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INFLATION CONVERGENCE IN NEW EMU MEMBERS

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Abstract: *The European central bank is responsible for managing the common monetary policy for 19 countries that are geographically and economically very heterogeneous. The question is whether the common monetary policy suits all of them. We focused on countries that joined the Monetary union since 2007 (new members), to understand if they managed to "fit in". Those countries made impressive progress in macroeconomic and price stability, but is it enough to simply enjoy net benefits from EMU membership? After analyzing statistical characteristics of their inflation processes since 1997 (mean and median inflation, standard deviation and coefficient of variations), we wanted to understand if their inflation rates have converged towards EMU average inflation rate and if they tend to form a more homogeneous group of countries. We conducted a unit root test to statistically check the significance of the convergence process, and analyzed autocorrelation coefficients of inflation rates to assess the influence of the common monetary policy on the persistence of inflation. The results did not statistically confirm the existence of absolute convergence of inflation rates in New EMU members.*

Keywords: *inflation convergence / European monetary union / new EMU members / inflation processes / inflation persistence.*

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INTRODUCTION

The European monetary union was founded in January 1999, when the European central bank took the responsibility for managing the common monetary policy for 11 countries that fulfilled the defined Maastricht convergence criteria (Germany, France, Italy, Spain, Portugal, Finland, Austria, the Netherlands, Luxemburg, Belgium and Ireland). Greece was not ready in 1999, but joined two years later, when it managed to satisfy the Maastricht criteria. These are 12 old members and very often when analyzing convergence process in the monetary union, especially in the light of a debate between the old and new theory of optimal currency area (OCA), researchers focus on the economic parameters and the convergence indicators for those countries. The old OCA theory defined conditions that individual countries must satisfy in order to have higher benefits than costs of membership in a monetary union in the long-term. According to the new OCA theory, the environment of monetary union will facilitate the process of convergence between members' economic performances, even though the sufficient level of convergence did not exist prior to the establishment of a monetary union. As a result of compromise between these two views, convergence criteria were defined, as well as the term when a third phase of monetary unification begins. These criteria relate to the level of inflation rate, long-term interest rate, participation in the mechanism of foreign exchange rates, the level of budget deficit and public debt.

The process of the monetary union enlargement started in 2007, when Slovenia joined the Eurozone. Cyprus and Malta became members in the following year, Slovakia in 2009, Estonia joined in 2011, then Latvia in 2014 and Lithuania in 2015. It is expected that Croatia will become the 20th member of the European monetary union in 2023. So EMU currently has 19 members. These are countries which are very different in geographical and economic size and structure, which applied different economic growth models; they have different political structures and different fiscal policies. Thus, the question is whether these countries are similar enough to share a common monetary policy, whether the benefits of membership are greater than costs for all of them? So, the question is whether the views of the new OCA theory were justified, and if the environment of a monetary union (larger intra-EMU trade, financial integration and increased synchronization of economic cycles) indeed facilitated the convergence process. Another possibility is that Germany

and the old OCA theory were right, so that it was necessary to satisfy the defined conditions before entering the monetary union. Was it right to insist on the long process of economic performances convergence as a prerequisite for the successful membership and smoother conduct of the common monetary policy? The analysis is especially important considering that some EU members are trying to become members of the monetary union. The question is whether it is better to rush to became a member as soon as possible, at any costs, which is politically popular, or to ensure the necessary preconditions and then enjoy the long-term benefits of membership (but probably with different government, because structural reforms are not politically popular)?

We will test the hypothesis that the monetary union environment, common monetary policy and joint currency contributed to the convergence of the inflation rates of new members (Slovenia, Cyprus, Malta, Slovakia, Estonia, Latvia and Lithuania) towards the average EMU rate. New members went through a long and complex process of transformation from centrally planned economies towards free market and market based economies, undertaking serious structural economical and political reforms. That process was unequivocally successful, having in mind their economic performances before transition and now, but did it prepare them for successful membership in the monetary union? Were they prepared for the common monetary policy and the single currency? The subject of analysis covers several issues: have their inflation rates converged enough, how homogeneous are their inflation processes, as well as whether there was a diminishing dispersion of inflation- around EMU average and around the average of the group. This analysis is also important since events from 2021 and especially 2022 have caused a significant rise in inflation. Although central banks explained that it was transient growth of prices, and ECB even announced that it will not introduce changes in monetary policy, inflation growth seems to be more persistent. The growth of amount of money in circulation since 2008 has been very high (monetary aggregate M2 rose 40% in a number of countries) due to the financial crisis and Covid-19 measures. There has also been a significant increase of prices of oil, gas and food as a consequence of the sanctions introduced to Russia. That led to a significant dispersion of inflation rates in EMU member countries and made the management of the common monetary policy more complicated.

