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EMPIRICAL RESULTS FOR SOME MONETARY AREAS ACCORDING TO OPTIMUM CURRENCY AREA CRITERIA

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Abstract

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The euro area is the biggest monetary union in the World. In post-crisis time, the possibilities of creation a new monetary union are discussed again. The aim of this article is to evaluate, according to OCA criteria, an appropriateness of selected countries for a membership in a monetary union or for creation new monetary union. The second aim is to confront the existing monetary union – the euro area, with two potential monetary areas – NAFTA and MERCOSUR. The criteria are based on the OCA theory and partly on the so called OCA index. According to the results, there are countries (so called core countries) such as Austria or Luxemburg which reach satisfactory values. On the other hand there are countries such as Estonia, Finland, Latvia, Greece or Italy which reach worse values. Quite surprisingly, the values of most indicators (except for DISSIM) have worsened since the crisis in the euro area. It seems to be convenient for both Canada and Mexico to adopt a common currency with the USA. In case of MERCOSUR we could barely find a pair of countries with better values compare with euro area's all-time average.

Keywords: monetary union, monetary systems, economic integration, OCA index, eurozone, NAFTA, MERCOSUR, monetary policy

INTRODUCTION

The euro area remains the biggest and the most important monetary union in the World. But in post-crisis time, the possibilities of creation a new monetary union are discussed again. It is spoken about the monetary integration in America. In North America, there is NAFTA (Canada, Mexico and USA), and there is MERCOSUR (Argentina, Brazil, Paraguay, Uruguay and Venezuela) in South America.

The theory of the optimum currency area (OCA) remains the basic approach for the analysis of monetary areas and for the quantification of benefits and costs for a membership in a monetary union. In the sixties, so called traditional version of OCA was developed; there are well-known papers of Mundell (1961), McKinnon (1963) and Kenen (1969). In the seventies, the interest in the optimum currency area decreased. From the eighties, the research has increased with some considerations and with subsequently creation the euro area. The concern persists also with some considerations of creation of new monetary unions. During the time, other criteria have been added; they are (Mongelli, 2002): price and wage flexibility, financial market integration, similarities of inflation rates, fiscal integration, political integration, similarities of supplies and demands shocks and business cycles synchronization.

The aim of this article is to evaluate, according to OCA criteria, an appropriateness of selected countries for a membership in a monetary union or for creation monetary union. The second aim is to confront the existing monetary union – the euro area, with two potential monetary areas – NAFTA and MERCOSUR. The criteria are based on the OCA theory and partly on the so called OCA index, which was created by Bayoumi and Eichengreen

(1997). The index consists of output disturbances as the standard deviation of real output, dissimilarity of the commodity composition of the export, importance trade linkage, the size of economy and the openness of economy.

The remainder of the paper is organized as follows. Next section deals with the theoretical and empirical basis of this paper, methods and data are introduced in the next section. Then, results are discussed. Our conclusion is offered in the final section.

Theoretical and Empirical Basis

As mentioned above, the theoretical approach of this paper is based on the OCA theory. This theory has developed since the sixties. Mundell is regarded as a pioneer of the OCA theory. Mundell (1961) defines the optimum currency area as an area with internal mobility and external immobility of production factors, especially labour and with fixed exchange rates. With internal immobility of production factors, the adaptation in the case of asymmetric shock can be reached only with a flexible exchange rate. According to Mundell (1961), the world is not an optimum currency area, therefore a flexible exchange rate must exist among some regions or states. The economy should adapt through a flexible exchange rate to an asymmetric shock. McKinnon (1963) extends the OCA theory and adds another criterion, the degree of economic openness. He defines the openness as a proportion of tradable and non-tradable goods. According to McKinnon (1963), a flexible exchange rate is more appropriate for the closed economy. In opposite, a fixed exchange rate is more appropriate for the open economy. The flexible exchange rate is not appropriate for a small open economy because it provides neither external equilibrium nor stability of internal level price. Kenen (1969) adds the third criterion, the diversification of production and consumption. The fixed exchange rate is more appropriate for the economy with diverse production. In opposite, a flexible exchange rate is appropriate for the economy with less diversity of a production. Asymmetric shocks can be eliminated by the flexible exchange rate in the case of a less diversity of production.

