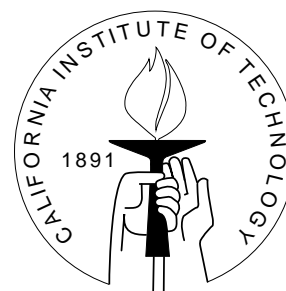DIVISION OF THE HUMANITIES AND SOCIAL SCIENCES

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CORPORATE CAPITAL STRUCTURE AND THE INFLUENCE OF UNIVERSAL BANKS IN PRE-WAR GERMANY

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Information asymmetries and conflicts of interest are theorized to inflate the cost of external finance, but formal bank relationships are thought to ameliorate such problems and may even lead to excessive leverage. Bank oversight is associated with slightly higher leverage but not with greater use of bank debt. Older and cash-rich firms have lower leverage and less bank debt, suggesting that information problems affected firms' financing decisions; but bank attachment appears not to alter these patterns. The findings suggest that bank oversight had little to do with leverage decisions, particularly short-term borrowing, in the later stages of the German industrialization.

In the late nineteenth and early twentieth centuries, German firms accessed a wide range of financing sources–internal funds, bank current accounts, various types of bonds, and outside equity shares. The capital structure of these firms was based on manifold individual choices between external and internal funding and, in the case of external finance, between debt and equity instruments. The universal banks, particularly because of their supposed involvement in corporate governance, are widely viewed as the dominant institution in German corporate finance; and as such, they may have played an important role in firms' financing decisions.

This paper investigates the funding sources and capital structure of German corporate firms at the start of the twentieth century and assesses the possible impact of formalized banking relationships on these financing decisions. Corporate finance theory suggests that information asymmetries and conflicts of interest systematically influence the relative extent of debt and equity financing used as well as with the choice between

bank debt and bonds. Institutions that facilitate access to information about firms or ameliorate conflicts of interest between debt and equity holders may temper the problems that lead to inefficient financing decisions. In the historical literature, Germany's joint-stock universal banks are seen as such an institution. These financial supermarkets provided a full complement of services—commercial banking, securities underwriting, and brokerage—for medium and large firms. In addition, many of these universal banks held positions on the supervisory boards of industrial joint-stock companies, voted equity shares in proxy for customers, and took at least occasional, short-term stakes in companies. It is plausible, at least on the surface, that this integration of universal and relationship-based corporate finance may have given some firms greater access to external finance and may have altered their decisions (perhaps even unwillingly) about the various sources of funds to tap as they grew and matured.

Corporate financing choices are important. Most firms need outside financing in order to invest and grow rapidly, and different forms of finance present varying costs to the firm. The ability to choose the lowest-cost form of financing affects returns to investment and possibly the decision to invest at all. If firm capital structure reveals information about the presence of information asymmetry and conflicts of interest, then it also allows clearer insights into the potential financial constraints faced by individual firms and the economy as a whole. Moreover, if formal bank involvement alters firms' decisions, then we may infer a significant role for banks in corporate governance and firm investment more generally.

The effects of formal bank relationships, however, turn out to be surprisingly small. Though there is some indication of a positive relationship between bank oversight and leverage, neither leverage nor debt maturity structure (proxy for bank debt use) changes markedly in the presence of formal bank relationships. Controlling for other firm attributes, older firms have lower leverage and short-term debt, but bank attachment is not associated with earlier than average reductions in leverage as firms mature or with alterations in the predictors of short-term debt use. The findings generally fall in line with predictions of recent capital structure theories but offer little support for the idea that formal bank-firm relationships altered the financing options or choices of German industrial firms.

HISTORICAL AND THEORETICAL MODELS

This paper addresses an issue that concerns both economic historians and financial economists. The first group has long debated the role of the universal banks in the industrialization period. This debate, however, has been poorly specified and has yielded few concrete hypotheses about the impact of institutional structure on industrial growth and development.[1] Alexander Gerschenkron, for example, made sweeping claims about the vital role that banks played in moderately 'backward' economies and pointed to the representation of bankers in company boards as the primary means by which banks influenced firms.[2] The older literature seems to suggest that banks, because they had access to firms' information and maintained at least partial control over (at least some) corporations, resolved problems of moral hazard on the part of firms and conflicts of interest between equity and debt-holders. At the same time, the historical literature has always probed the more nefarious side of banking relationships, emphasizing excessive control, abuses of power, and anti-competitive behavior. This *bankenmacht* debate raises the possibility that formal banking relationships force firms into decisions they would not otherwise make and that may even be deleterious to firm performance.

While the historical literature makes few explicit predictions about the influence of banking relationships, it does clearly suggest that bank board memberships made some impact on firms' decisions and performance. The choice of financing instrument is one of the most obvious arenas in which banking relationships might have been influential. Banks may have gained access to board seats in return for funding new projects or younger firms for which sufficient equity funding may have been difficult to find (the venture capital role). Less plausibly, the banks may have used their existing votes to force over-borrowing in order to earn interest off of attached firms. On the other hand, the German banks may have gained access to boards through the underwriting of equity issues, since they often held votes as a result of their indirect (proxy) and direct ownership of shares. The banks also stood to gain from underwriting fees and commissions, so they may have pushed already-attached firms to float securities.

