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On the Costs of a Bank-Centered Financial System: Evidence from the Changing Main Bank Relations in Japan

DAVID E. WEINSTEIN and YISHAY YAFEH*

ABSTRACT

We examine the effects of bank–firm relationships on firm performance in Japan. When access to capital markets is limited, close bank–firm ties increase the availability of capital to borrowing firms, but do not lead to higher profitability or growth. The cost of capital of firms with close bank ties is higher than that of their peers. This indicates that most of the benefits from these relationships are appropriated by the banks. Finally, the slow growth rates of bank clients suggest that banks discourage firms from investing in risky, profitable projects. However, liberalization of financial markets reduces the banks' market power.

THE CLOSE RELATIONSHIP BETWEEN manufacturing firms and financial institutions in Japan has recently been at the center of the debate on the appropriate financial system for the reforming economies of Eastern Europe. As opposed to the Anglo-Saxon separation of finance and industry, long-term ties between main banks and their client firms (involving bank loans, bank equity holding, and some bank-appointed personnel), which are common in Japan and Germany, have often been described as a growth-oriented financial system that could serve the needs of developing and reformed economies better than anonymous capital markets modeled after the American and British financial systems. The claim that close ties between investment-oriented banks and industrial firms could help overcome the difficulties of "relative backwardness" dates back to Gerschenkron (1962) who investigates European development. Rosovsky (1961) applies Gerschenkron's framework to the analysis of Japanese growth. More recently, Aoki, Patrick, and Sheard (1994), Hoshi, Kashyap, and Loveman (1994), and Teranishi (1993), among others, portray the close ties between finance and industry in Japan as an important factor in the international competitiveness of modern Japanese

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firms, which could serve as a model for the reforming economies in Eastern Europe. They argue that close bank–firm relationships can solve agency problems of managerial behavior as well as problems of asymmetric information between lenders and borrowers.

In this paper we cast some doubt on the magnitude of the benefits from close ties between finance and industry. Using data on a large sample of Japanese firms, we argue that although close ties to a bank improve firm access to capital, they are not necessarily accompanied by higher profits or growth rates. Indeed, we show that before the liberalization of Japanese financial markets in the 1980s, firms paid dearly for the privilege of access to bank finance; that is, banks appropriated a large part of the benefits generated through relationships with client firms.

Before the liberalization of the 1980s, capital markets in Japan were highly regulated and immature. Firms could raise only limited amounts of capital through commercial flotation of debt or equity and had to rely mainly on internal and bank finance for investment funds (Hamada and Horiuchi (1987), Meerschwam (1991), and Frankel (1991)). In addition to being underdeveloped, Japanese capital markets have traditionally been segmented. Some firms with close ties to a financial institution could raise large sums of money in the form of bank finance, but many firms did not have these kinds of relationships and were forced to raise funds through arm's length transactions. The division of firms into those with better access to bank finance and those with only limited access was determined largely during World War II (Hoshi (1993)), and during the 1950s (Yafeh (1995)), and remained extremely stable until the mid-1980s. Firms with close ties to a financial institution would typically have their primary lender, or main bank, hold a significant share of their equity, and monitor their activities closely through the appointment of personnel to senior positions on their boards.

During the 1980s the Japanese financial system underwent a process of dramatic deregulation and liberalization which made corporate borrowing and raising of equity in both domestic and foreign capital markets much easier and more common. There were several important changes. First, the revision of the Foreign Exchange Control Law allowed Japanese firms to issue unsecured foreign bonds starting in late 1980. This had a dramatic effect on Japanese finance. As Kester (1991) argues,

> The real watershed for Japanese corporate finance came with the amendment of the Foreign Exchange Control Law in 1980. The amendment permitted cross-border capital transactions with only prior notification of the Ministry of Finance rather than the obtaining of a formal permit. This relaxation had an immediate and significant impact. Attracted by the lower cost of funds, less regulation, greater flexibility, and, for some, the benefits of liabilities denominated in foreign currencies, major Japanese companies turned to the Euromarkets as a source of funds. Total funds raised in overseas markets in 1981 exceeded 1.4 trillion yen, nearly triple the 1975–1979 annual average of 560 million yen. . . . As a frac-

> tion of all securities issued by Japanese companies, overseas issues rose steadily from a level under 20 percent prior to 1980 to nearly 50 percent by 1985. Much of the funds so raised were used to repay notes payable and long-term borrowings from banks, resulting in a restructuring of Japanese corporate liabilities in which various types of bonds were substituted for trade and bank credit. (p. 188)

Ramseyer (1994) provides similar evidence showing that between 1980 and 1984 foreign issuances increased from 683 billion to 2.8 trillion yen while the domestic bond market increased from 1.1 trillion to 2.3 trillion yen. Indeed, within three years of the revision of the Foreign Exchange Control Law, the value of bonds issued abroad exceeded the value of bonds issued domestically.

The increased access to foreign capital markets was followed by tremendous growth of the local bond market, driven in part by the rapid decline of a domestic bond underwriting cartel. Since 1933 Japanese banks had belonged to a bond underwriting cartel (*kisaikai*) that had placed severe restrictions on the issuance of unsecured straight and unsecured convertible bonds domestically (Hoshi, Kashyap, and Scharfstein (1990a) and Ramseyer (1994)). Furthermore, by law, only Japanese banks could manage the collateral associated with bond issuances. Given this legal monopoly, the bond cartel charged extremely high collateral management fees as well as commissions on domestic bond issuances which were, on average, about 15 times higher than commissions on similar issuances in the Euromarket (Semkow (1992)). Because the revision of the Foreign Exchange Control Law enabled Japanese firms to circumvent the bond cartel by using foreign markets to raise capital, domestic banks were forced to lower their collateral management fees on some secured bonds, and even to sell them at a discount. In addition, the bond cartel was forced to revise its criteria for allowing the domestic issuance of these financial instruments.

This had a dramatic effect on the Japanese bond market. As Figure 1 illustrates, between 1977 and 1987 the total number of bonds issued increased by more than 300 percent and the value of these bond issues rose by a factor of seven. In 1980 for example, the value of unsecured bonds issued was only 40 billion yen, by 1981 it was 268 billion yen, and five years after that (at the end of our sample period) it had increased by a factor of ten. The number of firms issuing bonds increased as well. As Hoshi, Kashyap, and Scharfstein (1993) relate, in 1979 only 2 firms had balance sheets that met criteria for issuing unsecured (straight or convertible) domestic bonds; by 1982, after the criteria were loosened by the cartel, at least 112 firms were eligible to issue convertible (not necessarily unsecured) bonds. Subsequent relaxations increased this number rapidly so that by 1989 approximately 300 firms met the criteria to issue unsecured straight bonds and 500 firms could issue unsecured convertible bonds.

Finally, in addition to changes in Japanese bond markets, relaxation of regulations in equity markets made equity finance easier and resulted in a substantial shift toward equity rather than debt finance. With access to for-

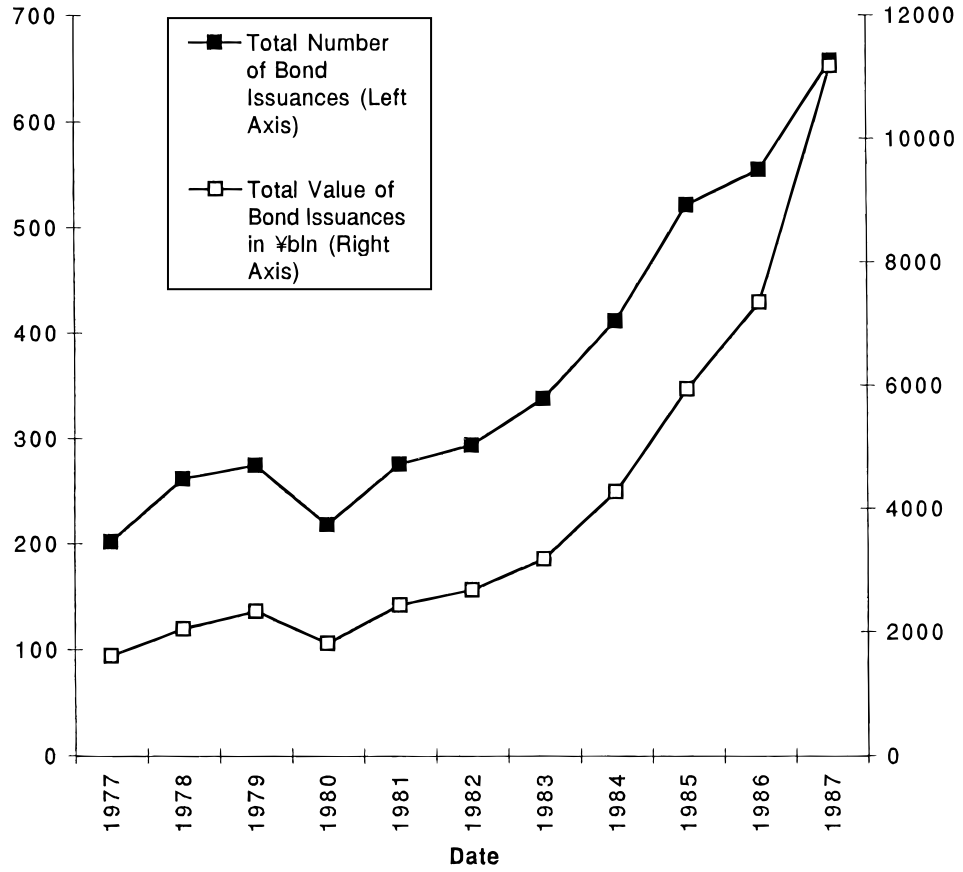

Figure 1. Growth in the bond market. The data on bond issuances are from the Bank of Japan, Economic Statistics Annual, 1992.

eign markets, and more developed domestic capital markets, Japanese firms gained alternatives to bank debt. We will argue that this fact dramatically changed the relationship between main banks and their client firms.

The literature on Japanese corporate finance and on the close ties between leading financial institutions and their client firms (main bank relationships) generally follows two distinct paths. First, in the spirit of theoretical work by Diamond (1984) and others, involvement of main banks in the management of their client firms has often been described as a mechanism of monitoring managers and a solution to principal-agent problems (Aoki (1990), Prowse (1992), and Sheard (1989)). The focus of this paper, however, is on a second line of research on Japanese finance, which emphasizes imperfect information between lenders and borrowers. When firm managers have information that investors do not have, internal and debt finance become their preferred methods of raising capital. In this context, long-term main bank relations are viewed as an institution that mitigates problems of asymmetric

information between lenders and borrowers, and thus facilitates access to capital for firms with close ties to a bank. Hoshi, Kashyap, and Scharfstein (1990a, 1991) show that, indeed, firms with closer ties to a main bank are less liquidity constrained than other firms in their investment decisions, although they do not detect any significant differences in investment levels. Similarly, Petersen and Rajan (1994) look at U.S. data on small firms and demonstrate that close relationships with a bank increase the availability of capital but do not significantly reduce its cost.[1]

If, indeed, firms with a main bank have easier access to loans as these studies suggest, one should expect superior performance by main bank client firms, either through faster growth or higher profits, in a manner that reflects their advantageous access to bank finance. And yet a number of studies have shown that, in fact, main bank clients tend to grow at a slower pace than "independent" firms (Nakatani (1984)), and moveover, main bank clients tend to have lower profits (Caves and Uekusa (1976), Nakatani (1984), and Weinstein and Yafeh (1995)).[2]

We believe there are two main reasons for the fact that main bank client firms do not perform better than other firms. First, banks, as major debtholders, are likely to be more risk averse than equity holders. Indeed, evidence on the volatility of firm profits (Nakatani (1984)) suggests that firms closely related to banks are less involved in risky operations than other firms. Second, we show that in return for providing capital and other services, banks are able to extract rents from their client firms so as to offset any gains they may have over other firms.

