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VOLATILITY OF THE POLISH ZLOTY AGAINST MAJOR INTERNATIONAL CURRENCIES COMPARED TO OTHER CENTRAL AND EASTERN EUROPEAN CURRENCIES IN 2004-2010 AND 2011-2019

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Abstract: Exchange rate volatility reached significant levels as one of the problems of the 2008 financial crisis, which showed that the market mechanism, even internationally, is not always conducive to restoring stability in various aspects. The aim of the paper is to compare the exchange rate volatility of the Polish zloty and several other currencies (mainly in the Central European region) against major international currencies such as the US dollar, British pound, euro and Swiss franc before and after the crises in 2004-2010 and 2011-2019. A review of the existing literature aimed to show some effects of exchange rate volatility on the economy. An analysis was made by comparing two periods (2004-2010 and 2011-2019). Exchange rate volatility was calculated as a standard deviation of the twenty-day moving average (by market days). Exchange rate volatility became much lower in the second examined period (in the European Union countries, including Poland) after the strong institutional (activities and interventions of central banks and governments) support started because of the financial crisis in 2008. There was a decrease in currency volatility in the European Union countries, including Poland.

Keywords: exchange rate volatility, currency market, exchange rate risk, capital market, central banks.

1. Introduction

Exchange rate instability is a natural feature of the economy regardless of the degree of openness, being a factor of broad involvement and impact on almost every sector. A special feature of this phenomenon is the need to monitor whether its size does not

pose an excessive threat. It is difficult to determine a fixed size of volatility, the achievement of which will provide an undoubted signal for intervention. In practice, one has to focus more often on the need to endure this phenomenon, which is rarely a threat to all areas of the economy. Usually this is a situation requiring tolerance of volatility interactions generated by external and internal factors, but recent years have brought a significant drop in currency volatility. The Polish zloty in relation to the main international currencies also contributed to this trend.

In the Annual Global CEO Survey 2010 report, entrepreneurs indicated currency fluctuations as one of the key risk factors, definitely more important than fluctuations in the prices of other major assets. This is because they are considered by managers to be particularly difficult to predict, and therefore are an important risk factor (PricewaterhouseCoopers, 2010). Frequent appreciation pressure associated with the Balassa-Samuelson effect also influenced the frequent strengthening of the Polish zloty (Narodowy Bank Polski, 2009, p. 4). Negative effects of exchange rate fluctuations on certain macroeconomic aggregates have been proven (Demir, 2010). For a set of developing or emerging economies, there is evidence that the increase in volatility reduces the volume of exports (2000-2011), this was particularly evident during the 2008 crisis (cf. Vieira and MacDonald, 2016). The presence of exchange rate volatility has an indirect impact on economic growth by affecting key determinants of economic activity (Barguellil, Ben-Salha, and Zmami, 2018, p. 1305). For the 2002-2016 trial period a negative relationship between the exchange rate movements and the value of joint-stock companies was found. The highest exposure is observed in Hungary and the Czech Republic. A positive trend can be seen compared to the pre-crisis and post-crisis periods (Simakova, 2017). The exchange rate is a powerful instrument by which trade imbalances can be reduced when the economic environment is stable (Rajković, Bjelić, Jaćimović, and Verbič, 2020, p. 195). During the crisis, national authorities had limited possibilities of applying the exchange rate (Schiliro, 2017). The value growth of foreign currencies has continued in the long term relative to the local currency, which has an inflationary impact on domestic prices through the import channel. This is obtained through the effect of switching from exchange rates to domestic inflation. Since these countries are heavily dependent on imports, their local currency depreciates, raising the price of imported goods, and then the increase in prices of imported goods is reflected in domestic prices (Şen, Kaya, Kaptan, and Cömert, 2019, p. 24).

This article sets the goal of comparing the volatility of the Polish zloty against major international currencies. Two periods were analysed (the first is 2004-2010, the second is 2011-2019 and the comparison covers the currencies of countries in the close vicinity of Poland). However, it should be noted that several of these countries switched to the euro, which limited the scope of the comparison of volatility.

2. Volatility of the Polish zloty against the euro, US dollar, British pound and Swiss franc

The decrease in the number of national currencies in Central and Eastern Europe by the transition to a single currency significantly affected the region's exchange rate volatility. The move away from national currency significantly reduced the importance of local factors affecting the exchange rate and thus reduced the number of currency regimes. Therefore, countries with neighbours using the euro have become more closely involved in the global interaction process, as the euro as the currency of some new member states is related to other international currencies. As a result, investors must perceive the exchange rate of the single currency differently than they do for any single country.

Exchange rate volatility was calculated based on the standard deviation of the twenty-day moving average (by market days). The annual minima and maxima of variability are indicated, calculated as the average of returns from the time series of rates, then the square deviation from the average for each of the returns, then the average of the square deviations, adding them together and dividing by $n - 1$ (in our case $21 - 1 = 20$) for the month. The authors divided them by n – 1 instead of n to calculate the standard deviation of the sample (estimating the standard deviation from the sample). The maxima and minima of variability are one-day values (Starnes and Tabor, 2018, p. 140).