The historical literature therefore motivates the following set of hypotheses to be tested (Table 1): first, that firms with banking relationships, formalized through board memberships, used more debt than independent

firms; second, that higher leverage arose mainly in the form of short-term debt (predominantly from banks); third, that leverage, and particularly bank debt, declined as firms aged; and finally, that bank-attached firms made earlier transitions to lower leverage (including less bank debt). If the venture capital function or lending motivation of banks dominates, then the first two hypotheses will prove correct. If age (years since initial public offering) proxies for information availability or transparency, and if lack of information inhibited access to equity markets, then the third hypothesis will hold. If banks removed barriers to equity markets, if securities commissions motivated banks, or if banks' presence on boards resulted from equity issues, then the fourth proposition should also hold. Finally, if the lending and issuing motivations of universal banks exactly offset each other for all types of firms, or if bank relationships did not affect either lending or issuing decisions, then all but hypothesis three should prove false. Note that these hypotheses are all phrased as correlations, since the qualitative literature proposes bi-directional causal links.

These four propositions can be clarified and further motivated by two distinct lines of inquiry within the corporate finance literature: the determinants of capital structure and the impact of banking relationships. The theoretical literature centers on the idea that firms have information that investors do not have and that the interests of debtholders, equityholders, and managers may not coincide. In theory, information asymmetry leads to opportunistic behavior or moral hazard. These models start with the premise that debt is less sensitive to the existence of private information than is equity. Unlike fixed debt returns, equity returns depend directly on information that may be unobservable by outsiders. 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 may impose lower information-related costs on firms and should be preferred over equity.[3]

Conflicts of interest between debt and equity holders (and between equityholders and managers) may also influence the choice of capital structure. Since debtholders bear the costs of failed investments but do not share fully in the benefits of highly successful projects, equity holders have the incentive to take on excessive risk. Assuming debtholders expect suboptimal investment, debt will be priced accordingly and will pose an

extra cost to existing shareholders.

Debt, of course, takes several forms. 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.[4] Monitoring, renegotiation, and the potential for rent-extraction due to the banks' access to proprietary information makes bank debt relatively costly, so that firms may avoid bank financing when bond-issuance is feasible.[5]

Because of changing growth opportunities, riskiness, and information availability, capital structure is also thought to vary over firms' life cycles. In many cases, as firms age, relevant information becomes more transparent to investors, new funding sources open up, and the hypothetical financial pecking order emerges–from insider equity, to intermediated equity (venture capital), bank debt, bond debt, and outside equity–to which firms gain access as they mature.[6] Capital structure cannot fully adjust overnight, but the infusions of new sources allow leverage to adapt gradually.

Bank relationships

Another strand of the corporate finance literature studies the impact of formal bank relationships on the decisions and performance of non-financial firms. This literature assesses the role of banks in ameliorating problems that arise due to asymmetric information between borrowers and investors and due to conflicts of interest between debt and equityholders; it also investigates possible exploitation of attached firms. Thus far, researchers have focused on the potential link between formal banking relationships and lending conditions, liquidity constraints, investment, sales growth, profitability, and rates of return; but so far, there is little research on the connection between capital structure and bank relationships.[7] Calomiris, "The Costs," however, brings the two issues together in reviewing the literature on the financial pecking order. Specifically referring to the German experience, Calomiris argues that firms move from bank debt to bond debt to equity as they mature and that formal bank oversight partially substitutes for this seasoning process. This argument

yields hypotheses three and four laid out previously: all firms should access more equity, thereby lowering leverage, as they age; but bank-affiliated firms should do so faster than average.

Hypotheses one, two, and four hinge on the qualitative descriptions of banking relationships in the German historical literature: board memberships, direct equity stakes, and proxy votes. The previous literature attributes particular importance to the practice of bank representation on clients' supervisory boards as a conduit of information, monitoring, and control, but board positions may also provide signals of credit worthiness to capital markets.[8] Historically, direct stakes have accounted for a very small share of bank assets, and only in a handful of cases did the universal banks hold industrial shares for long periods. Banks did apparently hold shares in proxy for depositors and therefore frequently maintained significant control rights nonetheless.[9] In other words, the banks often maintained control rights without direct rights to cash flows.

Depending on shareholders' access to information, banks' primary position as creditor may dominate their incentives to act in the interest of equityholders whose proxy votes they hold. If the dual incentives are balanced, banks' roles as both debt and equity claimholders may ameliorate conflicts of interest between the two groups and reduce the potential for asset substitution problems. In addition, if bank positions on firm boards permit close monitoring and control over firms' disposition of debt funds, then creditors may worry less about excessive risk taking. On the face of it, such influences should make debt relatively more desirable.[10]

If board membership represents commitment to a long-term relationship between a bank and a firm, then a firm with a banker on its board should enjoy greater access to bank assistance in times of illiquidity or distress. Such influences may make bank-attached firms less averse to debt than they might otherwise be. Legal limits on bond funding and the potential for bank abuse of potential monopoly power, however, may offset such incentives for debt.

Clearly, theoretical models based on asymmetric information and conflicts of interest allow for competing forces in determining firms' capital structure (see Table 1). Thus, the ultimate impact of bank relationships is somewhat ambiguous. While there seem to be more reasons to hypothesize a leaning toward higher leverage among bank-attached firms, the net effect must be tested empirically.

Harris and Raviv, "The Theory," review a wide range of theoretical and empirical literature on corporate capital structure, and Rajan and Zingales, "What Do We Know," seek further evidence from several developed economies. These papers suggest a number of firm characteristics that, if related to leverage, can support or undermine theories of capital structure. The two classes of models dealt with here–asymmetric information (pecking order) and conflicts of interest–supplement one another and offer few conflicting predictions. Theoretically, anything that mitigates conflicts of interest or problems of asymmetric information tends 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, default probability, and managerial equity ownership but to decrease with growth opportunities, investigation costs, and the interest coverage ratio (Harris and Raviv, "The Theory"). These factors are difficult to measure directly and therefore require several proxies: age, tangibility of assets, firm size, and market-to-book value of equity. Table 1 lays out the main contributing factors analyzed here, explains the variables used, and distinguishes among the various causes and effects of bank relationships.

