Stylized Facts of Macroeconomics: the Polish Experience

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1. Introduction[1]

Recent years have shown an increase in the number of studies on transition economies. However, the economic theory for those economies is scarce, thus the growing literature is rather of theoretical than empirical nature and macroeconomic modelling of transition economies is still very much an uncharted area. The aim of my research is to satisfy the growing demand for high-quality quantitative publications, and especially those dealing with empirical macroeconomic modelling of the Polish economy. Although, several econometric models of Polish economy have been constructed (among others, see [Narodowy Bank Polski, 2005; Welfeet al., 2002]), they all lack the preliminary analysis, namely the detailed evaluation of the principal macroeconomic stylized facts underlying each equation of those models. The examination of a number of stylized facts characterizing the process of economic growth may lead to some extensions of the existing models. This paper contributes to the work that has been done so far by further thorough investigation of the widely accepted stylized facts of macroeconomics and other combined tests of empirical evidence for various theoretical hypotheses.

The stylized facts have been largely developed with reference to mature market economies. This paper examines how well the different theories can account for the behaviour of macroeconomic aggregates in a country undergoing rapid development, such as Poland in post-communism period.

In Poland since 1995 more or less reliable and comparable macroeconomic data have been mostly available due to continuous improvement in the national accounting system. Nevertheless, detailed econometric analysis of Polish economy is still very difficult. The following areas of concern have been highlighted:

[1] The author is indebted to Ryszard Kokoszczyński for his helpful comments and suggestions.

- short data sample,
- changes in data classification.

Moreover, the relatively short period of transition and the dynamism of undergoing changes make it perplexing to identify the relevant relationships. The situation is even worse if taking into account, that the Polish time series are contaminated with outliers due to the influence of unusual and non-repetitive events (this fact was preliminary proved in [Rosiak, 2006]). This paper provides the evidence that if one is able to identify the outliers and then adjust their effects for purpose of analysis or use robust techniques of estimation, it is possible to confirm the exploit of stylized facts of macroeconomics in Poland.

The findings of this paper may serve as justification for: 1) use of robust techniques that would provide resistant results in the presence of unusual data in macromodelling of Polish economy, 2) econometric analysis in conjunction with judgment, provided that sufficient prior knowledge and experience about the data and potential structural changes are available, 3) the thesis, that transition of the Polish economy is far advanced and that the structure of macroeconomic aggregates is already established.

The rest of this paper is organized as follows. Section 2 examines the Polish quarterly data in order to evaluate the stylized facts of balanced growth. Section 3 compares the empirical performance of the New Classical, New Keynesian and Hybrid specifications of the Philips curve. The change analysis of macroeconomic stylized facts across monetary regimes is provided in section 4. The conclusions and areas for further research are provided in the final section.

2. The Kaldor Facts

In the theoretical growth literature (e. g. [Kaldor, 1961; Solow, 1956]) as well as in macroeconomics textbooks (e. g. [Blanchard and Fisher, 1989; Romer, 1996]) it is assumed that a developed economy is characterized in the long run by balanced growth. In particular, as noted for example in [Evans, 2000] (the paper which is in some respect related to the analysis presented in this section), this assumption implies the following stylized facts about these economies:

- the growth rate of output is mean-stationary;
- the growth rate of labour productivity is mean-stationary;
- the investment rate is mean-stationary.

See [Evans, 2000] or [Foelmi and Zweimueller, 2002] for further discussion on these as well as other stylized facts.

The aim of this section is to investigate whether Polish economy can be reasonably characterized as approximately balanced. The data source for the analysis are the Quarterly National Accounts of the Central Statistical Office. In keeping with most of the previous empirical literature, labour productivity is defined as a ratio of GDP (seasonally adjusted) and employment.

The productivity growth is obtained by log first differencing the above defined time series.

The rest of this section is organized as follows. Subsection 2.1. provides plots of the data and subsection 2.2. introduces a formal econometric analysis.

2.1. The visual inspection of data

The figures below plot the growth rate of labour productivity, the growth rate of GDP and the growth rate of investment in period from 1995 to 2005 (for labour productivity the sample covers the period from 1997).