In order to examine these issues, we collect data on a sample of about 700 listed manufacturing firms for the period 1977 to 1986 (see Section I for a detailed description). We examine the performance of firms with a main bank in our sample and find, as in previous studies, that they have lower profits and slightly lower growth rates than their industry peers. This, together with Hoshi et al.'s (1990a) study of the phenomenon of firms leaving their main banks, leads us to attempt to identify more precisely the costs incurred by firms that maintain main bank ties. We find that the banks are able to capture most of the rents that client firms may enjoy due to their access to capital, and thereby push down firm profits. Furthermore, our results suggest that conservative investment strategies motivated by the bank's position as a major debtholder may inhibit firm growth.

[1] A third line of research (e.g., Hoshi, Kashyap, and Scharfstein (1990b), Kaplan and Minton (1994)) emphasizes the role of banks when clients are in financial distress.

[2] There are only a few studies in which a positive relationship between ties with a main bank and profitability or performance is found. Hoshi et al. (1990b) show that main bank clients in financial distress return to normal performance more quickly than other firms. Lichtenberg and Pushner (1994) report a positive correlation between profitability and stock holding by all financial institutions—a measure that in our view is only a very rough proxy for main bank ties. Yafeh (1995) argues that firms with a main bank tie were able to recover more easily from the adverse effects of the American occupation reforms, but his result is based on a small sample of reformed firms.

The basic framework that we use for this paper is based on the model of Weinstein and Yafeh (1995), which predicts high levels of capital intensity and low profit margins for main bank client firms that are subject to bank pressure. Empirical evidence provided by Weinstein and Yafeh confirms that profit margins of main bank clients are relatively low. In this paper, we extend that analysis, and examine the effects of main bank relations on firm behavior and performance. First, we examine whether firms with strong bank ties tend to use more capital than their industry peers. Using the elaborate measures of capital stock and cost of capital developed by Hayashi and Inoue (1991), as well as data on the use of other inputs, we show that the share of capital used by main bank clients was significantly higher than that of "independent" firms prior to 1980. However, differences in capital use have virtually disappeared since the liberalization of Japanese financial markets in the early 1980s. This result is consistent with the view that main banks provided client firms with improved access to capital during the period of severe capital market regulation. Second, we find that in exchange for their financial services, main banks extracted significant rents from their client firms. The transfer of funds from firms to their primary lenders can explain, in part, the low profitability of main bank firms. We show that this transfer often takes the form of higher than average interest payments on debt. Our third major result is that main bank client firms tend to grow no faster than "independent" firms. We interpret this result as additional evidence of bank influence on firms to forgo risky but profitable investment projects. Finally, by examining growth and profitability of main bank client firms during the 1960s, we establish the (stylized) fact that at no time in the past three decades did main bank clients outperform their "independent" peers.

The analysis leads us to the conclusion that, as Caves and Uekusa (1976) speculated twenty years ago, the benefits of a rationed capital market accrue largely to the main bank, which is able to capture most of the rents through high interest payments and through pressure on clients to use large quantities of bank-financed capital inputs. If this view of main bank behavior is correct, and banks further their interests by exerting pressure on their clients to accommodate bank demands that are different from pure profit maximization, it is easy to interpret the surprisingly low growth rates of main bank firms as evidence of bank pressure to avoid some high risk-high return investment projects. We conclude, then, that when capital markets are underdeveloped and entry into the banking sector is restricted, a system of close ties between firms and financial institutions may lead to a redistribution of rents away from the manufacturing sector to the financial sector, without clearly visible benefits in the form of fast growth rates. We therefore suggest that some caution be used in prescribing a German–Japanese system of bank finance to the struggling economies of Eastern Europe and the developing world.

The rest of this paper is organized as follows. In Section I we describe the theoretical background, data construction, and estimation procedures in de-

tail. In Section II we present and discuss our major empirical results on the adverse effects of bank pressure on the performance of client firms. Section III concludes.

I. Methodology

Even when the financial system is fairly competitive (as in the case of the United Kingdom or the United States), private information that banks have about their clients may give them some monopoly power (Rajan (1992), and Houston and James (1996)). In Japan, prior to financial liberalization, when alternatives to bank finance were very limited, it is likely that banks had even more monopoly power. Because equity and bond finance were restricted, most firms had to rely heavily on bank loans. Furthermore, the Ministry of Finance tightly controlled entry into the banking sector. In addition, since main banks typically maintain long-term relationships with their clients, the amount of private information they have about borrowing firms is probably substantial, and hence switching main banks may not be a cost effective option.

We model the behavior of banks and firms in this environment by considering the problem faced by one main bank and client firm i. We assume that the main bank has the ability to set the interest rate, r_i, that it charges each of its client firms. After interest rates are set, all firms in the market, both main bank clients and other firms, simultaneously choose inputs and outputs.[3] Suppose further that managers of client firms do not simply maximize profits but rather maximize a weighted average of the shareholders' and the main bank's objective functions. Let a_i denote the amount that managers weigh nonbank shareholder preferences and $(1 - a_i)$ the amount that they weigh bank preferences. Let t be the equity stake held by the main bank and assume that a is a decreasing function of t.[4] a_i is assumed to be less than one because the bank may influence firm decisions through ownership of equity, the presence of former bank officials on the firm's board, the exchange of personnel, and loan negotiations, and also because the firm may value various bank services and maintain good relations with this important creditor.

Nonbank shareholders of firm i want the managers to pick output levels and choose factor inputs in order to maximize firm profits:

$$pf(K_i, \mathbf{X}_i) - r_i K_i - \boldsymbol{\mu}_i \mathbf{X}_i, \tag{1}$$

[3] In addition, we assume that: (a) client firms are not competitors in the product market. Main bank client firms are generally spread across all sectors in the economy and a bank is rarely the main bank for two competing firms; and (b) no lump sum transfers between the bank and the firm are possible, because such transfers are difficult to arrange and probably do not occur in reality.

[4] By law, bank shareholding of firms was limited to a maximum of 10 percent for the period under examination. This limit was later reduced to 5 percent. Bank shareholding was on average approximately 4 percent (Prowse (1990)).

where p is output price (a decreasing function of aggregate output), f is the firm's production function, K_i is capital stock, $\mathbf{X}_i$ is a vector of other inputs, and $\boldsymbol{\mu}_i$ is a vector of factor prices. Banks, however, are concerned not only with firm profits, but also with maximizing their profits from loans to the firm. The bank maximizes

$$(r_i - r')K_i + t_i[pf(K_i,X_i) - r_iK_{i'} - \boldsymbol{\mu}_i\mathbf{X}], \tag{2}$$

where r_i is the interest rate the bank charges the firm and $r' < r_i$ is the cost to the bank of raising funds. That is, the bank chooses an interest rate r_i so as to maximize profits from both debt and equity holdings.[5] Equation (2) can be rewritten as

$$t_i\left[pf(K_i,X_i) - \frac{1}{t_i}(r' - r_i(1 - t_i))K_i - \boldsymbol{\mu}_i\mathbf{X_i}\right]. \tag{2'}$$

It can be easily shown that the "cost of capital" term in equation (2′) is strictly smaller than r_i (as long as $r' < r_i$). If the bank could determine the amount of capital employed by the firm, it would have the firm use capital as if the cost of capital were less than (the firm's actual cost) r_i. In other words, to the extent that the bank can influence the behavior of the firm, it will try to induce the firm to use more capital-intensive production techniques than profit maximization would warrant.

Because we have assumed that managers of main bank client firms maximize a weighted average of the bank's and the shareholders' objective functions, and because in the bank's objective function (2′) the perceived cost of capital is lower than the actual cost of capital in the shareholders' objective function, the cost of capital used in the managers' objective function is lower than the true cost of capital r_i. Formally, the objective function of firm managers is

$$\max_{K_i,\mathbf{X}_i}\left\{[a_i + (1 - a_i)t_i]\left[pf(K_i,\mathbf{X}_i) - \boldsymbol{\mu}_i\mathbf{X}_i - \left(r_i - \frac{(1 - a_i)}{a_i + (1 - a_i)t_i}(r_i - r')\right)K_i\right]\right\}. \tag{3}$$

The model therefore predicts that for any given level of output and factor prices, bank-influenced firms will tend to use a more capital-intensive factor input mix than their industry peers. This difference in capital use between main bank client firms and independent firms will be even bigger if, in addition to the effect of main bank influence described in the model, non–main bank client firms are rationed in their access to capital because of limited

[5] Difference in risk between debt and equity holdings is ignored here.

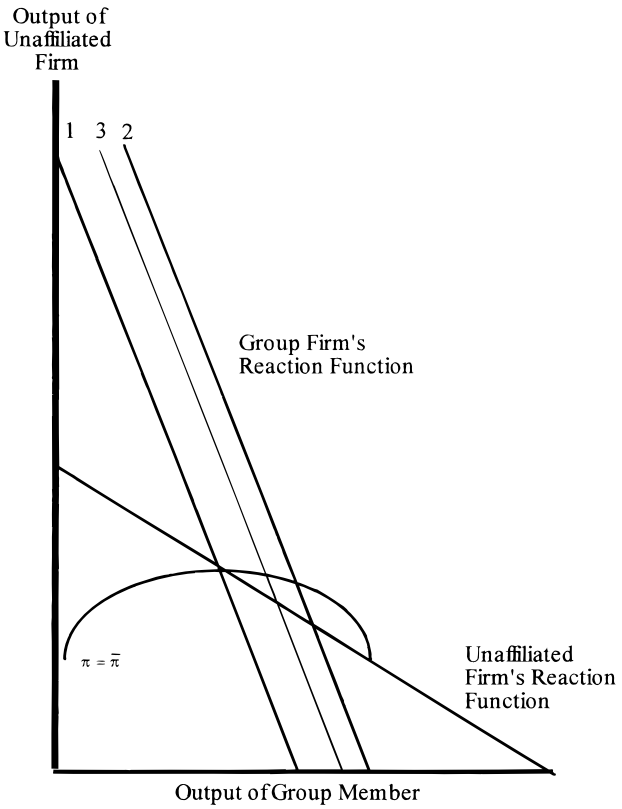

Figure 2. Impact of a lower σ_k on output and profits. Cournot-style competition between a main bank client firm, *G*, and an "unaffiliated" company, *U*. The figure shows how main bank ties can serve as a "commitment" to use more capital and produce higher output, thus shifting *G*'s reaction curve to the right, from (1) to (3). The shift back to (2) is due to a higher interest charged by the main bank.

availability of bank loans. A second implication of the model is that for any given factor prices, main bank client firms will choose to produce a higher level of output than non–main bank firms. This is because main bank client firms behave as if their cost of capital is lower than the actual cost.

