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Andreas Hackethal and Reinhard H. Schmidt

Financing Patterns:
Measurement Concepts and Empirical Results

No. 125
January 2004

WORKING PAPER SERIES: FINANCE & ACCOUNTING

FINANCING PATTERNS: MEASUREMENT CONCEPTS AND EMPIRICAL RESULTS

by

Andreas Hackethal and Reinhard H. Schmidt*

University of Frankfurt, Germany

No. 125

January 2004

First version: June 1999

This version: December 2003

ISSN 1434-3401

* Andreas Hackethal is assistant professor and Reinhard H. Schmidt is Wilhelm Merton Professor of International Banking and Finance at the finance department of the Johann Wolfgang Goethe-University in Frankfurt, Germany. Address correspondence to either author at Mertonstr. 17, P.O.B. 1111932, 60054 Frankfurt/M., Germany. Their e-mail addresses are hackethal@em.uni-frankfurt.de and rschmidt@wiwi.uni-frankfurt.de. Financial support from the Deutsche Forschungsgemeinschaft is gratefully acknowledged. The authors thank Franklin Allen, Jan Krahnen, Colin Mayer and Marcel Tyrell, as well as the participants at several seminars and conferences, for valuable suggestions concerning the substance of this paper as well as the exposition.

Abstract

A widely recognized paper by Colin Mayer (1988) has led to a profound revision of academic thinking about financing patterns of corporations in different countries. Using flow-of-funds data instead of balance sheet data, Mayer and others who followed his lead found that internal financing is the dominant mode of financing in all countries, that financing patterns do not differ very much between countries and that those differences which still seem to exist are not at all consistent with the common conviction that financial systems can be classified as being either bank-based or capital market-based. This leads to a puzzle insofar as it calls into question the empirical foundation of the widely held belief that there is a correspondence between the financing patterns of corporations on the one side, and the structure of the financial sector and the prevailing corporate governance system in a given country on the other side.

The present paper addresses this puzzle on a methodological and an empirical basis. It starts by comparing and analyzing various ways of measuring financial structure and financing patterns and by demonstrating that the surprising empirical results found by studies that relied on net flows are due to a hidden assumption. It then derives an alternative method of measuring financing patterns, which also uses flow-of-funds data, but avoids the questionable assumption. This measurement concept is then applied to patterns of corporate financing in Germany, Japan and the United States. The empirical results, which use an estimation technique for determining gross flows of funds in those cases in which empirical data are not available, are very much in line with the commonly held belief prior to Mayer's influential contribution and indicate that the financial systems of the three countries do indeed differ from one another in a substantial way, and moreover in a way which is largely in line with the general view of the differences between the financial systems of the countries covered in the present paper.

I Introduction

More than ten years after Harris and Raviv (1991) concluded in their survey article that the theoretical research on asymmetric information and capital structure has reached the point of diminishing marginal returns, the gap between this very theory and the empirical evidence on firms' capital structures seems to have become even wider. Fama and French (2002) acknowledge in the last sentence of their extensive empirical study that they "[…] cannot tell whether the results are due to trade-off forces, pecking order forces, or indeed other factors overlooked by both."[1] Hence, whether firms' financing decisions are determined more by transaction cost of issuing new securities and the extent of informational asymmetries between management and investors as suggested by the pecking order model (Myers 1984) or more by management attempts to achieve optimal leverage levels by trading-off the benefits - e.g. tax deductibility of interest and reduction of free cash flow problems - and the costs – e.g. bankruptcy cost and agency conflicts between stockholders and debt holders - of taking on extra debt is still not fully understood.

Whereas empirical tests that rely on panel data hence struggle to reach consensus concerning the determinants of capital structure, most studies based on aggregate country data have indeed derived the very same results with respect to international differences of financing behaviors of firms. Because "retained earnings are by far and away the dominant source of finance in all countries" (Mayer and Sussman 2002) and because "differences in leverage across the G-7 countries are not as large as previously thought" (Rajan and Zingales 1995), "[t]he celebrated distinction between the market based financial pattern of the United Kingdom and the United States and the bank-based pattern of Germany is inaccurate"(Corbett and Jenkinson 1997).[2] These results are important not only because they challenge established views, but also because they lead to a research puzzle[3]: There does not seem to be a correspondence between the financing patterns of corporations in a given country on the one side and the prevailing corporate governance system in that country on the other side - a correspondence which the theory of incomplete contracts would lead one to expect (La Porta et al., 1997). In fact, one would expect the financing patterns to "fit" the governance systems in the sense that those to whom the governance system gives most

[1] Schmid Klein et al. (2002) finish off their survey article on recent contributions in that area by stating that the lack of support for prevailing theories suggests that additional work is needed on both fronts.
[2] For similar results see e.g. Mayer (1988, 1990), Mayer and Alexander (1990), Bertero (1994), Edwards and Fischer (1994), Prowse (1995), Rajan and Zingales (1995) and Corbett and Jenkinson (1996).
[3] Mayer's findings are also classified as an extremely stimulating puzzle and discussed at length in Mishkin (1998), chapter 9. See also Schmidt and Tyrell (1997).

power to influence the policies of the corporations would also be the main providers of funds, and there can hardly be a doubt that governance systems differ widely between countries.

In our paper we address the "net-flow puzzle" created by the empirical studies of Mayer (1988) and those who followed his lead on methodological and empirical grounds. To that aim we demonstrate that all studies that rely on aggregate net flows of funds between economic sectors make one critical implicit assumption concerning the question which sources of funds finance which uses of funds. It is assumed that new external funds like bank loans to the enterprise sector are first used to repay any outstandings of the same type of financial instrument and that only the remainder, i.e. the net flow from the banking sector to the non-financial enterprise sector in a given period, which may be positive or negative, is used for financing real investment. Because by definition internal funds do not have to be repaid, they are assumed to fully flow into investment. Only in the rare cases in which the volume of internal funds exceeds that of investment, the excess of internal funds over investment is assumed to be used to repay debt or repurchase equity. It appears to us that, for answering the question of how investment is financed, this arbitrary assumption is not warranted. Nevertheless, the assumption is responsible for the results at which Mayer and his followers arrive, and that it overestimates the role of internal funds and underestimates that of external sources of the financing of investments.

In this paper we propose an alternative method of measuring financing patterns, which is very close in its spirit to previous aggregate studies, but avoids the critical assumption. The empirical results which the alternative concept yields turn out to be in line with expectations grounded in financial system theory as well as with commonly held beliefs about the dominance of banks as a source of financing in Germany and Japan and of markets as a source in the case of US firms. Our empirical results suggest that the overlooked determinants mentioned by Fama/French may in fact be found in the institutional context and the ownership structures of firms. Such an explanation has been largely ruled out by existing empirical studies, which could not find systematic international differences in financing patterns.

The paper is structured as follows: In the next section, we examine the basic approaches to measuring financing patterns using a simple numerical example. We derive five observations that we use in section III to briefly discuss the relevant empirical literature. Inter alia we will reveal the critical assumption implicit in all net-flow studies in the spirit of Mayer (1988) and argue that net flows only indicate the change in importance of various financing sources, but not the importance

itself. Section IV also builds upon the observations and presents a new measurement concept that is based on gross flows and thereby avoids the critical assumption. The concept is applied to the enterprise sectors of Germany, the United States and Japan and offers a fresh look at international differences in financing patterns, i.e. in the relative importance of financing flows from various internal and external sources in funding investment. By adjusting gross flows based on average maturity information we demonstrate that international differences in financial patters, which we define as the relative importance of financial flows of funds in financing investment, can be easily reconciled with international differences in financial structures, which we define as the relative importance of various liability and equity items as they are reflected on firms' balance sheets. Section V concludes by discussing the implications our results might have for future empirical and theoretical work on firms' capital structures and the comparison of financial systems.

II The measurement of financing patterns

A) Alternative measurement concepts and their results for a simple example

There are at least six general conceptual ways to analyze the financing patterns and financing structures. One can either examine (i) data on gross flows from specific financing instruments, (ii) data on net flows – i.e. gross inflows minus gross outflows for the same type of instrument - or (iii) data on levels – i.e. accumulated net flows plus any value changes. For each of the three options one can then either (a) examine individual company accounts or (b) look at sector aggregates as they are reported in National Accounts Statistics.[4]

Providers of company account data, such as Global Vantage or Compustat, use annual statements of selected firms to build their datasets. These datasets comprise items from balance sheets, income- and cash flow statement. Aggregate sector data are typically provided by the central bank or the statistical office of a country and cover the entire non-financial company sector. For some countries the sector accounts are further broken down for subsectors such as corporations, farming or housing enterprises. The reported time series are partly based on individual company accounts but to a much larger extent on already aggregated data provided by banks, stock exchanges or other financial institutions. As a consequence, National Account Statistics almost exclusively contain data on levels and net-flows but hardly any gross flow data.

[4] Moreover, one can distinguish between time periods. For example, Mayer/Sussman (2002) compare firm-years, during which firms experienced particularly high investment expenditures and hence can be assumed to have a higher demand for external financing to those firm-years with normal levels of investment expenditures.

Furthermore, levels and net flows are adjusted for intrasectoral transactions and hence correspond to intersectoral claims and liabilities of all sectors.[5]

Each of the six measurement concepts has its strengths and weaknesses and is hence better suited to answer some questions and less appropriate to answer others. In choosing between individual company accounts and aggregated sector accounts one essentially trades off possibilities to test theories on the determinants of financial structure of firms from the same country against possibilities to compare the roles of various financing sources in funding investment across countries and longer time periods.

Data from individual companies' financial statements are much more detailed than aggregate sector data and allows for panel analysis. However, they are typically only available for the largest corporations of a given country and as such they are not necessarily representative of all firms in that country. Secondly, differences in accounting standards often make comparisons among firms from different countries problematic. Thirdly, analyses of long-term developments in financing behavior are difficult as the available data in most sources only dates back one or two decades. The providers of National Accounts Statistics have undertaken many efforts in recent years to standardize both the compilation and the presentation of outstandings and net flows. Although some discrepancies in terms of sector definitions and instrument classifications still remain, total sector coverage, international comparability and availability of historical data is arguably superior to that of most databases containing individual company accounts. At the same time, regression analysis is hardly possible due to the high level of data aggregation.

The trade-off that comes with the choice between levels, net flows and gross flows is more subtle. The simple example in Table 1 below clarifies the differences between the three broad measurement concepts and also points out their major strengths and weaknesses.[6] It thereby attempts to disentangle some important misunderstandings concerning the questions that can be answered by each of them.

Insert Table 1 here

Columns 2 to 10 in the upper part of panel A show gross and net flow figures for the firms A, B and C in the three periods 1 to 3. Levels are reported in the lower part of panel A. For each firm and all periods, the flows of internal funds are 10 and the levels of paid-in equity are 5. The firms are identical, except that each firm experiences an investment spike in another of the three periods.