Tables 1a and 1b show the PLN exchange rate against the euro, pound sterling, US dollar, Swiss franc. It covers the time series from Poland's accession to the European Union (2004) to the end of 2010 (Table 1a) and the period 2011-2019 (Table 1b). Both tables in date columns contain double rows, every first row is for "exchange rate" and every second row is for "volatility".

As Table 1a shows, Poland's accession to the EU structures was accompanied by an increase in the average exchange rate to 4.53 PLN against the euro. In 2008, when the crisis occurred, there was an extreme change and the average value of the euro was only 3.52 PLN (the temporary minimum was 3.21 PLN). Significant fluctuations occurred shortly before the crisis in 2007, and already in 2009 volatility assumed an average maximum value of 13.23%, and temporarily even 22.16%.

In relation to the USD, the average exchange rate minimum is 2.41 PLN in 2008, and the highest level is 3.65 PLN in 2004. It is worth noting that the exchange rate fluctuations of PLN against the euro were accompanied by corresponding changes against the USD. This consisted in the fact that the accession of new member states to the EU was associated with a capital shift in the currency turnover from the dollar to the so-called common money (the volatility index reached as much as 42% in 2008).

The pound, however, had the largest spread (the highest value was 7.34 PLN and a minimum of 4.05 PLN). However, the highest volatility exceeded even 32% in 2008.

Table 1a. Average, minimum and maximum rates of the exchange rate and its volatility for EURPLN, USDPLN, GBPPLN, CHFPLN (2004-2010)

	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
	EURPLN			USDPLN			GBPPLN			CHFPLN		
2004 exR/V	4.53	4.06	4.91	3.65	2.98	4.06	6.69	5.74	7.34	2.94	2.63	3.12
	8.52%	5.37%	13.07%	11.31%	8.08%	14.55%	9.50%	6.16%	12.49%	9.50%	6.05%	11.48%
2005 exR/V	4.03	3.83	4.3	3.24	2.92	3.45	5.89	5.59	6.36	2.6	2.45	2.79
	8.97%	6.14%	11.52%	13.00%	9.72%	16.62%	10.32%	8.06%	12.27%	9.63%	7.25%	12.29%
2006 exR/V	3.91	3.77	4.13	3.11	2.86	3.29	5.72	5.48	5.98	2.48	2.37	2.63
	7.76%	5.89%	10.07%	9.30%	5.03%	13.03%	7.92%	4.11%	11.84%	8.25%	4.58%	12.64%
2007 exR/V	3.79	3.57	3.95	2.77	2.43	3.05	5.54	4.89	5.98	2.31	2.15	2.45
	6.58%	5.16%	8.67%	8.30%	4.54%	10.69%	8.10%	4.19%	10.86%	8.16%	4.67%	10.70%
2008 exR/V	3.52	3.21	4.13	2.41	2.03	3.1	4.43	4.05	4.94	2.22	1.97	2.77
	11.09%	6.77%	27.14%	17.37%	8.14%	41.95%	14.97%	7.79%	32.39%	16.09%	8.12%	38.03%
2009 exR/V	4.34	3.98	4.87	3.12	2.72	3.88	4.87	4.31	5.52	2.87	2.65	3.31
	13.23%	8.19%	22.16%	20.85%	12.84%	31.13%	18.73%	10.56%	29.51%	18.96%	9.60%	31.52%
2010 exR/V	4	3.84	4.2	3.02	2.75	3.49	4.67	4.26	5.14	2.9	2.65	3.19
	10.02%	7.07%	17.59%	17.10%	10.93%	28.06%	15.01%	7.64%	22.55%	14.75%	7.89%	22.35%

exR – exchange rates, min and max are highlighted, V – volatility.

Source: own calculations (Narodowy Bank Polski [NBP], 2020).

Table 1b. Average, minimum and maximum rates of the exchange rate and its volatility for EURPLN, USDPLN, GBPPLN, CHFPLN (2011-2019)

	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
	USDPLN			EURPLN			CHFPLN			GBPPLN		
2011 exR/V	2.96	2.64	3.51	4.12	3.84	4.56	3.35	2.97	4.04	4.75	4.36	5.42
	2.15%	0.82%	5.29%	1.20%	0.48%	2.79%	2.05%	0.92%	6.16%	1.63%	0.61%	3.34%
2012 exR/V	3.25	3.06	3.56	4.18	4.04	4.50	3.47	3.34	3.70	5.15	4.87	5.50
	1.74%	0.77%	4.41%	1.04%	0.49%	2.78%	1.06%	0.51%	2.54%	1.38%	0.70%	3.17%
2013 exR/V	3.16	3.00	3.38	4.19	4.07	4.35	3.41	3.30	3.55	4.94	4.74	5.12
	1.31%	0.60%	2.32%	0.68%	0.24%	1.33%	0.82%	0.33%	1.98%	1.09%	0.67%	1.71%
2014 exR/V	3.15	3.00	3.59	4.18	4.09	4.37	3.44	3.35	3.64	5.19	4.97	5.58
	1.07%	0.32%	3.54%	0.61%	0.24%	1.55%	1.24%	0.27%	8.78%	0.84%	0.38%	2.26%
2015 exR/V	3.77	3.53	4.04	4.18	3.99	4.37	3.92	3.55	4.34	5.76	5.44	6.09
	1.52%	0.77%	2.57%	0.89%	0.38%	2.10%	1.13%	0.31%	6.78%	1.26%	0.48%	2.06%
2016 exR/V	3.94	3.72	4.25	4.36	4.24	4.50	4.00	3.88	4.17	5.34	4.70	5.91
	1.52%	0.69%	2.98%	0.87%	0.40%	1.47%	0.92%	0.41%	1.78%	2.08%	0.98%	3.78%
2017 exR/V	3.77	3.45	4.22	4.26	4.16	4.41	3.83	3.55	4.12	4.86	4.59	5.18
	1.21%	0.67%	2.27%	0.51%	0.27%	0.86%	0.82%	0.32%	1.68%	1.06%	0.51%	2.54%
2018 exR/V	3.61	3.32	3.84	4.26	4.13	4.40	3.69	3.47	3.85	4.82	4.65	4.98
	1.06%	0.38%	2.99%	0.49%	0.13%	1.17%	0.90%	0.32%	2.33%	0.86%	0.48%	1.47%
2019 exR/V	3.84	3.72	4.02	4.30	4.24	4.39	3.86	3.74	4.04	4.90	4.64	5.16
	0.84%	0.30%	1.77%	0.46%	0.17%	1.07%	0.74%	0.24%	1.72%	0.92%	0.40%	1.59%

