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HORIZONTAL FISCAL IMBALANCE IN THE UNITED STATES

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Abstract

Regional inequalities are currently a challenge for the majority of countries, in particular large ones, certain of which are federations. The federal state system is more complex than the unitary system. This results in specific problems. One of them is the issue of differing level of economic development of individual territorial units, whereby the problem of income redistribution emerges. The difference between income and expenses results in the formation of fiscal gaps, both horizontal and vertical ones. The aim of the paper is to present the measures applied for measuring the horizontal fiscal imbalance. It is also the starting point for conducting measurements of those imbalances in the USA based on the presented measures. The paper presents the measures applied in the literature for the purposes of measuring horizontal fiscal imbalance. In addition, the measurement of those imbalances in the USA are presented.

Keywords: fiscal imbalance, fiscal gap, measures of horizontal fiscal imbalance, convergence, intergovernmental relations, USA.

JEL classification: H73, H77, O11, O18, O47, R12.

Introduction

The decentralisation of public finances coupled with the state federal structure results also in the emergence of specific problems and subsequently their solution, apart from benefits. The main problem is the decentralisation of tax authority and financial equalisation. Due to possible differentiation of the economic development level of territorial units of a federation, the problem of public income redistribution emerges – both horizontal and vertical. The most often considered one is the vertical distribution of income between individual levels of the public authority. At the same time units richer than others can occur at each lower government level. The differences arising from the resources possessed at the same level may be defined as horizontal fiscal imbalance, horizontal fiscal gap[1]. It occurs when it is impossible to achieve income which is equal to the needs of the authorities at the same level of authority. A certain level of mismatch between income and expenses at different levels is unavoidable in the case of all federations. Effective tax administration for certain types of income requires central administration, which contributes to the problems of vertical imbalance. After assigning tax obligations and expenses, the division of income and transfers may adjust the imbalance which results from the assignment of liability. Difficulties in planning or the opposing needs of different levels of public administration mean that the division of income and the transfer mechanism may not fully solve the problem of imbalance[2]. A fiscal deficit at the federation level does not indicate a correlation with the degree of federation's control over the regional authorities but with their financial dependence on the central authority.

The horizontal division of income is considered far less frequently and it seems to have a supplementary significance. Nevertheless, A. Shah argues, despite hardly any empirical evidence, that horizontal fiscal imbalance or regional tax inequalities seem to be graver than the vertical imbalance, particularly in developing countries[3]. It is important to remember that horizontal inequalities are a natural phenomenon. If they are not eliminated, they may lead to movement of persons and capital from less efficient regions to more efficient regions. If they are excessively equalised, they may impede effective allocation of funds within the entire country, thereby influencing economic growth. Horizontal inequalities are most often eliminated by equalisation transfers.

The issues of fiscal imbalance encourage comparative research of states, especially those with a federal form. According to M. Bitner and, K.S. Cichocki, comparative research on local government subsector finance is particularly rare in public finance literature[4]. There are no up-to-date measurements and comparisons of horizontal fiscal imbalance between countries. Results

obtained by the end of the 20th century can be found in English-language literature. R. Bird and A.V. Tarasov as well as R. Shankar and A. Shah performed measurement of horizontal fiscal imbalance. The calculations were conducted based on data before 2000 in the case of R. Bird and A.V. Tarasov[5] and before 1998 in the case of R. Shankar and A. Shah[6]. Apparently, the European Union is an exception as it calculates the regional GDP for its regions within the NUTS classification as % of the European Union average and dispersion, on the basis of which comparisons are made.

1. Static and Dynamic Measures of Horizontal Fiscal Imbalance

Various measures may be used for measuring horizontal differences[7]. Statistical measures most commonly used are presented in table 1[8].