[5] For example, industrial crossholdings of equity shares and trade credit among firms are often consolidated and are hence not reported in the National Account Statistics.

[6] Refer to Mayer/Sussman (2002) for a representation that is very similar in construct.

Investment spikes are defined here as investments that are four times as high as in normal times. Investments are always financed from available internal sources as much as possible and only if internal funds are not sufficient they are financed from external sources. Any excess internal funds are used to repay liabilities or to acquire liquid assets that serve as a store of liquidity. As a consequence, firm A, which has an investment spike in period 1, has to finance half of the investment externally, e.g. by taking out a bank loan of 10. Firm B, which mainly invests in period 2, has at that time already accumulated 5 units in internal funds through prior accumulation of liquid assets and hence only requires 5 units of external funds to finance the investment spike. Firm C is able to finance its entire investment spike by means of internal funds that have been generated and accumulated during periods 1 to 3. Panel B provides the aggregated company accounts from panel A for each single period and, in the last column, averaged over periods 1 to 3.

Insert Table 2 here

The six general measurement concepts imply remarkably different answers to the question "How is investment financed?". This question was chosen by Jenny Corbett and Tim Jenkinson (1997) as the title of their influential empirical study of firms' financing patterns in five countries. Following their approach of measuring aggregate net flows for the entire sector yields a portion of 0 percent for external funds in total investment and consequently a portion of 100 percent for internal funds (see Table 2 above). If the concept recently proposed by Mayer/Sussman (2002) is applied, i.e. if only net financing flows of firm-years, during which the firms experienced an investment spike, are considered, one arrives at a portion of 25 percent for external net funds; and, because no debt repayments occur in the spike years in our example one arrives at the very same portion for gross funds. Measuring financing patterns based on gross inflows into the entire sector constitutes a third alternative and yields an average portion of external funds in investment of 16.7 percent. We will argue in section IV that the third alternative constitutes the most appropriate way of measuring the roles of various sources in funding investments. We hence consider it also as the most appropriate way of comparing financing patterns across countries and time intervals.

The example also allows for the measurement of capital or financing structures. Based on the level data provided in the lower panel of Table 1, three different leverage ratios can be computed. One can compute the ratio of debt over total liabilities and equity for each single firm in the sample and then build the average across all firms (three-period average: 18.5 percent; third line in Table 2) or alternatively, across the subsample of firms with investment spikes (three-period average: 38.9 percent). Thirdly, one can directly compute the sector leverage ratio by using the

corresponding items from the consolidated balance sheet in the last column of the table (three-period average: 26.7 percent).[7]

B) Observations and implications

The following five observations summarize what appears to us as the main insights to be drawn from the example.[8] They point out the mechanisms that are responsible for the discrepancies between the results from different measurement approaches. We will later build upon these observations to discuss the relevant empirical literature and to develop and implement a new measurement concept.

Observation 1: Net flows $NF_{t,i}$ for instrument i - defined as the difference between gross inflows $IF_{t,i}$ and gross outflows $OF_{t,i}$ from the same period t - equal the first difference in end-of-period nominal levels L_i.

(1) $NF_{t,i} = IF_{t,i} - OF_{t,i} = L_{t,i} - L_{t-1,i}$

In our example, which only reports nominal values, this proposition holds for both debt-financing and the purchasing of liquid assets. Indeed, equation (1) also holds for most data series in National Account Statistics. Exceptions only occur if levels are reported at their market values or if levels are affected by flow items not fully reflected in the corresponding flows series. The two most prominent examples for the second exception are retained earnings in the case of equity and conversions of convertible bonds into equity in the case of equity and bonds. Hence, for all but a few instruments, time series of net flows do not contain more information than time series on levels.

Observation 2: Net flows indicate growth patterns of levels.

Over the lives of any debt instrument, the sum of gross inflows into each firm and also into the entire sector must equal the sum of gross outflows in the form of repayments and of obligations that had not been met, e.g. because of loan defaults.[9] Hence, accumulated net flows from debt instruments are by definition only positive if not all inflows are repaid during the observation

[7] See Rajan/Zingales (1995) for an application of the first and the third concept.

[8] There area number of secondary insights that can be drawn from Tables 1 and 2. It becomes apparent, for example, that financing patterns are the same for aggregated single company accounts and for the entire sector accounts as long as the companies in the sample represent the entire sector. Computing weighted averages across flow figures from all single company accounts is conceptually equivalent to computing the same ratios for sector accounts. Financing patterns for spike years deviate from sectoral patterns because the exclusive focus on company years in which capital expenditures strongly exceed internal funds overemphasizes the role of gross inflows from debt financing.

[9] Again, convertible bonds are an exception to this rule, as they can be converted into equity shares. In this case repayments via dividends and share buybacks do not necessarily match the original inflows into the firm.

period. They are higher the more the amount of debt outstanding at the end of the observation period exceeds the beginning balance. Net inflows thus mainly indicate the growth path of corresponding levels. As a consequence, empirical studies based on aggregate net flows can only provide evidence on the *change* in the relative importance of different external funding sources, but typically do not reveal the general importance of different funding sources in financing investment.

Observation 3: Internal funds are conceptually different from other financing sources.

Because internal funds are not "repaid", there are no corresponding gross outflows. Therefore, net internal inflows equal gross internal gross inflows. This implies that if one compares net flows from external sources over investment to internal funds over investment, one implicitly assumes that external inflows are firstly used to make repayments to external claimants and that only the remainder is used to finance investment. In sharp contrast, all internal funds are assumed to be exclusively used to finance investment. This problem of a preset allocation of sources to uses is aggravated if aggregate firm data is analyzed. Gross inflows for some firms are implicitly assumed to be used for repayments of liabilities of *other* firms in the sample. In our view, this arbitrary allocation of sources to uses is a critical assumption inherent in all aggregate net flow studies. And it is precisely this assumption that drives one of their main results, namely that internal funds are by far the most important source for financing investment, as quoted above. One possibility to fix the problem of systematically overestimating the relative role of internal funds is to use external gross flows instead of external net flows. If one proceeded in this way, no assumption concerning the use of funds from specific sources would be made at all. Rather, it would be postulated that each financing source can in principle be used to finance any real or financial investment or to repay any liability.

Observation 4: Levels can be reconstructed from past gross inflows.

Levels or outstandings of a given financing instrument are the outcome of the entirety of gross inflows, gross outflows (which are themselves a function of past gross inflows) and any value changes for that instrument that may have occurred in the past. If annual gross inflows are constant across time and if levels are reported at nominal values, the steady-state relationship between gross inflows and levels is determined by the duration of the stream of repayments (gross outflows). Because interest payments are neither considered in our example nor in the

data series from National Account Statistics a simplified duration concept can be used, in which the interest rate is set to zero (see equation (2)). To avoid confusion with the standard duration concept, we henceforth use the term average maturity instead, which we denote by m_i.

$$(2) \qquad m_i = \sum_{t=1}^{n} t \cdot OF_{i,t} \big/ IF_{i,t=0}$$

Consider the following example for a given firm: Annual gross inflows from new debt are 10 in each year and all debt matures after 5 years on average. In a steady state, the nominal value of outstandings must equal 50 - irrespective of the repayment schedule, i.e. the exact timing of repayments around the average maturity.[10] In a second scenario, in which liabilities are repaid after one year on average, outstandings must equal gross inflows in a steady state. Outstandings in this scenario are nothing but the gross inflows that have accumulated during the previous twelve-month period.

In the latter case of stable one-year average maturities, the simple relationship also holds for situations in which gross inflows grow at a constant rate $g \neq 0$. If, however, average maturities are greater than one for instruments with nonzero growth rates, levels are no longer exclusively determined by m_i but also by $g_{i,t}$ and to a smaller extent also by the exact form of the repayment schedule. Consider again the simple example: Assume that gross inflows $IF_{i,t}$ from instrument i have been growing at an annual growth rate g_i since the 1970s and that they have reached $IF_{i,1990}=100$ in 1990. Further assume that instrument i matures after 10 years on average and that the bulk of repayments occurs around that average maturity.[11] In 2000, gross inflows are greater than they were in 1990 by the factor $(1+g_i)^{10}$ and hence $IF_{i,2000}$ equals $100*(1+g_i)^{10}$. Gross outflows reflect gross inflows from m_i years ago. Hence, $OF_{i,2000}$ must approximately equal $IF_{i,1990}$ and, as a consequence, must be about the same as $IF_{i,2000}(1+g_i)^{-m_i} = 100$.

[10] Provided that the repayment schedule is constant across time it does not make a difference whether the 100 in debt are repaid in full after 5 years or whether for example, 50 are repaid in year two and year nine. The relationship also holds for our example from Table 1. The debt of firm A (firm B) matures on average after 1,5 (one) periods. The weighted average maturity m for the entire sector thus equals 4/3. Multiplying average gross inflows, which amount to 5 over the three periods, by 4/3 yields 6 2/3, which is precisely the average liability level over all three periods.

[11] We analyzed numerically the impact of the exact timing of repayments on the accuracy of observation 4 and hence on the extent to which it can be generalized (the corresponding tables are available from the authors on request). If the stream of repayments is bell shaped, steady-state inflows as implied by equation (4) deviate from true inflows by (far) less than 3 percent for growth rates below 20 percent and for average maturities greater than 5 years. Deviations are slightly larger for schedules that either increase or decrease in a monotonous fashion and for an evenly distributed stream of repayments. Deviations are largest for schedules with bulks of payments in the beginning and in the end (roughly 10 percent for a 20 percent growth rate and an average maturity of 6 years).However, the larger a sample, the more should the stream of total repayments of the entirety of firms converge to a skewed bell-shape and hence the more accurate we expect equation (4) to be.

Subtracting year-2000 gross outflows from year-2000 gross inflows yields net flows NF_i for the year 2000. $NF_{i,2000}$ must by definition also equal the difference between year-end 2000 levels and 1999 levels. Because gross flows have grown at g_i during the nineties, the same must hold for levels L_i, so that the difference in levels can also be written as $L_{i,2000} - L_{i,2000}(1+g_i)^{-1}$. We obtain the following general relationship between gross flows for a given year and levels at the end of the year.

(3) $L_{i,t} - L_{i,t}\,(1+g_{i,t})^{-1} = NF_{i,t} = IF_{i,t} - IF_{i,t}\,(1+g_{i,t})^{-m_{i,t}}$

Solving (3) for $IF_{i,t}$ yields

(4) $IF_{i,t} = L_{i,t}\,(1 - (1+g_{i,t})^{-1}) / (1 - (1+g_{i,t})^{-m_i})$, [12]

and solving (3) for m_i yields

(5) $m_{i,t} = (\ln IF_{i,t} - \ln [IF_{i,t} - L_{i,t}\,(g_{i,t}/(1+g_i))])/\ln (1+g_{i,t})$.

