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Fiscal convergence and sustainability in the European Union

VLADIMIR ARČABIĆ, Ph.D.*

Article**
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Abstract

This paper analyzes fiscal convergence and sustainability in the European Union using data on government debt, revenues, and expenditures. Absolute fiscal divergence is present in the EU, especially after the sovereign debt crisis. However, we find evidence of fiscal club convergence when clubs are endogenously determined. Club convergence is important for the EU because there is no single fiscal policy and member states' policies are heterogeneous. Endogenous clubs do not share the usual geographical, political, or development similarities. Fiscal policy in the EU is found to be unsustainable, but it is countercyclical. We use a policy response function where the primary surplus is a function of public debt and the output gap. The primary surplus does not respond to changes in public debt, and this is considered to be unsustainable. However, it increases in expansions and decreases in recessions thus being countercyclical. The countercyclical primary surplus is important for smoothing business cycles.

Keywords: convergence clubs, fiscal sustainability, public debt, structural breaks, log t test, dynamic panel

1 INTRODUCTION

With the sovereign debt crisis in the Eurozone, fiscal policy has become an increasingly important topic. The sovereign debt crisis and the Great Recession led to many European Union countries breaching the public debt and deficit goals set by Stability and Growth Pact (SGP). The goals are for public debt not to exceed 60% of GDP and for the deficit not to exceed 3% of GDP. These goals, which are part of the nominal convergence criteria, were established to ensure sound and sustainable public finances in the European Union. However, whether or not there is a convergence of member states' fiscal policies and whether fiscal policy is sustainable is still an open question.

This paper analyzes fiscal convergence and tests for fiscal sustainability in the European Union. We test fiscal convergence directly using government revenue, expenditure, and debt as key government variables instead of testing for GDP convergence as is usual in the convergence literature. The paper considers both absolute convergence and convergence clubs, which is important because the European Union does not have a single fiscal policy and member states' policies are heterogeneous. Heterogeneous fiscal policies among member states could easily lead to different fiscal convergence clubs, which are analyzed in the paper. Based on the identified convergence clubs, we test for fiscal sustainability in the clubs as well as in the whole of the European Union. Fiscal sustainability has become an especially important topic for the EU countries after the Greek crisis.

The literature on fiscal convergence is relatively scarce. Economic integration, common institutional factors, and common policies in the EU should lead to convergence in key fiscal indicators. On the other hand, the sovereign debt crisis and the Great Recession affected member states in different ways, possibly leading to

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fiscal divergence. It seems that the observed period plays an important role. Earlier research finds some evidence of fiscal convergence in the period from the late 1960s to the early 2000s (De Bandt and Mongelli, 2000; and Delgado, 2006), while more recent studies such as Kočenda, Kutan and Yigit (2008) show the lack of it in the period from 1995 to 2005. The mentioned papers measure convergence using the popular β- and α-convergence tests as well as cointegration tests in a time series framework.

The literature does not tackle the issue of convergence clubs regarding fiscal policy. However, the idea of convergence clubs is implicitly included in discussions on the EU core and periphery, or on the *two-speed* Europe idea popularized by Blanchard (2010) which argues that different groups of European countries show faster and slower recoveries after the Great Recession. Accordingly, fiscal convergence and the possibility of convergence clubs are important issues for EU policymakers. This paper analyzes both absolute convergence and club convergence. Instead of grouping countries according to *ad-hoc* criteria such as geographical location or EU accession date, we determine convergence clubs endogenously.

We also analyze fiscal sustainability within the clubs and in the whole EU 28 using a policy response function proposed by Bohn (1998, 2007). Fiscal policy is sustainable if the primary government surplus increases as a response to the increase in public debt. This is considered responsible and sustainable behavior because the government increases its revenue or decreases spending when faced with a higher public debt. Bohn (1998, 2005) concludes that U.S. fiscal policy is sustainable. Cassou, Shadmani and Vázquez (2017) refine this finding by showing that the U.S. fiscal policy is sustainable only during good economic times, but not in times of economic distress.