Another approach is represented by Bayoumi and Eichengreen (1997). They created the OCA index for measuring the structural convergence of two economies. The OCA index is a bilateral index and it is based on the OCA theory. The index is computed using variables which represent the symmetry of business cycles, intensity of trade linkage, dissimilarity of the commodity composition and a size of the economy. It is used as a tool for assessing the possibilities of successful functioning of countries in a monetary area. It would be more appropriate for two countries which accept one currency, if the OCA index were smaller.

Bayoumi and Eichegreen (1997) computed the OCA index for the European countries. During the time, the OCA index is also modified and computed for the non-European countries, e.g. Bankagé (2008) for some African countries, Chaudhury (2009) or Achsani and Partisiwi (2010) for some Asian countries. The OCA index is computed for the Czech Republic; see Cincibuch and Vávra (2000) and Skořepa (2013) from recent studies.

It follows part, where the (potential) monetary areas are described. It is in order the euro area, NAFTA and MERCOSUR.

The Euro Area

The euro area is the biggest and the best known monetary union in the world. It was established in 1999. The origins are form European Coal and Steel Community (ECSC) and the European Economic Community (EEC), formed in the fifties. In 1986 was signed the Single European Act. This Act set an objective of establishing a single market. The European Union was formally established by the Maastricht Treaty in 1992, which came into force in 1993.

The European Monetary System was a predecessor, established in 1979. In 2014, the euro area had eighteen members. There are many theoretical and empirical studies about the European monetary integration, Eichengreen (2008), Mink, Jacobs and de Haan (2007) or Fidrmuc and Korhonen (2003); including textbooks, e.g. de Grauwe (2012), or from Czech authors e.g. Dědek (2008) or Lacina *et al*. (2007).

NAFTA

The North American Free Trade Agreement (NAFTA) was established as a free trade agreement in 1994. This economic area consists of Canada, Mexico and the United States of America. Arndt (2006) explores the development of NAFTA and the implications for monetary union in NAFTA, their pros and cons. Cohen (2004) claims that a creation of NAMU (North American Monetary Union) would have more costs than benefits for USA. In opposite, Chriszt (2000) argues that NAFTA is ready for creating monetary union on the base of the OCA theory. He adds two basic approaches of creating monetary union. This means dollarization – an acceptance of US dollar by Mexico and Canada, or a creation of a new currency. Amero is the most frequent name.

MERCOSUR

MERCOSUR – Common Market of the South (Mercado Comúndel Sur in Spanish) is a trade agreement in some countries of South America, specifically among Argentina, Brazil, Paraguay, Uruguay and Venezuela. It was created in 1991 (Venezuela has become a member since 2012) as a free trade zone at first and as custom union MERCOSUR has operated since 2006 (Grigoli, 2012). Baer, Calvati and Silva (2002) show, that two biggest economies – Brazil and Argentina, did not coordinate their economic policy in the nineties.

It led to negative mutual trade and it did not result to a deeper economic relationship in the frame of MERCOSUR. Numa (2011) claims, that MERCOSUR are not an optimum currency area.

METHODOLOGY AND DATA

Our research is based on traditional approaches of the OCA theory and we use methodology of Bayoumi and Eichengreen (1997); they estimated the OCA index. Their estimating equation is:

$$SD(e_{ij}) = \alpha + \beta_1 SD(\Delta y_i - \Delta y_j) + \beta_2 DISSIM_{ij} + \\ + \beta_3 TRADE_{ij} + \beta_4 SIZE_{ij}, \quad (1)$$

where

$SD(e_{ij})$ ..... the standard deviation of the exchange in the logarithm of the end-year bilateral exchange rare between countries *i* and *j*,

$SD(\Delta y_i - \Delta y_j)$ ... the standard deviation of the difference in the logarithm of a real output between *i* and *j*,

$DISSIM_{ij}$ ..... the sum of the absolute differences in the shares of agricultural, mineral, and manufacturing trade in a total merchandize trade,

$TRADE_{ij}$ ..... the mean of the ratio of bilateral exports to domestic GDP for two countries and

$SIZE_{ij}$ ..... the mean of the logarithm of the two GDPs measured in U.S. dollars.