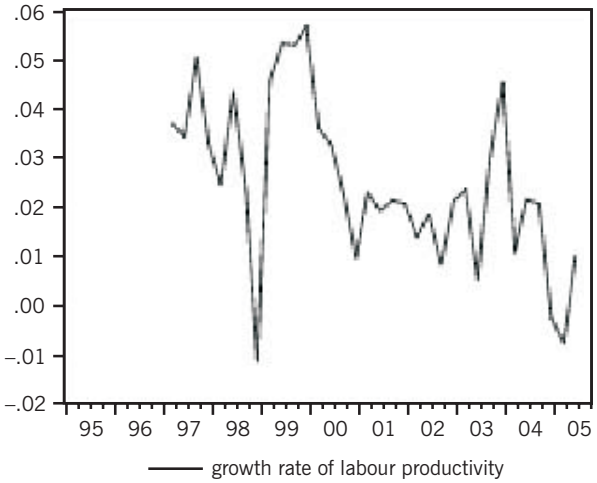

Fig. 1.

The growth rate of labour productivity

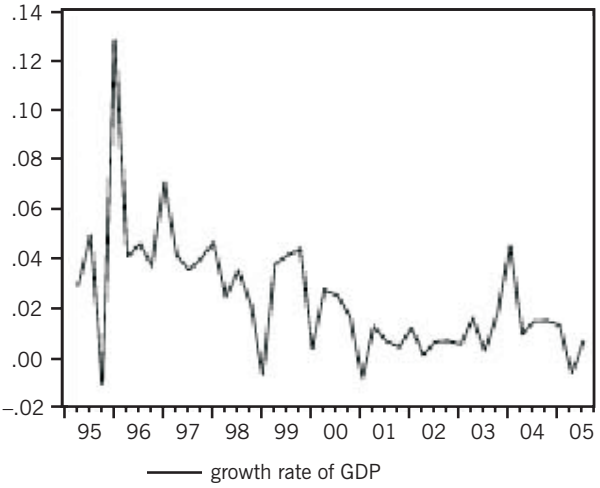

Fig. 2.

The growth rate of GDP

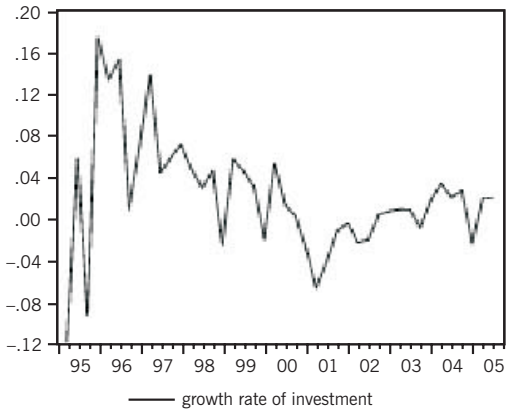

Fig. 3.
The growth rate of investment

At first glance there is little, if any, apparent trend in the series over the considered period. This may suggest that the figures provide evidence on stylized facts mentioned above. Additionally, the figures show that those series appear to be contaminated with outliers. For example, even without performing any formal tests, 1995q4 seems to be outlier.

Nevertheless, it is hard to rely purely on the visual inspection, especially when the data set contains outlying observations. Therefore, formal statistical analysis is essential.

2.2. Econometric analysis

To investigate whether the growth rate of labour productivity, GDP and investment can be well characterized as mean-stationary in period 1995–2005, the Dickey-Fuller test for each of the series was carried out. This approach was also adopted in [Evans, 2000] to examine if the US growth has been approximately balanced during the post-war period. Table 1 reports Dickey-Fuller t-ratios for each of the considered series for the years 1995–2005. It provides strong evidence that labour productivity and GDP growth rate are mean-stationary. By contrast, there is no evidence that the growth rate of investment is mean-stationary.

Table 1.
Dickey-Fuller t-statistics on full dataset for log first differences

	without trend	with trend
growth rate of labour productivity	–3.52* (0)	–3.46* (3)
growth rate of GDP	–5.48* (0)	–7.74* (0)
investment rate	–2.58 (1)	–3.12 (1)

Note: The integer in parentheses is the lag length in the augmented Dickey-Fuller regression. The superscripts * indicates rejection of the null hypothesis of unit-root.

As was shown in [Frances, Lukas, 1998] or [Rodrigues, 2004], the Dickey-Fuller test is sensitive to typical events such as outliers and structural breaks. Moreover, in [Person and Vogelsang, 1992] it was proved that unit-root tests are biased toward non-rejection of null hypothesis of unit root, if there is a level shift in the sample. In other recent studies, for example [Vogelsang, 1999], it was established that the presence of outliers induces in the error a negative moving-average component, which causes the unit root tests to exhibit substantial size distortions towards rejection of the null hypothesis too often (see [Darne, 2004]).