The research regarding European fiscal policy is somewhat different. Collignon (2012) develops a policy response function to analyze European fiscal sustainability. His policy response function is adjusted to EU fiscal rules looking at the primary surplus response to changes in debt and deficit. Results indicate that European fiscal policy is sustainable in this respect, but conditions on financial markets and the risk of financial contagion can make it insufficient, as shown by the Greek crisis. Research has also focused on the cyclical behavior of fiscal policy. The common understanding is that fiscal policy should be countercyclical; higher government spending in recessions followed by fiscal consolidation in expansions to smooth business cycles. The countercyclical fiscal policy is sustainable in the long run when extra deficits accumulated in recessions are compensated for during times of economic growth. Balassone, Francese and Zotteri (2010) show that budget balance in fourteen EU countries deteriorates during recessions, but does not improve to the same extent during expansions. Government expenditures are responsible for the asymmetry.

Public debt sustainability has been widely analyzed for individual countries as well. Babić (2003) and Mihaljek (2004) analyze the sustainability of public and external debt in Croatia. This early analysis[1] concluded that Croatian public debt is not too sensitive to the various shocks analyzed, but credit rating and interest rate spread in Croatia are worse than those of central European countries. Deskar-Škrbić and Šimović (2017) on the other hand showed that public debt level affects the effectiveness of fiscal spending by reducing the size of fiscal effects in Croatia.

This paper contributes to the literature by analyzing absolute fiscal convergence and convergence clubs using quarterly data for government debt, revenues, and expenditures in EU member states from 2000:1 to 2017:2. We test convergence using a log *t* test proposed by Phillips and Sul (2007, 2009) accompanied with the clustering algorithm for endogenous club classification. Commonly used β- and σ-convergence tests might be biased and suffer from low power as noted in Bernard and Durlauf (1995, 1996) among others. Such tests assume linear dynamics in the convergence process. Phillips and Sul's (2007) log *t* test is based on a nonlinear dynamic factor model, which allows a nonlinear adjustment in parameters both over time and across different countries. Therefore, it is suitable in testing for convergence. We check the robustness of our results by applying recently developed unit root tests, which control for both sharp and smooth structural breaks.

The paper also contributes to the fiscal policy sustainability literature. We use a policy response function proposed by Bohn (1998) in a panel framework where the primary government surplus is a function of public debt and the output gap. We use a dynamic panel model and include a lagged dependent variable in the equation since there is a strong inter-temporal relationship between the government surplus and public debt. Furthermore, EU countries are somewhat homogenous, and therefore there is a possibility of cross-sectional dependence. Unlike the previous literature, we use a dynamic panel system GMM estimator with common correlated effects proposed by Pesaran (2006) which controls for pronounced homogeneity among the EU countries.

The main findings can be summarized as follows. There is strong and robust evidence of absolute divergence in government debt, revenues, and expenditures among the EU countries. The process of divergence was intensified during the sovereign debt crisis and the Great Recession. However, we find two, three, and four endogenous convergence clubs in government debt, revenue, and expenditures respectively. The clubs are found to be quite heterogeneous; club members do not share the usual geographical, political, or development similarities. On the other hand, groups of EU-15 and EU-13 countries as well as EU core and EU periphery countries are shown to diverge, which suggests an important difference between endogenous and exogenous groupings.

[1] 1997-2003 period is considered.

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Fiscal policy is found to be unsustainable but countercyclical both in the EU as a whole and within identified convergence clubs. Our model does not show an increase in the primary surplus after debt upsurge, which is identified as unsustainable behavior. We find only limited evidence of fiscal sustainability in the EU-13 group and in a subsample with public debt higher than 90%. On the other hand, fiscal policy in the EU is countercyclical, indicating the efforts of fiscal policy to smooth business cycles.

The paper is structured as follows. Section 2 explains and presents the data. It describes empirical methods used in the paper, namely log *t* test and the clustering algorithm for club convergence analysis; unit root tests with structural breaks; and the dynamic panel model used for the sustainability analysis. Section 3 presents results on fiscal convergence and sustainability, while section 4 concludes.

2 DATA AND METHODOLOGY

2.1 DATA

For convergence analysis, we use quarterly general government debt, revenues, and expenditures in a percent of GDP as our key variables. Variables in current prices are divided by nominal GDP and expressed in real terms as a percent of GDP. The data span from 2000:q1 to 2017:q2, which is the longest available period for a balanced panel for 28 EU countries. For the sustainability analysis, we use primary surplus, public debt, and the output gap data, but the sample starts in 2002:q1 because of the availability of primary surplus data. The primary surplus is calculated as total surplus plus payable interest, and it is expressed as a percent of GDP. Public debt is expressed as a percent of GDP as well. The output gap is a percent deviation of GDP from its long-run trend computed using the Hodrick and Prescott (1997) filter.

