



THE WILLIAM DAVIDSON INSTITUTE
AT THE UNIVERSITY OF MICHIGAN BUSINESS SCHOOL

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Evidence from a Survey of Large Privatised Companies in
Hungary and Poland***

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William Davidson Institute Working Paper Number 666
March 2004

Ownership Characteristics and Access to Finance: Evidence from a Survey of Large Privatised Companies in Hungary and Poland

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This version: 3 December 2003

Abstract

We examine financial constraints and forms of finance used for investment, by analysing survey data on 157 large privatised companies in Hungary and Poland for the period 1998 – 2000. The Bayesian analysis using Gibbs sampling is carried out to obtain inferences about the sample companies' access to finance from a model for categorical outcome. By applying alternative measures of financial constraints we find that foreign companies, companies that are part of domestic industrial groups and enterprises with concentrated ownership are all less constrained in their access to finance. Moreover, we identify alternative modes of finance since different corporate control and past performance characteristics influence the sample firms' choice of finance source. In particular, while being industry-specific, the access to domestic credit is positively associated with company size and past profitability. Industrial group members tend to favour bond issues as well as sells-offs of assets as appropriate types of finance for their investment programmes. Preferences for raising finance in the form of equity are associated with share concentration in a non-monotonic way, being most prevalent in those companies where the dominant owner holds 25%-49% of shares. Close links with a leading bank not only increase the possibility of bond issues but also appear to facilitate access to non-banking sources of funds, in particular, to finance supplied by industrial partners. Finally, reliance on state finance is less likely for the companies whose profiles resemble the case of unconstrained finance, namely, for companies with foreign partners, companies that are part of domestic industrial groups and companies with a strategic investor. Model implications also include that the use of state funds is less likely for Polish than for Hungarian companies.

JEL classification: G32, P31, P34, F23, L33

Key words: financial constraints, investment, enterprises, foreign ownership, industrial groups, concentrated ownership, leading bank, proportional-odds model, Bayesian updating.

* The survey was financed by the European Commission (Phare ACE Programme P98-1048-R) and the coding and preparation of the dataset by the MC Grabowski Fund. We express our gratitude to the sponsors. We also take exclusive responsibility for all the opinions expressed in this study. We are indebted to Igor Filatotchev and Piotr Kozarzewski who co-authored the questionnaire, to Piotr Kozarzewski and Peter Vince for their excellent work supervising the surveys and to Kate Bishop and Beata Monthey for their work on the preparation of database.

1. Introduction

The measurement and determinants of financial constraints is a highly debated issue in the finance literature. The existence of financing constraints has implications for investment, financial system stability and economic development. Moreover, understanding factors shaping access to finance is of great importance for informing decisions supporting the process of market-oriented reforms. Financing constraints and access to finance generally refer to the notion of availability of external finance and hierarchy of finance, where “internally generated finance for investment is available at lower cost than external finance.” That contrasts with the earlier neoclassical model of investment, “in which firms have access to unlimited sources of investment at an exogenously given cost” (Bond and Meghir, 1994, p.197).

A large body of empirical evidence on the underlying multidimensional phenomenon relies on imperfect proxies, rendering inference vulnerable to alternative interpretations and criticism. The nature of studies describing and explaining financing constraints faced by the firms in the undergoing institutional change transition economies, where capital markets are underdeveloped and financial systems are ‘bank-oriented’, appears even more complex than that of investigations of financing options and budget constraints in firms in the high-income economies. Several arguments are advanced in the literature as explanations of the differences in financing structures. First, the transition economics literature notes a greater role of funds supplied by domestic industrial-financial groups and foreign direct investors for overcoming firms’ constraints in access to finance. Second, given nascent capital markets with thin trading in corporate securities and inadequate protection of minority shareholders under prevailing corporate governance structures and practices, ownership concentration can be offered as a partial explanation for financing constraints faced by transition firms. However, the direction of the impact of concentrated ownership on access to finance may vary. While company financiers may believe in gains of better monitoring provided by concentrated ownership, they are also likely to appreciate that such positive effects can be negated by the costs attributable to the agency problem resulting from concentrated equity holdings. The latter problem arises if for dominant equity holders, the entrenchment effects outweigh the incentive effects (Jensen and Meckling, 1976).¹ Third, in transition economies, government sponsored finance tends to play a

¹ In addition, the finance literature stresses that in closely held firms, adequate monitoring by lenders is difficult and costly because the information asymmetries result in the agency problem of equity. When a company with limited

role in relaxing financial constraints for some companies, with the effect not necessary being efficiency enhancing.

Our reading of the literature suggests that the issue of understanding financing constraints, especially in the context of transition economies, is calling for new operational measurements of the multidimensional concept and for more sophisticated empirical design employing survey instruments. In this study we contribute to the literature by constructing new indicators designed to exploit information on large industrial firms to identify the relative importance of firm-level and industry-level factors on access to and choice of financing sources over a recent period in a survey sample. We find that the presence of financing constraints is associated with the degree of ownership concentration. It also depends on ownership structures and is modified by ties with a leading bank. Moreover, by examining various types of financing, we show that avenues for overcoming financial constraints are determined by the foreign investor' interest in the firm. Specifically, the range of finance sources accessible to domestic companies differs from that available to firms with foreign ownership. The results also suggest that access to finance is influenced by company size and industry sector. We conduct an analysis of the survey data on large privatised industrial firms by using the Bayesian approach, which allows a more natural interpretation of parameter credible intervals and provides finite sample inference on the determinants of access to finance. Section 2 of this paper discusses the rationale for the choice of Hungary and Poland. Section 3 reviews the theoretical literature and some empirical results on financing constraints and addresses the relationship between firm- and industry-level factors and availability of external finance. Section 4 deals with design of the interview survey and the sample. Section 5 discusses the methodology for data analysis, while results are reported in Section 6. Section 7 concludes.

liability becomes financially distressed, equity takes on 'call option' characteristics (Black and Scholes (1973), Merton (1974)) and most downside costs will be born by creditors. That might provide an incentive and opportunity for the owners to misrepresent investment risks and returns and to take riskier actions than they would be willing to take in the absence of limited liability.

2. Why Hungary and Poland?

One particular problem related to financial constraints is that their economic implications may be very different, as they are affected by the nature of the financial environment. Relaxing financial constraints is beneficial only when the resulting allocation of funds is efficient. In particular, in the case of ‘soft budget constraints’ (Kornai 1986, 2001), the outcome may have the negative implications for the stability of financial systems, and for the overall macroeconomic stability. This argument was accentuated in a seminal contribution by McKinnon (1993), who argues that in the early phase of transition (liberalisation), i.e. before the financial systems consolidate, it is beneficial to impose hard financial constraints on industrial companies, restricting their access to external finance. This may be the only feasible second-best solution, as the financial sector stability remains a priority.² Moreover, empirical evidence on economic growth in transition indicates that in the early phase, large productivity gains were available without high levels of investment, as documented by available empirical estimates of the growth functions.³

These considerations have important implications for our choice of the sample. Firstly, we wish to focus on the countries and periods of time, which represent a sufficiently advanced stage of reforms and restructuring processes when investment becomes again a critical factor in restructuring and productivity enhancement. That justifies our choice of Hungary and Poland and our specification of mid 2001 as the relevant time period for conducting a questionnaire-based survey. All existing evidence points out that at the beginning of the new millennium, these two countries no longer suffered from soft budget constraint problems widespread in some other transition economies. Where the problems persist, these are mostly restricted to the residual state-owned sector in branches such as mining and heavy industry (Driffill and Mickiewicz, 2003). As our sample frame is restricted to privatised companies, majority of the soft budget constraint cases is eliminated by default.

The choice of Hungary and Poland is advantageous from another point of view. Both countries are characterised by variation in industrial structures and finance sources. Unlike in most transition economies, capital markets function relatively well. In particular, since the early

² A dissenting view is implied by Calvo and Coricelli (1992). They argue that the excessive financial constraints played a critical role in the early ‘transitional recession’. See also Campos and Coricelli (2002) for more recent overview.

1990s, the Warsaw Stock Exchange was unique in the region as a viable source of new capital, while in other countries, the stock exchanges were only used for privatisation related floatations (Glaeser *et al.* 2001). Yet, in a more recent period, the performance of the Budapest Stock Exchange has not been different, or has even been better than that of the Warsaw Stock Exchange.

The reverse logic applies to foreign direct investment. Hungary was a single transition country that became open to foreign direct investment very early, and by now records very high levels of foreign ownership in its enterprise sector. In this respect, Poland was initially lagging behind, and acceleration in inflow of foreign capital dates from mid 1990s. By now Poland has a significant foreign-owned industrial sector.