One proposed solution to account for outliers in unit root testing is to include zero-one dummy variables in the model. This approach assumes that there was a trend break at a known date. The Dickey-Fuller test results obtained on the data set with 1995q4 omitted are listed in Table 2 (discarding observation from data set is equivalent to including dummy variable equal to one for 1995q4 and zero otherwise[2]).

Table 2.

Dickey-Fuller t-statistics on data set without lying observations omitted for log first differences

	without trend	with trend
investment rate	–2.9* (1)	–4.2* (1)

Note: The integer in parentheses is the lag length in the augmented Dickey-Fuller regression. The superscripts * indicates rejection of the null hypothesis of unit-root.

Table 3.

KPSS test for log first differences

	without trend	with trend
growth rate of labour productivity	0.40[b]	0.10[a]
growth rate of GDP	0.09[a]	0.08[a]
investment rate	0.40[b]	0.10[a]

The superscripts a, b and c indicate statistical significance at the 1%, 5% and 10% respectively.

Deleting 1995q4 produces Dickey-Fuller t-ratios, which imply that the growth rate of investment has also been mean-stationary in the last ten years.

Given the conflicting results of the two approaches, with regard to growth rate of investment, it is difficult to decide whether the stylized facts mentioned above characterize Polish economy or not. If one is convinced of the model specification and wants to discard the atypical observation mentioned previously, dummy variable can be used. However, it is important to notice

[2] The other results are not presented because they confirm results obtained on full data set. Nevertheless they are available from the author upon request.

that the distribution of unit-root test depends on the deterministic regressors included. Moreover, in my opinion, simply discarding outliers from analysis without reffection is not always the remedy. In many situations, a more appropriate approach is to apply robust techniques, that would provide resistant results in the presence of unusual data points.

Therefore the next step of the analysis of the Kaldor facts is to carry out the test, which proved to be robust, to additive outliers, namely the stationarity test developed by Kwiatkowski, Philips, Schmidt and Shin (KPSS) in [1992]. The KPSS test differs from the DF test in that series y_t is assumed to be stationary under the null. In [Darne, 2004] the Monte Carlo simulations were used to study the size and power properties of KPSS test. It was proved that KPSS does not exhibit significant size and power distortions in the presence of additive outliers in the sample.

The results obtained from the KPSS test suggest that the growth in Poland is reasonably stable and therefore consistent with widely approved stylized facts of macroeconomics. It was difficult to discover this feature of Polish economy due to the influence of unusual and non-repetitive events. This result should support my advocacy for the use of robust techniques in macromodelling of Polish economy.

3. Philips curve

After examining the long run properties of the Polish economy in previous section, this section also analyses medium and short run characteristics. Namely, the relationship estimated for most developed economies—the Philips curve.

The macroeconomics literature heavily relies on the Philips Curve as a tool to explain the trade-off between unemployment and inflation (see for example [Phelps, 1967] or [Philips, 1958] for different Philips curve specifications). The literature provides a distinction between the short-run and long-run Philips curves, which in short can be described as follows: As long as inflation remains fairly constant, it is inversely related to unemployment rate. This is the short-run Philips curve. When the average rate of inflation changes, however, unemployment returns after a period of adjustment to the natural rate. That is, once the inflationary expectations have had time to adjust, the natural rate of unemployment is compatible with any rate of inflation. This is the long-run Philips curve. These long-run and short-run relationships can be combined in a single expectations-augmented Philips curve, which is investigated in more detail in section 3.2.

Using quarterly data from 1995q1 to 2005q4, this section investigates whether such relationships do indeed characterize the Polish economy well. The general result is that there has not been one steady curve showing the relationship over the past ten years. Evidence is found that periods inconsistent with the Philips theory, occurred in Poland. Firstly, between 1995 and 1998, when unemployment rate and inflation decreased together. Secondly,

from 1998 to 2000 when the Polish economy suffered from soaring inflation and growing unemployment simultaneously. Notwithstanding these unusual periods, recent years show that there is evidence of Philips Curve relationship between unemployment and inflation.

