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RISK PREMIUM ON THE SHORT RATE MARKET – COMPARISON OF THE POLISH AND EUROPEAN MARKETS BEHAVIOUR DURING THE CRISIS

Abstract: In the paper we investigate the risk premium on the Polish and European interbank markets based upon the LIBOR and OIS data. We compare the dynamics of the risk premia during the crisis period. The results of our analysis show that the risk premia on both markets reacted to the monetary policy movements. However, the results obtained for Poland clearly suggest the immaturity of the OIS market.

Key words: interest rate, Overnight Interest rate Swap, risk premium, GARCH-in-Mean.

1. Introduction

The aim of the research was to investigate risk premium on the Polish interest rates market and compare it to the dynamics of the interest rates market in the Eurozone. Due to the availability of data, we chose the market of the instruments of weekly maturity. We investigated the risk premium on the interbank market, taking into account the overnight interest rate swap (later referred to as OIS) as a benchmark. We took into account the OIS instruments of one week tenor in the period of January 2008 to September 2010, as well as the LIBOR rates of the corresponding maturity over the same period. The data was taken daily.

2. Risk premia – definitions

There are many definitions of risk premium. In literature the risk premium is interpreted as a difference between the rate of return from a given asset and the risk-free rate, i.e., it is an excess return compensating for the investment in the risky asset (e.g. [Merton 1973; Pagan, Hong 1990; Perron 1999; Linton, Perron 2002] and many others). In the literature concerning exchange rates the risk premium is identified via

so called "forward bias" or "forward discount", i.e. the difference between the forward and spot rate of the corresponding maturity (see e.g. [Froot, Frankel 1989; Verschoor, Wolff 2001; Marcinkowska-Lewandowska et al., 2010]). Eventually, the risk premium on the interbank market can be assessed using swap rates.

OIS is a swap of fixed interest rate in exchange for a floating interest rate where the floating rate is determined on the basis of the daily reference 1-day rate. In Poland such a reference rate is POLONIA while in the eurozone – EONIA. In the contract two money flows are swapped. The so-called fixed leg is a one-off payment, the interest rate and nominal value of which is set in the contract. The floating leg is also a one-off payment of which the interest rate is calculated based upon the overnight rate. The interest calculated based upon the floating rate is accrued daily. The interest payments are swapped at the contract maturity (in practice: on the first day after the maturity day) by way of net settlement. If we compare the risk of investment in the interbank market with the investment in swap we come to the conclusion that the investment in swap is less risky, since it requires only the exchange of interests, not the notional amount. Thus, investigating the difference between the WIBOR and swap rates of corresponding maturity can help assessing the risk premium on the money market (see e.g. [Michaud, Upper 2008]). Following e.g. [Soultanaeva, Strömqvist 2009] we assume that the swap rates are the best measure of the market participants' expectations. Thus, the spread between the LIBOR and swap rate is considered to be a measure of the relative stress in the money market (see [Sengupta, Yu 2008; Thornton 2009] for more details). Higher spread is said to be an indicator of lower willingness of the major banks to lend, while a lower one indicates the growth of liquidity.

Since the unconditional risk premium is frequently equal to zero, we decided to model so-called conditional risk premium. This allows us to observe the daily changes of the risk premium. The approach is justified also due to the fact that the period under study covers the hectic crisis period and it would be unreasonable to expect that the behaviour of the risk premium remained unchanged. Since the degree of uncertainty varied over time, the agents must have received varying compensation for investment in risky assets. We assumed that the risk premium is embedded in the difference between the LIBOR and OIS swap rates, as well as that it depends on the conditional variance. That is why we decided to model the risk premium using GARCH in Mean model whose application to modelling the behaviour of interest rates and risk premia is justified and well grounded in the literature (see e.g. [Engle et al. 1987; Backus, Gregory 1993; Castagnetti 2004; Hess, Kamara 2005] and many others).

