Jan Przystupa

Bureau of Macroeconomic Research

National Bank of Poland

The exchange rate in the monetary transmission mechanism.

1. A broadly accepted thesis in the economic literature states that in an open economy, with high mobility of capital, the only monetary policy efficient in the long run is the policy based on three pillars:

[1] flexible exchange rate;
[2] direct inflation targeting;
[3] clearly defined monetary policy rule[1].

Then, exchange rates become an essential element of the monetary policy transmission mechanism – allowing the arbitrage of domestic and foreign interest rates through expected changes of exchange rate. The substantial role of exchange rates in transmission mechanism has been also confirmed for Poland. Therefore we have decided to develop research works on that part of transmission. The results have been presented below.

Uncovered interest rate parity model.

1. The uncovered interest rate parity model (UIP), which relates expected exchange rate depreciation to changes in the level of domestic and foreign interest rates, seems to be a proper theoretical construction suitable both for research on transmission mechanism and for predicting the changes of exchange rates in the future.

Suppose that the UIP, in its classic form, holds in *n* periods. Then:

$$\mathbf{(1)} \qquad \frac{1}{n}\sum_{i=1}^{n}\left(E_t e_{t+i} - e_t\right) = i_{t,n} - i^*_{t,n} + \alpha_n$$

where

E_t - expected in time *t* change of the nominal exchange rate in the period $t+i$;

e_t - logarithm of the spot exchange rate (relation of domestic to foreign currency);

$i_{t,n}$ - domestic and foreign (marked by *), *n*-period interest rate in time t;

α_n - risk premium, constant in n periods.

Suppose that in the short period, expected changes of the exchange rate are determined by the white noise process, i.e. no considerable disturbances occur between period *t* and $t+1$:

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[1] See Obstfeld, Rogoff (1995) in regard to [1], Bernanke et al. (1999) in regard to [2], Taylor (1999) in regard to [3]. In an open economy the rules of the monetary policy can take the form of the following equation: $i_t = f\pi_t + gy_t + h_0 e_t + h_1 e_{t-1}$, where: i - the short term nominal interest rate set by the central bank, y – output gap, e – real exchange rate. For f>1 and g=h=0 only inflation has been stabilised. Implementation of the exchange rate to the rule, although promising in the theory, can only slightly stabilise inflation (by diminishing standard deviation – France, Italy) or substantially worsen results (Germany),whereas the variance of the output gap has increased in any case.

$$E_t e_{t+1} - E_{t-1} e_t = \varepsilon_t$$

and $\Delta e_t = e_t - e_{t-1}$

then the IUP model can be tested as the following regression:

$$\textbf{(2)} \qquad \frac{1}{n}\sum_{i=1}^{n} \Delta e_{t+1} = \alpha_n + \beta_n \left(i_{t,n} - i^*_{t,n}\right) + \varepsilon_{t,t+n}$$

Wadhwani (1999), basing on estimation of equation (2) has shown that the UIP model, in its classic form (β=1), does not hold in any analysed country; it is too restrictive not permitting any feed-backs between interest rate, fundamentals and exchange rate.

Taylor (1995) claims that even if the risk premium permits for β<1, it is unacceptable for parameter β to be close to or less than zero – however, the estimation of equation (2) usually gives such results. Let *n* denote monthly periods - if *n* is lower, the probability of the UIP rejection is higher, as Bekaert and Hodrick (2001) pointed out; however, the UIP model holds much better at long horizons (over 12 months) - Chinn and Meredith (2001).

Chinn and Meredith`s theses were not tested for exchange rate of zloty because even if the rolling estimations are applied, the short time series do not allow a 12 months time lag. However, for the exchange rate of zloty to U.S. dollar, the classic form of the UIP model has been tested for *n*=3 **(**equation (2)). The final form of the UIP has been chosen basing on the comparison of the cointegration among variables fulfilling UIP conditions[2] with proper signs of coefficients, adjusted R^2 and with the Durbin-Watson statistics..

$$\textbf{(3)} \qquad e^{PLN/USD}_{t+3} = \underset{(0,054)}{0,621}\, e^{PLN/USD}_{t} + \underset{(0,002)}{0,05}\left(Wibor\ 3M_t - Libor\ 3M_t\right) + \underset{(0,067)}{0,483}$$

$$Adj.R^2 = 0,72 \qquad \text{D-W=1,83}$$

In equation (3) β=0,05 seems to confirm results of Bekaert and Hodrick (2001), i.e. for low *n, the* relation between interest rate disparity and changes in nominal exchange rate is weak. It can imply (Mark (1995)) that the probability of a proper determination of the exchange rate path between period t and t+n based on the UIP model is lower than the one based on the random walk models. Nevertheless, the positive value of β suggests that the interest rates seem to be a factor (although not a leading one) explaining the exchange rate changes.

