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-Financial Businesses and the Level of Investment Outlays in
Manufacturing

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Keywords: investment, manufacturing, Poland, interest rate

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Abstract

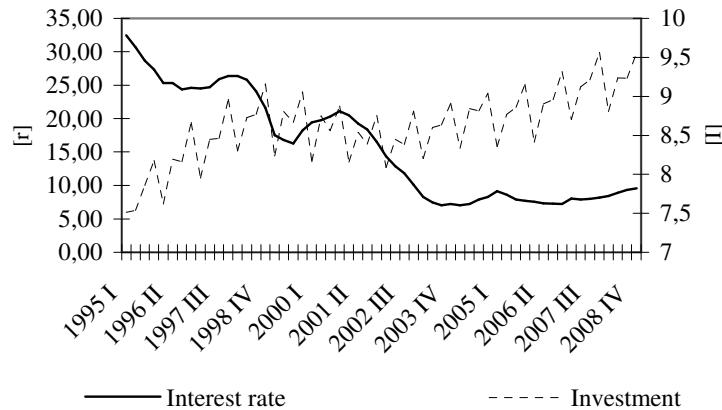
The purpose of this study is to investigate whether or not an observable long-term relationship exists between the average market interest rate and the level of investment in manufacturing at a macroeconomic level. The results of previous empirical studies have produced contradictory results, especially those referring to the economies of Central Eastern Europe. The tested relationship is very important for the role of monetary policy and how it impacts the real economy. The study will be conducted using cointegration analysis, which avoids the problem of spurious regression.

1. Interest rates

At the beginning of the period, in 1996, subjects in the NBP test sample did not support the argument that the barrier to the availability of credit was too high a price. (Boguszewski *et al.* 1997, p. 48). The average interest rate agreements during the period steadily decreased from above 30% in the mid-90s to around 5-10% in the past 6 years (see Figure 1).

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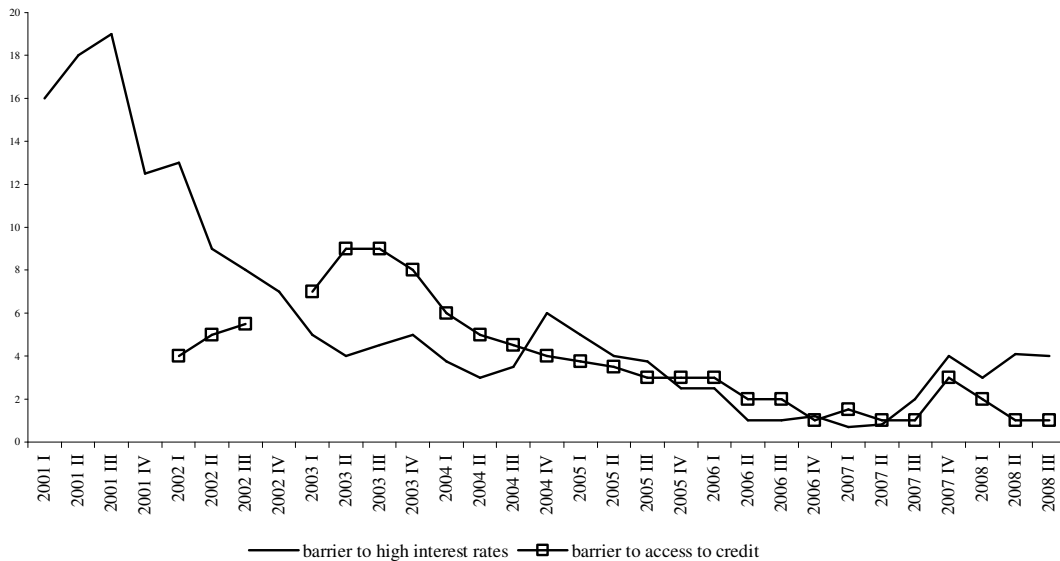
Figure 1 The average interest rate on PLN-denominated receivables from customers' businesses (a total of no current accounts) and investment in manufacturing 1995-2008



Source: own calculations based on NBP data, file "Sw_oprocentowanie_do 2009" of 07.09.2009r. From the http://www.nbp.pl/home.aspx?f=/statystyka/pieniezna_i_bankowa/oprocentowanie_n.html and CSO (investments - Statistical Bulletins from the years 1996-2009, investment in manufacturing³)

This situation has changed in subsequent years, where the very high interest rate has become a serious barrier to the use of credit, according to the responses of the surveyed companies (Boguszewski *et al.* 1998, Boguszewski *et al.* 1999, see Figure 2).