We now turn to discuss the interest rate charged by the main bank. In general, r_i, the interest charged by the bank, can be calculated as the outcome of a two-stage game, where in the first stage the bank sets its interest rate, r_i, taking into account the manager's objective function and product market equilibrium of the second stage.[6] Figure 2 describes an industry with two firms: a group-affiliated firm, *G*, and unaffiliated firm, *U*. We assume

[6] We ignore unrealistic cases where the bank controls the firm ($a_i = 0$) without holding any shares ($t_i = 0$). In such cases, the bank has an incentive to set an infinitely high interest rate because it does not benefit from firm profits.

goods are strategic substitutes. If G is unaffiliated, its best response curve is the curve indicated by 1. But as the discussion above suggests, group affiliated firms are "committed" to use more capital and produce more at any given factor prices, namely, G's best response curve will shift out to 2.[7] This implies that G's market share (and demand for capital) will be higher than without a main bank. As far as the bank is concerned, however, the affiliated firm's demand for capital is less elastic, and hence a higher interest rate will be charged. This higher cost of capital causes the best response function to shift back to 3. The way Figure 2 is drawn, it is possible for both the bank and the firm to raise profits through relationships that enable the firm to be "credibly committed" to a more aggressive best response function, although this need not always be the case.

Not only will firms with main banks tend to use more capital at any given interest rate, it is also possible to show that as long as the market interest rate, r_m, is below the rate that an ordinary monopolist supplier of capital would charge, firms with main banks may pay higher interest rates than unaffiliated firms. For simplicity, ignore bank shareholding (assume $t_i = 0$) and let a_i be smaller than one. We can now write the firm's demand for capital as

$$K_i = K_i\left(\boldsymbol{\mu}_i, r_i - \frac{1 - a_i}{a_i}(r_i - r')\right). \tag{4}$$

Partially differentiating (2) with respect to r_i yields the following first-order condition:

$$K_i + r_i \frac{\partial K_i}{\partial r_i}\left(1 - \frac{1 - a_i}{a_i}\right) - r' \frac{\partial K_i}{\partial r_i}\left(1 - \frac{1 - a_i}{a_i}\right) = 0$$

or

$$\left[K_i + (r_i - r')\frac{\partial K_i}{\partial r_i}\right] - \frac{\partial K_i}{\partial r_i}\frac{1 - a_i}{a_i}(r_i - r') = 0. \tag{2''}$$

If the bank were an ordinary monopolist (i.e., without influence on firm behavior and without holding any of its shares), the term in brackets would equal zero. Because the second term is positive, the interest rate charged must exceed the monopolistic interest rate.[8] Assuming the market rate can-

[7] Fershtman and Judd (1987), in a somewhat different framework, discuss incentive schemes that induce managers to maximize a weighted average of profits and sales in order to become more aggressive and raise firm profits.

[8] In order to guarantee that the second-order conditions are satisfied, it is sufficient (but not necessary) to assume that the firm's capital demand function is concave, and that shareholders' influence $a_i > 0.5$. The estimates of a_i reported in Section II indicate that this condition is easily satisfied for our sample.

not exceed the monopoly rate, then bank client firms will be charged a higher rate than nonclient firms. In other words, under the assumption of no bank shareholding, $r_i > r_m > r'$. Bank shareholding ($t_i > 0$) would naturally tend to make the interest charged lower, and yet for low values of t_i, the bank will still have an incentive to charge a very high interest rate (because its profits as a lender are more important than its share in firm income as a small shareholder). This discussion implies that when bank influence is present ($a_i < 1$), and bank shareholding (t_i) is small, it may well be the case that main bank client firms are charged higher interest rates than their unaffiliated peers. Whether this means that firm profits with a main bank will be higher than ordinary Cournot profits depends on the extent of the shift in the best response curve (see Figure 2).[9]

We now turn to empirical tests of the implications of the model. One way to examine if main bank clients use more capital intensive production techniques than their unaffiliated peers is to partially differentiate equation (3) with respect to capital, but it is very difficult to turn the resulting first-order conditions into equations that can be empirically estimated. Instead, our estimation strategy is based on the cost function of the firm.

A firm without a main bank will have a cost function of the form

$$C_m(Y_i, \boldsymbol{\mu}_i, r_i) \quad \text{where } Y_i = f_m(K_i, \mathbf{X}_i),$$

where m is an industry index. By partially log differentiating this, we obtain

$$\frac{\partial \ln C_i}{\partial \ln \mu_{ij}} = \frac{\boldsymbol{\mu}_{ij}}{C_i}\frac{\partial C_i}{\partial \mu_{ij}} = \frac{\mu_{ij}X_{ij}}{C_i} \quad \text{and} \quad \frac{\partial \ln C_i}{\partial \ln r_i} = \frac{r_i}{C_i}\frac{\partial C_i}{\partial r_i} = \frac{r_i K_i}{C_i}, \tag{5}$$

where j is an index over all factors other than capital and X_{ij} is firm i's demand for factor j. A firm with a main bank will not minimize actual costs because of bank demands, but will minimize the bank-influenced cost function that is the dual of equation (3) instead:

$$C_m(Y_i, \boldsymbol{\mu}_i, \theta_i) \quad \text{where } \theta_i = r_i - \frac{(1 - a_i)}{a_i + (1 - a_i)t_i}(r_i - r').$$

Partially differentiating the log of the bank-influenced cost function with respect to the log of the cost of capital yields

$$\frac{\partial \ln C_i}{\partial \ln r_i} = \frac{r_i}{C_i}\frac{\partial C_i}{\partial \theta_i}\frac{\partial \theta_i}{\partial r_i} = \frac{r_i K_i}{C_i}\left(1 - \frac{(1 - a_i)}{a_i + (1 - a_i)t_i}\right),$$

[9] Main banks, through a variety of services (e.g., implicit bankruptcy insurance) can make the relationship worthwhile for their clients even if operating profits fall.

which can be rewritten as

$$\frac{\partial \ln C_i}{\partial \ln r_i} = \frac{r_i K_i}{C_i(1 + \sigma_k)},$$

where[10]

$$\sigma_k = \frac{a_i + (1 - a_i)t_i}{a_i + (1 - a_i)t_i - (1 - a_i)} - 1 > 0. \tag{6}$$

Suppose that each firm i in industry m has a nonhomothetic translog cost function of the form

$$\ln C_i = \ln \alpha_{0m} + \sum_j \alpha_{mj} \ln \mu_{ij} + \frac{1}{2} \sum_j \sum_v \gamma_{mjv} \ln \mu_{ij} \ln \mu_{iv} + \sum_j \gamma_{mY_j} \ln Y_i \ln \mu_{ij} + \alpha_{mY} \ln Y_i + \frac{1}{2} \gamma_{mYY} (\ln Y_i)^2, \tag{7}$$

where j and v are indexes over all factors (including capital), μ_{ij} are factor prices, and the αs and the γs are parameters to be estimated which determine the price and output elasticities.[11] Rather than estimate equation (7) directly, various theoretical conditions can be imposed to improve efficiency. By Young's theorem, we know that $\gamma_{mjv} = \gamma_{mvj}$. Because the cost function is homogeneous of degree one in prices, the following conditions must hold:

$$\sum_j \alpha_{mj} = 1, \qquad \sum_j \gamma_{mjv} = \sum_v \gamma_{mjv} = \sum_j \gamma_{mYj} = 0.$$

Equation (5) can therefore be rewritten as

$$S_{ij} \equiv \frac{\mu_{ij} X_{ij}}{C_i} = \alpha_{mj} + \sum_j \gamma_{mjv} \ln \mu_{ij} + \gamma_{mYj} \ln Y_j, \tag{8}$$

where μ_{ij} and X_{ij} denote factor prices and factor inputs respectively and

$$\sum_j S_{ij} = 1. \tag{9}$$

Since in this model firms with main banks behave as if their cost of capital is equal to something less than their true cost, the share of capital will be

$$S_{ik} \equiv \frac{r_i K_i}{C_i} = (1 + \sigma_k)\left(\alpha_{mr} + \sum_j \gamma_{mrj} \ln \mu_{ij} + \gamma_{mYr} \ln Y_i\right) \tag{10}$$

[10] Formally, the expression is positive only if $a_i > (1 - t_i)/(2 - t_i)$. This assumption is not very restrictive. For example, if we assume that $a_i = 1 - t_i$ (i.e., bank control is linear in equity ownership), the inequality holds for all t_i less than one.

[11] The translog nonhomothetic cost function can be thought of as a second-order approximation to an arbitrary cost function. The specification and notation that we use here are discussed in greater detail in Berndt (1994).

and there must also exist a $\sigma_k' < 0$ such that

$$\sum_{j \neq k} S_{ij} \equiv \frac{\sum_{j \neq k} \mu_{ij} X_{ij}}{C_i} = (1 + \sigma_k')\left(\sum_{j \neq k} \alpha_{mj} + \sum_{j \neq k, v} \gamma_{mjv} \ln \mu_{ij} + \sum_{j \neq k} \gamma_{mYj} \ln Y_i \right).$$

Equations (8) and (10) provide us with a simple test of whether firms with main banks use a different cost of capital than firms without these relationships: *Within* any industry firms with main banks should use $(1 + \sigma_k)$ times more capital intensive production processes than firms without main banks, controlling for differences in factor prices and production levels.

