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UNOBSERVED VARIABLES AS INDICATORS OF RECESSION IN POLAND AND UKRAINE

ABSTRACT. The main aim of the paper is to present crisis trends in business cycles for Polish and Ukrainian economies at the turn of the XX and XXI century using unobserved variables method. The aim of the research is to analyze empirical tests for deviations from trend estimated using Hodrick Prescott (HP) filter. The results achieved can be interpreted both – as GDP (gross domestic product) gap and, when RBC attitude is applied, as cyclical component of time series. Moreover, authors made an attempt to find relationships between simple observations of economy and changes of unobserved variable. Research for Polish and Ukrainian Economies was conducted for the period from *I Q 1995 to III Q 2010*. Problem of going through economic slowdown is very important due to the fact that neither economics theory nor policy propose effective solution for stable sustainable development. The article provides some general conclusions stemming from analysis of Polish and Ukrainian economies on the centuries breakthrough, it can be also treated as guidepost useful in the modeling and deep explaining of recession trends.

JEL Classification: E13, E17, E32

Keywords: potential output estimation, output gap, Hodrick Prescott filter, real business cycle theory.

Introduction

The analysis of economic situation solely on the basis of simple time series may result in misrepresenting and omitting some crucial phenomena. The employment of quantitative methods allows to find relationships which might be skipped during simple database query.

The main tool used in the research is econometric filter proposed by R.J. Hodrick and E.C. Prescott (Hodrick, Prescott, 1997), one of the major developers of RBC (real business cycle) school. RBC assumes deviations from stochastic trend as cyclical component of macroeconomic aggregates. In order to find deviations from the trend, one has to find long run tendency and then subtract value from analyzed variable's trend. Time series of deviations estimated this way can be treated as cyclical fluctuations. The method presented can be used for assessing potential GDP and GDP gap. Since potential GDP is unobserved variable, it can be assessed using arbitrary method. In spite of the fact that they are numerous methods for estimating GDP gap, the authors decided to use only one method – HP filter, mainly due to the poor quality of data for Ukrainian economy. Other more sophisticated methods, i.e.

production function, require state of the art database, quality of data which in case of Ukraine can be questioned. However, the authors considered analysis of GDP gap as valuable source of information because the achieved results are very similar to those in mentioned methods (Gazda, Godziszewski, 2008).

GDP gap is defined as difference between potential and actual GDP. It has positive value when observed GDP is bigger than potential, while negative when potential GDP is higher than actual. Short run GDP gap represents supply side of economy and allows the assessment of sustainable, non inflationary growth path. Last issue is very important for economies under transition, which stems from the fact that most of them bearded high costs due to inflation on the beginning of transition. As a result, research on GDP gap is considered valuable as a tool for forecasting inflationary pressure. In the short run, economy can generate production over potential level. Such situation occurs when employment rate is very high, economic growth fast, and use of capital very effective. However such situation is usually linked to adverse condition-inflationary pressure. Proper, unbiased inflation forecasts are crucial element for developing guideposts for monetary policy. Estimates of potential output are necessary in assessments of the economic situation and outlook for policy-making or other purposes. Growth resulting from an increase in potential output does not cause an increase in the rate of inflation, for example when productivity is boosted by new technology. On the other hand, if output growth is driven by an increase in demand in excess of potential output, a positive output gap may develop that will cause the rate of inflation to speed up. GDP growth in excess of long-term output potential does not always have an inflationary effect, however. If there is a prior slack in the economy, businesses can meet increased demand by utilising the factors of production more efficiently.

The authors state negative GDP gap to be important symptom for recession trends. Deep fall of GDP below potential level means that resources are not fully used which is feature of economic slowdown. Applying broad interpretation to research one can draw conclusions not only for simple GDP gap analysis but also for general statements about business cycle.

Time series used in the research cover period from *I* quarter *1995 to III* quarter *2010*. Data for Polish economy were gained from Head Statistical Office (HSO). Nominal values were transformed into real terms by CPI *(1995=100)*, smoothed using Census *II/X-12* procedure and then processed into natural logarithms. Data for Ukraine were gained from NBU National Bank of Ukraine (NBU) and were adjusted using the same procedure as this used for Polish economy. Research employs nominal GDP time series, in PLN for Poland and in UAH for Ukraine and CPI m/m with base year *1995*.