Table 1. Static measures of horizontal fiscal imbalance and its sources

Specification	Formula	Source
1	2	3
Coefficient of minimum (maximum)	$\frac{y_{\min}}{\bar{y}} \cdot 100\%$ and $\frac{y_{\max}}{\bar{y}} \cdot 100\%$ (1)	Bird, Tarasov (2002, p. 12).
Range	$R = y_{\max} - y_{\min}$ (2)	Cowell (2011, p. 155).
Maximum-to-minimum ratio	$WMM = \frac{y_{\max}}{y_{\min}}$ (3)	Bird, Tarasov (2002, p. 12); Shankar, Shah (2003, p. 1422); Shankar, Shah (2008, p. 144); Li, Xu (2008, p. 34).
Simple coefficient of variation	$CV_U = \frac{\sqrt{\sum_i \frac{(y_i - \bar{y}_U)^2}{n}}}{\bar{y}_U}, \ \bar{y}_U = \frac{1}{n}\sum_{i=1}^{n} y_i$ (4)	Bird, Tarasov (2002, p. 12); Shankar, Shah (2003, p. 1422); Shankar, Shah (2008, pp. 144–145); Huang, Leung (2009, p. 28); Cowell (2011, p. 155).
Weighted coefficient of variation	$CV_W = \frac{\sqrt{\sum_i (y_i - \bar{y})^2 \frac{p_i}{P}}}{\bar{y}}, \ \bar{y} = \sum_{i=1}^{n} y_i \frac{p_i}{P}$ (5)	Bird, Tarasov (2002, p. 12); Shankar, Shah (2003, p. 1423); Shankar, Shah (2008, pp. 145–146).
Relative mean deviation	$R_w = \frac{\sum_i \lvert y_i - \bar{y} \rvert \frac{p_i}{P}}{\bar{y}}$ (6)	Bird, Tarasov (2002, p. 12); Shankar, Shah (2003, p. 1423); Shankar, Shah (2008, p. 146).
Unweighted Gini index	$G_U = \left(\frac{1}{2\bar{y}_U}\right)\frac{1}{n(n-1)}\sum_{i=1}^{n}\sum_{j=1}^{n}\lvert y_i - y_j \rvert$, $G_U = \frac{1}{2n^2\bar{y}}\sum_{i=1}^{n}\sum_{j=1}^{n}\lvert y_i - y_j \rvert$ (7)	Shankar, Shah (2003, p. 1423); Shankar, Shah (2008, pp. 146–147); Li, Xu (2008, p. 34); Portnov, Felsenstein (2010, p. 213); Litchfield (1999); Cowell (2011, p. 155).
Weighted Gini index	$G_w = \left(\frac{1}{2\bar{y}}\right)\sum_{i=1}^{n}\sum_{j=1}^{n}\lvert y_i - y_j \rvert \frac{p_i p_j}{P^2}$ (8)	Shankar, Shah (2003, p. 1423); Shankar, Shah (2008, p. 147); Li, Xu (2008, p. 34).

1	2	3
Theil index	$T_{B,T} = \sum_i \frac{y_i}{\bar{y}} \cdot \frac{p_i}{P} \log\left(\frac{y_i}{\bar{y}}\right), \quad T_C = \frac{1}{n}\sum_{i=1}^{n} \frac{y_i}{\bar{y}} \log\left(\frac{y_i}{\bar{y}}\right)$ (9)	Bird, Tarasov (2002, p. 12); Cowell (2011, p. 155); Litchfield (1999).
The Hoover coefficient	$H = \frac{1}{2}\sum_{i=1}^{n}\left\lvert \frac{p_i}{P}\frac{y_i}{\bar{y}} - \frac{p_i}{P}\right\rvert$ (10)	Portnov, Felsenstein (2010, p. 213).
The Coulter coefficient	$C = \left[\frac{1}{2}\sum_{i=1}^{n}\left(\frac{p_i}{P}\frac{y_i}{\bar{y}} - \frac{p_i}{P}\right)^2\right]^{\frac{1}{2}}$ (11)	Portnov, Felsenstein (2010, p. 213).

where: y_{max} – region with maximum parameter[9] per capita (e.g. GDP),
y_{min} – region with minimum parameter per capita,
$\bar{y}$ – national average of given parameter,
y_i – observed parameter per capita in region *i* (for example income per capita),
n – number of regions,
$\bar{y}_U$ – national average of given parameter, unweighted,
p_i – population of region *i*,
y_j – observed parameter per capita in region *j*,
p_j – population of region *j*.