Figure 2 Percentage of businesses indicating that the occurrence of barriers to development in years 2001-2008.



Source: Informacja o kondycji sektora przedsiębiorstw ze szczególnym uwzględnieniem stanu koniunktury, Narodowy Bank Polski, Instytut Ekonomiczny (Q3 2008) p. 33

According to NBP data, the average interest rate on PLN-denominated contracts in 1997 was 24-26% per annum. In 2001, half of those companies surveyed by the NBP felt the effects of falling interest rates, but pointed out that "the effects of the reduction in rates were often less than the proportional ratio of the actual financial cost" (Boguszewski *et al.* 2002, s.121). The average interest rate on loans to enterprises decreased throughout 2001 from about 20% to 16% per annum. (see Figure 5). This downward trend continued until 2004, when the average interest rate on loans was approximately 7.5% per annum. Since the end of 2004 there has been a slight increase in interest rates. In the first quarter of 2005 the average interest rate amounted to 9.14% per annum. From the second quarter of 2005 to the fourth quarter of 2006, borrowing rates decreased again to a minimum of 7.23% per annum. The NBP (2006) observes a clear negative correlation between the economic situation of the company and the price of bank credit. This may mean that the polish banking system as a whole improved its ability to correctly assess entities' creditworthiness. In 2008 companies in a good economic position obtained credit about 2.2 percent points cheaper than the companies in a worse financial condition.

In 2007-2008 there was a slow, yet systematic increase in the interest levied on the observed loans, from 8% to 9.5%. The population studied by the NBP expected this increase in loan interest rates in early 2007 (NBP, 2007-2009). As emphasized by the NBP (Report 1Q 2009) banks prefer very large companies, employing over 2000 people, as well as public enterprises They receive the lowest interest rate loans whilst the smallest companies obtain long-term loans with the highest interest rates. This is probably a symptom of credit rationing. New-Keynesian economists emphasize of the role of financial market imperfections. Lizal *et al.* (2001) underline that "cooperatives and small firms are credit rationed" p.1. This therefore confirms the results of the cited NBP survey (1Q Report 2009). This issue was discussed in greater detail in Kowalski, Wallusch, Zenka (2010) (forthcoming).

As can be seen in Figure 1, the ranks of the interest rate and investment (the exact definitions can be found in section 3) appear to be inversely correlated. On this basis, it is not possible, of course, to come to any conclusions. This first-hand observation will be verified using econometric tools in section 3.

2. Literature review

As was previously mentioned, the empirical results available in contemporary literature on the subject are contradictory, especially when the research subjects are CEECs. Brzoza-Brzezina (2002, p. 23) stresses the role of the availability of credit as an important factor determining the rate of investment. According to the author, the amount of capital expenditure incurred "undoubtedly" affects the real interest rate, calculated *ex-ante* (see p. 23). According to the author, this relationship is very traditional. The higher the interest rate, the lower the level of investment, because the more likely it is that the investment proves to be uneconomic.