exR – exchange rates, min and max are highlighted, V – volatility.

Source: own calculations (NBP, 2020).

In the case of CHF, despite lower exchange rates (1.97 PLN in 2008 and 2.94 PLN in 2004), the volatility was higher than against the pound and amounted to as much as 38.03% in 2009 (it averaged 18.96% in 2009). This was the result of crisis--related turbulence, leading to the largest credit crisis in mortgages in Poland, for which the Swiss franc was over-indebted with increasing exchange rate risk.

The financial crisis of that time had such an international impact that EU assistance funds did not prove to be sufficient strengthening for the new member states, which was associated with large financial transfers between countries, strongly changing the exchange rates.

A comparison of both periods of PLN exchange rate fluctuations against major world currencies indicates that in 2011-2019 (Table 1b) the problem studied was much smaller (earlier it was two-digit, then it became one-digit). The highest volatility occurred against the Swiss franc (8.78% in 2014) and the lowest against the euro (0.13% in 2018). It is worth noting that relative to this currency, the maximum volatility was only 0.49% in 2012 (for EURPLN the highest exchange rate was 4.56 and the lowest 3.89). In relation to GBP, the average minimum volatility was 0.84% (the minimum of minimum 0.38%) in 2014, and the maximum average averaged 2.0% (highest maximum 3.78%) in 2016.

In Figure 1a there are four time series presenting the exchange rate fluctuations of EURPLN, USDPLN, GBPPLN, CHFPLN. In the period 2004-2010, the Polish zloty showed increased volatility against major world currencies with significant

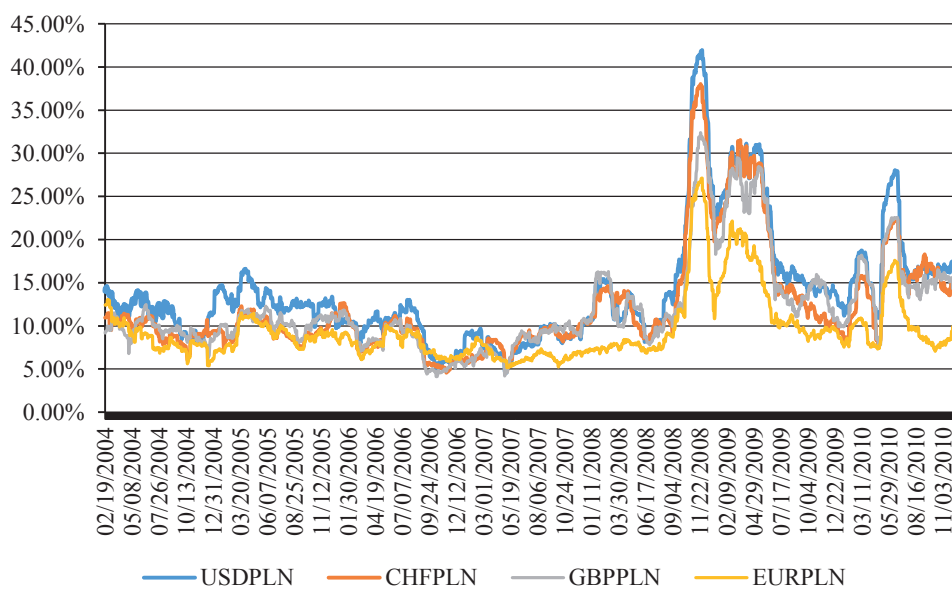

Fig. 1a. The currency pairs volatility USDPLN, CHFPLN, GBPPLN, EURPLN (2004-2010 period)

Source: own calculations (NBP, 2020).

intensities in some years (25-42%). The most stable exchange rate was shown against the euro and it was only the period of global crisis that significantly affected the exchange rate stability for this pair. The largest disturbances occurred against the US dollar, which also increased dramatically during the crisis.