3. The data

We took into account the behaviour of the spreads between the LIBOR and OIS rates over the period 1.01.2008 – 17.09.2010. Such spreads can be interpreted as the measures of the excess return on the interbank market or as indicators of the relative

stress on the market. Let us analyse the charts presenting the spreads on both markets. In Figure 1 we present the dynamics of the spread observed on the Polish market. It is clear that we can distinguish two subperiods. The moment of division is the beginning of 2009. In the first subperiod the mean value of the excess return was visibly smaller than the one in the second subperiod. In February 2009 there was a shift and – after a moment of turmoil – the excess return stabilised on a higher level.

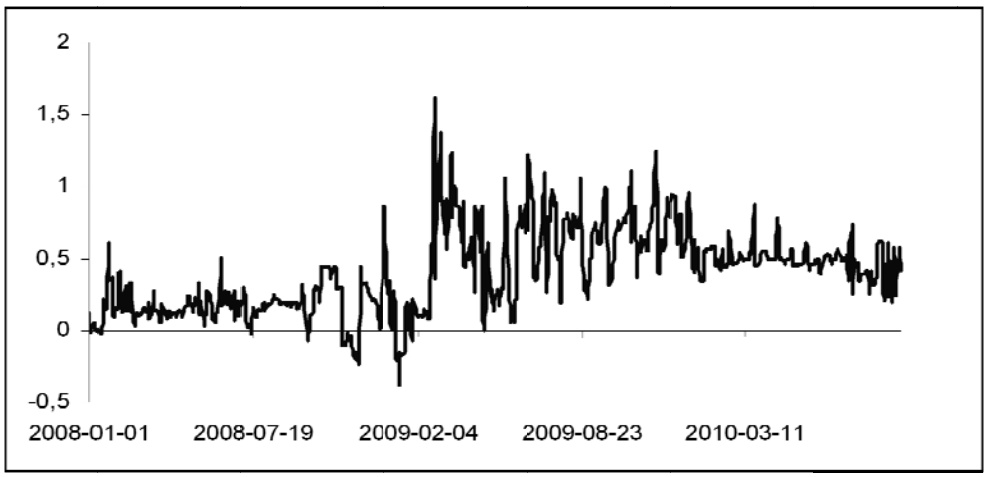

Figure 1. Realised excess return on the interbank market – the case of Poland

Source: Bloomberg, Stooq and own calculations.

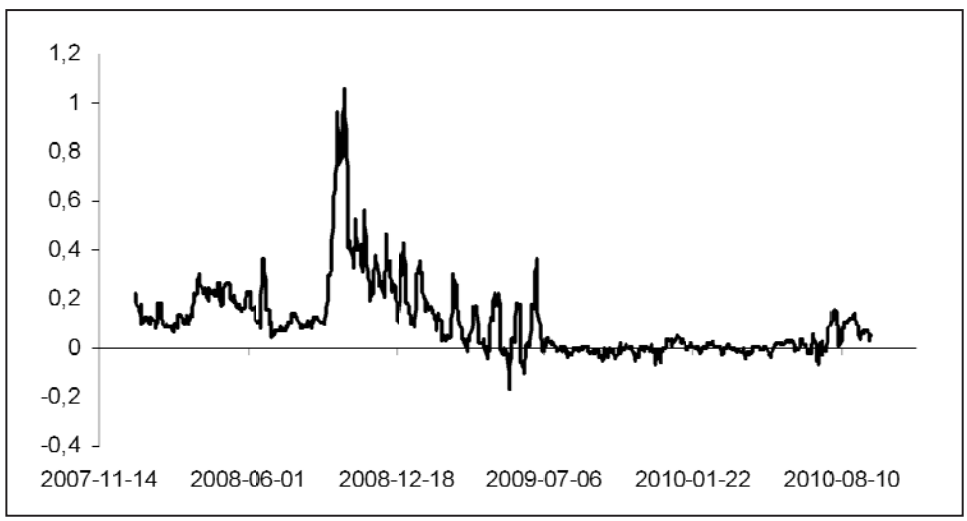

Figure 2. Realised excess return on the EURO market

Source: Bloomberg, Stooq and own calculations.