In the case where β parameter is positive but substantially lower than 1, Wadhwani (1999) proposed instead of rejecting the UIP model replacing it by the following equation:

$$\textbf{(4)} \qquad \Delta e_{t+n} = \alpha + \beta\left(i_t - i^*_t\right) - \rho\left(x_t - \bar{x}_t\right)$$

where ***x*** denotes risk premium, understood by Wadhwani as a deviation of the share of balance on current account in GDP and of net foreign assets in GDP or unemployment rate from long-term averages of these variables (marked by the upper bar). It should be mentioned that the time-varying risk premium separates expected changes of exchange rates from changes of interest rate disparity.

[2] The Phillips-Perron unit root test have been held by all variables used in the UIP model.

3. Bekaert, Wei and Xing (2002) pointed out the relation between uncovered interest rate disparity and term structure of interest rates. Model of the expectation hypothesis of the term structure of the interest rates (EHTS) holds, if the long-term, the *n*-period interest rate $\mathbf{i}_{t,n,}$ is an unbiased estimator of the average expected short-term interest rate $\mathbf{i}_{t+h,1}$ over the life of the bond increased by the premium c_n :

$$(5) \qquad i_{t,n} = \frac{1}{n}\sum_{h=0}^{n-1} E_t\left(i_{t+h,1}\right) + c_n$$

Campbell and Shiller (1991) proved that the EHTS model set off by equation (5) can be tested by regression (6):

$$(6) \qquad \frac{1}{k}\sum_{i=0}^{k-1} i_{t+im,m} - i_{t,m} = \alpha_n + \beta_{n,m}^{ehts}\left(i_{t,n} - i_{t,m}\right) + u_{t+n-m}$$

where $k=n/m$ and $m<n$

Suppose that UIP in the longer period n is given by UIP in the shorter period ***m*** and by EHTS in the period n. Bekaert, Wei and Xing (2002) showed then the UIP model also holds in period ***m***. So, the expected path of the nominal exchange rate between periods t and ***t+n*** can be expressed as follows:

$$(7) \qquad \frac{1}{n}\sum_{i=1}^{n}\Delta e_{t+i} = \alpha_n + a_n + \beta_n^{UIP}\left(i_{t,n} - i_{t,n}^*\right) - \beta_n^{EHTS}\left(\left(i_{t,n} - i_{t,m}\right) - \left(i_{t,n}^* - i_{t,m}^*\right)\right) - \rho_n\left(x_{t,n} - \bar{x}_{t,n}\right) + \mu_{t,n}$$

Equation (7) combines the current and implied forward rates with expected nominal exchange rate, where the level of exchange rate has been adjusted by the risk premium determined by fundamentals.

Equation (7), estimated for exchange rate of zloty to U.S. dollar, takes the following form:

$$(8) \qquad \begin{aligned} e_{t+3}^{PLN/USD} &= \underset{(0,068)}{0,506}\, e_t^{PLN/USD} + \underset{(0,123)}{0,580}\left(Wibor3M - Libor3M\right) + \\ &- \underset{(0,456)}{0,991}\left[\left(fWibor3M - fWibor1M\right) - \left(fLibor3M - fLibor1M\right)\right] + \\ &- \left[\underset{(0,122)}{0,564}dbp + \underset{(0,011)}{0,123}\, fdi + \underset{(0,079)}{0,735}bh_{t-1}\right] + \underset{(0,089)}{0,628} \end{aligned}$$

$$Adj.R^2 = 0,78 \qquad \text{D-W} = 1,96$$

where:

$e^{PLN/USD}$ - logarithm of the nominal exchange rate of zloty to U.S. dollar;

Wibor3M-Libor3M - nominal interest rate disparity;

fWibor3M, fWibor1M, fLibor3M, fLibor3M - implied three- and one-month forward rate calculated according to Nelson-Siegel (1987) procedure where implied forward rate $\boldsymbol{f}$ for the period (t_1, t_2) has been expressed by the following formula:

$$f(t_1,t_2)=\left[\frac{((1+i(t_0,t_2))^{t_2-t_0}}{((1+i(t_0,t_1))^{t_1-t_0}}\right]^{\frac{1}{t_2-t_1}}-1 \qquad \left.\begin{matrix} i(t_0,t_2)= \\ i(t_0,t_1)= \end{matrix}\right\}$$ spot interest rates;

dbp, fdi, bh - accordingly: logarithms of budget deficit, foreign direct investments and net exports, adjusted by logarithm of the output gap.