In the analysis to follow, four characteristics other than age are controlled for in testing the hypotheses articulated previously. First, tangibility of assets (fixed divided by total assets) proxies for the availability of collateralizable assets. Under the asymmetric information and conflicts of interest theories, the existence of liquefiable assets makes banks and bondholders more willing to provide credit, and is positively associated with leverage.

Second, 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) may relate positively to leverage.[11] If size also indicates lower investigation costs, then agency (conflicts of interest) theories would also predict a positive relationship. However, to the extent that size proxies for availability and transparency of information about the firm or for the company's reputation in equity markets–and thus the firm's ability to access additional equity financing–leverage should relate negatively to size.

Existing models yield opposing results on the relationship of leverage to a third factor, free cash flow. Pecking order models suggest that high-cash flow firms prefer to fund investment out of retained earnings and therefore predict a negative correlation.[12] Conflicts of interest induce a positive relationship between leverage and cash flow, since debt constrains firms' ability to overinvest.

Finally, equity share price (market to book value) is often used to measure the quality of investment prospects, and under agency theories strong growth opportunities are hypothesized to relate negatively to leverage. Market to book value may also relate to a firm's reputation in equity markets, and strong past performance may encourage share issuing rather than debt financing. Thus, a negative correlation between leverage and market-to-book value of equity might represent more than just the effects of investment prospects.[13]

DATA

The empirical analysis of this paper is based on a randomly-chosen cross-section of 320 German joint-stock companies in 1904. The data come from the *Handbuch der deutschen Aktiengesellschaften* (HDAG)–an 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 many cases, the HDAG also provides details of firms' origins, purposes, and important developments.

The year 1904 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.[14] Finding stable bank relationships requires choosing firms after this point. 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' life cycles.

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The stock market crash of 1900-01 might raise concerns about the potential for survivorship bias in the current sample. If the crash weeded out those firms in the greatest distress, then the sample may include unusually healthy firms with less variance in their financial structure than would a sample taken from shortly before the crash. Two factors all but eliminate such bias. First, the crash, while causing a significant decline in value, did not immediately wipe out a large portion of firms (31 Berlin-listed companies were in liquidation or bankruptcy in 1902, as opposed to 21 in 1900 and 26 in 1899). Second, the effects of the crash appeared over a number of years following 1901, so that many distressed firms were still in existence at the time of sampling (1904-05). Only 26 firms (8 percent) in the current sample were founded after the crash. Moreover, since many firms stayed in business for several years even as they underwent liquidation, and since the *Handbuch* reports all such firms, they are captured in the current sample. Nonetheless, the empirical analysis in the next section provides tests for survivorship bias.

The firms in this sample 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, choices about financing for expansion and new investments may still depend on firms' characteristics and their relationships to financial intermediaries.

Measuring formal bank oversight is fairly simple, since the data source reports the executive and supervisory boards of all firms. By matching the names of firm supervisory board members with the names of directors of the principal universal banks, I create an indicator variable for this form of bank oversight. Firms often maintained relationships with multiple banks, and in most cases of attachment, directors from more than one bank sat on company boards. Less than 10 percent of firms had one-sided representation, in which bankers sat on the company board without any reciprocation; and in only a handful of cases did one great bank maintain the only seats on a firm's board. Other forms of bank relationships, such as direct ownership of shares or control over votes in the general meeting of shareholders (by proxy), are exceedingly difficult, and in most cases impossible, to measure in this period. It is likely, however, that board memberships are correlated with control rights in the general meeting of shareholders, whether direct or by proxy.[15]

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 decisions at some point in a firm's history. 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 access to new instruments in 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 ("Universal Banking" and "Relationship Banking") indicates that bank-attached German companies are larger and more liquid than independent firms. Both types of firms invest at comparable rates and perform similarly. Moreover, the fact that many relationships formed long before the sample period tends to loosen the causal link from financing choices to the attachment decision. Nonetheless, as noted previously, the statistical relationships found here are viewed as correlations.

Table 2 summarizes the variables used in the following analysis, broken down by bank oversight category. 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 income), dividends, and profits all can be determined from the information reported.[16] 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. For most specifications, 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 last two columns of the table contain the results of probit models, in which a binomial indicator variable for bank oversight is regressed on several variables of interest.[17] The figures reported are the change in probability of bank oversight given a one unit increase in the relevant independent variable.

Leverage provides some useful prediction of bank attachment, though the effects are not enormous.

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A one-standard deviation increase in the debt/equity ratio from the overall sample mean of 0.64 to 1.42, for example, raises the estimated probability of bank oversight by less than 10 percent. Median leverage in the sample is .50 (and 1.42 is around the 85th percentile), so leverage must be increased markedly to yield a very noticeable increase in the probability of attachment. Moreover, while unattached firms maintained debt-equity ratios as high as 4, an attached firm was the most extreme case (debt-equity ratio of 7.4).[18] These findings foreshadow the subsequent tests of hypothesis one (that leverage is positively associated with bank oversight): there is some evidence in favor, but the evidence is not overwhelming.