By construction, equations (4) to (5) apply to cases in which growth rates, average maturities and repayment schedules remain constant over the entire observation period. However, as we will show in section IV, equation (4) provides fairly accurate estimations of gross inflows also in those cases, in which the three determinants vary across periods.[13]

Observation 5: Financing patterns differ from financing structures (as defined above) in a single year but the two can be reconciled for longer time periods.

The role of a specific financing source is typically different in a given year depending on whether it is measured based on gross flow data or based on level data. The main reason for this discrepancy is of course closely connected to observation 4: Levels of long-term financial instruments are not only affected by financing activities that have been taking place during the current period but also by transactions from previous periods. As a consequence, the relative portion of nominal outstandings in total outstandings must over a sufficiently long observation period of n years be a function of the portion of gross flows from that very same source over total gross financing. In fact, because ratios are considered in both cases, growth rates in levels and gross flows cancel out. The relationship between patterns and structures is therefore

[12] Note that equation (4) simplifies to $IF_{i,t} = L_{i,t}$ if m_i equals 1 and to $IF_{i,t} = L_{i,t} / m_i$ as g_i converges to zero.

[13] In order to limit possible distorting effects from changes in growth rates in our empirical study in section IV we use the average growth rate of levels over the previous $m_{i,t}$ periods as the value for $g_{i,t}$. Given that in our dataset, average growth rates $g_{i,t}$ range between -1 and 25 percent, with a concentration around 5 to 11 percent, equation (4) will only slightly underestimate true gross inflows for a large spectrum of realistic repayment schedules (see footnote 11). Hence, the portions of gross flows from external financing that we report in section IV tend to be lower bound estimates.

exclusively determined by the long-term average maturities m_i of the instruments. Normalizing gross flow portions by a standard maturity m* yields adjusted financing patterns that ought to be congruent with unadjusted financing structures from nominal outstandings over an n-year observation period. This is reflected in equation (6) in which the index j refers to the appropriate balance sheet items.

$$(6)\quad \frac{m_i}{m^*}\frac{1}{n}\sum_t IF_{i,t} \Big/ \sum_j \sum_t^n IF_{j,t} = \frac{1}{n}\sum_t L_{i,t} \Big/ \sum_j \sum_t^n L_{j,t}$$

In section IV, we will apply equation (6) to check our empirical evidence on financing patterns and financing structures for consistency. Note that financial structures from level data can only be reconciled with financing patterns based on gross flows but not with financing patterns based on net flows.

In summary, the general measurement concepts that have been presented in this section are complementary with respect to the questions that they help to answer. Net inflows indicate the change in importance of observed financing sources. Levels reveal long-term averages for the relative importance of liability items in financing assets and gross flows indicate the breakdown of funding of total investment in a given year. Some concepts are hence not well suited to answer particular questions. However, there have been prominent instances in the literature where exactly this has happened.

III Brief review of the related empirical literature

In their widely cited article "What do we know about capital structure – some evidence from international data", Rajan/Zingales (1995; hereafter RZ) approach the question of international differences in capital structure from several angles. They start out with an analysis of level data from 1991 company accounts obtained from the Global Vantage Database and find that "(i) the United Kingdom and Germany have the lowest leverage among the G-7 countries; and (ii) all other countries have approximately the same amount of leverage […]" (p. 1438). The numerous adjustments for major differences in accounting practices that they carry out in their study and their utilization of alternative measures of leverage are in their opinion responsible for the fact that their empirical results deviate strongly from the results obtained by most prior studies.[14]

[14] Rutherford (1988) surveys prior work and concludes that German and Japanese firms are more highly leveraged than Anglo-Saxon firms.

The lack of unanimity in empirical results indicates that differences in accounting practices indeed pose a great problem for studies based on individual company accounts. Sample selection bias certainly is another important issue at least in the case of German firms. The Global Vantage database used by RZ only contains data on 191 listed German firms, most of which belong to the largest in the country. Data from Deutsche Bundesbank (1998) indicates that in 1991 bank debt over assets was around 10 percent for German firms with a turnover exceeding 100 million DM but more than 25 percent for the large number of German firms with sales below 100 million DM and almost 40 percent for the German firms that fall into the category with an annual turnover smaller than 5 million DM.[15] It is hence questionable whether the result of RZ that has been cited above, would remain valid if the German sample had been extended to smaller firms.

Unanimity, however, seems to exist among empirical studies based on flow-of-funds data, be it in aggregate form as provided by central banks and the OECD, respectively, or be it in disaggregate, individual company format as provided for example by Global Vantage and Compustat. RZ report external net financing as a fraction of total financing, which must by definition equal total investment, for the G7 countries during 1984-1991. Based on their finding that, except for Japan, external financing was (much) less important then internal financing via cash flows from operations, RZ conclude that "there is no clear distinction between the Anglo-Saxon economies and the others". Mayer/Sussmann (2002) analyze Compustat data from more than 10.000 US companies for the 1988-1998 interval and obtain similar results to RZ. The fraction of internal funds in total financing is 77 percent on average. This is not only a support for the position advanced by RZ, but also for the findings of Corbett/Jenkinson (1996 and 1997).

Following the lead of Mayer (1988), Corbett/Jenkinson (1997) conducted the most extensive study based on net flows from aggregate flow of funds data so far.

Insert Table 3 here

Table 3 is taken from their article and shows that, averaged over the 25 periods between 1970 and 1994, internal funds dominate external funds strongly in all four countries. Surprisingly, bank finance seems to be less important in Germany than in the United Kingdom whereas new equity seems to more important in Germany and Japan than in both Anglo-Saxon economies. Similar

[15] A recent publication by Deutsche Bundesbank (2002) shows that these values have remained nearly unchanged over the course of the nineties.

tables can now be found in almost every textbook on corporate finance.[16] The view that internal funds dominate the financing of investment in most countries and that the patterns of external financing do not justify the conventional classification of economies into bank-based and market-based ones is hence by now part of mainstream academic thinking.[17] Given the insights from the last section and the empirical results from measuring gross flows that are presented below, we believe that this view is not justified.

In their study, Corbett/Jenkinson use net flows, and this in a double sense. Central banks and statistical offices present flow-of-funds data only after repayments have been netted out. For example, the figures for bank loan financing in any given year result from subtracting all loan repayments by the nonfinancial enterprise *sector* from the total volume of new bank loans taken out by firms from the sector during the same year. Similarly, equity financing is calculated as the difference between the proceeds from issuing new shares and the cash outflows for buying back shares from the public, including the acquisition of shares in other companies. One could call this form of netting "repayment netting". The second step of netting consists in eliminating firms' financial investments. For instance, net flows between banks and non-financial companies are the difference between the volume of (net) financing of firms by banks, e.g. in the form of bank loans, and firms' financial investments with banks, e.g. in the form of bank deposits. One could call this second type of netting "balance sheet netting". If we assume that all financial assets in our example in Table 1 are in the form of bank deposits and all liabilities are in the form of bank loans, balance sheet netting corresponds to subtracting the numbers in row "Liquid assets (Net

[16] For instance, Brealey and Myers present extensive tables with net sources of financing on pp. 364-367 of the 5th edition of their well-known textbook. With reference to the U.S., they write on p. 367: "*The most striking aspect* [of these tables] *is the dominance of internally generated cash, defined as cash flow from operations less cash dividends paid to stockholders. Internally generated cash normally covers a majority of firm's capital requirements*." Page 324 of their 4th edition contains the additional comment: "*Notice that the reliance on internally generated cash is the same the whole world over*." Similar textbook presentations of net sources of financing include Arnold (1998), p. 351, and Pike and Neale (1996), p. 465 (both with special reference to the United Kingdom), Buckley et al. (1998) p. 354, Damodaran.(2001), p. 513. Damodaran (2001) presents results of an earlier version of this paper to highlight international differences in financing patterns.

[17] Explicit references to Mayer in the research literature include Allen (1993), Allen and Gale (2000), Conti (1992), Dewatripont and Tirole (1994), Hellwig (1991, 1997), and Thakor (1996).

flows)" from the numbers in row "Debt (Net flows)". The flows - thus netted twice - are then expressed by Corbett/Jenkinson as a fraction of total physical investment.[18]

Our simple example captures the essence of how flow-of-fund studies measure the "the relative significance of different sources of finance in physical investment" (Mayer and Alexander 1990, p. 454). As can be seen from the last column in Table 2, "repayment netting" implies that, accumulated over the three periods, external net financing is zero. "Balance sheet netting" implies that net financing is zero for every single of the three years, because net flows from liabilities cancel out with net flows from liquid assets. Because we know by construction of our example that 16.7 percent of investment is financed by external sources, it seems fair to say that net flow approaches of determining how investment is financed lead to a distorted picture of the reality which they aspire to capture, and that they might even suggest far-reaching, but misleading implications. Imagine that, based on the results for the model economy in our example, someone would conclude that there was no reason to have banks or any other source of external finance at all! This does, however, not imply that there would not be important questions to which studies based on (double) netting present important insights. They indeed show the relative *net* contributions of different sources of finance over a given time interval and hence indicate the *change* in importance of different sources.

As mentioned above, the main factor which produces the results of net-flow studies is the implicit assumption concerning how funds from each particular source are used: It is assumed that funds from bank loans are used in the first instance to pay back bank loans, while proceeds from the issue of new bonds or equity shares are first of all used to redeem or buy back bonds and shares, respectively - and this on a sector-wide level. Only what remains after these "primary" uses of funds is assumed to finance investment. The case of internal financing is the only one in which there is no corresponding "use of first resort", and this creates the impression that investment is almost exclusively financed internally (see observation 3 in section II).