The section is structured as follows. The subsection 3.1. provides the visual inspection of the relationship between rate of unemployment and inflation rate. In subsection 3.2. the three Philips curve specifications are introduced. The results of econometric analysis are reported in subsection 3.3.

3.1. The visual inspection of the Polish data

Empirical studies, carried out in the fifties and sixties worldwide, confirm the Philips theory. For many economies, such as United States and United Kingdom, the downward sloping Philips curve proved to be true. However in the 1970s most developed countries suffered from stagflation, when world oil prices rose dramatically, fuelling sharp inflation. This was the first breakdown of the Philips initial theory.

In the Polish economy, there also seems to have been no stable relationship between unemployment rate and inflation postulated in [Philips, 1958]. In fact there have been several distinct curves over the past ten years with several outlying data points. The closer look at the data shows that in period between 1996q1 and 1998q4 unemployment rate and inflation fell down together with the correlation coefficient of 0.73. Later, during the period of 1999q1 and 2000q3 the Polish economy suffered from soaring inflation and growing unemployment simultaneously. Although admittedly based on just eight observations, evidence clearly suggests a positive correlation between unemployment and inflation rate.

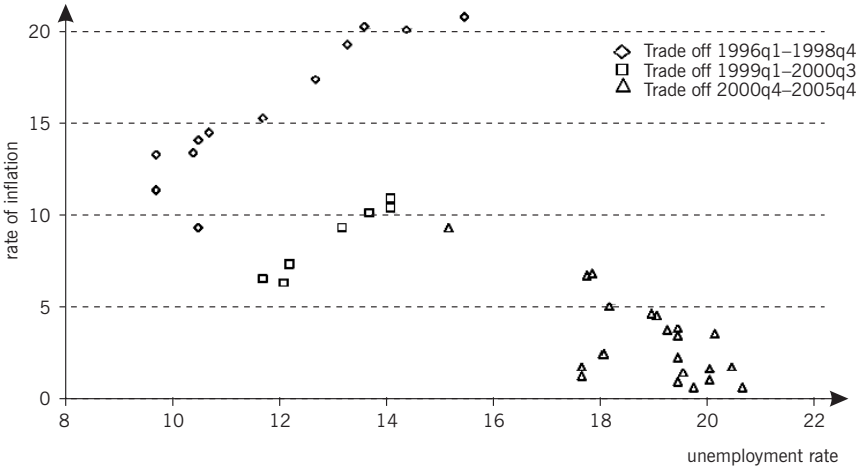

Fig. 3.

Trade-off between unemployment and inflation rate in Poland

The last five years, however, show that there is a trade-off between unemployment and inflation rate in Poland (cf. the figure above).

Although providing an explanation is beyond the scope of this paper, it is interesting to consider the possible features of the Polish economy that could explain this:

- A more developed labour market. In the 1990s in Poland wages largely followed the development in labour productivity and the retail prices. This shows that market forces have played a minor role in the labour market. It was due to high unemployment rate which dampened the bargain power of labour unions. Current development contributes to the reduction of labour market rigidities and increases the incentives to work.
- The use of inflation targeting in monetary policy. This explanation is supported by the empirical work of Luca Benati from Bank of England (see [Benati, 2006]) in which the author states that:

> **[…] the inflation targeting regime appears to have been characterized, to date, by the most stable (although not the flattest) unemployment-inflation trade-off in the recorded history […]**

The Philips original theory ignored the role of expectations and supply shock[3] which, in my opinion, was the main reason for the break-down of this theory in many countries. The observed inconsistency of economic data of the original Philips theory inspired economists to take into account the role of inflationary expectations theory with the concept of output gap. In the next subsection three different specifications of the Philips curve are considered.

3.2. Three specifications of the Philips curve

In this subsection three different Philips curve specifications are considered. They all involve distinct assumptions about the role of expectations in the inflation process. The analysis presented here is in line with the article of Maritta Paloviita of Bank of Finland (see [Paloviita, 2005]), where the study for OECD countries was performed. According to the obtained results, the New Keynesian Philips curve specification is apparently outperformed by the New Classical and the Hybrid Philips curves. Therefore, the author concludes that the backward-looking or sluggish features of the inflation dynamics are important to European data. The analysis below aims to find evidence for (at least) one of the aforementioned Philips curve specifications for Poland.

[3] Such as a sharp rise in world oil prices in 1974 and 1979.