LITERATURE REVIEW

The question of inflation convergence has attracted a lot of attention of researchers, even before the advent of EMU. Authors focused on different issues, they analyzed different time intervals and different groups of countries- the first 12 members, or segmented peripheral and core countries, new member countries, all (or chosen) EMU or EU countries. Different methodology has been used. Very often researchers use different unit-root tests in time series or panel data, or analyze characteristics of distribution of inflation rates; often indicators of beta and sigma convergence are studied. Various measures of inflation dispersion are used, like the spread between the highest and the lowest inflation rates, or the spread between average inflation in three countries with the highest and the lowest inflation rates, weighted or unweighted standard deviations of inflation differentials. Different components of inflation are analyzed, on sectorial or country level. Inflation benchmark could be differently set, based on the Maastricht criteria, inflation rate in Germany as the country with highest monetary stability (and largest economy in Eurozone), ECB target (below but close to 2%), or cross-sectional average. Thus, literature findings also differ. However, such analysis is very important for understanding the potential problems and costs of membership and net benefits, especially having in mind that it is expected that the majority of EU members will adopt the common currency with time. It was expected that the common monetary policy and common currency will facilitate inflation convergence among member countries. The existence of persistent inflation differentials in monetary union is dangerous, while it might impair the management of the common monetary policy. The single interest rate might be too high for countries with a lower-than-average inflation and too low for countries with above-average inflation, leading to a divergence of their business cycles and further inflation divergence.

Very often a distinction is made between absolute and relative convergence. Relative convergence means that inflation differentials converge to some level which is different from zero in the long run. Absolute convergence means that inflation differentials are converging to zero in the long run. Absolute convergence is more desirable, while relative convergence of inflation might indicate the existence of convergence clubs. That is the situation when only countries with similar characteristics converge, which can lead to a polarization (like between

core and peripheral EMU members). Absolute convergence facilitates the common monetary policy (Busetti et al, 2007, p. 6).

Karanasos, Koutroumpis, Karavias, Kartsaklas & Arakelian (2016) studied the convergence of inflation rates of the first 12 EMU member countries in the period 1980-2013, to understand if the introduction of euro made any significant difference, facilitating the decrease and the convergence of member countries' inflation rates. Since EMU countries are heterogeneous, there might be convergence of inflation rates among specific groups, but not all member countries. Authors discovered that for some countries inflation differentials are stationary both before and after the advent of euro, so that there are some convergence clubs of countries. For the pre-euro period there were three convergence clubs: Germany and France, the Netherlands and Finland, and Austria, Belgium and Luxemburg. After 1997, they found two convergence clubs: Germany, Austria, Belgium and Luxemburg on one side and France and Finland on the other side. For remaining EMU members, authors found the evidence of divergence.

Busetti, Forni, Harvey & Venditti (2007) applied unit-root tests on inflation differentials to test the hypothesis of absolute convergence in EMU countries. They found evidence for the convergence in the period 1980-1997. According to them, the exchange rate mechanism significantly facilitated the convergence process. However, authors observed diverging behavior of inflation rates in the following period. They also found two stability cluster clubs: low inflation countries: Germany, Austria, France, Belgium and Finland on one side, and higher inflation countries: Spain, Portugal, Ireland, Greece and the Netherlands on the other side. Italy is found to be somewhere between those two clusters. They concluded that although the common monetary policy was very successful in stabilizing individual inflation rates, there is still some degree of cross-country heterogeneity.

Rutjes (2019) proved that the group of ten Eurozone countries (the first 12 without Austria and Finland) has been in the process of absolute convergence since the introduction of euro. However that does not mean that Eurozone presents an optimal currency area. This issue was especially relevant for the sovereign debt crisis. The crisis revealed the weaknesses of Eurozone and one of the most serious problems of EMU

was vulnerability to asymmetric shocks. That is opposite to one of the main characteristics of OCA. On the other side, Eurozone seems to be successful from a price stability point of view, which is important for the smooth functioning of the monetary union. Absolute inflation convergence might also facilitate future enlargement of euro area and eventually EU. Certainly, inflation convergence is not sufficient. For the decision on EMU enlargement, it is important to understand whether EMU moves towards OCA, as well as whether other convergence criteria have been fulfilled and to implement appropriate policies which will foster this process. Without that, enlargement of suboptimal monetary union would bring further costs of adjustment.