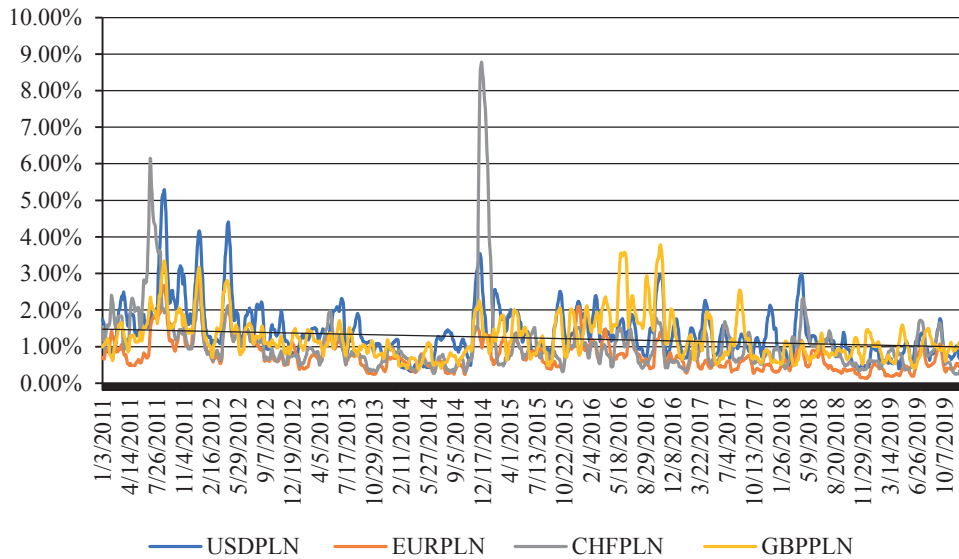

Fig. 1b. The currency pairs volatility USDPLN, CHFPLN, GBPPLN, EURPLN (2011-2019)

Source: own calculations (NBP, 2020).

In Figure 1b, the volatility is significantly lower in the entire 2011-2019 period than in 2004-2010. It should be noted that the 5% volatility level was previously the lower limit, and in the new period a 2% level can be more often indicated as the upper threshold with temporary violations (only exceptional deviations occurred). In the case of USDPLN, minimum exceedances of 4% occurred, which is several times smaller than in previous years. A specific exception in 2015 was the CHFPLN, for which volatility suddenly increased to almost 9%, but even this amount is incidental compared to the previous period, during which it was regularly achieved.

It can therefore be concluded that after the crisis there was a downward trend in the volatility of PLN against major global currencies. This resulted, for example, from the continuation of financing activities aimed at reducing development disparities between Poland and the Old EU. It is worth noting that after 2011 the attitude towards joining the euro area was still strongly maintained. This means that the focus has been on measures to meet the nominal convergence criteria (Maastricht Treaty) and attempts to maintain them. The latter issue in particular was to play a role in the context of exchange rate stabilization according to the criterion of joining and maintaining the ERMII system.

3. Central and Eastern European currencies volatility against the euro

It is worth noting that between the data from the period 2004-2010 (Table 2a, Table 2b) and 2011-2019 (Table 2c) there is a big difference in the composition of currencies. This results from the fact that some of the new EU member states have changed over to the euro (Slovakia, Slovenia, Lithuania, Latvia, and Estonia). Therefore, for these countries, since then the volatility of the euro against other currencies cannot be directly treated as a natural phenomenon for national currency due to the nature of the single currency area (currently 19 members, and Lithuania was the last country to give up its national currency completely in 2015). The Bulgarian Lev (BGN) was left out entirely in the period 2011-2019, as the exchange rate against the euro (1.956) was kept at a constant level.

In the period 2004-2010 (Table 2a), in relation to other currencies of the region, PLN showed increased volatility in relation to the euro (averaged maximum of 13.23% and maximum of 27.14%). Slovenia is a special example of this phenomenon (a variation over 38%), however these values should be treated as expected, as with the introduction of the national currency into the ERMII system strong speculative attacks occur.

Table 2b shows that building a currency regime based on subordination to the German mark as the leading future eurozone currency had a reducing effect on exchange rate dynamics (e.g. Bulgaria, the Czech Republic, Estonia and Lithuania). For example, from the perspective of long-term volatility, it is worth pointing out that the National Bank of Poland has completely abandoned its impact on the exchange rate of the Polish zloty. The Czech National Bank, on the other hand, preferred to use a managed floating exchange rate, subordinating its currency to the German mark since the early 1990s. This means a longer period of development of stability for this money, but it was also more conducive to reducing volatility in the long term (Table 2b). Low inflation in the 1990s was also affected by low volatility.

Among the other selected currencies (Table 2b), the Ukrainian hryvnia suffered the problem of extreme volatility of the national currency (in 2009 maximum of 70% and averaged 28.4%), moreover, in 2006-2009 the maxima did not fall below 33%. However, the case of the Ukrainian hryvnia finds its causes primarily in internal problems. As shown in Table 2c in this case the maximum volatility did not exceed 28% in 2014, and the annual average was 6.51% in 2015. In both cases, these are significantly lower maximum values compared to the previous period (up to 70% in 2009). Moreover, for the currency of Ukraine they are only part of the previous values, despite the very serious problems of this country, which strongly subject it to the crisis.