There are two general ways out of this dilemma. One way, which was recently explored by Mayer/Sussman (2002), is to analyze net flows for a specific subset of firms, namely for those

[18] They define the ratio of the net financing i_j from any one source j of financing - namely internal funds, banks, bonds, equity, trade credit, capital transfers, and others - to aggregate investment as the contribution of source j to the financing of total investment in a five-year period. The formula they use is $\Sigma_t\ i_{tj}\ p_t\ /\ \Sigma_t\ I_t\ q_t$, where I_t represents the total amount of gross investment in plant, machinery and other fixed assets and net additions to working capital in year t. The summation over t serves the purpose of aggregating over a certain number of periods in order to eliminate business cycle effects and other peculiarities of any given year. p_t and q_t are price indices.

firms that experience an investment spike. The idea behind the investment spike approach is straightforward: In the very period in which firms make heavy investments, financial gross inflows must substantially exceed financial gross outflows, which in turn depend on inflows from prior periods. If investment activity in these prior periods was very low compared to the spike period, the net flows of the spike period are indeed a good approximation of the respective gross flows. In the example of Table 1 the investment activity of all three firms was nil prior to their investment spike, so that in this special case net flows fully equal gross flows. If one omits those firm-years in which external funds are repaid – which is exactly what the investment spike approach calls for - the aggregated fraction of net external funding in total investment must be positive. In our example it amounts to 25 percent. Because only spike years are considered, the financing of all investment activity in all other firm-years, which according to Mayer/Sussman can be assumed to be "associated with routine replacement rather than expansion of the capital stock" (p. 2) is not accounted for by this approach. Hence it does not answer the question "how is overall investment financed?" but answers the question "how are large investment projects financed?". Because single firm-years with investment spikes have to be identified and extracted the measurement concept only works with data sources that provide single-company accounts. As a consequence, international comparisons have to deal with the problem of accounting differences and with a selection bias due to the dominance for some countries of firms of very large size. If, for example, firm A from our example presented above were not included in the sample, the portion of external funding in investment would drop to 12.5 percent.[19]

A second alternative to arrive at a better picture of how aggregate investment is financed is to analyze aggregated gross flows instead of aggregated net flows. This avoids the arbitrary assumptions concerning the allocation of sources to uses of funds altogether. Rather, it acknowledges the logical fact that all sources of funds are jointly employed for all uses of funds, and hence that all sources of funds also jointly provide the funding for physical investment. In the example from Table 1, the sum of physical and financial investments amounts to 35 units in each of the three periods on average (see last column). 5 units stem from external sources, another 5

[19] Furthermore, the exclusive coverage of spike years in combination with repayment and balance sheet netting of "other instruments" that do not qualify either as long-term debt or equity typically results in a underestimation of the importance of internal funds. In our example, firm B finances 50 percent of its period-2 investment spike by means of internal funds, and 25 percent each by selling liquid assets and by taking on new liabilities. Since the liquid assets are nothing else then last year's excess internal funds, the fraction of internal funds is only half the value that it would take on if the sample also included non-spike years.

units are financed by selling liquid assets and 25 units are financed by internal sources. Because the 5 units in liquid assets exclusively comprise internal sources from previous periods that are already accounted for by the 25 units, they can be omitted from the analysis. As a consequence, 5/30 or roughly 17 percent of each dollar invested stems from external sources. The remaining 83 percent are internally financed.

In the next section we carry forward the concept of measuring gross-flow financing patterns from our simple numerical example to the enterprise sectors of the three largest economies in the world. After presenting the empirical results we will explain how the underlying gross flows were obtained or estimated, respectively. At the end of the section we will assess the accuracy and consistency of the empirical results.

IV Measuring financing patterns on the basis of gross flows

A General approach and main empirical results

Our general approach to measuring financing patterns is closely related to that of prior net flow studies but substitutes net flows by gross flows. In a first step, gross flow time series are either directly retrieved from accessible data sources or, if no original data is available, they are estimated from available data on levels and average maturities (see next subsection). In a second step, annual gross flows from the various financial instruments that exist in each country are grouped into common categories that can be more easily compared internationally, i.e. long-term loans from banks and other financial intermediaries, equity instruments, bonds and all short-term debt. In a third step, aggregated gross flows from the same category are divided by total physical investment of the respective enterprise sector. These ratios are then compared to internal funds over investment in order to determine the relative importance of internal and external funds in financing physical investment. One could of course also divide gross flows from each long-term category by total gross flows from all internal and all long-term external financing sources to derive the categories' portions in total financing. Because long-term asset tend to be financed with long-term liabilities (see e.g. Hart/Moore 1994) total long-term financing should roughly equal total long-term investments and portions in long-term total financing should hence be identical to the portions in long-term total investment. For the sake of comparability of our results to those of prior net-flow studies, we have decided to express financing gross flows in terms of total physical

investment.[20] Irrespective of the denominator in step 3, one can in a fourth step compute the portions of long-term external financing sources in total external gross financing to analyze financial patterns in more depth.

Table 4 shows our results for step 3. It compares the average portion of external long-term financing over physical investment to the average portions of two standard forms of internal funds for Japanese, German and US firms. Averaged over the years 1970 to 2000, the volume of total internal funds ranges from 77 percent (Japan) to 87 percent (USA) of total physical investment. Internal funds mainly consist of cash flows that are designated as depreciation expenses and to a much lesser extent of internal funds that arise from retaining profits. The average portion of long-term external funds differs more strongly between the three countries: Whereas German and American firms obtained 66 cent and 74 cent, respectively, in long-tem external funds for every dollar they generated internally, Japanese firms obtained a remarkable 188 cents from external long-term sources. Although internal funds are hence a very important source of finance they are not the most important source in all countries. This evidence stands in stark contrast to a central result of those studies that have used net flows to examine financing patterns, namely that internal financing strongly dominates external net financing in all analyzed countries.[21]

Insert Table 4 here

Table 4 contains three additional rows that aim to capture the role of short-term financial sources, namely gross flows from short-term debt, net flows from short-term debt and net flows from short-term debt minus net flows from short-term financial investment ("double netting") as a percentage of investment, respectively. Following Baker/Wurgler (2000) we approximate gross flows from short-term instruments by taking the corresponding year-end levels, thereby assuming that these instruments have an average maturity of exactly one year. Because the term to maturity of most short-term instruments is indeed even lower, outstandings are only very conservative

[20] Given the figures on internal and external gross flows over physical investment in Table 4 and given the breakdown of total external funds in Figure 5, one can easily derive the breakdown of total long-term financing/investment.

[21] It is worth noting, that there also exists an opposite effect which applies to both net flow and gross flow studies and which leads to a slight underestimation of the role of internal funds vis à vis the role of external funds. This effect is due to the fact that most expenses on research and development activities have to be expensed by firms against their earnings, thereby reducing retained earnings and hence reported internal funds. If R&D expenses were treated as investments – what they arguably are - the portion of internal funds in total investments would increase and the portion of other financing sources would decrease.

estimates for gross flows from instruments with shorter maturities.[22] However, even these lower-bound estimates indicate that the inclusion of short-term gross flows would swamp our empirical results on aggregate financial patterns. Rather, short-term flows are an exception for which the use of net flows to measure financing patterns might make more sense than the use of gross flows. As can be safely assumed, most short-term instruments like commercial paper, short term bank loans and trade credits mainly serve working capital purposes like payroll needs, inventory management and liquidity management for smoothing out seasonal imbalances and much less the purpose of financing long-term investment. Hence, it seems justified to only look at the marginal contribution of the liability side of liquidity management to long-term financing. This is equivalent to looking at annual net flows from short-term liabilities. In order to account for the fact that liquidity management does not only involve short-term liabilities but also short term financial claims like cash, bank deposits and trade receivables, one should apply double netting to short-term liabilities and assets and use the resulting net flows as indicators for the role of short-term instruments.[23] The lower part of Table 4 above reports both variants of net figures and also one gross figure and indicates that the contribution of total double-netted flows from liquidity management activities are indeed negligible.

Insert Table 5 here

For an analysis of the relative importance of different external sources we broke down the total portion of external funds into the gross flow contribution of various instruments in Table 5. Note that the figures are percentages of total external long-term funding and thus add up to 100. Presenting the instrumental breakdown as percentages of total physical investment, as in the previous table, or as percentages of total physical and financial investment, would not alter the conclusions, but make them less obvious. Bank loans are by far the most important source of long-

[22] For example, Light/White (1979) find an average maturity of just 35 days for commercial paper issued by US firms in their sample. According to data provided by the Deutsche Bundesbank for the years 1991 to 2000, the average volume of gross inflows into the German nonbank sector from the issuance of commercial paper was roughly 100 billion DM per year and thereby almost half as high as inflows from all long-term loans taken out by German firms. However, most commercial paper was repaid in the very same year so that average outstandings were less than 10 billion during the ten years, which is only a small fraction of the roughly 1,200 billion in average outstandings of long-term loans.

[23] RZ neglect trade credit when computing their measures for financial leverage because short term assets and liabilities may jointly be influenced by industry considerations and not financing decisions.

term external funds in both Germany and Japan.[24] Their shares are more than four times as high as for US firms. This relation is reversed in the case of loans from other financial institutions. Between 1970 and 2000, more than 50 percent of the US mortgage loan market was in the hands of non banks like life insurance companies and public financial institutions and almost 90 percent of other loans and advances were provided by non-banks such as finance companies and by foreign financial institutions. Another sharp contrast exists with regards to the amounts raised through the issuance of bonds. Roughly a third of total US external funds comes from this source, whereas bond finance accounts for less than 10 percent of total external funds in Germany and Japan. Although new equity finance is the least important source in all three countries its share is clearly higher in the US than in the other two countries. The total share of securities, or organized capital markets, as a source of financing was hence much higher in the US than in Germany and Japan. Because US nonbank financial institutions are more important investors on these organized capital markets than US banks the importance of capital markets translates into an even greater dominance of nonbank financial institutions over banks than indicated by the figures for long-term loans alone. Assuming that the shares in bonds and equity shares outstandings, which are both readily available from National Account Statistics, provide a good approximation for the respective shares in purchases of newly issued equities, we are able to estimate the total portions of US banks and US non-bank financial institutions in US firms' external long-term gross financing. For the period 1970-2000 we obtain an average portion of 22 percent for banks and an average portion of 64 percent for nonbanks financial institutions.

Table 6 subdivides the entire time span covered so far and shows that financing patterns have not converged over the course of the last thirty years. Rather, differences have become more pronounced. The share of US bank loans dropped by more than a third whereas bank loans in Germany and Japan have only moderately lost ground. During the same period, the share of newly issued securities has increased from 36 percent to 53 percent for US corporations whereas it grew from 14 percent to 18 percent in Germany and from 14 percent to 17 percent in Japan. As a consequence the gap between the amount of public financing (stocks and bonds) in the US and the

[24] The share of bank loans in German firms' external financing would increase to above 80 percent if a broader definition of the non-financial company sector was chosen. Until 1998 the Deutsche Bundesbank published the flow-of-funds accounts for the housing sector and the "production company" sector separately. Throughout this paper, we apply the narrow definition, although the housing sector comprises to an unknown part of financing activities of companies that are part of the non-financial sector in the other two countries.

amount of private financing (bank loans) in Germany and Japan has widened.[25]

Insert Table 6 here

In summary, there are significant differences between financing patterns in the three financial systems which the measurement of gross flows brings out clearly, and these differences are characterized by a surprising stability over time. Contrary to the results of studies based on net flows, the presented evidence from gross flows is completely in line with generally held beliefs that banks are the most important external source of financing in Germany and Japan, whereas capital markets and non-bank financial intermediaries are of greater importance in the US.

B How to obtain times series on gross flows

Unlike levels and net flows, gross flows from external sources are typically not reported in National Account Statistics. Data for most tradable instruments, however, can be found in other publications of central banks and statistical offices or can be acquired from commercial vendors of financial data. From these very sources, we were able to obtain actual annual gross flows for all equity instruments and all domestic bonds issued by German, Japanese and US non-financial companies and for all marketable foreign debt issued by US firms for the years 1970 to 2000.