Broz & Kocenda (2017) found evidence for inflation convergence among EU countries for the period 1999-2016. Also, inflation rates of new members seem to be synchronized with rates in old member countries. Financial- and sovereign debt crisis influenced higher convergence for some countries- Italy, Austria, Finland, the Netherlands, Portugal, Latvia and Romania, their inflation rates moved towards cross-sectional average. For other member countries crisis caused some diverging trends- Spain, Slovenia, Luxemburg and Poland. Authors concluded that price oriented monetary policy strategies probably had contributed to inflation convergence. Also they found that ECB monetary policy did not contribute to the divergence of inflation rates in the post-crisis period and that inflation synchronization is not the problem for further enlargement of Eurozone.

Franks, Barkbu, Blavy, Oman & Schoelermann (2018) found strong convergence of inflation rates among the first 12 member countries towards rates in low-inflation countries before the adoption of euro, but in later stages inflation rates did not converge further. That is partially influenced by differences in cyclical positions, while some countries had witnessed a significant rise in economic activity and inflation before the crisis. Spain, Greece, Portugal and Ireland constantly had higher than average inflation rates, which led to real appreciation of their effective exchange rates and the loss of competitiveness. The cumulative effect of small but persistent inflation differentials together with converged nominal interest rates impeded real convergence.

Estrada, Gali & Lopez-Salido (2013) studied the extent of convergence in Eurozone over the period mid 1980s-2012. Authors discovered strong evidence of inflation convergence since the second half of 1980s. However the convergence seems unrelated to monetary union while it occurred in

the most of advanced countries, thanks to monetary policies oriented towards monetary stability, adoption of inflation targeting regimes and central bank independence. Impressive inflation convergence process in EMU occurred until the introduction of euro, but after that inflation differentials remained persistent, causing large cumulative changes in relative prices. However corresponding indicators for other advanced economies had slight increase.

A number of authors focused on core-periphery divergence as a source of instabilities in EMU. Popović (2013) stressed that Eurozone was not an optimal currency area from the very beginning, but it was expected that the common currency and monetary policy will facilitate the convergence of economic performances, including inflation rates. But instead of stabilizing convergence process, EMU witnessed divergence of economic performances and polarization on two groups. The first one consists of richer core countries mostly from Northern Europe, while the second one is composed of poorer peripheral economies, mostly from Southern Europe. Regling, Deroose, Felke & Kutos, (2010) stated that this issue is also relevant for prospect new entrants, which are characterized with large diversity and do not have economic performances in line with the core countries. Since they have a small economic size, we cannot expect sizeable effects on aggregate growth and inflation rates, but they would increase the share of periphery in the membership. Also, they would face pronounced catching up challenges, similar like existing catching-up countries. Anna, Enderlein & Fritz-Vannahme (2015) highlighted the significance of nominal sigma convergence and especially convergence in prices for the stability of Eurozone. According to them, the Maastricht inflation criteria was important as accession criteria, but after the advent of EMU inflation, differentials were ignored, because it was expected that they will not last too long. However they proved to be very persistent, and countries like Greece, Portugal, Ireland and Spain had inflation rates higher than average after joining EMU, while inflation in Germany was below average. Warthmann & Stahl (2016) stressed that the common monetary policy could not be managed smoothly in current core-periphery division. Monetary union influenced macroeconomic imbalances between and within core and periphery countries imposing further challenges for ECB, while those countries need different

monetary policy. ECB was criticized that it managed monetary policy too loose during crisis period to support struggle of peripheral countries to recover. But that had a negative impact on domestic savings, creation of price bubbles and the quantity of money in the circulation in the core countries. Bošković, Popović & Njegovan (2013) found no statistically significant differences among the core countries inflation rates, but inflation differentials among the peripheral countries have statistically significant both time and individual effects.

METHODOLOGY

Theoretically speaking, the best scenario for the new EMU members (as well as the old members) would be the full convergence of inflation. That would mean that their inflation rates are very close, in line with the ECB goal (inflation below but close to 2% in medium term), very similar transmission process of inflation shocks and also of the measures of ECB, as well as high correlation of inflation rates (and business cycles). Such a situation would ease the management of the common monetary policy, while the needs of member countries would be very similar. Thus they would require the same or a very similar response of monetary policy to changes in economic environment and goals. If in opposite case, there are significant and persistent inflation differentials or if member countries are faced with asymmetric shocks, that might affect them differently. That would cause problems with synchronization of inflation, income and unemployment, and thus would require different response of monetary policy. In monetary union, the room for maneuver for economic policy interventions is pretty cramped, since countries do not have independent monetary policy- interest rate and exchange rate policy, and there are rules related to the management of fiscal policy. And although only one of the Maastricht criteria focuses explicitly on inflation rates, other criteria are linked to it directly or indirectly via inflation expectations.