Equation (8) shows that the reaction of the nominal exchange rate of zloty to the expected changes of the future interest rates (appreciation) has been almost twice as high as the exchange rate reaction to disparity changes (depreciation). If the budget deficit and foreign direct investments simultaneously increase and trade balance improves, then, to reverse the appreciation, the fall of the interest rate disparity should be almost threefold higher than the changes in the dynamics of fundamentals.

Expected reaction of zloty to changes of individual categories has been shown in Chart 1.

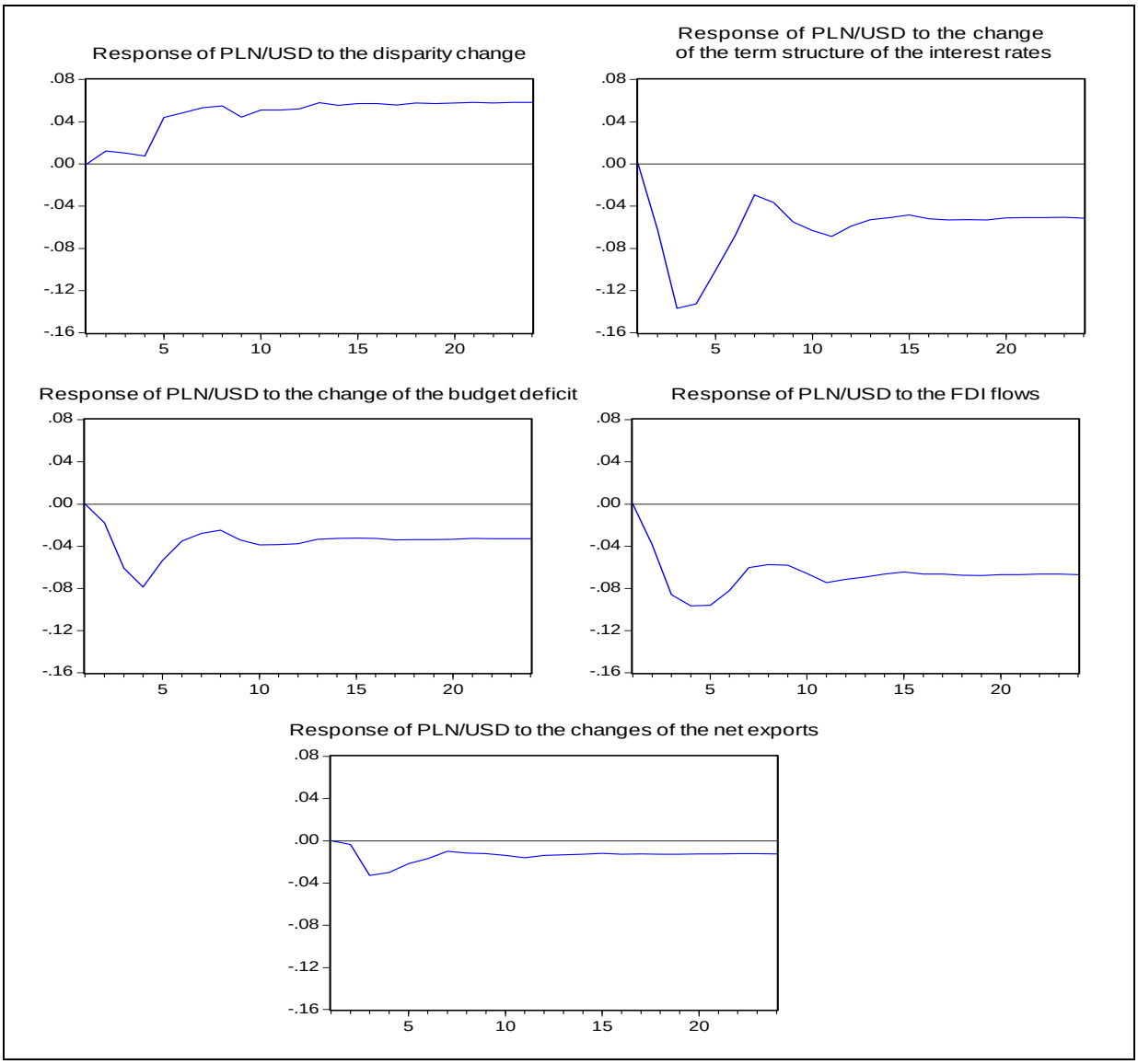
The impulse response of zloty is characterised by lack of return of zloty to the previous equilibrium level. However, in the case of any individual variable a new equilibrium has been reached in less than 12 months. A difference has been observed particularly for the foreign direct investments and budget deficit.