Figure A1 in the Appendix presents true gross inflows from the issuance of equity instruments as a percentage of annual physical investment. Data sources are reported in the comments to Figure A1. As expected, Japanese figures for equity issuances exceed US and German figures for most of the seventies and eighties but have dropped sharply after the crash in stock and real estate markets in 1990. The German graph reflects the IPO of the Deutsche Telekom in 1996 and the initial success of the Neuer Markt, which was launched in 1998 (and shut down in 2003).

Figure A2 in the Appendix presents gross flows from the issuance of long-term marketable debt as a percentage of investment, including the proceeds from, inter alia, straight bonds, convertible bonds and medium term notes. US firms were far more active in bond issuances than their German peers. Japanese firms took on a middle position during most of the thirty-year interval and have even surpassed US firms in the late nineties. Whereas we were able to acquire actual data on both levels and gross flows in the case of domestic bonds, we could find only level data in the case of corporate foreign debt. In estimating the corresponding gross flows we used equation (4) from section II, which itself encapsulates one main observation from our simple numerical example:

[25] RZ conclude from their evidence that it is precisely the different roles played by public and private financing that distinguishes bank oriented countries from market oriented countries.

Gross inflows for a given year can be approximated by a function that contains as variables the amount of outstandings in the same instrument at year-end, the annual growth rate in these outstandings and the average maturity of the instrument in question. Therefore, with time series on actual levels at hand, all that is needed is information on average terms to maturity of foreign bonds. Given that the proceeds from domestic and external bonds are used to finance similar types of assets, we assumed that the average terms to maturities of both types of bonds coincide. Terms to maturity of domestic bonds can in turn be inferred from available actual gross flows in two ways. Firstly, one can directly enter gross flows and level data into equation (4) from section II. However, if annual growth rates of levels develop quite erratically - as was for example the case for the narrow German domestic corporate bond market over much of the 1980s – implied average maturities show an unreasonably high variance. The second alternative to derive average maturities does not require level growth rates but builds primarily upon actual gross flows and thereby avoids large variances in implied terms to maturity. In a first step, two new time series are constructed, namely cumulative gross inflows from the issuance of domestic bonds and cumulative gross outflows from redeeming bonds plus any defaults.[26] In a second step, we counted, for each period t, the number of periods m_t it took until cumulative outflows had reached the level of cumulative inflows from period t. In essence, we thereby measure the average time span that elapsed between the period in which new debt had been taken on by firms and the period in which an equal amount was repaid, and written off by creditors, respectively. Counting lags should hence give us a fairly good, albeit slightly upward biased[27], proxy for the average number of periods the enterprise sector needed to redeem its bonds, or in other words: for the average maturity of this financing instrument.

Data on true gross flows from taking out new long-term loans were only available for one specific type of loans to Japanese firms, namely for bank loans for equipment funds. Gross flows for all other long-term loans from banks and other financial institutions in all three countries had thus to be estimated. We followed the same approach as in the case of foreign bonds, i.e. we entered data on levels, on moving averages of level growth rates and on average maturities into equation (4). Data on actual levels could once again be directly drawn from the relevant data

[26] In most instances in which we applied this method of counting lags, we chose 1970 as the starting period. In order to account for the debt, that was already outstanding at this time, we used the sum of outstandings at end 1969 and gross inflows during 1970 as the starting value for cumulative inflows.

sources. In further analogy to the case of foreign bonds, average maturities were approximated by other available information in combination with only a few simple assumptions: In the case of other loans to Japanese firms, we assumed that their average maturity is identical to that of loans for Japanese equipment funds as implied by the number of lags between cumulative gross outflows and cumulative gross inflows. For long-term loans to German firms we used the banking statistics of the Deutsche Bundesbank, which group all outstanding long-term bank loans into two distinct maturity bands. In assuming an average maturity of 2.5 years for all loans in the first band (1-4 years) and an average maturity of 7 years for all loans in the second band (>4 years) we were able to construct a times series on average maturities of bank loans. Loans from German insurance companies were assumed to have the same maturity as bank loans. For mortgage loans to US firms we used average maturities of mortgage bonds as reported in Guedes/Opler (1996). Because roughly two thirds of all other long-term loans to US firms were granted by non-bank financial institutions like finance companies we used the average maturity of auto loans as a proxy for all loans in this category.

Figure A3 in the Appendix shows the estimated gross flows aggregated over bank and non bank loans as a percentage of investment for the three enterprise sectors. Both US and German figures are fairly stable and much lower than Japanese figures. The latter grew from below 100 percent in the early seventies to over 150 percent in the late nineties. The comments to Figure A3 provide additional details on data sources and assumptions.

C Accuracy and consistency of our measurement concept

Two data series from the Japanese Statistical Office provide a unique opportunity to test the accuracy of our measurement approach. In particular, the series put us into a position to assess the applicability of equations (4) and (5) for situations in which levels do not grow at a constant growth rate over the entire observation period and in which the exact forms of repayment schedules are not known. The Japanese dataset contains quarterly outstandings as well as quarterly gross inflows of a specific type of bank loans to Japanese non-financial firms, namely loans for equipment funds. Over the 1970-2000 interval, loans belonging to this category accounted on average for about two-thirds of total long-term loans to Japanese firms.

[27] Even if cumulative outflows in period t+m are only one dollar smaller than cumulative inflows in period t, the method yields an average maturity of m+1 periods for those inflows. On average, counting lags should hence overestimate average maturities by about 0.5 periods.

Insert Figure 1 here

The solid black line in Figure 1 shows the quarterly volume of new loans for equipment funds taken out by Japanese non-financial firms. The dotted line shows the corresponding quarterly net flows that result from subtracting gross outflows due to repayments and defaults from gross inflows. It is apparent that in times during which the volume of new loans is increasing, the volume of outflows lags the volume of inflows and as a consequence net inflows are positive. In periods during which the volume of new loans is declining, repayments exceed gross inflows and net flows turn negative. As conjectured in observation 2, made in section II B, net flows show growth patterns of outstandings rather than the overall importance of the financing source in question.

A straightforward way to assess the accuracy of estimates of gross loans based on equation (4) is to compare our estimation results applied to the net figures with the true gross flows reported in the Japanese dataset. For that purpose we used true end-period level figures $L_{i,t}$, moving averages of level growth rates $g_{i,t}$ and average maturities $m_{i,t}$ of i="loans for equipment funds". Because average maturities are not reported in the Japanese dataset, we approximated them by counting the number of periods until true accumulated outflows catch up with true accumulated inflows. Figure 2 below shows the resulting estimates for maturities $m_{i,t}$ in quarters. Also shown in Figure 2 are implied average maturities that result from entering original data into equation (4). The average maturities for the entire period from 1971-2001 that result from the two methods are 14.3 and 13.9 quarters, respectively.[28]

Insert Figure 2 here

The bold gray line in Figure 1 shows estimated gross inflows when the number of lags is used as a proxy for the average maturity $m_{i,t}$.[29] Estimated inflows deviate notably from true inflows in periods in which true inflows move erratically, as was the case e.g. in the aftermath of the burst of Japanese equity and real estate price bubble in the early nineties. Over the entire time window, however, our estimates provide a very good approximation for true volumes: the estimated total volume of new equipment loans granted to Japanese firms is only 2 percent smaller than the true total volume (over 915 trillion yen) over the 30 years in question. The deviation changes slightly

[28] The method of counting lags yields slightly larger estimates primarily because of its crudeness (see previous footnote). We abstained from extrapolation for the sake of simplicity but have subtracted 0.4 quarters from all average maturities that were used to estimate the gross flows in Figure 1.

[29] If maturities implied by equation (5) were used the gray line would be identical to the black line in Figure 1.

to 0.5 percent if $m_{i,t}$ is set to a constant value of m_i=13.9 for all periods. Using greater and smaller constant values for m_i indicates that overestimating average maturities distorts estimates of gross flows less than underestimating: If m_i is set to 19 quarters, total inflows are 24 percent too low, whereas they turn out to be 50 percent too high if m is set to 9 quarters. The results imply that if direct information or reliable estimates on the average maturities are available, equation (4) allows for a fairly accurate estimation of gross flow volumes over a longer period of time. Estimates are biased if growth rates of outstandings are very erratic or if wrong values for average maturities are used and especially if these values are set far too low compared to true average maturities.

In order to check our financing patterns from gross flows for consistency, we examined whether the evidence presented in Tables 4-6 can be reconciled with financing structures reported in empirical studies that use aggregated level data on firms' liabilities from Flow-of-Funds Statistics (see e.g. Schmidt et al 1999 and Hackethal 2001). For that purpose we calculated average financing structures and *adjusted* average financing patterns for the three countries between 1970 and 2000. Financing structures indicate the average share of a financing source or a group of financing sources, respectively, in the total nominal value of all outstanding liabilities and equity. Adjusted financing patterns are based on gross flows, which were standardized by a uniform maturity to account for the differences in average maturities of the various instruments (see Table 7) and for the fact that levels are a linear function of the volume of gross flows and their average maturities (see equation (6) in observation 5).

Comparing the two columns for each country shows that slight deviations only occur in the case of bonds and short-term financing.[30] Overall, however, the exercise shows that the results of the measurement concept which we have presented here are clearly in line with the evidence on financing structures.

V Conclusion and suggestions for further research

In this paper we have developed and applied a new methodology of using flow of funds data to empirically assess the possible existence of differences between the financing patterns in the world's three largest economies. The new methodology employs gross flows of funds from different financial sources to non-financial firms, and in so far differs from the established

[30] This might indicate that our assumption concerning a flat one-year maturity for all short-term instruments might be too crude and that our estimates for the average maturities of bonds might be biased upwards over the entire 30-year period.

methodology which uses net flows of funds. The difficulty which our approach had to overcome is that not all gross flows are readily available in accessible data bases and therefore some gross flows have to be estimated. We developed an estimation procedure to overcome this difficulty, applied it to empirical data, and also showed that it is robust.

The comparisons of stocks of inter-sectoral financial claims and of gross flows of funds between sectors show that the financing patterns in the three large economies discussed in this paper differ substantially. The analysis of gross flows of funds provides a different answer to the important question of "*how is investment financed*" in different financial systems, asked by Corbett and Jenkinson (1997), than studies using net flows of funds. We tend to think that this answer is more in line with what researchers and policy makers would want to know about financing patterns. Our results suggest that it makes sense to speak of different national financing patterns. The "*celebrated distinction between the market-based financial patterns of ... the United States and of the bank-based patterns of Germany* is not "*inaccurate*", as Corbett and Jenkinson concluded in their article.