3.2.1. New Classical Philips curve

According to [Friedman, 1968] and [Phelps, 1967] the current inflation rate is related to the previously expected inflation rate and to the current excess demand

$$\pi_t = E_{t-1}\pi_t + \varphi\hat{y}_t \tag{1}$$

where:
π_t—the current inflation rate,
E_{t-1}—period $t-1$ representative market expectations,
$\hat{y}_t$—the output gap.

3.2.2. New Keynesian Philips curve

That specification implies that current inflation rate is determinated by currently expected future inflation rate and the current excess demand

$$\pi_t = \beta E_t \pi_{t+1} + \kappa\hat{y}_t \tag{2}$$

3.2.3. Hybrid Philips curve

This is the modification of the New Keynesian Philips curve, where the lagged inflation rate is added as an additional explanatory variable[4]

$$\pi_t = \omega_1 E_t \pi_{t+1} + \omega_2 \pi_{t-1} + \kappa\hat{y}_t \tag{3}$$

3.3. Econometric analysis

In order to build the models 1, 2 and 3, inflation expectations of private individuals obtained from National Bank of Poland, a monthly survey was used. Namely, for $E_{t-1}\pi_t$ and $E_t\pi_{t+1}$, π_t^* and π_{t+4}^* was inserted[5]. The estimate of output gap was constructed in several steps. First, the GDP in current prices was de-seasonalized using X11 procedure, with multiplicative adjustment. Then, in order to arrive at a measure of cyclical variation, log first differencing was applied. The widely used approach of applying HP filtered output gap was not used because the Holdrick-Prescott filter may lead to misleading conclusions being drawn from the relationship between short-term movements in macroeconomic time series. As was shown, for example, in [Jaeger, 1993],

mechanical detrending based on the Holdrick-Prescott filter can lead investigators to report spurious cyclical behaviour [...]

[4] Thus the Hybrid Philips curve implies persistence in inflation.
[5] The lag and lead of 4 instead of 1 was used because of quarterly data.

In order to discriminate between the alternative Philips curve specifications, the Wald test of coefficient restrictions was carried out to the following unrestricted regression, which incorporates the three specifications:

$$\pi^{t} = \alpha\pi^{*}_{\tau} + \beta\pi^{*}_{\tau+4} + c\pi_{t-4} + d\hat{y}_{t} \tag{4}$$

Since the aim of the econometric analysis introduced here is to compare the different models on their own, theoretical restrictions, analogous to those introduced in [Paloviita, 2005], were imposed in the estimated specifications. Namely, in the New Keynesian specification, the imposed value of β was 0.97 and in the Hybrid Philips curve the sum of forward and backward-looking components was restricted to unity.

As I have shown in [Rosiak, 2006] the Polish quarterly data are contaminated with outliers, which can have an impact on the determination of the classical estimators, making traditional statistical reasoning misleading. To make the analysis robust, several diagnostic procedures for detecting outliers and influential data in linear regression (see [Rosiak, 2006]) was applied. Only those observations which were identified by at least two of the diagnostic statistics were considered as inconsistent with the bulk of the data. The statistics identified the following data points: 1996q1, 1996q2, 1997q1, 1999q1. In this section, to make the analysis robust, the unusual data points are simply deleted from the sample. However, it is also very important and interesting to investigate why particular observations are unusual and treat them appropriately during the estimation process. This, rather extensive, issue of concern is left for further research.

When the parameter restrictions of all the three Philips curve specifications were tested against the unrestricted regression on the full data set, the Wald test clearly rejected restrictions implied by New Keynesian and New Classical Philips curve specification and at the typical threshold of five per cent the Hybrid model was also rejected. When the same tests were used on the data set with the unusual observations omitted, the Hybrid model was clearly accepted.

The results of the tests and the joint hypothesis are listed in tables 4 and 5.

Table 4.

Wald test results on full data set

	Joint Hypothesis				
NKPC vs. unrestricted regression	$(a, b, c) = (0, 0.97, 0)$	$F = 39.56$	0.000	$\chi^2 = 118.69$	0.000
NCPC vs. unrestricted regression	$(a, b, c) = (1, 0, 0)$	$F = 193.27$	0.000	$\chi^2 = 579.80$	0.000
HPC vs. unrestricted regression	$(a, b + c) = (0, 1)$	$F = 3.20$	0.052	$\chi^2 = 6.40$	0.040

Table 5.

