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INFLUENCE OF MONETARY POLICY INSTRUMENTS ON BUSINESS FLUCTUATIONS IN POLAND UNDER TRANSITION

Introduction

Observations of the economic processes occurring towards the end of the 20th century indicate that most of the highly developed market economies experienced cyclical fluctuations. Their consequence was, among others, a weaker dynamics of economic growth. Similar processes could also be observed in the Polish economy under transformation. This may mean that the structure of objectives of stabilization policy should be changed and that the state bodies through implementation of anti-cyclical policy should guarantee sustainable and steady economic growth.

The aim of these considerations is to analyse the range and consequences of applying the instruments of monetary policy in order to influence short- and medium-term changes in the economic activity in Poland during systemic transformation. The analysis of anti-cyclical function of the instruments of monetary policy is caused by two factors. The first one results from the properties of instruments belonging to this group because they are highly flexible, which is a precondition for their application in the short and medium run. The second factor is accessibility of empirical data characterizing the decisions made about the use of monetary policy instruments in the Polish economy.

The paper consists of two parts. The first one contains hypotheses concerning the anti-cyclical function of the instruments of monetary policy. The statements are formulated through the prism of theoretical achievement belonging to Keynesian and monetarist economics. The second part is an empirical verification of the theoretical hypotheses. It presents morphological features of business fluctua-

tions in the Polish economy of the transformation period, as well as links between certain, measurable instruments of monetary policy and changes of the economic activity in Poland.

2. Hypothetical influence of the instruments of monetary policy on changes of economic activity in Poland under transformation

Discretionary instruments and automatic stabilizers of business conditions are the tools applied by the state in the process of influencing short- and medium-run cyclical fluctuations. In the group of discretionary instruments the most important role is played by measures of monetary and fiscal policy. The role, range of activity and the mechanism of influence of these instruments are differently interpreted in particular approaches of the modern economics. The Keynesian economists treat monetary policy as much less effective in anti-cyclical activities than fiscal policy. They claim that even if monetary policy is applied its possible impact on the fluctuations of real magnitudes does not occur through the growth or decline in money supply on the market but, above all, through changes in` interest rates. Monetarists, as opposed to Keynesian school, question the sense of applying fiscal policy measures in the process of stabilization, both as regards their influence on business fluctuations and on inflation. They advocate the application of monetary policy instruments in the process of stabilization because, in their opinion, there exists a direct link between money supply and level of economic activity.

Assuming the Keynesian interpretation of the role of monetary policy, it can be said that in the phase of low economic activity expansive policy (policy of cheap money) should be carried out. Then the central bank should have the following aims:

- in the refinancing policy there should occur a decline in the costs of refinancing, i.e. a decline in rediscount rate and lombard rate; the central bank should eliminate quotas and additional qualitative requirements as regards bills of exchange and other securities;
- in the open market policy operations of the central bank should include temporary access of cash offered to commercial banks, increasing their liquidity, i.e. the central bank should buy commercial banks' securities;
- in the policy of obligatory reserve the central bank should decrease the rate of reserve which should lead to a growing supply of credit money in commercial banks;
- in the deposit policy the central bank should cause decrease in deposit accounts of the entities of the public sector, which should lead to the growth in deposits of these institutions in commercial banks;

- in the policy of direct influence the central bank should abolish by way of administrative decisions all bans or directives concerning, e.g. quantity, volume and interest rate on the credits granted, emission activity of commercial banks etc.

In the market economy these activities trigger adjustment processes in the money-credit sector which consist in the growth of commercial banks' cash reserves and wider possibilities of granting credits. In this way the supply of credit money increases, which should cause a decrease in interest rates. Through the mechanism a multiplier-accelerator those factors cause further changes in the real sector, which leads to the growth of demand for consumer and investment goods and consequently to a better utilization of production capacities, growth of employment and volume of production[1].

Similar activities of the central bank can and should be undertaken in the Polish economy of the transformation period as under this system the labour factor is underused, and production capacities are not sufficiently used either. According to the Keynesian economics, a gradual growth of demand due to multiplier mechanisms can accelerate economic recovery.

Because reducing the rate of growth of prices is the main target of the central bank in the Polish economy under transformation, the above-mentioned postulates concerning anti-cyclical monetary policy were not fully accomplished. Divergence between anti-inflationary and anti-cyclical activities of the central bank (particularly in the initial period of transformation) led to a longer phase with low dynamics of growth and to its increased amplitude and intensity.