Furthermore, in some countries, the privatisation process was completed with a dominant role played by one privatisation method. Examples of that situation are provided by mass privatisation programmes in Czech and Slovak republics, or mass privatisation with significant concessions to insiders in Russia. Yet in both Hungary and Poland, privatisation was completed by a variety of methods leading to diversified ownership and control structures.⁴ That makes these two countries an ideal ground for testing hypotheses related to ownership and control structures. Moreover, as ownership structures and company types were strongly affected by recent policy choices of privatisation methods, they are less prone to the Demsetz-type critique (Demsetz and Lehn 1985; Demsetz and Villalonga 2001). That is, the period of time since the privatisation process was completed may be too short to establish some equilibrium on the corporate control markets, where inefficient types of ownership structures are eliminated, in which case one should not expect any systematic differences in performance between different types of firms. Indeed, corporate control markets in transition economies are far from this hypothetical equilibrium, as empirical studies demonstrate consistent differences in performance between various ownership types (see Djankov and Murell 2002 for an overview of empirical evidence).

Summarising, our choice of the two countries is motivated by the fact that they are both characterised by diversity, not only in the available sources of finance, but also in terms of

³ See for instance Christofferson and Doyle (2000), Havrylyshyn and van Rooden (2003). An overview is offered by Campos and Coricelli (2002).

⁴ See Mickiewicz and Baltowski (2003) and Major (2003) for recent overviews of the Polish and Hungarian privatisation programmes, correspondingly.

ownership and corporate control structures. The latter characteristic is shared with some other transition economies and makes Hungarian and Polish companies a representative group of firms providing information necessary for exploring empirically differences in the enterprise behaviour related to investment financing.

3. The theoretical setting and empirical evidence on the determinants of access to finance

Financial constraints

The nature of the link between financing constraints and investment is a highly debated issue in the literature on finance and investment. One strand of the literature shows that high sensitivity and positive response of investment to cash flow can be interpreted as evidence of financial constraints and demonstrates an empirical link with the likely predictors of credit constraints. In particular, some researchers classify firms on the basis of dividend- payout behaviour (Fazzari *et al*, 1988), association with banks or business groups (Hoshi *et al*, 1991), ownership (Lizal and Svenjar 2002, among others) and firm size (see Schiantarelli 1996 and Hubbard 1998 for reviews of all but most recent literature). One seminal example of this approach is Bond and Meghir (1994), who develop a model incorporating the hierarchy of finance, relying on both dividend behaviour and issue of new shares. The investment behaviour of firms should differ across different financial regimes. Bond and Meghir (1994) argue that the following two types of companies may be identified as not being financially constrained:

/i/ those, which pay dividends, which indicates that they can generate abundant internal funds in relation to perceived investment opportunities, and

/ii/ the companies, which issue new stock to finance investment, i.e. have access to capital market finance.

In between those two categories, one observes the third category of companies, which neither pay dividends nor finance new investment by issuing new shares. These companies are liquidity constrained in the sense that ‘a windfall addition to current earnings, which conveys no information about the firm’s future prospects, will result in an increase in investment’ (*Ibid.*, p.203). This group of firm may be characterised by excess reliance on internal finance for investment.

However, Kaplan and Zingales (1997 and 2000) and Cleary (1999) present empirical evidence intended to demonstrate that the ‘investment-cash flow’ link is not a useful measure of financial constraints, due to non-monotonicities. While their conclusions were in turn questioned by Fazzari *et al.* (2000), the debate has yielded inconclusive results. In particular, Kaplan and Zingales (2000) notice that some prominent companies, e.g., the likes of Microsoft, have high cash balances and avoid dividend payments, while investment remain very sensitive to changes in available cash flows. They notice that one explanation of this behaviour may relate to the so called ‘flypaper effect’, which is discussed by Hines and Thaler (1995). According to the latter authors, while “the distinction between having money on hand and being able to raise money without difficulty should have no impact on spending decisions”, in practice, “when it comes to predict the behaviour of governments, organisations and individuals, it is important to distinguish between the resources they have on hand and resources they could easily get” (*Ibid.*, pp. 224-225). Correspondingly, a larger volume of cash flow may lead to more investment. Consistent explanation of this type of behaviour is offered by an important strand of the literature originated by Jensen (1986), who proposed the “free cash flow” approach. According to this, managers maximise objectives, which are not in common with shareholders’ interests, with managers aiming to increase firm size, as this boosts their pay, status and power. Thus the cash flows that are at the disposal of managers after valuable/efficient investment is carried out, is “free cash flow”. Managers may then still take on more investment projects at the expense of shareholders, increasing firm size but at the cost of lower net present value. Consequently cash flow and investment may be positively related and this may explain the puzzling behaviour of firms like Microsoft.

Corporate control structures

If Jensen’s (1986) argument is correct, than the structures of corporate control should be considered when examining empirically investment financing. The investment behaviour may be affected because parameters of the objective function will vary and also because differences in corporate control structures impact on efficiency of aligning the objectives of insiders with those of providers of finance. Therefore, the characteristics of corporate control structures and identity of owners may correspond to the extent to which firms are hindered by information and incentive

problems in capital markets, and thus investment may have varying degrees of reliance on internal cash flows.

One important dimension of corporate control is ownership structure and concentration, while a typical feature of Hungarian and Polish firms is highly concentrated ownership structures. That follows from the characteristics of nascent capital markets and also can be explained by the fact that protection of minority shareholders is still much less adequate than in countries such as the US or the UK. Yet the effect of concentrated ownership on access to finance may be ambiguous, as the providers of finance may perceive positive effects of better monitoring, but on the other hand may see the negative effects related to agency problems. The latter may arise, where, for concentrated owners, the entrenchment effects outweigh the incentive effects (Jensen and Meckling 1976). Empirical evidence documents that the resulting impact of concentrated ownership may be nonmonotonic (a classic study being Morck *et al.* 1988; for the overview of the issue in the transition economies context, see Filatotchev and Mickiewicz 2001).

While characteristics both of firms and of institutional frameworks of capital markets differ across transition economies, different control structures may emerge as a second-best response to those conditions. One example of that relates to the degree of firms' affiliation to wider industrial conglomerates. Hoshi *et al.* (1991) examine whether liquidity is a more relevant determinant of investment for the Japanese firms which are affiliated to a *keiretsu* or industrial group with close links to banks, then for those firms which are independent of these alliances. Their main result shows that the liquidity variable - cash flow⁵, is more important for the independent firms, than for the firms affiliated to an industrial group and/or leading bank. Hall *et al.* (1998b) study the determinants of investment in scientific firms for the US, France and Japan (1979-89) and find that the links between investment, profit, sales and cash flow are idiosyncratic and country-specific. In the US, investment is more sensitive to cash flow, as compared to France or Japan. The authors argue that this observation reflects differences in corporate governance structures, which appear country-specific. Firms in the US do not enjoy close links with banks while Japanese firms do, so the cost of external finance maybe higher, forcing firms to rely more on internal funds. Degryse and de Jong (2000) also hypothesise that corporate governance will

⁵ Measured in their study by net (after tax) income plus depreciation, less dividend payments.

affect investment expenditure. While estimating investment equation, they interact a cash flow variable with the measures of corporate governance, such as board structure, ownership and bank relations. In their analysis they find that firm-bank relations and the size of the largest shareholder have no impact on investment. However, the size of insider equity increases the impact of cash flow upon investment. Galindo and Schiantarelli (2002) provide an overview of recent research on investment financing in Latin America, reporting evidence that firms with foreign ownership are less restricted in their access to finance. The result may not be general, as Colombo (2001) found no significant impact of foreign ownership on access to short-term debt finance for Hungary. More recently, Harrison and McMillan (2003) using a sample of firms taken from the Ivory Coast demonstrate that foreign companies are less credit constrained than domestic firms. Foreign ownership may be conducive to easier access to finance not just because of direct funding from foreign partners and greater availability of foreign sources of finance. Another reason may be that firms with some degree of foreign ownership enjoy less bankruptcy risk, as they adopt faster international standards on product quality and therefore find it easier to gain access to domestic bank debt (Colombo 2001; Harrison and McMillan 2003).

