Searching for Optimal Balance Between Nominal and Real Convergence – Case of Poland

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Abstract

The aim of the paper is to assess degree of uncertainty about possible impact of the Balassa-Samuelson (BS) effect on inflation and real exchange rate in Poland. There exists vast empirical literature on the BS effect (also for EU accession countries), but the results are not clear-cut. One of the concerns for policy-makers is whether the future impact of the BS effect will be consistent with the Maastricht criteria. In the paper the degree of the BS effect impact on inflation in Poland is assessed using different econometric and data methodologies. The paper tries to answer what is the true extent to which the BS effect can influence inflation in Poland and whether different estimation results are due to differences in methodologies. Other explanation may be that the problem with obtaining consistent econometric evidence mainly stems from relatively short time series available and many structural changes during transformation period. The paper is concluded with policy implications, especially possible scenarios of balancing real and nominal convergence, given assessed uncertainty about the scale of the BS effect.

1. Introduction

For Poland, as for other EU accession countries, participation in ERM II mechanism (or a stricter exchange rate regime arrangement) after becoming a member of EU, is unavoidable. Those countries need efficient catching-up process. But in comparison with the present situation, policy-makers' (in particular monetary policy-makers') hands will be to some extend tied during period of participation in ERM II. Therefore it is crucial to understand developments that may take place in this intermediate period of being a member of EU, but not yet of EMU.

One of issues raised in discussions in a context of the catching-up process is an impact of the Balassa-Samuelson effect (Szapáry 2000; Sinn and Reutter 2001). The main problem there is whether Maastricht criteria on price and exchange rate stability are consistent and if not – what will be an impact on real convergence of economic (especially monetary) policy aiming at achieving criteria of nominal convergence.

There is a risk of misperception of potential magnitude of Balassa-Samuelson effect. If policy makers believe that impact of the Balassa-Samuelson effect will be significantly high, then, in general, they might allow for too high inflation. But on the other hand, in period preceding an assessment of Maastricht criteria, the monetary policy can be too restrictive (at least

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transitory) to fight also with inflation stemming from the assumed Balassa-Samuelson effect. But if actual impact of the effect is much lower then a policy maker believes, such a strategy slowers down economic growth and lengthens the period of catching-up.

Therefore estimation of magnitude of inflation, that can be allowed for, is crucial, because it reflects structural changes and real convergence in the economy. Comparing estimated size of the Balassa-Samuelson effect with maximum inflation rate that is in line with the Maastricht inflation criterion, it can be calculated how much of nominal exchange rate appreciation will be necessary to achieve conformity with the criterion. It allows for estimating appreciation that reflects developments on the real side of the economy and does not change international competitiveness. In the paper this problem will be analysed in case of Poland and policy-makers' point of view will be stressed.

To draw conclusions about policy implications one should be aware of degree of uncertainty in a model's parameters estimates. Literature so far offers quite different estimation of the Balassa-Samuelson effect even for same countries (c.f. Halpern and Wyplosz 2001; Égert 2002; Backé et al. 2002; Sinn and Reutter 2001). Reasons of that are mostly: different time periods considered, differences in assumptions and models specifications, differences in data-sets construction and even different econometric techniques utilized.

Almost always one can conclude that some of the model assumptions are not fulfilled. Extent to which they are not fulfilled may differ over periods considered and therefore influence results. In the real world theoretical constructs such as tradables' and non-tradables' prices and sectors are never observed and usually do not exist in a pure form[1]. So some aggregates that will resemble and approximate those theoretical concepts has to be constructed. On this stage a researcher finds many obstacles as far as data availability is concerned: comparable time series are short, frequency of time series is too low (especially for services – in some cases only yearly data are available), data differ in reliability. So assumptions made may have serious impact on final results. It is one of sources of uncertainty for policy makers, who are going to act on the basis of the model results, so they should be aware of it. In any methodologically controversial case, presentation of results of different approaches should be considered as a part of a good practice code.

[1] In practice, it can be found a non-tradable component in any seemingly tradable good.

