

## OPTIMUM CURRENCY AREA THEORY: OVERVIEW OF EMPIRICAL RESEARCHES

*In the times of high speed of globalization problem of effective integration becomes more popular, and new issues regarding Optimum Currency Area Theory appear. Current work presents overview of the most significant empirical investigations in the field of Optimum Currency Area (OCA) Theory, Most of researches proposed currency rate volatility as index of OCA, and applied regression models, cross-section and correlation analysis. Particularly, further work contains description of Bayoumi T. and Eichengreen B. regression model; similar model developed by Stanoeva G.; empirical research made by Drogobytskyi S. and Polevoy D. for post-soviet countries; cross-section analysis of macroeconomic indicators for countries all over the world by Alesina A., Barro R. and Tenreyro S.; comparison analysis of currency rate volatility among German regions by Von Hagen J. and Neuman M.; cross-section analysis of OCA criteria for Finland and Swiss by Jonung L. and Sjöholm F.; and investigation of Ukrainian scientist Gonchar O.M. about endogeneity of business cycle synchnization. Overview of major empirical researches of OCA criteria provides understanding of benefits and threats of different tools of empirical investigation, and support OCA Theory with practical evidences on OCA criteria applications.*

**Keywords:** Optimum Currency Area (OCA), Criteria OCA, Economic and Currency Integration, Exchange Rate Regimes, Empirical Studies, Ukraine.

**Introduction.** Widespread globalization encouraged new burst of interest around theoretical background of integration processes. A lot of works of modern economists are dedicated to new approaches and interpretations of the Optimum Currency Area (OCA) Theory, which was founded fifty years ago by Robert Mundell. This theory tries to propose principles of effective integration, and answer the question: what criteria should be done to make integration successful for all its potential members? In spite of plenty of theoretical hypothesis regarding criteria and conditions of effective economic and currency integration, many theoretical assumptions are in conflict with actual empirical evidences. A number of economic threats and crisis among integrated economies show the necessity of further investigations and upgrades of the OCA Theory. Considering big amount of existing theoretical OCA criteria, some of which are controversial, the most powerful methodology for concluding theoretical finding nowadays is empirical research. Empirical investigations provide evidential evaluation of theoretical assumptions, and make practical conclusions for particular economic circumstances. Also, modern empirical researches have massive statistical data of different macroeconomic and financial indicators of integrated economies as well as potential members of integrations, which provides strong confidence of results of such investigations. Obviously, empirical evidences add much to the modern

Optimum Currency Areas Theory. So, the *main purpose* of this paper is analytical overview of empirical researches of OCA and its criteria, which would help to make right accents and define strong concepts of the Theory of OCA, and surely will support further development of effective recommendations for successful integrations. Today such recommendations are definitely in demand for many modern governments trying to protect their economies from negative consequents of integration. Especially this topic is quite crucial for Ukraine, where ways of international integration is on the diplomatic agenda.

**Brief Literature Review.** The theoretical assumptions of OCA Theory were developed by a plenty of researchers in classical and modern stage of the Theory, they are: Mundell R. A. (1961), McKinnon R. (1963), Kennen P. B. (1969), Ingram J. (1969), Fleming J. M. (1971), Corden W. (1972), Ichiyama Y. (1975) refer to the classical period of OCA Theory development; and modern ones are Ogrodnik R. (1990), De Grauwe P. (1996), Frankel J. and Rose A. (1998), Fukuda H. (2002). Another scientists G. Stanoeva (2001), S. M. Drobyshevsky and D. I. Polevoy (2004), T. Bayoumi and B. Eichengreen (1997), R. Vaubel (1976), R. Ogrodnick (1990), A. Alesina, R. Barro and S. Tenreyro (2002) and others made empirical researches in the area of OCA Theory. Such economists as I. Maes (1992), Mongelli F. P. (2002), T. Broz (2005) and Makhmudova T.A.K. (2012) made analytical reviews of

OCA Theory. Among Ukrainian scientists OCA Theory was investigated in the works of Gonchar O. M. (2012), Savchenko T. G., Rebryk M. A. and Kazarinov D. I. (2012).

**Overview of empirical researches.** In the modern period of development of the Optimum Currency Area (OCA) Theory there are a number of works dedicated to empirical researches. In these works scientists applied different approaches to evaluate the significance of the OCA criteria, and their impact on integration process. The most significant researches will be described below.