According to Keynesian economics postulates, restrictive policy should be implemented in the phase of high dynamics of growth in the market economies. It assumes the so-called cooling of the economy and the essence of these activities can be reduced to the following:

- in the policy of refinancing the costs of refinancing should increase i.e. there should occur the growth of rediscount rate and lombard rate; the central bank should introduce quotas in the sphere of refinancing and additional qualitative requirements as regards the refinanced securities;
- in the open market policy the central bank should reduce cash reserves of commercial banks and their liquidity by selling securities;
- in the policy of obligatory reserve the central bank should cause the growth of the rate of reserve which will decrease cash resources (credit money) of commercial banks;

[1] More on the subject of transmission of monetary impulses to the real sphere see, among others: E. Drabowski, *Wpływ pieniądza na gospodarkę w teoriach keynesizmu i monetaryzmu*, PWN, Warszawa 1987, p. 49; M. Kruszka, *Współczesne wahania koniunkturalne a zmiany na rynku pieniądza*, Akademia Ekonomiczna, Poznań 2002, pp. 18-29.

- in the policy of deposits the central bank should reduce deposits of public institutions on the accounts in commercial banks, which should limit their cash reserves and decline in the supply of their credit money;
- in the policy of direct influence the central bank by way of administrative decisions should introduce bans and directives as regards the number, amount and interest rate of credits and the sphere of emission of securities.

Restrictive monetary policy implemented in the market economy under high level of economic activity, through gradual growth of basic interest rates of the central bank, can lead to increased interest rate on consumption and investment credits and therefore to decreased dynamics of the growth of demand for credit money. These factors can weaken the effects of multiplier mechanisms and hinder the rate of improvement of business conditions.

In the economy under transition, when business conditions are favourable, similar activities should be undertaken in the sphere of monetary policy because both in the opinions of Keynesian economists and monetarists they can restrict inflationary processes. A negative consequence of the instruments applied in this way can be persistent disequilibrium on the labour market and limited utilization of production capacities. The anti-cyclical policy conducted in this way, convergent with anti-inflationary policy, can shorten the phase of a high dynamics of growth and decrease its amplitude and intensity.

The activities of the central bank presented above, dependent on the level of economic activity, through changes in the liquidity of commercial banks and changes in the supply of credit money, should lead to changes in the costs of access to credit money, i.e. to the growth or decline in the price of credits and to changes in the demand for money. In the related literature dominates the opinion that effectiveness of the central bank's influence on the real economic processes through changes in credit interest rates is getting smaller and smaller[2]. Implementation of a restrictive or expansive monetary policy and the resulting changes in interest rates do not have to determine the demand for credit at all and exert a positive or negative influence on investment activity. This is caused by the fact that[3]:

- Growth of interest rate on credits granted by commercial banks under high economic activity very frequently coexists with the growth of interest rate on bank deposits. This may cause a speculative flow of capital e.g. from abroad and contribute to the growth of cash reserves in commercial banks and their increased credit-granting capacity which is contradictory to the assumptions of the implemented restrictive monetary policy of the central bank.
- High interest rate on credits may, contrary to intentions of the central bank, cause sustained or growing inflation. More expensive credits may lead to in-

[2] See: K. Markowski, *Rola państwa w gospodarce rynkowej*, PWE, Warszawa 1992, p. 66.

[3] Ibidem, p. 66 and further on.

creased costs of economic activity which can be compensated by a rise in prices.

- If monetary and fiscal policies are not synchronized, a high interest rate used by commercial banks can be levelled by the existing tax system and investment reliefs.
- Various sectors of the economy and particular enterprises react differently to changes in interest rates; multinational corporations are the least affected as they can finance their activities from their own means (self-financing). Most sensitive to the changes in interest rates are investment decisions made by small and medium-size firms belonging to the constructing or the trade sector.
- Quickly introduced technological progress and high profitability are responsible for the fact that investment activity yields sufficiently good results to cover high costs of credit. Changes in the functioning of banking systems and transformation (internationalization) of credit markets lead, among others, to the fact that a higher interest rate in one country results in a bigger amount of credits incurred in other countries where the interest rate is lower.
- Changes in interest rate very frequently cause changes in exchange rates, which is an additional factor influencing changes in economic activity. Increased interest rate can contribute to revaluation as well as to decline in exports and growth of imports along with all the negative effects for the economic processes in a given country.
- Changes in the price of money very frequently lag behind those in the level of economic activity.

Therefore, changes in interest rates influence the development of optimistic or pessimistic climate in decision-making processes. They are more of a psychological factor determining the behaviour of economic entities and provide information on the intentions of a central bank as to the monetary policy implemented.