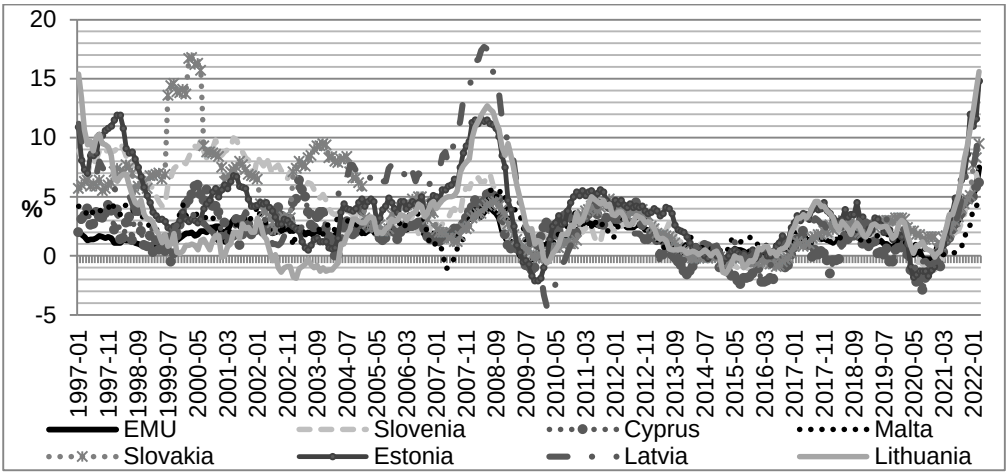
We will first analyze the characteristics of inflation processes in 7 new member countries, using relevant statistical indicators. Then we will focus on indicators of sigma convergence to understand if dispersion of inflation rates has decreased. We will also conduct unit root test to statistically check the significance of convergence process. At the end we will analyze autocorrelation coefficients of inflation rates to understand

the persistence of inflation in the observed countries. Persistence of inflation shows- when a country is hit by an inflation shock, how long it takes for the effect of that shock to fade. Reduced persistence means that it takes less time for that shock to fade out. Longer persistence means that a shock in the given time period will influence future inflation rates in a longer period. If autocorrelation coefficients differ significantly that means that the observed countries have different inflation transmission mechanism, which complicates the management of the common monetary policy. All this will help us to answer the question whether inflation processes in new member countries are getting more similar, linked to inflation in EMU and if there was a convergence of inflation. Our analysis covers the period from January 1997 to March 2022 for which we have monthly data from ECB. The observed countries became members in different time periods, so it is possible for each country to identify two subperiods- before and after the accession, to understand the influence of expectations and preparations for becoming a member and the influence of being a member of monetary union on the process of inflation convergence.

Characteristics of inflation processes in new member states

New EMU member countries had very diverse inflation rates since 1997, especially at the beginning of this period, as could be observed from Figure 1. Some of them had inflation rates even higher than 15% (like Latvia and Slovakia). Since 2009 the dispersion of inflation rates significantly decreased, and they became mutually much closer and also closer to average levels in EMU. That shows the significant success of monetary stabilization reforms which were the part of transition process but also reforms conducted in the process of preparations for EMU membership, as well as financial and debt crisis. However, we cannot say that their inflation rates tend to be stable, since variability seems quite high. Also, events since the mid of 2021- covid-19 crisis, anti-covid measures and sanctions to Russia brought a very massive rise in inflation rates in majority of those countries, and EMU as well.

Figure 1: *Inflation rates in new member countries, January 1997- March 2022*



Source: ECB, Statistical Data Warehouse

The analysis of statistical indicators of inflation in new member states will give us a deeper insight into characteristics of their inflation processes. Mean and median inflation rates, as well as standard deviations and coefficient of variations of inflation rates in new EMU member countries are presented in Table 1. For each country statistics is given in two columns: the first column presents statistics for the whole observed period (since 1997) and the second column gives statistics for the period that begins with their accession year.

Table 1: *Descriptive statistics of inflation in new member countries*

	Mean		Median		Maximum		Minimum		Standard deviation		Coefficient of variations, %	
	1997-2022	Since entry	1997-2022	Since entry	1997-2022	Since entry	1997-2022	Since entry	1997-2022	Since entry	1997-2022	Since entry
EMU	1.7		1.8		7.5		-0.6		1.1		62.8	
Slovenia	3.5	1.8	2.5	1.8	10.0	7.0	-1.4	-1.4	3.0	1.9	86.5	285.7
Cyprus	1.8	1.1	1.8	0.8	6.4	6.2	-2.9	-2.9	2.0	2.1	114.4	485.2
Malta	2.1	1.8	2.0	1.3	5.7	5.7	-1.1	-0.5	1.3	1.3	61	220.3
Slovakia	3.9	1.8	3.2	1.7	16.8	9.5	-0.9	-0.9	3.5	1.8	89.8	299.8
Estonia	3.9	2.7	3.7	2.9	14.8	14.8	-2.1	-1.8	3.2	2.7	82	219.7
Latvia	3.7	1.8	2.9	1.8	17.7	11.2	-4.3	-1.1	3.9	2.2	104.8	356.4
Lithuania	3.0	2.4	2.4	2.0	15.6	15.6	-1.9	-1.5	3.4	3.1	112.4	317.4