Firm size

Smaller companies may be constrained in their access to external finance (Keasey and Watson (1993), Jarvis (2000)). One possible explanation is that providers of finance incur fixed costs of evaluating the investment project. This condition alone will be sufficient to create a bias against smaller firms. Moreover, smaller firms tend to be subject to idiosyncratic risk, being less likely to have developed a good reputation with investors, as small firms are typically start-ups with no long credit history (Schiantarelli 1996; Colombo and Driffill 2003). However empirical evidence is mixed and again, the conclusions may be specific to particular countries or types of financial systems. Fazzari *et al.* (1988) investigate the link between firm size and access to capital and argue that in times of tight credit, small and medium-sized firms are often denied funds, in favour of better quality borrowers (p153). Gertler and Gilchrist (1994) show that there is a strong correlation between firm size and the scope for external financing: smaller firms rely on intermediary finance, while larger firms are not restricted in their access to capital market. Using firm-level data for US manufacturing companies, Bernanke *et al.* (1994) present strong empirical

evidence that the severity of the agency cost problem faced by firms depends on firm size. Lizar and Svejnar (2002) focus on enterprises in Czech Republic and in attempting to control for size, split their sample into sub-samples of large firms numbering 100 or more employees and of small firms with fewer than 100 employees. From this exercise they find evidence of credit rationing (i.e. a positive relationship between profit and investment) only for smaller, private firms. In contrast, larger firms in their sample have virtually unlimited access to capital implying a negative relationship between profit and investment for their data. However, contrasting results were obtained as well. For instance, Hu and Schiantarelli (1994) found that *ceteris paribus*, size is *positively* associated with the probability of the firm being financially constrained. Again, a possible explanation is that banks face a trade-off between higher evaluation and preparation costs for multiple small and medium size loans and higher risk resulting from a focus on smaller number of large projects.

The literature also notes the agency problem of equity peculiar to closely held firms. As already mentioned, information asymmetries make adequate monitoring of smaller firms by lenders difficult, because when a company with limited liability becomes financially distressed, equity takes on 'call option' characteristics (Black and Scholes (1973), Merton (1974)). That might provide an incentive and opportunity for the owners/insiders to misrepresent investment risks and returns and to take more riskier actions than they would be willing to take in the absence of limited liability.

To summarise, our reading of the literature is that, on balance, large firms should have lower agency costs per unit of external finance because of their greater diversification, longer track records, and because of economies of scale in collecting and processing information about their situation. This gives rise to the agency problem in credit markets for smaller firms who experience reduced access to credit relative to other borrowers.

Conclusions derived from this section

- Firms, which pay dividends and/or can rely in their investment finance on external sources, may be considered as not being financially constrained.⁶

⁶ A word of caution. Even if the conclusion is fairly standard, it needs a qualification. Namely, due to informational imperfections and the need for signalling, it might be that the firm ought to pay dividends even at the expense of foregoing a positive NPV investment opportunity.

- The relation between concentration of ownership and access to finance may be ambiguous, as the providers of finance may perceive positive effects of better monitoring, but on the other hand also the negative effects related to agency problems.
- We expect that less financially constrained firms are those, which are affiliates of foreign companies, which have close links with wider industrial structures, which have a leading bank, are which are of larger size.
- A corollary of the previous conclusion: firms belonging to corporate alliances such as foreign affiliates, affiliates of domestic industrial conglomerates, and enterprises established close links with their leading bank can use a wider range of available external finance sources to complement internally generated cash flows for investment programmes.
- It is likely that in some industry sectors companies with no access to these alternative sources of finance tend to resort to state support.

4. The survey sample

Method of Collecting Survey Data

In comparison with some other post-communist countries, especially the CIS countries, company accessibility for conducting a survey-based academic research in Poland and Hungary is relatively good, especially in the case of largest firms, which are generally more accustomed to openness than smaller enterprises. However, we note two problems. The first problem is the credibility of an investigator. Interview was the method of collection of information in our survey where opinions of chief executives regarding their firms' access to finance were sought alongside factual information. For a survey involving interviews where the desired information is likely to be divulged reluctantly, the selection of trained, experienced and credible investigators is crucial for obtaining the required data on firms and measuring attitudes of chief executive officers. It was important to ensure that owners, managers and employees of a participating company, trusted interviewers with information collected strictly for the purpose of academic research. The companies contributed to the surveys have also been given assurances as to complete anonymity in any form of the output resulting from the data analysis. Our face-to-face questionnaire survey of Polish and Hungarian companies involving interviews with the

companies' chief executive officers, was commissioned and conducted in mid 2001, respectively by the Research Department of the Polish Sociological Society (under supervision of the CASE Institute, Warsaw) and by the Hungarian Academy of Science. The Polish partners, CASE and the research department of the PSS, have extensive research experience in surveys at the company level. The Research Department of the Polish Sociological Society conducted the whole field phase of the survey study (training interviewer teams, collecting key company information, interviewing the firms' managers) as well as prepared initial data for further analysis. The team has conducted dozens of national and regional polls in companies of various legal types, industry sectors and ownership types. It has a stable network of professional interviewers, which covers the whole country. They are well aware of the situation in their regions, have huge experience of work with companies - both state-owned and private - and employ a range of techniques necessary for gaining entry into a company and gaining confidence of its personnel. In addition to methodological background, they also possess good practical knowledge about intra-company personal relations. Another strength of the team employed for conducting our survey is a comprehensive system of control used by the investigators at every stage of their work. Extensive experience in conducting surveys ensures high quality of their work. Similar assessments can be given in relation to quality of the survey work undertaken by the Institute of Economics of the Hungarian Academy of Science, a well-established economic research institute in Hungary with strong expertise in field surveys and data analysis.

The second problem is "sensitivity" of owners and managers of a company towards the questions tapping the information regarded as "confidential" or non-permissible on the grounds of protecting the competitiveness of a company. The questionnaire items which were initially seemed as being likely to evoke an adverse reaction related to ownership and control structures including the distribution of insider share-holdings; number of shares in the company held by interviewees; interviewees' positions in the company hierarchy; interviewees' participation in the Management Council and Supervisory Board, and interviewees' affiliations. Most reports dealing with past experience on this type of survey questions suggests that up to 10-15% of interviewees may refuse to co-operate and provide answers, irrespective of interviewer skills. The non-response rate for our interview survey was in the similar ballpark and can be considered satisfactory, however, item-non-response gave rise to the issue of choosing the appropriate missing data treatments in a subsequent data analysis. Fewer difficulties were encountered by our

investigators in relation to the questionnaire part dealing with financial performance and position of firms since, in both countries, company reports are available to external parties and under the adopted regulations large firms disclose sufficiently detailed accounting information which can be considered reliable.

In practice, item non-response due to confidentiality concerns did not occur, as care was taken to identify and eliminate possible sources of the problem at the time of questionnaire design and preliminary testing. However, given the time constraints of the interviewees, the missing answers arose due to the fact that some of the information was not readily available. That especially relates to the ownership dimension.

Care was taken to obtain a sample representative of the population of large companies. We defined the sample frame using large company lists, which are maintained by the two reliable, published databases. For Poland, we employed the list of 500 largest (in terms of sales) non-financial companies compiled by a team of Polish economists at the Institute of Economics of the Polish Academy of Sciences and published by the „Rzeczpospolita”, a top broad-sheet newspaper published in Poland, which covers finance and business law. A smaller database of large companies is available for Hungary, which reflects the fact that Hungary has fewer large firms. The list of the 200 largest companies is published annually by the ‘Figyelo’ magazine. These two lists representing the two countries were pooled together, producing a sample frame that was used to select the firms for the survey at random. At the first stage of the Polish survey, 84 questionnaires were completed,⁷ and questionnaires on further 16 companies were obtained during the second stage after additional sampling. The survey of Hungarian companies generated 57 usable questionnaires, yielding the total sample size of 157 firms. The survey results were additionally checked via re-sampling by using a sample of questions from the set of surveyed companies (10 companies for Poland, 5 companies for Hungary). No inconsistencies in answers were detected.

The questionnaire⁸ opens with the questions concerned with the key company characteristics, including sectoral affiliation, legal status, and date of privatisation (Section A).

⁷ Descriptive discussion of the results from this part of the survey is provided by Kozarzewski (2002).

⁸ The questionnaire is available on request from the authors.

Section B contains questions designed to measure a number of performance and financial position variables for three years prior to the survey (i.e. for 1998-2000). Section C deals with questions on finance. In section D we asked questions on employment, wage setting and industrial relations. Section E relates to internationalisation and market structures. Section F covers the areas of corporate governance and ownership structure. Points covered in this section of the questionnaire and in the sections dealing with finance and performance provide the information with which we investigate the issue of access to finance in this paper.

