and financing patterns in the later stages of the German industrialization as well as more recently. Problems of asymmetric information clearly influence the funding decisions firms make. If firms= capital structure impinges on attainable levels or quality of investment, then it likely also affects the aggregate development of industry and therefore economic growth.

The connection between information problems and the ultimate performance of the economy highlights the potential importance of the financial system in industrial growth. Financial intermediaries provide information gathering and dissemination services, and the German banks, because of their universal structure and supposed close links with industry, are believed in some quarters to perform such functions more successfully than specialized intermediaries. The results of this paper, however, argue for a moderate assessment of the role of universal banks in the financing choices of industrial firms. Thus, this paper adds to the mounting evidence that the particular organization of the German banks, especially the practice of formalized bank-firm relationships, provide little generalized boost to German industry.

TABLE I

SAMPLE MEANS AND CORRELATES OF BANK OVERSIGHT

Variable	Bank oversight	No bank oversight	Probit 1	Probit 2
Debt/equity	0.88	0.63	0.07	0.12
	1.01	*0.64*	*0.12*	*0.02*
Fixed assets/ total assets	0.56	0.60	-0.07	-0.11
	0.24	*0.24*	*0.51*	*0.40*
Natural log of Income	6.18	5.43	0.05	0.03
	1.52	*1.54*	*0.03*	*0.23*
Net profits/ total assets	0.04	0.09	-0.58	-0.22
	0.04	*0.59*	*0.38*	*0.77*
Market-to-face value of shares	167.22	149.65		
	74.44	*64.07*		
Age of firm[a]	13.76	16.49	-0.01	-0.01
	9.73	*12.69*	*0.01*	*0.07*
Listed on Berlin stock exchange[b]	0.30	0.14	0.20	0.16
	0.46	*0.35*	*0.02*	*0.07*
Listed on other German stock exchange	0.22	0.17	0.11	0.10
	0.42	*0.38*	*0.12*	*0.23*
p value of chi-squared test			0.00	0.01
pseudo-R^2			0.09	0.12
Predicted probability			0.19	0.21
Observed probability			0.22	0.24
Number of firms[c]	67	253	303	274
	(33)	(66)		

Note. Variables are computed using book values. Standard errors are given in italics below means. The dependent variable in the probit models is a binomial variable taking the value one when the firm has a bank representative on its board and zero otherwise. Probit 2 includes 14 industry indicator variables, while probit 1 does not. The probit results are the change in the probability of having bank oversight given an infinitesimal change in the independent variable (or the discrete change from being unlisted to being listed in the case of the two listing variables). P-values of z-statistics (two-sided tests) for the probit model are given in italics. Eight extreme outliers are removed from the probit models using the Hadi multivariate selection method.

[a] Age of firm is number of years since registration as a joint-stock company.

[b] The two listing variables take the value one for true and zero for false.

[c] The number of firms with share prices reported (market-to-face value of shares) is given in parentheses below the number of firms in the sample overall.

TABLE II

CORRELATES OF FIRM LEVERAGE

Variable	Equation 1	Equation 2	Equation 3	Equation 4	Equation 5
Fixed assets/	0.17	0.08	0.08	0.04	0.05
total assets	*1.24*	*0.59*	*0.63*	*0.34*	*0.35*
Natural log of	0.04	0.07	0.08	0.09	0.09
Income	*1.44*	*3.50*	*4.10*	*4.56*	*4.53*
Net profits/	-2.42	-4.35	-4.26	-4.44	-4.44
total assets	*-2.90*	*-8.97*	*9.09*	*-9.58*	*-9.32*
Market-to-face value of	-0.00				
shares	*-0.37*				
Age of firm[a]			-0.01	-0.01	-0.01
			-2.85	*-2.67*	*-3.08*
Listed on Berlin stock				-0.16	-0.25
exchange[b]				*-2.09*	*-1.92*
Listed on other German				-0.01	-0.13
stock exchange				*-0.17*	*-1.04*
Age x listed in Berlin					0.01
					1.02
Age x listed on other					0.01
German exchange					*1.34*
Constant	0.23	3.87	3.99	0.60	4.05
	0.94	*8.57*	*9.13*	*2.95*	*9.08*
P(F-statistic)	0.00	0.00	0.00	0.00	0.00
Number of firms	97	310	310	309	310

Note. The dependent variable is the ratio of book values of debt to equity. Regressions use a variant of the Huber limited-influence estimator. T-statistics (two-sided tests) are given in italics.

[a] Age of firm is number of years since registration as a joint-stock company.

[b] The two listing variables take the value one for true and zero for false.