Wald test results on data set with outlying observations omitted

	Joint Hypothesis				
NKPC vs. unrestricted regression	$(a, b, c) = (0, 0.97, 0)$	$F = 39.13$	0.000	$\chi^2 = 117.40$	0.000
NCPC vs. unrestricted regression	$(a, b, c) = (1, 0, 0)$	$F = 196.68$	0.000	$\chi^2 = 590.04$	0.000
HPC vs. unrestricted regression	$(a, b + c) = (0, 1)$	$F = 1.45$	0.249	$\chi^2 = 2.90$	0.235

4. Monetary regimes

As noted in [Paloviita, 2005] changes in monetary regimes may affect the inflation dynamics, and thus the shape of the Philips curve. Moreover, in [Benati, 2006] it is suggested that the stochastic properties of inflation are dependent on the underlying monetary regime.

Over the last decade Poland experienced remarkable changes in its monetary regimes. The aim of this section is to analyze if macroeconomic stylized facts have changed along with changes in monetary regimes. This should help understand which of the investigated stylized facts of macroeconomics reflect the structure of the Polish economy and which of them are depended on monetary rules. The available empirical work in that field provides mixed results and is rather scarce, especially for developing countries.

The section is organized as follows. Subsection 4.1. presents brief chronology of Polish monetary regimes. Subsection 4.2. investigates the correlation between inflation and money growth. In subsection 4.3. the changes in volatility of GDP are empirically exploit.

4.1. A brief history of Polish monetary regimes

Before investigating changes of the key macroeconomic stylized fact it is important to understand the major changes in the monetary regimes in Poland. Because a detailed analysis of this issue is beyond the scope of this paper, the attention is focused on the turning points in the history of Polish monetary regimes (see for example [Kokoszczyński, 2001] or [Pruski, 2002] for more details).

In 1990's Poland adopted fixed exchange regime with the principal aim to fight hyperinflation. The fixed exchange regime prevailed the next 18 months. After this time inflation rate still exceeded 40 per cent, but at the same time zloty regained its role as a medium of exchange and store of value and Poland increased its share of trade on international markets. Therefore, in order to prevent the real exchange rate from excessive appreciation and preserve the foreign competitiveness the system of fixed exchange was transformed into crawling peg regime (see [Pruski, 2002]). The next years bring reasonable stabilization of economy and the liberalization of cap-

ital inflows. The situation made it possible to change the strategy of monetary policy in 1995 and adopt a more flexible approach. During next three years Poland saw *Inflation Targeting Lite* (ITL) or *Eclectic Inflation Targeting* (EIT) type of monetary regime. Eventually, in 1998 this strategy was replaced by *full-fledged IT strategy* (FFIT).The main distinguishing feature between ITL, EIT and FFIT is the degree of clarity and institutional commitment to price stability. In pursuing the FFIT strategy, the National Bank of Poland commits itself to price stability as the main objective of monetary policy, along with stipulating that medium-to-long-term inflation is the nominal anchor where the inflation target is set.

The next subsections analyze changes in key macroeconomic stylized facts in Poland after 1995 in relation to aforementioned changes in monetary regimes.

4.2. Money aggregates and inflation

According to the old Chicago Monetarism of Viner, Simons and Knight, the velocity of money and the rate of inflation should be correlated. This subsection investigates the evolution across monetary regimes of the correlation between inflation and the money aggregates. The lag between monetary policy actions and the response of inflation is assumed. Namely, according to Friedman's result (see [Friedman, 1961]), it is assumed that it takes over a year before monetary policy actions have their peak effect on inflation (see also [Batini, Nelson, 2002] for empirical evidence of that fact based on UK and US data).

The figure on the next page shows scatter plot of the velocity of money (measured as the ratio of GDP and broad money, M3) and customer price index (quarterly data).

Although based on an extremely limited number of observations, the correlation clearly appears to be positive during the period from 1995 up to 1999 (equal to 0.96), and after 1999 there seems to be no correlation at all.

It is very difficult to interpret such instability in the correlation between money velocity and inflation rate, because the correlation does not necessarily imply a cause in any meaningful sense. However, in this context it is also very interesting to examine related stylized fact stressed, for example, by Svensson in [2003]. The author argues that precise meaning that can be attributed to the correlation between money growth and inflation depends strongly on the underlying monetary regime. In the regime of monetary aggregates targeting, inflation adjusts to the changes in money supply, controlled entirely by the central bank. Thus, under these circumstances money growth causes inflation. On the other hand, under inflation targeting regime the inflation rate is exogenous and money growth should adjust via an equilibrium condition on the money market, therefore inflation causes money growth (see also [Benati, 2006] for further discussion on this issue).