The smaller variables (except variable *TRADE*) mean higher structural convergences between researched economies.

The approach is similar in our paper. Nevertheless, we do not compute the OCA index because of some problems (see Horváth and Komárek, 2002). For example, there is a problem with a sample of the countries in the estimated equation. The original estimated equation of Bayoumi and Eichengreen (1997) includes incoherent countries – some European countries, Japan, USA, Canada, and New Zealand. The regression coefficients can be biased and may not reflect specifics for some monetary areas. Another problem is with the period, when the equation was estimated in. It was estimated for the period 1983–1992. This period is different from present days. And a new estimation of the equation would be problematic due to the inability of comparison among researched monetary areas – among the euro area, NAFTA and MERCOSUR. It would be lead to different estimations, different coefficients and different OCA indexes. It is not possible to compare.

For this reasons, we compute only the individual components of the OCA index. In some papers, a variable $OPEN_{ij}$ instead of the variable $SIZE_{ij}$ is used; see Horváth and Komárek (2003). The variable $OPEN_{ij}$ is the mean of the ratio of the trade, i.e. export and import to GDP. That is why we add this variable to the previous variables. Together, we compute five variables: $SD(\Delta y_i - \Delta y_j)$, $DISSIM_{ij}$, $TRADE_{ij}$, $SIZE_{ij}$ and $OPEN_{ij}$.

The variable $SD(\Delta y_i - \Delta y_j)$ is the standard deviation of the difference in the logarithm of real (2005's prices) GDP (in U.S. dollars) of two countries. It was computed as the difference of annual real GDP for each country:

$$SD(\Delta y_i - \Delta y_j) = SD\left[\ln\frac{RGDP_{i(t)}}{RGDP_{i(t-1)}}; \ln\frac{RGDP_{j(t)}}{RGDP_{j(t-1)}}\right], \quad (2)$$

where

SD ..... standard deviation,

$RGDP_{i(t)}$ ..... real GDP of country *i* in time *t*,

$RGDP_{i(t-1)}$ ..... real GDP of country *i* in time *t*–1,

$RGDP_{j(t)}$ ..... real GDP of country *j* in time *t* and

$RGDP_{j(t-1)}$ ..... real GDP of country *j* in time *t*–1.

The variable $DISSIM_{ij}$ is the sum of the absolute differences in the share of individual components[1] in total bilateral trade. It attains values from 0 to 2 where 0 means the same structure of bilateral trade whereas 2 means that commodity structure of bilateral trade of two countries is absolutely different. In our case lower value implies better conditions to adopt a common currency. It was computed as follows:

$$DISSIM_{ij} = \sum_{A=1}^{N}\left|\frac{XA_{ij}}{X_{ij}} - \frac{XA_{ji}}{X_{ji}}\right|, \quad (3)$$

where

XA ..... the export of each economic category,

X_{ij} ..... total export from country *i* to country *j* and

X_{ji} ..... export from country *j* to country *i*.

The variable $TRADE_{ij}$ is the mean of the ratio of bilateral trade (import plus export) on nominal GDP (in U.S. dollars) of two countries and it has the following specification:

$$TRADE_{ij} = MEAN\left[\frac{X_{ij}}{GDP_i}; \frac{X_{ji}}{GDP_j}\right], \quad (5)$$

where

X_{ij} ..... nominal export from country *i* to country *j*,

X_{ji} ..... nominal export from country *j* to country *i*,

GDP_i ..... nominal GDP of country *i* and

GDP_j ..... nominal GDP of country *j*.