All variables are seasonally adjusted using Census X11 method for Census Bureau's X12-ARIMA program. Data are collected primarily from the Eurostat and International Financial Statistics (IFS) database. For Croatia, we use central government revenues and expenditures provided by the Croatian National Bank as a proxy for general government. For some countries, we had to reconstruct data from different sources to work with balanced panels for the analysis. Details on data construction are explained in appendix. Appendix also plots series of government debt, revenues, expenditures, and primary surplus as a percent of GDP and presents basic descriptive statistics.

2.2 THE LOG *t* CONVERGENCE TEST AND CLUB CONVERGENCE

We use the log *t* test for convergence analysis of government debt, revenues, and expenditures as well as for analysis of convergence clubs. The test was developed by Phillips and Sul (2007, 2009) who built on a neoclassical growth model with heterogeneous technology and looked for the output convergence. Intuitively, the test looks at cross-sectional dispersion over time. If the dispersion decays over time, countries are becoming more similar, i.e. there is convergence. Phillips and

Sul (2009) introduced three sets of tools: relative transition curves, log *t* test, and the clustering algorithm for testing club convergence.

Allowing for a heterogeneous technology in a growth model is important because countries experience different growth paths. Such a framework is reasonable for studying fiscal convergence in the EU as well because countries have both a common part, such as institutions and policies, and an idiosyncratic part which is country-specific.

Consider a neoclassical growth model with the heterogeneous technology used in Phillips and Sul (2009):

$$\log y_{it} = \log \tilde{y}_i^* + \log A_{i0} + \left[\log \tilde{y}_{i0} - \log \tilde{y}_i^* \right] e^{-\beta_{it} t} + g_{it} t \tag{1}$$

where y_{it} is output per capita, $\tilde{y}_{i0}$ and $\tilde{y}_i^*$ are initial and steady-state levels of output per capita, respectively, and A_{i0} represents the initial level of technology. Heterogeneity is allowed through the convergence parameter β_{it} and the output growth rate g_{it} since both can vary over time and across countries. The model can be rewritten to show a common and country-specific component. We simplify the equation (1) as $\log y_{it} = a_{it} + g_{it} t$ where the term a_{it} collects all RHS variables except $g_{it} t$. Than the model can be written as a dynamic factor model:

$$\log y_{it} = \left(\frac{a_{it} + g_{it} t}{\mu_t} \right) \mu_t = b_{it} \mu_t . \tag{2}$$

In this dynamic factor model μ_t is a common component. The coefficient b_{it} explains how individual countries relate to the common component μ_t. In this paper, the focus is on fiscal convergence. Instead of looking at output per capita, we consider convergence in government debt, revenues, and expenditures. The common component μ_t in that case are EU institutions, integration process, and/or common policies, while b_{it} represents a share of a common trend for each EU member state.

Coefficients b_{it} could be empirically analyzed using relative transition curves h_{it} which are simply the relative departure of country *i* from the average, or:

$$h_{it} = \frac{b_{it}}{\frac{1}{N} \sum_{i=1}^{N} b_{it}} = \frac{x_{it}}{\frac{1}{N} \sum_{i=1}^{N} x_{it}} \tag{3}$$

where x_{it} are series on government debt, revenue, or expenditures.[2] We remove the cyclical component from the time series as suggested by Phillips and Sul (2009) by using the Hodrick and Prescott (1997) filter, but the results are not very sensitive to cyclical smoothing. Convergence is evident when h_{it} curves for all countries approach 1.

[2] For each variable we run a separate test.

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The log *t* test is a more formal way for testing convergence. The test builds on relative transition curves and has the following form:

$$\log\frac{H_1}{H_t} - 2\log\left(\log t\right) = a + \gamma \log t + u_t \tag{4}$$

where $H_t = 1/N\sum_{i=1}^{N}\left(h_{it}-1\right)^2$ is a quadratic distance measure which goes to 0 when countries converge. $t = T_0, ..., T$ where T_0 is the first observation after we discard the initial 30% of observations, as suggested by Phillips and Sul (2009). Second term on LHS is a penalty function which improves test performance, and u_t is an *iid* error. Convergence is tested with the coefficient γ. When γ is negative and statistically significant, we can conclude that countries diverge. If $0 \leq \gamma < 2$ we can conclude there is a conditional convergence in growth rates. For absolute convergence to hold, $\gamma \geq 2$.[3] The critical value at 5% level significance is 1.65.

