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*Investing in Turbulent Times: The Investment Behavior
of Polish Firms in the Transition*

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THE INVESTMENT BEHAVIOR OF POLISH FIRMS IN THE
TRANSITION***

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NONTECHNICAL SUMMARY

The investment behavior of firms in transition economies is important for several reasons. Investment is an important indicator of how firms respond to the new circumstances of transition by changing their technology, modernizing their production processes and taking advantage of new market opportunities. Investment by firms is also an important signal of recovery and renewed growth of output after the initial shock of stabilization at the start of the transition process. The investment behavior of firms is also important in that it determines the effectiveness of monetary policy. If firms change their investment plans in response to changes in interest rates, then the central bank can effectively influence economic activity through changes in the interest rate.

Unfortunately, most studies of investment behavior in transition economies have been unable to establish a link between the economic environment faced by firms and their investment behavior. The model most frequently used is the so-called capital adjustment model. It assumes that firms increase their capital stock in response to increases in output, but they do so only with a lag that reflects uncertainty and the cost of acquiring new capital.

In this paper, we use a different approach. First, we use a different model, one that recognizes that increases in fixed capital are a part of process of adjusting all the firm's assets and liabilities. This model gives us a richer

explanation of investment behavior. Second, we note that virtually all theories of investment apply mainly to firms that are growing and thus investing in new plant and equipment. In the case of a transition economy, however, the large falls in output in certain sectors mean that firms may want to reduce their capital stock permanently. Such decreases, however, depend on the rate at which capital depreciates and on the need to acquire specialized equipment to keep the firm in operation.

We therefore partition our sample of over 200 Polish firms into two groups: those who invested and those who did not. By estimating our model for these two groups of firms, we are able to confirm the appropriateness of our approach. Using data only from those firms that did invest over the sample period, we find that there is a significant and economically sensible explanation of investment behavior. For firms that did not increase their capital stock, the model yields different and less satisfactory results, thus confirming that economic theory can explain how firms increase their capital stock, but not how they decrease it.

ABSTRACT

We examine the investment behavior of a sample of Polish industrial firms over the period 1991-1993 by means of a model that views investment flows as part of the firm's effort to adjust its assets and liabilities so as to maximize the returns to the firm. We argue that the application of neo-classical models of investment is only appropriate in cases where net investment is positive. If firms are seeking to reduce their capital stock, then the major constraints are not financial but rather set by the level of depreciation. This paper examines the adjustments undertaken by Polish firms and shows that firms that did make positive net investments in this period were influenced by their capital intensity, profitability and by their cost of and returns to financial assets. The explanatory power of the model is relatively high when compared to previous studies of the investment behavior of firms in transition economies.

1. INTRODUCTION

In this paper we examine the investment behavior of a sample of 170 Polish firms over the period 1991-1993. A key innovation of our study is the separation of the sample into two groups of firms, those that were net investors over the sample period and those that were not. By means of this partitioning of the sample, which we justify on theoretical grounds below, we are able to obtain a much higher degree of explanatory power than have other studies of investment in transition economies.

Studies of investment by firms in transition economies such as Anderson and Kegels (1997) and Lízal and Svejnar (1997) are based on accelerator or neoclassical models of investment.¹ The accelerator model assumes that firms wish to maintain a fixed ratio between their long-run output and capital stock; investment is thus driven by changes in expected future output, which create a need to change the capital stock to accommodate the expected changes in output. The neoclassical model (see, e.g., Bond and Meghir, 1994) assumes that investment decisions are made so as to maximize the present discounted value of profits based on expectations about the future. In empirical applications, the models incorporate measures of adjustment costs or financial constraints in order to reflect the fact that investment does not bring the level of the capital stock to its new level instantaneously.

While both models are generally cast in a theoretical framework that appears neutral between investment and disinvestment, the rationale for the inclusion of financial constraints in both theory and applications is always implicitly cast in terms of increases in capital. That is, the firm is assumed to be growing,

and delays in increasing its capital stock to the equilibrium level are ascribed to the difficulties of obtaining sufficient internal and external financing to do so. This introduces a potential asymmetry in the model in that there may be no such constraints on disinvestment. A firm seeking to reduce its capital stock can sell it off or, failing that, make no investments and reduce its capital stock through depreciation. Notice that the former option is quite unrelated to the kinds of financial considerations that determine the speed with which a firm can increase its capital stock; rather the speed with which a firm can sell off its capital stock depends on the market demand for its specific stock of equipment and structures. If there is no such demand, then disinvestment is limited to the level of capital depreciation, which, in turn, is a function of the capital stock, its age and composition and technological progress (Mathews, 1959, Chs. 4, 10).

One of the notable features of the studies of investment in transition economies cited above is that, while they obtain significant and plausible coefficients for some explanatory variables, they actually explain very little of the investment behavior of firms. For example, Anderson and Kegels (1997) apply an accelerator model supplemented with financial variables to a sample of 961 Czech non-financial firms for 1993 and 1994. Their full specification over this sample yields an R^2 of 0.344, and only the coefficients of the financial variables are significant, with real variables thus playing no role in determining investment flows. Lizal and Svejnar (1997) apply a variety of specifications to a panel of 2860-4133 Czech firms for 1992-1995. Their results yield R^2 s for this sample that range from 0.010 to 0.230 over their specifications.

