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Investment in Polish manufacturing in the years 1996–2007 and the role of sector's financial positions and general credit risk

Abstract: Modeling determinants of investment remains a difficult challenge. It is even more difficult in new market economies such as Poland, due to limited availability of high frequency data and changes in institutional and financial infrastructure. In the article, following the research already done for developed economies we study the relationship between financial pressure, and other variables and investment in Polish manufacturing. By augmenting the set of determinants by a dummy representing institutional factors we, for the first time for Polish manufacturing, allow for the impact of changes in the quality of institutional framework and in consequence get much better fit of the model.
Keywords: investment in manufacturing, financial pressure, country risk, institutions, Granger test.
JEL codes: E01, G10, G31.

Introduction

Investment plays a crucial role in new market economies. It has a double character from a macroeconomic perspective, namely it is a component of aggregate demand and at the same time it is a key factor of the structural and modernization dimensions of aggregate supply. The later is of utmost importance for Poland which is a country striving to close the technological gap with the core European economies. Investment decision making has attracted the researchers' attention for years. Determinants of investment in the new market economies, such as Poland, are even more interesting

due to the underdevelopment of financial intermediation, institutional and contractual problems and extensive restructuring and modernization needs.

The aim of this paper is to investigate the relationship between selected financial factors, the general institutional framework and investment outlays in the Polish manufacturing sector. In particular, we focus on financial pressure (represented by a liquidity ratio) and general credit risk being a proxy for the quality of the institutional framework. We have also used real output and lagged investment outlays in manufacturing in Poland for the years 1996–2007 as explanatory variables.

The structure of the remainder of this article is as follows. Section 1 presents the stylized facts of investment outlay dynamics in Polish manufacturing. In Section 2 we describe the data set used. Empirical results based on a standard and augmented model are presented in Section 3. Section 4 offers interpretation of the results and the Conclusion summarizes the findings.

1. Investment outlays in manufacturing in Poland. Stylized facts

The literature on the importance of investments for countries under transition confirms the influence of investments on economic development (Liberda *et al.* 2002, Roszkowska 2004). Along with the variation in the quantity and quality of the labour force and technology, investments are the prime determinants of economic growth. The level of investment in Polish manufacturing has been so far the highest among all sections of the economy[1]. Such a trend was a result of the simultaneous operation of autonomic mechanisms in the external market and processes of European economic integration and it reflected Polish comparative advantages.

Descriptive data regarding investment expenditure will be presented according to sections of economy and divisions (groups of divisions) of manufacturing[2]. Important elements of the investment analysis include investment allocation on the four main classes of fixed assets, namely buildings and structures, machinery, technical equipment and tools, transport equipment as well as the remaining assets. From the perspective of development and the competitiveness of manufacturing, the most important expenses are those incurred as a result of the purchase of machinery, technical equipment and tools, as well as for vehicles, as they are directly

[1] The Central Statistical Office (henceforth GUS) publishes data along a standard, EUROSTAT division of the economy into sections.

[2] Note that this is a standard classification used by the GUS. All structural data and classification standards have been taken from GUS Yearbooks.

related to the technologies used (or implemented) and to the productivity or logistics of supply chains.

Figure 1 depicts investment spending for the period 1996–2007. Investments

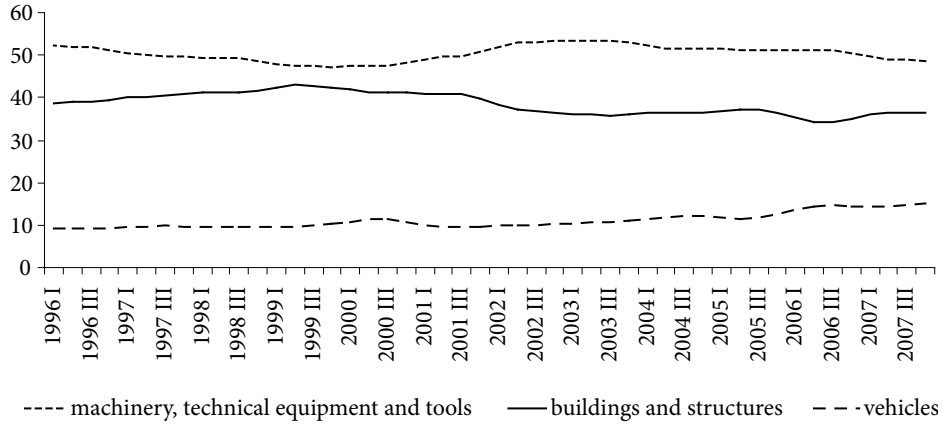

Figure 1. Structure of investment expenditure in the Polish manufacturing (1996–2007)
Source: Own work based on GUS data