Lower effectiveness of the influence of interest rate on short- and medium-run processes in the real sphere as well as frequently incorrect information resulting from these mechanisms caused that followers of the monetarist economics, using the so-called Gibson's paradox and Fisher effect, underline the importance of money supply in the implemented monetary policy[4]. If under low economic activity expansive monetary policy is carried out, then after initial decline in interest rate due to the so-called Keynesian effect of liquidity, in the following periods this interest rate rises as a result of increased demand for bank credit. This increase can be interpreted as the effect of restrictive policy whereas the real reason for it was expansive policy. Fisher's effect, in turn means that the policy of easy money intensifies inflationary expectations and leads to the growth of nominal interest

[4] Ibidem, p. 70.

rate. Disappearance of the effect of "money illusion" aggravates current inflationary processes, increases inflationary expectations and raises the nominal interest rate. Therefore, changes in interest rate can lead to erroneous conclusions formulated by monetary authorities, so monetarists emphasize the role of money supply in monetary policy.

Another significant question in the monetary policy is how the supply of money is shaped. Out of the two existing possibilities: indirect influence (fiscal policy, interest rates, exchange rates) and direct influence oriented towards changes in monetary base, monetarists prefer the latter. As the monetary base includes high powered money, i.e. cash and coins in circulation as well as monetary means of commercial banks on accounts in the central bank (reserve money) its change by one unit can cause multiple changes in the supply of money on the market. When the economic activity changes, the highest flexibility, i.e. capability to adjust to the growth or decline of the real values, should be exhibited by the categories which measure the supply of money of the highest liquidity (M0, M1). Reactions of categories M2 and M3 should be more weakly correlated with the growth or decline in business conditions.

An important factor which determines the supply of money and at the same time hinders its regulation is changes in money circulation and whether they are of permanent or temporary character[5]. Any errors made here can significantly influence the real economic situation.

According to Keynesian economists the influence of monetary policy on business fluctuations can have a slight effect as, under expansive policy implemented when economic activity is low, the so-called "liquidity trap" appears[6]. This means that with a low interest rate the growth of money supply will not cause a further decline of interest rate. This phenomenon is connected with slower circulation of money. Another factor diminishing the effectiveness of monetary policy can be the mechanism of making investment decisions by enterprises. In this process the most important role is played by expectations of economic entities about the future business conditions and the current interest rate is of much lesser importance. Enterprises' pessimism about the future can reduce propensity to invest more effectively than the price of credit. Optimistic forecasts as to the economic situation can contribute to the growth of investment demand despite the fact that interest rate increases. Time lags are also a significant restriction of the monetary policy. The period which passes from the monetary impulse sent by the central bank to changes in real magnitudes is relatively long and positive effects are differentiated

[5] Ibidem, p. 72.

[6] See: A. Krupa, *Wachstumspolitik. Wachstumskriesen und die Möglichkeit stabiler Wirtschaftsentwicklung in der Bundesrepublik Deutschland*, R. Oldenbourg Verlag, München-Wien 1976, pp. 154-157.

in time[7]. In this case the moment of implementation and adequate intensity of the instruments are of particular importance.

Monetarists postulate that in the process of stabilizing business conditions, first of all the instruments of monetary policy should be applied because there exists a direct connection between money supply and level of economic activity[8]. Assuming Fisher equation, they are of the opinion that velocity of money circulation is constant and does not depend on changes in its amount. According to Friedman, this velocity depends, among others, on the structure of the money market and producers' and consumers' habits. The growth in money supply under constant velocity of circulation and constant level of production (depending on structural factors, e.g. production capacities, must lead to the growth of average transaction price, not to the growth of production and employment. Therefore, expansive monetary policy (increase in money supply) is not able to overcome the phase of low dynamics of growth because it only causes increase in prices, inflationary expectations and nominal interest rate. Moreover, it does not increase employment the level of which depends on structural factors. The size of employment is determined by natural rate of unemployment which defines maximum employment without causing inflation under given labour demand and supply and under zero rate of growth in labour productivity.

According to monetarists, interpretation of dependencies between inflation rate and unemployment rate differs significantly from the views of Phillips. They claim that substitution between those phenomena occurs only within a short period of time. In a long run this dependence is shown as a straight line vertical in relation to X-axis which means that a given size of employment can be reached under any level of prices[9]. Thus, stabilization policy should not aim at reducing the rate of unemployment below the natural level because this will increase inflation when there is an increased level of uncertainty in the economy.

Monetarists claim that conducting an effective anti-cyclical policy by means of monetary policy instruments is very difficult. Even if one assumes the possibility of change in the velocity of money circulation in a short- and medium-run, it is absolutely impossible to be predicted accurately. A wrong monetary policy leads to economic instability, therefore it should be reduced to controlling the money supply in order to ensure a constant rate of its increase, equal to the dynamics of potential growth in GDP and the assumed rate of inflation.

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[7] Very frequently only after 12 months pass from the recognition that certain activities of the monetary policy should be taken there appear effects in the real sphere. More on the subject see: K. Markowski, op.cit., p. 77.

[8] More information in: M. Friedman, A.J. Schwartz, *Money and Business Cycles*, Review of Economics and Statistics vol. 45, 1963, pp. 60-62.