Brzoza-Brzezina (2002) also considers the assumption that investment is independent of the level of interest rates because of the high degree of self-financing of investments by entities (as do for example Choueiri *et al.* 2005) to be a mistake. According to him, any entity, even while investing its own resources, first compares the profitability of the given investment with the cost effectiveness of a bank deposit and if it is higher, then not all the planned investments will be realised. Attention should be paid to at least two issues linked with this reasoning. Firstly, the transmission channel of monetary policy in Poland is not 100% efficient, which can result in high central bank interest rates that do not necessarily result in high interest rates on deposits in commercial banks. Secondly, a company operating in a competitive and rapidly evolving market such as Poland, which for a time will stop investment in favor of bank deposits, may not be able to compete in subsequent periods. Brzoza-Brzezina's results confirm those of Liberda *et al.* (2002). These authors found that the interest rate affects the rate of investment in the constructed model¹ "The increase (decrease) in the interest rate by 1 percentage point is translated into a decrease (increase) in the rate of investment of about 0,33-0,53 percentage points" (p. 62). It is interesting that the rate of investment has proven to be more dependent on the loans' nominal interest rates, rather than the expected changes in real interest rates. Fic *et al.* (2005) measured the impulse response of the economy with respect to the interest rate in an ECMOD model. The analysis shows that the level of investment reacts negatively to interest-rate changes. Monetary stimuli are defined in the model as the raising of short-term central bank interest rates by 1 percentage point above its base variant level and their maintenance at such an elevated level for a period of 8 quarters. The largest negative investment response occurs over an average of 3 years. The test carried out by Boguszewski *et al.* (2000) also shows that the growth in the interest rate reduces "interest" expressed in loans. Breitung *et al.* (2003) occupied themselves with tests based upon financial statement panel data for

German firms, as well as using user cost of capital and creditworthiness data. The analysis shows that monetary policy is important for the level of investment. Private sector investment responds to changes in interest rates via the user cost of capital. Diron (2005) who also conducted a survey in the euro zone, confirms these results. Estimation of various financial indicators gave similar results as most of study's correlation coefficients fall within the range 0.3-0.5. The three measures of financial cost used in the text (long-term interest rate, the cost of equity, complex resource financing costs) indicate an expected negative correlation with investment. The cost of equity, however, has the strongest relationship. Studies regarding developed economies, such as Hein *et al.* (2000), emphasize that the real interest rate has a perfect opposite effect on the level of investment. What is worth emphasizing is that the speed of growth in the interest rate seems to be more important for Germany than its level, when taking in to account the level of investment (see page 27). Pelgrin *et al.* (2002) find that, using the panel cointegration within a sample set of OECD countries, the "rate of user cost of capital has proved to be significantly negatively related to investment, in line with expectations theory" (p.2). Gaiotti *et al.* (2001) examining the investment behavior of different Italian companies (panel data from the Company Accounts Data Service) in response to monetary policy came to the conclusion that the user cost of capital affects the level of investment, together with the financial variables (e.g., a variable representing the level of liquidity).

The BRE BANK study (2004) found that long-term investment is a decreasing function of the cost of raising capital. However, the reduction in interest rates gives a disproportionately small impact in terms of increased levels of investment compared with GDP growth for example, against a permanent reduction in the budget deficit. According to the authors any reduction in interest rates could be offset completely by the push effect and increase long-term interest rates in the case of accumulation of deficits. Therefore, although according to the authors a medium-term relationship exists between the Central Bank intervention rate and investment, the interest rate is neither the sole nor the dominant factor shaping entrepreneur investment decisions. According to Romer *et al.* (1989), only a small part of the fluctuations in demand are caused by monetary shocks. This effect is also not sustainable according to these authors and will not last longer than 33 months after the real variables return to their original path. Fifteen years later, these results were confirmed by Crespo-Cuaresma *et al.* (2004). They showed that, monetary policy in the U.S. affects the real sector with an average delay of four months, and their effects persisted for two years. Choueiri *et al.* (2005), on the basis of a panel analysis of industry divisions in Poland, conclude that there are a number of variables