To conclude the paper, we would like to briefly put the result of this paper in a broader context and to point out areas for further research. From an economic standpoint, financing patterns prevailing in a given country are an essential element of the financial system of this country; and differences in financial patterns which are consistent with other differences between the elements of the financial system elements of different countries suggest that it makes sense to speak of financial systems as coherent configurations of complementary elements. Indeed, the differences between the financing patterns of the three countries covered in this study are largely consistent with differences between the financial sector structure and the corporate governance regimes and several other financial system elements in these countries. As we have shown in another paper,[31] the issue of complementarity and consistency of financial systems is important for the questions of change and modernization of financial systems and of a possible convergence of financial systems.

The results of our paper point to a number of very interesting research opportunities. First and foremost, it would be interesting to see similar analyses of financial patterns of other countries emerge. Since our study covers countries for which one can assume that the basic characteristics of their financial systems are largely stable, we would particularly recommend to investigate how

[31] See Schmidt et al. (2002), where references to related studies covering other elements of financial systems and issues of financial systems development are provided.

financial patterns develop in countries, such as France, in which the character of the financial system has undergone a massive transformation in the course of the last 20 years. It would be equally fascinating to learn more about the way in which non-financial firms finance their investments in countries like the Netherlands whose financial systems cannot as easily as the U.S., Japan and Germany be classified as being either bank-based or capital market based.

Another implication for further research refers to the broader context and to the methodology of comparative work on financial systems. The results reported in this paper suggest that it is indeed promising to continue this line of research not only on a mainly theoretical level, as in the book by Allen and Gale (2000) and their related papers (e.g. Allen and Gale 2001), but also at the empirical level. This research strategy seems to require the development of relatively sophisticated measurement methods as well as country studies which investigate in depth how the various elements of a given financial system interact and mutually determine each other.

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Table 1

Illustration of alternative measurement concepts

In the table, financing patterns are derived for a model economy with three firms. Panel A shows annual financial flows, annual financial flows as a percentage of investment and year-end levels on a firm-level. Panel B shows the corresponding sector aggregates for each of the three periods as well as averaged over all three periods.

	Panel A									**Panel B**			
	Firm A			Firm B			Firm C			All firms			
Period	1	2	3	1	2	3	1	2	3	1	2	3	∅ 1-3
Investment	-20	-5	-5	-5	-20	-5	-5	-5	-20	-30	-30	-30	-30
Flows													
Internal sources	10	10	10	10	10	10	10	10	10	30	30	30	30
Liquid assets													
Purchases (gross)				-5			-5	-5		-10	-5	0	-5
Sales (gross)					5				10	0	5	10	5
Net flows				-5	5		-5	-5	10	-10	0	10	0
Debt													
Financing (gross)	10				5					10	5	0	5
Repayments (gross)		-5	-5			-5				0	-5	-10	-5
Net flows	10	-5	-5		5	-5				10	0	-10	0
Flows over investment													
Internal sources	0.5	2	2	2	0.5	2	2	2	0.5	1	1	1	1
Liquid assets													
Purchases (gross)				-1			-1	-1		-0.33	-0.17	0	-0,17
Sales (gross)					0.25				0.5	0	0.17	0.33	0,17
Net flows				-1	0.25		-1	-1	0.5	-0.33	0	0.33	0
Debt													
Financing (gross)	0.5				0.25					0.33	0.17	0	0,17
Repayments (gross)		-1	-1			-1				0	-0.17	-0.33	-0,17
Net flows	0.5	-1	-1		0.25	-1				0.33	0	-0.33	0
Levels													
Liquid assets				5			5	10		10	10	0	6.7
Debt	10	5			5					10	10	0	6.7
Equity	5	5	5	5	5	5	5	5	5	15	15	15	15
Leverage	0.67	0.5	0	0	0.5	0	0	0	0	0.4	0.4	0	0.27

Table 2

The role of external financing according to different measurement approaches

The ratios indicate the role of external financing in the model economy from Table 1 based on different measurement concepts. Columns two and three refer to panel A in Table 1 and column four refers to panel B. Leverage is defined as debt levels over the sum of debt and equity levels. External gross inflows and external net flows are defined as gross flows from taking on new debt over investment and net flows from taking on and repaying debt over investment, respectively. Internal funds are also expressed as a fraction of investment. Averages for all ratios based on flow figures are weighted by the respective investment volume. The "spike" column shows weighted averages of the four ratios for the three company years in which investment amounts to 20 (Mayer/Sussman (2002) use exactly this approach to analyze financing patterns). The next column shows ratio averages for all nine company years. The last column is based on aggregate sector data and hence corresponds to the very last column of Table 1.

	Company accounts (weighted averages)		Sector accounts
	Spike years	All years	
Gross inflows from liabilities	25.0%	16.7%	16.7%
Net inflows from liabilities	25.0%	0%	0%
Leverage (unweighted)	38.9%	18.5%	26.7%
Memo:			
Internal funds (gross = net)	50%	100%	100%

Table 3

Net sources of finance as a percentage of physical investment (1970-1994)

Net Source of Finance	Germany	Japan	United Kingdom	United States
Internal	78.9	69.9	93.3	96.1
Bank finance	11.9	26.7	14.6	11.1
Bonds	-1.0	4.0	4.2	15.4
New Equity	0.1	3.5	-4.6	-7.6
Trade Credit	-1.2	-5.0	-0.9	-2.4
Capital Transfers	8.7	-	1.7	-
Other	1.4	1.0	0.0	-4.4
Statistical adjustment	1.2	0.0	-8.4	-8.3

Source: Corbett/Jenkinson (1997)

Table 4

Gross flows from internal and external sources as a percentage of physical investment (1970-2000)

The table shows the unweighted averages of annual gross flows from different financing sources as a percentage of annual physical investment. Internal fund figures were directly taken from the German and the US Flow-of-Account Statistics and from the financial statements statistics of corporations that is provided by the Japanese Ministry of Finance. For the US depreciation and capital transfers include inventory valuation adjustments. If net flows into pension provisions are included for German firms. the portion of total internal funds increases to 88 percent. Gross long-term external funds are broken down in Table 5. Short-term funds comprise of debt instruments from financial institutions with maturities shorter than one year. trade payables and commercial paper. For net flows annual changes in the levels of the corresponding liability items have been used. Double netting figures result from subtracting liability net flows from net flows in the corresponding asset items. Based on the assumption that all short term funds have an average maturity of one year aggregated levels of short-term liabilities were used as a proxy for short-term gross flows. Therefore the numbers in the last row must be viewed as the lower bound for the true share of gross short-term funds in physical investment.

	Germany	Japan	United States
Retained earnings	3%	20%	13%
Depreciation and capital transfers	80%	57%	74%
Total internal funds	83%	77%	87%
Total long-term external funds (gross)	55%	144%	64%
Memo:			
Total short-term external funds (gross)	168%	768%	240%
Total short-term external funds (net)	11%	49%	18%
Total short-term external funds (double netting)	-5%	-7%	-1%

Table 5

Composition of external financing (1970-2000)

Figures are unweighted averages of annual shares of single instruments in total gross flows and add up to 100 percent (neglecting rounding errors). Long-term loans comprise all loans from financial institutions with a term to maturity exceeding one year. In contrast to the Deutsche Bundesbank and the Bank of Japan which both distinguish explicitly between loans from banks and other financial institutions the Federal Reserve does not report the sectoral breakdown for long-term debt instruments of the nonfinancial business sector (L.101). We used the corresponding instrument tables L.216-L.221 of the US Flow of Fund Accounts which show overall market shares of creditor sectors in the market for mortgages and other loans and advances to derive the portions granted by banks (48 percent of mortgages and 10 percent of other loans and advances) and other financial institutions. respectively. Underlying annual gross flows from the issuance of bonds and new equity are the same as in Figures A1 and A2. respectively.

	Germany	Japan	United States
Long-term bank loans	76%	78%	18%
Long-term loans from other financial institutions	10%	8%	38%
Bonds	7%	9%	32%
Equity	8%	5%	11%

Table 6

Portions of long-term external sources in total long-term external gross flows

This table is similar in construct to Table 5 but shows 5-year unweighted averages (6-year average for the most recent period) of annual shares in total external financing for each of four different external sources. Neglecting rounding errors. the figures add up to 100 percent for each country and each 5-year period.

	70-74	75-79	80-84	85-89	90-94	95-00
Japan						
Long-term bank loans	79%	79%	79%	75%	81%	74%
Long-term loans from other financial institutions	8%	9%	8%	7%	8%	9%
Bonds	7%	8%	6%	11%	9%	15%
Equity	7%	5%	6%	6%	2%	2%
Memo:						
Internal funds as a portion of investment	52%	76%	72%	81%	72%	98%
Germany						
Long-term bank loans	75%	74%	77%	72%	76%	74%
Long-term loans from other financial institutions	12%	11%	10%	10%	7%	8%
Bonds	7%	7%	5%	9%	9%	8%
Equity	7%	7%	7%	9%	8%	10%
Memo:						
Internal funds as a portion of investment	71%	87%	83%	92%	83%	83%
United States						
Long-term bank loans	22%	21%	21%	20%	11%	14%
Long-term loans from other financial institutions	42%	45%	47%	35%	31%	34%
Bonds	27%	28%	22%	38%	45%	34%
Equity	9%	6%	9%	7%	13%	19%
Memo:						
Internal funds as a portion of investment	72%	83%	84%	92%	99%	90%

Table 7

Average years to maturity of debt instruments (1970-2000)

The table shows average maturities of debt instruments as they are used throughout this paper. For the sake of simplicity we followed Baker/Wurgler (2000) in assuming that all short-term debt instruments like short-term bank loans. trade credit or commercial paper have a one-year average maturity. This assumption only affects the row "total short-term external funds (gross)" in Table 4 but none of our main results. Average terms to maturity for bonds in all three countries and for long-term loans in Japan were derived by counting lags between cumulated actual gross inflows and cumulated actual gross outflows. The resulting figure for bonds issued by US firms is close to the mean maturity of 12.2 years that was found by Guedes/Opler (1996. Table III) for their sample of 7.369 debt issues of US firms between 1982 and 1993. Average maturities for loans to German und US firms were derived from data provided by the Deutsche Bundesbank and the Federal Reserve. respectively (refer to Figure A3 for further details). According to data from the US Flows of Funds Statistics 48 percent of mortgage loans and 10 percent of other loans and advances were granted by banks during our observation period. with the remainder stemming from domestic and foreign non bank financial institutions. We used these portions to translate average maturities for mortgage loans (12 years) and average maturities of other loans and advances (5 years) into average maturities of loans from banks and loans from other financial institutions. The implied average maturity of all long-term debt of US firms is 9.9 years. which almost coincides with the estimate of 10 years that Baker et al. (2002) use in their study.