1 We used UN's Basic Economic Categories (BEC) classification which distinguishes economic categories into 7 parts: Food and beverages, Industrial supplies, Fuels and lubricants, Capital goods, Transport equipment, Consumption goods and Others.

For this component higher value means better conditions to adopt a common currency. That is because common currency is more convenient for those countries which have higher level of bilateral trade.

The variable $SIZE_{ij}$ measures the size of the economies and it was computed as the mean of the logarithm of two real (2005's prices) GDPs in U.S. dollars.

$$SIZE_{ij} = MEAN[\ln RGDP_i; \ln RGDP_j], \quad (6)$$

where
$RGDP_i$ ....real GDP of country *i* and
$RGDP_j$... real GDP of country *j*.

The variable $OPEN_{ij}$ represents the rate of openness of each economy. In particular it was computed as the mean of the share of nominal trade (import plus export) on nominal GDP (in U.S. dollars) of two countries:

$$OPEN_{ij} = MEAN\left[\frac{X_i + M_i}{GDP_i}; \frac{X_j + M_j}{GDP_j}\right], \quad (7)$$

where
X_i.....total nominal export of country *i*,
M_i..... total nominal import of country *i*,
GDP_i..... nominal GDP of country *i*,
X_j.....total nominal export of country *j*,
M_j..... total nominal import of country *j*,
GDP_j..... nominal GDP of country *j*.

Horváth and Komárek (2003) claim that the expected sign of the variable is theoretically indeterminate. We come out from McKinnon (1963) and we assume that higher values are better for a common currency.

Data

Data for variables $SD(\Delta y_i - \Delta y_j)$, $SIZE_{ij}$ and $OPEN_{ij}$. were used from World Bank Database (World Bank, 2014), variables $DISSIM_{ij}$ and $TRADE_{ij}$ were calculated with the use of the data from United Nations Commodity Trade Statistics Database (Comtrade, 2014) and World Bank Database (World Bank, 2014). We used annual data from 1999 to 2013.

RESULTS

We computed two averages for periods from 1999 to 2007 (pre-crisis period), resp. from 2008 to 2013 (crisis and post-crisis period). Then we computed all time averages, which are depicted in the last column of each table. Lower values (except for variables TRADE and OPEN) imply better conditions to adopt a common currency. We computed all variables for each pair of countries in case of NAFTA and MERCOSUR. In case of the euro area the situation was more complicated. If we had computed values for each pair, the matrix of results would have been too large. We decided then to compute all variables for pairs which consist of each country and the euro area. However there was another problem, because not all data were accessible for the euro area. So we used a Germany as an approximation of the euro area.

The Euro Area

The empirical results for the euro area are introduced in Tabs. I–II. In Tab. III, there is the overview of variables in the euro area. All values represent pairs of each country and Germany.

Tab. I shows results for variables $DISSIM_{ij}$ and $TRADE_{ij}$ which are related to bilateral trade and $SIZE_{ij}$. France, Austria, Slovenia and Italy seem to be countries with the most similar structure ($DISSIM_{ij}$) of bilateral trade with Germany. The worst values were observed in Greece, Malta, Ireland, Finland and Latvia. The values in 11 of 17 countries improved in period from 2008 to 2013 compared to period from 1999 to 2007. As concerns the volume of bilateral trade ($TRADE_{ij}$), the best values (higher numbers in this case) were observed in Germany's traditional trade partners such as Austria, Slovakia, Belgium and the Netherlands, the worst in Spain, Portugal, Cyprus and Greece. The improvement in this indicator after crisis was observed in 7 countries. The variable $SIZE_{ij}$ measures the size of the economy (using real GDP). That means that countries with higher GDP attain higher values of this indicator. For larger countries is more convenient to have their own currency. Common currency should be adopted either by smaller countries such as Estonia, Latvia, Cyprus or by Slovenia.