in 'buildings and structure' and 'machinery, technical equipments and tools' displayed a relatively high variability. They are also negatively correlated. Contrary to them, investment in 'transport equipment' remained relatively stable and drifted upwards. The structure of expenditure reflects the manufacturing's requirements resulting from the unification of the pan-European market and, consequently, the development of intra-industry trade[3].

Manufacturing, against the backdrop of other divisions, displays the highest and ever increasing level of investment expenditure (see Figure 2). Between 2001 and 2007, investment in manufacturing increased from 38% to almost 50% in all six examined sections. It is worth mentioning that the significant drop in investment expenditure generated by the whole manufacturing[4] in 1999 preceded the decrease in aggregate investment expenditure in the years 2000–2002 (see Figure 3). Therefore, the drop in investment expenditure in manufacturing largely contributed to the overall slowdown in general investment expenditure dynamics within the whole economy.

[3] The high growth in expenditure on transport in 2004–2005 results from tax changes, among others. For more on the topic, refer to *Institutional Change in the European Transition Economies. The Case of Poland,* T. Kowalski, S. Letza, C. Wihlborg, eds. Wydawnictwo Uniwersytetu Ekonomicznego w Poznaniu, Poznań 2010.

[4] The decrease in investment was observed in the following sections: manufacturing, production and supply of utilities, mining and quarrying.

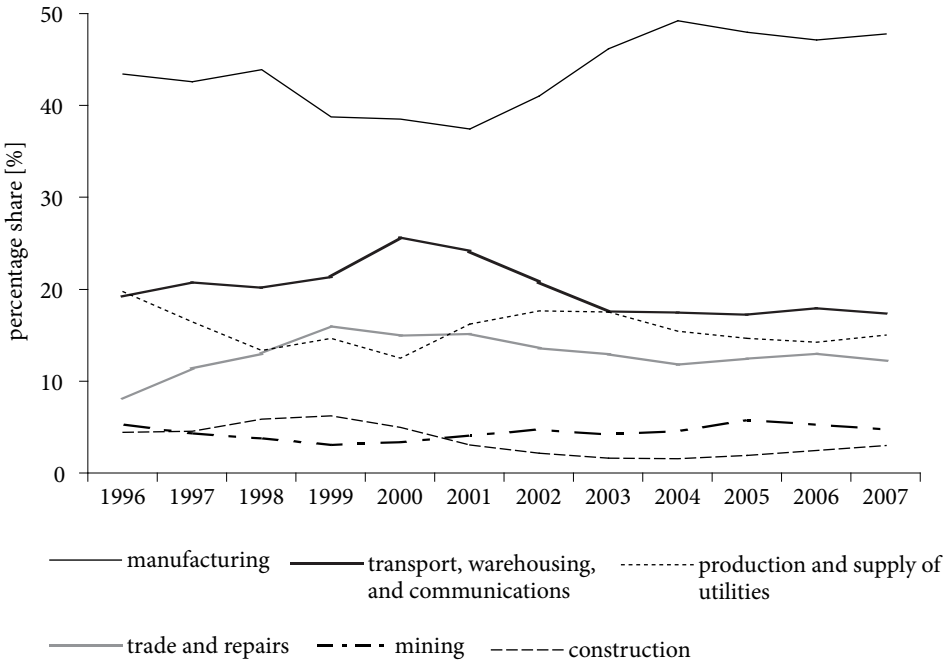

Figure 2. Contribution to total investment as a percentage share: 'manufacturing'*, 'construction', 'trade & repairs', 'transportation, warehousing, & communications' and 'utilities' (1996–2007)