Let us compare the dynamics of the excess return on the Polish market with the one in the eurozone (Figure 2). The dynamics of the EURIBOR spread was significantly different. First of all, we can observe very noticeable growth of tension in September and October 2008. During this period the famous bankruptcy of Lehman Brothers occurred, which seriously affected the situation on the EURIBOR market. However, starting from late October, the stress in the market gradually calmed and in June 2009 the situation stabilised.

4. The policy of the NBP and the ECB during the crisis

The observed discrepancies between the two spreads can be contributed to the different situation on the money markets during the crisis as well as to the different moment of the beginning of the crisis in both economies. While in the eurozone we can set the date of the crisis outbreak to the beginning of August 2007, in Poland its results became visible in the Autumn 2008, after the collapse of Lehman Brothers. Moreover, in the Polish banking sector overliquidity was present all the time during the crisis, which was not true in the case of the eurozone. However, both central banks attempted to provide liquidity into the banking sector in similar ways. The National Bank of Poland, for instance, introduced REPO operations of maturity six days (17 October, 2008) and fourteen days (21 October, 2008), as well as three months (November, 2008). Also, starting from 17 October, 2008 up to late February 2009 the supply of the bonds of one week maturity (the basic open market instrument of the NBP) were not published and the NBP supported the main refinancing instruments in the amounts needed by the commercial banks. Starting from the beginning of February 2009, we can observe the increase of the spread. In February 2009 the NBP returned to the so called "active" monetary policy which probably caused the turmoil in February, visible in Figure 2. However, the situation stabilised after a while and the swap spread has remained stable, but of higher mean – contrary to the EURIBOR-OIS spread. Moreover, the fluctuations of WIBOR-OIS spread around the mean are much more erratic than those of the EURIBOR-OIS spread.

In the case of the ECB, in mid-October the central bank adopted a fixed rate tender procedure with full allotment for all of its weekly main refinancing operations and its longer-term refinancing operations with maturities of up to six months. It also increased the number and frequency of longer-term refinancing operations, conducting three additional refinancing operations per month – two with a maturity of three months and one with a maturity of six months. Moreover, a new refinancing operation with maturity corresponding to the duration of the reserve maintenance period was introduced. These operations visibly contributed to the stabilization of the situation on the market [Trichet 2009].

5. Risk premium on the Polish interbank market

A bank which lacks liquidity can borrow on the interbank market where the interests on loan equal the WIBOR SW rate. Alternatively, the bank can enter the one week swap contract. The investment in an overnight swap is considered less risky, since it does not require exchanging the notional amount. Only the interest rates flows are involved. Usually, on the developed markets the OIS curve is 3–10 percentage points lower than the cash curve [Malocha 2010]. Thus, we can suppose that the risk premium is embedded in the spread between the weekly swap rate and the WIBOR SW rate. We assumed also that the difference between the two rates can be explained by the dynamics of the POLONIA rate (underlying the swap contract), the reference rate (influencing the WIBOR SW rate[1]) and the risk premium parameter. At the same time, the risk premium parameter is a function of the variance of the spread between the weekly swap rate and WIBOR SW.

The data was tested for unit roots using the ADF and KPSS tests. In both cases the output of the tests suggests stationarity of the data. However, it also seems that there was a shift in the realized excess return in February 2009. Thus, we divided our sample into two subsamples: the first one covering the period 1.01.2008 – 31.01.2009 and the second one: 1.02.2009 – 17.09.2010. We chose the best-fitted models according to the Schwarz criterion. We present the results of the estimation of the PGARCH [Ding, Granger, Engle, 1993] model with the coefficients change. The model does not only consider the asymmetry in the data but also allows for modelling the long memory in the variance in more flexible way, i.e., allowing the power of the conditional variance to take values different than 2. The model estimated by us took the following form:

$$s_t = p_t + a_2 \cdot POLONIA_t + a_1 \cdot NBP\_ref_t + a_3 \cdot s_{t-1} + y_t,$$

$$p_t = bh_t,$$

$$y_t = \sqrt{h_t}\,\varepsilon_t,$$

$$h^d{}_t = \alpha_0 + \alpha_1 \,|\, \varepsilon_{t-1} \,| - \alpha_2 \varepsilon^d_{t-1} + \beta h^d_{t-1}.$$