The results for variables $OPEN_{ij}$ and $SD(\Delta y_i - \Delta y_j)$ are depicted in Tab. II. Variable measures the mutual openness of two economies. We computed it for each country to both Germany (DE) and the euro area (EA); nevertheless, the results are similar. The least open economies of the euro area are economies of Italy, France, Greece, Spain and Portugal the most open economies are Estonia, Malta, Ireland and Luxembourg. There was only one country which became less open after crisis than before – Malta. Slovakia and Cyprus became less open to the euro area but more open to Germany.

The variable $SD(\Delta y_i - \Delta y_j)$ measures the alignment of business cycles. The more are business cycles of two countries linked the more convenient it is for them to adopt a common currency. The best values of this indicator were observed in Austria, Belgium, France, the Netherlands (the Germany's neighbours) and Italy, the worst in Ireland, Greece, Estonia and Latvia. It is interesting that this indicator has improved in only 7 countries since 2008.

Tab. III shows the order of components for each country. In the last column, there is an unweight average of the order for each country. It is important to realize that we are not able to conclude which of these variables has larger impact on conditions to adopt a common currency. The best values were observed in Austria, Luxemburg and Slovenia. The worst values can be seen in Greece, Finland and Spain.

I: *Variables DISSIM, TRADE and SIZE in the Euro Area from 1999 to 2013*

	$DISSIM_{ij}$			$TRADE_{ij}$			$SIZE_{ij}$		
	1999–2007	2008–2013	2099–2013	1999–2007	2008–2013	1999–2013	1999–2007	2008–2013	1999–2013
AT	0.274	0.299	0.284	0.148	0.169	0.156	27.527	27.628	27.568
BE	0.478	0.548	0.506	0.130	0.129	0.129	27.633	27.725	27.670
CY	0.654	0.383	0.546	0.029	0.026	0.028	26.068	26.199	26.115
EE	0.584	0.321	0.479	0.061	0.058	0.060	25.930	26.081	25.990
FI	0.708	0.747	0.723	0.050	0.043	0.047	27.296	27.392	27.334
FR	0.189	0.168	0.181	0.068	0.071	0.070	28.501	28.580	28.533
EL	0.712	0.492	0.624	0.024	0.020	0.022	27.387	27.446	27.411
IE	0.710	0.599	0.665	0.072	0.056	0.066	27.289	27.396	27.332
IT	0.349	0.208	0.293	0.052	0.053	0.053	28.418	28.461	28.436
LT	0.873	0.614	0.770	0.060	0.043	0.054	25.995	26.130	26.043
LU	0.408	0.378	0.396	0.100	0.107	0.103	26.460	26.585	26.510
MT	0.655	0.645	0.651	0.065	0.060	0.063	x	x	x
NL	0.360	0.399	0.376	0.117	0.145	0.128	27.901	27.990	27.937
PT	0.395	0.253	0.338	0.043	0.036	0.040	27.305	27.358	27.326
SK	0.483	0.435	0.464	0.132	0.143	0.136	26.699	26.899	26.770
SL	0.283	0.286	0.284	0.104	0.110	0.106	26.438	26.560	26.482
ES	0.372	0.410	0.387	0.044	0.038	0.041	28.167	28.263	28.205

Note: There were lack of data for Malta, so it is not included in table for variable SIZE
Source: World Bank (2014), own calculations

II: *Variables SD ($y_i - y_j$) and OPEN in comparison to Germany and the Euro Area for the Euro Area's countries from 1999 to 2013*