* According to GUS methodology, 'Industry' is the sum of three sections: manufacturing sector, mining sector, and the production and supply of utilities (electricity, gas, water and sewage)

Source: Own calculation based on the GUS data

Two decades of transition have put a mark on the Polish economy as the previously manufacturing-oriented economy has become a service-oriented one. Additionally, deep structural changes have occurred within the manufacturing. Despite maintaining the highest and most stable level of investment, the manufacture of food products and beverages recorded the largest fall in terms of the share of total output sold. In general, the changes in prevalence are heading from non-storable goods towards durable goods. Another notable regularity is observed in the metal production division. The proportion of metal production in industrial output sold has fallen steadily. The initial importance of metal production resulted from the inherited manufacturing structure, as centrally planned economies placed a great emphasis on heavy manufacturing.

The dynamics of total investment expenditure and investment in manufacturing are very similar (see Figure 3). Upon comparing the dynamics of total investment expenditure with the expenditure in manufacturing, it is clear that the latter was the overall leader (Figure 3).

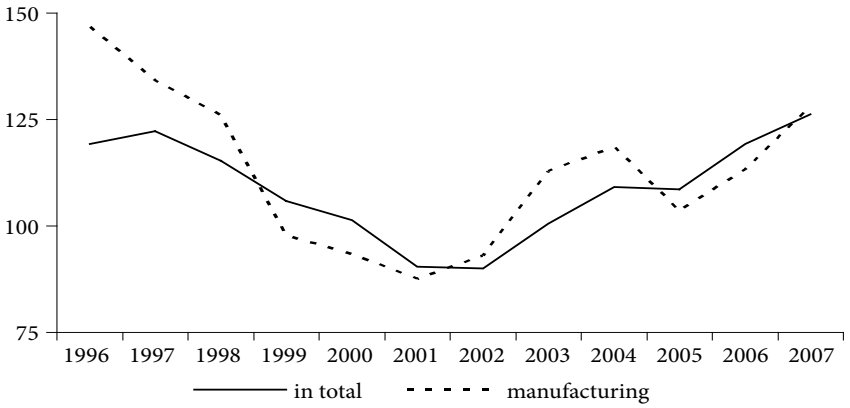

Figure 3. Dynamics of investment expenditure in Poland in 1996–2007
Source: Own work based on GUS Statistical Bulletins for the years 1997–2008

According to Figure 3, total investment expenditure during the period 1996–1998 grew by 15–22% p.a. In 1999 and 2000, expenditures experienced a period of stagnation, whilst in 2001 and 2002 they fell by approximately 10% p.a. Since 2003 and until the end of the studied period, expenditure steadily grew from an insignificant level of 0.6% to 26.2% in 2007.

Based on the analysis of the stylized facts investment in manufacturing in Poland during the period 1996–2007, we may draw the following major conclusions:

– there was a clear positive trend in Polish investment activity pertaining to expenditure on machinery and equipment;
– the proportion of investment expenditure for knowledge-absorbent divisions was rather small;
– investment expenditure was subject to strong variation – the variability ratio was generally high.

The greatest coefficient of variation in investment expenditure occurred in the 'metal production' division. The divisions with the lowest coefficient of variation included those with fairly low investment expenditure and 'manufacture of food products and beverages'.

Having thus sketched an outline of the trends in Polish industrial investment, we may attempt (in Section 2) to quantify the influence of selected financial variables and specific country risk on investment.

2. Data description and modeling procedure

All the data concerns the manufacturing NACE section, which is divided into 23 divisions. We use a quarterly sample over the period 1996:Q1 to 2007:Q4. All series

are seasonally adjusted using the Henderson Curve, HP-detrended with the standard smoothing coefficient $\lambda = 1600$ and expressed in log-linear terms.