Chart 1 shows that:

- reaction of the exchange rate to changes of the interest rate disparity by 1 percentage point seems to be relatively weak – three months after an impulse had occurred, the zloty could depreciate by less than 3/100 PLN. The new equilibrium, with expected 6/100 PLN depreciation, has been reached after six months;
- expected change of the interest rates by 1 p.p. causes an appreciation of zloty by 14/100 PLN expected in three months. A new equilibrium, with expected 6/100 PLN appreciation, has been reached after six months;
- the government bonds worth 10% of the planned budget deficit sold in period *t* can cause an appreciation of zloty by 8/100 PLN within 3 months. A new equilibrium, with expected 3/100 PLN appreciation, has been reached after six months;
- the fall in foreign direct investments by 10% shall cause a depreciation of zloty by 11/100 PLN within 3 months;
- zloty can appreciate by 3/100 PLN if the trade deficit improves by 10% .

Chart 1

Expected reaction (in zloty) of the nominal rate of zloty on changes in the period t of: interest rate disparity by 1 percentage point and budget deficit, foreign direct investments, net exports by 10%.



Pass-through effect.

1. Suppose that equation (8), estimated in the previous paragraph, holds for the Polish zloty both in the short and long horizon, i.e. the expected changes of the exchange rate of zloty depend on the interest rate disparity, term structure of the domestic interest rates and on the risk premium. Then, changes of the exchange rate, affecting the level of import prices expressed in the domestic currency, influence the consumption price index (CPI) directly - through prices of imported consumption goods - and indirectly - through changes in the production price index (PPI) caused by price fluctuations of the imported raw-materials and intermediate goods. Fluctuations of the domestic prices, generated by changes of the exchange rates, impact in turn on the domestic demand, changing relations between real and potential output. Changes of the output gap are directly transferred to the CPI.

In the same mode, but independently of the exchange rate changes, the CPI is affected by fluctuations of the foreign prices.

In the economic literature, the total effect of transmission of the external factors to the domestic CPI, which incorporates changes of the foreign prices (supply shock), as well as of the exchange rate (exchange rate shock) and of the output gap (demand shock), is known as the pass-through effect[3].

2. Theory of the purchasing power parity (PPP), in its standard version, suggests that in the long run, the depreciation of the exchange rate shall always lead either to a proportional increase of prices in a country with a depreciating currency or to the fall of prices in the country with an appreciating currency[4]. It that case, the transmission of the exchange rate changes to the CPI would be complete and the pass-through effect shall equal one. However, empirical analyses show that the standard version of the PPP theory has been rarely fulfilled.

Usually it is rather assumed that the relation between price levels of similar baskets of goods should be constant but not necessarily equal one - then the PPP theory in its relative version is applied (Rogoff (1996)).

Simultaneously, an occurrence of the Balassa-Samuelson effect (BS) indicates that even a relation between price levels can vary over time. Then, the pass-through indicator can fluctuate at the rate determined by the BS effect.

In Poland, a positive correlation between the BS and pass-through effects has been observed between 1996 and 2001; the correlation coefficient was 0,96. Hence, one can state that a reduction of the BS effect causes a proportional decrease of the total pass-through.

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[3] Calculation of the statistical pass-through effect is based on the following formula:

$PT_{t,t+j} = CPI_{t,t+j} / EXR_{t,t+j}$

where

$PT_{t,t+j}$ - cumulated pass-through effect after j months;

CPI - cumulated consumption price index (CPI);

EXR - cumulated index of the nominal effective exchange rate, see Dornbusch(1987) or McCarthy (1999).

[4] It is usually assumed that a small economy, with no impact on the world market, is being analysed. The second country usually means the rest of the world. Then, the price adjustment takes place only in the small economy and the pass-through effect is calculated for the nominal effective exchange rate.

3. Moreover, if in any analysed economy, there is a low elasticity of the minimum wages and prices of the production factors in relation to the domestic prices, then the reaction of the domestic prices to the import price changes is weaker and weaker. It means that the pass-through indicator should be continuously decreasing. In McCarthy`s works (1999 and 2001), the detailed description of the pass-through effect has been presented and the impact of sequence of the supply, demand and exchange rate shocks on the import, producer and consumer prices has been explained. Corresponding prices are functions of:

(9) $$\pi_m = E_{t-1}(\pi_m) + \alpha_1\varepsilon_s + \alpha_2\varepsilon_d + \alpha_3\varepsilon_e + \varepsilon_m$$

(10) $$\pi_w = E_{t-1}(\pi_w) + \beta_1\varepsilon_s + \beta_2\varepsilon_d + \beta_3\varepsilon_e + \beta_4\varepsilon_m + \varepsilon_w$$

(11) $$\pi_c = E_{t-1}(\pi_c) + \gamma_1\varepsilon_s + \gamma_2\varepsilon_d + \gamma_3\varepsilon_e + \gamma_4\varepsilon_m + \gamma_5\varepsilon_w + \varepsilon_c$$

where:

π_m - index of the import transaction prices expressed in the domestic currency;

π_w - price index of the sold production of industry (PPI);

π_c - consumption price index (CPI);

E_{t-1} - expected value of the corresponding variable in the period *t-1*.