A Description of the Sample and Coverage of the Questionnaire

Definitions of variables and their descriptive statistics are presented in Tables 1-2. 95% of companies are drawn from the manufacturing sector, with 5% being in either services or construction. The cross-sector boundaries tend to be blurred as a trend towards changing affiliation from manufacturing to services is generally observed since the liberalisation / transition programme was introduced at the beginning of the 1990s. Some of the sample firms are active in both manufacturing and services (trade in particular). Median employment values are 596 for Poland and 542 for Hungary, but the distributions are skewed due to the presence of few very large companies, especially in the Hungarian sub-sample, where the largest company had 15599 employees at the end of 2000. For that reason the mean employment values are higher than the medians for both sub-samples, being 907 for Poland and 1403 for Hungary. Distributions of two alternative measures of size – assets and total revenues – follow a similar pattern, with the median values being higher for Poland than for Hungary, while the opposite is true for the means. Based on the full sample, in 2000, the median value of total revenues was US\$37.7 million while the median value of total assets was US\$26.4 million. The data on asset size should be interpreted with caution, as it represents book values.

We grouped owners into three categories: foreign investors, domestic institutional investors and private individuals (the latter group including both insiders - managers and employees - and outsiders). From the corporate control perspective, there should be a significant difference in behaviour between insiders and outsiders, both because objectives may differ (esp. presence of wages and employment in the utility function) but also due to the possible entrenchment effects

on one side, and some productivity incentives on the other. Indeed, the difference is important when we compare *de novo* firms with privatised enterprises. It is the first group of *de novo* firms where individual private owners play an important governance role as entrepreneurs and founders of the firms, and typically retain important stakes in share ownership. Yet, the distinction between insider and outsider individual owners is far more blurred in the group of privatised companies from which our sample was drawn. The problem relates to the fact that in privatised companies, external individual owners are frequently either former employees or persons related to employees. For quoted firms, an important distinctive group is that of individual shareholders, who bought their shares on the stock exchange. Yet for this group it is difficult to identify the proportions of shares held respectively by employees and by outsiders. For that reason we employ an inevitably heterogeneous aggregate category of ‘individual owners’. The composition of ownership is best illustrated by distinguishing between the different types of the largest shareholder. Surprisingly, very similar distributions were found both for Hungary and for Poland, with differences between the two sub-samples being within a range of one percentage point. Thus, for the full sample, 46.3% of firms have foreign owners as the largest category of shareholders, 31.4% domestic institutional investors and 22.3% individual shareholders. In addition to the question about the largest shareholder category, we asked about the presence of a foreign partner as an investor, as this may be important regardless of the shareholding composition. Here, the differences between the two sub-samples are more pronounced, as 68.4% of Hungarian firms declare a presence of a foreign partner as compared with 59.0% for the Polish sub-sample. The category “the dominant owner being a foreign investor” is a subgroup within “the presence of foreign partner” category. In model specifications presented in Section 6 we take the presence of foreign partner as our choice variable. As will be explored, this variable has a significant impact on financing patterns.

The second corporate control dimension we take account for in modelling relates to concentration of shares, irrespective of ownership category. Respondents were asked about the proportion of shares held by the largest owner. It turned out that in our survey sample of largest companies, the level of share-ownership concentration was high. In Hungary, the dominant owner controlled on average 69.8% of shares and for Polish firms the corresponding figure was 58.8%.

We constructed two measures of financial performance and position, which are presented in Table 1. The first variable measures profitability as the ratio of earnings before taxes (but after financing expenses) to total revenues. Profitability distributions are skewed due to a small number of companies reporting high profitability. In particular, in 1988-2000, Hungarian companies reported higher profits than Polish firms, with median values being correspondingly 1.51% and 0.26%. A significant number of large Polish companies reported losses in 2000. The second financial variable is a measure of overall indebtedness. As no balance sheet data allowing to separate out long- and short-term debt obligations was available, we use a rather crude proxy represented by the ratio of total liabilities over total assets, with both components of the ratio being recorded at book values. While median values for both sub-samples are very similar, the mean values aren't, as the mean value for Hungarian firms is much smaller than the median value due to the presence of several firms with relatively small levels of debt. The median value for the whole sample is 56.1% (57.4% for Hungary and 54.7% for Poland).

We were also interested in two other dimensions of company behaviour connected with financing decisions of firms. Following the literature, dividend payments may indicate a category of firms, which were not financially constrained. In this respect, large Hungarian companies behave differently from large Polish large firms, specifically, 68.0% of Hungarian companies paid dividends in 2000, while only 18.9% of Polish firms made dividend payments in this year.

Last but not least, our main focus is on investigating investment financing and measuring financing constraints. Our proposed first ('direct') measure of financial constraint is based on the answers to the following two questions:

11. What is the company's estimate of the total cost of the modernisation investment over the next five years), required to achieve the strategic targets?

12. What you expect to be a realistic level of modernisation investment over the next five years?

Essentially, Question 11 asked about the desired level of investment funds and Question 12 about the expected realistic (obtainable) level of finance for investment. We interpret the cases where the latter is lower than the former as an indicator of constraints in investment. Interestingly, using this measure we may find that majority of companies in both countries were constrained in possibility of implementing their investment projects, while percentages are similar, 60.5% for Hungary and 54.9% for Poland.

The questionnaire went on to ask Question 13, a close-ended question on the opinions of the firms' chief executives regarding availability (accessibility in the future) of various sources of financing for their investment programmes. A common 7-point scale was used to describe managers' assessment of nine forms of finance (this fragment of the questionnaire is shown below). Answers to this question enable us to create ordinal variables reflecting the importance of major forms of finance and to construct an additional binary indicator of financial constraints to supplement the 'direct' measure of constraints defined above.

13. If you intend to raise all/some of the above sum of finance, what are the likely most important sources (score each factor as follows: 1 = low importance, 7 = high importance):

<i>Selling/leasing your buildings and equipment</i>	1	2	3	4	5	6	7
<i>Selling shareholding in other companies</i>	1	2	3	4	5	6	7
<i>Retained earnings (profits)</i>	1	2	3	4	5	6	7
<i>Credits from local banks</i>	1	2	3	4	5	6	7
<i>Credits from foreign banks 1</i>	2	3	4	5	6	7	
<i>Credits from industrial partners</i>	1	2	3	4	5	6	7
<i>State financial support</i>	1	2	3	4	5	6	7
<i>Issue of equity</i>	1	2	3	4	5	6	7
<i>Issue of bonds</i>	1	2	3	4	5	6	7

Interestingly, the overall pattern of relative importance of finance sources for the sample companies in both countries turned out to be very similar, retained earnings followed by credit

from domestic banks were ranked as the two most important sources of finance for investment⁹. For both sub-samples, those are the only two categories, where median values are different from 1 (where 1 represents ‘not important’). Looking at the mean values, we can also see the ranking of other alternative sources of finance. Again, these are very similar for both countries, with only two cases, where some sources of finance swap places respectively. For both countries the third most important source of finance is sell-off of assets, which indicates that privatised companies are actively seeking to restructure and overcome the legacy of asset composition inherited from the previous period. Next comes credit from foreign banks and state support for investment, presumably under industry branch restructuring programmes. A somewhat less important role is played by equity issues and financial restructuring via sell-off of shareholdings in other companies. The two least important sources of finance are issue of corporate bonds and direct finance from industrial partners.

As expected, retained earnings appear to be a most important source of financing for investment. Following the literature discussed above, we interpret the reliance on retained earnings as a second (‘indirect’) indicator of constrained finance.

And finally, as mentioned above we also combine information from the answers to the questions on financing modes to construct our third (‘indirect’) measure of financial constraints. We define firms as being financially constrained if both of the following two conditions are satisfied. First, the scores in the internal categories of finance (retained earnings, sell-offs of assets and shareholdings) and/or state support should be greater than the ratings the firm’s chief executive assigned to the forms of external financing (the remaining five categories of finance, as enumerated above). The second condition is non-payment (omission) of dividends in 2000.

In sum, we employ in modelling three measures of financing constraints on investment. Firstly, we use a ‘direct’ measure, based on expectations of chief executives related to possibility of implementing desired investment programme in full. Secondly, we use the importance of retained earnings for overall finance.

⁹ This finding seems consistent with the pecking order theory of capital structure (see, e.g., Myers, 1984).

Thirdly, we use a composite measure, where constrained firms are defined as those for whom internal sources of finance dominate external financing, and they do not pay dividends. The last two indicators may be labelled ‘indirect measures.