[9] More information, among others, in: J. Winiecki, *Źródła informacji w gospodarce rynkowej i w gospodarce planowej*, PWN, Warszawa 1986, p. 22.

A significant difference between advocates of Keynesian economics and monetarists concerns also the principles of procedure: should monetary policy be based on fixed principles e.g. a fixed rate of growth in money supply, or should it be changed and adjusted to the existing and anticipated economic situation[10]. This argument concerns the question whether an active monetary policy should be implemented or whether a passive policy should be carried out, the one with rigid procedures. Keynesian economists postulate the active monetary policy which should not be restricted by any fixed rules, however each time it should be adjusted to the existing and anticipated economic situation in order to effectively counteract business fluctuations. Monetarists claim that it is necessary to base stabilization policy on fixed principles unchangeable within long periods of time. Therefore, while implementing monetary policy the central bank should concentrate on stabilization of inflationary expectations which will require the principle of constant increase in money supply. Economic stability and a possibility to forecast exactly the increase in money supply will occur when this supply will change in a long period of time at the rate convergent with the dynamics of growth in real output.

2. Identification and analysis of the morphology of business fluctuations in the Polish economy in the years 1990-2003

In the empirical analyses of business fluctuations in economic system under transition, the main problem (apart from definition of oscillations) is selection of statistical data used in the research. This paper assumes that the measures of economic activity will be GDP and sold production of industry (SPI)[11]. Both indicators analysed quarterly are expressed in fixed prices of 1995.

The related literature contains different definitions of cycles which sometimes supplement one another but frequently they are mutually exclusive[12]. In this paper Lucas approach was applied. According to this approach the essence of business oscillations is a process of repetitive fluctuations around long-run macroeconomic trends of the time series[13]. This indicates complexity of the business phenomena

[10] K. Markowski, op.cit., pp. 73-76.

[11] More information on estimation of the analysed indicators in Poland see: R. Barczyk, M. Kruszka, *Cechy morfologiczne wahań koniunkturalnych w gospodarce Polski w okresie transformacji*, [in:] K. Piech, S. Pangsy-Kania (eds), *Diagnozowanie koniunktury gospodarczej w Polsce*, DW Elipsa, Warszawa pp. 42-43.

[12] More on this subject see: V. Zarnovitz, *Recent Work on Business Cycles in Historical Perspective: A Review of Theories and Evidence*, Journal of Economic Literature vol. 23, 1985, pp. 523-580.

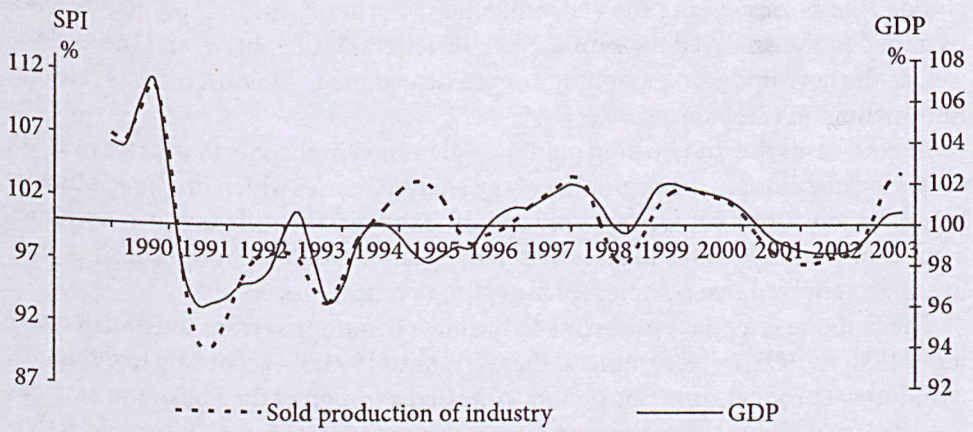
[13] See: R.E. Lucas, *Uderstanding Business Cycle*, reprint [in:] F.E. Kydland (ed.), *Business Cycle Theory*, Aldershoot-Brookfield, p. 7.

and therefore a necessity to study a few or more variables explaining the structure of the cycle. Secondly, of key importance for the identification of fluctuations in economic activity seems to be determination of a long-run trend.

Having a series which expresses the trend of reference index, it is possible to determine deviations of the empirical values from it. Having accepted such an approach, the authors decided that oscillations identified with business fluctuations will be determined by the indicators informing about a relative deviation of the GDP or industrial production from a long-run trend estimated for their levels[14]. This means that in our paper business fluctuations are defined as a deviation cycle.