Source: own elaboration.

As can be seen, attempts to measure horizontal imbalance and the impact of equalisation transfers have been made with use of simple measures of dispersion or concentration. The literature does not describe more effective techniques of inequality measurement. Attempts are made to use two statistics concepts which are useful for considering the dynamics of regional inequalities[10]. They are dynamic measures of beta (β) convergence[11] and sigma (σ) convergence[12] based on the convergence hypothesis or the divergence hypothesis[13]. Catching up the distance in income of the relatively poorer regions by faster growth is called beta convergence, while decreasing the regional dispersion in income in time is referred to as sigma convergence[14].

According to S.J. Rey and M.V. Janikas[15], the introductory work on the convergence hypothesis was based on the neoclassical theory of economic growth. The convergence hypothesis holds that the growth rate is directly proportional to the distance between the present level of income distribution and the steady-state growth rate. The convergence rate index is based on the assumption that the distance between the present and the steady-state ratios can be closed. This approach to convergence does not necessarily indicate that all state economies converge to the same income-level distribution rate, since it accounts for growth-rate differences between countries of different steady-state ratios and/or other differences between the present and the steady-state ratios. The above reasoning has stimulated numerous empirical studies and has led to the formulation of a growth regression model referencing the growth rate of GDP per capita within a timeframe of t_0 to $t_0 + T$ and the set of steady-state determinants (Z). The rate of convergence, in this approach, is a function of the β_T parameter and represents β-convergence.

For the purpose of verifying the existence of β convergence, M. Próchniak and R. Rapacki estimated the following regression equation[16]:

$$\frac{1}{T}(\ln y(T) - \ln y(0)) = \alpha_0 - \alpha_1 \ln y(0) \tag{16}$$

where:

$y(T)$ – regional GDP per capita in the end year,

$y(0)$ – regional GDP per capita in the initial year.

The left side of the above formula determines economic growth rate. The first variable on the right side of $\ln y(0)$ represents the initial level of regional GDP, and hence the α_1 parameter informs about the occurrence of real β-convergence. Such a convergence occurs where α_1 is negative and statistically significant. β-value can be determined in the following manner[17]:

$$\beta = -\frac{1}{T}\ln(1+\alpha_1 T) \tag{17}$$

As can be seen, it is very similar to the formula proposed by J. Villaverde and A. Maza[18], who defined the rate of convergence as $b = -\log[1 - \beta T]/T$.

2. Research results

The calculations were conducted based on statistical data obtained from the Bureau of Economic Analysis[19] regarding population[20] and the regional GDP for 50 federal states and District of Columbia[21] in the period 1963–2013.

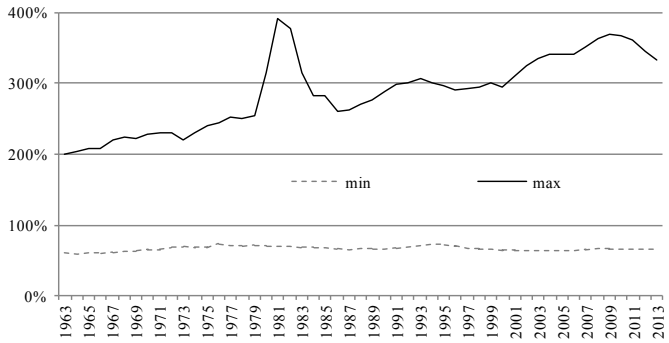

Fig. 1. Coefficient of minimum (maximum) as percent of national average

Source: own elaboration.

The difference between the minimum and maximum indicators as % of the national average in the 1960s and early 1970s was found at a relatively stable level of ca. 140–160%. In the second half of the 1970s, it increased to 180%. In the years 1980–1982, there was a marked increase of the index, reaching as much as 320% for the year 1981. Over the next few years, the disproportions between the richest and the poorest states were reduced to ca. 200-230%. Another significant increase of state disproportions was observed since 2001, peaking to 301.8% in 2009. Over the last four years, the difference decreased, but only slightly (Figure 1).