5. The Statistical model

Categorical Response Types

The data set created with responses to closed-ended survey questions, makes it possible to investigate perceptions of chief executive officers of large privatised Hungarian and Polish industrial companies, towards a range of finance sources likely to be available for modernisation programmes planned by their firms. We analyse the role of funds, which can be generated internally, by investigating separately *retained profits* and finance that can be raised by *selling stakes in other firms* and by *selling or leasing buildings and equipment* to other enterprises. In addition we consider the potential relevance to modernisation programmes of sources providing companies with new long- and short-term finance obtained via issues of *equity* and *corporate bonds*, *borrowings from domestic and foreign banks*, *support from the state*, and *credit from industrial partners*. The survey information also represents managers’ judgements both about the level of capital expenditure desired and necessary to achieve the firm’s strategic objectives and about the realistic estimates of internal and external finance potentially available to the firm. This particular dimension of the questionnaire survey enables us to propose and construct the direct measure of financing constraints likely to be experienced by the firms in implementing their desirable investment programmes.

It is important to note at this juncture that responses to the survey allow us to construct ordinal categorical and binary response variables for regression modelling of access to finance. Specifically, we utilise ‘assessed’ or ‘judged’¹⁰ ordinal 7-level¹¹ categorical variables generated by managers who possess an indeterminate amount of information before providing their judgements regarding the importance of a particular finance source, and binary indicators created

¹⁰ See Anderson (1984) for a relevant discussion of the major types of observed ordinal categorical variables.

¹¹ As discussed above, managers were asked to indicate how important a source will be for financing modernization, on a 7-point rating scale with end-points labelled *low importance* (1) and *high importance* (7).

with the survey information to capture the presence/absence of financing constraints. For both types of categorical responses we use parametric analysis based on the family of logistic distributions. In this study we employ separate regression models linking a response variable, y , with a set of predictor or explanatory variables x , underlying managers' opinions and associated with a possibility of financial constraints. The set of predictor variables includes firm-level characteristics that reflect asset size, profitability, indebtedness, ownership structure and concentration as well as controls for activity sector and economy-wide differences.

Bayesian Inference and the Proportional Odds Model for Ordinal Response

In this study, inference summarising opinions of chief executive officers is done using the Bayesian approach for analysing the interview survey data. A fundamental strength of Bayesian modelling is that posterior parameter estimates are assumed to have a distribution and therefore give more realistic picture of uncertainty. Other natural advantages over classical inference include: (i) avoiding the assumption of infinite amounts of forthcoming data; (ii) the potential for handling missing values as part of the estimation process; (iii) a direct interpretation of posterior credible intervals for model parameters and (iv) finite sample results (Congdon (2003), Gill (2002)). The Bayesian approach is based on updating previous knowledge about the distribution of some unknown quantity. In classical inference, the sample data are taken as random while population parameters are taken as fixed, while Bayesians make no fundamental distinction between the sample data, missing values and unknown model parameters, both these quantities are treated as random variables as a logical consequence of Bayesian conditional analysis. In Bayesian analysis, model parameters θ follow a probability distribution, knowledge of which is summarised in a prior distribution $\pi(\theta)$. The likelihood of the observed data y given parameters θ , denoted $L(\theta|y)$, is used to modify the prior beliefs $\pi(\theta)$, with the update knowledge summarised in a posterior distribution, $\pi(\theta|y)$ (for details see, e.g., Congdon (2003)). The updated beliefs are a function of prior knowledge and the sample data evidence:

$$\pi(\theta | y) \propto L(\theta | y)\pi(\theta) \quad (1)$$

An important feature of this model, which backs up its use for our analysis of survey data on Hungarian and Polish companies, is that in the Bayesian context, missing values are treated as another set of unknown quantities. As discussed in Section 4, our survey data contain missing values resulting from the failure to obtain answers to some individual items, however we should note that the incomplete data problem is not acute with average item non-response rates in order of 10-15%. Simply omitting companies with missing values from the analysis leads to valid inferences only if data are missing completely at random, that is the missing data values are a simple random sample of all data values. A less restrictive assumption, employed for our models, is that of missingness at random under which the probability that an observation is missing depends on the observed data but not on missing data. The data are missing at random if the missingness on one question is conditionally independent of the outcome on that question that would have been observed, given the observed responses to other questions (Congdon (2003)). The treatment of missing values involves the definition of what the data should be expected to look like given a specific probabilistic function conditional on unknown variable values. In generating samples from the posterior distribution we apply Gibbs sampling, a Markov chain Monte Carlo method (Gilks, Richardson, Spiegelhalter (1996)). Posterior distributions are summarised in terms of means and credible intervals for regression coefficients of independent variables.

For modelling a multilevel ordinal outcome, we assume the proportional odds model with a latent (continuous) variable y underlying the ordered categories (discussions of the model can be found in McCullagh (1980), Anderson (1994), Agresti (1996), Congdon (2003)).

Suppose the states are ranked from 1 (least important) to J (most important), with cutpoints θ_j from the continuous scale describing the transition from one category to the next.

If J (the number of levels) is equal to 7 (and this is the case with the observed in the survey ordinal responses), there are 6 cut points. It is usually assumed that there are additional start and end points to the underlying scale

$$\theta_0 \text{ and } \theta_7 \text{ such as } \theta_0 = -\infty, \theta_7 = +\infty \quad (2)$$

Then θ_j ($j=1, \dots, 6$) are free ancillary parameters to estimate, subject to the constraint

$$\theta_0 < \theta_1 < \dots < \theta_7. \quad (3)$$

The probability P_{ij} that the chief executive officer of an individual firm i will articulate the importance of the source of finance as j is then the same as the chance that the firm's underlying score is between θ_{j-1} , θ_j

The cumulative probability γ_{ij} that firm i with latent score Y_i will rank the importance of the source of finance as j or below is

$$\gamma_{ij} = \text{Pr ob}(Y_i < \theta_j). \quad (4)$$

We can write the chance of managers articulating a specific category as j

$$P_{ij} = \gamma_{ij} - \gamma_{i,j-1}. \quad (5)$$

The *proportional-odds model* uses the logit as a link function for γ_{ij}

$$\log \left\{ \frac{\gamma_{ij}}{1 - \gamma_{ij}} \right\} = \theta_j - \mu_i \quad (6)$$

where $\mu_i = \beta'x_i$ and x_i incorporates predictors which include firm - specific characteristics and controls for activity sector and economy - wide factors.

Note that model (6) assumes *parallel/identical effects* of covariates for all $J-1$ collapsings of the response into the binary outcome. Hence β does not have a subscript. In model (6), the negative sign on μ_i ensures that larger values of $\beta'x$ lead to an increased chance of belonging to the higher category.

We fit nine separate univariate proportional-odds models. The dependent ordinal variables measure importance of: (1) *retained profits*, finance that can be raised by (2) *selling investments in other firms*, funds generated by (3) *selling or leasing buildings and equipment* to other

enterprises, (4) *equity* and (5) *bond* finance, (6) *borrowings from domestic* and (7) *foreign banks*, (8) *support from the state*, and (9) *credit from industrial partners*¹².

In addition, we fit a standard logistic regression for the two binary indicators¹³ of financial constraints in terms of observed predictors \mathbf{x} :

$$\begin{aligned} y_i &\sim \text{Bernoulli}(\pi_i) \\ \text{logit}(\pi_i) &= \alpha + \beta'x \end{aligned} \tag{7}$$

In our study of finance sources accessible to a large privatised firm in a transition economy, previous substantive knowledge about model parameter distributions is not summarised and may be assumed non-existent. Therefore to reflect prior ignorance we resort to the strategy of non-informative priors.

In all the models presented in Section 6, β and α are assigned vague normal priors with zero means and large variances for letting the survey sample data to dominate the form of the posterior distributions.

6. Results

The output of the Gibbs sampler is presented in Tables 3a-3c below. The posterior distributions of regression coefficients are summarised in terms of their means and 95% Bayes credible intervals. In each of the models shown in Tables 3a-3c, inference is based on the last 5,000 Gibbs samples with a 5,000 burn-in.

When we take financing from retained earnings as an ordinal indicator of financial constraints (FINRET in Table 3b), a clear pattern emerges. Ranked in order of magnitude, we have the following four effects.

¹² The description of the nine ordinal indicators FINRET, FINSHR, FINSALE, FINEQ, FINBOND, FINCRED, FINFOR, FINSTRAT and FININD can be seen in Table 1.

¹³ The description of the two binary indicators UNC_FIN and UN_FI_IN can be found in Table 1.

Firstly, concentrated ownership is likely to result in better access to finance. As the concentration variable distribution was highly non-normal, we discretise this variable and use four categories, taking 25%, 50% and 75% as cut-off points and using the lowest category (dispersed ownership) as the baseline (reference) category. The mean effects of the two highest categories are negatively signed, with two of them being significant. Dispersed ownership is clearly associated with reliance on retained earnings, which suggests that from the financing point of view, benefits from concentrated ownership control clearly out-weight the costs associated with potential agency problem.