ε_s - supply shock, identified with the oil price (π_{oil}): $\pi_{oil} = E_{t-1}(\pi_{oil}) + \varepsilon_s$

ε_d - demand shock, identified with the output gap (φ): $\varphi = E_{t-1}(\varphi) + a_1\varepsilon_s + \varepsilon_d$

$\boldsymbol{\varepsilon}_e$ - exchange rate shock, identified with the changes of the nominal effective exchange rate: $\Delta e = E_{t-1}(\Delta e) + b_1\varepsilon_s + b_2\varepsilon_d + \varepsilon_e$

4. Results of the chain sequence pass-through model estimated for Poland are presented in the table below (Tab. 1). Model was estimated on quarterly data from 1993 – I quarter 2002.

McCarthy`s model and the model presented above differ from each other in the definition of the supply shock. In the presented work, oil prices are expressed in the dollar terms (instead of domestic currency), which lets separate the supply shock from the exchange rate shock. Apart from it, regarding the assumed identical reaction of the import prices to changes of the external prices and of the exchange rate, the demand shock has been proportionally splitted between two last categories.

Tab. 1

Pass-through effect calculated for the indices of import, producer and consumer prices.

Pass-through effect after → for ↓	**2 quarters**	**4 quarters**	**8 quarters**
Import transaction prices (PM)	**0,51**	**0,69**	**0,79**
of which PT effect identified exclusively with:			
supply shock (oil price)	0,12	0,15	0,17
exchange rate shock	0,39	0,54	0,62
Price index of the sold production of industry (PPI)	**0,26**	**0,50**	**0,59**
of which PT effect identified exclusively with:			
Supply shock (oil price)	0,05	0,09	0,11
Demand shock (assigned to the oil price changes)	0,01	0,01	0,01
together	***0,06***	***0,10***	***0,12***
Exchange rate shock	0,20	0,37	0,43
Demand shock (assigned to the exchange rate changes)	0,01	0,03	0,04
together	***0,21***	***0,40***	***0,47***
Consumption price index CPI)	**0,17**	**0,36**	**0,42**
of which PT effect identified exclusively with::			
Supply shock (oil price)	0,02	0,09	0,11
Demand shock (assigned to the oil price changes)	0,00	0,02	0,03
together	***0,02***	***0,11***	***0,14***
Exchange rate shock	0,14	0,21	0,24
Demand shock (assigned to the exchange rate changes)	0,01	0,04	0,04
together	***0,15***	***0,25***	***0,28***

Source: Author`s calculations.

In the equation of import prices, independently of the period chosen for estimation, all coefficients are stable. Hence, the proper estimation of the pass-through effect seems to be very likely. Short-term pass-through, defined as an effect of transmitting in two quarters the results of changes of the external prices and of exchange rate to the import prices, is 0,51. The long-term pass-through, understood as a cumulated effect of transmission, equals 0,79. Both

figures are similar to the results obtained by Camp and Goldberg (2002) for the OECD countries, averaging accordingly 0,6 and 0,75 (for Germany 0,6 and 0,8). Moreover, the method applied in this work allowed differentiating between a reaction of prices on the supply and

exchange rate shocks. The exchange rate shock, in the short as well as in the long period, explains 76-78% of the total pass-through effect. The rate of reaction of the import prices on changes of the exchange rate is also similar to the average for the OECD countries – about 65% of the cumulated pass-through effect appears between the first and the second quarter after the shock has occurred, about 87% - till the fourth quarter. The impulse fades totally after 7-8 quarters (chart 2).

In the equation of the price index of the sold production of industry all coefficients are unstable for subperiods including the years 1993-1995, probably because of the rapid changes in the structure of economy taking place during that time. Reduction of the data set can diminish the reliability to some extent, even despite the stabilisation of coefficients in the equation in all analysed subperiods containing years 1996- 2002. While the import prices absorb 79% of the supply and exchange rate shocks, the PPI absorb almost 100%. Long-term pass-through runs to 0,59 and it is close to the share of the imports of intermediate goods in the total Polish imports (60,8% in 2001). Short-term pass-through equals 0,26, so 45% of the total pass-through effect takes place after two quarters and 85% after one year. It means that the strongest reaction of the PPP shall be expected between the second and the fourth quarter since shocks have occurred (Chart 2).