Phillips and Sul (2007, 2009) also developed a clustering algorithm for detecting endogenous convergence clubs based on the log *t* regression. If the convergence hypothesis is rejected for the full sample, club convergence can be considered. The clustering algorithm has four steps. Simplified, in the first step we sort countries in the panel, and in the second step, we form a core group of k countries, where $k < N$, for which the log *t* regression yields the highest *t*-statistics.[4] The remaining $N - k$ countries form a complementary group. In the third step we add one country at the time from the complementary to the core group and for each we apply the log *t* test. If $t > -1.65$, the new country is added to the core group. The first convergence club is obtained after all countries that satisfy the condition are added. In the fourth step, we apply the log *t* test on the group of remaining countries which are not a part of the first convergence club. If the *t*-statistic is greater than -1.65, the second convergence club is identified. If not, we repeat steps (1) to (3) on the group of remaining countries to identify other possible convergence clubs.

To obtain as few clubs as possible, we run separate tests for club merging. Once initial clubs are identified, we run the log *t* test on them. If convergence hypothesis is not rejected for club 1 and club 2, we merge them and form a new club 1. New club 1 is then tested for merging with club 3 and so on. The advantage of this procedure is that it produces fewer convergence clubs, but the downside is that the evidence for convergence is less convincing, because the *t*-statistic on the γ coefficient is usually insignificant.

2.3 UNIT ROOT TESTS FOR CONVERGENCE

We use different unit root tests for convergence analysis within identified clubs to check the robustness of our results. We test for convergence in government debt, revenues, and expenditures both in the full sample of EU 28 and in each identified convergence club. Following the approach of Bernard and Durlauf (1995) and

[3] Phillips and Sul (2007, 2009) provide more technical details of the test. For empirical analysis we use a set of procedures described in Du (2017).

[4] To form a group, the *t*-statistic for parameter γ from log *t* regression must be $t > -1.65$.

Pesaran (2007) we compute a difference between country *i* and the average which we test for the unit root:

$$\tilde{x}_{it} = x_{it} - \bar{x}_t \tag{5}$$

where x_{it} represents government debt, revenues, or expenditures in country *i*, and $\bar{x}_t$ is an adjusted average excluding country *i* under consideration. The adjusted average should prevent a bias in testing, which could be large for big countries such as Germany.

If the difference series $\tilde{x}_{it}$ is stationary, then there is convergence in government debt, revenues, or expenditures. Shocks to an individual country's fiscal variables may be permanent or temporary, but all shocks to the difference series $\tilde{x}_{it}$ should be only temporary if country *i* converges to the average. Rejection of unit root is evidence of convergence. If our results are robust, rejections should be higher within identified clubs than in the full sample of EU 28.

We apply unit root tests developed by Lee and Strazicich (2003), and Enders and Lee (2012) that can control for structural breaks. Structural breaks are highly possible in government debt, revenues, and expenditures time series since they include the period of the sovereign debt crisis and the Great Recession in the EU. Ignoring structural breaks might be a serious problem that reduces the power of the test, as argued in Perron (1989). We also present results of a standard ADF test, which does not control for structural breaks. Intuitively, structural breaks are abrupt changes in the data such as the Great Recession. It is possible that the convergence was present both before and after the break, but the existence of the break violates our conclusions.

The Lee and Strazicich (2003) unit root test controls for two sharp breaks in the data. It is a Lagrange Multiplier (LM) test with the equation:

$$\Delta\tilde{x}_t = \delta'\Delta Z_t + \phi\tilde{S}_{t-1} + \varepsilon_t \tag{6}$$

where $\tilde{S}_t$ is a detrended $\tilde{x}_t$ series and ϕ is a coefficient of interest. Under the null hypothesis of unit root $\phi = 0$, and the rejection of unit root implies convergence.