that determine investment, but that the user cost of capital is not one of them. According to the authors this is because about half of investment is financed through firms' own financial resources. Only about one third of the investment is financed through loans. The authors allow for the possibility financial market imperfections. Choueiri *et al.* (2005) indicate that most empirical studies find it difficult to confirm the presence of a statistically significant relationship between the level of investment and the user cost of capital. They consider several imperfections, other than capital market, in order to explain the existence of such a situation: 1) firms may adjust expectations regarding economic activity in response to monetary policy changes, and thus revise their investment plans. 2) the cost of capital may be mis-measured, particularly at the aggregate level. 3) there may be an identification problem related to reduced-form estimates which include endogenous regressors" (p.20). Murgasova (2005) also does not include interest rates among the variables that determine the level of investment in Poland. The analysis was conducted using panel data and the user cost of capital was placed by the author among the control variables. It transpired that the user cost of capital components: either the real interest rate or the relative cost of capital are not significant determinants of investment. The author states that the high volatility of interest rates did not affect the level of investment. Murgasova also examined the impact of the Monetary Conditions Index (MCI): MCI was proved to be statistically insignificant or was preceded by the wrong sign. According to Murgasova, this could mean that monetary policy is "leaning against the wind" (p.20). An interesting analysis of the determinants of investment in the Polish manufacturing industry was carried out by Gradzewicz (2006) where the author used microeconomic panel data and examined a wide range of variables. The MIP factor proved to have an effect on the level of investment and the direction of the effect was in keeping with theory, albeit to a very limited extent. According to the author, this suggests that the components of the MIP (interest rate and exchange rate) are not "critical determinants of investment decisions," (p. 8). Capital cost dynamics were proved to insignificantly affect the examined decisions. As pointed out by the author, only in the case of a subset of exporting companies benefiting from external funding can the importance of this variable really be discussed, albeit with significant doubt. These results were also confirmed by the author using alternative definitions. The strength of the impact of the cost of capital upon investment decisions turned out to be marginal. Dobrinsky (2005) also shows that based on statistical estimation, the real interest rate on commercial loans in Central and Eastern European countries seems not to have a strong influence on investment decisions. Other factors, however, have a much stronger impact, according to this author. See

p.11. According to the author, however, this result may reflect the fact that the borrowing rate is only an approximation, to a certain degree, of the real cost of capital, which is theoretically a correct variable.

Based on the review of empirical literature above regarding the relationship between interest rates and investment, it is not possible to definitively draw any conclusions regarding the relationship between the importance of the variables studied. As emphasized by Bludnik *et al.* (2009) "one can not...automatically transfer discussions developed based upon Anglo-Saxon theories on to Central European soil " p. 153. This means that the subject requires further study and in-depth analysis.

3. Empirical analysis

The econometric model of the long run relationship between interest rates and investment was built using cointegration analysis. The idea of cointegration is to state that if the variables are non-stationary, but there is a linear combination which is stationary, then we can say that these variables are cointegrated. The vector of variables for a linear combination is known as the cointegration vector (Charemza, Deadman 1997).

A precondition for cointegration is the existence of appropriate degrees of integration between variables. Cointegration can be found only in stationary time series, where both time series are integrated at the same level.

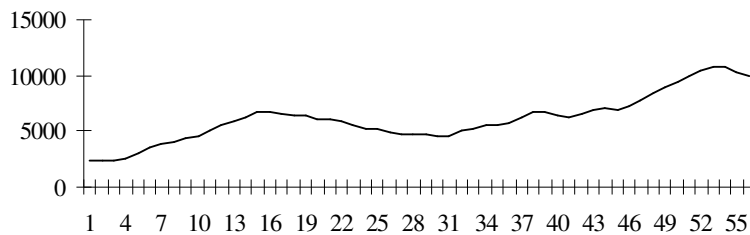
According to Granger's representation theorem (Johansen 1989), if two or more variables are cointegrated, this means that if a long – run relationship between them exists, then the short-run dynamics can be described using the vector error correction model (VECM). The theorem will be used in this paper and Johansen's procedure for testing cointegration (Hendry and Juselius 2000) is based on VECM.

In this study the following series were used: Investment [I] - investment in manufacturing (see Figure 3). By definition of the CSO (GUS), investment is divided into expenditure on fixed assets (buildings & structures, machinery, technical equipment & tools, means of transport and others such as drainage details, land acquisition costs etc.) as well as other inputs (so-called first investment equipment and other costs associated with undertaking the investment. These investments do not increase the value of fixed assets). Interest rates [r] in this paper are the average interest rate on PLN-denominated receivables from customers' businesses (a total number of current accounts) according to the NBP. These were obtained using average

quarterly data published by the NBP's Department of Statistics, adjusted for the effects of changes in methodology in January 2004 and March 2002.