	SD ($y_i - y_j$)			$OPEN_{ij}$ DE			$OPEN_{ij}$ EA		
	1999–2007	2008–2013	1999–2013	1999–2007	2008–2013	1999–2013	1999–2007	2008–2013	1999–2013
AT	0.005	0.004	0.005	0.847	0.995	0.906	0.851	0.949	0.890
BE	0.006	0.006	0.006	1.111	1.274	1.176	1.115	1.228	1.160
CY	0.011	0.015	0.012	0.871	0.926	0.893	0.875	0.853	0.867
EE	0.028	0.022	0.025	1.133	1.252	1.180	1.137	1.205	1.164
FI	0.009	0.008	0.009	0.743	0.863	0.791	0.747	0.817	0.775
FR	0.005	0.006	0.006	0.629	0.731	0.669	0.633	0.684	0.653
DE	x	x	x	x	x	x	0.725	0.868	0.782
EL	0.012	0.029	0.019	0.654	0.745	0.690	0.659	0.698	0.674
IE	0.022	0.010	0.017	1.168	1.268	1.208	1.173	1.212	1.189
IT	0.003	0.011	0.006	0.619	0.739	0.667	0.623	0.692	0.651
LT	0.032	0.030	0.031	0.855	0.967	0.900	0.860	0.902	0.877
LU	0.017	0.006	0.012	1.755	2.047	1.872	1.760	2.000	1.856
MT	x	x	x	1.203	1.196	1.200	1.208	1.131	1.177
NL	0.004	0.009	0.006	1.005	1.221	1.092	1.010	1.175	1.076
PT	0.005	0.013	0.008	0.692	0.826	0.746	0.697	0.779	0.730
SK	0.020	0.006	0.015	1.129	1.161	1.142	1.134	1.096	1.119
SL	0.014	0.014	0.014	0.946	1.055	0.989	0.950	0.990	0.966
ES	0.010	0.011	0.010	0.649	0.756	0.692	0.654	0.709	0.676

Note: There were lack of data for Malta. so it is not included in table for variable SD ($y_i - y_j$)
Source: World Bank (2014), own calculations

NAFTA

Unlike the euro area the North American Free Trade Agreement is not a monetary union. In this section we show the results to discuss which of its countries has better conditions to create a monetary union. In the Tab. IV, there are values of variables for NAFTA countries. In case of NAFTA, we computed all variables for each pair of countries. We computed period averages analogically as in the case of the euro area.

III: *The overview of order of indicators in the Euro Area as an average towards Germany from 1999 to 2013*

Country/variable	DISSIM	TRADE	OPEN	SIZE	SD	Avr.
AT	2	1	9	11	1	4.8
LU	8	6	1	5	10	6
SL	3	5	8	4	11	6.2
BE	11	3	5	12	2	6.6
NL	6	4	7	13	4	6.8
SK	9	2	6	6	12	7
EE	10	10	4	1	15	8
FR	1	7	16	16	3	8.6
MT	14	9	3	x	x	8.7
IE	15	8	2	8	13	9.2
PT	5	15	13	7	6	9.2
CY	12	16	11	3	9	10.2
IT	4	12	17	15	5	10.6
LT	17	11	10	2	16	11.2
ES	7	14	14	14	8	11.4
FI	16	13	12	9	7	11.4
EL	13	17	15	10	14	13.8

IV: *Variables DISSIM, TRADE, OPEN, SIZE and SD ($y_i - y_j$) in NAFTA from 1999 to 2013*

$DISSIM_{ij}$		1999–2007	2008–2013	2009–2013
CA	**MX**	0.739	0.725	0.733
CA	**US**	0.348	0.488	0.404
MX	**US**	0.485	0.498	0.490
$TRADE_{ij}$		1999–2007	2008–2013	2009–2013
CA	**MX**	0.012	0.016	0.014
CA	**US**	0.244	0.178	0.217
MX	**US**	0.191	0.199	0.194
$OPEN_{ij}$		1999–2007	2008–2013	2009–2013
CA	**MX**	0.633	0.618	0.627
CA	**US**	0.491	0.378	0.446
MX	**US**	0.386	0.374	0.381
$SIZE_{ij}$		1999–2007	2008–2013	2009–2013
CA	**MX**	27.587	27.735	27.646
CA	**US**	28.935	29.060	28.985
MX	**US**	28.796	28.934	28.851
SD_{ij}		1999–2007	2008–2013	2009–2013
CA	**MX**	0.007	0.007	0.007
CA	**US**	0.003	0.004	0.003
MX	**US**	0.007	0.009	0.007

Source: Comtrade (2014), World Bank (2014), own calculations

From values of variables $DISSIM_{ij}$, $TRADE_{ij}$, and $OPEN_{ij}$ it can be seen that both Canada and Mexico have better conditions to adopt common currency with the USA than to adopt it mutually, but most of values for pair Canada-Mexico are improving. Once again the variable $SIZE_{ij}$ itself means only that the US's GDP is way higher than the others.