Clearly, in order to estimate σ_k for main bank firms we must measure the stock of capital as well as its cost as accurately as possible. Our estimation of the capital stocks and the cost of capital are based on the methodology employed by Hayashi and Inoue (1991). The cost of using capital good h in period t, C_{ht}, can be written as

$$C_{ht} = PK_{ht} - E_t[\rho_t(1 - \delta_h)PK_{h,t+1}],$$

where PK_{ht} is the tax-adjusted real cost of capital good h, ρ_t is the real tax-adjusted discount factor between period t and $t + 1$, and δ_h is the rate of depreciation for capital good h. PK_{ht} is calculated according to the following formula:

$$PK_{ht} = \frac{(1 - z_{ht})PK_{ht}'}{(1 - \tau_t)p_{mt}},$$

where PK_{ht}' is the tax-unadjusted price of capital good h, z_{ht} is the expected present value of tax saving due to depreciation allowances on a unit investment in good h, τ_t is the corporate tax rate in period t, and P_{mt} is the price of output in industry m. The real tax-adjusted discount factor is equal to

$$\rho_t = \rho_t^N \left[\frac{(1 - \tau_{t+1})p_{m,t+1}}{(1 - \tau_t)p_{mt}} \right],$$

where ρ_t^N is the nominal discount factor between period t and $t + 1$. This enables us to rewrite the cost of capital as

$$C_{ht} = [1 - (1 - \delta_h)E_t(\rho_{ht}^R)] \frac{(1 - z_{ht})PK_{ht}'}{(1 - \tau_t)p_{mt}}, \tag{11}$$

where

$$\rho_{ht}^R = \rho_t^N \left[\frac{(1 - z_{h,t+1})PK_{h,t+1}}{(1 - z_{ht})PK_{ht}} \right].$$

We define the firm's aggregate cost of capital as a weighted average of the cost of all five capital goods:

$$r_{it} = \sum_{h=1}^{5} C_{ht} \frac{C_{ht} K_{ht}}{\sum_{h=1}^{5} C_{ht} K_{ht}}. \tag{12}$$

Our capital stocks are based on the perpetual inventory method (see Hayashi and Inoue (1991) for details on the algorithm used). Essentially this method involves starting with the book values of the capital goods in 1962 and updating them with investment series that account for asset sales and depreciation. While simple in theory, in practice this method is considerably more involved because for some of the early years a few of the variables are available only as aggregates. The firm's capital stock consists of five capital goods: nonresidential buildings, structures, machinery, transportation equipment, and instruments and tools; with corresponding depreciation rates (based on Hulten and Wykoff (1979, 1981)) of 4.7 percent, 5.64 percent, 9.489 percent, 14.7 percent, and 8.38 percent.

We calculate the real discount factor by assuming that $E_t(\rho_{ht}^R)$ is equal to the time average of ρ_{ht}^R where ρ_t^N is based on the call rate plus an equity premium (calculated by Ueda (1990)) at the beginning of each year.[12] Because each firm will have a different mix of capital goods, firms will have different costs of capital arising from differences in the input mix. However, because the underlying costs of financing those investments are assumed to be equal, these differences will be invariant to financial structure. We later modify this basic definition of the cost of capital so as to allow financial structure to influence costs.

Our data on firm performance are from the Japan Development Bank (JDB) data tapes. We use Dodwell Marketing Consultants' *Industrial Groupings in Japan* to identify those firms that are part of a bank-centered financial corporate group. The Dodwell classification is based on the extent and stability of credit and other ties a firm maintains with its primary lender and with other client firms of the same bank.[13] We find this classification satisfactory because it draws a distinction between bank-centered and manufacturer-centered groups (allowing us to focus on the former), covers the eight major

[12] See Hayashi and Inoue (1991) for a discussion of the problems of using a time-varying expected discount rate. The call market is a short term interbank lending market. Note that our definition of the cost of capital differs from Hayashi and Inoue's in that we add a measure of the equity premium to the calculation of the discount factor. The estimates of σ_k reported below do not change when Hayashi and Inoue's original discount factor (based on the call rate only) is used.

[13] Firms are classified as group members according to the 1988 Dodwell volume. This could cause sample selection problems because our sample of bank clients consists of only those firms that did not abandon their main banks. Because of the availability of the Dodwell surveys and their cost it was not possible to use a volume for every year in the sample. However, a comparison between the list of member firms in 1973 and 1988 reveals that only 26 of 279 group-affiliated firms left their groups over this fifteen year time period. Therefore, we do not believe that the sample selection problem is likely to be very severe.

city bank groups, and does not dismiss or include firms in groups due to short-term changes in financial structure.[14]

Table I presents sample statistics for the full sample as well as for main bank clients and unaffiliated firms separately. Approximately 40 percent of the firms in the sample are classified as having main banks.[15] These firms tend to be larger than firms without main banks. The growth rate of firms with main banks is almost a full percentage point lower than that of unaffiliated firms. Client firms also have slightly lower ratios of ordinary income to sales and higher debt to equity ratios than unaffiliated firms. However, the subsamples of bank client firms and unaffiliated firms appear to be quite heterogeneous, and it is difficult to argue that the two subsamples differ systematically in firm characteristics.

II. Results and Discussion

A. Input Mix of Main Bank Clients versus Independent Firms

We begin by examining the use of capital inputs by firms with a main bank relative to unaffiliated firms. Our basic estimated system of equations is

$$\frac{\mu_{ijt} X_{ijt}}{C_{it}} = \alpha_{mj} + \sum_{v} \gamma_{mjv} \ln \mu_{ivt} + \gamma_{mYj} \ln Y_{it} + MB_i \sigma_j \left(\alpha_{mj} + \sum_{v} \gamma_{mjv} \ln \mu_{ivt} + \gamma_{mYj} \ln Y_{it} \right) + \varepsilon_{ijt} \; \forall j,$$

[14] Other definitions of main bank clients are also available, yet the choice of a classification scheme does not qualitatively affect our results. One such definition is based on *Keiretsu no Kenkyu* and another on *Kigyo Keiretsu Soran* (*KKS*). The first of these definitions is a popular one in the literature but is problematic because the number of banks covered is more limited than in the Dodwell definition. This means that firms affiliated with banks such as the Industrial Bank of Japan are listed as not having a main bank. More importantly, because *Keiretsu no Kenkyu* does not distinguish between bank-centered groups and vertical groups (i.e., groups of suppliers surrounding a manufacturer) many firms that belong to vertical groups are listed as being main bank client firms. The *KKS* definition identifies firms as having a main bank if their largest lender is their largest bank shareholder and this relationship is stable over time. Notice that this definition is based solely on bank–firm ties and ignores affiliation with a bank-centered group. Although theoretically appealing, this definition is problematic in practice because occasionally some firms with main banks (e.g., Mazda, whose main bank is Sumitomo) fail one of the criteria, and other firms that are not typically thought of as main bank clients satisfy the criteria. Regression results using the *KKS* definition are reported in the Appendix.

[15] This figure may seem low for a "bank-centered" economy, yet it is very similar to the figure reported in Hoshi et al. (1990b), and to two alternative estimates reported in Weinstein and Yafeh (1995). Although bank debt is an important source of capital for most Japanese firms, not all of them maintain long-term relations with their primary lender. The Dodwell definition enables us to distinguish between firms that use "arm's length bank debt" and firms that borrow from an informed and influential main bank. Nevertheless, it is possible that some firms are classified as not having a main bank even though they maintain a long-term relationship with a regional or local lender.

Table I

Sample Statistics 1977–1986

Panel A presents statistics for the entire sample, and Panels B and C present statistics for the subsamples of main bank clients and unaffiliated firms respectively. Accounting data are from the JDB database and the capital stock is from Hayashi and Inoue (1991). The units for capital stock, ordinary income, and sales are millions of yen, 1985 prices. Debt in the debt/equity ratio is the sum of current and fixed liabilities.

	Mean	Std. Dev.	Minimum	Maximum
Panel A: Full Sample, 686 Firms				
Capital stock	44,564	142,876	47	2,541,100
Real annual growth rate of sales	0.056	0.119	−0.585	1.2830
Ordinary income/sales	0.056	0.40	−1.250	28.4
Ordinary income	5,118	14,742	−68,843	270,649
Sales	117,181	275,474	711	3,910,625
No. of employees	3,247	7,233	30	79,140
Debt/equity	1.734	1.626	0.013	22.014
Nonbond interest expenses/ nonbond liabilities	0.0425	0.0200	0.0001	0.1976
Panel B: Main Bank Clients, 279 Firms Defined as Bank Clients in the Dodwell Classification				
Capital stock	59,828	141,320	47	1,692,700
Real annual growth rate of sales	0.050	0.108	−0.554	0.72350
Ordinary income/sales	0.0399	0.1215	−1.185	3.731
Ordinary income	5,152	10,879	−24,923	125,900
Sales	146,402	237,342	711	2,130,270
No. of employees	4,246	7,521	30	68,463
Debt/equity	2.058	1.839	0.032	13.733
Nonbond interest expenses/ nonbond liabilities	0.0466	0.0182	0.0007	0.1316
Panel C: Unaffiliated Companies, 407 Firms Classified by Dodwell as Not Having a Main Bank				
Capital stock	34,192	143,014	64	2,541,100
Real annual growth rate of sales	0.061	0.126	−0.585	1.283
Ordinary income/sales	0.067	0.51	−1.250	28.4
Ordinary income	4,973	16,773	−64,024	255,910
Sales	97,129	297,210	916	3,910,625
No. of employees	2,894	8,248	50	79,140
Debt/equity	1.495	1.358	0.013	14.144
Nonbond interest expenses/ nonbond liabilities	0.0396	0.0206	0.0001	0.1976

where MB_i is a dummy that equals one if the firm is a main bank client and zero otherwise. The factors in the production function are capital, labor, and raw materials. Note that this specification allows each industry to have a different cost function, but constrains the impact of the main bank on the cost of capital to be the same for all client firms. The share of labor in total cost is measured as total labor expenses for the firm, and labor's factor price

Table II

Cost Function Estimation Results

Cost function estimation of a system of factor share equations using pooled data for the entire sample. σ_k is a measure of the difference in the perceived cost of capital between main bank clients and other firms. Heteroskedasticity-consistent standard error is reported in parentheses.

σ_k	0.0428 (0.0165)
Log likelihood	18,458
N	6,836

is defined as labor expenses divided by the number of workers. We use the GDP input price deflators for each two-digit sector as a measure of raw material prices, and the GDP sectoral output price deflators as our output price indices. Cross-equation restrictions enable us to drop the equation for raw materials and to estimate (using maximum likelihood) the following two equations for capital and labor shares:

$$\frac{\mu_{ijt}X_{ijt}}{C_{it}} = \alpha_{mr} + \sum_{v \neq g} \gamma_{mjv} \ln\left(\frac{\mu_{ivt}}{\mu_{igt}}\right) + \gamma_{mYj} \ln Y_{it} + \mathrm{MB}_i \sigma_j \left(\alpha_{mj} + \sum_{v \neq g} \gamma_{mjv} \ln\left(\frac{\mu_{ivt}}{\mu_{igt}}\right) + \gamma_{mYj} \ln Y_{it}\right) + \varepsilon'_{ijt}, \quad (13)$$

where g is the index value for raw materials.[16]

Table II presents estimation results of this system of capital and labor share equations using pooled data for the period 1977 to 1986. In general, virtually all of the coefficients of the cost function are significant (see the Appendix). Notice that σ_k, our measure of the difference in perceived cost of capital between bank client firms and their peers, is positive and significantly greater than zero. This suggests that firms with a main bank tend to use more capital than their industry peers who do not have access to main bank finance. The estimated difference in capital use implies that firms with main banks behave as if their cost of capital is 4 percent lower than firms without such relationships. To see the impact of this difference on the firm's choice of factor inputs, observe (Table I) that the average capital to sales ratio is 0.408 for main bank firms and 0.352 for unaffiliated firms, and as-

[16] Initial values are calculated by estimating the linear system that arises when the σ_js are constrained to be equal to zero. Notice that we could have also tried to constrain $\sigma_j = \sigma_v$ for v, $j \neq k$. In practice, however, it is not possible to do this after dropping the raw materials equation because the relationship between the σ_js is a complex function of all of the parameters of the cost function. Because the share equations for each firm must sum to one for both client and nonclient firms, we simply report σ_k and note that $\sigma_k > 0$; $\sigma_j < 0$ for $j \neq k$.

sume that the elasticity of capital with respect to its cost is one.[17] Without any differences in the perceived cost of capital ($\sigma_k = 0$), main bank client firms would have used 4 percent less capital—namely, their capital to sales ratio would have been about 0.392. This means that about 28 percent of the gap in capital to sales ratios is explainable by σ_k. This is probably an underestimate because in the early years of the sample the estimated value of σ_k is much higher than 0.04 (see below). We interpret this as evidence of the potential difficulties faced by non-main bank firms when trying to finance capital-intensive projects, and also as an indication that main bank client firms use a lower cost of capital when making their financing and investment decisions. Note that because the coefficients are estimated separately for each industry, this result cannot be due to uneven concentration of main bank clients in certain sectors. We also show in the Appendix that this result is not sensitive to the use of alternative definitions of main bank clients.