	Germany	Japan	United States
Short-term debt	1	1	1
Long-term bank loans	6.1	3.4	11.1
Long-term loans from other financial institutions			8.2
Bonds	7.1	8.1	11.7

Table 8

Reconciliation of financing structures and financing patterns (1970-2000)

Columns denoted by "Levels" break down total liabilities of non-financial company sectors in Germany. Japan and the US. Items such as tax payables. pension provisions and other miscellaneous liabilities have been omitted to improve comparability. Equity is at nominal value to avoid distorting valuation effects. Equity levels at nominal value are only available for the Japanese company sector. The German and US time series were obtained by cumulating (nominal) net flows from equity issuances. equity retirements and retained earnings. Doing the same with Japanese data yields a times series that traces nominal levels fairly close (average deviation is less than 2 percent). Columns denoted by "Adj. flows" show the breakdown of maturity-adjusted external gross flows. Because average maturities of equity instruments are unknown equity portions from the "level" columns were used. The portions for all other external sources were obtained by standardizing the corresponding figures in Tables 4 and 5 with a standard maturity. i.e. by multiplying the share in total gross financing by the respective average maturity from Table 6 and dividing it by the stipulated standard maturity. By taking the equity portion as given we have implicitly chosen the implicit average maturity of equity as the standard maturity. The alternative use of the average duration of asset lives for the standard maturity (Guedes/Opler 1996) report an average asset life of 8 years for US firms) or of any other number would not change the relation between portions of non-equity sources. Figures in columns add up to 100 percent (neglecting rounding errors).

	Germany		Japan		United States	
	Levels	Adj. flows	Levels	Adj. flows	Levels	Adj. flows
Short-term debt	27%	25%	49%	46%	27%	24%
Long-term bank loans	37%	38%	22%	23%	10%	11%
Long-term loans from other financial institutions	5%	5%	2%	2%	16%	16%
Bonds	3%	4%	5%	7%	18%	20%
Equity (nominal value)	28%		22%		29%	

Figure 1

Gross and net flows from loans for equipment funds to Japanese firms (1970-2000)

The figure shows true quarterly gross inflows (black line) and true net flows (dotted line) from new industrial loans taken out by Japanese firms and compares them to estimated gross flows (gray line) as implied by equation (4). As inputs for equation (4) we used time series on true levels and average maturities as implied by counting lags between times series on accumulated gross inflows and outflows (see Figure 2 below). True gross flows. net flows and level data were taken from tables 13-19 and 13-24 of the Japanese Statistical Yearbook. The dimension of the vertical axis is 100 million yen.

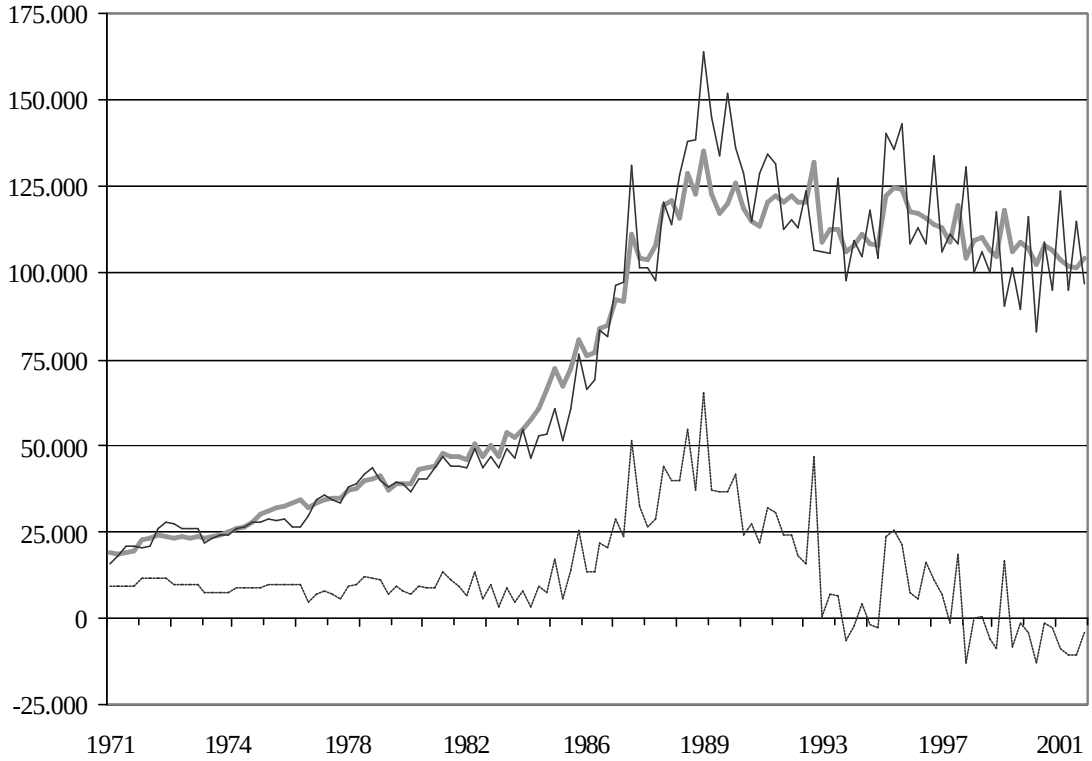


Figure 2

Implied average maturities (in quarters of a year) of Japanese loans for equipment funds (1971-2001)

The dotted line indicates average maturities of loans for equipment funds as implied by entering true gross flows and true level data into equation (5). The gray line results from counting the number of quarters until cumulative loan repayments catch up with cumulative inflows from new loans and hence plots estimated average maturities. Data sources are the same as for Figure 1. Because the method of counting lags stops to produce values after III/1997 we assumed that average maturities for the last 17 quarters are equal to the last implied value (17).

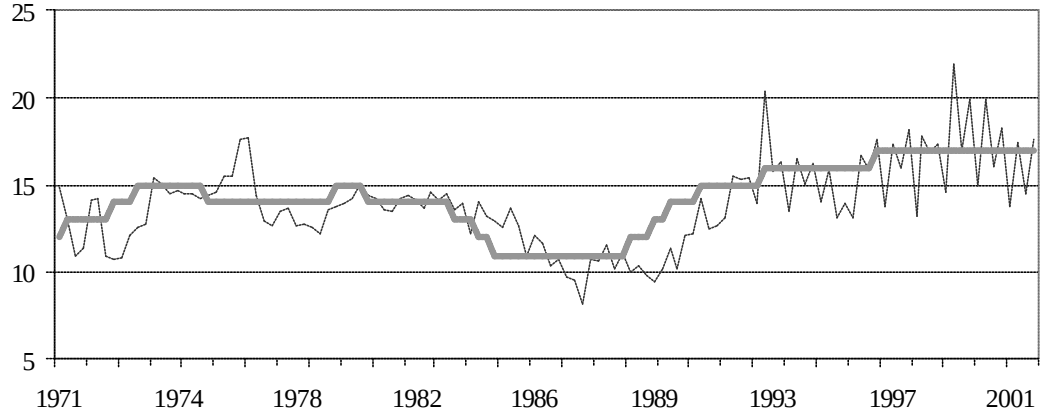


Figure A1

Gross flows from the issuance of new equity as a percentage of physical investment

The figure shows gross flows from the issuance of new equity as a percentage of total capital expenditures of private non-financial companies in Germany. Japan and the U.S. For Japanese and German companies. we used net flow figures from National Accounts Statistics because the reported net flows are almost identical to actual gross flows from other publications. which. however. cover only part of our entire observation period. The series "Supply of Industrial Funds" (11-18) from the Japanese Statistical Yearbook provides true gross flows from equity instruments only for the years 1960 to 1984. Accumulated amounts raised through the issuance of new equity as reported in the yearbook exactly match accumulated amounts raised as indicated by the net flows from the National Accounts. Likewise. net flows reported in the German flow-of-funds statistics actually correspond to data on the issuances of new equity by domestic non-financial corporations which are provided by the Bundesbank through its capital market statistics. Only the 1998-figure had to be adjusted for the distorting effect of the Daimler-Chrysler merger. In contrast to the Japanese and German authorities. the Federal Reserve reports flows from equity instruments on a true net basis. that is after subtracting equity retirements due to share repurchases and cash financed mergers. Between 1995 and 2000 alone. $819 billion in outstanding equity was retired by US corporations. implying negative net flows for all six years. For US firms. amounts raised through equity issuances were hence obtained from Security Data Corporation's Platinum database. which reports all US transactions on a deal-by-deal basis. For all three countries. proprietors' investments into non-corporate businesses were not included because of differences in compilation methods across countries and missing data for earlier years.