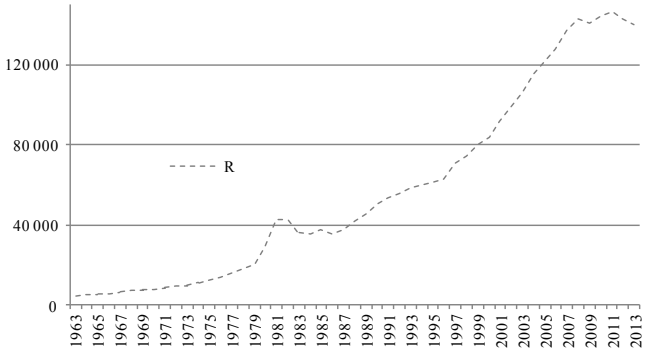

Fig. 2. Range (USD)

Source: own elaboration.

The spread between the maximum and minimum values is considerably high, attesting to large disproportions between the richest and the poorest US states. For the year 2013, it was estimated at ca. 140.2 thousand USD per capita, marking a decrease of 6,313 USD compared with the maximum value peak of 2011 (Figure 2). The oil crisis of 1973 was the main force responsible for the large disproportions observed at the turn of 1970s and 1980s. Over the period of 1979–1981, the difference between the poorest and the richest state doubled up (Figure 2). This is confirmed by other indexes (see Figures 3–6). Another dramatic spread increase was observed in the early years of the 21st century. The difference between the richest and the poorest state rose from 83,909 USD in 2000 to 122,238 USD in 2005 and 144,349 USD in 2010, representing an increase of ca. 70% (Figure 2).

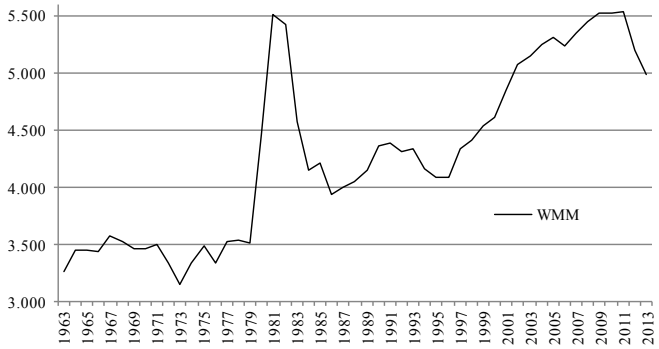

Fig. 3. Maximum-to-minimum ratio

Source: own elaboration.

The maximum-to-minimum ratio for the USA suggests that similar level of disproportion was only observed till the late 1970s. The maximum point was registered in 1981, with the ratio reaching over 5.5. It dropped to 3.943 in 1986, but never returned to the pre-increase levels. A steady growth rate of the ratio was observed since mid-90s, suggesting increased disproportion between the richest and the poorest state. Another maximum was registered in 2011. And again, over the last three years, the disproportion has decreased (Figure 3).

Other indexes (see Table 2, Figures 4–6) seem to confirm the existence of large disproportion between the richest and the poorest state, but without exceeding the 1981 maximum point.

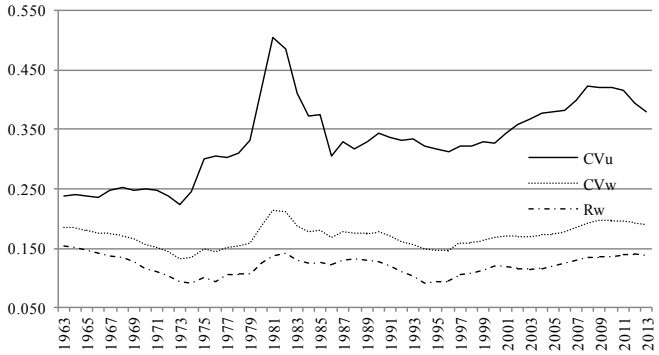

Fig. 4. Simple and weighted coefficient of variation, relative mean deviation

Source: own elaboration.