One reason for this inability to explain the major part of the investment behavior of firms in transition economies is that these firms' behavior is governed by the desire to disinvest rather than by the desire to expand their stock of fixed capital. Moreover, in the conditions of the early transition, such disinvestment likely took the form of depreciation rather than the sale of machinery, equipment and structures to other firms. Thus, the use of models based on the implicit assumption that firms generally seek to increase or maintain their capital stock and face financial constraints in doing so is unlikely to explain well the investment decisions of firms whose objective is to reduce their capital stock.

2. INVESTMENT AND DISINVESTMENT IN A TRANSITION ECONOMY

The period 1991-1993 was a particularly turbulent time for Polish firms and for their managers. The "big bang" approach to stabilization and reform of the economy brought not only large changes in relative prices but also a burst of inflation and great changes in relative prices. It also caused a major decline in aggregate output (Table 1). The decline in domestic demand that was brought about by the stabilization measures was exacerbated by the decline in exports caused by the collapse of the Council for Mutual Economic Assistance (CMEA) and the consequent need to reorient exports to the West. There was also considerable uncertainty about what the future course of the economy would be and whether the shock therapy administered by the Solidarity-led government was credible in the long run.

In this environment, the investment decisions of Polish firms were more likely to be oriented toward reducing the physical capital of the firm than toward increasing it. The decline in aggregate demand and the loss of markets in the ex-CMEA countries implied that many firms, and particularly the big state-owned firms, held large stocks of no-longer needed machinery, equipment and technology whose output could not be sold on the depressed domestic market or whose output was only suited for the suddenly-lost CMEA market. Many of these firms also owned social assets, such as housing for workers and recreation, health and child-care facilities, whose costs, in a market economy and with impending privatization, they could no longer bear. Consequently, many Polish firms had excess fixed capital given their current and expected future levels of output, and the types of products that their existing machinery, equipment and structures could produce no longer accorded with prospective market needs.

Under these circumstances, many Polish firms likely wished to reduce their capital stock. However, there were two limitations on the rate at which they could disinvest. The first of these was that the only practical means of reducing their capital stock was through depreciation. By making no gross investment outlays, they would be able to reduce their capital stock by an amount equal to depreciation. The decline in the firm's physical capital could be accelerated by scrapping capital or by selling it off. The former was not likely to be used frequently because it involved additional costs, such as those of demolition of buildings and the

disassembly and removal of machinery, that firms would have found difficult to bear given their financial difficulties in the transition period. Selling off physical capital also was not feasible because, given the depressed state of the Polish economy, there was unlikely to be a market for much of the plant and equipment of which firms wished to dispose.

Despite the desire of many Polish firms to reduce their stock of physical capital, there were also reasons why these same firms did wish to invest in new plant and equipment. Moreover, a demand for additional plant and equipment existed among the newly started private firms that emerged as part of the transition to a market economy. Newly formed private firms were better attuned to the needs of the emerging market, and they were often undercapitalized when they started out. Thus, they were likely to seek to expand their productive capacity and to increase their physical stock to bring it into equilibrium with their expected long-run output and with their other assets. Case study evidence (Brada & Singh, 1998) as well as the survey results reported in the following section demonstrate that large state-owned and formerly state-owned firms also had to make investments to adapt to the new market economy even if they found themselves with excess physical capital. In part, this was due to the need to purchase specific pieces of equipment that would enable firms to change their product lines or to upgrade the quality of their products so that they could respond to the needs of the domestic market or begin to compete on world markets. Firms also had to make investments in new information and data processing equipment to enable managers to better monitor performance; in equipment for environmental protection to comply with new environmental protection laws; and in retail and wholesale facilities to make up for the collapse of the former state-run distribution network.

For the firms that found themselves with below-equilibrium levels of capital, traditional western models of investment, incorporating uncertainty and financial constraints, are appropriate and should yield a good explanation of investment behavior. For firms with excess capital stock, the possibility of explaining their investment flows is limited. If these firms merely disinvested at the maximum rate by setting investment outlays to zero, then the stock of capital would serve as useful explanatory variable since depreciation is roughly proportional to assets. However, to the extent that even these firms had to make some investments in order to

remain viable, it is unlikely that specifications based on models of capital stock growth or on the assumption of zero gross investment are likely to explain the investment decisions of these firms well. We test this hypothesis by segregating our sample into firms that were net investors and those who were not.

3. DATA AND INSTITUTIONAL BACKGROUND

The investment behavior of Polish firms in the transition must be seen as part of a more complex and broader set of responses of firms to their business, legal and economic environment. This process, which involves privatization and organizational change as well as changes in financial and physical assets and liabilities is popularly called restructuring.² Carlin *et al.* (1994) in their survey of the literature on enterprise restructuring suggest four dimensions of enterprise restructuring: internal organization, output, labor and investment, a typology that reflects the approach of most of the research that their study surveys.

Changes in organization may involve changing to a divisional structure or to a holding company and subsidiary arrangement; disposing of certain operations, often social benefit facilities; changing the management structure to place greater emphasis on finance and marketing while reducing the number of managerial and white-collar employees. Changes in the legal structure of the firm can also be categorized as organizational changes. Privatization is perhaps the most dramatic such change, but corporatization, the change from a state-owned firm to a corporation whose stock is held by the state; involvement of workers in management; and entering into a joint venture with a foreign partner, all can influence the behavior of the firm as well. Indeed, Estrin *et al.* (1995) argue from case study evidence that privatization, or at least the imminence of privatization, is a key factor in changing the behavior of East European state-owned firms. Even if this interpretation of the data does not hold for all state-owned enterprises, we would expect to find differences between the behavior of large state-owned or formerly state-owned enterprises and new private firms, whose behavior ought to better reflect the objectives of their owners.