There is also related question of period that should be analysed to obtain estimates valuable for current policy-making process. In this context it is not the case that the longer time-series, the more valuable conclusions. For economies undergoing deep structural changes, parameters of any model are very likely to change over time. Therefore using time-series in the whole length available may not be a good strategy, because final results will be biased in a sense that they will reflect average of a changing parameter value over time, but not the recent one. Such an estimate should not be used in forecasting, especially for policy-making purposes.

To allow for relative stability of economy over estimation period, empirical analysis starts in 1995. Up to that moment at least part of the price structure inadequacies stemming from a command economy disappeared and important part of structural changes in the economy was completed.

The remaining part of the paper is organized as follows. In the next section the Balassa-Samuelson model is briefly presented. The third section offers a few comments on methodological issues as far as modeling for policy-making purposes is concerned. The fourth section describes data sets used. Then results of an empirical work are presented with comments on possible developments in monetary policy, given obtained results. The sixth section concludes.

2. Theoretical model

The Balassa-Samuelson model in the original formulation (Balassa 1964; Samuelson 1964) deals with explaining structural deviations from purchasing power parity. In context of the catching-up process it can be used to explain persistent differences in tradable and non-tradable goods inflation within an economy and differences in overall inflation between economies[2]. Both effects stem form differences in productivities. The within-economy effect exists because of higher productivity growth in the tradables sector then in the non-tradables sector. The between-economies effect is observed because productivity growth in the tradable sector in a country with higher inflation is higher then productivity growth in that sector of the other country (in this case changes in productivities of non-tradables sectors of both countries

[2] If nominal exchange rates does not fully reflects relative changes in price levels, the real exchange rate is also changing.

are often assumed to be equal). Fast growing country, with higher rate of growth (at least in the tradables sector) is assumed to be a small open economy.

Other important assumptions of the model are: perfect capital mobility between countries and between sectors and perfect labour mobility between sectors within a country, but perfect labour immobility between countries. Capital stock is set one period ahead and wages are equalized within both sectors of a country. Real interest rate and the price of the traded good are set on world markets. For a given technology they determine in first step capital-labor ratio in the tradables sector. Marginal product of labor in the tradables sector determines then wage level in the tradables sector and subsequently in the whole economy - wage equalization in sectors is assumed as a result of perfect labor mobility and its homogeneity[3]. Wage, capital and labor prices, as well as a technology used, determines relative price of non-tradables to tradables.

Above considerations for Cobb-Douglas production functions can be summarized as follows. Output levels in the tradables sector (Y_T) and non-tradables sector (Y_{NT}) are determined according to equations (1) and (2)

(1) $Y_T = A_T L_T^{\theta} K_T^{1-\theta}$

(2) $Y_{NT} = A_{NT} L_{NT}^{\gamma} K_{NT}^{1-\gamma}$,

where K_T and K_{NT} denotes capital in the tradables and non-tradables sectors and L_T and L_{NT} labor in the both sectors, respectively. It is assumed that in the non-tradables sector more labor-intensive technology is utilized, so $\gamma>\theta$. Marginal product of capital in both sector is equalized to world interest rate R (because of perfect capital mobility) – eq. (3). Value of marginal product of labor in the tradables sector determines wage W and then value of marginal product of labor in the non-tradables sector is equalized to the wage – eq. (4)

(3) $(1-\theta)A_T(K_T/L_T)^{-\theta}P_T = R = (1-\gamma)A_{NT}(K_{NT}/L_{NT})^{-\gamma}P_{NT}$

(4) $\theta A_T(K_T/L_T)^{1-\theta}P_T = W = \gamma A_{NT}(K_{NT}/L_{NT})^{1-\gamma}P_{NT}$

After rearranging and log-differentiating it may be shown that relative price of non-tradable good in relation to tradable good price is a function of total factor productivities in both sectors (lower-case letters denotes natural logarithms and ^ denotes rate of growth):

[3] Another explanation might be strong trade unions or centralized pay negotiations.