Similarly, firm age, measured as the number of years since becoming a joint-stock firm, relates negatively but fairly weakly, to bank attachment. 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 (or approximately 6 percent for a one-standard deviation increase in age). The negative prediction of age, however, is due primarily to the fact that 19 of 20 old firms (at least 35 years since founding as a joint-stock company) and all three extremely old firms (over 50 years: 52, 69, and 79) appear in the unattached sample. Without controlling for any other firm characteristics, firms under 10 years old have the same rate of bank attachment as the sample overall—twenty-one percent—and the very youngest (1-2 years old) actually have a much lower chance of being attached.

Two other factors correlate much more strongly with bank attachment. Sectoral fixed effects (included in column four but not in column three) clearly influence the oversight probability estimate, with bank board membership being almost ubiquitous in some sectors and nearly absent in others. 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. Thus, while there are several differences between bank-attached and independent firms, industry identification and stock market listings carry the greatest weight. These factors are therefore included as controls in the subsequent analysis.

Table 2 here.

TESTING THE FOUR HYPOTHESES

The four hypotheses can be tested various ways. The first proposition holds that the lending motivations and venture capital role of banks lead to relatively high leverage among attached firms. That is, by implication, other factors that favor equity have a secondary impact. As a first step in investigating this idea, I measure absolute differences in leverage among firms with and without bank relationships. Tables 3 and 4 compare debt-equity ratios for firms with and without bank board representation. Table 3, 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.

Tables 3 & 4 here.

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 measures, however, provides less convincing evidence 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 high-leverage categories at slightly higher rates (62 and 35 percent, respectively).

Further comparisons of distributions offers confirmation of this rudimentary test. The Kruskal-Wallis

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(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 4).[19] 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. This same test indicates that the leverage distributions of firms with great-bank attachments are not significantly different from those of all other firms (p=0.57). Clealry, 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 a small, but uneven, net impact on firms' capital structure. These findings offer preliminary evidence that either bank relationships were loosely related to firms' borrowing decisions (either as cause or effect) or that the countervailing forces offset one another. In either case, the first hypothesis can be accepted only weakly so far.

As noted previously, not all characteristics of the German system should lead unequivocally to higher leverage. In fact, some attached firms may have particularly low leverage. The fact that, in an uncontrolled comparison, the attached and unattached samples have very similar leverage distribution functions (in other words, the bank-attached population does not exhibit a bi-modal distribution of particularly high- and low-leverage firms), mitigates concern about offsetting positive and negative selection biases; but it remains a possibility to bear in mind.

An examination of debt composition sheds light on the issue of firms' use of bank debt. Though the HDAG reports only the type of securities issued, and not the funding source, inferences can be made about the prevalence of bank debt from maturities. Long-term obligations consist of bonds and mortgages, while short-term debt includes bank advances, credits from other companies (including accounts payable), and sometimes bills of exchange. The historical literature emphasizes that most lending through universal banks took the form of short-term, rolled over credits on current account, and that these lines of credit were the primary means of

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financing new investment during the German industrialization. Current account loans, particularly when made on little collateral, could pose substantial risk to banks; board seats are thought to have offset part of that risk. For the current firms, most of this non-tradable, short-term debt appeared under the heading of credits (*Kreditoren*) or current account credits (*Kontokorrent-kreditoren*), and only a few firms reported bank credits under a separate heading. Some short-term debt, particularly bills of exchange, could be traded, but, as they were meant to be backed by real orders for goods, carried less risk than long-term debt. These sources were typically booked under acceptances (*Akzept*) or bills of exchange (*Wechsel*). In the current sample, however, these items appear much less frequently than the general credit item. Thus, while it is difficult to determine what share of short-term debt originated from universal banks, the category gives an upper bound on bank credits and gives a good idea of firms' use of short-term, non-marketable debt.

From the cases in which the HDAG describes the sources of long-term lending, it is clear that much, but not all long-term debt was marketable. Some firms borrowed long-term through mortgages (*Hypotheken*), but many firms used mortgage-backed securities and other types of bonds and debenture securities (*Obligationen, Schuldverschreibungen, Hypothekenpfandbriefe*). Since bank presence includes universal banks, and not mortgage banks, the oversight variable should not relate strongly to mortgage debt. Thus, given the general lack of source information, the ratio of short-term to total debt offers the best available proxy for the extent of universal bank lending relative to other forms of debt.

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 5). 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 have used slightly more debt relative to equity, but they structured that debt in much the same way as independent firms. Thus, hypothesis two appears to be rejected in the current sample.[20]

Table 5 here.

Multivariate tests of leverage decisions

More complex models are needed in order to evaluate the relationship between bank oversight and firm leverage while controlling for the other relevant firm characteristics noted in the previous section. The strategy is first to analyze baseline reduced-form models suggested by the theory and then to evaluate the added impact of a bank relationship variable. Unfortunately, data constraints prevent the construction of proxy variables for each empirical implication of the capital structure theories. Nonetheless, several hypotheses can be tested (refer to Table 1). 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 (discussed subsequently), market-to-face value of common equity shares, and the age of the firm (since becoming a joint-stock company). As suggested by the probit analysis of the bank relationship variable, the models include indicator variables to control for industry fixed effects and for the existence of a listing on the Berlin or other German stock exchange. Since only roughly one third of the sampled firms had listings on a 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 minimal amount of truncation 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.[21]

The baseline results for this sample (Table 6) largely fall in line with those predicted by theory and found in other studies. Tangibility of assets, as expected, relates positively to leverage, however, the coefficient estimates are statistically weak for all models. Though weak in the base model, size coefficient estimates are positive and highly significant in all other specifications; thus supporting the diversification or investigation cost explanation over the information transparency interpretation. Also as predicted, both profits and firm age consistently relate negatively (and highly statistically significantly) to firm leverage.[22]

Obviously, given the cross-sectional nature of the data in this sample, the age variable reflects the behavior of different firms at varying ages, rather than that of the same firms as they mature. Though panel data might offer more definitive results, given the apparent lack of a survivorship bias in the current cross section, the negative coefficient of age still suggests the usefulness of age as a rough proxy for information problems. It is also worth noting that these findings support the third hypothesis: total leverage tends to decline with age.