We divide our testing and modeling strategy into two steps. In the opening step we begin with causality tests. Then, following (ECB, 2008; Hernando, Martinez-Carrascal 2008; Baumann, Price, 2007) we use a standard modeling approach in order to determine (in the case of Polish manufacturing) its investment function. In doing so we have used the following detailed data:

- investment, (investment outlays by manufacturing divisions – source: Statistical Bulletin, Central Statistical Office, 1996 – 2008: Frequency: quarterly, period: 1996–2007, more information regarding the data used: Statistical Bulletin, Central Statistical Office, No. 2, 2009, p. 21[5],
- manufacturing output sold (source: Statistical Bulletin GUS 1996–2008: Frequency: quarterly, period: 1996–2007, more information regarding the data used: Statistical Bulletin, Central Statistical Office, No. 2, 2009, p. 21[6],
- financial pressure – we used the quick ratio (liquidity ratio of the second degree is the relation of the short-term investments and short-term receivables to the short-term liabilities (without special funds), expressed as a percentage, source: Results of financial entities in 2007, Central Statistical Office, Warszawa, 2008, p. 15),

In the second step we augment the investment equations by dummies that could be used as proxies of institutional quality and general credit risk. Since it has not been directly observed we have used the Institutional Investor's Country Credit Rating for Poland as the proxy. Thus we run various models with this proxy added to the right-hand variable set. We assume that in such a transition economy as Poland, these qualitative factors could play an important role. This specific role could be strengthened by the fact that foreign direct investment in manufacturing played a significant role in Poland (see Section 2).

3. Empirical results

Due to the small sample size (48 quarterly observations), estimations for separate sectors could have been biased. Additionally, the proxy for the institutional factor was available only at the macroeconomic level. Thus, we decided to apply panel estimation techniques. Throughout this paper, the subscript *j* denotes the specific manufacturing division. To avoid any possible confusion connected to the variable selection, we began our empirical analysis with the Granger causality tests. Then

[5] http://www.stat.gov.pl/cps/rde/xbcr/gus/PUBL_oz_biuletyn_statystyczny_02m_2009.pdf.
[6] http://www.stat.gov.pl/cps/rde/xbcr/gus/PUBL_oz_biuletyn_statystyczny_02m_2009.pdf.

we employed the cross section fixed-effect EGLS with SUR cross-section weights to estimate the investment equation coefficients. We first estimate an investment model with financial pressure, output and lagged investment. Finally, proxies for the institutional factors enter the investment model.

3.1. Causality tests

We separately test two null hypotheses of no Granger-causality of the financial pressure indicator fp_t on investment i_t and of output y_t on investment. We apply the two-stage procedure presented by Sargent (1976), which we then adapt for the panel estimations. Firstly, we estimate the following auxiliary model (1):

$$i_{j,t} = \sum_{z=1}^{k} \lambda_z i_{j,t-z} + \eta_{j,t}, \tag{1}$$

where λ_z and $\eta_{j,t}$ are the fixed-effect EGLS coefficients and residuals, respectively. The optimal lag length (equal to 4) is set by the minimising the Schwarz criterion. Once the Wold decomposition is obtained, we run the test models (2a, 2b):

$$\eta_{j,t} = \sum_{z=1}^{k} \lambda_z^{(y)} i_{j,t-z} + \sum_{z=1}^{k} \nu_z^{(y)} y_{j,t-z} + \varepsilon_{j,t}^{(y)} \tag{2a}$$

and

$$\eta_{j,t} = \sum_{z=1}^{k} \lambda_z^{(fp)} i_{j,t-z} + \sum_{z=1}^{k} \nu_z^{(fp)} fp_{j,t-z} + \varepsilon_{j,t}^{(fp)}. \tag{2b}$$

The null hypotheses of no Granger-causality are as follows (3a, 3b):

$$H_0^{(y)} : \nu_1^{(y)} = \nu_2^{(y)} = \ldots = \nu_k^{(y)} = 0, \tag{3a}$$

$$H_0^{(fp)} : \nu_1^{(fp)} = \nu_2^{(fp)} = \ldots = \nu_k^{(fp)} = 0. \tag{3b}$$

The estimation results are summarised in Table 1. In both cases the null hypotheses of no Granger-causality are decisively rejected (Table 1). Thus, we have provided quantitative evidence that financial pressure variable and output may enter the investment equation.

