CONVERGENCE OF TAX REVENUES IN THE EUROPEAN UNION

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Abstract

Formation of a single market is one of the main priorities during the integration process of the European Union. For this purpose it was planned to unify tax rules throughout the entire Community. The main question of this paper is whether the European Union has been meeting the objective of single market. It focuses on a question whether the tax systems are converging in the context of fiscal pressure and tax mixes. Beta and Sigma convergences are used for meeting the goal of the paper. The results present the difficulty of tax harmonization and convergence at the field of tax quotas and tax mixes during the analysed period as well. Results also point out the fact of possible influence not by the EU integration but by world globalization.

Introduction

Currently, the European Union is a unique community that combines both economic and political partnerships. The first step in European integration consisted in strengthening economic cooperation between The Member States whose goal was to establish a single market. That means free movement of goods, persons, services, and capital [9] and a common currency, the euro.

If a country wants to join the European Union, first, it needs to go through accession negotiations. Basically, it is an agreement on how and when the candidate country adopts and implements rules and procedures of the contemporary members of the Community. However, the negotiations also include financial matters (e.g. contribution of the new member into the EU budget) or possible transitional measures and exceptions.

As a result, the original purely economic-oriented cooperation gave birth to a community that is now cooperating in a number of areas. Among others, these include the tax policy that – through harmonization – can contribute to the creation of a single market by eliminating distortions that arise by transitions between individual Member States.

The European Union has been trying to converge tax systems, which should result lead to removal of all obstacles to the creation of the single market. This objective should result in a single tax system that would be applied by the entire Community and that should provide equal benefits for all of its members.

The issues of coordination, approximation, and harmonization of tax systems in the EU are addressed, for instance, in [2], [12], [13] and specially in [17]. The very methodology that is

used to verify the objective of this paper is dealt with in [3]. It is usually used for analysis of gross domestic products for example in [4] or [7]. Literature [5], [8], [15], [19], and especially [6] deal with the similar problem this paper solves, but in this case a different view is given.

This paper aims to verify whether there is convergence between the tax systems of the Member States within the meaning of convergence of tax mixes and tax quotas of the Member States.

1   Methodology

The aim of this paper is to analyse whether there is convergence in the area of tax quotas and tax mixes in the EU countries. A tax quota is understood as the overall tax burden, which is determined as a proportion of the total tax revenue to GDP. A tax mix shows representation of individual taxes in the total tax revenues.
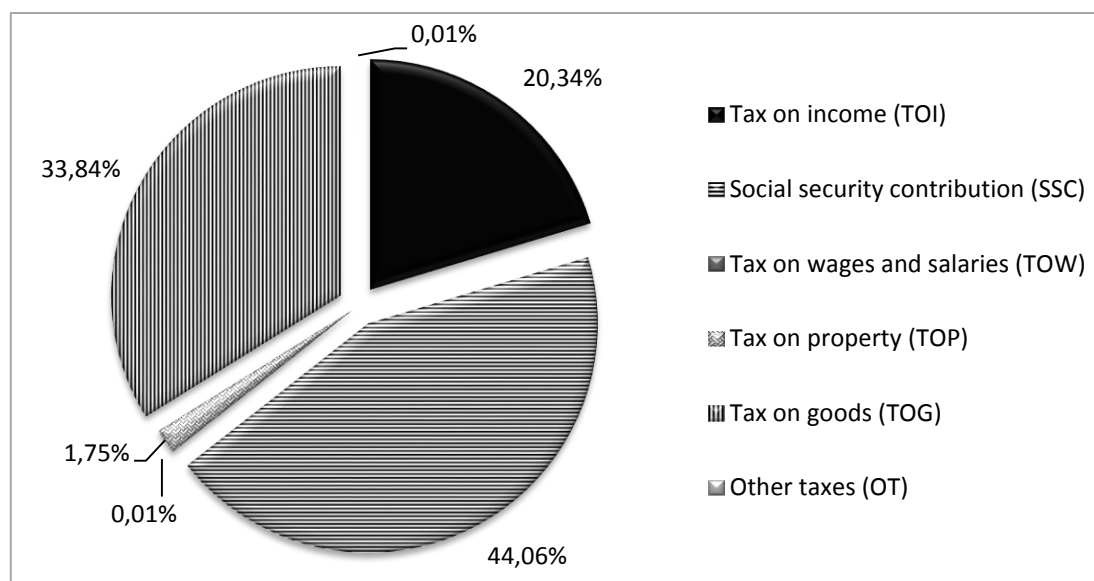
Source: OECD, Tax Revenue Statistics 2012 edition and own processing
Fig. 1:   *Example of the tax mix of the Czech Republic in 2011 (%)*