In the equation of the consumer prices (CPI) all coefficients are stable in the subperiods where years 1993-1996 are excluded. Because of the significant reduction of the data set, the model has been also estimated for the monthly data from June 1998 to April 2002. Then, the long-term pass-through equals 0,42 and 41% of the total effect is cumulated in the first two quarters and 85% in the first year. Structure of the time-lags is similar to that of the PPI equation (Chart 2).

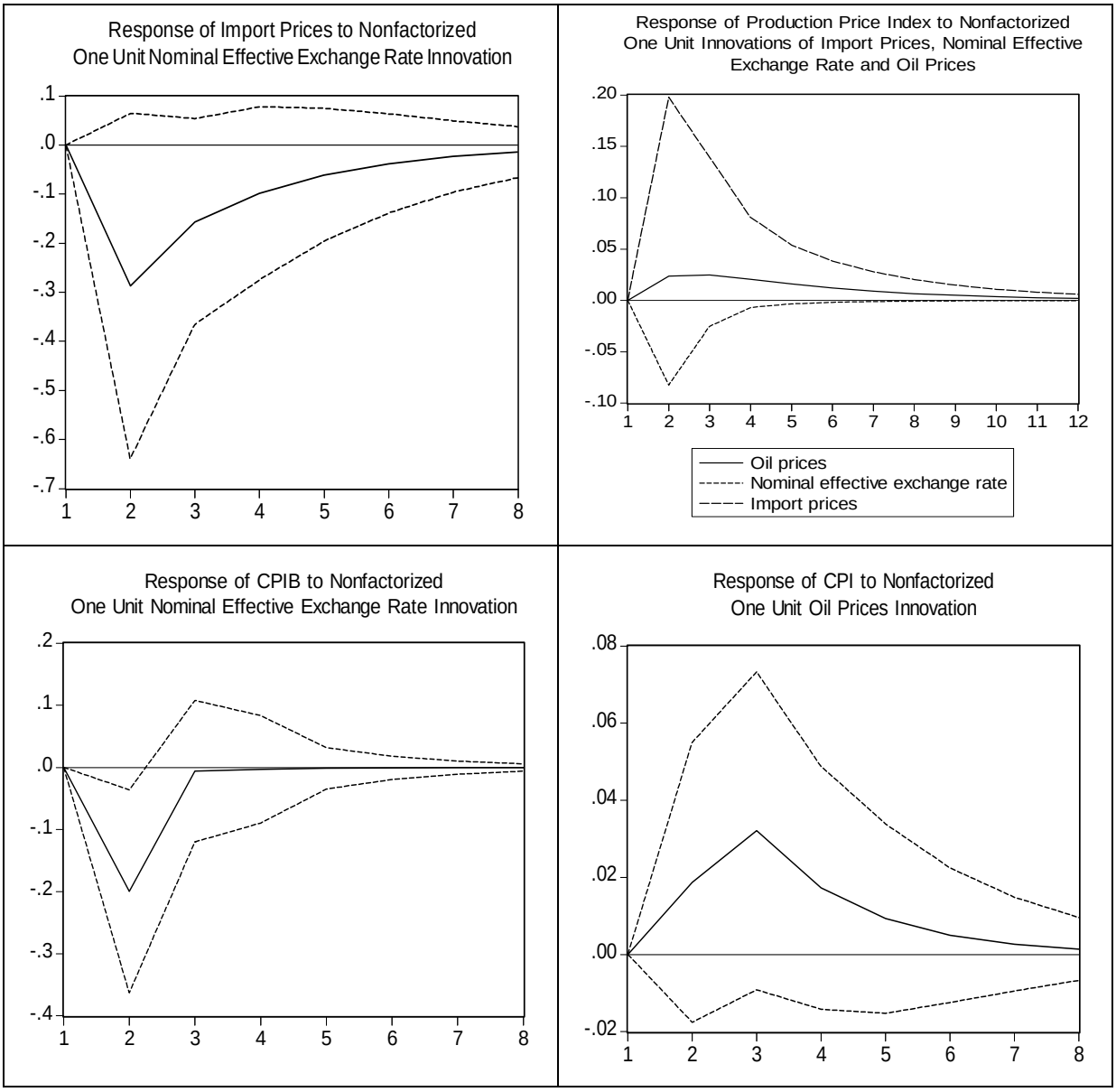
5. The model based on the monthly data allows identifying more precisely the time structure of reaction of prices to the supply and exchange rate shocks. Results are as follows:

- for the import prices, the highest pass-through shall be expected between the second and the fourth month since the shocks have occurred;
- the strongest reaction of the PPI occurs between the third and the seventh month;
- for the CPI, the strongest reaction shall be expected between the fourth and the eighth month.