Identification of the cyclical components by means of deviation method creates doubts because the selection of function describing the trend is arbitrary, which may deform the results obtained. This problem, however, concerns only a deterministic trend. In reality a vast majority of macroeconomic magnitudes are the processes of random walk with drift[15]. This means that it is necessary to apply stochastic methods facilitating identification of the growth tendency which is subject to changes in time. To achieve this objective Hodrick-Prescott's (HP) filter was used.

According to the above-mentioned procedures of identification of cyclical oscillations, deviations of the real GDP and sold production of industry from their trends were estimated. Both series are presented in the figure below.



Fluctuations of GDP and sold production of industry in Poland in the years 1990-2003

[14] A seasonal adjustment was carried out before estimation of the growth tendency and deviations from the trend.

[15] See: C.R. Nelson, Plosser C.I., *Trends and Random Walks in Macroeconomic Time Series; Some Evidence and Implications*, Journal of Monetary Economics vol. 10, 1982, pp. 139-162.

The fluctuations presented cannot be interpreted univocally when identifying the turning points. This is so because successive turning points occur one after another and this is commonly regarded as a phenomenon characteristic of contemporary business cycles subject to considerable deformation as compared with the classical cycles. Therefore, while finding such turning points one should make *a priori* assumptions which in the empirical analyses are dictated by practical aspects.

A trough can be identified only when it is preceded by a peak (and *vice versa*). When in the series there appear double peaks or troughs (of relatively equal character), then the moment of the first peak is usually chosen as a turning point. If, however, between the possible turning points appear falls (rises) in the values of appropriate indicators, and both sites cannot be regarded as relatively equivalent, then the moment where maximum (minimum) values of a given measure of economic activity appears is regarded as the turning point[16]. Moreover, it should be assumed that particular phases have to last at least for 3 quarters, otherwise this type of dynamic changes may result from purely accidental phenomena, unrelated to business conditions.

If we know when and where the turning point appears, we can also determine amplitudes. This analysis assumes that the amplitude of a phase is absolute difference between the values of extreme deviations occurring within a given period, whereas the amplitude of a cycle is a difference between the amplitudes of growth and decline phases. Using the above-mentioned criteria, turning points were determined in the analysed measures. Next the length of the phases and the cycle as well as the corresponding amplitudes were determined. Table 1 contains relevant information on this subject.

In both cases the first turning point was identified in the fourth quarter of 1990, so it is located close to the beginning of the analysed series which may mean that its identification is not completely univocal. If, however, the differentiated extremes are accepted, it is possible to state that in the years 1990-2003 in the Polish economy there appeared five complete phases of the cyclical process.

The first one is a phase of decline in business conditions (from the fourth quarter of 1990 to 1991:2 – according to the GDP, or to 1991:3 – according to dynamics of industrial production). This period witnessed a trough of the Polish transformation recession. Subsequent years saw improvement in the level of economic activity, however, it should be remembered that initially there was a slowdown of decline and only later growth in the real value of measures of economic activity occured. The peak which completed the phase of growth fell on the turn of 1997-1998. Subsequent quarters are a phase of low dynamics with phenomena indicating a slow-

[16] R. Barczyk, Z. Kowalczyk, *Metody badania koniunktury gospodarczej*, PWN, Warszawa-Poznań 1993, p. 22.

Table 1

Specification of certain morphological features of business fluctuations in Poland's economy in the years 1990-2003

Morphological features	Phases of business cycles				
	decline phase	growth phase	decline phase	growth phase	decline phase
Gross Domestic Product					
Duration	1990:4 – 1991:2	1991:3 – 1997:4	1998:1 – 1998:4	1999:1 – 1999:3	1999:4 – 2002:3
Length (in quarters)					
– phase	3	26	4	3	11
– cycle	29		7		
Amplitude (in per cent points)					
– phase	10,95	5,97	2,35	2,37	3,41
– cycle	4,98		0,02		
Coefficient of volatility (in per cent)	2,08				
Sold production of industry					
Duration	1990:4 – 1991:3	1991:4 – 1997:4	1998:1 – 1998:4	1999:1 – 1999:4	2000:1 – 2002:2
Length (in quarters)					
– phase	4	25	4	4	10
– cycle	29		8		
Amplitude (in per cent points)					
– phase	20,83	13,64	6,80	5,84	5,58
– cycle	7,19		0,96		
Coefficient of volatility (in per cent)	4,20				

down of economic growth. The trough which seems to have finished that phase was identified in the fourth quarter of 1998. It was followed by a 3- or 4-quarter long phase of improvement in business conditions and at the beginning of the year 2000 another decline phase started to last until the second half of the year 2002.

Assuming the existence of five phases, it is possible to group them into two complete cycles. The first one lasted for slightly over 7 years and began with a phase of low dynamics of growth where special attention should be paid to its very big amplitude exceeding 20 per cent points (as regards industrial production) or almost 11 – if GDP is taken as a measure of activity. The observed rate of decline was very fast, unusual in well developed economic systems, which certainly should be related to the implementation of economic reforms. The following phase of growth was much longer but with a smaller amplitude. On these grounds a conclusion can be formulated about a positive amplitude of the cycle and its asymmetry both as regards duration and amplitude.