The paper uses abbreviations for the individual groups of taxes. FP means fiscal pressure, TOI is short for taxes on income and gains (number 1000 in the classification of OECD), SSC for social security contribution (2000), TOW for taxes on payroll and workforces (3000), TOP for taxes on property (4000), TOG for taxes on goods and services (5000), OT for other taxes (6000).

The term "European Union" includes all 27 Member States.

We analysed whether there was convergence of tax quotas and tax mixes between 1965 and 2011 in all current EU Member States and also for periods when individual states became EU members (e.g. for the Czech Republic, between 2004 and 2011, etc.).

The methods used were the causal analysis and synthesis of the information obtained, as well as induction and deduction, the application of which results from the need to create an objective and systematic quantitative description of the issue. Other methods for meeting the objective are specified below.

1.1 Arithmetic Mean

To obtain the average values, we used the arithmetic mean. The mean was used to determine average values for the whole EU. The calculations always include values of the countries since the year they official accessed the EU.

$$\bar{A} = \frac{1}{n}\sum_{i=1}^{n} a_i \tag{1}$$

where $\bar{A}$ is arithmetic mean, a_i is tax rate of the year in the Member State, n is quantity of variables.

1.2 Beta Convergence

This method was used also in [3], [8], [10] or [16]. The Beta convergence considers growth of variables in dependence on the initial values (the so-called "Barro regression"). This concept of convergence focuses on the fact that countries with low initial values grow faster than countries with high initial values. In this case, it is convergence of tax mixes to the average value which is defined as the average of all EU Member States in a given year.

This approach allows estimation of the annual growth rate or rate of β-convergence.

$$\ln\left(\frac{y_t}{y_0}\right) = \alpha + \beta \ln(y_0) + \varepsilon \tag{2}$$

where T is the last year of the analysis (2011), 0 is the initial year of the analysis (1965 or the year of a country's accession to the EU), y represents tax mixes in different time periods or tax quota. α is a level constant, β is the regression coefficient, and its significant negative value indicates the Beta convergence, ε is a random component.

The equation (2) expresses the growth rate of the tax mix / tax quota (left side of the equation), which depends on its initial level (y_0), or more precisely on its difference from the average level in the EU.

In other words, the regression coefficient β expresses how much of the difference – to the average of the EU – countries "on average" managed to eliminate during the given period. Thus, the greater the coefficient β in absolute value, the faster the convergence/divergence. The paper utilizes the classic method of least squares.

Twenty observations were used for both variants, and the missing values were abstracted.

Furthermore, it should be emphasized that the Beta convergence is a condition for the Sigma convergence, where the Sigma convergence uses absolute values. However, this relationship does not have to work conversely [16].

1.3 Sigma Convergence

The time evolution of convergence or divergence of tax mixes can be determined by measuring the distance. One such indicator was used in [1]. For n countries, the average distance from the average (Di) was measured by the index (D).

$$Dt = \frac{1}{n}\sum_{i=1}^{n} D_t^i = \frac{1}{n}\sum_{i=1}^{n}\sum_j\sum_j S_{jt}^i - S_{jt}^{EU} \tag{3}$$

where i is short for country, j is short for tax, t is the year, S_{jt}^i is the proportion of the tax in the total tax revenues, and S_{jt}^{EU} is the average of the EU. The Sigma convergence is based on the development of variance in time. This variance can be analysed using various indicators; here, it is the standard deviation.

$$\left| \sigma = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(a_n^i - E(a)^2} \right| \tag{4}$$

where σ is the standard deviation, a_i is the amount of the tax mix of i-year and n-state, E represents the arithmetic mean of the EU.