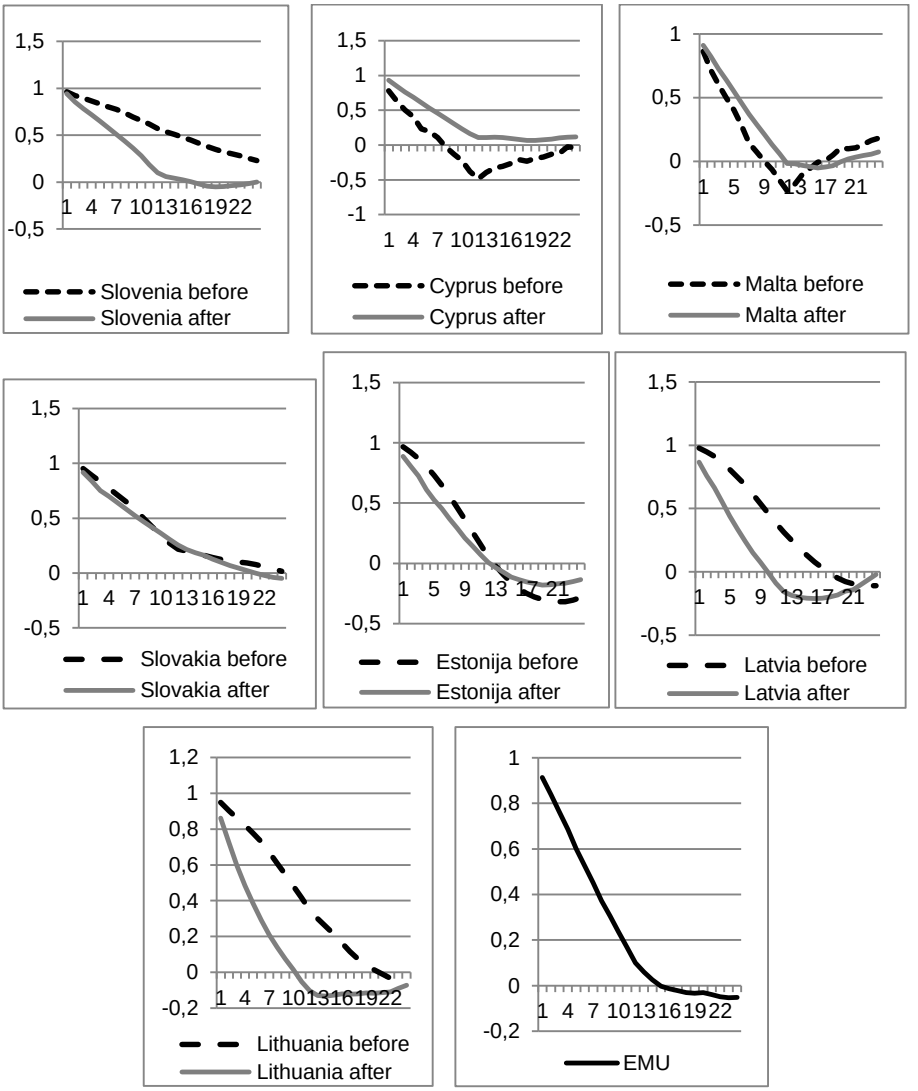
Source: Author's calculation based on data from ECB, Statistical Data Warehouse