We use the so-called break model which allows for two breaks in both level and the trend of the series using dummy variable vector $Z_t = [1, t, D_{1t}, D_{2t}, DT_{1t}, DT_{2t}]$. Dummy variables D_{1t} and D_{2t} control for breaks in level and take value 1 if $t \geq T_{Bj}+1$ and 0 otherwise for breaks $j = 1, 2$ where T_{Bj} are break locations. On the other hand, dummy variables DT_{1t} and DT_{2t} control for breaks in the trend where $DT_{jt} = t - T_{Bj}$ for $t \geq T_{Bj}+1$ and 0 otherwise for breaks $j = 1, 2$. Break locations T_{B1} and T_{B2} are endogenously determined in a grid search which minimizes the *t*-statistics of coefficient ϕ.

Critical values for the LM test with two breaks in a level and the trend are taken from table 2 of Lee and Strazicich (2003). Number of lags in the equation (6) is chosen based on general to specific procedure.

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We also use the Enders and Lee (2012) unit root test, which controls for an unknown number of smooth structural transitions approximated by a flexible Fourier function. The Fourier function has proved to accommodate smooth breaks very well, there is no need for a grid search as in Lee and Strazicich (2003) test, and the number of estimated parameters is relatively small, so the test does not lose power. The test equation is simple and can be estimated by OLS:

$$\Delta \tilde{x}_t = c(t) + \phi \tilde{S}_{t-1} + \varepsilon_t \tag{7}$$

where again $\tilde{S}_t$ is detrended $\tilde{x}_t$ series and ϕ is a coefficient of interest. The null hypothesis of unit root assumes $\phi = 0$, and again a rejection of unit root implies convergence. However, equation (7) includes a time-dependent deterministic term $c(t)$ which is approximated by a single frequency Fourier function of the form

$$c(t) = c_0 + c_1 \Delta \sin\left(\frac{2\pi t}{T}\right) + c_2 \Delta \cos\left(\frac{2\pi t}{T}\right) \tag{8}$$

where c_0, c_1, and c_2 are coefficients estimated by OLS, t is a current time period, and T is a number of observations. Note that the equation (8) nests a standard linear specification when c_1 and c_2 are equal to zero. We run the model with a single frequency equal to one, and with a number of lags chosen by general to specific procedure. Critical values are taken from Enders and Lee (2012) table 1.

2.4 POLICY RESPONSE FUNCTION FOR THE SUSTAINABILITY ANALYSIS

We analyze fiscal policy sustainability using a policy response function as suggested by Bohn (1998, 2007).[5] Our model can be written as:

$$s_{it} = \rho s_{it-1} + \beta_1 d_{it} + \beta_2 \tilde{y}_{it} + \varepsilon_{it}. \tag{9}$$

Equation (9) is a dynamic panel version of Bohn's policy response function where s_{it} is the government primary surplus in country i at time t, d_{it} is public debt, and $\tilde{y}_{it}$ is the output gap. e_{it} is the residual where $e_{it} = \alpha_{it} + \varepsilon_{it}$, and α_i are country fixed effects. The error term ε_{it} is independent, or $E[\varepsilon_{it}\varepsilon_{jk}] = 0$ for each i, j, t, and k where $i \neq j$.

Fiscal policy is sustainable when β_1 is positive, suggesting an increase in primary surplus as a response to higher public debt. Such behavior is considered sustainable and responsible, because the government tends to increase its revenue or decrease spending as a response to higher debt.

Bohn (1998) stressed the importance of controlling the model with the output gap. Coefficient β_2 next to the output gap also tells us if the fiscal policy is pro- or countercyclical. When $\beta_2 < 0$, the positive output gap decreases government sur-

[5] Bohn (2005, 2007) criticize fiscal sustainability analysis based on unit root and cointegration techniques popularized by Trehan and Walsh (1988), and Hamilton and Flavin (1986). He argues that such techniques are not capable of rejecting sustainability hypothesis because the relevant debt variables are necessary stationary after a finite number of differencing and thus in compliance with the intertemporal budget constraint (IBC).

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plus and fiscal policy can be considered as procyclical and vice versa (Balassone, Francese and Zotteri, 2010).

Our model includes a richer dynamic than initially proposed in Bohn (1998) by including a lagged primary surplus (Cassou, Shadmani and Vázquez, 2017). This specification is more appropriate because it allows for fiscal policy persistence and because of a possible feedback effect between public debt and surplus in a panel framework; accumulated government deficits (negative surpluses) are closely related to public debt.