The variable s_t denotes the spread, p_t – the risk premium, $POLONIA_t$ – the value of the POLONIA rate, and NBP_ref_t – the value of the NBP reference rate at time t. In the first subperiod the POLONIA rate did not influence the level of the spread (see Table 1 for details). However, the spread reacted significantly to the changes of the

[1] In theory the reference rate should influence the WIBOR SW and the swap rate in the same manner and thus, its influence on the spread should not be visible. However, as our model shows, this influence is noticeable. This can be interpreted as a result of the faster reaction of POLONIA – underlying the OIS – and the OIS rate itself to the changes of the reference rate, than the reaction of WIBOR SW to the same event.

reference rate. The growth of the reference rate caused the growth of the spread. In the case of the POLONIA rate the relation was opposite. The parameter *d* took value 0.17 in the case of the first period and the value 0.36 in the second one. In both cases the parameter *b* was significant and negative, indicating the negative risk premium.

Table 1. Estimates of the PGARCH model in both subperiods

1.01.2008 – 31.01.2009					2.02.2009 – 17.09.1010				
Variable	Coefficient	Std. error	*z*-stat.	*p*-value	Variable	Coefficient	Std. error	*z*-stat.	*p*-value
a_1	0.029246	0.000474	61.75149	0.0000	a_1	0.170818	0.006208	27.51514	0.0000
a_2	0	–	–	–	a_2	–0.037122	0.008346	–4.447648	0.0000
a_3	0.652886	0.020478	31.88206	0.0000	a_3	0.722439	0.016005	45.13915	0.0000
α_0	0.011197	0.001477	7.582817	0.0000	α_0	0.013038	0.003767	3.461231	0.0005
α_1	0.222187	0.018582	11.95681	0.0000	α_1	0.052235	0.023393	2.232938	0.0256
α_2	0.110393	0.013796	8.001585	0.0000	α_2	0.220051	0.026569	8.282165	0.0000
D	0.172162	0.061470	2.800755	0.0051	d	0.369183	0.161865	2.280803	0.0226
B	0.887733	0.010075	88.11350	0.0000	β	0.717940	0.028136	25.51699	0.0000
B	–0.367797	0.083343	–4.413072	0.0000	b	–0.216599	0.043220	–5.011594	0.0000
log likelihood	264.4139				log likelihood	247.0438			

Source: own calculations (Eviews 7).

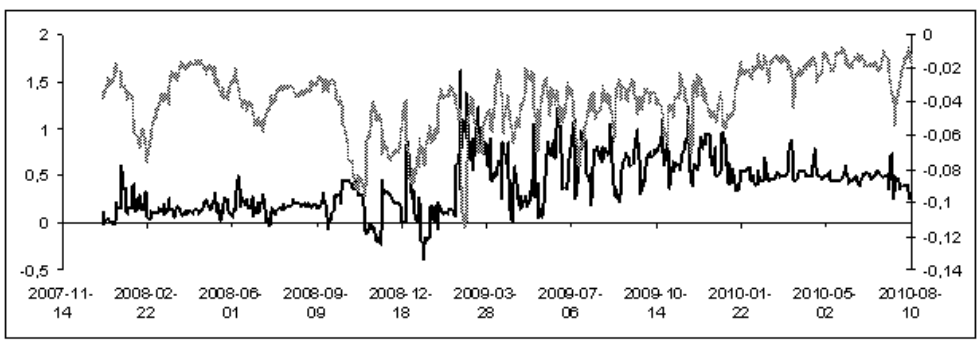

Figure 3. Excess return and the risk premium on the Polish interbank market

Source: own calculations.

Figure 3 shows the dynamics of the risk premium ($p_t = b \cdot h_t$) over the whole period (right axis) in comparison with the realized excess return (left axis). The risk premium was negative over the whole period. In the first subperiod it was, however, a little downward sloped, while in the second subperiod the risk premium showed a slightly positive trend. Let us note that the periods in which the risk premium was lower correspond to the periods in which the excess return on the market was lower, and this is not in contrast with our intuition. The risk premium took its minimum

values in late February 2009.The change of the tendency of the risk premium and the shift in excess return in February 2009 may have been caused by the change of the monetary policy of the NBP from the so called "passive" one into the "active" one. Commercial banks reacted nervously, since for security reasons, they still preferred to accrue as much liquidity as possible and the demand for NBP bills declared by them was much higher than the real one.