Bayoumi T. and Eichengreen B. developed in 1996 a regression model for European countries in terms of creating European Union, where common currency will be applied [2, p. 761–770]. These authors were first who proposed to use currency rate volatility as index of optimum currency area. So, currency rate volatility, which was calculated as standard deviation of nominal exchange rate for two countries, was taken as dependent variable in the model. Independent variables were chosen from the known OCA criteria, and included: similarity of production shocks, specialization and intensity of international trade, benefits of single currency. To describe production shocks the Standard Deviation of the difference of logarithms of real GDP of two countries was taken. Intensity of international trade was included in the model as Average share of export in GDP for two countries. Specialization of the international trade was characterized by the sum of absolute differences of the shares of agriculture, mineral and industrial goods in the whole export amount for each country. Also the authors assumed that the smaller the economy is, the more benefits it would gain from the using common currency. That is why the last independent variable in the model was the size of economy as average logarithm of real GDP (in USD) of two countries. The methodology of comparison of two countries is based on the approach that every potential member of EU is compared with Germany, which economic indexes are considered to be the prototype of EU area indexes. The data for mentioned criteria was taken for the period of 1983–1992 on yearly base. So, the following model was built for evaluation:

$$SD(e_{ij}) = \alpha + \beta_1 SD[\ln(y_i) - \ln(y_j)] + \beta_2 DISSIM_{ij} + \beta_3 TRADE_{ij} + \beta_4 SIZE_{ij}$$

where:

$SD(e_{ij})$  → Standard Deviation of nominal currency rate of countries  $i$  and  $j$ ;

$SD[\ln(y_i) - \ln(y_j)]$  → Standard Deviation difference of logarithm of real GDP of countries  $i$  and  $j$ ;

$DISSIM_{ij}$  → Similarity of export specialization (agriculture, mineral and industrial categories) of countries  $i$  and  $j$ ;

$TRADE_{ij}$  → Average rate of export in GDP for countries  $i$  and  $j$ ;

$SIZE_{ij}$  → Average logarithm of real GDP in USD for countries  $i$  and  $j$ .

$$\beta_1 > 0, \beta_2 > 0, \beta_3 < 0, \beta_4 > 0 [2, p. 765].$$

After evaluation of proposed model the significance of variables and signs of coefficients were proved. Further Bayoumi T. and Eichengreen B. built a forecast for dependent variable, basing on the forecast of independent variables. So, the authors calculated the standard deviation of nominal exchange rates for 1987, 1991 and 1995 years. According to received results, autscientists defined countries, which are ready to integrate to EU by the time of research, they are: Austria, Belgium, Netherland, Ireland and Switzerland. Also, basing on their investigation researchers identified second cluster of countries, which could enter the European Union in the nearest future, they are: Great Britain, Denmark, Finland and France. And the third group of countries, which are not ready for integration to EU includes Swiss, Italy, Greece, Portugal and Spain. Mainly, such results corresponded to actual processes in European integration in that time, especially, considering first two groups of countries, which are potential members of EU according to the results of the research. However, some mismatch took place, mostly in the third group, where most counties actually were already members of EU for a long period of time (Italy since 1957, Greece 1981, Portugal and Spain both since 1986). However, investigation showed that these countries are not ready for membership in EU, basing on comparing their indexes with German ones.

Stanoeva G. in 2001 developed the regression model to evaluate the potentials of Central and East European countries (Bulgaria, Hungary, Latvia, Lithuania, Poland, Rumania, Slovakia, Czech Republic, Estonia) for entering the European Union [11, p. 3–20]. She took the currency rate volatility as a dependent variable, assuming that the less changes of currency rate by the time are, the less costs will bring currency integration for the economy. Independent variables include the following criteria: similarity of production and monetary shocks, size and openness of economy, development of financial markets. To describe production shocks was taken the absolute difference of logarithms of the GDP dynamics of the potential member of EU and average for EU zone. Monetary shocks were characterized in the same way through the aggregate money supply. Size and open-

ness of economy were included in the model as share of trade amount with EU-region in the total Consumption amount in the CEE country. And development of financial markets was interpreted as a share of credits to private companies in the total internal credit amount of the CEE country. For mentioned modeling was used quarterly and monthly data for the period of 1997–2000 years. So, the following regression was evaluated by Stanoeva G.:

$$\left| \ln \frac{S_{ij}^t}{S_{ij}^{t-1}} \right| = C + A_1 \left| \ln \frac{GDP_i^t}{GDP_i^{t-1}} - \ln \frac{GDP_j^t}{GDP_j^{t-1}} \right| + A_2 \left| \ln \frac{M_i^t}{M_i^{t-1}} - \ln \frac{M_j^t}{M_j^{t-1}} \right| + A_3 \left( d \left( \frac{Exp_i^{t,j} + Exp_j^{t,i}}{Cons_i^t} \right) \right) + A_4 \left( d \left( \frac{PC_i^t}{TDC_i^t} \right) \right) + u_{ij},$$

where:

$S_{ij}^t$  → Nominal currency rate for country  $i$  regarding euro in the period  $t$ ;

$GDP_i^t$  → Real GDP (in fixed prices) of country  $i$  in the period  $t$ ;

$M_i^t$  → Monetary base of country  $i$  in the period  $t$ ;

$Exp_i^{t,j}$  → Export amount from country  $i$  to country  $j$  in the period  $t$ ;

$Cons_i^t$  → End consumption amount (in current prices) in country  $i$  in the period  $t$ ;

$PC_i^t$  → Private credits of country  $i$  in the period  $t$ ;

$TDC_i^t$  → Total internal credits of country  $i$  in the period  $t$ ;

$A_1 > 0, A_2 > 0, A_3 < 0, A_4 < 0$  [11, p.11].

he signs of proposed coefficients describe the character of impact the criteria provide on dependent variable. According to the results of the model evaluation all independent variables are statistically significant and have the proposed signs, which proves following assumptions about taken criteria: similarity of production and monetary shocks increase the effectiveness of potential integration, the same does development of financial market, and size of economy provides opposite effect on the results of integration – the smaller economy gains more from integration. So, Stanoeva's investigation provides empirical evidences for such theoretical OCA criteria as similarity of shocks, size and openness of economy, and development of financial markets.

Next economists S. Drogobyshevskiy and D. Polevoy developed significant research of macroeconomic indicators of post-soviet countries (Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Turkmenistan, Ukraine and Uzbekistan) to evaluate their potentials for currency integration with Russia and European Union [16, p. 64–96]. Authors have calculated thirteen indicators, which represent ten theoretical

criteria of OCA. Basing on calculated values for each country, and comparing these indicators with average for EU zone and Russia, scientists concluded that all post-soviet countries are much closer to Russian economic indexes than to European ones. The most appropriate partners for currency integration with Russia are Kazakhstan, Moldova and Ukraine according to the results of macroeconomic comparison, and the least suitable for such integration are Turkmenistan and Uzbekistan.

Also mentioned Russian authors provided a regression analysis of cross-section model for mentioned countries. Their model also uses currency rate volatility as dependent variable, and independent variables are the criteria of OCA. Also some dummy variables were included to the model in order to consider such factors as 1) significant Oil power of the economies of Azerbaijan, Kazakhstan, Russia and Turkmenistan; and 2) participation in Common economic Area for Belarus republic, Kazakhstan, Ukraine and Russia. As major OCA criteria were chosen production and monetary shocks, size and openness of economy, development of financial markets. To describe production shocks was taken the absolute difference of standard deviation of logarithms of industrial production growth; monetary shocks were characterized in the same way through the money supply and inflation rate. Size of economy was interpreted by average logarithm of real GDP in USD (in fixed prices), and openness of economy were included in the model as average share of external trade in GDP. And development of financial markets was described as a private credits share in total internal credits amount. Dummy variable for Oil economic power indicates countries with high rate of mineral goods in export volumes, and dummy Union variable indicates countries which are members of Common Economic Area. Final equation for the regression is following:

$$SD(E_{ij}) = \alpha_0 + \alpha_1 SD(IP_{ij}) + \alpha_2 SD(M_{ij}) + \alpha_3 SD(CPI_{ij}) + \alpha_4 TRADE_{ij} + \alpha_5 SIZE_{ij} + \alpha_6 FC_{ij} + \alpha_7 OIL + \alpha_8 UNION + \varepsilon_{ij}$$

where:

$SD(E_{ij})$  → Standard Deviation of logarithm of currency rate growth for counties  $i$  and  $j$ ;

$SD(IP_{ij})$  → Absolute difference of Standard Deviation of logarithm of industrial production growth for counties  $i, j$ ;

$SD(M_{ij})$  → Absolute difference of Standard Deviation of logarithm of money supply growth for counties  $i, j$ ;

$SD(CPI_{ij})$  → Absolute difference of Standard Deviation of logarithm of inflation for counties  $i, j$ ;

$TRADE_{ij}$  → Average rate of external rate in GDP for counties  $i$  and  $j$ ;

$SIZE_{ij}$  → Average logarithm of real GDP in USD (in fixed prices) for countries  $i$  and  $j$ ;

$FC_{ij}$  → Private credits rate in total internal credits amount for countries  $i$  and  $j$ ;

$OIL$  → Dummy variable to indicate countries with high rate of mineral goods in export volumes (1/0);

$UNION$  → Dummy variable to indicate countries which are members of Common Economic Area (1/0).