A second area of response is in the product market, where firms abandon old products, introduce new ones or adjust their product mix to meet new market demands (Singh and Gelb, 1994, pp. 58-59) or to seek

new markets abroad. Foreign technologies, product design and even packaging can play an important role in such adjustments. In view of the collapse of the distribution networks in Central Europe and of the difficulties in obtaining timely payment from retailers and distributors, the creation of marketing and distribution departments is also an important product-market response.

Changes in employment policies are also a potentially important element of adjustment. Shedding labor is, of course, key, but motivating workers through more differentiated wages and retaining skilled workers in the face of competition from foreign firms or from the private sector are also important elements of adjustment. Finally, alternatives to direct employment, via subcontracting or other indirect employment arrangements, may be viable forms of response (Singh and Gelb, 1994, p. 61). Adjustments in employment and wages are subject to a variety of pressures, including worker opposition, government regulations and tax policies, managerial reluctance, etc.

From the foregoing discussion, it is evident that the final component of restructuring, investment, is intimately connected to the other three elements. Firms that change their organization may require additional machinery, equipment and technologies to support these changes even as they find themselves with surplus capital of other types. The ability to enter new markets and to adopt new products often depends on possibly small, but nevertheless critical, investments. If surplus workers cannot be shed, then the desired level of capital for a given level of output is reduced. Privatization may influence a firm's desire for capital, although how is a matter of controversy as Belka *et al.* (1994) and Lizal and Svejnar (1997) come to opposite conclusions for Poland and the Czech Republic respectively.

Investment decisions are also connected to the restructuring of the firm's assets and liabilities. As we discuss further below, physical capital is only one of the firm's productive assets. Socialist firms tended to hoard physical capital and inventories, but they lacked liquidity, which was controlled by the banking system. With the emergence of a market economy, these firms required greater amounts of working capital to finance wage payments, receivables, etc. Thus, even if physical capital were below equilibrium levels, priority may have been given to building up cash. The structure of liabilities and assets was also influenced by the problem

of arrears in interenterprise payments. Thus, investment decisions by firms in transition economies should be viewed within the context not only of adjusting physical capital to output but also in relation to other assets and liabilities of the firm.

We utilize data drawn from a survey of Polish enterprises to provide evidence on their restructuring behavior in general and specifically on their investment in physical capital. Some 200 firms in Poland were surveyed by the World Bank to provide both standard financial data and responses to questions that bear on the issues of enterprise restructuring raised above. The data cover the period 1989 to 1993 for some variables and 1991 to 1993 for others. Characteristics of this sample of Polish firms are reported in Table 2. The sample was divided into four groups. The largest group is state-owned firms, which make up almost half the sample. Given the slow pace of privatization of state-owned firms in Poland, such a distribution is not surprising. Privatized firms are those state-owned enterprises that have been put into private hands. Joint stock companies are largely those formerly state-owned firms that have had their legal form changed from state-owned enterprise to joint stock company, even though the state may continue as the sole owner of all the shares. Finally, the emerging private sector consists largely of new startups by private entrepreneurs and also includes several cooperatives and small private firms with diverse roots.

As Table 2 indicates, the development of the four groups differed over the period surveyed. The emerging private sector proved most dynamic in terms of sales, and therefore of output, per worker. In this regard the privatized firms' performance was quite weak; they failed to increase nominal output per worker in a period of appreciable inflation. Their poor performance is also evident in the failure of their profits to grow and in their shrinking profit margins. Also quite evident from the Table is the relatively small size of the emerging private firms; about one-tenth of the size of the other firms by most measures.

Table 3 presents a number of measures of output adjustment by Polish firms. Looking at the distribution of sales among markets, only the emerging private sector gained appreciably in foreign markets, surprisingly in ex-CMEA markets. All other types of firms experienced a reallocation from CMEA to other foreign markets. Also noteworthy is the relatively large shift toward non-CMEA markets by state-owned firms

and the relatively feeble response by privatized firms. Use of marketing channels changed in much the same way for all types of firms. Direct sales to domestic customers declined while sales to retailers and wholesalers held relatively steady. In export sales, on the other hand, direct sales to customers increased, as did use of foreign trading companies. Thus on the domestic market, the role of distributors is growing, while on export markets Polish firms appear to be taking matters into their own hands or increasingly relying on the expertise of foreigners.

All types of firms also altered their product mix somewhat over the sample period. With the exception of joint stock companies, the trend was toward a focussing of emphasis on the firms' main products. All the other categories of firms increased the share of their main product in total output by more than the increase of other major products. This trend is, not unsurprisingly, most evident in state-owned firms, which formerly produced a broad range of output, much of it not very efficiently. Concentration of production should thus help to raise labor productivity and profitability.

Some firms made major new technology acquisitions, but emerging private firms did so most often, 73 percent of firms sampled, while state-owned firms did so least frequently, 45 percent of firms sampled. In part, this may be due to the fact that emerging private firms are growing more rapidly and have ongoing investment needs. In contrast, established state-owned firms have integrated production and technology structures that may not allow for partial infusions of new technology. At the same time, the emerging private firms are much more dependent on foreign production technology and product designs than are other types of firms. Greater openness toward the West may account for part of this tendency, sub-contracting for western firms may also be a factor.