Given the theoretical definition σ_k (equation (6)) and its empirical estimate (4 percent), and assuming a simple functional relationship between bank influence and bank shareholding such that $a_i = 1 - t_i$, we can test the validity of our model by calculating the implied value of bank shareholding t_i which is consistent with σ_k equal to 4 percent. The estimated model implies that average bank shareholding should be 3.75 percent. This figure is surprisingly similar to actual main bank shareholding: Prowse (1990) reports average main bank shareholding of 3.5 percent for his 1984 sample of manufacturing firms, and Flath (1993) reports average main bank shareholding of about 3.9 percent for his 1980 sample.

One possible explanation for these results is that they are due to differences in capital structure that are not accounted for in the Jorgenson–Hayashi definition of the cost of capital. If the cost of debt-financed capital is significantly lower than that of alternative methods of finance (as in Myers and Majluf (1984)), one may suspect that the differences in the share of capital reported in Table II are due simply to higher leverage of main bank client firms. We therefore modify our definition of the cost of capital so as to reflect differences in the cost of debt and equity financing. Instead of assuming that the discount factor in the cost of capital is based on the short term call rate and the equity premium for all firms, we calculate ρ_{it}^N using a weighted average cost of capital for each firm. Specifically, we calculate the nominal discount rate for each firm according to the following formula:

$$\rho_{it}^N = 1/(1 + (1 - \tau)d \times \text{Interest rate on Debt} + (1 - d) \times \text{Cost of Equity}),$$

[17] In theory, it is possible to calculate the elasticity of capital with respect to its price from the estimated cost function parameters. These, however, vary across industries, and are sometimes imprecisely estimated. Instead, assuming a Cobb–Douglas production function, it is possible, under some assumptions, to calculate the elasticity of capital with respect to its price as a function of the share of capital expenditures in total cost (Varian (1984), p. 29). In our data, this estimate suggests an elasticity of -1.07, a figure close to the unit elasticity we assume in this calculation.

Table III

Cost Function Estimation Results

Cost function estimation of a system of factor share equations using pooled data for the entire sample. σ_k is a measure of the difference in the perceived cost of capital between main bank clients and other firms. Heteroskedasticity-consistent standard errors are reported in parentheses. In the Revised Cost of Capital regression the discount rate used for deriving the cost of capital is based on a weighted average cost of debt and equity rather than on the (risk-adjusted) call rate. Estimation for three-year periods are based on the basic cost of capital. The prereform, middle years, and postreform are respectively, 1977 to 1979, 1980 to 1983, and 1984 to 1986.

	Revised Cost of Capital	Prereform	Middle Years	Postreform
Period	1977–1986	1977–1979	1980–1983	1984–1986
σ_k	0.0421	0.0989	0.02508	0.0275
	(0.0190)	(0.0362)	(0.0467)	(0.0339)
Log likelihood	19,583	5,954	8,033	5,883
N	6,836	2,053	2,735	2,048

where d is the ratio of debt to debt plus the market value of equity.[18] Because interest payments are tax deductible, the cost of debt is adjusted by the overall (national, regional, and city) corporate tax rate, τ. The cost of equity is calculated as the call rate plus an equity premium.[19]

This approach can be criticized for a number of reasons. First, it may not be appropriate to assume that the average cost of raising funds equals the marginal cost. This is true, but it is hard to argue that this would bias the estimated cost of capital for main bank client firms any differently than for other firms. Second, we are unable to account for interfirm differences in risk, but since share price volatility of main bank clients and unaffiliated firms is equal (Beason (1997)), this feature is unlikely to systematically vary between the two sets of firms. In sum, we believe that there is no a priori reason to suspect that the modified cost of capital overestimates the actual cost of capital of firms with main bank ties. As the first column of Table III indicates, even after making this correction our results continue to hold: main bank client firms use more capital intensive technologies than their industry peers, even when a definition that allows for differences in capital structure to influence the cost of capital is used.

All our estimates so far have been based on pooled time-series and cross-section data that do not take into account the impact of liberalization on

[18] Because we do not have data on the market value of debt (much of which is not tradable), we assume that the book value is equal to the market value.

[19] See Section I for a discussion of the call rate and Ueda's (1990) calculation of Japanese equity premia. Other calculations of the cost of equity based on dividends or on the actual cost of debt plus a risk premium are also possible and do not qualitatively affect the results. Similarly, the use of alternative definitions of main bank clients does not qualitatively affect the results (see the Appendix).

these relationships. The deregulation of bond and equity markets is likely to have increased the amount of competition that banks faced in the provision of capital to firms. Petersen and Rajan (1995) argue that competition in the provision of financial services is likely to destabilize relationship banking because banks can no longer expect to extract rents from their client firms. In order to examine if the effect of main bank relations on capital use changed with the financial liberalization of the 1980s, we estimate capital and labor share equations for the first three years of the sample, prior to most liberalization measures (1977–1979), for the middle years (1980–1983), and for the last three years of the sample (1984–1986), after substantial liberalization is achieved. The results, presented in Table III, are quite striking: the difference between main bank client firms and their industry peers in capital use is only significant in the early period. Our estimate of σ_k for the first three years implies that during this period, main bank client firms behave as if their cost of capital is about 10 percent lower than that of their peers. Although we cannot formally reject the hypothesis that σ_k is not lower in the later period at conventional levels of significance, the dramatic decline in the point estimate suggests that the difference in capital use between bank clients and their peers was much smaller in later years. Furthermore, given our estimate for σ_k and assuming average bank shareholding of about 4 percent, it is easy to show that the implied level of bank influence is much higher prior to liberalization than in later years. Equation (6) enables us to derive an explicit expression for bank influence, $1 - a_i$, in terms of bank shareholding, t_i, and σ_k. The decline in σ_k implies that the weight placed on bank preferences $(1 - a_i)$ declined from 0.08 to about 0.03 over the time period. In other words, banks lost about half of their influence, and ended the time period having influence (roughly) proportional to their shareholding.[20]

The decline in magnitude of the point estimate is also apparent in cross-sectional regressions. Figure 3 plots yearly estimates of σ_k (from cross-sectional regressions). Because in each of these regressions there are 54 parameters, the t-statistics are generally smaller than in the pooled estimation. Even so, σ_k is significantly greater than zero only for 1977 and 1978. In 1979 the magnitude of the coefficient is somewhat smaller and its t-statistic is 1.4. σ_k is significant for some years prior to the reform, but not at any time after much of the reform took place. In other words, differences in capital use existed prior to 1980, but these differences disappeared after capital markets were liberalized.

The reform of capital markets in Japan proceeded gradually in the early 1980s, but our estimates of σ_k for the middle years (1980–1983) in Table III

[20] Part of the decline in estimated bank influence may be due to decline in actual bank shareholding because banks were required to reduce their equity stakes in nonfinancial firms to 5 percent by 1987. However, this effect seems to have been small: Flath's (1993) and Prowse's (1990) figures suggest that bank shareholding was on average below 5 percent even in the early 1980s (see footnote 6 above). We also find a very marginal decline in bank shareholding over the period for firms in our sample which are members in Presidents' Clubs.

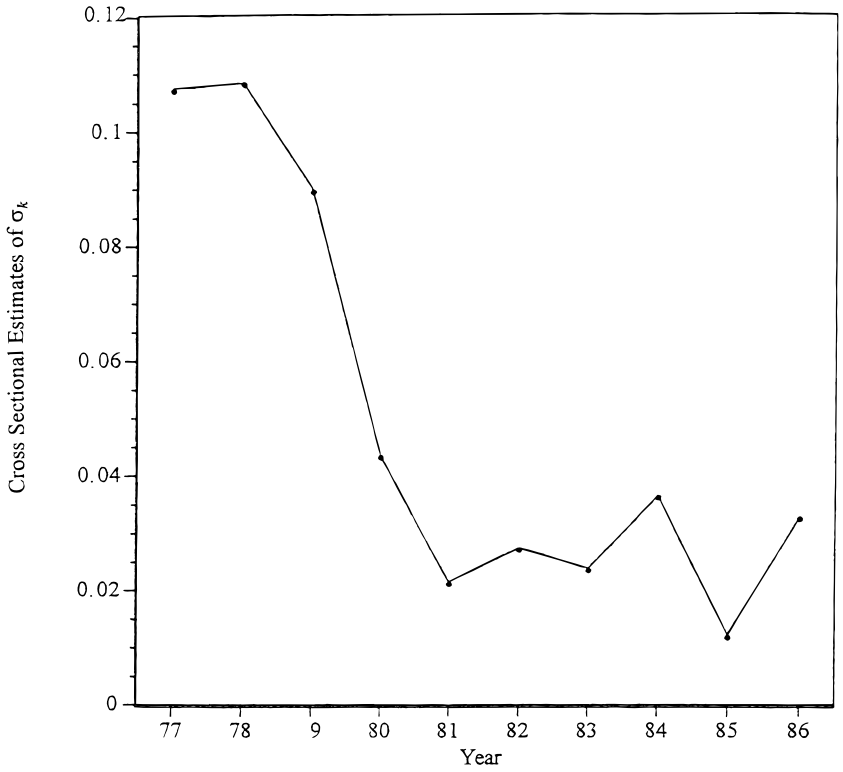

Figure 3. Cross-sectional estimates of σ_k. σ_k is a measure of the difference in the perceived cost of capital between main bank clients and other firms, as measured in a series of annual cross-sectional regressions of cost function factor share equations.