(5) $\hat{p}_{NT} - \hat{p}_T = \gamma/\theta \hat{a}_T - \hat{a}_{NT}$

Denoting by α share of tradable goods in a price index, overall price log-level can be expressed as:

(6) $p = \alpha p_T + (1-\alpha) p_{NT}$

Combining (5) and (6) we obtain a formula for assessing impact on overall inflation of sectoral differences in productivity:

(7) $\hat{p} = \hat{p}_T + (1-\alpha)(\gamma/\theta \hat{a}_T - \hat{a}_{NT})$

Form (7) and the assumption that $\gamma > \theta$ it is now clear that higher productivity growth in tradables sector then in non-tradables sector effects in higher inflation rate.

Analysis so far has dealt with within-economy effects of higher productivity in the tradables sector. Analogous reasoning is applied to the other country to find relationship for inflation differential. Denoting by * foreign variables we obtain:

(8) $\hat{p}^* = \hat{p}^*_T + (1-\alpha^*)(\gamma^*/\theta^* \hat{a}^*_T - \hat{a}^*_{NT})$

If we assume identical shares of tradables in price indices and constant exchange rate of the currencies of both countries, we obtain:

(9) $\hat{p} - \hat{p}^* = \hat{p}_T - \hat{p}^*_T + (1-\alpha)[(\gamma/\theta \hat{a}_T - \hat{a}_{NT}) - (\gamma^*/\theta^* \hat{a}^*_T - \hat{a}^*_{NT})]$, or

(10) $(\hat{p}_{NT} - \hat{p}_T) - (\hat{p}^*_{NT} - \hat{p}^*_T) = (\gamma/\theta \hat{a}_T - \hat{a}_{NT}) - (\gamma^*/\theta^* \hat{a}^*_T - \hat{a}^*_{NT})$

The conclusion is that higher growth of relative (i.e. tradables vs. non-tradables) productivity in the home country yields in higher inflation differential against the foreign country. If inflation differential implied by the right hand side of equation (9) is too high to be accepted by monetary authorities, then the only way to diminish inflation is to allow for nominal exchange rate appreciation. Then, for given changes in p^*_T calculated in foreign currency terms, the changes in p_T calculated in the home currency become smaller.

3. Methodological notes

Policy-makers' point of view means that we are interested in values of the model parameters specific for a given country. The first result of such an approach is that cross-country

(including panel) studies are of less interest. In previous years a number of papers testing for Balassa-Samuelson effect in developed, emerging and transition countries have been published. Many of them utilised panel techniques, including panel cointegration (c.f. Strauss 1999; Swagel 1999; Canzoneri et al. 1999). Theoretically, Balassa-Samuelson effect is a long-run and equilibrium phenomenon, so using cointegration methods is in line with the model (Strauss 1996), all the more, analyzed time series (inflation, international and intersectoral inflation differentials, productivity) turn out to be non-stationary. But low power of tests for co-integration (especially when short time series of low frequency are available – what is usually the case for transition economies) calls for extension of observations set.

When time-span of data cannot be extended[4], the possible solution is to construct a panel of countries. But it does not cure the illness entirely. Estimates obtained from a panel study can only be interpreted as average values for a group of countries. One is forced to assume common values of some coefficients over countries[5]. The problem is also present in panel co-integration, when common co-integrating vector is assumed and estimated. However, for more home-country oriented estimates, one has to pay the price of less efficient estimators and more uncertain results, as a sample restricted to the one country only brings in less information.

Panel approach still has many virtues when a researcher is interested whether the effect is in fact present in a group of countries (e.g. estimators are more efficient than in one-country sample), but is of less use for specific policy-makers' purposes. In addition, as far as transition countries are concerned, some further methodological problems should be taken into account[6].

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[4] Because one is going to test a potentially long-run equilibrium phenomenon, increasing time-frequency of data is only a minor improvement.

[5] In general, when constructing a panel we hope that countries are homogenous enough to make assumption of identical parameters reasonable but on the other hand that those countries are heterogeneous to some extent – because it allows to obtain more efficient estimates.