1. Filtering as a method of GDP gap estimation

Since *80s of XX* century HP filter has been a very popular method of smoothing time series. Hodrick-Prescott filter (Hodrick, Prescott, 1997) assumes independent trend and cyclical component. Considering prior smoothing and low significance of cyclical component, decomposition into unobserved variables can be written down as: $y_t=c_t+g_t$, where g_t is a long run trend, and c_t is cyclical component. Estimation of both elements can be conducted by minimizing function:

$$\min_{\{g_t\}_{t-1}^{T}} \left\{ \sum_{t-1}^{T} c_t^2 + \lambda \sum_{t-1}^{T} (g_t - g_{t-1}) - (g_{t-1} - g_{t-2})^2 \right\}, \qquad (1)$$

where:

c_t – cyclical component,

g_t – growth component,

λ – smoothing parameter.

First sum in the equation (1) is estimation precision (residuals from trend), while the second one represents trend's smoothing. λ parameter is a weight of each component in the total sum. Higher value of λ gives more fixed trend. If $\lambda \to \infty$, results of filtering could be identical with the linear trend. Adjusting value of weight parameter to certain conditions results in more efficient research. Discussion over λ value suggests that tailoring it to changing cycles of observations results in its better effects of estimations. The majority of researchers employing HP filter adapts opinions of its developers who suggested value of $\lambda = 1600$ for quarterly data. Such attitude towards λ value can by supported by Hodrick and Prescott observations: 5% quarterly deviation from trend results in 8% change (growth) of trend (Hodrick, Prescott, 1997). Designers of filter showed that lambda may be interpreted as changes of cyclical component divided by increase of trend component, on condition that both cyclical component and second differences have zero mean and normal distribution, as a result: $5^2/(1/8)^2=1600$. If the analyzed time series has a unit root, T.C. Mills (Mills, 2003) proposal can be applied which assumes λ interval between *1000 – 1050*, however even omitting this suggestion will not result in significant differences from standard procedure. Generally, a big advantage of presented tool is the possibility of analysis of non stationary time series (Prescott, 1986). However, one can find many critical opinions about this filter, some of them are listed below:

- Results of filtration are very sensitive to changes of values and adding new observations (Gomez, 2001; Kaiser, Maraval, 1999).
- When raw data was subject to prior seasonal smoothing statistical interference, resulting in *spurious cycle* may occur (Kaiser, Maraval, 1999).
- It has been proved that simple, mechanical use of HP filter may result in *spurious cycles* even if there were no cycle in input data (Schenk-Hoppe, 2001).

Finding stochastic trend using HP filter allows to assess GDP gap using equation (2):