The Sigma convergence is constructed in order to obtain additional information about the development of the Beta convergence, which is not able to provide this information. In this case, the Sigma convergence includes countries at the moment of their accession to the EU. This means that before the accession, their existence was taken into account, even for determination of the average value for the whole EU. The smaller the standard deviation, the higher the convergence (and vice versa). Thus, if the standard deviation curve decreases, there is convergence during the given period.

2 Data

The source of the data is secondary information provided by the OECD [14] and the European Commission [18]. Tax mixes are divided in classes according to the OECD classification, and the missing data was left out for the purposes of the following analysis.

Tab. 1: *The fiscal pressure data example*

Period of 1965 - 2011		Period of memberships in the European Union	
Dependent variable	**Explanatory variable**	**Dependent variable**	**Explanatory variable**
0.215	3.522	0.014	3.722
0.338	3.438	0.338	3.438
-0.107	3.665	-0.041	3.599
0.468	3.401	0.173	3.696
-0.107	3.591	0.070	3.415
0.354	3.414	-0.048	3.817
0.255	3.532	0.255	3.532
0.155	3.453	0.155	3.453
0.554	2.888	0.356	3.086
-0.244	3.817	-0.054	3.627
0.102	3.216	-0.022	3.340
0.712	3.043	0.049	3.707
0.292	3.321	0.292	3.321
0.148	3.490	0.148	3.490
-0.072	3.526	0.002	3.453
0.675	2.765	0.190	3.251
-0.344	3.697	-0.100	3.453
-0.062	3.663	-0.038	3.639
0.760	2.688	0.082	3.366
0.286	3.505	-0.069	3.860
0.150	3.416	0.124	3.441

Source: OECD Tax Revenue Statistics 2012 edition, own processing

3   Results

3.1   Beta Convergence

The analysis of the tax mixes and tax quota demonstrated convergence of the given variables for both examined periods. The summary of the results is provided in the tables below.

Tab. 2: *Beta convergence of tax mixes in the EU area in 1965 – 2011*

	FP	**TOI**	**SSC**	**TOW**	**TOP**	**TOG**	**OT**
β	-0.879	-0.537	-0.262	-0.529	-0.394	-0.905	-0.619
t	-7.563	-3.622	-1.956	-1.911	-3.151	-4.675	-2.610
P-value	$< 10^{-4}$	0.002	0.065	0.098	0.005	0.00016	0.026
R²	0.751	0.422	0.168	0.342	0.343	0.535	0.405

Source: OECD Tax Revenue Statistics 2012 edition, own processing

The table above shows that all the analysed dependences are significant; the significance level is always less than 10%, in some cases even less than 1%. The Beta coefficient is negative in all the examined groups. This indicates convergence over the whole period between 1965 and 2011 both in tax quotas and groups of individual tax revenues.

The fastest is the convergence of indirect taxes (TOG), which are, in terms of harmonization, of the greatest interest in the EU. The coefficient of determination (R2), in this case, also shows a high value (0.535), indicating that the initial value of the tax mix is able to explain the 53.5% variance of the growth rate between the countries.

Another high values were revealed in the coefficient of determination of tax quotas (FP), which stands at 75.1%. The convergence rate, in this case, is also high, which indicates overall convergence of tax systems.

However, these harmonized indirect taxes were not in place throughout the entire analysed period, and other tax groups are not on such a high degree of harmonization. Therefore, the authors believe that the convergence of tax countries is rather influenced by globalization itself – as described in [11] – since most countries have not been members of the EU during the examined period, and this trend of convergence is also evident throughout all OECD countries [5].