[6] As was mentioned above, building panels for testing co-integration is an attempt to widen (artificially) time-span of data. It rests on an assumption that given existence of a common co-integrating relationship, there are some differences in stages of restoring long-run equilibrium relationship between variables over cross-section. In the case of transition countries, given relatively similar developments in their economies over last decade, the assumption of significant diversity in the process of restoring equilibrium does not seem to have sufficient grounds. The other problem may stem from changes in equilibrium relationship over time. We point these

Number of empirical studies analysing the Balassa-Samuelson effect use GDP deflators as price series. However, for a conduct of monetary policy CPI is of interest. For example, Maastricht criterion on price stability is expressed in CPI terms and among wide public other than CPI inflation measures are almost not known, so using them would not be in line with information transparency of a central bank[7].

The related issue is connected with assumed weight of non-tradables in a price index. As shown in theoretical exposition, the Balassa-Samuelson effect influence a price index only in part expressing price of non-tradables. As weights of the non-tradables sector in CPI and in creation of GDP are usually different, this distinction should be made clear.

4. Description of the data

In testing for the Balassa-Samuelson effect, a way of constructing time series for the tradables and non-tradables sectors is of importance. For Poland monthly data on output (sold production) are available only for industry and its subsections and construction. Quarterly national accounts data on output are published for industry, construction and market services (market services consist of following sections: trade and repair; hotels and restaurants; transport, storage and communication; financial intermediation; real estate and business activities; other community, social and personal service activities). More disaggregated national accounts data are available only annually. However, comparable quarterly national accounts data starting only in 1995 are available, so for purposes of econometric analyses those time series are painfully short. But, as discussed above, use of earlier data may not be useful for analysis.

Each variable in the model presented in section 2 can be approximated by a number of real-world time series[8], which are used in assessing implications of the model. As is a common

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problems as a basis for a potential discussion about optimal approach to empirical work concerning transition countries and specially policy-makers' needs.

[7] It should be admitted that the Balassa-Samuelson model concentrates on a supply side of an economy and a demand side is neglected. Therefore, from purely theoretical point of view, using of GDP deflators in empirical verification of the model would be recommended.

[8] For example, as tradables price in empirical part of the paper series of: PPI, price of durable consumer goods, prices of production sold in manufacturing and deflator for industry from national accounts are used.

practice in the empirical literature, average product of labor is used as measure of productivity[9].

Therefore to sets of empirical results are presented. The first one uses available monthly productivity data for tradables and assumes that changes in productivity in non-tradables sector are equal to zero. The results for this data set are presented rather in order to assess stability of estimation results then for forecasting purposes because changes in productivity in non-tradables sector should not be neglected, e.g. because of results of improvements in information technology.

The second data set utilizes quarterly national accounts data as well and therefore it is possible to take into account actual difference in productivity growth in the both sectors. Short time series make volatility of results more probable.

As far as monthly data set is concerned, productivity in tradables sector was measured using two variables – productivity in manufacturing and productivity in industry. Productivity in manufacturing seems to be superior, because industry includes electricity, gas and water supply, which output is of much less degree of tradability. CPI was considered as an overall price index (p in model presented), while p_T was approximated by PPI, and indices of prices of durable consumer goods and prices of production sold in manufacturing. Non-tradable prices were measured by index of services' prices (sub-index of CPI). Productivity in the tradables sector was measured in two ways: as a ratio of index of production sold of industry to index of employment in industry and as a ratio of index of production sold of manufacturing to employment in manufacturing.

In the second, quarterly, data set, additional series from national accounts were used. GDP deflator was used to measure overall prices, sectoral deflators of market services - for non-tradables price and industry – for tradable prices. Additional measures of productivity are sectoral average products of labor: for tradables – ratio of index real value added in industry to index of employment in industry and for non-tradables ratio of index of real value added in market services to employment in market services. Also series assuming that the non-tradables sector consist of market services and construction were constructed, so then prices of non-tradables are measured as weighted sum of deflators for market services and

[9] Canzoneri et al. (1999) give arguments in favor of using average product of labor.

construction and productivity in the non-tradables sector as weighted sum of productivity in market services and construction. Shares of both sectors in value added were used as weights.