The benchmark model is estimated by a system GMM augmented with common correlated effects (CCE) proposed by Pesaran (2006) to deal with cross-sectional dependence. The system GMM estimator proposed by Arellano and Bover (1995), and Blundell and Bond (1998) is often used for dynamic panel estimation, and we use their two-step procedure with robust standard errors where fixed effects are removed by first differencing.[6]

Our panel consists of European Union countries which are somewhat homogenous in terms of common institutions and policies, and therefore a cross-sectional dependence can be an important issue affecting our results.[7] To deal with the issue of cross-sectional dependence, we augment the system GMM estimator by adding cross-sectional means of all variables as instruments in the model from the equation (9). Common correlated effects procedure is proposed by Pesaran (2006) for a group of OLS estimators. However, we use this principle to augment system GMM estimator. Pesaran (2006) showed that adding CCE has satisfactory small sample properties for relatively small N and T even in heterogeneous models. We call this model system GMM-CCE model.

We confirm the robustness of the benchmark model by estimating a dynamic panel model with fixed effects (FE) using robust errors. Our data set is a balanced panel with a reasonably large $T = 62$ and therefore the FE estimator should not be biased. We refer to this model simply as the FE model.

3 FISCAL CONVERGENCE AND SUSTAINABILITY

3.1 CONVERGENCE CLUBS

We do not find any evidence to support the absolute convergence of government debt, revenues, and expenditures in the EU using relative transition curves and log *t* test. The relative transition curves in figure 1 show lack of convergence, because they do not approach 1 in the observed period. By contrast, curves are scattered equally at the beginning and the end of the sample.

[6] We use first differencing instead of forward orthogonal deviaton (FOD) because our data set is a balanced panel. Refer to Arellano and Bover (1995), and Blundell and Bond (1998) for complete technical details.
[7] Indeed, when we apply Pesaran (2015) test for weak cross-sectional dependence to the model, the null hypothesis of cross-sectional independence can be easily rejected.

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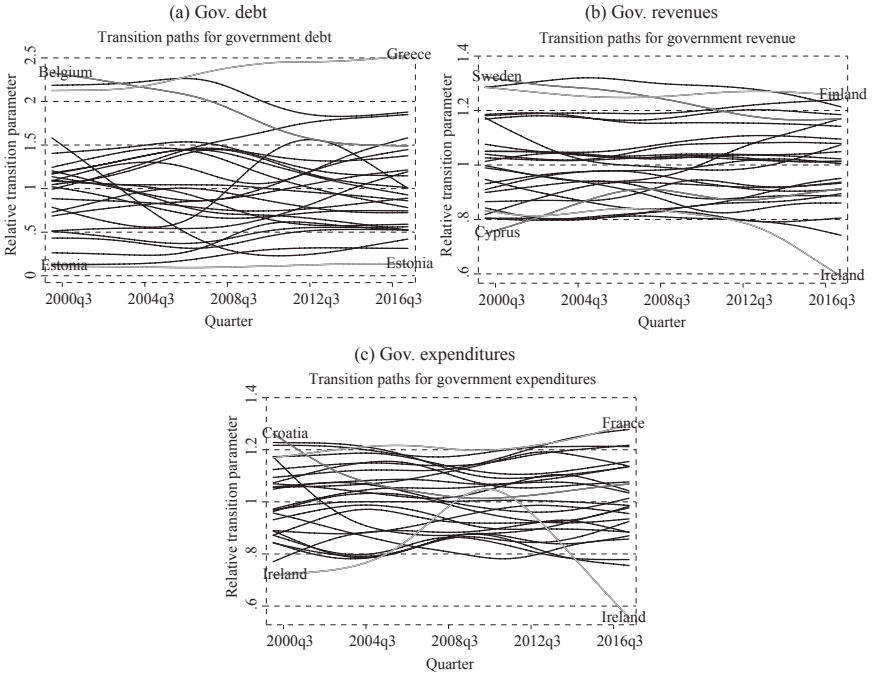
FIGURE 1
Relative transition paths



This is further supported by a more formal log *t* test presented in table 1. Table 1 shows γ coefficient from the log *t* regression applied to government debt (1a), revenues (1b), and expenditures (1c) data. Again, $\gamma < 0$ implies divergence, $0 \leq \gamma < 2$ is evidence of conditional convergence, and $\gamma \geq 2$ implies absolute convergence in levels. Table 1 shows that γ coefficient is significantly negative (marked with an asterisk) when log *t* test is applied to all EU countries, which rejects absolute convergence of government debt, revenues, and expenditures. Kočenda, Kutan and Yigit (2008) also find fiscal divergence in a form of pronounced level of heterogeneity in public debt and deficit among EU member states.