Only Cyprus had average inflation rate in line with the average inflation in EMU since 1997. However, its mean inflation in the period since it became a member is much lower, i.e. only 1.1% due to the debt crisis. Slovenia, Malta, Slovakia and Latvia had mean inflation rates in the period since their accession also very close to the average inflation in EMU. In the period prior to their joining the monetary union, their inflation rates were quite above the Eurozone level, which shows significant improvements in monetary stability. Estonia and Lithuania struggled with significantly higher inflation since accession, while in Cyprus the average inflation was very low in comparison to the EMU average. Slovenia, Slovakia and Latvia have the same or very similar median inflation like in the Eurozone, but median inflation since accession gives a bit different information for Malta. It is significantly smaller, which means that Malta had higher inflation rates in the period prior to its accession, and after 2008 inflation was below the EMU level. Deviations of inflation rates from both sides are not desirable, since that means departure from the Eurozone level. The last four columns in Table 1 indicate sizeable dispersion of inflation rates. While the maximum level for Eurozone is 7.5% (in March 2022), in Lithuania it is 15.6%, 14.8% in Estonia and "only" 5.7% in Malta. However, in Slovenia, Slovakia and Latvia, maximal inflation rates were reached in the period preceding the monetary union. The data on minimum inflation show that the observed countries faced serious deflation in the period after 2008 crisis, only Malta had worse deflation in the period before the accession. Probably the debt of deflation would not be so severe if those countries were not the members of the monetary union and had their independent monetary policy, exchange rate and interest rate policy. So, partially, that was the price of membership. Indicators of dispersion, standard deviation and coefficient of variations in the observed countries are significantly above the relevant EMU indicators, showing larger variability of inflation rates in new member countries than EMU average.

In Figure 2 we presented autocorrelation coefficients for new EMU members. Data enable the analysis of the inflation persistence since 1997, as well as the influence of the common monetary policy on it. For each country we calculated autocorrelation coefficients for 2 periods. The first one is a longer period- since 1997, and the second is the period after their accession in the monetary union. For Slovenia, Lithuania and Latvia the common monetary policy brought a significant reduction in inflation persistence, for Malta that reduction was very small, for Slovakia and Estonia there are no differences in inflation persistence, while for Cyprus

inflation persistence rose. This might also suggest that the common monetary policy did not suit some countries.

Figure 2: *Autocorrelation coefficients of new EMU member countries' inflation rates- before and after joining EMU*

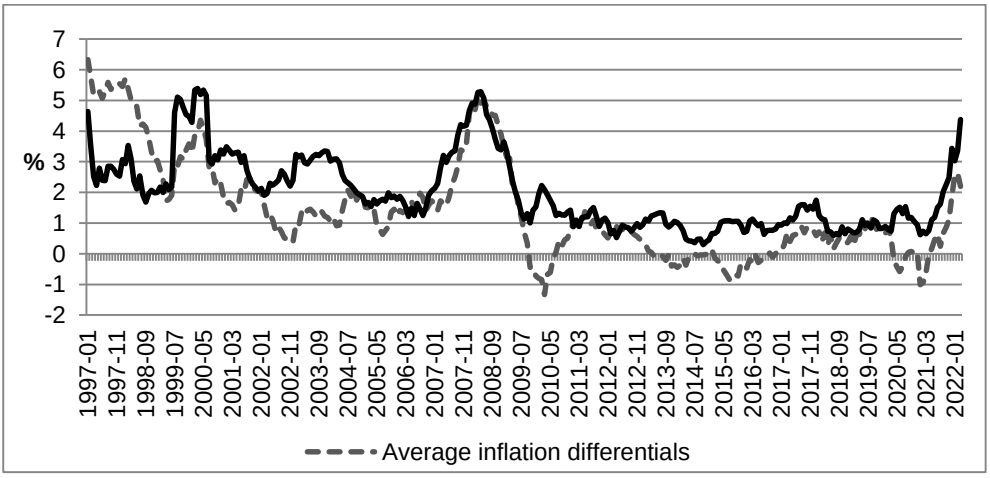


Source: Author's calculation based on data from ECB, Statistical Data Warehouse

Convergence of inflation rates of new member states- Unit root test

Average inflation differentials and standard deviations of inflation differentials, for the period since 1997 until March 2022, are presented in Figure 3:

Figure 3: *Inflation differentials and their standard deviations in new member countries*



Source: Author's calculation based on the data from ECB, Statistical Data Warehouse

The average inflation differentials had a diminishing trend in the first five years. However the dispersion of inflation rates described by standard deviations of inflation differentials was not reduced. In 2007 and 2008 the differences even rose, but in 2009 they started to decrease. At the end of 2009 and the first half of 2010, inflation differentials were even negative, which confirms that observed countries were seriously hit by financial and debt crisis and suffered from deflation. The average inflation differentials were negative also during 2013, 2015, 2020 and 2021, which shows that new members had, in several periods, inflation significantly lower than EMU average. During 2010s the dispersion of inflation rates, measured by standard deviations, was much lower than in the previous decade, indicating some positive results in terms of inflation convergence. Unfortunately, the Covid-19 crisis and related measures, the Ukraine war,

and sanctions to Russia brought a rise in the dispersion of inflation rates among the observed group of countries again.