Secondly, having domestic institutional investor as a major shareholder helps to overcome financial constraints.

Thirdly, firms with foreign partners are also characterised by lower financial constraints.

And finally, Polish firms seem to be relying less on retained earnings than their Hungarian counterparts.

We note that past profitability enters model with a positive sign, however, the credible interval contains zero. One possible explanation for this finding is that past profitability impacts upon availability of this mode of finance in two different ways. On the one hand, higher profitability may lead to accumulation of retained earnings (assuming that they are not distributed to shareholders), but on the other hand, good profitability records should facilitate the firm's access to the alternative external modes of finance.

The results for our second measure of financial constraint, a binary indicator, (UN_FI_IN in Table 3c) are consistent with the first one, albeit less pronounced. Note that in interpreting the direction of the effect, the positive signs correspond to negative signs on the previous measure, FINRET. This is because we define this second variable as (indirect) measure of unconstrained finance, a situation, where external sources of finance are more important than internal and/or dividend payments are positive. All the three corporate control variables have expected sign, being consistent with the coefficient sign pattern observed for the previous variable, although this time the only significant indicator of the absence of financial constraints is dominant ownership of domestic institutional investors.

In contrast, modelling unconstrained financing with our third measure, which is represented as a binary dependent variable recording that the level of expected obtainable investment is not lower than the expected level of desired investment (UNC_FIN in Table 3c) is dominated by two dimensions: sectoral controls and past profitability. Firms in heavy industry (the baseline (reference) category for sectoral controls) are more likely to be unable to implement their investment programmes, as one would expect. Furthermore, higher levels of past profitability result in lower constraints in investment, again as could be expected. For this measure, the corporate control variables are all insignificant.

Our results on the three measures of unconstrained finance are further corroborated by results from proportional odds models for alternative modes of finance. This enables us to see the alternative channels of financing, where different structures of corporate control and different firm characteristics determine different ways of overcoming financial constraints. We restrict ourselves only to those relationships, which turned out to be statistically significant (Tables 3a – 3c).

Firstly, it is clear that institutional domestic investors have some owner-specific advantage in using internal restructuring as a strategy for financing new investment. Companies, which have institutional domestic investors as dominant owners, are most likely to rely in their financing strategies on sell-offs both of assets and of stakes in other companies (FINSALE and FINSHR). Another effect we register for this category of dominant owners is that they may in the future rely more heavily on bond issues (FINBOND).

Secondly, the financing strategy of companies with foreign partners is clearly different. Along the financing dimensions represented in the specifications, the mean effects are better defined in the models where the coefficient for the variable capturing the presence of a foreign partner is negatively signed. Clearly, companies with foreign partners seem unlikely to rely on issue of bonds (FINBOND) and equity (FINEQ), albeit this second effect is insignificant. That is consistent with a popular belief that domestic capital markets are less important for foreign affiliates. Also, companies with foreign involvement are unlikely to rely on government-sponsored finance (FINSTRAT). Finally, in a sharp contrast to the firms with the prevalence of domestic institutional owners, privatised companies with foreign involvement are unlikely to rely on sell-offs on assets (FINSALE) in their financing strategies.

Thirdly, we found two effects for the firms with concentrated ownership. Interestingly, there seems to be a non-monotonic effect in relation to investment financing by equity issues (FINEQ). This financing option is most probable for companies where 25%-49% of shares are held by the dominant owner. It seems that companies with most dispersed ownership may not be perceived as attractive by the capital market, and that affects negatively their access to equity finance. At the other end of the spectrum, companies with high levels of concentrated ownership may not need to use the capital market. Yet, in the case of the largest companies, the mode of finance may differ according to the identity of the dominant owners and is better captured by the relevant variables defined above [REWORD].

We also found some additional miscellaneous significant effects worth mentioning.

While links with a leading bank turned out to be insignificant for our measures of unconstrained finance, this characteristic is a significant determinant of specific financing sources. Interestingly, it is positively associated with financing supplied by industrial partners (FININD). It indicates that the existing in the two countries industrial groupings are indeed of industrial and financial nature and the two network elements may have strong complementarity. In addition, as could be expected, links with a leading bank seem to facilitate raising investment finance by issuing corporate bonds (FINBOND). Generally, one can speculate, that the presence of a leading bank may have a beneficial signalling effect for other providers of finance, while the bank may perform some monitoring functions, alleviating basic agency problems.

High levels of past profitability turn out to be a significant predictor in two cases. First, it is negatively associated with sell-offs both of assets and of shareholdings as a financing strategy (FINSALE and FINSHR). It suggests that both financing policies are triggered more by 'push' factors than by 'pull' factors. This is corroborated by the result for domestic credit (FINCRED), which for all the companies tend to be the most important, alternative to retained earnings source of finance (Tables 2a and 2b). And in the case of domestic credit, firms with high levels of past profits clearly enjoy most easy access (Table 3a).

Interestingly, our results suggest a strong firm size effect on the possible availability of domestic credit. Within a sample range, a non-linear component with a positive sign dominates over a linear one with a negative sign. Thus, we may conclude, that the size of the firm has a positive, albeit non-linear effect on access to credit, much in line with the existing literature.

The ratio of debt to total assets employed here is significant for two types of external finance. Firms with high level of debt financing tend to seek new finance from industrial partners (FININD), which may suggest that the ‘push’ rather than ‘pull’ effect is operating here. Similarly, they are more likely to seek finance from foreign banks (FINFOR), which may suggest a pecking order, where firms with lower levels of indebtedness believe that they will utilise sources of domestic credit first.

Sectoral differences, represented by control dummies, matter in some cases. Firms in heavy industry are most constrained when the degree of financing constraints is judged by the ratio of expected to desired investment spending. Most effects of other industry sectors are less certain, as posterior distributions include zero. One interesting exception is ITECH (firms in high and middle technology sectors). Here, reliance on retained earnings is less likely, which may be consistent with intuitive explanations. As those sectors are expected both to expand and innovate; we may predict the retained earnings to be an insufficient source of funding, and this is consistent with the estimated effects. Another significant effect relates to sectoral ranking in use of domestic credit. Here, the coefficient for high/middle technology sector is lowest (negative), which is again consistent with less reliance on fixed claims funding in the high growth / high innovation sector. While coefficient for this sector is insignificant in this case, it can be compared with other sectors, where it is positive and significant. In particular, reliance on bank credit is most typical for the service sector firms.

Finally, we found differences between Polish and Hungarian companies significant in some cases. Polish companies are more likely to rely on finance from industrial partners in their investment programmes (FININD). They are also more likely to rely on sell-offs of assets (FINSALE) and similarly on selling their stakes in other firms (FINSHR, albeit this latter effect

is insignificant). On the other hand, they are less likely to expect government-sponsored finance (FINSTRAT) for their investment programmes.

Conclusions

We believe that the three measures of financial constraints applied in this empirical investigation produced meaningful results. Estimations for the two ‘indirect’ measures reveal effects and relationships which are consistent with the stylised facts about finance in the countries, where financial systems are not yet fully developed, and enrich these stylised facts by adding a few additional details related to the impact of corporate control dimensions. We find that the foreign companies, firms that are part of domestic industrial groups and enterprises with concentrated ownership are all less constrained in their access to finance. Interestingly, modeling results for the third, ‘direct’ measure of constraints in investment suggest the dominant role of sectoral differences. In particular, it is clear that firms in heavy industry may encounter particular difficulties in their access to finance. This may not necessary imply an inefficient outcome, as the capital market valuation of investment projects may differ from assessments coming from the chief executives and the former may simply be more realistic. As the heavy industry sector is typically more prone to soft budget constraint (Driffill and Mickiewicz 2003), signs of restrictions in investment finance may not be a bad outcome.

Aside from that, application of survey instruments enabled us to identify alternative modes of finance, as both different corporate control structures and past performance records influence the sample firms' choice of finance source. In particular, access to domestic credit is positively associated with company size and past profitability. Industrial group members tend to favour bond issues as well as sells-offs of assets as appropriate types of finance for their investment programmes. Preferences for raising finance in the form of equity are associated with share concentration in a non-monotonic way, being most prevalent in those companies where the dominant owner holds 25%-49% of shares. Close links with a leading bank not only increase the possibility of bond issues but also appear to facilitate access to non-banking sources of funds, in particular, to finance supplied by industrial partners. Finally, reliance on state finance is less likely for the companies whose profiles resemble the case of unconstrained finance, namely, for companies with foreign partners, companies that are part of domestic industrial groups and

companies with a strategic investor. Model implications also include that the use of state funds is less likely for Polish than for Hungarian companies.