We also find that the Great Recession and sovereign debt crisis further increased fiscal divergence in the EU. In figure 2 we show results of estimated rolling window γ coefficient for government debt, revenues, and expenditures. We estimate the log *t* regression with a centered rolling window of 20 quarters (five years) together with 95% confidence intervals. For all three variables, estimates are significantly negative throughout the observed period, which further confirms the result of fiscal divergence. An interesting finding is that the estimated γ further decreases from 2008 in the case of government revenues and expenditures and from 2011 in the case of government debt. Therefore, it could be argued that the Great Recession and sovereign debt crisis pushed the EU further away from fiscal convergence.

Table 1

log t convergence test results and convergence clubs classification

(a) Government debt convergence results					
log(t)	All countries				
γ	-0.253*				
t-stat	-22.13				
Club classification					
log(t)	Club 1 [19]	Club 2 [9]			
γ	-0.00900	0.560			
t-stat	-0.686	6.100			
(b) Government revenues convergence results					
log(t)	All countries				
γ	-0.729*				
t-stat	-33.34				
Club classification					
log(t)	Club 1 [19]	Club 2 [5]	Club 3 [2]	Club 4 [2]	
γ	0.00700	0.792	0.114	-3.378*	
t-stat	0.527	22.75	0.395	-2.779	
(c) Government expenditures convergence results					
log(t)	All countries				
γ	-1.075*				
t-stat	-10.68				
Club classification					
log(t)	Club 1 [5]	Club 2 [11]	Club 3 [6]	Club 4 [3]	Club 5 [2]
γ	0.284	0.264	0.113	0.851	-0.125
t-stat	1.016	16.05	8.963	9.936	-0.154
Final classification					
log(t)	Club 1 [5]	Club 2 [11]	Club 3 [9]	Club 4 [2]	
γ	0.284	0.264	0.169	-0.125	
t-stat	1.016	16.05	14.93	-0.154	

Note: The table presents γ *coefficient from log* t *regression together with t-statistics.*
** Marks a rejection of convergence at 5% level. Numbers in brackets are number of countries in the club. Club classification is a result of the initial clustering algorithm. Final classification is a result after club merging. Final classification is presented only when club merging is significant. Countries that form different clubs are presented in figure 3.*

However, we find strong evidence of club convergence. Convergence clubs are implicitly included in discussions about the EU core and periphery as well as in the idea of *two-speed* recovery in Europe popularized by Blanchard (2010). We use the clustering algorithm of Phillips and Sul (2007, 2009) to determine convergence clubs endogenously. Results are presented in table 1 under Club classification section. Countries that form convergence clubs are shown in figure 3.

Table 1a presents results for government debt. We find two convergence clubs, one containing 19 and the other 9 countries. The γ coefficient is statistically zero in the first, and positive, but less than 2 in the second club, which indicates conditional convergence of clubs. Similarly, for government revenues, three conver-