Sigma convergence for the USA, measured by a simple variation coefficient, was:

- stable in the periods: 1963–1971, 1994–2000, 2008–2010,
- convergent in the periods: 1971–1973, 1976–1977, 1981–1986, 1987–1988, 1990–1994, 2010–2013,
- divergent in the periods: 1973–1976, 1977–1981, 1986–1987, 1988–1990, 2000–2008.

Table 2. Summary table on measures of horizontal fiscal imbalance in the USA based on per capita regional GDP

Specification	Figures are calculated values for the first year of series	Figures are calculated values for the last year of series	Overall range of values over corresponding period
Number of regions	51		
Data	1963–2013		
Number of observations	51		
min/max as % of average	61.21–199.83	66.55–331.93	59.30–391.40
R	4,465	140,204	4,465–146,517
WMM	3.264	4.988	3.155–5.534
Cvu	0.238	0.380	0.222–0.504
CVw	0.186	0.189	0.132–0.213
Rw	0.153	0.139	0.091–0.153
Gu	0.122	0.152	0.101–0.180
Gu2	0.119	0.149	0.099–0.176
Gw	0.103	0.093	0.066–0.103
Theil B,T	0.007	0.007	0.004–0.008
Hoover	0.077	0.070	0.045–0.077
Coulter	0.026	0.021	0.014–0.026

Source: own elaboration.

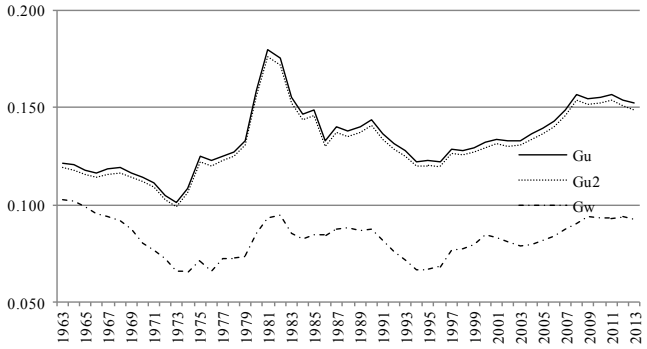

Fig. 5. Unweighted and weighted Gini index

Source: own elaboration.

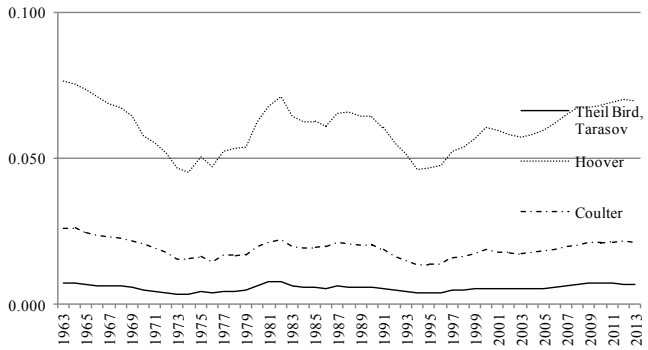

Fig. 6. Theil index, Hoover and Coulter coefficient

Source: own elaboration.

The highest *β*-convergence levels were observed in the years 1980–1991, at 2.67%, with the corresponding determination coefficient remaining at a low level. However, over the whole period under study (1963–2013), the *β*-convergence was registered, even if only at a distinctly low level of 0.35% and at a marginally low determination coefficient of 0.04% (Table 3), meaning that, for all the US states, the distance to a long-term steady-state level has decreased at an annual ratio of 2.67%. In other words, reducing the distance by half would take them 198 years or more.