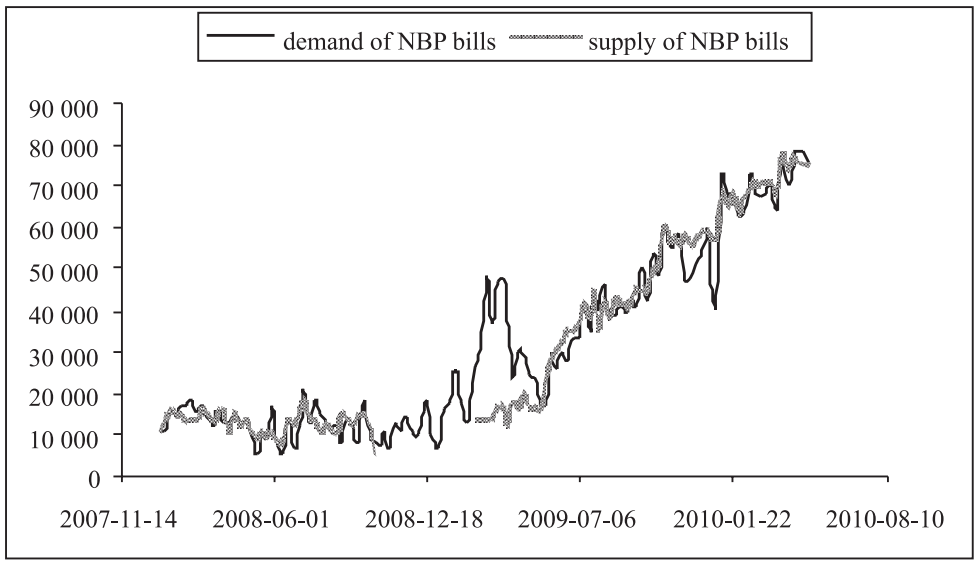

Figure 4. Supply and demand of NBP bills over the period 2008–2010

Source: http://nbp.pl.

Figure 4 presents the declared demand and supply of the NBP bills. It is clear that up to 17 October 2008, the supply and demand almost matched. Although the supply of the bills was made public, the NBP always supplied the amount of the bills needed by commercial banks in order to avoid underbidding. When the NBP stopped publishing the supply of the bills, the demand at first did not react but a while later started to grow. When the NBP returned to the active monetary policy, it transpired that the demand declared by the commercial banks was much higher than the supply. The banks took the risk of declaring higher demand even if they would not be able to acquire as much bills as they called for. In consequence tension in the market rose. After a while the central bank decided to increase the amount of bills available on tenders and the demand and supply again matched. However, the trend remained upward-sloped. Since the uncertainty on the interbank market grew and the amount of the supplied one-week money was not sure, the risk of investment on the market had to grow. Thus, the risk premium must have been shifted up with positive trend (see Figure 3).

6. Risk premium on the euro market

In the case of the eurozone we divided the sample into the following two periods: the hectic one – from 1st January 2008 up to 20th January 2009, and the more tranquil one – from 21st January 2010 up to 17th September 2010. The moment of division was the day of the ECB reference rate change onto 2%. The ECB frequently lowered the key ECB rate during the period of the crisis. At the moment of writing the paper the key ECB rate amounted to 1%. The volatility of the overnight money market tended to decrease together with the decrease of the interest rate.