(and in Figure 3) suggest that much of the difference in capital use disappeared by 1981. We interpret this result as evidence that the liberalization process may have had an impact on bank–firm relationships even before nonbank debt became widely used. Japanese firms gained access to foreign capital markets with the amendment of the Foreign Exchange Control Law in 1980, which was followed by relaxation of the restrictions on bond issues imposed by the bond cartel. As Kester (1991) has argued, these changes seem to have had an "immediate and significant impact" that we believe is reflected by the observed changes in σ_k. σ_k in 1980 is substantially below previous levels (and a little above future levels) despite the fact that firms had only operated for four to five months in the liberalized environment. This suggests that Japanese firms began adjusting their investment decisions either immediately following the onset of liberalization or in anticipation of further deregulation measures.

Two (not mutually exclusive) mechanisms can explain the trend of increasing similarity in capital use between main bank clients and other firms. First, non–main bank firms may have been rationed prior to the liberaliza-

tion of financial markets and could not always raise the desired amounts of capital without close ties to a major bank. With the development and deregulation of capital markets, these firms may have gained access to more capital, and thus could increase their capital use. In addition, main bank client firms may have been influenced by their banks to use more capital than pure profit maximization would warrant. If liberalization made them less responsive to bank pressure, client firms may have cut back on their capital use.

B. Profitability of Main Bank Clients versus Independent Firms

The results discussed so far suggest that at least prior to the liberalization of Japanese financial markets in the 1980s, main bank clients had access to more capital than firms that did not maintain strong banking relationships. In an environment where some firms' supply of capital is limited while others have better access to bank finance, one would expect the unconstrained main bank clients to outperform their capital-rationed peers. However, as Nakatani (1984) has found, firms affiliated with bank-centered groups do not have higher rates of profit. In Table IV we confirm Nakatani's original findings for our sample. Main bank clients appear to be slightly less profitable than their industry peers, in spite of their ability to borrow from their banks relatively easily.[21] The coefficient of the main bank dummy is negative and significant at the 5 percent level after controlling for firm ownership structure as well as for various factors that may affect accounting measures of profitability (growth rates, capital intensity, leverage, etc.; see Weinstein and Yafeh (1995), and Fisher (1987)). Notice that the regression specification includes (unlike Nakatani's experiments) a measure of firm risk, namely the standard deviation of profitability. We therefore conclude that profitability differences between main bank clients and other firms cannot be due solely to differences in risk. The relatively low profitability of main bank client firms remains unchanged even when a nonlinear relation between profitability and capital intensity is allowed (by including capital/sales squared in the regression), or when capital intensity is excluded from the regression (because it may be correlated with the main bank dummy). Our interpretation of this finding is that the rents from preferential access to capital do not accrue to main bank client firms.

C. Cost of Capital of Main Bank Clients versus Independent Firms

One of the reasons for the failure of client firms to be more profitable may be that the main banks are able to extract rents in the form of higher interest payments in return for improved access to capital. Ideally, the actual interest rate

[21] Running these regressions with other measures of profits (e.g., operating profits before taxes and net income before taxes) produces similar results. Correcting for size-based heteroskedasticity by using weighted least squares with capital stocks or sales as weights does not qualitatively affect the results in these regressions, the interest rate regressions (Tables V and VI), and the growth rate regressions (Table VII). The results from these experiments are not reported.

Table IV

Profitability Regressions, 1977–1986

The dependent variable is ordinary income over sales, and the regressions are OLS using pooled data for the entire sample. Heteroskedasticity-consistent standard errors are reported in parentheses. The main bank client dummy equals one for firms that are affiliated with a main bank according to the Dodwell definition, and the capital stock is based on Hayashi and Inoue (1991). Debt is the sum of current and fixed liabilities, and the standard deviation of operating income/sales is calculated for 1977 to 1986.

Main bank client dummy	−0.0060	−0.0060	−0.0065	−0.0059
	(0.0015)	(0.0015)	(0.0015)	(0.0015)
Debt/sales	−0.0735	−0.0731	−0.0636	−0.0739
	(0.0054)	(0.0054)	(0.0044)	(0.0054)
Real sales growth from previous year	0.0726	0.0727	0.0702	0.0726
	(0.0088)	(0.0089)	(0.0087)	(0.0089)
Capital/sales	0.0505	0.0506		0.0288
	(0.0049)	(0.0049)		(0.0110)
(Capital/sales)^2				0.0240
				(0.0109)
Log (sales)	0.00163	0.00152	0.00135	0.00145
	(0.00084)	(0.00085)	(0.00085)	(0.00085)
Std. deviation of operating income/sales		−0.0014	−0.0010	−0.0013
		(0.0016)	(0.0016)	(0.0017)
Percent shares held by top ten shareholders	4.04E−07	−3.24E−07	−4.93E−07	3.88E−07
	(1.11E−06)	(1.11E−06)	(1.12E−06)	(1.11E−06)
Percent shares held by individuals	−0.96E−05	−0.96E−05	−1.00E−05	−0.97E−05
	(1.25E−06)	(1.25E−06)	(1.26E−06)	(1.25E−06)
Percent shares held by financial institutions	−7.41E−06	−7.42E−06	−7.72E−06	−7.44E−06
	(1.09E−06)	(1.09E−06)	(1.11E−06)	(1.09E−06)
Percent shares held by nonfinancial firms	−1.41E−05	−1.40E−05	−1.40E−05	−1.41E−05
	(9.64E−07)	(9.64E−07)	(9.75E−07)	(9.63E−07)
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
N	6152	6152	6152	6152
Adj. R^2	0.2933	0.2934	0.2722	0.2940

on main bank loans should be examined. Unfortunately, such data are not available, and instead we use average interest on nonbond liabilities (interest payments and discount expenses divided by nonbond current and fixed liabilities). Although this measure undoubtedly includes some components in the denominator that do not bear interest, it is virtually impossible to correct for this, perhaps because of accounting irregularities in the sample of firms.[22]

[22] For example, attempts to use total loans, trade notes, and deposits as the denominator result in several firms having implied interest rates of over 100 percent and a substantial number of firms, close to a fifth of the sample, with interest rates of over 30 percent. This is probably because firms pay interest on other liabilities that usually are not thought of as interest bearing.

Table V

Interest Expenses: The Entire Sample (1977–1986)

The dependent variable is nonbond interest expenses over nonbond debt and the regressions are OLS using pooled data for the entire sample. Heteroskedasticity-consistent standard errors are reported in parentheses. The main bank client dummy equals one for firms that are affiliated with a main bank according to the Dodwell definition, debt (in the debt/equity ratio) is the sum of current and fixed liabilities, and the standard deviation of operating income/sales is calculated over the entire sample period.

Main bank client dummy	0.0049	0.0053	0.0049	0.0053
	(0.0004)	(0.0004)	(0.0004)	(0.0004)
Main bank client dummy times operating income/sales		−0.0073		−0.0067
		(0.0019)		(0.0019)
Std. deviation of operating income/sales			0.0027	0.0027
			(0.0010)	(0.0010)
Debt/equity	0.0031	0.0031	0.0031	0.0031
	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Operating income/sales	−0.0001	0.0001	−0.0011	−0.0009
	(0.0006)	(0.0004)	(0.0007)	(0.0006)
Log (sales)	−0.0023	−0.0023	−0.0021	−0.0021
	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
N	6836	6836	6836	6836
Adj. R^2	0.3221	0.3226	0.3281	0.3285

Table V presents estimation results of the determinants of interest rates (as defined above). Explanatory variables include measures of profitability and risk which may affect the cost of capital as well as a main bank client dummy.[23] We find that interest rates are an increasing function of the debt-equity ratio, which probably reflects a higher default risk of leveraged firms. Larger firms appear to pay lower interest rates, perhaps because they are seen as less risky. Furthermore, when other measures of risk (e.g., the standard deviation of profits) are included, we find that firms with more variation in earnings pay higher interest rates. Profitability seems to be negatively correlated (or uncorrelated) with interest rates, possibly due to a negative correlation between cash flow and risk of default. For the purposes of this paper, however, the most important coefficient is the one on the main bank dummy which is positive and significant. Had main banks been reducing the cost of capital for their clients through lower interest rates, one would expect this coefficient to be negative. The positive sign of the coefficient suggests that, controlling for other factors, firms with main banks pay higher average interest rates on their liabilities than unaffiliated firms. This difference is

[23] These results are not sensitive to an adjustment of gross debts by cash and deposits to account for compensating balances.

also quantitatively significant: multiplying the interest rate differential by the debt to sales ratio reveals that a little more than one-third of the profit differential between the two sets of firms (see Table IV) can be explained by interest rate differentials. These results are consistent with rent extraction by main banks through higher interest rates.

One should expect to find that banks have less influence over more profitable client firms either because more profitable firms are likely to be able to finance investment through other means or because they are less willing to pay for implicit bank insurance against bankruptcy (Nakatani (1984)). Because more profitable client firms are likely to value main bank services less, one should expect main banks to be less capable of charging them high interest rates. To test this, an interaction term of the main bank dummy with firm profitability (operating income to sales) is included in the regression. Profitability appears to affect main bank clients differently than unaffiliated firms. Although there is a weakly negative relationship between profitability and interest rates for the full sample, this relationship is significant and much stronger for main bank firms. This suggests that banks do not charge profitable clients as much as unprofitable ones, presumably because the demand for bank services or the influence that banks have over these firms is lower.

The higher interest charges paid by firms with main banks is consistent with rents being extracted in exchange for access to capital, but that is not the only possible explanation. If banks provide firms with insurance against bankruptcy, they may be able to charge higher interest rates in exchange for these services (an "insurance premium"). Nakatani's (1984) empirical evidence on low levels and variance of profitability among members of bank-centered corporate groups is consistent with this "implicit insurance" hypothesis. An in-depth examination of whether banks provide these kinds of services is beyond the scope of this paper, but we do provide some indirect evidence indicating that main bank influence and liquidity services are important in understanding the interest rate differential. Because market liberalization is likely to have reduced the influence of banks and made it easier for firms to raise capital from other sources, one should expect that the ability of main banks to charge higher interest rates to their clients in exchange for liquidity services should have declined following financial liberalization. On the other hand, there is no reason to believe this would be the case with respect to the "bankruptcy insurance premium." Table VI presents interest rate regressions for the three years of the sample prior to liberalization, the middle four years, and the last three years of the sample, after capital markets are significantly liberalized. In all three time periods, we find a significant coefficient of the main bank client dummy, indicating that firms continue to pay a premium for main bank services. However, in all specifications, we can accept (at the 5 percent level) the hypothesis that the main bank interest premium is lower in the periods following the completion of most reforms (1984–1986) relative to the prereform period (1977–1979). This suggests that following liberalization firms valued main bank services

Table VI

Interest Expenses

The dependent variable is nonbond interest expenses over nonbond debt and the regressions are OLS using pooled data. Heteroskedasticity-consistent standard errors are reported in parentheses. The main bank client dummy equals one for firms that are affiliated with a main bank according to the Dodwell definition, debt (in the debt/equity ratio) is the sum of current and fixed liabilities, and the standard deviation of operating income/sales is calculated for 1977 to 1986. Panel A shows the preliberalization period (1977–1979), Panel B the middle period (1980–1983), and Panel C the postliberalization period (1984–1986).