At the lowest level of mutual convergence stand the tax mixes of social security contributions and income from property taxes. In these areas, convergence is poor, as well as the coefficient of determination.

In the EU, therefore, there was convergence of tax mixes, thus further meeting of the objective of convergence of tax systems, regardless of whether they were members of the European Union or not.

Tab. 3: *Beta convergence of tax mixes in the EU for Member States*

	FP	**TOI**	**SSC**	**TOW**	**TOP**	**TOG**	**OT**
β	-0.424	-0.232	**-0.22100**	*-1.550*	-0.220	-0.482	*-0.026*
t	-3.134	-1.841	**-5.19100**	*-0.938*	-1.778	-2.989	*0.242*
P-value	0.005	0.081	**0.00005**	*0.417*	0.091	0.008	*0.813*
R²	0.341	0.151	**0.58600**	*0.227*	0.143	0.32	*0.005*

Source: OECD Tax Revenue Statistics 2012 edition, own processing

Table 3 illustrates the convergence in situations where the initial value was the variable of the year in which the county officially joined the Community, and the last value was the value as at 2011.

Even here, there is apparent convergence of tax mixes, however, individual dependences are lower than in the previous case (about half). Also, the coefficients of determination decreased, indicating an increase of the examined variables in the given models. One reason for this change – leaving out the impact of globalization – may be the absence of the changes necessary for the accession to the Community; which were not included in the analysis simply because the initial value taken into account was as late as the year of the country joining the EU.

The coefficients of determination get again one of the highest values in tax quotas and indirect taxes, however, even in this case they are lower, only 34.1% and 32%.

Of note, however, are the results of social security contributions, where the convergence rate remained the same, but at the same time the coefficient of determination increased. The initial value of this part of the budget revenue can explain the 58.6% variance of the growth rate between the countries compared to the original 16.8%.

Another exception is the insignificant dependence in tax revenues from salaries and wages (TOW), as well as in tax revenues from other taxes (OT); therefore, it is not possible to confirm that there is any Beta convergence there. Even the coefficients of determination R^2, in this case, amount to smaller values than in the previous case.