The second cycle has different morphology as compared to the first one. Altogether it only lasted for two years and the length of its component phases was almost equal. Moreover, fluctuations' amplitudes in particular sub-periods were very similar to each other. A subsequent cycle starting from the phase of decline has not finished yet, although one can see that it is going to be much longer than the previous one because the period of unfavourable business conditions exceeded two years.

These morphological features show that in the process of growth the Polish economic system exhibits significant cyclical components. Their repetitive character, however, can by no means be identified with stability of structure either as regards length, frequency or amplitude of fluctuations. This indicates deformation of oscillations characteristic of contemporary business cycles, which in the case of Poland results both from a specific character of transformation and the implemented policy of stabilization.

3. Business fluctuations and monetary policy instruments in Poland under transformation

Identification of changes in the economic activity measured by means of fluctuations in the real sold production of industry and GDP facilitates their comparison with the phenomena observed in the monetary sphere. To do so it is necessary to analyse the magnitudes which seem to be the most significant from the viewpoint of the monetary policy implemented.

According to the theoretical concepts presented in the first part of the paper, the authors take into consideration both money supply and interest rates. Central

banks, determining the money supply, group particular monetary assets by adding their values. In this way aggregates are created which are usually denoted by letter *M* with a numerical figure. The higher the figure at *M*, the less liquid are the components in the constructed aggregate[17]. Today the supply of money is described by means of three aggregates: M1, M2 and M3. Somewhere around there is a monetary base (sometimes defined as M0), i.e. the most liquid measure which is a sum of cash and obligatory reserves.

In Poland until February 2002 the widest measure was M2 treated as a sum of cash in circulation, current deposits and all kinds of long-term deposits, deposit certificates and negotiable securities. However, in March 2002 The National Bank of Poland implemented ECB standards[18]. Thus in Poland banking statistics started to use aggregates M0, M1, M2 and M3, defined according to the schedule binding in the EU. This was a significant problem when selecting the variables describing the money supply because the change in classification made it impossible to gather longer series aggregated on the same basis. Due to this the set of monetary variables was limited, the period of analysis was shortened to the years 1993-2003 and only M0, M1 and M2 were used.

In the case of interest rates the analysis included interest on NBP credits, i.e. rediscount rate and lombard rate as well as interest rate on deposits on the Warsaw inter-bank market (WIBOR) for the period of three months. The level of WIBOR is identified with the market cost of capital. Apart from the above-mentioned magnitudes the analysis included interest on deposits in PLN *a vista* and 12-month deposits. The measures of the amount of money were converted to fixed prices (1995=100), whereas interest rates were analysed on a yearly basis. Monetary indicators (with the exclusion of rates on NBP credits) were subject to statistical decomposition which facilitated the identification of the cyclical elements, i.e. they were subject to seasonal adjustment and deviations from the trend estimated by means of HP filter were determined.

The series prepared in the above-mentioned way were used first of all to study correlation with fluctuations in business activity. To achieve this Pearson's correlation coefficients were calculated and then time shifts up to 8 quarters were introduced[19]. It was assumed that longer transpositions would lose the value of significance of the studied links. The results obtained are presented in tables 2 and 3.

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[17] Apart from classical aggregates constructed by adding the values of their components, the weighted indicators of DIVISIA type are estimated. The National Bank of Poland (NBP) stopped constructing them in March 2002. See: N. Cieśla, *Konstrukcja pieniężnych agregatów DIVISIA w warunkach polskich*, Materiały i Studia, no. 89, NBP, Warszawa 1999.

[18] *Biuletyn Informacyjny NBP* (2002), no. 3, p. 5.

[19] In further research the shift showing the highest absolute value of the correlation coefficient was taken into account.

The correlation coefficients inform that there exist visible links between oscillations in business activity and fluctuations in money supply, however, their force and character depend on the category of money and a referential variable. In the case of SPI the strongest correlation appears between fluctuations in this aggregate and the money supply from the central bank (M0) as well as M1, which indicates a strong position of settlements made in the narrow money. As regards GDP a much stronger link is shown with broad money measure M2.

Table 2

Matrix of correlation between fluctuations of GDP, SPI and oscillations of monetary variables (without time lags) in Poland in the years 1993-2003

Explained variables	Explaining variables							
	M0	M1	M2	RR	LR	ADI	12MI	WIBOR3M
GDP	**0,22**	**0,44**	**0,50**	**0,10**	**0,08**	**0,00**	**0,35**	**0,30**
SPI	-0,05	0,17	-0,16	0,12	0,10	0,44	0,34	0,39

Explanations: RR – rediscount rate; LR – lombard rate; ADI – interest rate on a vista deposits; 12MI – interest on 12-month deposits; WIBOR3M – three-month interest rate on deposits on the Warsaw inter-bank market. The values of correlation coefficients significant at level 5% are printed in bold.