Market-to-book value of equity relates negatively, but insignificantly, to firm leverage. A significant negative relationship would support both information and agency (conflicts of interest) theories, but 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. As expected, a negative relationship does emerge between stock market listing and leverage. 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 may indicate that the Berlin market was more important for equity issuers than were the provincial exchanges. Although the role of the stock exchanges is beyond the scope of the current paper, such questions offer promising avenues of further research.

The foregoing models cannot test a complete model of capital structure, yet they can offer insight into certain correlates of importance that should be acknowledged in evaluating the impact of banks. The results

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so far provide stronger support to asymmetric information models than to conflicts of interest theories. To the extent that the profit measure captures free cash flow, and that its relationship to leverage is negative, the evidence lends further credence to the idea that asymmetric information between borrowers and lenders and between potential owners and managers influences the financing decisions of corporate firms. These same findings undermine the conflicts of interest theory (that is, debt does not appear to be used to limit free cash flow). Though the leverage-cash flow relationship is the main direct test of the two theories, the proxy variables less clearly reject the conflicts-of-interest theory. The weak coefficients of market-to-book value (proxying for growth opportunities) and of asset tangibility (proxying for liquidation value) provide evidence against conflict-of-interest in the context of early twentieth century Germany; but the positive findings on firm size (as a proxy for diversification) support such theories.[23]

Table 6 here.

Rerunning the leverage regressions using only short-term debt indicates that the hypothesized determinants of capital structure enter similarly for maturity structure and overall leverage (Table 8). Size is still a significant positive indicator of short-term debt ratios, but the effect appears to be smaller. Likewise, both profits and age are negatively associated with short-term debt ratios, but the relationships are mostly much weaker than for the total leverage ratio. Coefficients of both variables drop about two thirds in magnitude. Thus, while the theories seem to describe the choice between debt and equity, they appear 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 had more information about firms than would a specialized bond underwriter, since the bank likely also provided direct lending prior to issuing public debt. Thus, bonds and bank debt may have had greater complementarity in the universal system of the time.[24]

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By including an indicator for bank attachment and the interaction of that variable with the original independent variables in Table 6, a second set of econometric models evaluates the impact of bank affiliations on firms' capital structure, debt maturity, and the determinants thereof–thus providing further tests of the four hypotheses. The new regressions (Table 7) produce findings similar to the simple comparisons of firm leverage: weak acceptance of proposition one. That is, bank attachment appears to relate positively to leverage, but the estimates are not robust to changes in leverage definition or model specification.[25]

The regressions using only short-term debt also confirm the findings on debt maturity differences for attached versus independent firms. In particular, short-term debt is statistically invariant to the presence of a banker in the firm supervisory board, thus fairly certainly rejecting proposition two (that bank oversight is correlated with use of short-term bank debt). Equations 2 through 4 in Table 8 use three alternative definitions of debt maturity, while column 1 of Table 8 repeats results on overall leverage (from column 3 of Table 7). 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 previously. Asymmetric information models, such as Diamond's "Reputation," suggest that firms move to longer-term, traded debt when information problems are less severe, thus predicting negative correlation between debt maturity and both age and size. This study also includes controls for stock market listing–a variable that should also proxy for information availability. The results are moderately supportive of the theory: both listing and age obtain negative coefficient estimates (though the latter are smaller than those found for leverage overall). Size is positively associated with short-term debt, but the variable, again, may capture firm diversification more than information effects.

Interactions between bank attachment and correlates of capital structure

Hypothesis four holds that bank oversight has dynamic information-related effects as well. Thus, firm age, which relates negatively to leverage in the population generally, should enter the leverage equation even more negatively for bank-attached firms. Such an information effect might be expected to be magnified, if attached firms began with higher than average leverage, but their information problems were then resolved by the appearance of the banker on the board. In the new specifications, leverage still declines with number of years as a joint-stock company, but bank attachment does not yield a larger negative coefficient estimate. If age proxies for seasoning and information availability, then the results undermine the idea that banks' formal oversight speeds firms' use of equity instruments. Thus, the findings clearly reject proposition four.

Table 7 here.