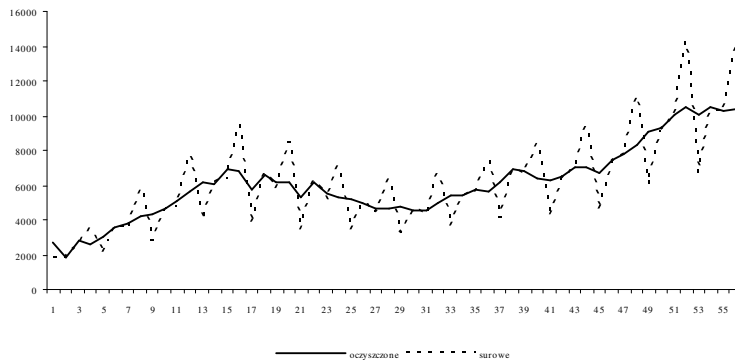
Data obtained from the NBP and the CSO Statistical Bulletins on the interest rate and investment have been subjected to a seasonal fluctuation purification process. Data were cleaned using the Census II X-11 using the Henderson curve (see Figures 4 and 5). Purification of seasonality is important for the results of further cointegration analysis. Data regarding investment is particularly seasonal in Poland which involves investment growth in the fourth quarter of each calendar year (see Figure 4). This is due, inter alia, to specific regulations, which require production in progress to be included in investment figures for the fourth quarter.

Figure 3 Investment outlays in manufacturing expressed in current prices in PLN and purified from the seasonality in years 1995-2008



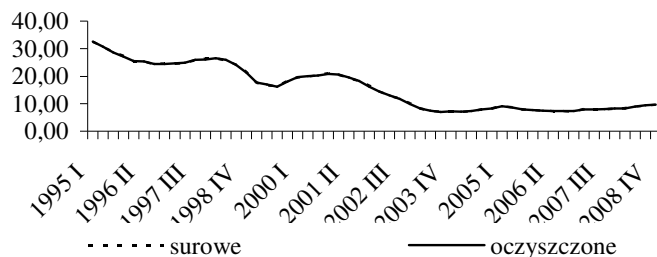
Source: own calculations based on CSO (GUS) data

Figure 4 Capital expenditures in the manufacturing of seasonal cleaning before and after in years 1995-2008



Source: own calculations based on CSO (GUS) data (investments - Statistical Bulletins from the years 1996-2009, investment in the manufacturing)

Figure 5 The average interest rate on loans to companies with seasonal cleansing before and after in years 1995-2008.



Source: own calculations based on NBP data (PLN-denominated receivables from customers' businesses in total, without current accounts of 07.09.2009r. From www.nbp.pl/home.aspx?f=/statystyka/pieniezna_i_bankowa/oprocentowanie_n.html)

Unit root tests are used to examine the degree of integration of the series. The most well-known tests are the ADF and KPSS. Analysis of Figure 5 suggests that the series [r] is characterized by a constant as well as a trend and therefore ADF 3 and KPSS 2 were chosen in order to verify the unit root. Analysis of the first differences $[r]^2$, shows that there is no trend or constant in the test series. ADF 1 and KPSS 1 were selected for the unit root tests. The value of the ADF test is less than the critical values at all confidence levels and therefore H_0 is rejected, and thus series [r], according to the ADF test results, is integrated in the first degree. The KPSS test value is less than the critical values at all levels of confidence and therefore the test of the null hypothesis is rejected. This means that series [r], according to test results for the KPSS, is integrated in the first degree (no unit root). As the results of both tests are consistent, series [r] is considered integrated in the first degree.

The next step is to determine whether or not time series of [I] is integrated in the first degree. Based upon the observation of Figure 6 it appears that [I] is characterized by a constant and trend. Hence, the following unit root tests were applied: ADF 3 and KPSS 2. Analysis of Figure 6 suggests that the series [I] is characterized by a constant as well as a trend and therefore ADF 3 and KPSS 2 were chosen in order to verify the unit root. An analysis of the first differences in investment expenditure in the manufacturing industry (not included in this paper) yields no trend or constant. ADF 1 and KPSS 1 tests were applied. The ADF test shows that there is no reason to reject the null hypothesis that the investment series [I] is nonstationary, whilst the KPSS test shows that the null hypothesis of stationarity is rejected. It therefore appears that a range of investments in industrial processing [I] are also integrated in the first degree. Since

both series have proved to be integrated in the same manner, a cointegration analysis is possible. Summary results of tests for the presence of a unit root can be found in Table 1.