A general remark about productivity measures for Poland should be made here. At the beginning of 2000 Central Statistical Office changed way of collecting data about employment and production sold in industry and construction. Before 2000 data for entities with 5 or more employees were reported and from 2000 – more then 9 employees. In empirical work for construction of indices of employment it was assumed that before 2000 dynamics of changes in employment in enterprises employing 5-8 persons were the same as for larger firms.

Germany was used as a reference country when international inflation differential stemming from changes in productivity was assessed. The reason for that is construction of Maastricht inflation criterion – inflation should not exceed average of three best performers plus 1.5 percentage points. It is quite reasonable to assume that inflation of three best performers will be of magnitude of that in Germany.

Data for Germany were constructed similar to those for Poland. As price of non-tradables services in CPI and deflator for services were used, tradables prices were representing by PPI. Productivity in the tradables sector was measured as a ratio of value added in industry (from national accounts) to number of employed in industry and a ratio of index of output in manufacturing to index of employed in manufacturing. For productivity in the non-tradables sector, a ratio of value added in services to number of employed in services was used.

Some of the time series are published already as seasonally adjusted. So to maintain comparability, other time series, if appropriate, where seasonally adjusted using X-11 method.

Measures of inflation based on price indices and deflator were used to check, whether results differ for them in any systematic way.

Monthly data-set spans period from January 1995 until May 2002. Quarterly data set spans period form first quarter of 1995 until fourth quarter of 2001.

Sources of data were: Central Statistical Office, OECD databases: Main Economic Indicators and Quarterly National Accounts and NBP's own data and calculations.

5. Empirical results and its implications

In the first step time-series were tested for presence of unit root using ADF test. Results (not reported here) confirm that series are non-stationary and therefore in subsequent analysis cointegration techniques were used. Further analysis concentrates more on magnitudes of obtained estimates rather then on econometric purity in hypotheses testing[10]. Small number of observations may be a reason of rejecting an existence of a relationship between variables to often, but quite large number of significant relationships in the data has been found (and these are reported). We are interested mostly in stability of results and their implications.

On the basis of model two kinds of long-run relationships have been investigated. First, relationship for Poland between relative prices of non-tradables and tradables and productivity differentials between two sectors was analysed. Because as a measure of sectoral productivity average labor productivity was utilized, on the basis of equation (5) we are testing for existence of long-run relationship between variables: $[p_{NT}-p_T;\ a_T-a_{NT}]$ in the form of a vector $[1\ \beta_1]$, where expected sign of β_1 is negative. This relationship was tested e.g. by Canzoneri et al. 1996, 1999 and Égert 2002.

If long-run relationship between these two variables can be established and β_1 is estimated, it is possible to calculate theoretical impact of productivity difference on overall inflation:

$$(11)\quad \hat{p} = -(1-\alpha)\beta_1(\hat{a}_T - \hat{a}_{NT})$$

In equation (11) it is implicitly assumed that inflation of tradable goods is zero. Alternative interpretation is that we obtain theoretical value of inflation differential against country, where productivity differential is zero and therefore overall inflation is equal to $\hat{p}_T$.

Alternative way of arriving to conclusion about impact of the Balassa-Samuelson effect on domestic inflation is to take equation (7) as a starting point. We now look for cointegration for variables $[p-p_T;a_T-a_{NT}]$. Expected sign of β_2 in cointegrating vector is also negative and expected additional inflation because of the Balassa-Samuelson effect is:

$$(12)\quad \hat{p} = -\beta_2(\hat{a}_T - \hat{a}_{NT})$$

[10] More in-depth econometric analysis of the data sets has been left for further research.