Figure 2a shows that EURPLN and EURHUF stand out in terms of high volatility, while EURCZK turns out to be the most stable currency pair in the examined period. Even at the peak of the crisis, its volatility did not exceed 15%, when at that time

Table 2a. The average, minimum and maximum rates of the exchange rate and its volatility of the currencies of Latvian lats (LVL), Romanian leu (RON), Slovak koruna (SKK)), Slovenia tolar (SIT) (2004-2010)

		2004		2005		2006		2007		2008		2009		2010	
		exR	Volatil	exR	Volatil	exR	Volatil	exR	Volatil	exR	Volatil	exR	Volatil	exR	Volatil
EURLVL	Average	0.67	6.60%	0.7	3.48%	0.7	9.19%	0.7	11.26%	0.71	10.39%	0.71	9.85%	0.71	11.44%
	min	0.65	3.69%	0.69	0.82%	0.69	5.06%	0.7	6.35%	0.69	7.21%	0.7	5.31%	0.7	6.77%
	max	0.7	12.76%	0.71	9.29%	0.71	14.02%	0.72	14.08%	0.72	15.67%	0.73	14.61%	0.72	14.35%
EURRON	Average	4.15	13.26%	3.65	13.69%	3.54	7.27%	3.35	7.01%	3.7	11.58%	4.25	7.96%	4.22	6.78%
	min	3.89	7.16%	3.39	3.11%	3.35	4.66%	3.13	3.97%	3.5	5.97%	4.01	3.83%	4.07	3.75%
	max	4.28	20.06%	4.03	27.37%	3.7	12.21%	3.65	12.22%	4.04	21.74%	4.36	15.77%	4.39	9.19%
EURSKK	Average	40.11	4.07%	38.65	5.53%	37.27	5.78%	33.85	7.52%	31.39	9.56%	30.13	0.00%	30.13	0.00%
	min	38.66	1.71%	37.61	2.60%	34.32	3.63%	32.92	5.13%	30.05	5.08%	30.13	0.00%	30.13	0.00%
	max	41.28	7.67%	39.93	10.76%	39.1	12.82%	35.41	10.71%	34.05	12.24%	30.13	0.00%	30.13	0.00%
EURSIT	Average	242.9	13.22%	240.4	7.38%	239.8	10.58%	239.8	0.24%	239.8	0.00%	239.8	0.00%	239.8	0.00%
	min	230.1	8.70%	232.7	1.21%	217.3	1.71%	217.3	0.00%	217.3	0.00%	239.8	0.00%	239.8	0.00%
	max	248.9	24.82%	246.6	20.85%	243.2	38.32%	243.2	2.99%	243.2	0.00%	239.8	0.00%	239.8	0.00%
EURHUF	Average	252.1	6.64%	248.5	5.43%	264.9	7.70%	252.1	7.43%	252.4	11.51%	281.2	12.33%	275.9	9.94%
	min	244.2	3.92%	242.1	2.87%	250	4.56%	245.6	5.38%	229.4	5.73%	265.1	6.22%	262.1	6.83%
	max	269.8	11.47%	257.4	7.73%	284.6	11.22%	260.6	10.32%	281.9	26.62%	316.3	19.28%	290.3	17.52%

exR – exchange rates, min and max are highlighted, volatil – volatility %.

Source: own calculations (Oanda, 2020).

Table 2b. Average, minimum and maximum rates of the exchange rate and its volatility of the currencies of Bulgarian lev (BGN), Czech koruna (CZK)), Estonian kroon (EEK)), Lithuanian litas (LTL) (2004-2010)

		2004		2005		2006		2007		2008		2009		2010	
		exR	Volatil	exR	Volatil	exR	Volatil	exR	Volatil	exR	Volatil	exR	Volatil	exR	Volatil
EURBGN	Average	1.96	9.11%	1.96	9.78%	1.97	6.07%	1.96	5.22%	1.96	7.22%	1.96	7.14%	1.96	6.42%
	Min	1.91	3.11%	1.92	5.84%	1.93	3.23%	1.95	3.79%	1.94	4.37%	1.94	4.39%	1.93	4.63%
	Max	2.02	13.57%	1.98	12.75%	2.01	10.88%	1.98	7.06%	1.99	11.04%	1.99	10.99%	1.98	8.72%
EURCZK	Average	31.95	6.37%	29.84	5.44%	28.37	3.22%	27.78	3.58%	24.99	7.74%	26.48	7.88%	25.32	4.68%
	Min	30.49	4.11%	28.92	3.46%	27.53	2.20%	26.04	2.13%	23.03	3.98%	25.15	4.16%	24.48	2.50%
	Max	33.51	9.73%	30.65	6.97%	29.14	4.43%	28.8	5.58%	26.62	15.43%	29.38	15.02%	26.45	8.76%
EUREEK	Average	15.65	0.00%	15.65	0.00%	15.65	0.00%	15.65	0.00%	15.65	0.00%	15.65	0.00%	15.65	0.00%
	min/max	15.65	0.00%	15.65	0.00%	15.65	0.00%	15.65	0.00%	15.65	0.00%	15.65	0.00%	15.65	0.00%
EURLTL	Average	3.45	3.81%	3.45	2.72%	3.46	8.47%	3.46	10.05%	3.48	9.96%	3.47	10.76%	3.46	13.15%
	Min	3.39	1.46%	3.43	0.68%	3.4	4.59%	3.44	6.07%	3.44	6.42%	3.43	7.21%	3.41	7.12%
	Max	3.5	12.60%	3.5	9.10%	3.51	13.49%	3.55	12.50%	3.52	13.96%	3.55	14.49%	3.52	16.32%
EURUAH	Average	6.8	11.60%	6.43	16.42%	6.56	16.87%	7.09	6.45%	7.83	17.18%	11.36	28.40%	10.69	14.39%
	Min	6.48	7.12%	5.87	8.03%	5.98	3.59%	6.8	4.43%	6.83	6.34%	9.97	8.46%	9.6	10.60%
	Max	7.43	19.79%	7.4	33.41%	7.02	48.11%	7.65	9.71%	13.52	58.15%	12.85	70.08%	11.94	18.42%