Table 1. Granger causality test results

Null hypothesis	Test statistics	Critical value	P-value	Conclusion
Changes in financial pressure do not Granger-cause changes in investment	15.844	$F_{0.05,\ 4,\ 828} = 2.383$	0.000	null rejected
Changes in output do not Granger-cause changes in investment	23.051		0.000	null rejected

Source: Own estimation.

3.2. Estimation of the investment equation

3.2.1. The first step

Following the standard routine, we estimate the basic investment model of the following form:

$$i_{j,t} = a_1 fp_{j,t} + a_2 y_{j,t} + a_3 i_{j,t-1} + \varepsilon_{j,t}. \tag{4a}$$

We estimate the parameters a_1–a_3 using the cross section fixed-effect EGLS with SUR cross-section weights[7]. The estimation results are reported in the top row of the Table 2. All coefficients are statistically significant at the standard significance level. Importantly, all coefficient signs are consistent with our expectations[8]. We find a strong autocorrelation in investment, which is somewhat contradictive to the results obtained for the old EU-Members. For instance, Hernando and Martinez-Carrascal (2008), who used the investment-to-capital ratio as the left-hand variable in their baseline specification of the investment model, found the highest value of the lagged investment-to-capital ratio coefficient for France (0.357). Even if there may be some differences connected to the choice of the investment variable, the large value of the a_3-coefficient seems to be an important difference between the Old and New EU-Members.

3.2.2. The second step

As already mentioned, in the next step we add a right-hand dummy variable that captures the institutional factors. This procedure should better express the reality

[7] The cross-section fixed-effect estimates for sectors are available upon request.

[8] If indebtedness or debt burden approximates the financial factors, a negative sign of this coefficient is to be expected. By using the quick ratio our results correspond to ones obtained for cash flow. Thus, a positive sign was expected. For details see for example ECB (2008) or Hernando and Martinez-Carrascal (2008)

of an economy under transition. Additionally, we expect that once the institutional dummy variable enters the model, the fit should be improved. We construct the dummy by using Poland's Institutional Investor's Country Credit Rating. The respecified investment model is now:

$$i_{j,t} = a_1 fp_{j,t} + a_2 y_{j,t} + a_3 i_{j,t-1} + a_{\theta,4} dummy_{\theta,t} + \varepsilon_{j,t}; \quad \theta = 1,2. \tag{4b}$$

We generate two dummies (5a, 5b):

$$dummy_{1,t} = \begin{cases} 1 & if \ \dfrac{p_t}{p_{t-1}} > 1 \\ 0 & otherwise \end{cases}, \tag{5a}$$

$$dummy_{2,t} = \frac{p_t}{p_{t-1}}. \tag{5b}$$

To fit the sample frequency, we re-arrange the semi-annual series as quarterly data. We simply calculate the dummies for a semi-annual series in accordance to equations (5a) and (5b) and then replace the missing values by the entries for Marches and Septembers. Figure 4 depicts the Institutional Investor's Country Credit Rating for Poland. The dotted line presents the actual rating (left vertical axis), whilst the solid line the rated of change of the rating (right vertical axis).

Since the year 1996, Poland's Rating has slowly but constantly escalated and there has been only one period when the rating has fallen (see the dotted line). Hence, the first dummy mostly consists of zeros and only four non-zero entries appear. The solid line in Figure 4 depicts the rate of change of Poland's rating. Although the curve looks suspiciously 'non stationary', the unit root tests indicate that the series is in fact stationary[9]. Thus, the second dummy satisfies the standard conditions and may enter the equation (4b) without further differentiation. It is also worth mentioning that its explanatory power seems to be much greater. Dummy 1 captures mostly the effects of a slowdown in the year 2001, so the estimation results must be treated with the necessary caution.

The estimation results are reported in the second and third row of Table 2. There are no considerable differences between the coefficient values for financial pressure, output and lagged investment. It is worth mentioning, however, that financial factors have a slightly smaller impact on investment than the real output. This is another difference between the Old EU-Members and Poland, as the coefficient values obtained by Hernando and Martinez-Carrascal (2008) indicated a larger impact of

[9] KPSS test (model with intercept) statistics is 0.488 while the critical value at 1% significance level is 0.739. For the ADF (model with intercept) the probability that the series has a unit root is 0.026.