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Table 1. Description of variables

Variable	Explanation
	<u>Financial variables:</u>
SALE_2000	Sale revenue in US\$ million in 2000
EBT_SALE_2000	Earnings before taxes ('gross profit') dived by sale revenue, in percentages, in 2000
EBT_SALE_(AVER)	Earnings before taxes ('gross profit') dived by sale revenue, in percentages, 1998-2000 average
ASSET_SIZE_2000	Total assets measured in US\$ million in 2000
ASSET_SIZE_2000_SQ	Total assets measured in US\$ million in 2000, squared
DEBT_2000	debt to total assets ratio calculated as (assets minus equity)/assets, in 2000
POSDIV_2000	positive dividend payments in 2000, dummy variable
EMPLOYMENT_2000	employment, as of 31 December 2000
	<u>Corporate control variables:</u>
LSP	Percentage of of shares of held by the largest shareholder
DINS	largest shareholder = domestic institutional investor (industrial company or financial institution), a dummy variable
FINS	largest shareholder = foreign investor
IND	largest shareholder = individuals (outsiders and insiders)
LEADBANK	one or two leading banks, a dummy variable
FOREIGN	presence of foreign investor
	<u>Industry dummies:</u>
IHEAV	heavy industry (ISIC: <14 and 27)
ILAB	labour intensive industry (ISIC: 15-20 and 36)
IRES	resource intensive industry (ISIC: 21-26)
ITECH	medium and high technology industry (ISIC: 28-35)
ISERVICES	services and construction (ISIC: 45, 50-52, >55)
	<u>Importance of a source of finance (Likert scale, 1-7; 7 – high importance)</u>
FINSALE	sale of assets
FINSHR	sale of shareholdings in other companies
FINRET	retained earnings
FINCRED	credit – domestic
FINFOR	credit – foreign
FININD	credit from industrial partners
FINSTRAT	state support
FINEQ	issue of equity
FINBOND	issue of bonds
	<u>Measures of financial constraints:</u>
IVT	desired level of modernisation investment expenditure over 5y
RIVT	expected (realistic) level of modernisation investment expenditure over 5y
UNC_FIN	equals: 0 if ivt>rivt, and 1 if ivt=rivt (unconstrained access to finance)
UN_FI_IN	unconstrained finance – indirect measure: 0=firms, for which internal sources of finance (FINSALE, FINSHR, FINRET) and FINSTRAT are more important than external financing <u>and</u> they did not pay dividends (i.e. there was no information about dividend payments in 2000) 1=otherwise

Table 2a. Descriptive statistics - means and standard deviations

variable	All firms			Poland			Hungary		
	Obs	Mean	Std.Dev.	Obs	Mean	Std.Dev.	Obs	Mean	Std.Dev.
dins	121	.314	.466	80	.312	.466	41	.317	.471
fins	121	.463	.501	80	.462	.501	41	.463	.505
ind	121	.223	.418	80	.225	.420	41	.220	.419
foreign	157	.624	.486	100	.590	.494	57	.684	.469
lead	135	.200	.401	93	.226	.420	42	.143	.354
isp	122	62.46	32.60	81	58.77	33.81	41	69.76	29.09
asset_size_2000	126	42.79	58.75	91	38.92	49.17	35	52.86	78.39
sale_2000	143	65.45	84.73	98	58.47	69.17	45	80.65	110.81
ebt_sale_2000	129	2.16	8.826	90	.90	8.98	39	5.08	7.80
debt2000	125	.524	.397	90	.556	.277	35	.442	.605
posdiv_2000	115	.296	.468	90	.189	.394	25	.680	.476
employment_2000	137	1063	1771	94	907	857	43	1404	2891
iheav	152	.053	.224	95	.021	.144	57	.105	.310
ilab	152	.362	.482	95	.379	.488	57	.333	.476
ires	152	.211	.409	95	.189	.394	57	.246	.434
iservices	152	.053	.224	95	.084	.279	57	.000	.000
itech	152	.336	.474	95	.337	.475	57	.333	.476
finsale	142	2.29	1.81	93	2.24	1.76	49	2.37	1.91
finshr	141	1.66	1.47	92	1.57	1.29	49	1.84	1.76
finret	142	5.15	1.92	92	5.37	1.85	50	4.76	2.00
fincred	142	4.17	2.11	93	4.34	2.14	49	3.84	2.03
finfor	142	2.01	1.75	92	1.87	1.65	50	2.26	1.91
finind	141	1.45	1.23	92	1.51	1.32	49	1.35	1.03
finstrat	141	2.01	1.72	92	1.88	1.70	49	2.24	1.75
fineq	138	1.89	1.62	90	1.76	1.36	48	2.15	2.01
finbond	138	1.40	1.16	89	1.35	1.11	49	1.49	1.26
un_fin	143	.671	.471	97	.691	.465	46	.630	.488
unc_fin	125	.432	.497	82	.451	.501	43	.395	.495

Table 2b. Descriptive statistics - medians (excluding control dummies)

variable	All firms		Poland		Hungary					
	Obs	Median	95% Conf. Interval	Obs	Median	95% Conf. Interval				
isp	122	63.1	51.5	81	60.0	49.4	41	77.0	57.7	96.2
asset_size_2000	126	26.4	21.0	91	23.5	16.7	35	36.2	26.5	44.4
sale_2000	143	37.7	32.0	98	31.0	25.9	45	45.1	36.9	52.9
ebt_sale_2000	129	.797	.355	90	.259	.126	39	1.513	.987	5.173
debt_2000	125	.561	.467	90	.547	.447	35	.574	.474	.689
employment_2000	137	595	527	94	596	529	43	542	438	762
finsale	142	1	1	93	1	1	49	1	1	2
finshr	141	1	1	92	1	1	49	1	1	1
finret	142	6	5	92	6	5	50	5	4	6
fincred	142	4	4	93	4	4	49	4	3	5
finfor	142	1	1	92	1	1	50	1	1	2
finind	141	1	1	92	1	1	49	1	1	1
finstrat	141	1	1	92	1	1	49	1	1	2
finreq	138	1	1	90	1	1	48	1	1	1
finbond	138	1	1	89	1	1	49	1	1	1

Table 3a. Estimation results

	Proportional Odds Model			Proportional Odds Model			Proportional Odds Model			Proportional Odds Model		
	finbond Mean	95% Bayes Credible interval	fincrd Mean	95% Bayes Credible interval	finred Mean	95% Bayes Credible interval	fineq Mean	95% Bayes Credible interval	finfor Mean	95% Bayes Credible interval	finfor Mean	95% Bayes Credible interval
<i>Independent Variables</i>												
asset_size_2000	0.726	-0.315	1.677	-1.556	0.008	-0.128	-1.087	0.908	0.447	-0.567	1.310	1.310
asset_size_2000_sq	0.001	-0.789	0.935	0.086	1.731	0.499	-0.408	1.364	-0.480	-1.414	0.481	0.481
dins	3.034	1.037	5.074	-0.054	1.875	-0.441	-1.633	0.853	-0.553	-2.039	0.991	0.991
foreign	-2.078	-3.882	-0.473	-0.795	0.933	-0.566	-1.531	0.322	0.736	-0.458	1.867	1.867
debt_2000	0.003	-0.033	0.040	-0.030	0.038	-0.007	-0.035	0.023	0.065	0.024	0.156	0.156
ilab	0.842	-1.615	3.468	0.096	2.964	0.338	-1.532	2.474	-1.248	-3.838	1.040	1.040
ires	1.040	-1.332	3.765	0.258	3.159	-0.422	-2.155	1.626	0.686	-1.871	2.862	2.862
iservices	1.859	-2.218	5.426	0.487	4.935	-0.763	-3.479	2.167	-0.335	-4.291	2.927	2.927
itech	0.763	-1.642	3.412	-0.736	1.957	1.479	-0.285	3.403	-0.452	-2.950	1.793	1.793
lead	2.585	0.558	4.552	-1.038	1.108	0.918	-0.160	1.933	-0.232	-1.437	0.948	0.948
lsp[2] 25-49%	0.358	-1.169	1.779	-1.203	0.885	1.641	0.516	2.811	0.251	-1.079	1.510	1.510
lsp[3] 50-74%	0.121	-1.294	1.585	-0.913	1.377	-0.151	-1.550	1.211	-0.737	-2.084	0.477	0.477
lsp[4] 75-100%	1.258	-0.088	2.718	-0.478	1.437	-0.304	-1.326	0.733	0.183	-1.008	1.466	1.466
poland	0.467	-1.157	2.307	-0.757	0.837	0.679	-0.472	1.915	0.313	-0.808	1.428	1.428
ebt_sale_(aver)_ [2]	0.457	-0.860	1.738	-0.304	1.421	-0.069	-1.084	0.801	0.200	-0.960	1.416	1.416
ebt_sale_(aver)_ [3]	-0.897	-2.345	0.534	0.294	1.962	-0.135	-1.287	0.843	0.164	-0.864	1.290	1.290
ebt_sale_(aver)_ [4]	-0.064	-1.499	1.340	-0.636	1.342	-0.185	-1.489	1.105	1.084	-0.027	2.231	2.231
<i>Cutpoints</i>												
theta[1]	5.577	3.071	8.054	-0.657	2.410	1.950	0.567	3.623	1.129	-2.309	4.552	4.552
theta[2]	6.158	3.734	8.625	-0.142	2.873	2.395	0.997	4.092	1.678	-1.741	5.072	5.072
theta[3]	7.242	4.606	9.678	0.496	3.573	3.245	1.865	4.898	2.313	-1.103	5.669	5.669
theta[4]	8.160	5.689	10.520	1.247	4.335	4.113	2.689	5.785	3.392	-0.048	6.807	6.807
theta[5]	8.453	5.920	10.830	1.994	5.123	4.606	3.086	6.273	4.158	0.705	7.664	7.664
theta[6]	10.670	7.307	14.680	3.048	6.320	5.630	3.932	7.522	5.142	1.570	8.735	8.735