Panel A: Preliberalization Period (1977–1979)				
Main bank client dummy	0.0055 (0.0007)	0.0059 (0.0007)	0.0055 (0.0007)	0.0059 (0.0007)
Main bank client dummy times operating income/sales		−0.0050 (0.0014)		−0.0047 (0.0014)
Std. deviation of operating income/sales			0.0015 (0.0005)	0.0014 (0.0005)
Debt/equity	0.0028 (0.0002)	0.0028 (0.0002)	0.0028 (0.0002)	0.0028 (0.0002)
Operating income/sales	0.0002 (0.0003)	0.0003 (0.0002)	−0.0004 (0.0004)	−0.0002 (0.0003)
Log (sales)	−0.0026 (0.0003)	−0.0027 (0.0003)	−0.0025 (0.0003)	−0.0026 (0.0003)
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
N	2053	2053	2053	2053
Adj. R^2	0.3812	0.3819	0.3823	0.3829
Panel B: The Middle Years (1980–1983)				
Main bank client dummy	0.0049 (0.0007)	0.0049 (0.0011)	0.0049 (0.0007)	0.0027 (0.0010)
Main bank client dummy times operating income/sales		0.0019 (0.0162)		0.0025 (0.0162)
Std. deviation of operating income/sales			0.0019 (0.0004)	0.0019 (0.0004)
Debt/equity	0.0027 (0.0003)	0.0027 (0.0003)	0.0027 (0.0003)	0.0027 (0.0003)
Operating income/sales	−0.0449 (0.0089)	−0.0454 (0.0106)	−0.0453 (0.0089)	−0.0461 (0.0105)
Log (sales)	−0.0019 (0.0003)	−0.0017 (0.0003)	−0.0018 (0.0003)	−0.0018 (0.0003)
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
N	2735	2735	2735	2735
Adj. R^2	0.273	0.273	0.277	0.277

Table VI—*Continued*

Panel C: Postliberalization Period (1984–1986)				
Main bank client dummy	0.0037 (0.0007)	0.0025 (0.0010)	0.0037 (0.0007)	0.0027 (0.0010)
Main bank client dummy times operating income/sales		0.0265 (0.0163)		0.0213 (0.0157)
Std. deviation of operating profits/sales			0.0059 (0.0020)	0.0058 (0.0020)
Debt/equity	0.0038 (0.0003)	0.0038 (0.0003)	0.0039 (0.0003)	0.0039 (0.0003)
Operating income/sales	−0.0541 (0.0091)	−0.0625 (0.0111)	−0.0504 (0.0085)	−0.0571 (0.0101)
Log (sales)	−0.0017 (0.0003)	−0.0017 (0.0003)	−0.0014 (0.0003)	−0.0014 (0.0003)
Ind. dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
N	2048	2048	2048	2048
Adj. R^2	0.285	0.2857	0.3092	0.3095

less, or banks were less able to charge for the services. In addition, liberalization seems to have made market factors like profitability (which was not important in setting interest rates before) much more important. Figure 4 presents the main bank interest premium calculated in cross-sectional regressions. In all regressions, the premium is significantly different from zero, and, moreover, coefficient estimates for the last two years are significantly lower than those for the first two years. However there is clearly a lot more noise in the cross-sectional regressions, and some of the point estimates in the middle of the sample period actually exceed those in the early period. What is clear from these regressions is that main banks charge a premium for their services. The cross-sectional evidence is suggestive of a postliberalization decline in this premium, and although there is too much noise in the cross-sectional data to draw strong conclusions, our evidence is more suggestive of a postliberalization decline in bank monopoly power (or firm demand for liquidity) than of a decline in the implicit bankruptcy insurance premium.

D. Growth Rates of Main Bank Clients versus Independent Firms

We have argued that in an environment of segmented capital markets, where some (historically determined) set of firms has more access to capital than another group of firms, there seems to be no evidence of higher profitability of the "privileged" firms, even though they evidently use more capital in their production processes. One possible explanation of this phenomenon

Figure 4. Estimated main bank interest rate differential. The effect of main bank ties on the firm's cost of capital, measured by the coefficient of a main bank dummy variable in a series of annual cross-sectional regressions where the dependent variable is interest expenses over nonbond liabilities.

is that firms with better access to capital are less liquidity constrained in their investment decisions (Hoshi et al. (1991)), and hence may exhibit a superior growth record, without necessarily being more profitable at any given point in time. In fact, the original description of the German *Grossbanken* by Gerschenkron (1962) and others emphasized their ability to sustain fast growth of large scale enterprises, without making specific reference to their profitability.

In order to examine whether the advantage of a main bank relationship is manifest in faster growth rates rather than high profits, we compare in Table VII, Panel A, the real annual growth rates of main bank client firms with those of their industry peers for the period 1977 to 1986, controlling for the (log) level of firm sales lagged one period. Again, we find that in spite of their preferential access to capital and ability to invest in desirable projects and technologies, annual growth rates of main bank client firms are about the same as those of unaffiliated firms during the sample period. This result

Table VII

Growth and Profit Rates for Main Bank Clients and Unaffiliated Firms

In Panel A the dependent variable is real annual growth rate of sales. In Panel B the dependent variable is ordinary or operating profits over sales. All regressions are OLS using pooled data, and heteroskedasticity-consistent standard errors are reported in parentheses. The main bank client dummy equals one for firms that are affiliated with a main bank according to the Dodwell definition, and the standard deviation of operating income/sales is calculated for 1977 to 1986.

Panel A: Growth Rate Regressions

Time period	1977–1986	1977–1986	1956–1971
Main bank client dummy	−0.0027	−0.0027	0.0007
	(0.0030)	(0.0030)	(0.0039)
Log (lagged sales)	−0.0009	−0.0009	−0.0094
	(0.0011)	(0.0012)	(0.0016)
Std. deviation of operating income/sales		−0.0001	
		(0.0046)	
Industry dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
N	6152	6152	7478
Adj. R^2	0.1081	0.1080	0.1599

Panel B: Profitability in the Early Postwar Period

	Operating Income/Sales	Ordinary Income/Sales	
Time period	1956–1971	1956–1971	1956–1971
Main bank client dummy	−0.0125	−0.0061	−0.0061
	(0.0037)	(0.0011)	(0.0011)
Log (sales)	0.0009	0.0007	0.0009
	(0.0005)	(0.0004)	(0.0005)
Real sales growth from previous year		0.0017	
		(0.0010)	
Industry dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
N	8169	7478	8169
Adj. R^2	0.133	0.175	0.175

is very much in line with the view that banks exert pressure on their client firms and influence their behavior according to the bank's preferences. As the main bank is the firm's largest debtholder but holds a relatively small percentage of its shares, it is likely to try and influence client firms to forgo certain risky investment projects with positive net present value to share-

holders. The lack of a significant advantage in growth rates for firms under main bank influence is, in our view, evidence that banks induce client firms to behave more cautiously in choosing their investment projects, leading to growth rates that are no faster than those of their nonbank client peers despite better access to capital. This interpretation is consistent with Yafeh and Yosha (1997) who find that main bank clients tend to spend less on research and development than unaffiliated firms, and with Montalvo and Yafeh (1994) who show that main bank clients gain access to new technologies through licensing of relatively safe, proven foreign technologies. It is also close in spirit to the results of Houston and James (1996) who find that firms that maintain a long-term relationship with a single creditor tend to have poor growth opportunities.

E. Relative Performance in Earlier Periods

Our results so far lead us to view the main bank as an institution that siphons some of its clients' profits in exchange for liquidity services, and does not improve growth prospects because of its risk attitude as a major debtholder. Yet our experiments have been confined to firm behavior between the mid-1970s and the mid-1980s. It is still possible that main banks induced fast growth during the 1960s, a period in which the Japanese economy grew at an unprecedented pace. In order to evaluate whether main bank clients enjoyed superior performance in earlier periods, we examine the behavior of firms in our sample during the late 1950s and throughout the 1960s. We use all available data on each firm prior to 1972 (starting with its first reported fiscal year), and repeat our experiments comparing profitability and growth rates of main bank client firms and their industry peers.[24] Our results are presented in Table VII, Panel A (growth rates regression) and Panel B (ordinary or operating income regressions). In spite of popular belief, close ties between financial institutions and manufacturing firms are not associated with significantly faster growth in the 1960s and seem to have produced significantly lower profit levels. This, together with Nakatani's (1984) result of lower profitability and growth rates of bank clients during the 1970s, suggests that in fact there is no evidence of superior performance of main bank client firms at any time during the postwar period. Although initially surprising, this result is consistent with our previous analysis. When capital markets provide only inadequate opportunities to raise capital, as was the case in Japan during the 1960s, financial institutions have monopoly power as suppliers of capital. Our results indicate that main banks have indeed taken advantage of their position, extracted rents from firms that depended on them, and may have made their investment decisions more cautious than would otherwise have been the case. The neg-

[24] We use the Dodwell figures for 1971 as a measure of main bank relationships during the 1960s. Some variables used in the profitability regressions for later periods (Table IV) are not available for early years.

Table VIII

Shares of Main Bank Clients in the Economy

The figures are from Dodwell Marketing Consultants' *Industrial Groupings in Japan* and are in percent.

	1973	1986
Sales	25.2	16.0
Paid-up capital	26.0	19.2
Employment	12.7	5.4

ative effects of close bank ties must have been even more important in the early postwar period than later, when the monopoly power of banks gradually eroded.

F. Bank Influence or Sample Selection?

An alternative explanation for the poor performance of firms with main bank ties is sample selection bias: perhaps it is the case that firms without main banks tend to go bankrupt more easily and hence our sample of unaffiliated firms consists only of high-performing survivors. It may also be the case that firms with main banks have certain attributes that make them less profitable. If main bank client firms are "weaker," they may have fewer opportunities to raise capital and will therefore tend to find main bank relations more valuable. According to this view, main banks may induce growth by supplying capital to firms that would have found no way to raise funds otherwise.

Even if this is the case, this interpretation is a far cry from popular views of the Japanese financial system as an engine of growth for highly efficient firms. Nevertheless, we doubt if this accounts for the correlations we observe in the data. First, if the overall death rate of unaffiliated firms were indeed higher, one would expect to see the share of main bank firms rise over time.[25] However, as can be seen in Table VIII, the economy-wide share of main bank firms in output, capital, and employment seems to have fallen quite dramatically between 1973 and 1986. Second, sample statistics for the two subsamples (Table I) indicate that there is a large degree of heterogeneity within each set of firms. Indeed, in spite of the difference in sample means, the least profitable firm is an unaffiliated firm and the smallest firm is a main bank client, suggesting that there is no clear selection on the basis of size or profitability. In addition, none of the studies on the formation of main bank

[25] Unless, of course, the growth rate of surviving independent firms is high enough to offset the frequent "deaths" of their peers. This discussion ignores possible differences in "birth rates" between main bank clients and unaffiliated firms.

relations in the 1940s and 1950s show that the "weaker" firms were the ones with whom such ties were formed. Hence, we believe it is unlikely that our results are being driven solely by death of poorly performing unaffiliated firms, or by "flocking" of losers into bank-centered groups.[26] Finally, if, indeed, surviving unaffiliated firms are "superior," it is not clear why banks would continue to supply capital to perennial losers.