In the case of the eurozone it was impossible to model the behaviour of the spread using any other model than the IGARCH one. We tried to model the conditional mean of the spread taking advantage of some additional explanatory variables. Similarly to the case of the risk premium on the Polish market, we chose EONIA and the MRO (main refinancing operations) rate and introduced them to the equation. Thus, the model took the following form:

$$s_t = p_t + a_1 s_{t-1} + a_2 s_{t-2} + a_3 \cdot EONIA_t + a_4 \cdot MRO_t + \varepsilon_t,$$
$$p_t = b \cdot \sqrt{h_t},$$
$$y_t = \sqrt{h_t}\,\varepsilon_t,$$
$$h_t = (1-\beta) \cdot h_{t-1} + \alpha \varepsilon_{t-1}^2.$$

In the first subperiod (1.01.2008 – 20.01.2009) we explained the conditional mean of the spread by means of EONIA and the MRO rate. The latter, however, was not significant. We decided to leave the reference rate in the equation, since the model in this case had better properties. The parameter *b*, the multiplier of the risk premium, was positive but lower than one. The distribution was Gaussian.

Table 2. Estimates of the IGARCH model in both subperiods

1.01.2008 – 20.01.2009					21.01.2009 – 17.09.1010				
Variable	Coefficient	Std. error	*z*-stat.	*p*-value	Variable	Coefficient	Std. error	*z*-stat.	*p*-value
a_1	0	–	–	–	a_1	0	–	–	–
a_2	0.824452	0.017986	45.83837	0.0000	a_2	0.727641	0.027154	26.79670	0.0000
a_3	0.070983	0.012273	5.783614	0.0000	a_3	0.162795	0.017761	9.166103	0.0000
a_4	–0.010160	0.012567	–0.808458	0.4188	a_4	0	–	–	–
A	0.302934	0.027953	10.83716	0.0000	α	0.168525	0.021803	7.729441	0.0000
B	0.697066	0.027953	24.93689	0.0000	β	0.831475	0.021803	38.13588	0.0000
D_f	–	–	–	–	d_f	5.928494	1.232987	4.808237	0.0000
B	0.137355	0.021602	6.358373	0.0000	b	0.212857	0.053933	3.946716	0.0001

Source: own calculations (Eviews 7).

In the second subperiod (21.01.2009 – 17.09.2010) the parameter *b* was also positive and lower than one. It seems that also the EONIA rate significantly influenced the behaviour of the spread. The model is well-fitted in a sense that all the parameters are significant and there appears no autocorrelation in the squared residuals. In Figure 5 we plot the excess return together with the obtained risk premium.

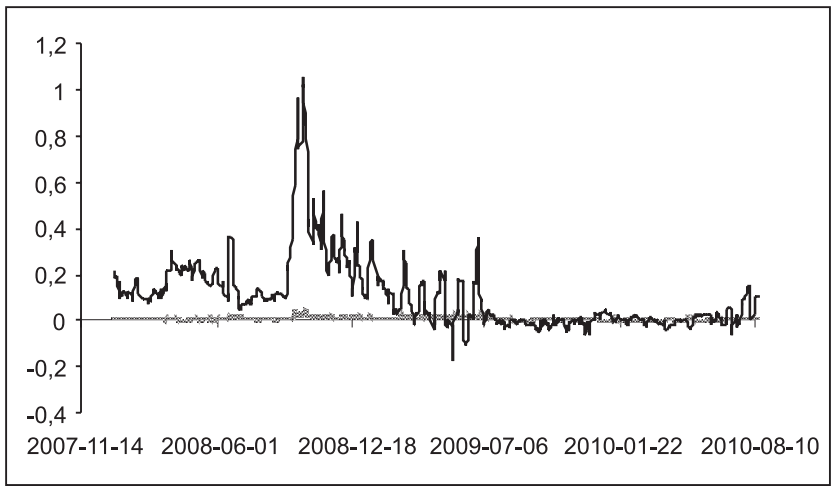

Figure 5. Excess returns and risk premium on the European interbank market

Source: own calculations.