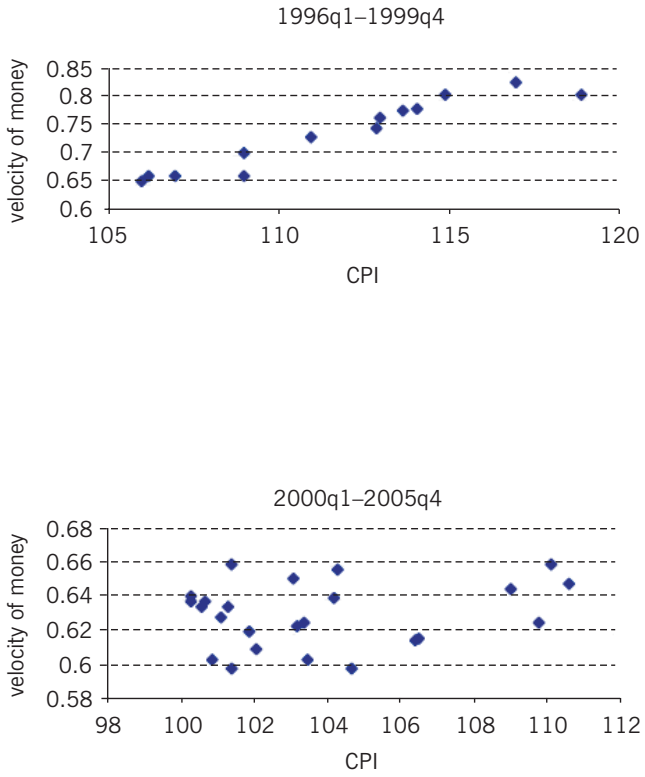

Fig. 4.
The velocity of money

In order to investigate this stylized fact, monthly time series were used. Prior to the analysis, the series were de-seasonalized using X11 procedure, with multiplicative adjustment for money aggregate (M3) and additive adjustment for inflation rate (CPI). The econometric procedure applied to check the validity of the aforementioned stylized fact is the Granger Causality Test. The Granger approach to the question of whether x causes y is to see how much of the current y can be explained by past values of x and then to see whether adding lagged values of x can improve the explanation. y is said to be Granger-caused by x if x helps in the prediction of y, or equivalently if the coefficients on the lagged x's are statistically significant.

The results are listed in Table 6.

Table 6.
Granger Causality Test for money growth and inflation rate in period 1995m1–1999m12

Null hypothesis:	F-Statistic	Probability
inflation does not Granger cause money growth	0.02285	0.8808
money growth does not Granger cause inflation	4.65817	0.03851

Table 7.

Granger Causality Test for money growth and inflation rate during 2000m1–2005m12

Null hypothesis:	F-Statistic	Probability
inflation does not Granger cause money growth	3.74042	0.05721
money growth does not Granger cause inflation	2.73810	0.10252

According to the table, the hypothesis that M3 growth does not cause CPI can not be rejected in FFIT regime and is rejected in sample period 1995m1––1999m12. By contrast, the hypothesis that CPI does not cause M3 growth is rejected for period of inflation targeting regime and cannot be rejected for the period before FFIT regime. Therefore it appears that Granger-causality runs one-way under inflation targeting regime from inflation to M3 growth and not the other way.

4.3. The variability of GDP

The macroeconomic volatility has been, over the last decade, one of the most intensively investigated topic in the field of stylized facts of business cycles. As argued in e. g. [Alper] or [Benczur, Raftai, 2005], macroeconomic fluctuations in developing countries are relatively more intense than in the developed ones. Thus, it is very important to investigate the sources of those fluctuations and find possible economic features that would smoothen them to the level of developed economies. The aim of this subsection is to examine the stability of macroeconomic environment in Poland across the monetary regimes using quarterly data from 1995 to 2005.

Table 8 reports the percentage standard deviation of the first log differences of the main macroeconomic aggregates in Poland.

Table 8.