Two other interaction effects may offer additional insight into the influence of banks on firms' capital structure. For example, in the current sample, bank oversight exerts a statistically insignificant influence on the coefficient of asset tangibility. If bank board membership ameliorates information asymmetries between banks and firms, then bank lending should be less sensitive to the availability of collateral. Agency costs (due to conflicts of interest) may also induce a positive relationship between tangibility and leverage (refer to Table 1), and bank oversight should weaken this relationship. Empirically, if bank oversight on company boards made a noticeable impact on information availability to lenders or on conflicts of interest, we should find a significantly weaker relationship between leverage and tangibility of assets among bank-attached firms than among the general population of firms, but we do not.[26]

A second effect involves firms' responsiveness to cash flow. Cash flow is a much stronger negative correlate of leverage for bank-attached companies than for unattached firms. If bank oversight eliminates

information problems, then firms with such connections may experience no correlation between leverage and cash flow. That is, if the cost differential between inside and outside finance is eliminated, then the firm may prefer to use retained earnings for other purposes than to reduce leverage. It is important to bear in mind that the relationship between cash flow and leverage is likely to be non-linear, so that cases in which the cost differential between debt and inside funds is reduced but is still significant may yield no change in cash flow coefficients. The findings suggests the opposite of information improvement: though all firms decrease their debt or increase their equity in response to higher cash flows, 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. Given the potential nonlinearity in the relationship between leverage and cash flow, however, a more negative relationship may not indicate greater information problems. Nonetheless, the fact that the negative relationship is not offset for bank-attached firms does suggest that information problems or conflicts of interest persist even in the presence of bank board representation.

It is tempting to hypothesize that attached firms' response to cash flows results from constraints placed by bankers, or indicates a desire of managers to extricate themselves from bank-controlled debt. This question requires further research, but the results on debt maturity offer at least preliminary evidence. Of particular interest, bank oversight is associated with no significant changes in the sensitivity of debt structure to either age or cash flows. If firms desired to limit the control of banks, short-term bank debt would have been the place to start.

Bank oversight also exerts no significant influence on any of the other determinants of short-term debt ratios. 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.[27]

The interaction results show that bank attachment may slightly alter firms' capital structure decisions,

but that information problems–to the extent they can be identified–are not generally resolved. Given the lack of evidence in favor of conflicts of interest among the population as a whole, it is not surprising that bank relationships seem to have little impact on the relevant variables. These findings might be argued to support both positive and negative interpretations of formal bank oversight. The slightly higher leverage among bank-attached firms may signal either increased access to desirable debt or persuasion by banks to over-lever. Moreover, formal relationships do not seem to improve information flows outside of banks–that is, in capital markets.

CONCLUSIONS

This paper offers a number of insights into the impact of formalized universal banking relationships during the later stages of the German industrialization and focuses on four hypothesis in particular. First, the paper shows that formalized bank relationships are weakly associated with higher debt-equity ratios overall but not with any change in the use of short-term debt. The fact that bank-attached firms used short-term debt in similar proportions as did unattached firms and that bank oversight altered none of the other determinants of short-term debt ratios suggests that affiliations were not directly related to bank lending on rolled-over, and perhaps unsecured, lines of credit. Though older firms generally used less debt relative to equity, this paper suggests that formal bank relationships did not speed firms' capital structure adjustments as they aged.

At the same time, relative to independent firms, bank-attached companies moved more rapidly away from debt in response to increased cash flow. Though appearances are suggestive, the inability to identify the source of debt, as well as the non-linear relationship between cash-flow sensitivity and information problems, makes it difficult to determine whether the behavior of attached firms reflects a desire to extricate themselves from bank lending whenever profits allow. The fact that increased cash flow did not prompt attached firms to move away from short-term debt (under which category most 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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important source of information or means of eliminating conflicts of interest between debt and equity holders. At the same time, the results also undermine claims of banks' abuse of inside information gathered on clients.

This paper also supplements the recent literature on capital structure and on relationship banking. 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 used by corporate firms. The findings provide no compelling evidence of asset substitution resulting from conflicts of interest.

This study underscores the need for further investigation of firm investment and financing patterns in the later stages of the German industrialization. Problems of asymmetric information and concerns about potential financial distress clearly influenced the funding decisions firms made. If firms' capital structure impinged on attainable levels or quality of investment, then it likely also affected the aggregate development of industry and therefore economic growth. The findings also clearly argue for deeper investigation of the role of the stock exchanges in certifying firms' quality, equalizing information problems, and opening up new sources of capital for industry. The negative relationship between leverage and stock market listings uncovered here suggests that exchange listings offered such positive information effects. Perhaps, contrary to common wisdom, the universal banking system did not obviate an active, productive secondary market for securities.

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 have performed such functions more successfully than specialized intermediaries. The results of this paper, however, argue for a moderate assessment of the impact of the German universal banks on the financing choices of industrial firms. Thus, this paper adds to the mounting evidence that the particular institutional structure of the German banks, and especially the practice of formalized bank-firm relationships, provided little generalized boost to German industry in the later stages of industrialization.

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1. See the discussion in Caroline Fohlin, "Universal Banking."

2. This claim appears earlier in Jacob Riesser, *Konzentration*, and even earlier in Otto Jeidels, *Das Verhältnis*. Rudof Hilferding, *Finanzkapital*, argued that the banks wielded excessive control over industry.

3. See Harris and Raviv, "The Theory" and Hellwig, "Banking" for reviews of this large literature. Examples include Myers and Majluf, "Corporate Financing," Diamond, "Financial Intermediation," Gale and Hellwig, "Incentive-compatible," and Townsend, "Optimal Contracts," as well as Ross, "The Determination," Leland and Pyle, "Information Asymmetries," and Lee, Thakor, and Vora, "Screening." Brennan and Kraus, "Efficient Financing" and Noe, "Capital Structure" set out models in which information asymmetry fails to generate a pecking order; thus, leaving the issue open to empirical testing.

4. Jensen and Meckling, "Theory of the Firm," Myers, "Determinates," and Stulz, "Managerial Discretion."

5. Rajan, "Insiders and Outsiders" and Sharpe, "Asymmetric Information."

6. Diamond, "Reputation" suggests that firms move from bank debt to marketable debt as they age, but Berger and Udell, "Relationship Lending" and "The Economics," find that U.S. public bond markets are mostly accessed by the most seasoned firms (though other types of debt still precede equity). The analysis here sheds light on these finer details of the pecking order.