Table 4 presents data on labor adjustment by Polish firms. The labor shedding in Polish industry post-1993 that was evident from labor market surveys (King and Adamcik, 1999) is well predicted by the information on the current level of employment, which many respondents regarded as too high in 1993. In fact, the majority of state-owned firms and joint-stock companies regarded employment as too high, while, in contrast, the majority of privatized and emerging private firms claimed to have about the right level of

employment. Inability to shed excess labor may be both financial barrier to investment as well as a factor promoting lower levels of the firm's desired capital stock.

The failure to shed labor is well-explained when we consider the reasons firms cited for not reducing employment. No privatized or emerging private firm listed the low financial burden of wages as a reason; the hard budget constraint makes any excess labor a meaningful financial burden to these firms. In contrast, social factors play a large role in the employment decisions of joint-stock (but state-owned) and state-owned firms. All enterprises had vacancies, indicating some difficulty in attracting workers with specific skills. Private firms had greater vacancies, given their smaller size, than did other types of firms.

In all, there are significant differences between the labor-force adjustment of state-owned and joint-stock companies and privatized and emerging private firms. The latter appear more constrained by the hard budget constraint, or, perhaps, they find it easier to adjust labor to output because of their more rapid expansion of sales. Surprisingly, while privatized firms are outliers in terms of output-market adjustment, their labor-market adjustment is quite similar to that of the emerging private sector.

In Table 5 we examine firms' adjustment of their capital stock. The emerging private sector, consisting of newly founded firms or spin-offs of older firms, has a relatively modern capital stock. The other three categories of firm have a more traditional age distribution of capital, with joint stock companies having the least favorable age distribution. State-owned and joint stock companies also have a significantly lower capacity utilization rate.

About 75 percent of privatized, joint stock and emerging private firms are able to identify profitable investment opportunities in their operations or have made such investments; for state-owned firms, the percentage is around 60 percent. Proportionally to their size, as measured by sales or employment, private firms make larger investments. Given the age structure of their capital, emerging private firms invest mainly to expand new capacity; other types of firms make the bulk of their investment outlays for repairs. This suggests relatively low or even negative levels of net investment by these categories of firms. Even among these firms, investments to expand output may coexist with negative net investment because the firms may be expanding

capacity to produce one or a few key products while reducing their overall capacity. Financing of investment by means of bank credits is most prevalent in the private sector, reflecting either a lack of internal cash-flow to finance investment or the better creditworthiness of this sector.

In sum, all types of Polish firms are undertaking a restructuring of products, markets, employment and capital stock. The emerging private sector exhibits the greatest change, perhaps due to its more dynamic past and prospects. Nevertheless, their output and market adjustments are moving all firms in more or less the same direction. In terms of labor and capital adjustment, there are greater differences between those firms that remain in state hands, whether SOEs or joint-stock companies, and private firms. This survey clearly shows that investment decisions need to be considered within the broader context of a complete realignment of the firm's productive assets.

4. THE MODEL

The framework that we use for our study of the investment behavior of Polish firms is based on a model of portfolio choice developed by Courakis(1988) and applied to the study of the investment behavior of firms in the United Kingdom by Hay and Louri(1989, 1994). In this model, the firm is viewed as a portfolio of assets and liabilities. The assets yield returns to the firm, while the liabilities impose costs on the firm. Individual assets and liabilities differ in their returns and costs and the task of the manager is to adjust the mix of assets in such away as to maximize the value of the firm over time. Because future returns are uncertain, the manager must consider not only the returns (costs) that each asset (liability) entails but also the variances of the costs and returns and the covariance that are likely to exist among them. The manager's decisions must also respect the constraints imposed by the asset-liability relationships implied by the balance sheet constraints and the relationship among the assets and liabilities that result from the firm's production function.

A model of investment based on such a general-equilibrium approach to asset and liability choices by the firm is particularly attractive for modeling the investment behavior of firms in transition. Such firms not only

needed to bring physical capital into equilibrium with production, but they also had other, perhaps more important, asset and liability imbalances that were a legacy of their socialist past. For example, firms had very little working capital. Because all their payments for inputs had been cleared through the central bank, which issued credit automatically, there was no need for working capital; indeed, such "loose funds" were seen as undesirable by the authorities. When automatic funding by the central bank ceased, managers had to accumulate working capital, which some did through the expedient of interenterprise arrears. Similarly, with very low interest rates and uncertainty about deliveries, socialist firms carried excessively large inventories; these, too had to be adjusted as the old system was replaced by one where inventory costs were a real burden and where interest rates suddenly increased many fold. Thus managers had to make major adjustments to all assets and liabilities not just to physical capital, and, as a result, a model that takes the entire balance sheet into account should yield more meaningful results than can a model that focuses exclusively on physical capital and on *ad hoc* financial constraints.

To develop such a model, Hay and Louri (1994) assume that the manager's utility function is given by:

$$U = b - c \exp(-a P/W) \quad \text{Eq. 1}$$

where a , b , and c are parameters, P is profits and W is the value of the firm's assets at the start of the period.³ Further, assume that, of the n assets and liabilities, k of them can be varied by the firm within the decision period while $n-k$ of them are fixed during that time. Then, letting the subscript v denote the variable assets and liabilities and f the fixed ones,

$$P = (1+r_v)'A + (1+r_f)'B \quad \text{Eq. 2}$$

where A is the vector of variable assets and liabilities, B the vector of fixed ones and r the stochastic costs and returns on the n liabilities and assets.