3.2   Sigma Convergence

As mentioned above, the Sigma convergence completes the picture of the Beta convergence and illustrates its course. The graphs below provide information on the development of the Sigma convergence in the analysed periods.
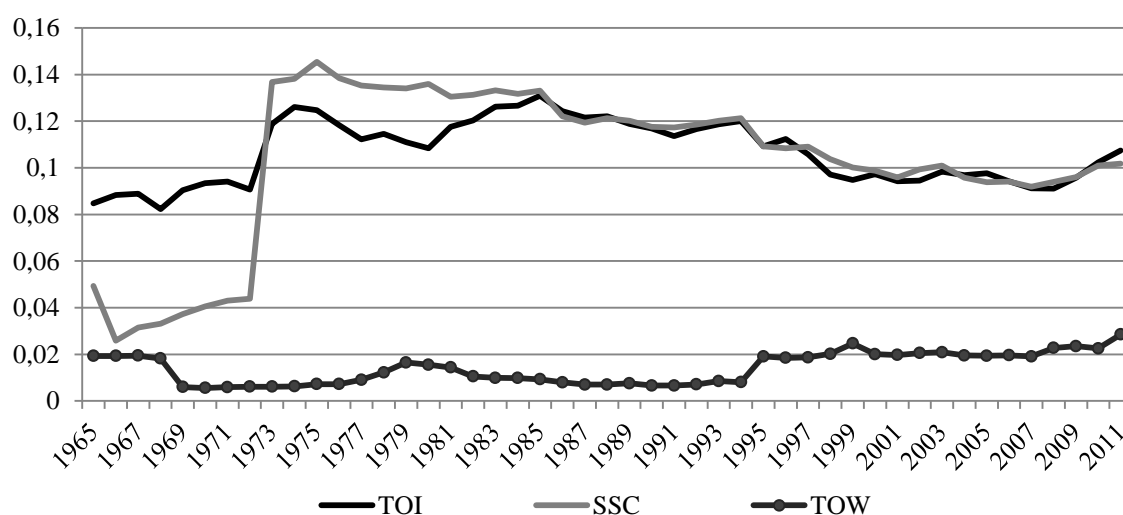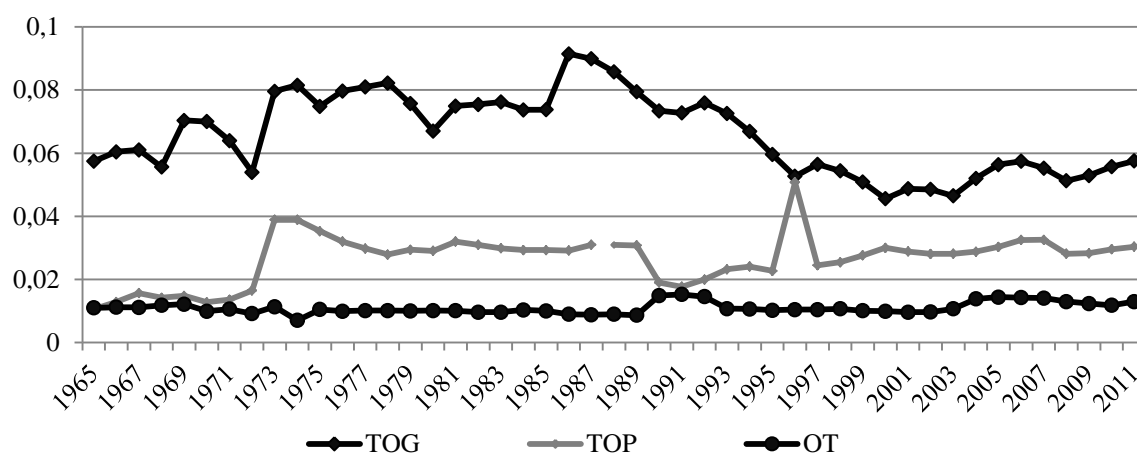

Source: OECD Tax Revenue Statistics 2012 edition, own processing
Fig. 2:   *Sigma convergence of TOI, SSC and TOW in the EU during 1965 – 2011 (%)*

The graph above shows the development of standard deviations between 1965 and 2011. Until 1975, there is noticeable divergence in the tax mixes of social security contributions, however after this year, convergence starts to occur until the end of the analysed period. This is shown also by the result of the Beta convergence.

The tax mix of income taxes indicates the same course, but as late as from 1985. An interesting development can be seen in the standard deviation of the tax mix of salaries and wages, which shows an entirely opposite course. The reason for this development will be the subject of further research.
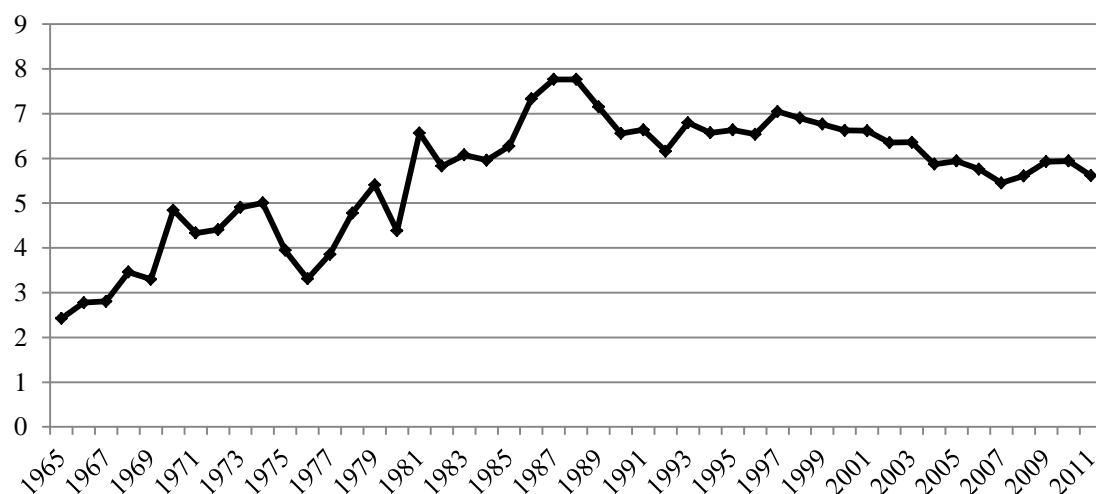