$\alpha_1 > 0, \alpha_2 > 0, \alpha_3 > 0, \alpha_4 < 0, \alpha_5 >$

$> 0, \alpha_6 < 0, \alpha_7 > 0, \alpha_8 < 0$  [16, p. 52–53].

Regression analysis of cross-section model has proved most hypotheses considering significance of proposed variables and signs of coefficients. However, some hypotheses were refused, particularly: inflation volatility appeared statistically irrelevant, and has negative coefficient, which contradicts theoretical assumptions of OCA; and development of financial markets appeared insignificant, which also goes in conflict with theoretical criteria of OCA. Although, proposed cross-section model does not answer the question which countries could form effective currency area, it provides empirical evidence of most known criteria OCA, and kind of influence they make on the main index of OCA – exchange rate volatility. These results could be used in further researches of optimum currency areas, and investigations of potential members of effective currency area among post-soviet countries.

Economists Von Hagen J. and Neuman M. in 1994 applied another approach to research the perspectives of currency integration [14, p. 236–244]. They explored the potentials of integration of Germany with some European Countries (Austria, Belgium, Denmark, France, Italy, Luxemburg, Great Britain). The authors in this research have investigated the only OCA criteria – the currency rate volatility, which was calculated for Deutsche mark and currencies of mentioned European countries. Then, such volatilities were compared with volatility of price level in different regions of Germany. Authors assumed that such price level volatility between regions of German represents actually real currency rate for such regions. So, the closer the external currency rate volatility is to internal German one, the more potential has such country for integration with Germany. Also in the model was included season component and irregular element of real currency rate changes. However, any other criterion wasn't explored in this research. According to the results of proposed research Austria, Belgium, Netherland, Luxemburg and France were ready for currency integration with Germany; still currency volatilities of Great Britain, Denmark and Italy were too high for effective integration.

Later, significant research was made by economists Alesina A., Barro R. and Tenreyro S., who tried to propose the measures for optimum currency areas [1, p. 2–49]. The methodology of the research is cross-section analysis of macroeconomic indicators. They gathered considerable historical data of macroeconomic indexes for many countries all over the world for the period of 1960–1997, and indicated three main centers of integration – USA, EU and Japan, which currencies could be used as common in OCAs. Then, marginal indexes for each center were calculated for such macroeconomic indicators as intensity of international trade, price level correlation and dynamic of real GDP in fixed prices in USD, using the base level of 1995Y. Finally, geographical measures of potential currency areas were proposed, basing on comparison analysis of macroeconomic indexes of potential members of integration with the calculated marginal indexes for every center. So, authors concluded that currency area of USD could form Canada, Mexico, most countries of Central and South America, and also Hong Kong and Singapore. And currency area of euro among most West European countries could be widen with many African countries. Considering the potentials of Japan yen, according to the results of the investigation no countries would surely fit this area of integration.

L. Jonung and F. Sjöholm in 1999 analyzed perspectives of entering Finland and Swiss to EU through investigation of all main classical and modern criteria of Optimum currency areas: price and salary flexibility, factor mobility, openness and diversification of economy, similarity of production structure and economic policies, business cycles synchronization, and also culture and historical background [6, p. 683–700]. The methodology of the research is cross-section analysis of macroeconomic indicators. According to the results of the research Finland and Swiss would form optimum currency area using whether common currency or applying common monetary policy. Considering that Swiss wasn't member of EU at the time the research was made, the authors recommended Swiss applying to it.

Vector autoregression modeling was chosen by S. Dibooglu and J. Horvath in 1997, and later by Ling in 2002 for their researches of Optimum Currency Areas in different regions. Production shocks, real fiscal and monetary shocks were explored for the Asian countries by Ling, and the same investigation was made by S. Dibooglu and J. Horvath for the European countries [4, p. 37–49]. This methodology allows to evaluate the influence of different shocks and correlation between such shocks. According to the results of Ling's research in the Asian region three potential currency areas could be defined, they are:

Singapore and Malaysia; Japan and South Korea; Taiwan and Hong Kong. This economist emphasized that for further global integration of Asian countries, they should convergent in such small groups first. And considering similar investigation for European countries, it showed that correlation of production, monetary and fiscal shocks between European countries is quite low, both for members and non-members of EU. The most asymmetric appeared fiscal shocks. Due to such results authors recommended development a number of mechanisms for balancing such asymmetric shocks among potential participants of Euro integration.