TABLE III

COMPARISONS OF LEVERAGE BY BANK-AFFILIATION CATEGORY

Statistic	No banks	Private Banks	Provincial Banks	Great Banks [a]
Mean	0.63	0.67	0.96	0.77
Smallest	0.00	0.00	0.00	0.00
5	0.00	0.00	0.09	0.06
10	0.03	0.02	0.19	0.14
25	0.17	0.22	0.32	0.25
50	0.48	0.50	0.68	0.58
75	0.80	0.88	1.07	1.28
90	1.47	1.65	1.89	1.94
Largest	4.13	2.48	7.41	2.47
Number of firms	236	17	37	30
P(t): any versus no bank	0.07			
P(t): provincial vs. great banks	0.42			
P(oneway ANOVA)	0.07			
P(Kruskal-Wallis)	0.19			

Note. Leverage is the ratio of debt to equity measured at nominal book values. T-statistics result from two-sided tests. Kruskal-Wallis is a Chi-squared statistic testing if multiple samples come from the same population. Oneway ANOVA tests for differences among the means of several samples.

[a] Great banks are the largest nine universal banks; provincial banks are all others.

TABLE IV

TWO-SAMPLE KOLMOGOROV-SMIRNOV TESTS FOR EQUALITY OF LEVERAGE DISTRIBUTION FUNCTIONS

D/E ratio less than	Any bank		Provincial banks		Great banks [a]	
	Difference	P-Value	Difference	P-Value	Difference	P-Value
1	0.20	0.08	0.22	0.18	0.17	0.49
2	0.18	0.07	0.22	0.08	0.14	0.62
5	0.17	0.07	0.20	0.11	0.14	0.56
no limit	0.17	0.07	0.20	0.09	0.14	0.57

Note. Leverage is the ratio of debt to equity measured at nominal book values. P-values are for the combined test that the given category-s distribution is greater or less than that of the omitted category and are corrected based on an empirical continuity correction. Difference refers to the largest difference in values of the distribution.

[a] Great banks are the largest nine universal banks; provincial banks are all others.

TABLE V

CORRELATES OF FIRM LEVERAGE AND THE EFFECTS OF BANK RELATIONSHIPS

Variable	Equation 1	Equation 2	Equation 3
Bank board member	0.70	0.65	0.59
	2.11	*1.97*	*1.77*
Fixed assets/ total assets	0.22	0.19	0.14
	1.47	*1.27*	*0.95*
Bank x fixed assets	-0.43	-0.40	-0.37
	-1.58	*-1.48*	*-1.37*
Natural log of income	0.05	0.07	0.08
	2.50	*3.16*	*3.46*
Bank x income	-0.01	-0.03	-0.03
	-0.22	*-0.63*	*-0.55*
Net profits/ total assets	-2.82	-2.80	-2.91
	-5.50	*-5.44*	*-5.68*
Bank x net profits	-4.45	-4.54	-4.26
	-2.94	*-3.00*	*-2.82*
Age of firm[a]		-0.01	-0.01
		-2.95	*-2.89*
Bank board member x age		0.01	0.01
		1.61	*1.85*
Listed on Berlin stock exchange[b]			-0.14
			-1.75
Listed on other stock exchange			0.01
			0.16
Constant	0.49	0.55	3.95
	2.28	*2.53*	*8.83*
P(F-statistic)	0.00	0.00	0.00
Number of firms	309	309	309

Note. The dependent variable is the ratio of book values of debt to equity. Regressions use a variant of the Huber limited-influence estimator, and t-statistics (two-sided tests) are given in italics.

[a] Age of firm is number of years since registration as a joint-stock company.

[b] The two listing variables take the value one for true and zero for false.

TABLE VI

COMPARISONS OF DEBT MATURITY BY BANK-AFFILIATION CATEGORY

Statistic	No banks	Private Banks	Provincial Banks	Great Banks [a]
Mean	0.48	0.40	0.46	0.52
Smallest	0.00	0.00	0.00	0.02
10	0.03	0.02	0.02	0.07
25	0.11	0.09	0.15	0.20
50	0.41	0.32	0.35	0.50
75	0.98	0.57	0.94	0.85
90	1.00	1.00	1.00	1.00
Largest	1.00	1.00	1.00	1.00
Number of firms	224	16	36	29
P(t): any versus no bank	0.73			
P(t): provincial vs. great banks	0.53			
P(oneway ANOVA)	0.76			
P(Kruskal-Wallis)	0.76			

Note. Debt maturity is the ratio of short-term debt to total debt measured at nominal book values. T-statistics result from two-sided tests. Kruskal-Wallis is a Chi-squared statistic testing if multiple samples come from the same population. Oneway ANOVA tests for differences among the means of several samples.