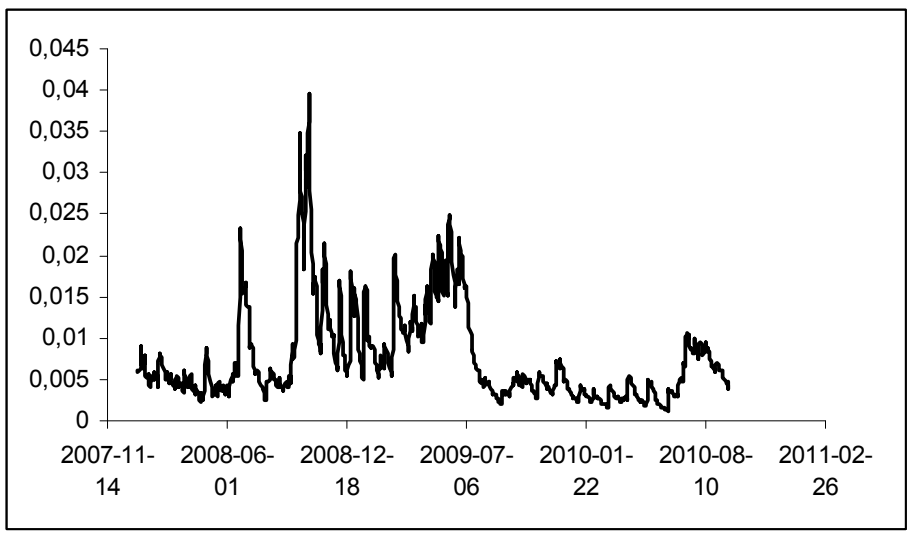

Figure 6. Risk premium on the European interbank market

Source: own calculations (Eviews 7).

In comparison to the excess return, the risk premium was very low, but still positive. In Figure 6 we present additionally the plot of the risk premium itself. It is now visible that in the first phase of the crisis the market reacted quite nervously and both the risk premium and the excess return were growing. The highest values were observed in September and October 2008, then the tension calmed a little, but the stress increased anew and did not decrease until the middle of 2009. Starting from late July, the situation on the market stabilized. A little growth of the risk premium was observed however in August, 2010.

7. Conclusions

In the paper we presented the results of the risk premium estimation during the crisis period. We compared the immature Polish market with the eurozone. Based upon our results we can conclude that – opposite to the eurozone – the risk premium in the Polish interbank market grew after the most hectic phase of the crisis, while in the European market it declined. Moreover, the risk premium in the Polish market was negative, while in the European one – positive, albeit close to zero.

The differences between the risk premium behaviour can be contributed first of all to the maturity and liquidity of the markets. OIS transactions in Poland were used by banks mainly for speculating on the POLONIA rate and hedging against changes in the cost of financing in the interbank deposits market. In April 2010 they constituted 33% of all IRS transactions, whereas in April 2007 it was over 53% [*Turnover in the Polish*… 2010]. The average daily net turnover in the OIS transaction in April 2010 amounted to USD 215 million, and was almost 65% lower than in April 2007. The liquidity of this market was still limited by the relatively small number of participants. No transactions with non-financial institutions were registered in April 2010.

Since in Poland the swap market is very young and the turnovers are relatively small, it may not reflect the price of the money properly. Moreover, the phenomenon of overliquidity may have made investment on the interbank market less risky, since it reduced the risk of default. At the same time the banks were reluctant to lend each other on the free market. These factors probably contributed to lowering risk premium below zero.

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PREMIA ZA RYZYKO NA RYNKU KRÓTKOTERMINOWYCH STÓP PROCENTOWYCH – PORÓWNANIE ZACHOWAŃ NA RYNKACH POLSKIM I EUROPEJSKIM W OKRESIE KRYZYSU

Streszczenie: Artykuł przedstawia wyniki estymacji premii za ryzyko na rynkach międzybankowych: polskim i europejskim. Premia za ryzyko wyznaczana była na podstawie stóp międzybankowych i stóp kontraktów OIS. Badanie dotyczyło okresu kryzysu 2008–2009. Okazuje się, że premia za ryzyko na obu rynkach była wrażliwa na posunięcia polityki monetarnej banków centralnych. Wyniki badań dla rynku polskiego sugerują jednak, że rynek OIS w Polsce nie jest rynkiem dojrzałym.

Słowa kluczowe: stopa procentowa, kontrakt *swap* na stopę *overnight*, premia za ryzyko, model GARCH-in-Mean.