Valuable research was made by Ukrainian economist O. M. Gonchar in 2012 [15, p. 206–213], who explored business cycles synchronization for 12 members of European Union (Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherland, Portugal, Spain). He divided the research period into three phases: 1991–1998 (period of preparation for integration), 1999–2008 (pre-crisis period for euro zone), and 2009–2011 (crisis period for euro zone). To evaluate the level of business cycles synchronization author applied two approaches: 1) cross-section analysis of Standard deviation of GDP and GDP Discrepancies between mentioned countries; 2) evaluation of the level of correlation of business cycles between every investigated country and average for euro area (basing on the correlation coefficients for GDP Discrepancies). According to the first approach the general tendency of business cycles synchronization for all countries was investigated for the two first periods of EU-preparation (1991–1998) and pre-crisis (1999–2008), and some resynchronization for period

of crisis (2009–2011). The results of second approach implementation showed quite high level of business cycles synchronization (mostly above 0,85) for all countries for the whole research period. Also synchronization of business cycles between countries significantly increased in the second research period, after the EU-preparation process has finalized. Interesting fact is that the highest level of business cycle synchronization was investigated in Finland, Austria, Luxembourg, Italy, Belgium and France (all above 0,94 in 2003–2011), and the lowest are in Greece (0,667), Portugal (0,752) and Netherlands (0,766). This research, made by Ukrainian economist Gonchar O.M., shows that business cycles of integrated counties tend significantly to synchronization after integration process, which means that business cycle synchronization is endogenous criterion of OCA. Such results provide empirical evidence for one of the main assumptions of modern Theory of Optimum Currency Areas – endogeneity of such criteria of OCA as business cycles synchronization.

**Conclusion.** Overview of empirical researches of the Theory of OCA provided evidences for most significant criteria of OCA, and represented most popular methodology of investigating such criteria. This overview showed weaknesses and advantages of different approaches of empirical investigation. Basing on this overview new empirical researches of ways and potentials of effective integration could be developed for different countries. Particularly, mentioned empirical findings would be used for modeling Ukrainian perspectives of integration in different ways and spheres, comparing macroeconomic and financial compatibility of its potential members.

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## ТЕОРІЯ ОПТИМАЛЬНИХ ВАЛЮТНИХ ЗОН: ОГЛЯД ЕМПІРИЧНИХ ДОСЛІДЖЕНЬ

*У час глобалізації проблема ефективної інтеграції стає дедалі популярнішою, з'являються нові дискусійні питання в теорії оптимальних валютних зон (ОВЗ). Нові тенденції в економічному середовищі породжують необхідність нових досліджень наслідків валютної інтеграції, останнім часом у цій галузі з'явилося багато емпіричних робіт. У статті наведено огляд основних емпіричних досліджень з теорії оптимальних валютних зон, більшість з яких пропонують волатильність обмінного курсу як індексу ОВЗ та використовують такі інструменти, як регресійні моделі, крос-секційний та кореляційний аналіз. Дослідження основних емпіричних здобутків теорії ОВЗ дозволяє порівняти та оцінити переваги та недоліки різних методів дослідження, а також забезпечує практичну аргументацію основних положень теорії.*

**Ключові слова:** економічна та валютна інтеграція, оптимальна валютна зона (ОВЗ), критерії ОВЗ, емпіричні дослідження, Україна.

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## DYNAMICS OF PROPENSITY TO PERSONAL FINANCIAL SAVINGS IN THE POST-CRISIS PERIOD: CASE OF BELARUS AND UKRAINE

*The article investigates trends in the saving activity of the population of Belarus and Ukraine in the context of the economic crisis and post-crisis period. The empirical analysis of the statistical data was held; features of formation of population saving rates in Belarus and Ukraine in the presence of structural breaks were revealed. The main prerequisites for enhancing saving activity of the population were underlined.*

**Keywords:** savings, marginal propensity to save of population, financial assets, deposits, currency.

**Problem description.** Achievement of high rates of economic growth depends largely on increasing investment activity of economic entities. Solution of such a task is related not only by the activity of foreign investors, but also by attracting additional sources of investment, in an advantageous manner of internal reserves of the country, and by increasing the efficiency of the so-called market of

savings, which unites a totality of institutions responsible for the accumulation, transformation and distribution of savings in the economy. Nowadays personal savings in the form of financial assets can be considered as one of potential source of investment in the real sector. The stimulation and further efficient use of organized savings require a detailed and in-depth analysis of the dynamics and the mul-