Simultaneously, both for the quarterly and for the monthly model, the share of the exchange rate shock in the total long-term pass-through equals 57%, whereas in the short-term pass-through it's over 82%. Hence, in the long horizon the supply shocks (represented by the oil prices) seem to be more and more significant. On the other hand, while the role of the demand shock in the short period can be omitted, in the long run it increases to 17%.

Chart 2

Response of the domestic prices on the changes of the oil prices and the nominal effective exchange rate of zloty.



Simultaneously, a positive correlation $\left(R^2 = 0{,}67\right)$ between the pass-through and the output gap is observed. Hence, it can be concluded, that the pass-through effect is linked with the business cycle[5].

[5] Assuming that the output gap is lower during recovery and decline, positive correlation coefficient implies that in the mentioned phases of the business cycle the pass-through effect should decrease. On the other hand, the greater output gap characteristic of the boom as well as of the crisis, implies an increase of the pass-through effect. Moreover, during the crisis, an increase of the pass-through effect causes a fall of inflation (connected with a negative output gap). This correlation is confirmed by the research conducted in the IMF for the developed economies (*World Economic Outlook. May 2001).*

6. In the emerging economies, the huge volatility of the output gap occurrs both between the phases of the business cycle and inside its separated phases. Mann (1986) says that – under the imperfect competition – the huge volatility of the output gap together with the fluctuations of the domestic currency shall rather change the importers` profit margin than influence the domestic prices – then, the pass-through effect should decrease. A similar reaction of the importers can be observed during high volatility of the exchange rate – they rather change their profit margin than prices – hence, the pass-through effect falls.[6] Indirectly, similar phenomenon can be observed in Poland – maximum correlation between standard deviation of the PLN/USD exchange rate and changes of the CPI is –0,31 and for PLN/EUR exchange rate is -0,25.

The empirical works done by Feinberg (1986) or Goldberg and Knetter (1997) show that the market structure is essential for the pass-through effect: the lowest pass-through is observed in the sectors of the imperfect competition, where producers dispose of the great monopolistic power and are able to make the market segmentation.

For the American economy, similar investigations, confirming that thesis, were made by Dornbusch (1987). He analysed the pass-through effect in the various segments of the market characterised by the different level of the import penetration[7] and substitution between imported and domestic goods. Dornbusch showed that - according to the pricing to the market - foreign exporters who sell their product at the market with the depreciating currency, rather prefer keeping their share in the market than increasing prices in line with depreciation; hence, the pass-through effect has been diminished. So, the pass-through effect depends on the pricing to the market, structure and concentration of production and on the structure and import penetration. The more positive pricing to the market, higher concentration of production, higher import substitution and lower level of import penetration, the lower the pass-through effect.

7. Works done for Poland are not complete. Nevertheless, basing on this investigations a pass-through effect at the macroeconomic level could be evaluated. It seems that while the reaction of the import prices is similar to the reaction observed in any small, open economy, a further transmission of the supply and exchange rate shocks to the PPI and CPI is substantially higher in Poland then in other developed countries. For the U.S.A., France and Switzerland the long-term pass-through effect equals 0,1, for Germany 0,15, but for the Netherlands and Belgium 0,35 (Mc' Carthy (2001)). The long-term effect for Poland is similar to that of the South Africa (Smal (2002)) and is much lower than in Turkey where it equals 0,78 (Domaç (2002)). But also in Poland during the two digit inflation between 1993-1995, the pass-through effect was similar to the one currently observed in Turkey. It might suggest that also in Poland the pass-through effect depends on the level of the observed inflation. Such a conclusion set up by Taylor (2000) has been positively verified by Choudhri and Hakura (2001) for 71 countries.

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[6] This relationship occurrs in the developed economies. Results for the developing countries are different. Ghosh, Ostry, Gulde and Wolf (1997) have observed that implementation of the floating exchange rate regime and a resulting higher volatility of the exchange rate increases the pass-through effect and, consequently, increases the inflation by 3 percentage points one year after the change, by 1,8 points after two years and by 2,3 points after three years.

[7] Import penetration index relates value of imports to domestic demand.