The manager's expected utility can thus be rewritten as:

$$E(U) = b - c \exp((-aP/W)(1+a^2 V/2W^2)) \quad \text{Eq. 3}$$

where V is the variance of the returns on the entire portfolio of assets and liabilities. Equation 3 is maximized subject to the constraint that assets must equal liabilities and shareholders' wealth and that there are $n-k$ fixed assets and liabilities. Solving this constrained maximization problem yields a set of demand functions for the variable assets and liabilities that take the form:

$$A = (1/a)WG(1+r_v) - HB \quad \text{Eq. 4}$$

where G and H are matrices of coefficients that depend on the covariances between the costs and returns of the various elements of the portfolio. For purposes of estimation, we normalize Equation 4 by W , yielding

$$W^{-1}A = (1/a)G(1+r_v) - HW^{-1}B \quad \text{Eq. 5}$$

In this specification, the share in total assets of any asset that is subject to managerial discretion within the planning period is a function of the returns to or costs of the other variable assets and liabilities and of the levels of the assets and liabilities that are fixed during the decision period.

The balance sheet of the firm consists of the following items:

Assets	Liabilities
<i>Net physical capital</i>	<i>Long term liabilities</i>
<i>Inventories</i>	<i>Short term loans</i>
<i>Trade credit and cash</i>	<i>Shareholders' equity</i>

Net physical capital consists of the stock of physical assets that the firm has at the start of the planning period, and this starting value is thus not subject to managerial control. The stock of physical capital changes over the period in two ways. It is reduced through depreciation, over the rate of which the manager has no control, and it is increased by means of positive net investment. While the stock of capital, K , is thus fixed at the start of the period, the level of net investment, NI , is a decision variable for the manager, although it is bounded from below by the amount of depreciation that occurs in the planning period. Inventories are treated in analogous fashion: the stocks on hand at the start of the year are beyond managerial control, although inventories can be

augmented or run down in the course of the planning period. Starting stocks of long-term liabilities, which for Polish firms consisted largely of long-term credits from banks, were also beyond managers' control. Indeed, managers could neither control the initial stock of long-term debt at the start of the planning period, nor could they increase it much during the planning period because banks were generally unwilling to make new long-term loans at this time.

Trade credit and cash on the asset side and short-term loans on the liability side are assumed to be under the control of the manager. This is because managers have the ability to use cash to pay off short-term loans, which mostly take the form of supplier credits from the suppliers of the firm's inputs. Finally, shareholder equity is a residual whose value at the end of the planning period is determined by its starting value and by the results achieved by the firm during the course of the implementation of the portfolio changes decided by the manager.

5. EMPIRICAL RESULTS

We have previously hypothesized that some Polish firms were attempting to reduce their stock of physical capital while other firms were trying to increase their physical capital according to the model set out above. If this hypothesis is indeed true, then the firms in the former category will have investment flows that are unlikely to be explained well by our model of investment because their (dis)investment may be the upper bound of disinvestment, which is determined by the statutory level of depreciation. Moreover, even a simple model of their investment behavior that uses the capital stock to explain the level of depreciation is unlikely to explain their behavior well, because many of these firms did have to make investments for repair, modernization, etc. in order to remain viable. On the other hand, we would expect that firms that are increasing their capital stock are doing so in a way that reflects the portfolio-adjustment model of investment that we have presented in this paper.

In order to test this hypothesis, we partitioned the sample of Polish firms into two sets after deleting firms that had incomplete data or where obvious coding errors were evident. In one set, which consisted of 137

firms, we included ones whose net investment was negative in at least two of the three years of the sample period. In the other group, which consisted of 32 firms, we included those firms that had positive net investment in at least two of the three years of our sample period. Descriptive statistics for the two samples are contained in Table 6, along with variable definitions. Some differences between the two sets of firms emerge. The non-investing group has negative net investment, an obvious consequence of the criteria for partitioning the sample, with firms on average reducing their physical capital by an amount equal to 3% of their total assets per year. Since physical capital accounts for about 60 percent of their total assets, this means that declines in physical capital *ceteris paribus* would be close to 6 percent per year. Given the rather conservative depreciation rates that existed in Poland at the time, this suggests that there are likely to be firms in the sample whose gross investment at times was close to zero.

Firms that made positive net investments, on the other hand, made rather significant increases in their physical capital. Nevertheless, the implied rate of 30 percent per year must be interpreted with caution. First, many Polish firms had on hand a considerable amount of already depreciated equipment, and thus the physical capital base tended to be understated. A more serious problem is that the value of previously-installed equipment was not adjusted or was adjusted insufficiently to reflect the high rates of inflation that occurred during the transition. Thus, net additions to capital, valued at current prices and also, in the case of imported machinery and equipment reflecting the sharp devaluation of the Polish *zloty*, tended to look large against the existing stock of capital and other assets.

The two groups also differ in terms of their starting asset and liability structure. The firms that made positive net investments had a lower share of assets consisting of physical capital. This may reflect their relatively better financial condition that thus enabled them to hold a proportionately larger stock of cash and inventories. The better financial condition of the investing firms is confirmed by the structure of their liabilities, which involve a lower proportion of long-term bank loans. The better financial condition of the investing firms is also evident in the income statement variables that we use to measure some of the costs and returns to the balance sheet items. For example, the investing firms generate twice the sales per *zloty* of assets, and their

normalized cash flow, consisting of profits and depreciation divided by assets, is about 20 times that of the non-investing firms. Of course, they also pay twice the taxes that the non-investing firms do, but the striking result here is the high tax per *zloty* of profits paid by the non-investing firms relative to their cash flow.