Table 3

Matrix of correlation between fluctuations of GDP, SPI and oscillations of monetary variables (time lags included) in Poland in the years 1993-2003

Explained variables	Explaining variables							
	M0	M1	M2	RR	LR	ADI	12MI	WIBOR3M
GDP	**0,63** (+5)	**0,67** (+3)	**0,71** (+4)	**-0,40** (-4)	**-0,37** (-4)	**0,11** (+2)	**0,53** (+2)	**0,51** (+2)
SPI	**0,50** (+6)	**0,50** (+4)	**0,45** (+5)	**-0,23** (-4)	**-0,20** (-4)	**0,58** (+1)	**0,41** (+1)	**0,47** (+1)

Explanations: numbers in brackets inform about time shift of the explaining variables. Mark (+) shows the lag calculated in quarters compared with fluctuations in GDP or SPI, whereas (-) indicates the lead.

The time shifts applied suggest that oscillations appear first in the real sphere and then the turns occur in fluctuations of particular *M*. Therefore, in Poland the changes in economic activity correspond after some time to the increasing amount of money in circulation. Similar patterns were observed for all the measures of money, although transpositions changed from 2 to 6 quarters.

Analysing the links between cyclical fluctuations and interest rates it can be noticed that the NBP rates are more strongly correlated with fluctuations in the GDP than with oscillations in the sold production of industry.

Moreover, this is a relation of reverse character and the NBP rates lead the changes in GDP. This can suggest that general business conditions are sensitive to the steps taken in the sphere of interest rate policy. However, this result has to be interpreted cautiously. There is a possibility of apparent spurious correlation resulting from non-decomposition of these rates, facilitating identification of the cyclical components, was not justified because their administrative determination hinders the application of the previously used instruments.

This type of objections did not concern other interest rates. In that case it was assumed that these were pro-cyclical variables in relation to oscillations from the real sphere (fluctuations in the GDP and a vista deposits were an exception). Moreover, it should be noticed that the extent of pro-cyclical character increased when interest rates lagged behind.

The next step in this research was estimation of regression equations. Fluctuations in GDP or sold production of industry were assumed as dependent variables. First the set of independent variables included oscillations in money supply then – only changes in interest rates and finally equations considering all the analysed magnitudes. In the estimated equations time series were used – shifted according to the results of correlation measurements. Equations (1) – (6) present the polynomials obtained in this way[20].

$$GDP_t = \mathbf{73{,}748} - 0{,}002\ M0_{t+5} + \mathbf{0{,}137}\ \mathbf{M1}_{t+3} + \mathbf{0{,}128}\ \mathbf{M2}_{t+4};\quad R^2 = 0{,}800 \tag{1}$$

$$GDP_t = \mathbf{100{,}924} - 0{,}471\ RR_{t-4} + 0{,}385\ LR_{t-4} - 0{,}255\ ADI_{t+2} + 0{,}276\ 12MI_{+2} + 0{,}099\ WIBOR3M_{t+2};\quad R^2 = 0{,}400 \tag{2}$$

$$GDP_t = \mathbf{78{,}687} - 0{,}021\ M0_{t+5} + \mathbf{0{,}093}\ \mathbf{M1}_{t+3} + \mathbf{0{,}138}\ \mathbf{M2}_{t+4} - 0{,}382\ RR_{t-4} + 0{,}359\ LR_{t-4} - 0{,}351\ ADI_{t+2} + \mathbf{0{,}152}\ \mathbf{12MI}_{t+2} + \mathbf{0{,}167}\ \mathbf{WIBOR3M}_{t+2};\quad R^2 = 0{,}872 \tag{3}$$

$$SPI_t = \mathbf{77{,}328} - 0{,}019\ M0_{t+6} + \mathbf{0{,}242}\ \mathbf{M1}_{t+4} - 0{,}032\ M2_{t+5};\quad R^2 = 0{,}333 \tag{4}$$

$$SPI_t = \mathbf{97{,}320} - 3{,}032\ RR_{t-4} - 2{,}627\ LR_{t-4} + \mathbf{1{,}147}\ \mathbf{ADI}_{t+1} + 0{,}145\ 12MI_{t+1} - 0{,}170\ WIBOR3M_{t+1};\quad R^2 = 0{,}339 \tag{5}$$

[20] Variables significant at 5 per cent significance level are printed in bold.

$$SPI_t = \mathbf{70{,}452} - 0{,}042\ M0_{t+6} + \mathbf{0{,}362\ M1_{t+4}} + 0{,}020\ M2_{t+5} + \\ + 0{,}766\ RR_{t-4} - 0{,}706\ LR_{t-4} + \mathbf{1{,}681\ ADI_{t+1}} + 0{,}005\ 12MI_{t+1} + \\ - 0{,}341\ WIBOR3M_{t+1}; \\ R^2 = 0{,}628. \qquad (6)$$

All of the obtained equations were statistically significant. However, it should be remembered that the starting source material covered 44 quarters and the introduction of time lags still reduced the set of observations. Therefore, the results obtained must be interpreted cautiously and treated as a starting point for further studies.