7. Recent work on modern Germany–for example, Harhoff and Korting, "Lending Relationships" and Elsas and Krahen, "Is Relationship Lending"–finds surprisingly little impact of banking relationships. Gorton and Schmid, "Universal Banking," however, find a positive influence on market returns. See also Cable, "Capital Market Information." Among small and medium-sized American firms in the late 1980s, Petersen and Rajan, "The Benefits," and "The Effect," Berger and Udell, "Relationship Lending," and Blackwell and Winters, "Banking Relationships," find varying degrees of improvements in credit availability and terms depending on the length of bank relationships. In the Norwegian case, Ongena and Smith, "The Duration" find that firms become more likely to terminate a relationship as the duration grows, and those most in need of bank financing maintain short relationships with multiple banks. Fohlin, "Relationship Banking" finds, for pre-war Germany, little impact of formal relationships on rates of investment, profitability, or liquidity sensitivity of investment. For Japan, Hoshi, Kashyap, and Scharfstein, "Corporate Structure" find positive effects of relationships, while Weinstein and Yafeh,

"On the Costs" reveal several costs.

8.By law, German share companies had a supervisory board (Aufsichtsrat) to represent shareholder interests and an executive board (Vorstand) to manage operations. Calomiris, "The Costs" and Da Rin, "Understanding the Development" set out a modernized version of the traditional view on Germany. Riesser, *Konzentration* and Jeidels, *Das Verhältnis* remain the contemporary classics on universal bank operations as viewed by an insider. See also DeLong, "Did Morgan's Men" on the signaling value of J. P. Morgan's men sitting on American boards.

9.See Fohlin, "Bank Securities" and "Balancing Act" on bank securities holdings. There is very little available evidence on proxy voting by universal banks, making it exceedingly difficult to know just how pervasive the practice was.

10. This issue is quite complicated, and the evidence is mixed. See Rajan and Zingales, "What Do We Know." They point out that the costs of long-term bank relationships may limit the amount of debt that firms are willing to take on.

11.The literature tends to use income to measure size. Income is highly correlated with total assets in the current sample. Using natural logarithms helps control heteroscedasticity.

12.Banks' preference for lending to high profit firms may induce a positive relationship; though if the firm's resistence to debt is strong enough, supply conditions may make little difference in equilibrium.

13.Bossaerts and Fohlin, "The Pricing" find that market-to-book ratio relates positively to stock returns.

14.See Fohlin, "The Rise." The 1904 volume is also the earliest volume available in the United States. Data collection from volumes held in Germany is underway.

15.Such information is available in the recent period, and board memberships prove to be positively correlated with control rights. See Gorton and Schmid, "Universal Banking," Elston, "Investment," and Chirinko, "Finance Constraints."

16.Empirically, free cash flow and profitability are often closely related, and the difference often hinges on the commitment of firms to specified dividend payouts. In the current sample, raw correlations between different definitions of profits and retained earnings range from 86 to 99 percent. The definition used in the current analysis, net profits (after taxes, dividends, and required payments to reserves) proxies for free cash flow as closely

as possible. In general, interest payments are included in costs and cannot be distinguished consistently, preventing measurement of operating profits. The inclusion of interest payments on debt may induce a spurious negative correlation between cash flow and leverage, since, for a given level of operating profits, high debt firms will have higher interest payments and lower cash flow. Interest payments account for a small portion of firms' costs, so spurious correlation is likely to account for only a part of the overall effect. A problem would arise if profits are positively correlated with leverage, but the artificial negative relationship offsets it–yielding no observable correlation. A second problem might arise if low cash flow indicates financial distress, since financially distressed firms may simultaneously experience low profits and high leverage. Possible corrections for both of these problems are noted in the results section.

17. Fohlin ("Universal Banking" and "The Rise") studies the characteristics of bank-attached firms in great depth. The findings of those papers are largely supported by the results here.

18. Having only one bank board membership makes little difference in median leverage, but the one extreme value belongs to one of the exclusively attached firms.

19. The KS and KW tests were implemented in Stata5; the manual provides full details of the tests.

20. The slight hesitation stems from the uncertainty over the sources of short-term debt. It is still possible that the sources of such lending varied systematically with formal bank oversight, and that bank-affiliated companies gained priority access to funding from the banks placed on their boards. The origin of funding matters if it affected the cost of financing or the choice of investment. Such data are missing 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–a promising area for further research.

21. I use the Hadi method for identifying multivariate outliers and find 8 such outliers at the five percent level of confidence. Robust regression and Hadi outlier selection were implemented in Stata5; both methods are discussed in the Stata5 and Stata6 manuals. Appendix B reports a comparison of results using robust regression, Tobit, and OLS.

22. Coefficients of both age and profits present potential problems. Given the possibility of survivorship bias due to the stock market decline of 1900-01, it is important to note that the coefficient estimates for firm age appear to be unaffected by the inclusion of firms that were founded after the crash. Though these firms appear to have

somewhat higher leverage than the rest of the sample, there is no significant difference in leverage between the firms founded shortly before the crash and immediately after. Moreover, excluding the post-1901 firms from the sample does not alter the regression results on age. The difficulty with the profit variable involves the possible introduction of a spurious negative correlation between profits and leverage due to the subtraction of interest payments from gross operating profits and simultaneity between financial distress and high leverage. As a test of the first problem, I have estimated interest payments based on the amount of debt reported in firms' balance sheets and the median interest rate on bonds, 4 percent (since only a quarter of firms reported interest rates, and then only on some bonds, I could only estimate the actual interest rate for all firms and all types of debt). Adding interest payments back into net profits results in equivalent regression findings to those reported here. In order to test for simultaneity, I have also rerun the regressions with an indicator variable for the most distressed firms (those in liquidation) and removing those firms altogether. While firms in liquidation experienced clearly lower profits, all of the findings are completely robust to both changes in model specification. Additional regression results for all of these corrections are available from the author.