Notes:

(1) (2) Coefficients for *lsp* are contrasts with *lsp*[1] = percentage of shares < 25%, with intervals being:

(2) Pre-tax profit margin, *ebt_sale_(aver)*, is categorized by its quartiles. Coefficients are contrasts with quartile 1 (smallest)

$$(-\infty, x_{|25}], (x_{|25}, x_{|50}], \dots, (x_{|75}, +\infty).$$

Table 3b. Estimation results

node	Proportional Odds Model			Proportional Odds Model			Proportional Odds Model					
	finind Mean	95% Bayes Credible interval	finret Mean	95% Bayes Credible interval	finsale Mean	95% Bayes Credible interval	finshr Mean	95% Bayes Credible interval				
									Proportional Odds Model			
<i>Independent Variables</i>												
asset_size_2000	0.173	-1.023	1.356	0.016	-0.623	0.703	0.101	-0.652	0.898	-0.040	-0.924	0.900
asset_size_2000_sq	-0.573	-2.139	0.806	-0.011	-0.666	0.670	-0.223	-1.172	0.559	0.084	-0.795	0.901
dins	-0.424	-2.268	1.289	-1.170	-1.991	-0.314	1.755	0.801	2.771	1.752	0.387	2.941
foreign	-1.212	-2.698	0.403	-1.147	-1.942	-0.374	-0.270	-1.103	0.553	-1.196	-2.329	-0.102
debt_2000	0.076	0.027	0.184	0.000	-0.016	0.018	0.001	-0.018	0.021	0.001	-0.033	0.032
ilab	-2.715	-5.038	-0.481	0.154	-0.986	1.429	1.188	-0.482	2.595	0.773	-1.090	2.478
ires	-1.258	-3.590	0.958	0.338	-1.033	1.685	0.857	-0.786	2.438	0.932	-1.034	2.869
iservices	-7.710	-21.640	-0.922	0.847	-0.848	2.533	1.208	-1.282	3.584	-0.240	-4.213	3.025
itech	-1.871	-3.969	0.237	-0.327	-1.421	0.868	1.081	-0.638	2.510	0.573	-1.406	2.281
lead	2.408	0.779	4.099	-0.282	-1.282	0.675	0.419	-0.726	1.589	-0.314	-1.913	1.167
isp[2] 25-49%	0.956	-0.337	2.182	-1.198	-2.272	-0.181	0.070	-1.003	1.109	0.974	-0.232	2.320
isp[3] 50-74%	0.286	-1.437	1.778	-0.802	-1.756	0.197	-0.917	-2.038	0.263	-0.397	-1.770	0.878
isp[4] 75-100%	0.232	-1.115	1.601	-0.986	-1.829	-0.080	-0.185	-1.097	0.812	0.647	-0.595	1.846
poland	3.581	1.497	5.979	-1.007	-1.736	-0.220	1.049	0.186	2.036	0.222	-1.000	1.383
ebt_sale_(aver)_ [2]	1.046	-0.216	2.228	0.551	-0.397	1.431	0.283	-0.650	1.139	-0.889	-1.987	0.149
ebt_sale_(aver)_ [3]	-0.233	-1.632	1.106	0.753	-0.092	1.614	-1.088	-2.146	-0.191	-1.419	-2.622	-0.224
ebt_sale_(aver)_ [4]	-0.274	-1.760	1.201	0.928	-0.057	1.899	-0.840	-1.918	0.240	-0.761	-2.124	0.599
<i>Cutpoints</i>												
theta[1]	3.522	2.137	5.282	-5.100	-6.610	-3.785	1.856	-0.080	3.132	1.922	-0.511	4.015
theta[2]	4.284	2.858	6.054	-4.584	-6.020	-3.377	2.662	0.684	3.954	2.780	0.249	4.863
theta[3]	5.096	3.606	6.919	-3.840	-5.228	-2.676	3.370	1.354	4.623	3.251	0.683	5.306
theta[4]	5.818	4.204	7.738	-2.946	-4.319	-1.742	4.152	1.993	5.508	3.952	1.362	6.068
theta[5]	7.751	5.451	10.710	-2.262	-3.653	-1.049	4.865	2.604	6.309	4.348	1.713	6.614
theta[6]	9.854	6.731	13.980	-1.223	-2.605	0.034	5.825	3.322	7.422	5.386	2.457	7.916

Table 3c. Estimation results

	Proportional Odds Model				Binary Logit				Binary Logit			
	finstrat		95% Bayes Credible interval		un_fi_in		95% Bayes Credible interval		unc_fin		95% Bayes Credible interval	
	Mean				Mean							
<i>Independent Variables</i>												
asset_size_2000	-0.211	-1.147	0.639	-0.896	-1.929	0.368	1.063	-0.133	2.064			
asset_size_2000_sq	0.194	-0.602	1.032	0.702	-0.567	1.753	0.070	-1.237	1.768			
dins	-0.703	-2.021	0.536	1.341	0.216	2.599	-0.433	-1.774	0.770			
foreign	-1.401	-2.454	-0.398	0.714	-0.272	1.787	0.504	-0.564	1.490			
debt_2000	0.001	-0.020	0.023	0.141	-0.402	0.730	0.030	-0.613	0.654			
ilab	0.618	-1.010	2.460	0.053	-1.980	2.113	13.220	6.982	19.850			
ires	0.539	-1.021	2.442	-0.200	-2.311	1.737	12.400	6.113	19.260			
iservices	-26.130	-72.010	-1.414	-1.022	-3.851	1.438	13.540	7.029	20.630			
itech	1.330	-0.372	3.103	-0.574	-2.686	1.348	13.970	7.661	20.630			
lead	0.856	-0.314	1.955	-0.183	-1.404	1.112	0.639	-0.746	1.997			
isp[2] 25-49%	0.860	-0.318	2.054	0.567	-0.456	1.563	0.451	-0.675	1.623			
isp[3] 50-74%	-1.627	-2.867	-0.223	0.172	-0.798	1.167	0.375	-0.884	1.561			
isp[4] 75-100%	-0.423	-1.377	0.525	0.003	-1.982	1.896	-0.015	-1.885	1.936			
poland	-2.115	-3.180	-1.171	-0.115	-1.109	0.848	-0.857	-1.924	0.236			
ebt_sale_(aver)_ [2]	0.698	-0.305	1.742	-0.342	-1.364	0.716	0.363	-0.777	1.529			
ebt_sale_(aver)_ [3]	0.021	-1.076	1.095	0.961	-0.121	2.167	0.156	-0.898	1.249			
ebt_sale_(aver)_ [4]	-0.418	-1.500	0.744	0.718	-0.495	1.887	1.176	0.020	2.302			
<i>Cutpoints</i>												
theta[1]	-0.891	-3.217	0.610									
theta[2]	-0.330	-2.663	1.162									
theta[3]	0.519	-1.856	2.076									
theta[4]	1.021	-1.335	2.558									
theta[5]	1.576	-0.794	3.213									
theta[6]	2.846	0.432	4.673									
Intercept				-0.091	-2.607	2.329	-13.840	-20.130	-8.050			

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