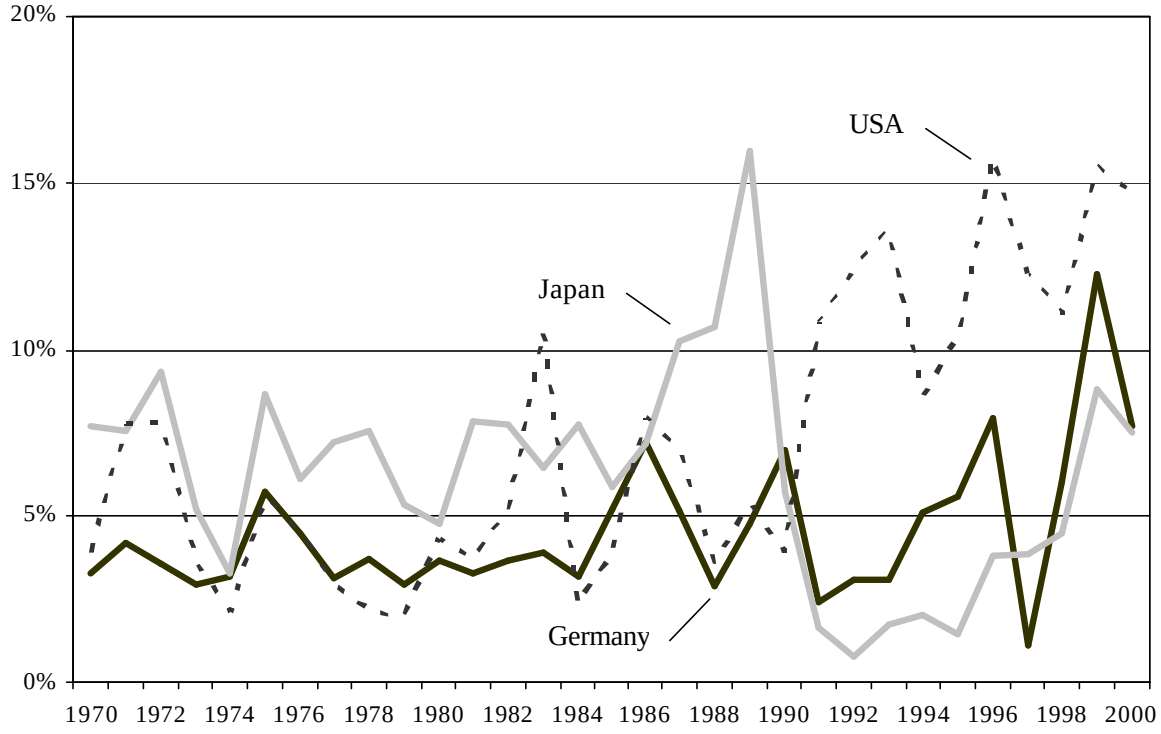


Figure A2

Gross flows from the issuance of bonds as a percentage of physical investment

The figure shows gross flows from the issuance of domestic and external bonds as a percentage of total capital expenditures of private non-financial companies in Germany. Japan and the U.S. Gross issuances of domestic industrial and convertible bonds by Japanese companies were directly taken from the Japanese Statistical Yearbook (11-23). Annual amounts raised through external bonds had to be estimated by entering level and maturity data into equation (4). Levels are reported in the Japanese National Accounts (external bonds accounted on average for 19 percent of total bonds outstanding between 1970 and 2000). To obtain average maturities we assumed that external bonds have the same average maturity as domestic bonds for a given year. Average maturities for domestic bonds were derived by counting lags between cumulative gross inflows and cumulative gross outflows from domestic bonds (see section IV B). The Deutsche Bundesbank reports in its capital market statistics annual gross flows from the issuance of domestic corporate bonds as well as annual gross flows from all international issuances underwritten by consortia that were led by German financial institutions. The portion of international issuances that pertained to German non-financial companies and their foreign subsidiaries is not reported. Corresponding gross flows were hence again estimated by applying equation (4). Level data was obtained by subtracting the volume of outstanding domestic corporate bonds as reported in the capital market statistics from the total level of long-term marketable debt as reported in the German National Account Statistics for the same year. Average maturities were derived by counting lags between the two cumulative gross flow time series from all international issuances. We thereby assumed that average maturities of bonds of German corporations coincide with average maturities of international debt issued by other debtors. Data on annual long-term debt issuances by US corporations were obtained from Securities Data Corporation (SDC) and from various issues of the Bulletin of the Federal Reserve. series 1.45. Because coverage of the SDC database was apparently not exhaustive in the earlier years. we used Federal Reserve data until 1981. For the subsequent years we used SDC figures which cover external debt and medium term notes and exceeded Federal Reserve figures considerably in some years. Gross flows from industrial revenue bonds (municipal securities issued by state and local governments to finance private investment and secured by the industrial user of funds) were not available from either of the two data sources and hence had to be estimated by means of equation (4). Levels were taken from National Account Statistics and maturities were assumed to be identical to those of corporate bonds. Again. maturities for corporate bonds were obtained by counting lags.

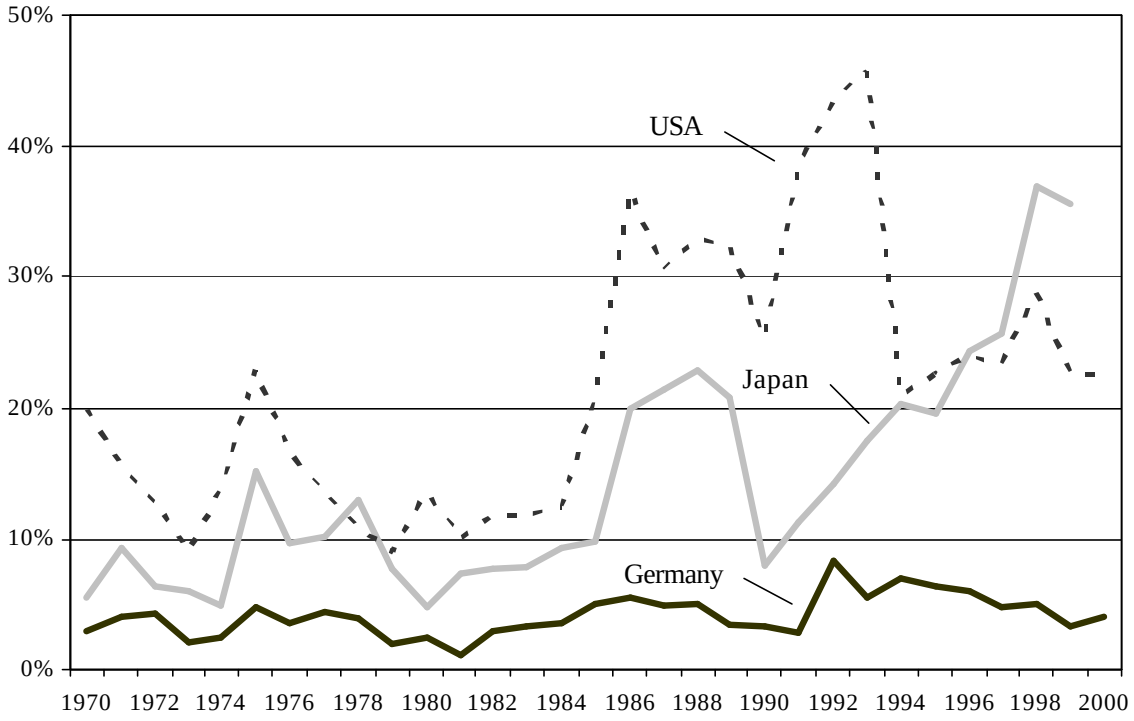
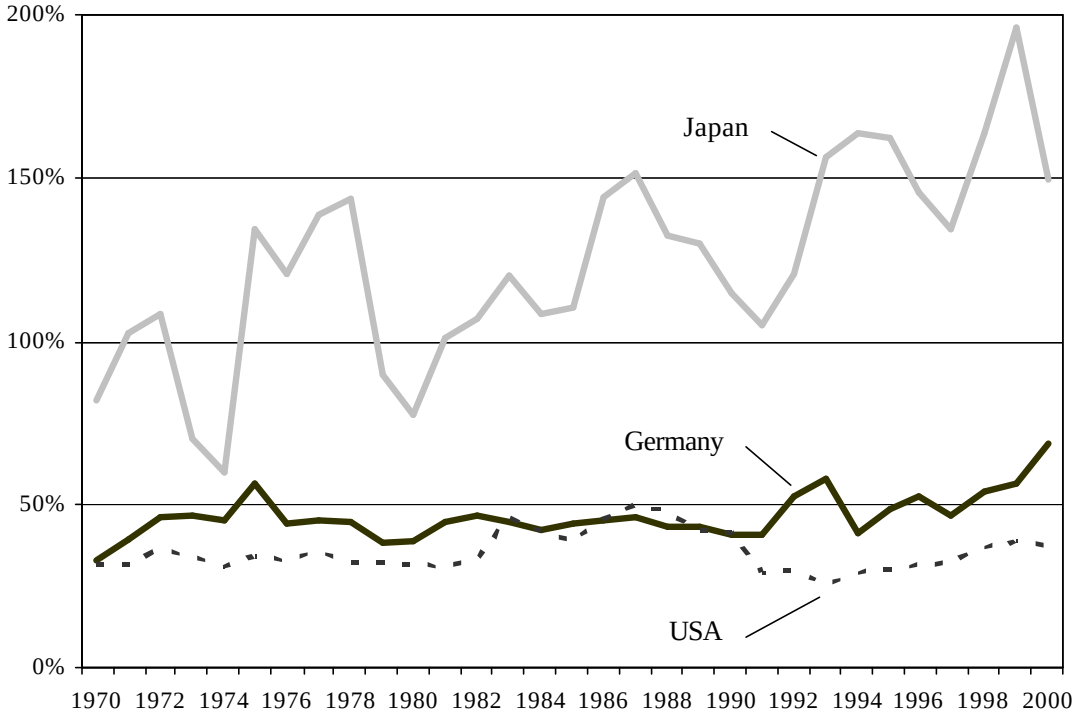


Figure A3

Gross flows from long-term loans as a percentage of physical investment

The figure shows gross flows from long-term loan financing as a percentage of total capital expenditures of private non-financial companies in Japan. Germany and the U.S. Long-term loans to Japanese firms comprise of bank loans for equipment funds and other long-term loans that also include loans from other financial institutions (available from the Financial Statements Statistics of Corporations of the Ministry of Finance. series "long-term other borrowings"). Data on gross flows for equipment funds were directly taken from the statistical yearbook published by the Statistics Bureau of the Japanese Ministry of Public Management. Home Affairs. Posts and Publication (series 11-19 (through 1984) and series 13-24 (from 1985)). Gross flows for all other types of long-term loans. which accounted for roughly 35 percent of total loans between 1970 and 2000. were estimated by means of equation (4) and based on the assumption that the average maturities in both loan categories are identical for the same time interval. Gross flows for German and US firms were also estimated by entering level data and maturity estimates into equation (4). Maturity estimates for loans to German firms were derived from the monthly bank statistics of the Deutsche Bundesbank. which distinguishes between loans with original maturities below and above 4 years (since 1998 a threshold of 5 years is used). Assuming average maturities of 2.5 years and 7 years. respectively. for the two categories yields an overall average maturity of 6.1 years. In its Flows of Funds Accounts the Federal Reserve groups both levels and net flows of loans to US firms into three categories: "bank loans not elsewhere classified". "mortgages" and "other loans and advances". The quarterly surveys of terms of business lending (statistical release E.2 of the Federal Reserve) which show weighted average maturities of all commercial and industrial loans that were granted by a sample of domestic and foreign commercial banks during a specified 5-day interval. indicate that loans in the first category have an average maturity of about one year. We hence treated them as short-term instruments. Most US mortgage loans amortize over 20-30 year periods. but usually require balloon payments after 10 to 15 years. Their average maturity should be comparable to mortgage bonds. According to data from Guedes/Opler (1996) the average maturity of 1.153 mortgage bonds that were issued by US corporations between 1982 and 1993 was 21 years with the average duration being close to 8 years. Data from the Security Data Corporation for the years 1970-2000 confirms this range. Based on this evidence we used a constant 12-year average maturity for mortgage loans to estimate the corresponding gross flows. During our observation period loans from finance companies accounted for almost two thirds of "other loans and advances". The remainder was contributed in about equal portions by foreign entities on the one hand and other domestic financial institutions such as banks. savings institutions and ABS issuers on the other hand. In its statistical release G.2 the Federal Reserve reports average maturities only for auto loans. Averaging over the years 1985-2000. for which maturity data was available. we arrive at an average maturity for auto loans of roughly 5 years. Therefore we applied a constant average maturity of 5 years to derive gross flows from "other loans and advances".



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Kontaktadresse für Bestellungen:

Professor Dr. Reinhard H. Schmidt
Wilhelm Merton Professur für
Internationales Bank- und Finanzwesen
Mertonstr. 17
Postfach 11 19 32 / HPF66
D-60054 Frankfurt/Main

Tel.: +49-69-798-28269
Fax: +49-69-798-28272
e-mail: rschmidt@wiwi.uni-frankfurt.de
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