Source: OECD Tax Revenue Statistics 2012 edition, own processing
Fig. 3: *Sigma convergence of TOG, TOP and OT in the EU during 1965 – 2011 (%)*

As for the tax mixes of indirect taxes, there is the same development of convergence / divergence as in the case of income taxes. Until 1985, there was divergence, which then turns into steep convergence. The reason for this turnover may be the mandatory introduction of value added tax in the EU Member States, which took place in the 1980s.

According to the Sigma convergence, the tax mixes of property taxes and other taxes do not meet the convergence objective, however, in this case, it is not possible to claim that there is divergence as the Sigma convergence is not a condition for confirmation of the Beta convergence, which was not refuted in these taxes in the period 1965 – 2011 [16].

Source: OECD Tax Revenue Statistics 2012 edition, own processing
Fig. 4: *Sigma convergence of fiscal pressure in the EU during 1965 – 2011 (%)*

The development of the Sigma convergence in the tax quota nearly exactly follows the development of the tax mix of indirect taxes, income taxes, and social security. Graph 4 presents the change in the growing trend of the standard deviation in 1985, from which point there is convergence of the overall tax burden in the EU.

Similarly interesting is always the end of the analysed period, when Europe was struck by the global economic crisis; between 2007 a 2009, the development of the Sigma convergence shows divergence of tax mixes, thus of the tax quota.

Conclusion

The results presented use the traditional neo-classical methods for finding out convergence of tax systems of European countries. The paper deals with the question of whether the European Union fulfils the objective of a single market also in the field of tax policy. In that area based on all assumptions, there should be convergence of tax systems of the Member States, with aim to eliminate distortions arising from the transition between individual Member States.

To meet the objective, we used the methods of the Beta and Sigma convergence. Convergence was investigated separately first, for the group of all the contemporary EU Member States, regardless of whether they had been EU members or not. This confirmed the fact that there is convergence even if a country is only located in the given area and is not an official member of the EU. The second methodology took into account only the states when they were official members of the Community.

The Beta convergence between 1965 and 2011 of the group of all the current Member States confirmed the existence of convergence of tax mixes (graded according to the OECD classification) and tax quotas. Their convergence occurred even at a time when the contemporary Member States had still not been official members of the Community. The reasons may be, in particular, globalization and the on-going trend of convergence, as described in [11] or Becker [5], but also the convergence effort by the countries seeking to join the EU.

The second methodology of the Beta convergence took into account only the Member States since the moment they became official members of the Community (thus, it considered only the EU). In this case, the convergence of tax mixes was confirmed, but at a lower rate than with the previous methodology. It was confirmed for income taxes, indirect taxes, and property taxes. It is interesting that the revenues from social security contributions did not show that significant decrease in the second methodology; in fact, the coefficient of determination increased nearly to 60%. The tax mixes of salaries and wages, as well as other taxes, showed no significant dependence, and the Beta convergence, in this case, cannot be confirmed.

The Beta convergence itself, however, does not give a complete picture of the course of convergence of tax mixes and quotas. Therefore, we also used the Sigma convergence, which completes the overall picture of convergence of the tax mix and tax quotas. In the tax quota, in this case (using the Sigma convergence), convergence was confirmed since 1985, as well as in the tax mix of income taxes and indirect taxes.