exR – exchange rates, min and max are highlighted, Volatil – volatility.

Source: own calculations (Oanda, 2020).

Table 2c. Average, minimum and maximum exchange rates for selected currencies (2011-2019)

		EURON		EURUAH		EURHUF		EURCZK	
2011	Average	4.24	0.59%	11.11	1.44%	279.07	1.36%	24.54	0.72%
	Min	4.07	0.13%	10.28	0.73%	262.33	0.42%	23.96	0.39%
	Max	4.37	1.14%	11.87	2.84%	316.8	3.35%	26.01	1.57%
2012	Average	4.46	0.63%	10.41	1.09%	288.9	1.3%	25.11	0.76%
	Min	4.33	0.12%	9.78	0.64%	275.19	0.48%	24.31	0.34%
	Max	4.63	1.47%	10.89	2.18%	320.42	3.36%	25.86	1.28%
2013	Average	4.42	0.58%	10.88	1.35%	296.52	0.97%	25.95	0.66%
	Min	4.3	0.18%	10.4	0.42%	286.51	0.44%	25.05	0.22%
	Max	4.54	1.79%	11.61	8.48%	306.59	2.01%	27.67	2.75%
2014	Average	4.44	0.38%	16.44	6.51%	308.34	0.81%	27.51	0.3%
	Min	4.39	0.11%	11.54	0.78%	296.92	0.32%	27.28	0.04%
	Max	4.54	0.81%	28.42	27.96%	317.57	1.62%	27.92	0.7%
2015	Average	4.45	0.38%	25.25	3.21%	309.74	0.75%	27.28	0.24%
	Min	4.39	0.08%	22.79	1.14%	296.53	0.38%	27.02	0.03%
	Max	4.54	0.75%	38.09	14.67%	322.67	1.62%	28.31	0.76%
2016	Average	4.49	0.31%	28.51	1.51%	311.32	0.58%	27.03	0.05%
	Min	4.44	0.11%	27.04	0.69%	303.95	0.22%	27.01	0.01%
	Max	4.54	0.65%	30.18	3.13%	318.05	0.96%	27.17	0.15%
2017	Average	4.57	0.29%	30.89	1.41%	309.23	0.5%	26.33	0.37%
	Min	4.49	0.11%	28.39	0.41%	302.69	0.26%	25.43	0.02%
	Max	4.67	0.55%	35.71	3.37%	314.92	0.9%	27.15	0.77%
2018	Average	**4.66**	0.26%	31.59	1.2%	318.85	0.53%	25.64	0.38%
	Min	4.62	0.09%	29.64	0.51%	308.22	0.24%	25.2	0.17%
	Max	4.73	0.95%	33.14	2.2%	330.11	1.15%	26.11	0.63%
2019	Average	4.75	0.27%	28.26	1.64%	325.38	0.61%	25.67	0.32%
	Min	4.71	0.09%	25.75	0.97%	313.08	0.32%	25.41	0.1%
	Max	4.8	0.82%	31.11	3.09%	336.34	0.96%	25.95	0.58%

Min and max are highlighted.

Source: own calculations (Oanda, 2020).

EURPLN and EURHUF reached over 25%. From April 2004 to December 2005, one could notice relative stabilization on the EURCZK, EURHUF, EURLIT pairs, but unfortunately the Polish currency turned out to be an exception. Over the next few years, one can see the increase in fluctuation in all the pairs in Figure 2a, but after the crisis the most noticeable decrease in volatility occurred for EURCZK. At the same time, it can be seen that during the peak volatility of other EURLIT pairs, it showed very high stability, similar to that before the crisis. It can be pointed out here that the Lithuanian currency system has allowed a high level of security to be maintained in the most difficult period. Unfortunately, later this country was in a much more difficult situation than other new Member States. The volatility of