Standard deviations of business-cycle components by sample periods

	1995–1999	2000–2005
GDP	2.82	1.12
Consumption	1.94	1.14
Investment	7.35	2.80
Export	4.94	4.60
Import	4.64	5.10
Inflation(CPI)	7.71	3.29

Several facts are readily apparent from the table.

First, based on quarterly data, the volatilities of the first log differences of real GDP and investment were observed before the introduction of full--fledged inflation targeting regime almost three times as large as that associ-

ated with the inflation targeting. The volatility of the other GDP components has remained reasonably stable during the period 1995–2005.

From data it is also possible to see that in Poland volatility of the real GDP has been, since 1995, systematically lower; in the first years of inflation targeting regime markedly so. For example in period 1995–2001 the volatility stayed above 3% and after 2000 has remained markedly less volatile with standard deviation of about 1.8% (cf. figure below).

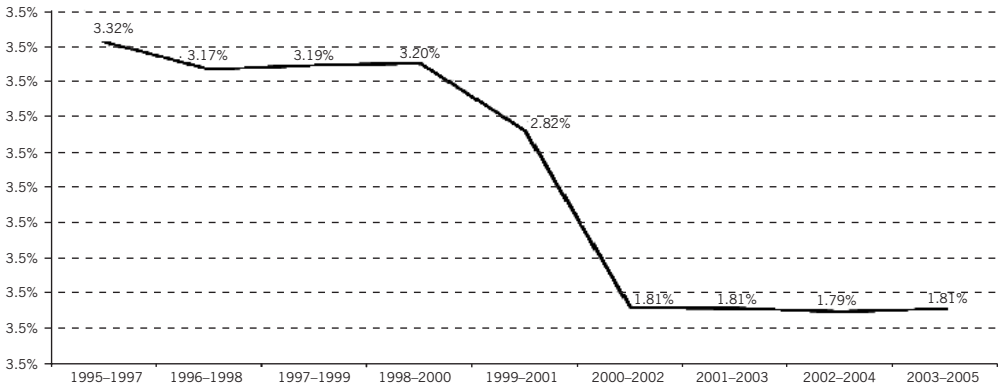

Fig. 5.

The volatility of the real GDP in Poland (1995–2005)

Second, the full-fledged inflation targeting regime appears to have been characterized by lower volatility of the consumer price index (CPI) fluctuations than the ITL/EIT regime.

The results are in line with those obtained by Luca Benatiin [2006], who argues that

> **[...] inflation targeting regimes appears to have been characterized, to date, by the most stable macroeconomic environment in recorded U.K. history, with the standard deviations of the business-cycle components of real GDP, national accounts aggregates, and inflation measures having systematically been lower than for any previous regimes/period.**

5. Conclusions and further research

This study attempted to investigate if the key macroeconomic stylized facts characterize Polish economy well. The analysis suggests that, provided that it is possible to identify the outliers and then adjust their effects or use robust techniques of estimation, it is possible to confirm the exploit stylized facts of macroeconomics in Poland. The key findings are outlined below.

The results obtained suggest that in Poland the New Keynesian and New Classical Philips curve specifications are surpassed by the Hybrid model. This paper also provides strong evidence that Kaldor's stylized facts have been held in Poland during the last ten years. Finally, the analysis of changes in macroeconomic stylized facts in Poland has proven, that the behaviour of some macroeconomic aggregates is related to underlying monetary regime. These results may have important implications to the development of macroeconomic theory and modelling.

Further research will concern regression techniques in macromodelling Polish economy, that would provide robust results in the presence of unusual data points. It is also important to investigate why a particular observation is unusual, and try to find some feature of the economy (like fiscal or monetary policy, tax system etc.) that could explain the unusual data points.

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Abstract The aim of this paper is to provide detailed analysis of quarterly frequency dynamics in macroeconomic aggregates in Poland. The following areas of concern have been included: the balanced growth theory, the comparison of empirical performance of the New Classical, New Keynesian and Hybrid Philips curve specifications and the changes of macroeconomic stylized facts across the monetary regimes. Thorough analysis of those, as well as other facts, may contribute significantly to the development of macromodelling of Poland. Analysis of other facts has also been conducted, however due to limited space is not provided.

The main result of the presented analysis is to give overwhelming evidence that the standard textbook stylized facts of macroeconomics present a reasonably good approximation to the behaviour of Polish economy, providing that this analysis takes into account that the Polish time series are contaminated with outliers.