Using the Sigma convergence, tax revenues from social security contributions converged since 1975. However, according to the Sigma convergence, tax revenues from wages, other taxes, and property taxes in this period diverge. This, however, does not mean that there was no convergence, as the Sigma convergence is not a condition to confirm the Beta convergence [16]. Therefore, the convergence demonstrated throughout the analysed period using the Beta convergence could not be completely disproved.

The result of the analysis is the statement that the tax mixes in the European Union converge throughout the entire analysed period of 1965 − 2011. Considering the EU Member States only since their official accession to the EU, convergence also occurs, however, it is slower and the number of explained variables is increased as the coefficients of determination

decreased. In the tax revenues from other taxes, wages and salaries, convergence was neither confirmed nor refuted.

Acknowledgements

Literature

[1] ASHWORTH, J.; HEYNDELS B.: The evolution of national tax structures in view of the EMU. *The Economic and Business Consequences of the EMU – A Challenge for Governments, Financial Institutions and Firms* (Ed.), 2000.

[2] ADÁMKOVA, V.: *Ekonomická a politická integrace Evropy: vybrané kapitoly*. Praha, Oeconomica, 2003.

[3] BARRO, R. J.; SALA-I-MARTIN, X.: Convergence, *Journal of Political Economy*. 100, 223-251, 1992.

[4] BAUMOL, W.: Productivity growth, convergence and welfare: what the long-run data show. *American Economic Review*, 76(5), 1075-1085, 1986.

[5] BECKER, J.; ELSAYYAD, M.: The Evolution and Convergence of OECD Tax Systems. *Verein für Socialpolitik*, vol. 13(1-2), pp. 4-18, 02, 2012, Available from WWW <intereconomics.eu/downloads/getfile.php?id=676>.

[6] DELGADO, F. J.: Are the tax mix and the fiscal pressure converging in the European union? *Working Papers*, No 11-06, 2006, Instituto de Estudios Fiscales.

[7] BOYLE, G. E.; MCCARTHY, T. G.: A simple measure of beta convergence. *Oxford Bulletin of Economics and Statistics*, 59(2), 257-264. 1997.

[8] ESTEVE, V.; SOSVILLA-RIVERO, S.; TAMARIT, C.: Convergence in fiskal pressure across EU countries. *Applied Economics Letters*, 7(2), 117-123, 2000.

[9] EUROPEAN COMMISSION: *Konsolidované znění smlouvy o fungování Evropské unie*. [online]. 2010, [accessed 2013-01-06]. Available from WWW <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2010:083:0047:0200:cs:PDF>.

[10] FURCEDI, D.: β and σ-convergence: a mathematical relation of causality. *Economics Letters*, 89(2), 212-215, 2005.

[11] KUBÁTOVÁ, K.; VANČUROVÁ, A.; FOLTYSOVÁ, M.: Impact of globalization on taxation mixes in OECD countries during 1965-2003. No 01-08., pp. 40-53, *Prague Economic Papers*, 2008.

[12] KUBÁTOVÁ, K.: *Daňová teorie a politika*, 5. aktualiz. vyd., Praha: Wolters Kluwer Česká republika, 2010.

[13] LÁCHOVÁ, L.: *Daňové systémy v globálním světě*. 1. vyd., Praha: ASPI, 2007.

[14] OECD: *Tax Revenue Statistics 2012 edition*. [online]. 2012, [accessed 2012-12-08]. Available from WWW: <http://www.oecd.org/tax/taxpolicyanalysis/oecdtaxdatabase.htm#ssc>.

[15] SOSVILLA, R.; SIMÓN & GALINDO, M.; ÁNGEL & ALONSO, M. J.: Tax burden convergence in Europe. *Estudios de Economía Aplicada*, vol. 17, pp. 183-191, 2001.