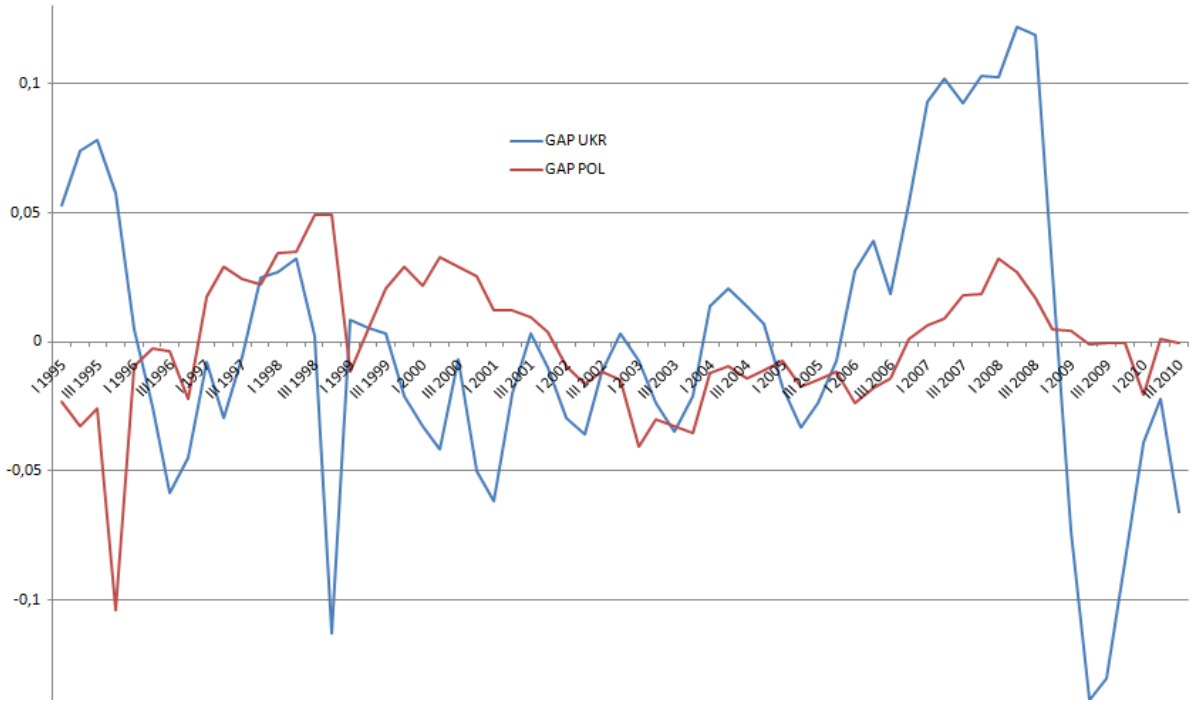
$$\text{GDP GAP} = \frac{\text{GDP}_t - \text{GDP}_{HPt}}{\text{GDP}_{HPt}}, \qquad (2)$$

Potential output cannot be observed directly from available data. Since it has to be estimated using statistical methods, it is a subject to a high degree of uncertainty (Monetary Bulletin, 2005).

2. Empirical Findings

Due to limited availability of trustworthy statistical data for Ukrainian economy, the authors assumed GDP gap estimations achieved using various methods to be very similar. Such statement bases on the earlier findings of authors for Polish economy (see: Gazda, Godziszewski, 2006). In the case of Poland, one can observe relatively high correlation between GDP gap estimations achieved using different methods. Additionally, estimated

deviations from HP trend can be interpreted as cyclical element of GDP. The results of findings are presented on *Graph 1*.



Graph 1. Output gap for Poland and Ukraine *1995 I - 2010 III*
Source: Own calculations.

Additionally, in *Table 1* was estimated correlation coefficients for selected periods.

Table 1. Correlation coefficients for GDP gap in Poland and Ukraine – selected periods

Period	I 95 – III 10		I 04 – IV08		I 07 – IV 08	
R-value$_{(x;y)}$	-0,0255		0,262		0,63	
Statistical significance of correlation	T_{EMP}	|2,42|	T_{EMP}	|1,18|	T_{EMP}	|2,55|
	T-CRIT	2,004	T-CRIT	2,1	T-CRIT	2,44
	T_{EMP}>T-CRIT	significant	T_{EMP}<T-CRIT	insignificant	T_{EMP}>T-CRIT	significant

Source: Own calculations

In the case of both economies one can observe the risk of economic slowdown, however analysis of data suggests higher probability of such a phenomenon in Ukraine, where the economy is much below potential level (in *2009* real GDP fall by *15%*). Moreover, such findings can be supported by other data for Ukrainian Economy – unemployment rate rose from *6.4%* in *2007* to *10%* in *2009*[1]. Such negative trends were boosted by lack of reforms and two significant features of Ukrainian Economy – adverse structure of trade (a steel accounted for up to *40%* of export) and rapid inflow of short term foreign capital which was covered by currency reserves only in *75%* (Polyvana, 2010). Other analyses confirm that

[1] However, one has to consider the fact that very often estimations of unemployment rate in Ukraine are not compliant with ILO methodology.