The model of the firm developed above implies that we should estimate a system of simultaneous equations, with the assets and liabilities that are under the manager's control during the planning period as the dependent variables and the non-varying assets and liabilities and the costs and returns to variable balance sheet items as explanatory variables. However, because it is difficult to provide direct measures of the costs and returns for the balance sheet items, we are forced to utilize proxies for some of these variables. Consequently, we have to use a single equation estimation approach and focus on net investment divided by total assets as the dependent variable. This has implications for interpreting the signs of the estimated coefficients because they are therefore derived from a reduced-form specification.

For the stocks of financial assets and liabilities, the costs and returns are given by the real interest rate, RINTRATE. The return to inventories is given by the variable SALES, which is the ratio of the current year's sales to assets. The higher sales, the greater the value of inventories since running short would reduce sales, and having to produce more at times of peak demand would impose higher production costs on the firm. The return to additions to plant and equipment, NI, is modeled as depending on CASHFLOW, TAX, and CAPUTIL. The first of these variables measures the return to capital when viewed from the standpoint of the firm because the firm benefits both from the profits realized by operating the capital and from the cash flow generated by the depreciation of this fixed capital. The TAX variable measures the burden of additional profits, which may increase the firm's taxes, and it also captures the firm's wage policies. The latter factor is due to the fact that, for many Polish firms, above-average wage increases triggered the payment of the *popiwiek*, a punitive tax on high wage growth. Thus, firms with high taxes can be assumed to be following a policy of above-average wage increases, perhaps at the behest of their workers' councils, and, therefore, they are likely to invest little in fixed capital. Alternatively, they may be exceptionally profitable and thus in a better position to finance investment as well as wage increases. We also use a sectoral variable to measure the return to investment in plant and

equipment. This sectoral variable is CAPUTIL, which is the ratio of the sector output in the present year over sectoral output in 1989, the pre-“big-bang” year. If capacity utilization in the sector is high, then we would expect that returns to additions to productive capacity would be more profitable for firms in that sector as compared to firms in a sector where capacity utilization is low. On the other hand, if all firms in a sector have excess capacity but some find that they are unable to compete on the market because they lack certain specific technologies or pieces of equipment, then the coexistence of excess capacity with positive gross, and even positive net, investment is possible.

Entering the pre-determined stock variables and the costs and returns to variable assets into the regression equation, we obtain:

$$NI_{i,t} = \alpha + \beta K_{i,t} + \chi LTLIAB_{i,t} + \delta STOCKS_{i,t} + \omega RINRATE_t + \phi SALES_{i,t} + \gamma CASHFLOW_{i,t} + \eta TAX_{i,t} + \lambda CAPUTIL_j + \varepsilon_{i,t} \quad \text{Eq. 6}$$

where $\varepsilon_{i,t}$ is the stochastic error term. Equation 6 is estimated using panel data for 1991-93. Because we hypothesize that the behavior of investing and non-investing firms will differ, we estimated Eq. 6 separately for the two samples.⁴ Parameter estimates and diagnostic statistics are reported in Table 7. To test whether sectoral factors were of importance, we stratified the sample by sector and also by ownership form, estimating individual sectoral or ownership dummies. An analysis of these dummies revealed no significant effects of sector or ownership form investment behavior and thus we do not report these estimates.

The empirical results strongly support our hypothesis that there is a fundamental difference between the behavior of firms that made positive additions to their physical capital and those that did not. The model of the firm as a portfolio of assets and liabilities does a good job of explaining the behavior of the firms that increased their physical capital. Equation 6 explains 69 percent of the variance in net investment (*NI*) using the explanatory variables proposed by the theory, and the estimation procedure yields parameters that are consistent with the theory. On the other hand, the same specification does much less well in explaining the investment decisions of firms that sought to reduce their stock of physical capital. Indeed, the specification explains only 10 percent of the variance of the dependent variable in the case of firms that failed to make

positive net investments during two years of the three-year sample period. The coefficient estimates also demonstrate significant differences in investment behavior by the two groups of firms. The share of fixed capital in assets has a significant and positive impact on the net investment of firms that invested over the sample period. This is to be expected because firms with more capital-intensive production processes would invest more than less capital-intensive firms so as to adjust their capital upward by larger amounts. On the other hand, non-investing firms had a negative and very significant coefficient for this variable. This is consistent with our hypothesis that, for such firms, the major way of adjusting their capital stock was through depreciation, which is proportional to physical capital.

Both groups of firms increased investment in physical capital in response to increases in the real interest rate. Because Equation 6 is a reduced form, this suggests that increases in the real interest rate, the price of financial assets and liabilities, tended to reduce investment in other assets, including liquid assets such as receivables as well as inventories, thus directing funds toward investment in fixed capital. Both groups of firms also increased investment in fixed capital in response to higher sales per unit of fixed capital. Since the SALES variable proxies the return to inventories, the negative coefficient suggests that, as returns to inventories increased, firms sought to increase their fixed capital so as to reduce reliance on inventory stocks to buffer fluctuations in sales. The return to net investment is proxied by CASHFLOW, TAX and CAPUITL. In the case of investing firms, the coefficient of the CASHFLOW variable is negative, suggesting that as firms with high cash flow tended to invest less per zloty of fixed capital than did firms with lower levels of profit and depreciation per unit of fixed capital. The CASHFLOW variable represents a historical return to capital in the sense that a large part of it may consist of capital depreciation rather than current or prospective profits. Thus, even though firms may have benefited from the cash generated by depreciation, such cash flows need not have stimulated investment in new capital. The tax variable for this group of firms is positive and significant. It is also a better indicator of the return to current capital outlays in that taxes on profits are less subject to the influence of cash flows from depreciation and thus reflect the near-term return to investment better than does cash flow. Moreover, firms that had large profits were often pressured by workers to raise wages aggressively, thus making these firms subject to very high wage taxes. Therefore, the TAX variable is a better indicator of the