In similar way, using equations (9) and (10) one can assess theoretical inflation differential between two countries resulting from differences in relative productivities in those countries. The first set of variables, in which existence of cointegration is tested, is

$[(p-p_T)-(p^*-p^*_T); (a_T-a_{NT})-(a^*_T-a^*_{NT})]$

and cointegrating vector that we are looking for is $[1\ \beta_3]$. In that case theoretical difference in inflation rates is:

$$(13)\ \hat{p} - \hat{p}^* = -\beta_3[(\hat{a}_T - \hat{a}_{NT}) - (\hat{a}^*_T - \hat{a}^*_{NT})]$$

For equation (10) set of potentially cointegrated variables is:

$[(p_{NT}-p_T)-(p_{NT}^*-p^*_T); (a_T-a_{NT})-(a^*_T-a^*_{NT})]$.

If establishing cointegrating vector $[1\ \beta_4]$ is possible, then theoretical inflation differential can be expressed as:

$$(14)\ \hat{p} - \hat{p}^* = -\beta_4(1-\alpha)[(\hat{a}_T - \hat{a}_{NT}) - (\hat{a}^*_T - \hat{a}^*_{NT})]$$

The last value needed for calculations is share of non-tradables in CPI. If we identify non-tradables with services, then for Polish CPI share of services is 35 %. This value was used to obtain presented results.

Obtained results for sets of variables, for which it was possible to establish cointegrating relationships are presented in Tables 1-4. Table 1. and Table 2. present results of cointegration for monthly data set, but without assessments of magnitude of the Balassa-Samuelson effect because, as explained earlier, productivity data for non-tradables are not available on monthly frequency. It was often the case that establishing cointegration relation for the whole period, starting in January 1995. However, for period January 1996 – May 2002 existence of cointegrating relationships is much more often.

Tables 3. and 4. contain results of cointegration for variables from quarterly data set. Also two theoretical values of the effect are provided in last two columns. They are based on assumption that changes in productivity measures are equal to average from periods: 1999-2001 and 1995-2001.

The results confirm that for Poland the Balassa-Samuelson effect is of moderate size and its impact on CPI is likely not to exceed 2 percentage points. An appealing aspect of the results

presented is, that despite of using different approaches to calculate the Balassa-Samuelson effect, they are of similar magnitude.

One should be, however, cautious analyzing the results. There might be a fundamental drawback of data that can cast some doubt on validity of the results. Until late 1990-ties large part of services (that form main part of non-tradables) were subject to administered prices. As administered prices are very likely not to fully follow developments in real economy (e.g. changes in productivity), it can introduce much noise to the data. But possibility to establish long-run cointegrating relationship seems to be an argument in favour of the results presented.

One can expect that after period of dynamic growth of foreign direct investment and substantial transfer of know-how and technologies, as well as elimination of inefficiencies of command economy origin, the productivity growth in future will be of smaller magnitude. So taking last three years as a benchmark for probable rate of productivity growth seems to be reasonable.

However rise in productivity in Polish non-tradables sector during last two years is a result of declining employment in market services sector. It can be expected that in long run employment in services should rise and it is not clear whether growth of output will ensure still high productivity growth.

As real convergence will go further, it is possible that consumption structure will be affected by income growth and share of services will be higher in CPI, so impact of the Balassa-Samuelson effect on overall inflation will be more pronounced.

But even if assumptions that lead to the presented results are changed in a way that increases calculated theoretical magnitude of the Balassa-Samuelson effect (e.g. higher share of non-tradables in inflation or higher rate of growth of relative productivity in the tradables sector), the results still remain in line with the Maastricht criteria. On basis of the results, an assumption of the yearly impact of Balassa-Samuelson on inflation of 3 or 3.5 percentage points seems to be rather pessimistic. But even then, with 1.5 percentage point margin for inflation differential, the bands of +/- 15 % for exchange rate fluctuation should be enough even if participation in ERM II will be extended to more then 2 years. It seems also that in the year of assessing fulfillment of the Maastricht criteria it will not be necessary to cool down the economy seriously in order to meet the inflation criterion.