MERCOSUR

This part deals with situation in MERCOSUR which forms a customs union nowadays. The results for MERCOSUR are presented in this part. As there are five countries in MERCOSUR, we computed values for all of 10 combinations.

Tab. V shows results for variables *SIZE*, $SD(\Delta y_i - \Delta y_j)$ and *OPEN*. Since Paraguay is the smallest economy of MERCOSUR, its values of variable $SIZE_{ij}$ are the lowest. On the other side there is Brazil which is largest. As concerns variable $SD(\Delta y_i - \Delta y_j)$ the most linked economies seem to be those of Argentina – Uruguay, Brazil – Paraguay and Brazil – Uruguay. As the worst pair we can consider all pairs with Venezuela. The last variable is variable *OPEN* in Tab. V. It is Paraguay which is the most open economy from MERCOSUR. The least open is Brazil. That is why pairs with Paraguay has the highest values in variable $OPEN_{ij}$, whilst Brazilian pairs has the lowest. It can be seen that values for Venezuela are getting lower, which means that Venezuela is even less open in these days than it was before crisis.

In Tab. VI, there are results for variable $DISSIM_{ij}$ and $TRADE_{ij}$ in MERCOSUR. As concerns the worst values were observed in Venezuela, which exports mainly fuels and lubricants (fuels and lubricants represent over 90% of its export to other MERCOSUR countries). The most similar structure of bilateral trade was observed between Argentina and Uruguay and between Argentina and Brazil. The value of this component improved between Argentina and Brazil, Brazil and Paraguay, and Paraguay and Uruguay after crisis. The variable $TRADE_{ij}$ shows that Argentina, Brazil and Paraguay have the highest level of mutual bilateral trade. Once again it is Venezuela which reaches the worst

V: *Variables SD ($y_i - y_j$), SIZE and OPEN in MERCOSUR from 1999 to 2013*

		SD ($y_i - y_j$)			$SIZE_{ij}$			$OPEN_{ij}$		
		1999–2007	2008–2013	1999–2013	1999–2007	2008–2013	1999–2013	1999–2007	2008–2013	1999–2013
AR	**BR**	0.028	0.008	0.020	26.755	27.073	26.882	0.276	0.288	0.281
AR	**PY**	0.022	0.022	0.022	24.459	24.782	24.588	0.618	0.665	0.637
AR	**UY**	0.014	0.010	0.012	24.807	25.152	24.945	0.393	0.447	0.413
AR	**VE**	0.025	0.022	0.024	26.539	26.829	26.655	0.406	0.400	0.404
BR	**PY**	0.011	0.020	0.015	25.152	25.430	25.263	0.596	0.627	0.608
BR	**UY**	0.017	0.012	0.015	25.500	25.799	25.620	0.371	0.407	0.384
BR	**VE**	0.031	0.016	0.025	26.539	26.829	26.655	0.383	0.360	0.375
PY	**UY**	0.013	0.023	0.017	23.205	23.508	23.326	0.713	0.793	0.742
PY	**VE**	0.036	0.028	0.033	24.243	24.538	24.361	0.725	0.746	0.733
UY	**VE**	0.027	0.021	0.025	24.591	24.908	24.718	0.501	0.520	0.508