return to current net investment in that it better reflects current profits as well as the benefits of substituting capital for labor. In the case of non-investing firms, neither of these variables is significant, although capital utilization, with the expected sign, is. In sum, our results demonstrate that the behavior of investing and non-investing firms in Polish industry differed significantly, as theory suggests, and that, for investing firms both real and financial variables play a role in determining the level of investment. Moreover, for investing firms, these explanatory variables explain a large part of the inter-firm and inter-temporal variation in net investment. Our results also show that there are systematic factors that influence the investment behavior of non-investing firms, but these factors are able to explain only a small part of the variation in investment outlays among firms and over time.

These findings have some broader implications for transition economies. One is that we need to take care in applying standard models of economic behavior to transition-economy phenomena by considering how the contraction of economic activity in these economies may limit the usefulness of models developed for economies characterized by steady growth. The second broader implication of our findings is that monetary and fiscal policies were unlikely to have much impact on firms' willingness to invest in new plant and equipment during the early transition. As the regression results for the non-investing firms bear out, these firms' investment decisions are quite unresponsive because these firms are simply reducing their physical capital as quickly as they can, and the great disequilibria they face in their asset structure are unlikely to be influenced by efforts to stimulate investment by means of low interest rates or by the implementation of pro-investment industrial policy.

TABLE 1
Macroeconomic Indicators for Poland, 1989-1993
(% change from previous year)

Indicator	1990	1991	1992	1993	1989-93
Gross domestic product	-11.6	-7.8	1.5	4.5	-13.6
Gross industrial production	-24.2	-11.9	3.9	5.6	-25.5
Industrial employment	-9.1	-3.4	-8.2	-1.3	-20.4

Source: Główny Urząd Statystyczny, Rocznik Statystyczny (various issues)

TABLE 2

		Basic Indicators for Polish Enterprises by Type, 1991-93 Enterprise Average (million zloty)				
		State-Owned Firms (n= 81)	Privatized Firms (n = 41)	Joint Stock Cos. (n = 40)	Emerging Private (n = 45)	
Gross Profit	1991	19813.	24533.	29137.	2073.	
	1993	16261.	25364.	57069.	3838.	
	% change	-17.9	3.4	95.9	85.1	
Total Assets	1991	139777.	122390.	326603.	36847.	
	1993	165693.	170248.	401042.	N.A.	
	% change	18.5	39.1	22.8	N.A.	
Sales	1991	132613.	144712.	246031.	15390.	
	1993	171702.	215658.	359394.	43020.	
	% change	29.5	49.0	46.1	179.5	
Number of workers	1991	916	746.	1301.	119.	
	1993	718	1132.	1051.	150.	
	% change	-21.6	51.7	-19.2	26.1	
Net wage bill	1991	17499.	15930.	15390.	1538.	
	1993	29432.	32720.	43020.	4301.	
	% change	68.2	105.4	79.5	179.6	
Wages % change		89.8	53.7	98.7	153.5	
	Gross profit/sales	1991	0.149	0.169	0.118	.135
		1993	0.095	0.118	0.159	.089
% change		-36.6	-30.2	34.1	-34.1	
Sales/worker	1991	145.	194.	182.	129.3	
	1993	239.	191.	342.	286.8	
	% change	65.1	-1.8	80.7	121.8	

N.A. = total not available due to coding errors.

TABLE 3

Output Adjustments in Polish Firms						
	State-Owned Firms (n = 81)	Privatized Firms (n = 41)	Joint Stock Cos. (n = 40)	Emerging Private (n = 45)		
<u>Markets & Product Mix</u>	1989	1989	1989	1989	1989	1993
	1993	1993	1993	1993	1989	1993

Distribution of Sales (%):									
domestic	78.8	78.5	81.1	86.4	77.3	77.9	82.1	78.6	
CMEA and ex-CMEA	10.6	3.4	8.5	2.2	10.6	3.1	2.7	6.4	
other foreign	10.2	17.9	10.4	13.2	16.3	21.5	10.1	9.3	
Shares of marketing channels (%)	1991	1993	1991	1993	1991	1993	1991	1993	
Domestic sales (% total)	82.0	78.6	85.9	86.4	76.0	76.8	84.9	78.1	
of which: direct to customer	52.0	49.8	47.4	46.0	57.2	53.7	49.2	43.0	
retailers & wholesalers	30.0	28.8	38.5	40.4	18.8	23.1	33.4	32.8	
foreign sales (% total)	18.0	21.4	11.7	13.6	24.0	23.2	12.7	21.9	
of which: direct to customer	2.9	7.3	3.7	5.8	4.9	8.9	10.8	15.5	
via Polish trading co.	12.8	10.9	5.6	4.0	13.6	18.4	1.4	3.1	
via foreign trading co.	2.3	3.2	2.4	3.8	0.6	0.8	0.6	3.3	
Change in share of total output (1991-3)									
of:									
largest product		9.4	5.8		0.9		5.8		
2 nd largest product		4.1	3.3		1.9		-5.3		
3 rd largest product		4.9	-0.2		NA		5.3		
Acquisition and introduction of major technologies, 1991-3	37 yes		28 yes		24 yes		33 yes		
% Output based on:									
foreign technology		16.3	7.7		12.7		33.0		
foreign product design		13.1	8.2		9.2		23.4		