[16] SLAVÍK, C.; Reálná konvergence České republiky k Evropské unii v porovnání s ostatními novými členskými zeměmi, Politická ekonomie 1/2007, 2007. Available from WWW <http://www.vse.cz/polek/abstrakt.php3?IDcl=588>.

[17] ŠVEHLÍK, M.: *Daňová harmonizace v EU*. [online presentation]. PF UK, [accessed 12. 12. 2013]. Available from WWW <http://svehlik.cz/downloads/P6728151812.pdf>.

[18] EUROPEAN COMMISSION: *Taxation trends 2012* [online]. 2012, 2012 [accessed 2012-12-01]. Available from WWW <http://ec.europa.eu/taxation_customs/taxation/gen_info/economic_analysis/tax_structures/index_en.htm>.

[19] VINTILA, G.; IONANA, L. T.: *Fiscal Pressure and Tax Mix Convergence in the European Union*. 2012.

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KONVERGUJÍ DAŇOVÉ MIXY V ZEMÍCH EVROPSKÉ UNIE?

Vznik jednotného trhu je jednou z hlavních priorit v procesu integrace Evropské unie, a proto mezi hlavními cíli EU nalezneme také harmonizaci daňových pravidel. Tato práce se zabývá otázkou, zda Evropská unie tento cíl naplňuje a dochází k naplňování plánu vzniku jednotného trhu. Zaměřuje se na otázku, zda daňové systémy konvergují ve smyslu sbližování daňových kvót a daňových mixů. K ověření této hypotézy byly použity metody Beta a Sigma konvergence. Výsledek prezentuje složitost přímé daňové harmonizace a stejně tak konvergenci, ke které jak v oblasti daňových kvót, tak v oblasti daňových mixů během analyzovaných období dochází. Poukazuje ovšem také na skutečnost možného ovlivnění konvergence daňových mixů a daňových kvót nikoliv ze strany integrace Evropské unie ale celosvětové globalizace.

GIBT ES EINE KONVERGENZ IM STEUERN MIX IN DER EUROPÄISCHEN UNION?

Bildung eines Binnenmarktes ist eine der wichtigsten Prioritäten während des Integrationsprozesses der Europäischen Union. Zu diesem Zweck war es geplant, steuerlichen Regelungen in der gesamten Gemeinschaft zu vereinheitlichen. Die zentrale Frage dieser Arbeit ist, ob die Europäische Union wurde um das Ziel der Binnenmarkt. Es konzentriert sich auf die Frage, ob die Steuersystemen sind im Rahmen der Steuer-und Abgabenbelastung und Steuern Mixe konvergieren. Beta und Sigma Konvergenzen sind für die Erfüllung des Ziels des verwendeten Papiers. Die Ergebnisse präsentieren die Schwierigkeiten bei der steuerlichen Harmonisierung und Konvergenz auf dem Gebiet der Steuern Quoten und Steuern Mixe während der analysierten Periode als gut. Die Ergebnisse auch darauf hin, die Tatsache der mögliche Einfluss nicht von der EU-Integration, sondern von Welt Globalisierung.

TAX ZBIEGA MIXES W UNII EUROPEJSKIEJ?

Powstanie jednolitego rynku jest jednym z głównych priorytetów w procesie integracji z Unią Europejską, a więc jednym z głównych celów Unii Europejskiej, istnieje również harmonizację przepisów podatkowych. Dokument ten odnosi się do kwestii, czy Unia Europejska i Dążenie do tego celu jest realizacja planu jednolitego rynku. Skupia się na pytaniu, czy systemy podatkowe zbieżne w sensie zbieżności kwoty podatku oraz mieszanki podatkowych. Aby sprawdzić tę hipotezę, metody stosowano beta i Sigma konwergencji.Wynik przedstawia złożoność bezpośredniej harmonizacji podatkowej, jak również spójność, do której kwota podatku, więc w podatku miesza w analizowanym okresie. Ale wskazuje również na fakt ewentualnego wpływu nie przez integrację Unii Europejskiej, ale globalizacja.