situation on international steel market has strong influence not only on economic growth, but also on the inflation in the whole Ukrainian economy (IMF Country Report No. 08/228). It is broadly accepted that huge parts of Ukrainian economy stay unchanged since collapse of Soviet Union. Moreover, one has to consider the fact that household consumption of natural gas is highly subsided by government (price of gas for household is only slightly below 16% of import price paid by NAFTOHAZ to its Russian partners (IMF Country Report No. 10/262). Such situation makes Ukrainian economy very vulnerable to external shock. Usually when adverse conditions arise, Ukrainian government is strongly dependant on international assistance. The total programmed aid for Ukraine accounted up *32* Billion of USD as of September *2010* (however, one has to remember that it could not be granted). Presented findings allow the authors to state that Ukrainian economy is highly unstable and it is not ready to be compliant with EU requirements. Such situation may also result in deflationary trends in case of crisis in the future. Considering such perspective it is very interesting to make a brief look at Polish economy which also has been hit by economic slowdown, and compare it with situation in Ukraine. However, prior to detailed analysis of Polish economy one has to consider three important factors influencing economic situation in Poland. First is the fact that Poland joined European Union in *2004* and as a result became a part of Common Market which boosted international trade, especially with EU[2]. Moreover, Polish export is, in contrast to Ukrainian, heterogeneous so it is much less vulnerable to currency shocks. Second important factor is the possibility for Polish citizens to work in selected EU countries (especially UK and Ireland) which resulted in much lower unemployment rate. In the analyzed period unemployment rate fall from over *16%* to around *11.5%*[3] (such phenomenon obviously affected the size of potential labor force, however, at this time there are not trustworthy estimations of the scale and consequences of labor outflow for Polish economy). Another important factor linked with intra-EU immigration is the fact that many immigrants decided to transfer part of their income from country of temporary residence (usually UK or Ireland) to Poland which also affected internal situation[4]. Third important matter to be considered is the fact that Polish economy benefited from EU structural policy and Common Agriculture Policy. As a result one a huge inflow of money from EU can be observed (similarly to changes in labor supply, influence of this phenomenon on potential GDP has not been deeply investigated).

In the analyzed period, some negative trends in Polish economy were observed but they were not as strong as those observed in Ukraine. Moreover, if above presented remarks are considered, economic slowdown is much less hazardous for Poland than for Ukraine. The analysis of potential GDP estimations suggests that Polish situation is much better but it cannot be said it is good, especially when compared to periods *2006-2008* or *1996-1998* which were treated as the peaks of business cycle.

Both analyzed economies undergo economic slowdown and simultaneously no symptoms of return to stable, sustainable growth path can be observed. However, one can state that Ukrainian economy is much more unstable than Polish. One the other hand, Ukrainian economy's business cycle has one feature specific for non-developed economies. During the boom a growth phase is faster than in developed economies while recession results in much deeper GDP shrunk in comparison to developed economies. Considering this fact, it is possible to come to the conclusion that Polish economy is much more stable. One can

[2] In the period of 2005-2009 export to EU rose by 80% – (Polish Central Statistical Office, http://www.stat.gov.pl/gus/wskazniki_makroekon_PLK_HTML.htm).
[3] One has to consider that in the analyzed period, economic slowdown occurred and unemployment rate exceeded 20% at the beginning of 2004 (applying labor office methodology – BAEL research suggested even higher rate).
[4] However, his phenomenon requires further analysis.

expect Ukrainian growth to be more sustainable after *20* years of independence, even though during so called "Russian crisis" in the years *1998-1999* resulted in *10*% GDP gap. The year *2009* will stay a negative base for Ukrainian economy for many years.

Due to the fact that Poland and Ukraine are neighboring countries it would be interesting to analyze relationships between their economies and business cycles (share of Polish export to Ukraine accounted for around *2.3%* of total export). One can expect mutual dependency between analyzed economies. However authors' findings suggest positive correlation only in the peak of business cycle (see *Table 1*). During economic slowdown significant differences between Poland and Ukraine can be notified. It has to be underlined that Polish situation is much better due to the fact that it can benefit from EU membership. Moreover, Polish economy has undergone significant institutional changes since the collapse of centrally run economy. Such changes has been introduced to much lower extent in Ukraine. As a result, Ukraine which is present in none international institution, has to deal with economic shocks itself. Ukraine, of course, is a member of International Monetary Fund (IMF), however, one has to remember that IMF assistance is treated as an emergency and IMF's support is usually conditional (IMF officials very often enforce deep, painful reforms which are not necessarily politically accepted). The research conducted by authors confirms such a situation – estimated negative GDP gap in Ukraine was *15*% in *2009*. Moreover, poor economic situation of Ukraine was linked with deep political crisis.