TABLE 4

Labor Adjustment in Polish Firms

	State-owned Firms (n = 81)	Privatized Firms (n = 41)	Joint Stock Cos. (n = 40)	Emerging Private (n = 45)
Current Employment level (% of firms)				
too high by > 20%	10	5	5	4
too high, 10-20%	15	5	33	7
too high, 5-10%	28	30	20	31
about right	46	52	35	53
too low	1	7	7	5
If too high, not reduced due to: ^a				
low financial burden of wages	3	0	1	0
output expected to increase	22	11	15	11
legal obstacles	4	3	1	3
social factors	24	6	13	5
worker resistance	12	6	4	5
other	5	2	5	2
Number of vacancies open > 2 mos.	62	26	98	26
Industrial action				
Yes	13	2	3	2
No	64	39	29	43
Threat	4	0	8	0

^a firms could list more than one reason

TABLE 5

Capital Adjustments in Polish Firms

	State-owned Firms (n = 81)	Privatized Firms (n = 41)	Joint Stock Cos. (n = 40)	Emerging Private (n = 45)
Age structure of capital stock (%)				
0-5 years	18.3	21.5	11.2	62.2
5-10 years	20.7	25.4	14.1	23.9
10-15 years	21.8	20.5	31.5	8.6
> 15 years	49.4	33.7	50.8	7.6
Capacity utilization (%)	58.8	69.8	57.7	76.4
Does profitable investment opportunity exist?	48 yes	33 yes	31 yes	34 yes
Major investment in 1991-93	53 yes	33 yes	30 yes	35 yes
Type of investment (no. of responses) ^a				
Repair	27	20	13	10
New capacity	27	13	11	27
Social investment	2	0	1	0
Other	6	2	6	4
Objective (no. of responses) ^a				
Cost reduction	16	8	7	10
New product	19	12	8	13
Expand output	23	16	8	14
Environment	7	5	8	4
Better work conditions	14	4	5	3
Other	5	3	7	6
Value of investment (mill. zl.)	23002.	14417.	14669.	4143.
Source of financing (number of responses) ^a				

^a firms could give more than one response

Internal	32	30	20	29
Bank Credit	11	9	8	20

TABLE 6

Descriptive Statistics and Variable Definitions

Variable Name	Investing Firms		Non-Investing Firms	
	Mean	Std. Dev.	Mean	Std. Dev.
NI	0.1459	0.4506	-0.034	0.1033
SALES	2.8558	2.7841	1.4127	1.2821
STOCKS	0.2178	0.1544	0.1906	0.1204
LTLIAB	0.6263	0.2624	0.7042	0.3577
K	0.5164	0.2196	0.6141	0.3832
CASHFLOW	0.2603	0.4617	0.0143	0.2366
TAX	0.4102	0.4872	0.2292	0.2024
RINTRATE	6.2333	3.6350	6.2333	3.6350
CAPUTIL	0.7017	0.0672	0.6915	0.0685
n =	32		137	

Variable Definitions Based on Balance Sheet and Income Statement Items:

NI= gross investment in P&E minus depreciation*

SALES= revenues from goods sold*

STOCKS= inventories at start of year*

LTLIAB= long-term loans from banks, other loans and shareholder equity*

K= value of plant and equipment at start of year*

CASHFLOW= profits plus depreciation*

TAX= tax liabilities incurred over the year*

RINTRATE= bank lending rate minus change in producer price index

CAPUTIL= sectoral output in year t / sectoral output in 1989

Note: *= variable is divided by total assets

TABLE 7

Parameter Estimates for Equation 6

Variable	Investing Firms	Non-investing Firms
K	0.511** (0.210)	-0.080* (0.026)
LTLIAB	-0.059 (0.138)	0.023 (0.028)
STOCKS	-0.015 (0.268)	-0.054 (0.050)
RINTRATE	0.015** (0.008)	0.005* (0.001)
SALES	0.036** (0.021)	0.011** (0.005)
CASHFLOW	-0.266** (0.110)	-0.028 (0.028)
TAX	0.800* (0.132)	-0.005 (0.030)
CAPUTIL	0.105 (0.552)	0.234** (0.117)
R ²	0.6905*	0.1008*
Adjusted R ²	0.6457 n=96	0.0714 n=411
Notes: 1. Standard errors in parentheses. 2. * - significance level [p-value] < 0.01 3. ** - significance level [p-value] < 0.05		

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FOOTNOTES

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¹ For surveys of these models and their applications, see Jorgenson (1971), Chirinko (1993).

² For discussions of enterprise restructuring in Poland, see Gomulka (1993), Pinto *et al.* (1993) and Schaffer (1993).

³ The parameter a is thus the measure of the manager's risk aversion, and so the term (a/W) implies that risk aversion declines with asset size. This is a useful assumption for the Polish case because large firms were politically powerful, and it was widely expected that the Solidarity government would not allow large firms, especially ones with powerful trade union movements, to go bankrupt.

⁴ Estimations based on pooling the entire sample yielded poor results in terms of explanatory power and significance of coefficients.



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