References:

Adolfson M.	*Optimal Monetary Policy Delegation under Incomplete Exchange Rate Pass-Through*	SSE/EFI Working Paper No. 478, Stockholm, 2001
Bekaert G., Hodrick R.J.	*Expectations Hypotheses Tests*	Journal of Finance, No. 56/4, 2001
Bekaert G., Wei M., Xing Y.	*Uncovered Interest Rate Parity and the Term Structure*	NBER Working Paper No. 8795, Cambridge, 2002
Bernanke B.S., T. Laubach, F.S. Mishkin, A.S. Posen	*Inflation Targeting*	Princeton, New Jersey: Princeton University Press, 1999
Campa J.M., Goldberg L.S.	*Exchange Rate Pass-Through into Import Prices. A Macro or Micro Phenomenon*	NBER, April 2002
Campbell J.Y., Shiller R.J.	*Yield Spread and Interest Rate Movements: A Bird s Eye View*	Review of Economic Studies No. 58/3 1991
Chinn M., Meredith G.	*Testing Uncovered Interest Parity at Short and Long Horizons*	NBER Working Paper No. 8643, Cambridge, 2001
Choudhri E.U., Hakura D.S.	*Exchange Rate Pass-Throuhg to Domestic Prices: Does the Inflationary Environment Matter?*	IMF Working Paper WP/01/194, 2001
De Grauwe P., Grimaldi M.	*The Exchange Rate and Its Fundamentals. A Chaotic Perspective*	CES ifo Working Paper No. 639(6), 2002
Devereux M,B., Lane Ph. R.	*Exchange Rates and Monetary Policy in Emergin Market Economies*	CEPR, 2001
Devereux M.B., Engel Ch.	*Exchange Rate Pass-Through, Exchange Rate Volatility and Exchange Rate Didconnect*	NBER Working Paper No. 8858, Cambridge, 2002
Domaç I.	*On the Exchange Rate Pass-Through: Evidence From Turkey*	Central Bank of the Republic of Turkey, April 2002
Dornbusch R.	*Exchange Rates and Prices*	American Economic Review, No. 77/1987
Engel Ch.	*The Responsiveness of Consumer Prices to Exchange Rates and the Implications for Exchange-Rate Policy: a Survey of a Few Recent New*	NBER Working Paper No. 8725, Cambridge, 2002

	Open-Economy Macro Model	
Feinberg M.	*The Interaction of Foreign Exchangeand Market Power Effects on German Domestic Prices*	Journal of Industrial Economics, No. 35/1986
Filipović D.	*Exponential-Polynominal Families of the Term Structure of Interest Rates*	Department of Mathematics, ETH, Zurich, 2001
Ghosh A., Ostry D., Gulde A., Wolf C.	*Does the Exchange Rate Regime Matter for Inflation and Growth*	IMF, 1997
Goldberg P., Knetter M.	*Goods Prices and Exchange Rates: What Have We Learned?*	Journal of Economic Literature, No. 35/1997
Halpern L., Koren M.	*Products, Firms and Exchange Rate*	Institut of Economics of Hungarian Academy of Sciences, 2001.
Holman J.A.	*International Transmission of Anticipated Inflation under Alternative Exchange-Rate Regimes*	Federal Reserve Bank od Kansas City, Kansas City, 1999
Kilian L., Taylor M.P.	*Why is it so difficult to beat the random walk forecast of exchange rates*	University of Michigan, 2001
Mann C.	*Prices, Profit Margins and Exchange Rates*	Federal Reserve Bulletin, No. 72/1986
Mark N.C.	*Exchange Rates and Fundamentals: Evidence of Long Horizon Predictability*	American Economic Review No. 85/1 1995
McCarthy J.	*Pass-Through of Exchange Rates and Import Prices to Domestic Inflation in Some Industrialized Economies*	Federal Reserve Bank of New York, 2000
Nelson Ch.R., Siegel A.F.	*Parsimonius Modeling of Yield Curves*	Journal of Business, No. 60/4 1987
Obstfeld, Maurice, K. Rogoff	*The Mirage of Fixed Exchange Rates*	Journal of Economic Perspectives, Fall 1995, Nr. 9 (4)
Rogoff K.	*The Purchasing Power Parity Puzzle*	Journal of Economic Literature, nr 34/1996
Smal M.M.	*Recent exchange rate developments in South Africa and the pass-through effect*	South African Reserve Bank, April 2002

Taylor J.	*Low Inflation, Pass-Through, and the Pricing Power of Firms*	European Economic Review No. 44, 2000
Taylor J.B.	*The Role of Exchange Rate in Monetary Policy Rules*	Stanford University, 2001
Taylor M.P.	*The Economics of Exchange Rate*	Journal of Economic Literature, No. 33, 1995
Wadhwani S.B.	*Currency Puzzles*	LSE Lecture on 16 September 1999