The CPI inflation is now of order of magnitude of inflation resulting from adjustments on the real side of the economy and the real convergence. It is clear that it is necessary to change

way of thinking about monetary policy for Poland - from disinflation to stabilizing inflation. In the light of results presented, trying to make inflation lower then 2% (or maybe even 2.5%) may have negative impact on real convergence. In such a case monetary policy would try to fight with inflation that is a natural phenomenon, reflecting moving equilibrium. So monetary policy makers should closely look at the inflation of tradables, which is related to changes of the exchange rate. This, with participation in ERM II, would make monetary policy more "exchange rate oriented". Small influence of the Balassa-Samuelson effect makes it possible to set quite comfortably inflation target within limits set by the Maastricht criterion on price stability and allow for some additional nominal appreciation, when appropriate.

A continuation of keeping real interest rates high in order to disinflate will hit producers in the tradables sector twofold. First, they will be hit, as all other economic agents, by high cost of capital because of high real interest rate and second – because of nominal appreciation caused by high real interested rates. But this appreciation will not reflect adjustments in equilibrium, so international competitiveness of the home tradables sector will deteriorate. Such scenario may lead to reallocation resources in the economy from the tradables sector to the non-tradables sector. Because this new allocation was not a result of adjustments in equilibrium, it may be not the optimal one.

The Balassa-Samuelson effect will be present in Polish economy for a long time, as long as real convergence will not be achieved. Therefore it will influence inflation differential between Poland and the rest of Euroland also when Poland will be a member of EMU. It implies that equilibrium real exchange rate at the moment of joining EMU and long-run equilibrium exchange rate, that would prevail if Poland remain outside EMU and takes into account also future inflation differentials, will be different. If the difference is assumed to be large, then other members of the monetary union would insist on fixing exchange rate of Polish Zloty to Euro at the level of long-run equilibrium exchange rate. It is probable that market may anticipate such a scenario and therefore in ERM II mechanism real appreciation of the Zloty may take place, that is driven by expectations about future (and not reflecting current) impact of the Balassa-Samuelson effect. Such developments may have as a result, that monetary authorities may face deflationary pressures in a short run because of expectations about existence of the Balassa-Samuelson effect in the long run and perspectives of joining a monetary union.

6. Conclusions

The main result of the paper is that impact of the Balassa-Samuelson effect on inflation in Poland is of moderate size (1-2 %) and does not imply inconsistency of the Maastricht criteria. Different approaches to empirical testing of the effect yield results in similar magnitude. It is quite probable, that with catch-up process going further, productivity differentials will decrease and impact of the Balassa-Samuelson effect on inflation will decrease.

As CPI inflation is now of magnitude of the estimated impact of the Balassa-Samuelson effect, monetary policy should be conducted very carefully. It is very important to understand with which inflation we fight – the tradables inflation (which is the proper target) or the inflation resulting from adjustments in the real economy. The latter is a natural phenomenon and should be allowed for – trying to diminish it may result in slowing down the economy and appreciation of real exchange rate that does not reflect productivity changes and therefore worsens international competitive position.

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Period	p	p_{NT}	p_T	a_T	trace statistic	β_1 or β_2
1995:01-2002:05	CPI		PPI	Manufacturing	18.5898	-0.265
1996:01-2002:05	CPI		PPI	Manufacturing	20.4851	-0.263
1995:01-2002:05	CPI		PPI	Industry	16.4843	-0.285
1996:01-2002:05	CPI		PPI	Industry	15.881	-0.275
1996:01-2002:05	CPI		PPI	Industry	21.0096	-0.279
1996:01-2002:05	CPI		Durable consumer goods	Manufacturing	20.8788	-0.493
1996:01-2002:05	CPI		Durable consumer goods	Industry	21.2405	-0.511
1996:01-2002:05		Index of services prices from CPI	Durable consumer goods	Manufacturing	17.472	-0.61
1996:01-2002:05		Index of services prices from CPI	Durable consumer goods	Industry	16.8719	-0.635

Table 1. Results of testing for cointegration, monthly data set, within-country effect