Table 1. Tests for a unit root.

Variable	Type	Augmented Dickey Fuller				Kwiatkowski-Phillips-Schmidt-Shin			
		Lag length	Test statistic	Critical values	Conclusions	Type	Test statistic	Critical values	Conclusions
r	3	1	-2.424	-3.495	H0 is not rejected	2	0.153	0.146	H0 is rejected
Δr	1	0	-8.888	-1.947	H0 is rejected: I(1)	1	0,24	0,46	H0 is not rejected: I(1)
ln I	3	0	-2.104	-3.494	H0 is not rejected	2	0.222	0.146	H0 is rejected
$\Delta \ln I$	1	3	-2.257	-1.947	H0 is rejected: I(1)	1	0.091	0.463	H0 is not rejected: I(1)

Source: own calculations based on NBP and the CSO performed in the package EViews SV.

The results for the unit root tests allowed us to carryout a cointegration analysis. An example of the application of cointegration for a short time series (twice as short as that included in our analysis), examining the link between investment and interest rates is BRE Bank publication (2004). A vector error correction model was estimated using the trace test or alternatively the maximum Eigenvalue test. Johansen's trace test (Table 2) rejects the hypothesis about existing the cointegration at the 95% significant level. Johansen's trace test (Table 2) rejects the hypothesis of cointegration at the 95% significant level. The maximum eigenvalue test (Table 3) rejects the hypothesis about existing the cointegration at the 95% significant level. It was found, that there are no cointegrating vectors ($r=0$). The maximum eigenvalue test (Table 3) also rejects the hypothesis of cointegration at the 95% significant level. It was found, that there are no cointegrating vectors ($r = 0$). It can be concluded, that there is no lung- run relationship between [I] and [r].

Table 2. Johansen's trace test outcomes

Null hypothesis	Number of lags	Version of the model	Test statistics	Critical value	Conclusion
r = 0	5	1	6.344497	12.32090	r = 0
r = 1			0.551202	4.129906	
r = 0	5	2	13.00723	20.26184	r = 0
r = 1			5.504244	9.164546	

Source: Own calculations of the author.

Table 3. Maximum eigenvalue test outcomes.

Null hypothesis	Number of lags	Version of the model	Test statistics	Critical value	Conclusion
r = 0	5	1	5.793295	11.22480	r = 0
r = 1			0.551202	4.129906	
r = 0	5	2	7.502991	15.89210	r = 0
r = 1			5.504244	9.164546	

Source: Own calculations of the author.

It can be concluded, that there is no long-run relationship between [I] and [r]. The analysis indicates the lack of a cointegrating vector between investment outlays in the manufacturing sector and the average interest rate of PLN-denominated non-financial sector company debts at the 95% confidence level. These results indicate the probable lack of a long-term relationship between the examined variables.

Conclusions

The long - run relationship between the interest rate (average interest rate on PLN-denominated receivables from customers' businesses (a total of no current accounts)) and investment (investment outlays in manufacturing) was discussed in this paper. Using Johansen's cointegration analysis, the hypothesis of an existing long - run relationship between the examined variables was rejected at the 95% significant level. Using Johansen's cointegration analysis, the hypothesis of an existing long - run relationship between the investigated variables was rejected at the 95% significance level. It may be the case that in the Polish Economy the real NBP interest rate has a more important impact on the level of investment, as demonstrated in the empirical research of Liberda *et al.* (2002). Meanwhile, in this instance, interest rates deemed to represent the market interest rate level were applied.

The long-run relationship between the interest rate and investment should be investigated further, using more sophisticated research. This analysis is much too superficial, to be treated as proof of the link between interest rates and the level of investment. It does, however, illustrate the fact that the relationship between interest rates and investment is not entirely explained. These outcomes are similar to Gradzewicz (2006), BRE Bank (2004) and Chouirieri (2004). The main conclusion is probably that other factors than interest rates are more important, in the long run for investment decisions.

Endnotes

1. Understood the rate of investment to be the share of investment in GDP during the period.
2. Not mentioned in this paper.
3. All calculations in this work have been carried out using the following programs: Statistica 8, EViews 6 SV and Microsoft Office Excel.

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