III. Concluding Remarks

Our empirical results suggest the existence of negative components within the main bank system. Prior to the liberalization of financial markets in Japan, main bank clients did not exhibit high profitability or grow faster than their industry peers, even though their superior access to capital resources was evident in their production techniques. This finding is robust both to changes in the period of observation and to changes in the measures of performance used. The low growth rates of main bank clients and the relatively high interest they have been paying on their bank loans suggest that banks could use their monopoly power both to squeeze their clients' profits through interest payments, and to inhibit their growth through conservative investment policies.

This picture of the banking system as it has existed in much of the postwar era in Japan implies that although the main bank system and close ties between finance and industry may have helped some firms gain access to capital, this access has not been without costs. Underdeveloped capital markets endow financial institutions, or suppliers of capital, with monopoly power. Our data indicate that Japanese main banks have certainly taken advantage of this situation; indeed the transfer of resources from the manufacturing to the financial sector and the adoption of risk-averse, debtholder-oriented investment strategies do not seem to be a growth-inducing formula. In the absence of contestable capital markets, large banks with close ties to industry siphon profits and restrict investment, and thus may inhibit rather than encourage growth.

Appendix

This appendix includes two parts: The first presents the entire list of estimated cost function parameters, as well as a list of industries included in the sample (Table AI). The second part shows that the estimated differences in perceived cost of capital between main bank and unaffiliated firms are not affected by the use of different definitions of main bank client firms (Tables AII and AIII).

[26] In fact, after controlling for prewar ties, probit estimates demonstrate that current firm attributes such as capital intensity and profitability do not help identify firms that maintain main bank relationships.

Table AI

Cost Function Estimation Results

Cost function estimation of a system of factor share equations using pooled data for the entire sample. The estimated system of equations includes two factor share equations, one for capital and one for labor (the share equation for raw materials is omitted). Each factor share equation takes the following form:

$$\frac{\mu_{ijt}X_{ijt}}{C_{it}} = \alpha_{mr} + \sum_{v \neq g} \gamma_{mjv} \ln\left(\frac{\mu_{ivt}}{\mu_{igt}}\right) + \gamma_{mYj} \ln Y_{it} + \mathrm{MB}_i \sigma_j \left(\alpha_{mj} + \sum_{v \neq g} \gamma_{mjv} \ln\left(\frac{\mu_{ivt}}{\mu_{igt}}\right) + \gamma_{mYj} \ln Y_{it}\right) + \varepsilon'_{ijt},$$

where MB_i is a main bank client dummy which equals one for firms that are affiliated with a main bank according to the Dodwell definition, σ_k and σ_l are the coefficients on the main bank dummy in the capital and labor share equations respectively, i is index over all firms, j and v are indexes over all factors of production, t is a year index, and m is an industry index over the 13 industries listed below. The cost of factor j to firm i is denoted by μ_{ij} (μ_{ig} is the cost of raw materials), and the αs and the γs are parameters to be estimated that are determined by the price and output elasticities. The standard errors are heteroskedasticity-consistent.

Log of Likelihood Function = 18457.7
Number of Observations = 6836

Parameter	Estimate	Standard Error	t-statistic
σ_k (capital)	0.0428	0.0165	2.5990
σ_l (labor)	−0.0119	0.0115	−1.0309
α_{1K}	0.3471	0.0345	10.0614
γ_{1KL}	−0.0567	0.0052	−10.8636
γ_{1KK}	0.1037	0.0161	6.4260
γ_{1YK}	−0.0026	0.0019	−1.3742
α_{2K}	0.2884	0.0602	4.7933
γ_{2KL}	0.0000	0.0105	0.0039
γ_{2KK}	0.1081	0.0300	3.6070
γ_{2YK}	0.0025	0.0023	1.0662
α_{3K}	0.2242	0.0554	4.0448
γ_{3KL}	−0.0086	0.0091	−0.9523
γ_{3KK}	0.1045	0.0250	4.1766
γ_{3YK}	0.0131	0.0027	4.8499
α_{4K}	0.4238	0.0549	7.7149
γ_{4KL}	−0.0763	0.0069	−11.0303
γ_{4KK}	0.1389	0.0295	4.7064
γ_{4YK}	0.0044	0.0017	2.5221
α_{5K}	0.1199	0.0279	4.2937
γ_{5KL}	0.0185	0.0106	1.7531
γ_{5KK}	0.0424	0.0115	3.6830
γ_{5YK}	0.0072	0.0012	6.1005
α_{6K}	1.1443	0.1837	6.2278
γ_{6KL}	−0.1071	0.0156	−6.8477
γ_{6KK}	0.5850	0.0969	6.0400
γ_{6YK}	0.0260	0.0033	7.8897
α_{7K}	0.0220	0.0392	0.5594
γ_{7KL}	0.0431	0.0094	4.6024
γ_{7KK}	0.0176	0.0170	1.0355

Table AI—*Continued*

Log of Likelihood Function = 18457.7
Number of Observations = 6836

Parameter	Estimate	Standard Error	*t*-statistic
γ_{7YK}	0.0084	0.0019	4.5035
α_{8K}	0.4665	0.0841	5.5454
γ_{8KL}	−0.0112	0.0053	−2.1184
γ_{8KK}	0.1828	0.0422	4.3351
γ_{8YK}	−0.0059	0.0031	−1.8912
α_{9K}	0.3813	0.0370	10.3004
γ_{9KL}	−0.0472	0.0082	−5.7791
γ_{9KK}	0.1263	0.0199	6.3544
γ_{9YK}	−0.0010	0.0012	−0.8085
α_{10K}	0.2301	0.0263	8.7634
γ_{10KL}	−0.0144	0.0080	−1.8028
γ_{10KK}	0.0891	0.0150	5.9375
γ_{10YK}	0.0036	0.0007	5.4376
α_{11K}	0.3691	0.0289	12.7526
γ_{11KL}	−0.0055	0.0040	−1.3531
γ_{11KK}	0.1428	0.0148	9.6518
γ_{11K}	−0.0036	0.0008	−4.6073
α_{12K}	0.1485	0.0605	2.4545
γ_{12KL}	−0.0054	0.0126	−0.4285
γ_{12KK}	0.0409	0.0329	1.2428
γ_{12YK}	0.0038	0.0024	1.5600
α_{13K}	0.3963	0.0812	4.8827
γ_{13KL}	−0.0124	0.0048	−2.5782
γ_{13KK}	0.1373	0.0389	3.5319
γ_{13YK}	−0.0078	0.0019	−4.0162
α_{1L}	0.1054	0.0213	4.9527
γ_{1LL}	−0.0111	0.0048	−2.3180
γ_{1YL}	−0.0137	0.0027	−5.0051
α_{2L}	0.2169	0.0266	8.1503
γ_{2LL}	0.1257	0.0133	9.4366
γ_{2YL}	−0.0228	0.0038	−5.9716
α_{3L}	0.2119	0.0221	9.5866
γ_{3LL}	0.0691	0.0106	6.5000
γ_{3YL}	−0.0269	0.0031	−8.6400
α_{4L}	0.1337	0.0170	7.8617
γ_{4LL}	−0.0030	0.0036	−0.8337
γ_{4YL}	−0.0175	0.0017	−10.4000
α_{5L}	0.3162	0.0275	11.5133
γ_{5LL}	0.1170	0.0158	7.3850
γ_{5YL}	−0.0302	0.0031	−9.8560
α_{6L}	−0.2088	0.0357	5.8409
γ_{6LL}	0.0478	0.0161	2.9706
γ_{6YL}	−0.0312	0.0044	−7.1493
α_{7L}	0.2896	0.0254	11.4127
γ_{7LL}	0.0787	0.0140	5.6062
γ_{7YL}	−0.0250	0.0025	−10.0693
α_{8L}	0.2815	0.0383	7.3447
γ_{8LL}	0.0994	0.0078	12.8217

Table AI—*Continued*

Log of Likelihood Function = 18457.7
Number of Observations = 6836

Parameter	Estimate	Standard Error	*t*-statistic
γ_{8YL}	−0.0322	0.0063	−5.1152
α_{9L}	0.3054	0.0198	15.4127
γ_{9LL}	0.0786	0.0074	10.6859
γ_{9YL}	−0.0393	0.0025	−15.9602
α_{10L}	0.2579	0.0189	13.6637
γ_{10LL}	0.0841	0.0077	10.9519
γ_{10YL}	−0.0254	0.0015	−17.1675
α_{11L}	0.3018	0.0133	22.7571
γ_{11LL}	0.0575	0.0076	7.5277
γ_{11YL}	−0.0292	0.0016	−18.1128
α_{12L}	0.3357	0.0431	7.7961
γ_{12LL}	0.0883	0.0254	3.4824
γ_{12YL}	−0.0348	0.0058	−6.0159
α_{13L}	0.2703	0.0317	8.5380
γ_{13LL}	0.0448	0.0064	6.9712
γ_{13YL}	−0.0314	0.0037	−8.4202

Industries Used

1	Processed foods	8	Fabricated metal products
2	Textiles	9	General machinery
3	Pulp and paper	10	Electrical machinery
4	Chemicals	11	Transportation equipment
5	Petroleum products	12	Precision instruments
6	Ceramic, stone, and glass products	13	Miscellaneous manufactures
7	Basic metals		

Table AII

KKS versus Dodwell Definition of Main Bank Clients

Cost function estimation of a system of factor share equations using pooled data for the entire sample. σ_k is a measure of the difference in the perceived cost of capital between main bank clients and other firms. Heteroskedasticity-consistent standard errors are reported in parentheses. KKS is a classification of main bank clients based on *Kigyo Keiretsu Soran.* The Dodwell definition is taken from Dodwell Marketing Consultants' *Industrial Grouping in Japan* reports.

	Dodwell	KKS
σ_k	0.0428	0.0310
	(0.0165)	(0.017)
Log likelihood	18458	14932
N	6836	5042

Table AIII

Revised Cost of Capital: KKS versus Dodwell Definition of Main Bank Clients

Cost function estimation of a system of factor share equations using pooled data for the entire sample. σ_k is a measure of the difference in the perceived cost of capital between main bank clients and other firms. Heteroskedasticity-consistent standard errors are reported in parentheses. KKS is a classification of main bank clients based on *Kigyo Keiretsu Soran.* The Dodwell definition is taken from Dodwell Marketing Consultants' *Industrial Grouping in Japan* reports. In the Revised Cost of Capital regression the discount rate used for deriving the cost of capital is based on a weighted average cost of debt and equity rather than on the (risk-adjusted) call rate.

	Dodwell Revised Cost of Capital	KKS Revised Cost of Capital
σ_k	0.0421 (0.0190)	0.0438 (0.0191)
Log likelihood	19583	19117
N	6836	6656

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