Period	p	p*	p_{NT}	p_{NT}*	p_T	p_T*	a_T	a_T*	trace statistic	β_3 or β_4
1996:06-2002:05			Index of services prices from CPI	Index of services prices from CPI	Durable consumer goods	Durable consumer goods	Manufacturing	Manufacturing	17.45277	-1.04836
1995:01-2002:05	CPI	CPI			PPI	PPI	Manufacturing	Manufacturing	18.4934	-0.39487
1996:01-2002:05	CPI	CPI			Durable consumer goods	Durable consumer goods	Manufacturing	Manufacturing	17.63367	-0.77648

Table 2. Results of testing for cointegration, monthly data set, between-country effect

Period	p	p_{NT}	p_T	a_T	a_{NT}	trace statistic	β_1 or β_2	1999-2001	1995-2001
1995:1-2001:4		Index of services prices from CPI	Prices of production sold in manufacturing	Productivity in industry	Productivity in market services	21.76	-1.248	1.584%	1.937%
1996:1-2001:4		Index of services prices from CPI	Prices of production sold in manufacturing	Productivity in industry	Productivity in market services	23.4	-1.18	1.498%	1.832%
1995:1-2001:4	CPI		PPI	Productivity in industry	Productivity in market services	21.32	-0.45	1.632%	1.996%
1996:1-2001:4	CPI		PPI	Productivity in industry	Productivity in market services	23.59	-0.444	1.611%	1.969%
1995:1-2001:4		Index of services prices from CPI	PPI	Productivity in industry	Productivity in market services	24.47	-1.014	1.287%	1.574%
1995:1-2001:4		Index of services prices from CPI	Durable consumer goods	Productivity in industry	Productivity in market services	37.2	-1.409	1.789%	2.187%
1996:1-2001:4		Index of services prices from CPI	Sectoral deflator of industry	Productivity in industry	Productivity in market services	26.58	-1.33	1.689%	2.065%
1995:1-2001:4	GDP deflator		Sectoral deflator of industry	Productivity in industry	Productivity in market services	20.7647	-0.6252	2.268%	2.773%
1995:1-2001:4		Sectoral deflator of market services	Sectoral deflator of industry	Productivity in industry	Productivity in market services	21.0654	-0.9466	1.202%	1.470%
1995:1-2001:4		Weighted sectoral deflators of market services and construction	Sectoral deflator of industry	Productivity in manufacturing	Weighted productivity in market services and construction	17.1349	-1.1016	1.435%	1.704%
1995:1-2001:4		Weighted sectoral deflators of market services and construction	PPI	Productivity in manufacturing	Weighted productivity in market services and construction	17.647	-0.6574	0.722%	1.464%

Table 3. Results of testing for cointegration and theoretical impact of the Balassa-Samuelson effect on domestic inflation, quarterly data set, in last two columns theoretical impact of the Balassa-Samuelson effect on domestic inflation assumption that changes in productivity measures are equal to average from periods: 1999-2001 and 1995-2001.

Period	p_{NT}	p_{NT}^*	p_T	p_T^*	a_T	a_T^*	a_{NT}	a_{NT}^*	trace statistic	β_4	1999-2001	1995-2001
1995:1-2001:4	Sectoral deflator of market services	Sectoral deflator of services	PPI	PPI	Productivity in industry	Productivity in industry	Productivity in market services	Productivity in services	17.69	-1.104	0.792%	1.493%
1995:1-2001:4	Sectoral deflator of market services	Sectoral deflator of services	PPI	PPI	Productivity in industry	Productivity in industry	Productivity in market services	Productivity in services	15.55	-1.346	0.966%	1.822%
1995:1-2001:4	Sectoral deflator of market services	Sectoral deflator of services	PPI	PPI	Productivity in manufacturing	Productivity in manufacturing	Productivity in market services	Productivity in services	20.53	-1.083	0.817%	1.800%

Table 4. Results of testing for cointegration and theoretical impact of the Balassa-Samuelson effect on international inflation differential, quarterly data set, in last two columns theoretical impact of the Balassa-Samuelson effect on international inflation differential under assumption that changes in productivity measures are equal to average from periods: 1999-2001 and 1995-2001.