The highest coefficients of determination were obtained in the case of modeling of the GDP oscillations because it turned out that about 85 per cent of the changes in the economic activity in Poland can be explained by means of fluctuations in the monetary magnitudes included in the analysis (see: equation (3). The goodness-of-fit of the models obtained for fluctuations in sold production of industry should be evaluated as being much worse.

Analysing the variables which describe the amount of money it can be seen that information from the correlation calculus is confirmed. Widely defined money (M1, M2) exert a stronger influence on the GDP, whereas the narrow M1 is the only significant determinant of the oscillations of SPI (equation (4)). In the case where the amount of money could be regarded as an instrument linked with the changes in economic activity, its proportional influence on referential variables was proved, which is convergent with the hypotheses formulated on the grounds of monetarism.

Equations (2) and (5) show that interest rates generally cannot be regarded as autonomous instruments of shaping economic activity[21]. However, a joint study on the influence of the amount of money and interest rates (relations (3) and (6)) presents certain links between interest rate on a vista deposits and changes in GDP and SPI.

It should be underlined that monetary policy of the central bank which would apply only the instruments controlled by this bank does not have an anti-cyclical character in Poland. This is proved by the fact that oscillations in the GDP and SPI are not significantly determined by fluctuations in M0 and changes in NBP interest rates on credits. On the other hand, however it would seem that monetary authorities can indirectly influence the economic activity by shaping the supply of broad money. For example the policy of obligatory reserves and open market operations are the instruments which make it possible, although partially, to influence the creation of money by a commercial banking system. An obstacle to this type of interpretation, however, is the lagging character of oscillations of monetary aggregates as compared with changes in business conditions.

[21] See: W.M. Orłowski (2000), *Has the Economic Policy in Poland in the 1990s had an Anti-Cyclical Character*? ZBSE GUS and PAN Research Bulletin vol. 9, no. 3-4, pp. 39-40.

Very similar conclusions can be drawn as regards the links between market interest rates and fluctuations in the GDP and sold production of industry. The central bank can indirectly determine liquidity of the banking sector which certainly influences the price of money on the inter-bank market (WIBOR). However, once again the lagging (not the leading) character of changes in this indicator is visible, moreover its oscillations are pro-cyclical. This means that the monetary authorities do not pursue an active counter-cyclical policy.

Conclusions

The conducted research shows that Poland's economy under transformation is an economic system where significant cyclical fluctuations can be observed. Their morphology is similar to the characteristics of contemporary business fluctuations exhibiting a considerable deformation in comparison with classical definitions of business cycles. The morphological features of oscillations in business conditions prove that indicators of sold production of industry are much more sensitive to business fluctuations than those of GDP.

Taking into account relations between fluctuations in the real indicators and the magnitudes regarded as instruments of monetary policy, there is a possibility to verify their links by Keynesian and monetarist approaches. The results of statistical analyses seem to show fairly univocally that the Polish monetary policy is not pro-Keynesian. This is proved by the fact that there is no significant influence of the central bank interest rates on changes of the economic activity and lagging character of the market rates shaped indirectly by the decisions of the monetary authorities.

On the other hand, many facts prove that activities of the Polish central bank were carried out according to the monetarist theory. It is confirmed by a significant positive correlation between fluctuations in money supply and indicators in the real sphere of the economy, with a simultaneous time lag of the former. This can be interpreted as a clearly visible implementation of the fixed rules of a passive monetary policy linking the rate of changes in money supply with the dynamics of the GDP. Moreover, a pro-cyclical character of the price of capital corresponds to the conclusions derived from the neoclassical school[22].

The presented analysis shows, therefore, that the NBP's priority was not to counteract excessive changes in the economic activity. Its policy was clearly oriented towards curbing inflation. However, it should be underlined that this is one of the aspects of a correctly implemented stabilization policy of widely approached busi-

[22] More on the subject: R.J. Barro, *Makroekonomia*, PWE, Warszawa 1997, p. 271; M. Kruszka, op.cit., pp. 179-180.

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ness conditions. This policy should be supplemented with instruments from the fiscal sphere which, however, goes beyond the research range assumed, although there is no doubt that further research should be conducted in this field.

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