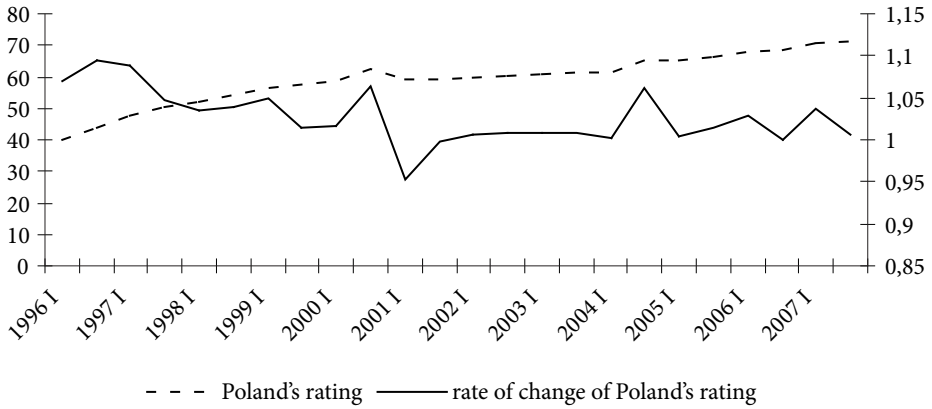

Figure 4. Institutional Investor's Country Credit Rating for Poland
Source: Own calculation based on Institutional Investor database

the financial factor (cash flow ration) on investment than real output. The relatively unstable environment offers a possible explanation of the Polish case. Current sold real output may be interpreted as a proxy for expected output and thus growing output may stabilize expectations[10].

Controlling for the year 2001, we considered a negative sign for the $dummy_{1,t}$ coefficient. Indeed, the sign of the $a_{1,4}$ – coefficient is negative. Not surprisingly, its value is small but significant. Thus, it is reasonable to conclude that the slowdown in the year 2001 has temporarily reduced the propensity to invest. Obviously, the first dummy does not capture all the information. Once the second dummy is added, the importance of institutional factors becomes more visible. The $a_{2,4}$ – coefficient is significant, whilst its sign is positive.

Table 2. Estimation results

Constant term	Financial pressure	Output	Lagged investment	Dummy 1	Dummy 2	Adjusted R^2
0.007 (0.003)	0.106 (0.025)	0.096 (0.031)	0.804 (0.018)	–	–	0.689
0.013 (0.003)	0.084 (0.026)	0.093 (0.031)	0.805 (0.017)	–0.068 (0.009)	–	0.724
–0.349 (0.099)	0.087 (0.026)	0.104 (0.032)	0.804 (0.018)	–	0.347 (0.097)	0.706

cross section SUR panel corrected standard errors in parentheses

Source: Own estimation.

[10] A similar effect was described by Kalecki (1979).

Consequently, an improving institutional background increases investment. More important than this evident but somewhat trivial statement is the power, with which institutional factors affect investment. The investment elasticity to changes in institutional factors is more than three times greater than the values of output and financial pressure coefficients in equation (4b).

4. Analysis of results

The research results (presented in Section 3) show that there is a Granger causality between both financial pressure and investment, and between output and investment. The ratios for the two variables (Table 2) are at a comparable level. The ten-fold greater ratio for the lagged investment variable (Table 2) is not surprising (cf. Shapiro 1986). The specific nature of investments, i.e. their evolvement over time (periods from several to over a dozen years), ensures the continuation of investment projects already initiated, even against the background of significant changes in the macroeconomic environment of a given company. Our results confirm those obtained for this variable in other research projects (Table 3) concerning Poland (cf. Choueiri et al. 2005; Gradzewicz 2006).

Table 3. Research synopsis

Variable	Empirical work						
Financial pressure	Boguszewski and Kocięcki (2001)	Konings et al. (2001)	Hutchinson et al. (2004)	Murgasova (2005)	Choueiri et al. (2005),	Gradzewicz (2006)	Popowski and Sawicka 2008
Output	Chirinko (1993)	Pelgrin et al. (2002)	Choueiri et al. (2005),	Murgasova (2005)	Gradzewicz (2006)		
Lagged investment	Murgasova (2005)	Choueiri et al. (2005)	Gradzewicz (2006)				

Source: Own synopsis.