Table 3. *β*-convergence in the USA

Observation period	Independent variable	Number of regions	Speed of convergence (%)	Beta convergence	R^2
1963–2013	ln(1963PKBp.c.)	51	0.35	yes	0.0402
1963–2007	ln(1963PKBp.c.)		0.11	yes	0.0052
1991–2000	ln(1991PKBp.c.)		0.99	yes	0.0672
1970–1980	ln(1970PKBp.c.)		–0.83	no	0.0179
1980–1991	ln(1980PKBp.c.)		2.67	yes	0.2309
2007–2013	ln(2007PKBp.c.)		0.91	yes	0.0344
2000–2013	ln(2000PKBp.c.)		0.79	yes	0.0302
2001–2007	ln(2001PKBp.c.)		–0.25	no	0.0029
2003–2007	ln(2003PKBp.c.)		–0.66	no	0.0140

Source: own elaboration.

Beta convergence suggests that the period of 1970–1980 was a time of the greatest divergence. Divergence was also observed in the pre-crisis period (2001–2007) (Table 3).

Weighted values are lower than unweighted values, thus proving that the regions with the highest regional GDP *p.c.* have a low population.

Conclusions

Convergence of regions is currently one of the most frequently addressed research problems, in particular in the context of equalising inequalities among the European Union member states. Despite the growing interest of research on convergence in the regional approach, the measurement of fiscal inequalities between and inside regions are rarely analysed.

The public finance system, in particular in federations, is often very complex. Public finance of federations and federated states are not often placed within the same assumptions. This leads to differences between regions, both vertical and horizontal. The use of the presented measures helps identify those differences and permits developing mechanisms equalising those inequalities. It should be remembered that those measures may have certain drawbacks, and they mainly focus on certain specific values of income redistribution. Thereby several measures should be applied in measurements and the obtained results should be compared.

The most frequently applied measures of horizontal fiscal imbalance are the minimum and maximum indicators, range, maximum to minimum, weighted and unweighted variation coefficient and Gini and Theil indexes.

The United States of America is the oldest and largest federal state in the world. States have independent taxing powers and substantial expenditure responsibilities. Federal and state taxes are essentially independent, but there is no formal "revenue-sharing" system between federal and state or local governments. Indeed, there are no transfers specifically intended to deal with vertical and horizontal fiscal imbalance[22]. Therefore, as shown by the results, horizontal fiscal imbalance in the USA is relatively high. However in the recent years it has a decreasing tendency, what shows a beta convergence indicator. Nonetheless, there are very substantial intergovernmental fiscal transfers in the USA, especially to finance various social programs carried out at the state and local levels.[23]

Notes

[1] The two notions are used interchangeably.

[2] Shah (1994).

[3] Ibidem.

[4] Bitner, Cichocki (2012).

[5] Bird, Tarasov (2002).

[6] Shankar, Shah (2003).

[7] They may be static – they show inequalities in the given moment, or dynamic – they reflect historical trends. Dynamic measures are based on the hypothesis of convergence or divergence.

[8] More widely, see e.g. Kowalik (2012).

[9] This parameter may be the regional GDP, regional income, regional expenses, regional own income, regional total income, inter-government transfers, gross added value, personal available income.

[10] Hence their names – dynamic measures.

[11] And their modifications. It assumes that countries with a lower initial income level are characterised by a greater pace of growth than the initially richer countries, which leads to the equalisation of income per capita with time.

[12] It refers to the measurement of the diversity of wealth of countries. Sigma convergence is referred to in the case of decreasing values of the adopted indicator in successive moments of the defined time.

[13] Shankar, Shah (2003); Shankar, Shah (2008); Rey, Janikas (2005); Villaverde, Maza (2009).

[14] Shankar, Shah (2003); Shankar, Shah (2008).

[15] Rey, Janikas (2005).

[16] Próchniak, Rapacki (2007).

[17] Ibidem; Rapacki, Próchniak (2009); Próchniak, Witkowski (2012).

[18] Villaverde, Maza (2009).

[19] www.bea.gov (June 2014).

[20] *SA1-3 Personal income summary Population* (2014).

[21] *GDP by state all industry total (current dollar)* (2014).

[22] Widely see Kowalik (2013).

[23] Ibidem.

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