To test the hypothesis that the environment of monetary union, common currency and monetary policy facilitated the convergence of the inflation rates of new member countries towards the EMU rate, we analyzed the stationarity property of inflation differentials. We conducted Unit root test on the series of standard deviations of inflation differentials for new Eurozone member countries. We used annual inflation rates data, based on monthly HICP (harmonized index of consumer prices) from ECB Statistical data warehouse database. This measure shows the inflation rate for country *i* and time period *t*:

$$\pi_{i,t} = \ln(HICP_{i,t}) - \ln(HICP)_{i,t-12} \quad (1)$$

$\ln(HICP_{i,t})$ is the natural logarithm of the price level (measured by HICP) of country *i* and in time period *t* (inflation rate for the current month), while $\ln(HICP)_{i,t-12}$ is the natural logarithm of the price level of country *i* one year ago (inflation rate for the same month one year ago). A series of inflation differentials is obtained as the difference of inflation rate in a country *i* and time period *t* ($\pi_{i,t}$) and HICP for Eurozone as a whole in time period *t* (π_t^{EMU}):

$$d_{i,t} = \pi_{i,t} - \pi_t^{EMU} \quad (2)$$

Finally, we calculated standard deviations of inflation differentials for each period as:

$$\sigma = \sqrt{\sigma^2} \quad (3)$$

$$\sigma^2 = \frac{\sum \left(d_{i,t} - \mu_{dt}\right)^2}{N} = \frac{\sum \left[\left(\pi_{i,t} - \pi_t^{EMU}\right) - \frac{\sum \left(\pi_{i,t} - \pi_t^{EMU}\right)}{7} \right]}{7} \quad (4)$$

Where μ_{dt} presents average inflation differential for the period *t*. N is the number of countries in our population.

We conducted analysis for two periods. The first one covers data from January 1997 until March 2022. The longer period was observed with a goal to capture the effects of reforms and preparations for the monetary union on inflation rates and their convergence. The second period covers data from January 2008 until March 2022, when the first countries from the observed group already joined Eurozone. Analyzing those two periods separately helps to understand whether convergence of inflation rates indeed occurred before those countries joined Eurozone, as the Maastricht criteria required, and if there was convergence process- whether it was sustainable in later stages. If there was a convergence of inflation rates in this group of countries towards the EMU level, inflation differentials and their standard deviations would have a diminishing trend, and they would tend to zero. In that case our series of standard deviations of inflation differentials would be stationary, and inflation differentials would not be persistent. That would mean that they have converged to an equilibrium level and any shock that causes departure from equilibrium would fade out in a relatively short period of time. Nonstationary series do not have constant mean and finite variance, so shocks lead to further departure of inflation rates. So if the analysis shows that there is a unit root in the series of standard deviations of inflation differentials, we cannot say that there was a statistically significant process of convergence of inflation rates towards the EMU average levels. Thus the observed group of countries does not tend to form a more homogenous group.

We conducted unit root tests both with and without intercept. Test without intercept tests for absolute convergence. Using the test with intercept might result in false acceptance of null hypothesis of no convergence (Busetti at al. 2007). Unit root test could be also conducted for each country- on the series of their individual inflation differentials to find out whether a particular country tends to be more in line with Eurozone average, and which countries tend to be outliers. Results of unit root tests are presented in the Table 2.

Table 2: *ADF test of standard deviations of inflation differentials*

		January 1997- March 2022			
		Without intercept		With intercept	
		t-Statistic	Prob.	t-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-1.30063	0.1785	-2.441811	0.1312
Test critical values:	1% level	-2.572642		-3.451847	
	5% level	-1.941877		-2.870899	
	10% level	-1.615997		-2.571828	
		January 2008- March2022			
		Without intercept		With intercept	
		t-Statistic	Prob.	t-Statistic	Prob.
Augmented Dickey-Fuller test statistic		0.920215	0.9043	0.194747	0.9716
Test critical values:	1% level	-2.578636		-3.46898	
	5% level	-1.942710		-2.878413	
	10% level	-1.615460		-2.575844	

Source: Author's calculation based on data from ECB, Statistical Data Warehouse

The obtained results show that there is a unit root in the series of standard deviations of inflation differentials in both periods and also when testing with or without intercept. The conclusion was made based on Augmented Dickey-Fuller test. It tests null hypothesis that a given time series has a unit root. According the test without intercept (so test of absolute convergence) for the longer period (from January 1997 until March 2022), ADF τ statistics was found to be equal to -1.3, which is above critical value τ^k (-1.94) at 5% confidence level. Probability of rejecting the correct null hypothesis is 0.18, which is high. So, we cannot reject the null hypothesis that the series of standard deviations has unit root. Conclusion is the same when we conduct the test with the intercept, ADF τ_μ statistics is -2.44, which is higher than critical value τ^k (-2.87) at 5% confidence level.