Summary

The output gap is an important concept in assessments of the economic situation. Research conducted in the paper suggests that estimation of deviations from HP trend allows for more detailed analysis of economy than simple observation of pure GDP changes. Estimations presented in the paper confirm that both economies were hit by negative trends. On the other hand, it is worthwhile to notify the fact that GDP gap in case of Ukraine was more volatile than this estimated for Poland (which was clearly visible when negative gap was observed). Moreover, the authors claim that leaving Ukraine outside EU will result in many negative consequences in the long run (not only economic but also social and political). The very important factor that influence the situation of Ukrainian is lack of self stabilization mechanism inside Ukrainian economy. Remaining Ukraine outside international organization such as UE will probably result in unstable, weak economic growth. Even when assuming membership and simultaneously an assistance from international organizations, the growth of Ukrainian economy will be very vulnerable to external shock due to fact that the structure of Ukraine's export depends mainly on low-processed steel products. Moreover, other important factors, not analyzed in the paper (such as subsiding natural gas prices for households or poor institutions' performance and high corruption level) undoubtedly will not boost Ukraine's growth. Poland seems to be in much better situation thanks to EU membership which allows to reduce the influence of adverse conditions.

References

Economic and monetary developments and prospects. Improved inflation outlook if the króna stays strong, "Monetary Bulletin", The Central Bank of Iceland, 1, March 2005.

Gazda, J., Godziszewski, B. (2008), *Estimation of Output Gap in Poland – Selected Methods*, (in): *Social and Economic Condition of Regional Development*, ed. Tomasz Bernat, Barbara Czerniachowicz, Print Group, Szczecin.

Gazda, J., Godziszewski, B. (2006), *Próba identyfikacji tendencji recesyjnych w gospodarce polskiej na podstawie zmian luki PKB*, (in): *Funkcjonowanie współczesnych*

gospodarek i przedsiębiorstw: aspekty globalne, regionalne, sektorowe, ed. Małgorzata Kokocińska, Wydawnictwo AE Poznań, Poznań.

Gomez, V. (2001), *The Use of Butterworth Filters for Trend and Cycle Estimation in Economic Time Series*, Journal of Business and Economic Statistics, 19(3).

Hodrick, R. J., Prescott, E.C. (1997), *Postwar US business cycles: An empirical investigation*, Journal of Money, Credit and Banking, 29(1), February, 1997.

IMF Country Report (2008), No. 08/228.

IMF Country Report (2010), No. 10/262.

Kaiser, R., Maraval, A. (1999), *Estimation of the Business Cycle: A Modified Hodrick-Prescott Filter*, Spanish Economic Review, 1(2).

Mills, T.C. (2003), *Modelling Trends and Cycles in Economic Time Series*, Palgrave Macmillan.

Polyvana, T. (2010), *International and Domestic Policy Responses to the Financial Crisis in Central and Eastern Europe: Lessons for Ukraine*, Romanian Journal of Political science, 10(1).

Prescott, E.C. (1986), *Theory ahead of business cycle measurement*, Federal Reserve Bank of Minneapolis Quarterly Review, Fall.

Schenk-Hoppe, K.R. (2001), *Economic Growth and Business Cycles: A Critical Comment on Detrending Time Series*, Studies in Nonlinear Dynamics and Econometrics, 5(1).

Wośko, Z. (2009), *Czy filtry liniowe są przydatnym narzędziem badania koniunktury? Analiza spektralna na przykładzie ankietowych wskaźników koniunktury*, Ed. Joanna Czech-Rogosz, Jacek Pietrucha, Rafał Żelazny, Koniunktura Gospodarcza, C.H. Beck, Warszawa.