One should also pay special attention to the financial pressure variable (Table 3). The relatively high sensitivity of investment to financial pressure may suggest the existence of financial market imperfections[11]. Some economists, mainly New-

[11] These imperfections, in the case of Poland, should be linked in particular with the structural characteristics of the banking sector (*Institutional Change*…, 2010) and shifts in manufacturing.

Keynesian, emphasize the role of financial market imperfections; Lizal et al. (2001, p. 1.) underline that cooperatives and small firms are credit rationed. They show that imperfections in the newly established banking sector lead to rationing of access to financial recourses for smaller or newly formed companies. Konings et al. (2001) claim that investments in Poland and the Czech Republic depend on the level of corporate liquidity. They also point out that such a relationship may be a result of defects in the financial system and difficulties with access to capital. Hutchinson et al. (2004) compared the role of internal finance for growth of firms using the cases of Slovenia and Belgium. According to them, SMEs[12] in CEE are unable to raise external finance. Thus, they are forced to use only internal finance. From the estimates of Hutchinson et al. (2004) one can draw the conclusion that firms in CEE are much more dependent on internal finance than in more developed economies (Table 3). According to their estimations, the cash flow coefficient for Slovenia is about 1.04–1.594 while for Belgium it is 0.678–1.108, depending on the method of estimation[13]. The coefficient for small firms is, in both cases, larger than for larger firms. This outcome confirms that small enterprises have more difficulty accessing external finance[14].

The financial constraints stemming from information asymmetry in the investment equation was also studied by Popowski and Sawicka (2008). In their model, the constraints are expressed by the influence of the financial condition on a given company's investments. These authors assumed (following Fuss 2004; Ghosal, Loungani 2000; Guiso, Parigi 1999) that when there is a significant positive cash-flow influence on the investment level, the presence of a financial constraint may be ascertained. Popowski and Sawicka (2008) state that the high level of information asymmetry mostly concerns young and small enterprises. According to Mazzoli (1998) one of the implications of credit rationing is that some borrower classes may be denied credit at any interest rate. Also Fazzari et al. (1988) showed that capital market imperfections can limit the availability of external finance to particular types of firms, depending whether or not a firm is able to respond to variations in q[15].

Another variable (output) is also standard in other empirical analyses[16]. Shapiro (1986, p. 111) emphasizes that '… one of the best established facts in macroeconomics is that business fixed investment and output move strongly together over the business cycle'. An example of such research is the study by Pelgrin et al. (2002); they use panel co-integration in a sample of a number of European countries. Specifically, they added indicators of financial development (like liquid liabilities, private credit,

[12] Small and medium-sized enterprises.

[13] Cf. also Breitung et al. (2003).

[14] See also, for the case of Poland, Boguszewski and Kocięcki (2001).

[15] As the model uses the Tobin's q.

[16] Jorgenson ([1971] 1996, p. 201) considers production, internal funds and the user cost of capital as the three most important variables determining the investment level. Cf. also Shapiro (1986).

stock market capitalization) to a standard Jorgenson's investment model (Jorgenson, 1971). The authors found these indicators to be highly significant. What is important, by augmenting the model with those variables, they got better estimates for other variables, especially for output. The importance of output as the determining factor for investments was also stressed by Choueiri et al. (2005); Murgasova (2005), and Gradzewicz (2006).

Conclusion

Our results prove the presence of a robust relationship between investment in Polish manufacturing and financial pressure, output and lagged investment. Institutional factors in new market economies, as already indicated, play an important differentiating role. It is for this reason that we augmented the standard investment function by including a proxy variable representing institutional situations and general credit risk. This substantially improved the estimation of the model's fit. Further research is needed to allow for more detailed analysis of the institutional factors determining investment decisions such as taxation, amortization and uncertainty due to low law making qualities, law enforcement and functioning of public agencies or even changing perceptions of corruption. These factors play an important role and have impact on business models, current production decisions and on the potential and actual profitability of investment projects.

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