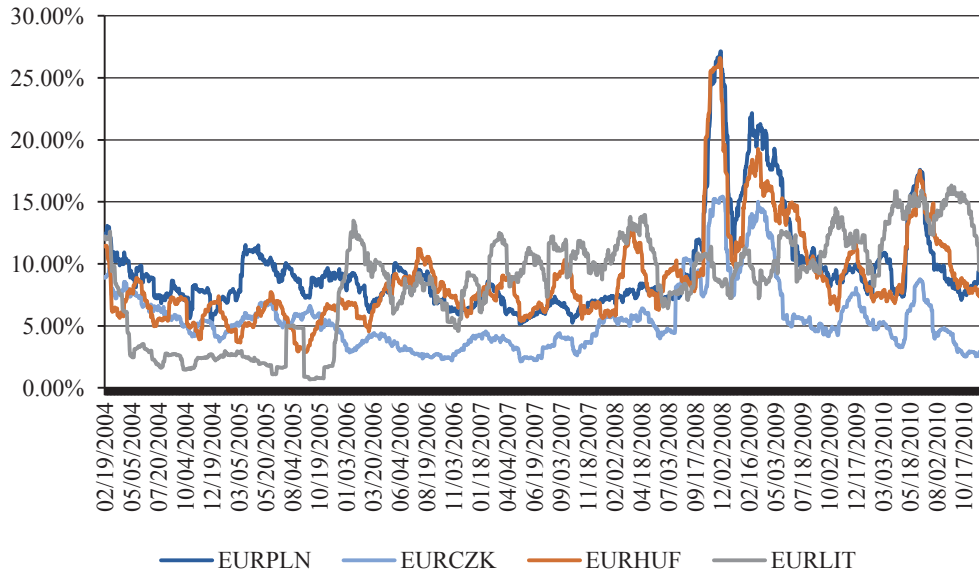

Fig. 2a. The course of exchange rate variability of the Polish zloty, Czech koruna, Hungarian forint and Lithuanian litas (2004-2010)

Source: own calculations (Oanda, 2020).

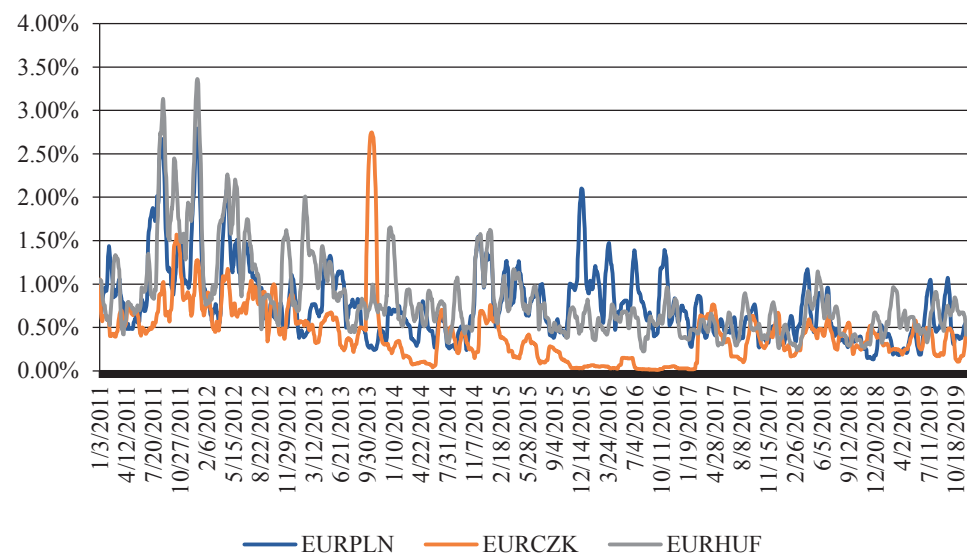

Fig. 2b. The course of exchange rate variability of the Polish zloty, Czech koruna, Hungarian forint and Lithuanian litas (2011-2019)

Source: own calculations (Oanda, 2020).

EURLIT increased significantly, exceeding 15%, i.e. reaching EURPLN and EURHUF levels from February to October 2010.

In the previous period (2004-2010, Figure 2a), volatility ranged from 5% upwards with an upward trend, and in the later period (2011-2019, Figure 2b) the studied phenomenon was definitely below the above level (without exceeding this threshold), but with a downward trend. More specifically (Figure 2b), the course of volatility against the euro on the part of the Polish zloty, Czech koruna and forint remained mainly below 2%.The lowest volatility was mainly achieved by PLN, but the lowest levels were noted in the case of the Czech koruna. Currency pairs incidentally exceeded 2% level, but only the latter currency approached 3.5% briefly.

4. The main reasons for the volatility of Central and Eastern European currencies with the special case of Poland

It is obvious that the reasons for exchange rate changes in an open economy are so numerous that categorizing them alone may not be sufficient for calculation.

It should be emphasized that the accession of Poland and other member states to the EU has formalized their degree of economic openness, raised by accession preparations. In this way, they had to be more affected by exchange rate effects. Therefore, internal factors were not necessarily an indicator of the degree of national currency variability, but rather they were a signal of the direction of changes in value against international currencies, yet the size of the impact was linked to external entities, which were mainly speculative. In addition, the new Member States, due to the less developed financial market, had to tolerate the high volatility of their currencies, often generated outside their territory, for example on the London money market this accounted for as much as 44-51% of PLN trade (Poland was only in third place with an index of 12% (Szmelter, 2017, p. 451)).

It seems that in the first of the analysed periods, from the point of view of broadly understood economic stability, it was important to ensure compliance with nominal convergence requirements. However, it turned out that achieving them even to a greater extent did not translate into lowering the volatility of the Polish zloty against the euro and the US dollar. For example, the reduction of budget problems after 2011 has become an important context.