Source: World Bank (2014), own calculations

VI: *Variables DISSIM and TRADE in MERCOSUR from 1999 to 2013*

		$DISSIM_{ij}$			$TRADE_{ij}$		
		1999–2007	2008–2013	1999–2013	1999–2007	2008–2013	1999–2013
AR	**BR**	0.763	0.535	0.672	0.037	0.041	0.039
AR	**PY**	0.664	1.095	0.836	0.040	0.051	0.045
AR	**UY**	0.403	0.546	0.460	0.031	0.031	0.031
AR	**VE**	1.115	1.304	1.190	0.002	0.003	0.002
BR	**PY**	0.973	0.889	0.939	0.065	0.100	0.080
BR	**UY**	0.773	0.956	0.847	0.034	0.040	0.037
BR	**VE**	1.499	1.554	1.521	0.009	0.008	0.009
PY	**UY**	1.228	0.953	1.118	0.022	0.014	0.019
PY	**VE**	x	x	x	0.002	0.013	0.005
UY	**VE**	1.916	1.986	1.944	0.006	0.012	0.008

Note: There were lack of data for Venezuela and Paraguay, so it is not included in table for variable DISSIM
Source: Comtrade (2014), World Bank (2014), own calculations

value in this indicator. It can be seen that except for Argentina – Uruguay, Brazil – Venezuela and Paraguay – Uruguay all bilateral values grew up after crisis which led to better conditions to accept a common currency.

DISCUSSION

It is important to say that there were significant differences among the euro area's countries. There are countries (so called core countries) such as Austria, France or the Netherlands which reach satisfactory values. On the other hand there are countries (usually small open economies and their trade is not related with Germany) such as Estonia, Finland, Latvia, Greece, Ireland or Malta which reach worse values. Quite surprisingly, the values of most indicators (except for *DISSIM* and *OPEN*) have worsened since the crisis in the euro area.

It seems to be convenient for both Canada and Mexico to adopt a common currency with the USA. Most of indicators have improved in NAFTA, especially those between Mexico and Canada. For pair of Canada and USA some values (especially those which are related to trade) are even better that in case of most euro area's countries. Venezuela reaches the worst values in almost all indicators. The other countries reach better values, especially Argentina and Brazil. Variables *TRADE* and $SD(\Delta y_i - \Delta y_j)$ have improved since the end of crisis in most countries. In case of MERCOSUR we could barely find a pair of countries with better values compare with euro area's all-time average.

CONCLUSION

The aim of this article is to evaluate, according to OCA criteria, an appropriateness of selected countries for a membership in a monetary union or for creation new monetary union. The second aim is to confront the existing monetary union – the euro area, with two potential monetary areas – NAFTA and MERCOSUR.

The euro area is the biggest monetary union in the World. In post-crisis time, the possibilities of creation a new monetary union are discussed again. There are states of MERCOSUR (Argentina, Brazil, Paraguay, Uruguay and Venezuela) and states of NAFTA (Canada, Mexico and the United States of America).

Our research is based on traditional approaches of the OCA theory and we use methodology of Bayoumi and Eichengreen (1997) who estimated the OCA index. Nevertheless, we do not compute the OCA index because of some problems. We compute only the individual components of the OCA index.

In the euro area there were differences among the euro area's countries. There are countries such as Austria, Luxemburg, Slovenia, Belgium or Netherlands which have good values towards Germany (or alternatively towards the euro area). In opposite, there are countries which have worse values, e.g. Greece, Finland, Spain, Latvia or Italy. Some values (*TRADE*, *SD*($\Delta y_i - \Delta y_j$) and *SIZE*) have worsened in the most countries of the euro area.

In case of MERCOSUR we could barely find a pair of countries with better values compare with euro area's all-time average. It seems to be convenient for both Canada and Mexico to adopt a common currency with the USA. Most of indicators have improved in NAFTA, especially those between Mexico and Canada. Venezuela reaches the worst values in almost all indicators. The other countries reach better values, especially Argentina and Brazil. But we can say that the states of MERCOSUR are not appropriate candidates for creation of monetary union according to optimum currency area criteria which were approximated by OCA index in our paper.

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