23. Size is also often hypothesized to proxy for information availability, but it may actually add little information that firm age and the stock market listing variable do not already capture. Among joint-stock companies, size, age, and stock market listing are all very strongly related to one another.

24. 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 of a strong link between listings and securities issues and suggests that gaining and maintaining listings improved information availability. 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.

25. Magnitude and significance, for example, are substantially diminished by the inclusion of controls for firm age and stock market listing variables (equation 3), and the reported specifications represent the strongest results on the bank-attachment variable. The significance and influence of the Berlin listing variable could indicate the importance of stock market listings for ameliorating information problems, but as noted previously, this possibility

needs to be pursued more thoroughly in future work. The formed interaction variables are very highly correlated

with the attachment variable, thus introducing multicollinearity and potentially reducing the perceived significance

of the attachment variable. Without interaction variables, the attachment indicator is more robust to various

specifications, but clearly the independent variables enter differently for attached and independent firms. When

analyzing the attached and independent samples separately, the estimated constants are statistically insignificant

both sub-samples (additional results may be obtained from the author).

26.Actual levels of collateral were not usually reported and therefore cannot be regularly observed for the firms in

this sample, hence the use of tangibility as a proxy.

27. Fohlin, "Relationship Banking," shows that, in the early twentieth century, bank attachment (controlling for

selection bias) was not associated with higher investment or with lower liquidity sensitivity of investment–a

common measure of firms' liquidity constraints. On the other hand, Gorton and Schmid, "Universal Banking,"

find that bank relationships raise firms market returns in modern Germany. Edwards and Fischer (*Banks, Finance

and Investment*), however, offer a different view.

TABLE 1
HYPOTHESIZED FACTORS IN LEVERAGE DECISIONS

Factors in leverage decisions	Explanation	Bank debt/ liabilities	Bank debt/ total debt	Total debt/ equity
Bank board memberships (possible causes and effects thereof)				
interim monitoring of bank debt (cause)	asset substitution, excessive risk reduced	++	++	+
ex post monitoring, decreased investigation costs (effect)	agency cost of debt lowered	++	++	+
interest on current accounts (effect)	bankers earn more from lending than from equity issues or returns	++	++	+
signaling firm quality to equity markets (cause)	seal of approval due to ex ante monitoring (selection process)	-	0	-
proxy votes and direct equity stakes (cause)	bank gains votes (control rights) through underwriting process	-	0	-
underwriting commissions and fees (effect)	bankers earn more from equity issues or returns than from lending	-	0	-
Information asymmetry				
age	proxy for information availability	-	-	-
	proxy for lower default probability (endogenous)	-	0	-
size	proxy for information availability	-	-	-
tangibility of assets	proxy for collateralizable assets	+	?	++
cash flow	debt is costly; prefer inside funds	-	?	-
market-to-book value of shares	proxy for reputation in equity market	-	0	-
Agency costs (conflicts of interest)				
age	proxy for lower default probability (endogenous)	-	0	-
size	proxy for diversification, lower bankruptcy risk & investigation costs	+	?	++
tangibility of assets	proxy for liquidation value	+	?	++
cash flow	debt limits overinvestment	+	?	++
market-to-book value of shares	proxy for growth opportunities	-	?	-

TABLE 2
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/	0.56	0.60	-0.07	-0.11
total assets	*0.24*	*0.24*	*0.51*	*0.40*
Natural log of	6.18	5.43	0.05	0.03
income	*1.52*	*1.54*	*0.03*	*0.23*
Net profits/	0.04	0.09	-0.58	-0.22
total assets	*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	0.22	0.17	0.11	0.10
exchange	*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 deviations 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 3
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 4
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 5

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 6
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 7
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/	0.22	0.19	0.14
total assets	*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	0.05	0.07	0.08
income	*2.50*	*3.16*	*3.46*
Bank x income	-0.01	-0.03	-0.03
	-0.22	*-0.63*	*-0.55*
Net profits/	-2.82	-2.80	-2.91
total assets	*-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 8
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.

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.

CORRELATES OF LEVERAGE–THREE ESTIMATORS

Variable	Huber Robust Regression	Tobit with Outliers Removed	OLS with Outliers Removed
Fixed assets/	0.04	-0.08	-0.07
total assets	*0.34*	*-0.51*	*-0.41*
Natural log of	0.09	0.10	0.09
income	*4.56*	*3.66*	*3.16*
Net profits/	-4.44	-6.91	-6.35
total assets	*-9.58*	*-9.15*	*-8.54*
Age of firm[a]	-0.01	-0.01	-0.01
	-2.67	*-2.29*	*-2.38*
Listed on Berlin stock exchange[b]	-0.16	-0.21	-0.20
	-2.09	*-2.17*	*-2.06*
Listed on other German stock exchange	-0.01	0.04	0.05
	-0.17	*0.47*	*0.56*
Constant	0.60	0.33	0.43
	2.95	*1.36*	*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.