It should be emphasized that only the circumstance of financial crisis launched extensive stabilization activities, coordinated by many different institutions and bodies. These entities gave a strong signal that they would take all possible anti--crisis measures that did not favour the speculative treatment of countries such as Poland and their currencies. Therefore, there was a significant difference in exchange rate volatility between 2004-2010 and 2011-2019.

In the international environment, the reduction of exchange rate volatility was influenced by measures stabilizing the financial system, coordination of central bank

activities and stimulation of economic activity. For the EU, the newly created (in May 2010) European Stability Mechanism (with EUR 750 billion) has played a role by guaranteeing assistance to countries threatened by insolvency (Vasylchyshyn, 2018, p. 53).

Strengthening the financial supervision in the EU and the establishment of the European System of Financial Supervision (ESFS) exercising the so-called micro--prudential supervision. The Financial Stability Board was appointed (in place of the Financial Stability Forum), which in cooperation with the IMF oversees the state of global finances, including monitoring the implementation of new regulations, identifying threats to financial stability and developing actions to prevent them. The G-20 with the European Union has deepened its focus on influencing the global economy. The OECD has also increased its involvement in stabilization activities (OECD, 2019, p. 8). There have also been activities of the European Central Bank to defend against the systemic risk of liquidity loss by Member State banks and to ensure the availability of loans for companies and households on affordable terms.

As for internal actions in Poland, their implementation was the result of international coordination for the reintegration of financial markets, and not an independent action to defend national interests. The Polish Financial Supervision Authority (Komisja Nadzoru Finansowego) introduced regulations limiting the granting of foreign currency loans (in 2015 the amount of additional capital requirement for the risk associated with the currency loan portfolio was set), as a result of which in 2011 the so-called Antispreading Act obliging banks to enable borrowers to pay back the loan directly in the currency in which the loan was granted, at no additional charge. The currency risk incurred by the customer was further limited by the provisions of the Mortgage Loan Act and the supervision of mortgage brokers and agents of 2017 and Recommendations S and T of good practices in the management of credit exposures (Komisja Nadzoru Finansowego, 2020).

5. Conclusion

Characteristic levels of variation can be distinguished in both studied periods. The more so that this phenomenon cannot be eliminated entirely, because in a way other mechanisms take over them, increasing in some euro area countries, e.g. budget deficit problems in some years. On the other hand, too rigorous attempts to commonly limit variability turn out to be impermanent, as evidenced by the failures of e.g. the Breton Woods system. Unfortunately, in the period 2004-2010 Poland, in comparison to the countries of our region, was seen as the infamous leader conducive to attracting many speculators. Currently, the discussion about doubts about market interference is heading towards periodic stimulation, however the scale of the sums of money that can be used for these purposes boils down to overdrive of entire markets.

This problem had to be faced for quite a long time when financial markets completely dominated the price formation in other markets. The occurrence of long

periods of undervaluation and overvaluation favoured strong capital flows. This resulted, for example, in the attitude of exporters to seeking contracts that would allow them to hedge unfavourable exchange rate fluctuations, however, the lack of adequate supervision over the financial market led to the conclusion of harmful option contracts (Jurek, 2007, p. 27).

That is why in the period 2004-2010 the Polish economy attracted various impacts in monetary terms. The great problem of constant destabilization due to the financial crisis is evidenced by the need for a very large change in the conditions of money functioning in the form of decisions to introduce zero interest rates, and then even negative ones, e.g. by the Central Bank of Sweden in 2009, and the European Central Bank in 2014 (Heider, Saidi, and Schepens, 2018, p. 4).

Unfortunately, external entities for too long included Poland in the so-called emerging markets. It was not until 2018 that Russell, the global supplier of FTSE indexes, reclassified Poland from the status of an emerging market to that of a developed market, effective from September 24. Poland is currently classified as one of the 25 most advanced world economies, a list of countries including the United States, Great Britain, Germany, France, Japan, Australia and others. Moreover, Poland is the first country in almost a decade and the first in Central and Eastern Europe to be upgraded to developed market status (FTSE Russell, 2020, pp. 41-42).

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ZMIENNOŚĆ ZŁOTEGO WZGLĘDEM GŁÓWNYCH WALUT MIĘDZYNARODOWYCH W PORÓWNANIU Z INNYMI WALUTAMI EUROPY ŚRODKOWEJ I WSCHODNIEJ W LATACH 2004-2010 I 2011-2019

Streszczenie: Celem artykułu jest porównanie zmienności kursu złotego i kilku innych walut (głównie w regionie Europy Środkowej) w stosunku do głównych walut międzynarodowych, takich jak dolar amerykański, funt brytyjski, euro i frank szwajcarski przed kryzysem i po nim – w latach 2004-2010 i 2011-2019. Analizy dokonano przez porównanie obu tych okresów. Zmienność kursu walutowego obliczono jako odchylenie standardowe dwudziestodniowej średniej kroczącej (według dni rynkowych). Dzięki szeroko podejmowanym działaniom niwelującym przyczyny i skutki kryzysu finansowego (rok 2008) zmienność kursów walutowych staje się znacznie niższa w drugim badanym okresie, co objęło kraje Unii Europejskiej, w tym Polskę.

Słowa kluczowe: zmienność kursu walutowego, rynek walutowy, ryzyko kursowe, rynek kapitałowy, banki centralne.