[a] Great banks are the largest nine universal banks; provincial banks are all others.

TABLE VII

CORRELATES OF DEBT MATURITY AND THE EFFECTS OF BANK RELATIONSHIPS

Variable	Equation 1	Equation 2	Equation 3	Equation 4
Bank board member	0.59	0.09	0.11	-0.18
	1.77	*0.82*	*0.80*	*-0.45*
Fixed assets/	0.14	-0.09	-0.05	-0.55
total assets	*0.95*	*-1.77*	*-0.89*	*-2.51*
Bank x fixed assets	-0.37	-0.12	-0.17	0.20
	-1.37	*-1.40*	*-1.49*	*0.58*
Natural log of	0.08	0.02	0.02	0.06
income	*3.46*	*2.25*	*1.77*	*1.91*
Bank x income	-0.03	-0.00	0.01	-0.03
	-0.55	*-0.13*	*0.31*	*-0.47*
Net profits/	-2.91	-0.82	-0.94	-3.05
total assets	*-5.68*	*-4.95*	*-4.46*	*-3.94*
Bank x net profits	-4.26	0.53	0.22	3.20
	-2.82	*1.08*	*0.35*	*1.62*
Age of firm[a]	-0.01	-0.00	-0.00	-0.00
	-2.89	*-1.41*	*-1.60*	*-0.35*
Bank board member x age	0.01	0.00	-0.00	0.01
	1.85	*0.23*	*-0.21*	*1.14*
Listed on Berlin stock exchange[b]	-0.14	-0.07	-0.10	-0.17
	-1.75	*-2.83*	*-2.82*	*-1.67*
Listed on other stock exchange	0.01	-0.04	-0.06	-0.15
	0.16	*-1.57*	*-1.84*	*-1.62*
Constant	3.95	0.44	0.18	0.80
	8.83	*3.02*	*1.96*	*1.58*
P(F-statistic)	0.00	0.00	0.00	0.00
Number of firms	309	310	309	228

Note. The dependent variable is the ratio of debt to equity in equation 1, short-term debt divided by all other debt plus equity in equation 2, short-term debt divided by equity in equation 3, and short-term debt divided by long-term debt in equation 4. All ratios use book values. Regressions use a variant of the Huber limited-influence estimator, and t-statistics (two-sided tests) are given in italics.

[a] Age of firm is number of years since registration as a joint-stock company.

[b] The two listing variables take the value one for true and zero for false.

APPENDIX A

ALTERNATIVE DEFINITIONS OF LEVERAGE

Percentile	Definition 1	Definition 2	Definition 3
Mean	0.33	0.34	0.35
Smallest	0.00	0.00	0.00
5	0.00	0.00	0.00
10	0.05	0.05	0.05
25	0.18	0.19	0.19
50	0.33	0.35	0.35
75	0.47	0.49	0.50
90	0.61	0.61	0.62
95	0.67	0.67	0.68
Largest	0.88	0.89	0.93
Number of firms	320	320	320

Note. Definition one is the ratio of outside liabilities (*Fremdkapital*) to total liabilities (including net worth). Definition two is the ratio of debt to the sum of debt, total share capital, and reserves. Definition three is the ratio of debt to the sum of debt, ordinary share capital, and reserves.

APPENDIX B

CORRELATES OF LEVERAGEBTHREE ESTIMATORS

Variable	Huber Robust Regression	Tobit with Outliers Removed	OLS with Outliers Removed
Fixed assets/ total assets	0.04 *0.34*	-0.08 *-0.51*	-0.07 *-0.41*
Natural log of income	0.09 *4.56*	0.10 *3.66*	0.09 *3.16*
Net profits/ total assets	-4.44 *-9.58*	-6.91 *-9.15*	-6.35 *-8.54*
Age of firm[a]	-0.01 *-2.67*	-0.01 *-2.29*	-0.01 *-2.38*
Listed on Berlin stock exchange[b]	-0.16 *-2.09*	-0.21 *-2.17*	-0.20 *-2.06*
Listed on other German stock exchange	-0.01 *-0.17*	0.04 *0.47*	0.05 *0.56*
Constant	0.60 *2.95*	0.33 *1.36*	0.43 *1.80*
P(F-statistic, Chi-squared statitistic)	0.00	0.00	0.00
Pseudo-R-squared, adjusted R-squared		0.21	0.26
Number of firms	309	303	303

Note. The dependent variable is the ratio of book values of debt to equity. In columns two and three, outliers are identified using the Hadi multivariate method. T-statistics (two-sided tests) are given in italics.

[a] Age of firm is number of years since registration as a joint-stock company.

[b] The two listing variables take the value one for true and zero for false.

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