In the period from January 2008 until March 2022, ADF τ statistics (without intercept) was found to be equal to 0.92 which is larger than critical value τ^k of -1.94 at 5% confidence level, and p=0.9. Thus, we cannot reject the null hypothesis that the series has unit root also for the period since the crisis emerged. When testing with intercept, for the same period, ADF τ_μ statistics is 0.195, which is larger than critical value τ^k of -2.87 at 5% confidence level, and probability of rejecting correct null hypothesis is high (p= 0.9713).

Thus, although the observed countries made significant progress towards higher monetary stability, the convergence of inflation rates in new EMU member countries was not statistically confirmed. This might suggest that some of the observed countries maybe were not sufficiently prepared for the common currency and the monetary union, while they do not have sufficient level of similarity of their inflation processes with old members. Of course this analysis must be supported with the analysis of other relevant indicators of convergence and macroeconomic data. The rise of inflation that started in 2021 brought an even higher dispersion of inflation rates.

CONCLUSIONS

A country must achieve a sufficient level of economic performances convergence to enjoy benefits of membership in the monetary union. ECB manages common monetary policy which cannot be adjusted to target the specific needs of individual countries. It is very important that a country has inflation in line with the average rate (which is the target for ECB). For countries with above-average inflation, the ECB main interest rate will be too low, they will have lower real interest rates which will facilitate demand and a new investment cycle, leading to an even higher inflation rate and real divergence. For countries with below-average inflation, the main rate will be too high. That would depress demand and further lower the inflation. Thus, both countries will departure further from the average. Also, if transmission of shocks to inflation differs significantly, that would require different responses of ECB monetary policy. A special problem is the lack of synchronization of business cycles, which means that the common monetary policy will not be appropriate for all members. Also countries with higher inflation will lose their competitiveness, which will lead to a current account deficit and increased indebtedness.

We focused on new EMU member countries to understand if they managed to “fit in” and also check whether macroeconomic reforms during transition process and preparation for EMU membership have enabled a higher level of inflation convergence. We found significant variability of inflation rates among them and also compared them to the EMU average. Some of them suffered serious deflation, while some were faced with significantly higher than average inflation. Although new members made significant progress in monetary stability, decreasing previously very high inflation rates, unit root test indicated that sufficient level of convergence

was not reached. Obviously, they do not have a sufficient level of homogeneity of their inflation processes with the old members. That has also been a challenge for ECB since the second half of 2021 when inflation has been rising, reaching unprecedented levels. So, financial crisis, Covid-19 measures, war in Ukraine, and sanctions to Russia posed impressive challenges to the ECB monetary policy. Inflation heterogeneity is rising, while the countries are differently exposed to risks of rising prices of energy and food and the transmission of shocks to inflation is different. We have to question whether some of those countries had been adequately prepared for joining the monetary union. This issue is relevant for further enlargement of the European monetary union. Is the enlargement of a suboptimal monetary union justifiable, if it brings larger adjustment costs?

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KONVERGENCIJA INFLACIJE U NOVIM EMU ČLANICAMA

Svetlana Popović

Sažetak: *Evropska centralna banka je odgovorna za zajedničku monetarnu politiku 19 zemalja koje su geografski i ekonomski veoma heterogene. Pitanje je da li svima odgovara zajednička monetarna politika. Fokus ovog rada stavljen je na zemlje koje su pristupile Monetarnoj uniji od 2007 (nove članice), da bi se razumelo da li su one uspele da se uklope u okruženje monetarne unije. Te zemlje su ostvarile impresivan napredak na planu makroekonomske stabilizacije i stabilnosti cena, ali da li je to dovoljno da uživaju neto koristi od članstva u EMU? Nakon analize statističkih karakteristika njihovih inflatornih procesa od 1997. godine (prosečna inflacija i medijana, standardna devijacija i koeficijent varijacije), analizirano je da li se njihove stope inflacije približavaju prosečnoj stopi inflacije EMU i da li teže da formiraju homogeniju grupu. Sproveden je test jediničnog korena da bi se statistički testirala značajnost procesa konvergencije i analizirali koeficijenti autokorelacije I stopa inflacije da bi se procenio uticaj zajedničke monetarne politike na postojanost inflacije. Dobijeni rezultati nisu statistički potvrdili prisustvo apsolutne konvergencije stopa inflacije u grupi novih članica EMU.*

Ključne reči*: konvergencija inflacije, Evropska monetarna unija, inflatorni procesi, nove EMU članice, upornost inflacije.*