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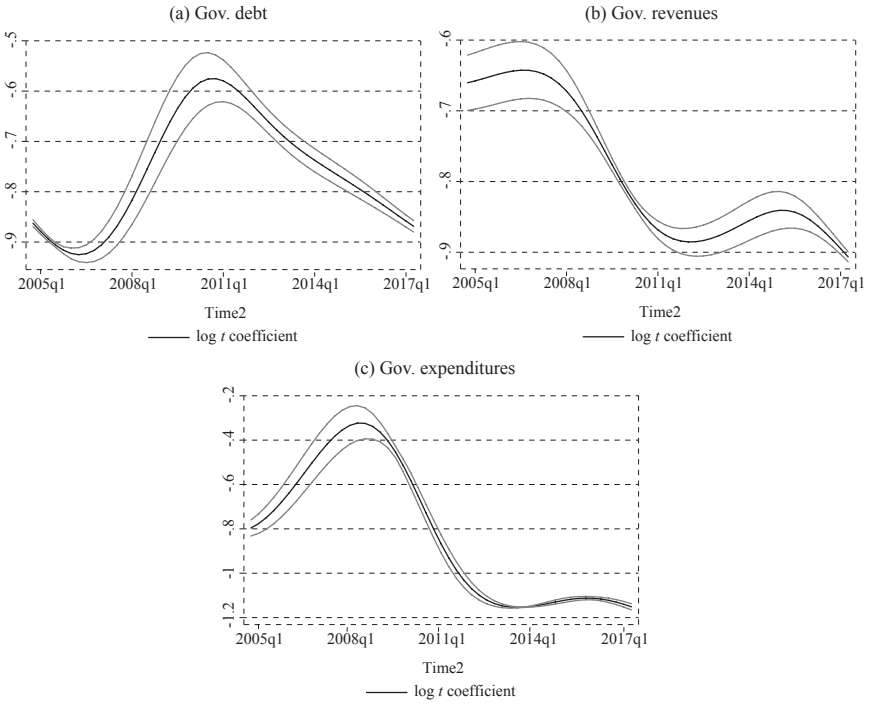
gence clubs emerged and club sizes are 19, 5, and 3 (table 1b). Ireland and Romania form a divergence group, since they do not converge to any club. For government expenditures, club classification finds five clubs in total, plus Ireland as a divergent group. However, clubs 3 and 4 can be merged together according to log *t* test, so the final classification shows four convergence clubs plus Ireland (table 1c). Club sizes are 5, 11, 9, and 2 for Clubs 1, 2, 3, and 4 respectively. In each case $0 \leq \gamma < 2$ indicating conditional convergence.

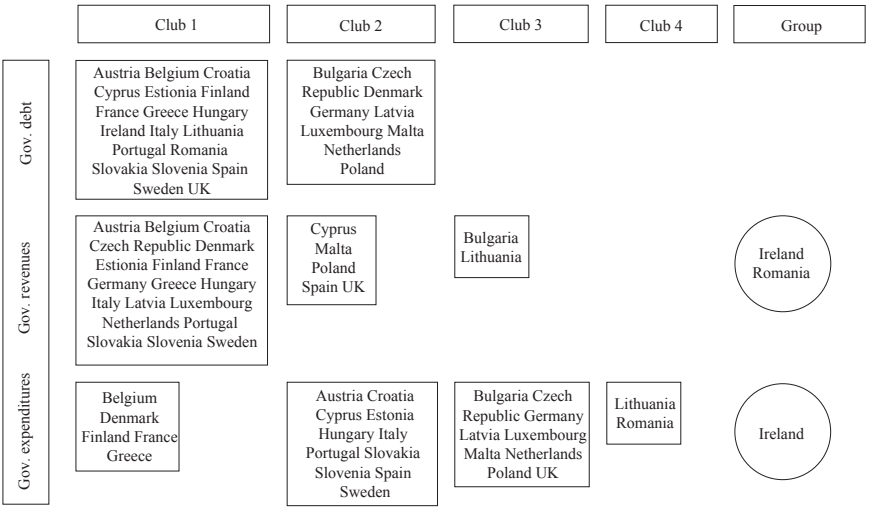
Figure 2

Rolling window estimation of log t regression



Identified clubs are heterogeneous in a sense that countries within a club do not share common geographical, political, or development similarities. In figure 3 we show countries that form different clubs. The first row of figure 3 shows clubs from 1 to 4 and divergent groups. The first column indicates fiscal variables: government debt, revenues, and expenditures. Convergence clubs are in squares, while divergent groups are in circles. For example, government debt Club 1 includes Croatia, Cyprus, Estonia, Hungary, Lithuania, Romania, Slovakia, and Slovenia, which are new member states, mostly small countries, and most of them experienced the transition from centrally planned to market economy. However, Austria, Belgium, Finland, France, Greece, Ireland, Italy, Portugal, Spain, Sweden, and the UK are also members of the same club (government debt Club 1). Similar diversity can be found within other clubs.

FIGURE 3
Convergence clubs



Note: Convergence clubs are in squares, non-convergent groups are in circles.

We find a substantial degree of homogeneity in government debt, revenues, and expenditures clubs. For example, government debt Club 1 and government revenues Club 1 share 12 of 19 countries (figure 3). All eleven countries in government expenditures Club 2 are also in government debt Club 1. There is a major overlap between government debt Club 2 and government expenditures Club 3. Other similarities can also be observed in figure 3. Therefore, clubs are heterogeneous within countries, but homogenous in fiscal variables.

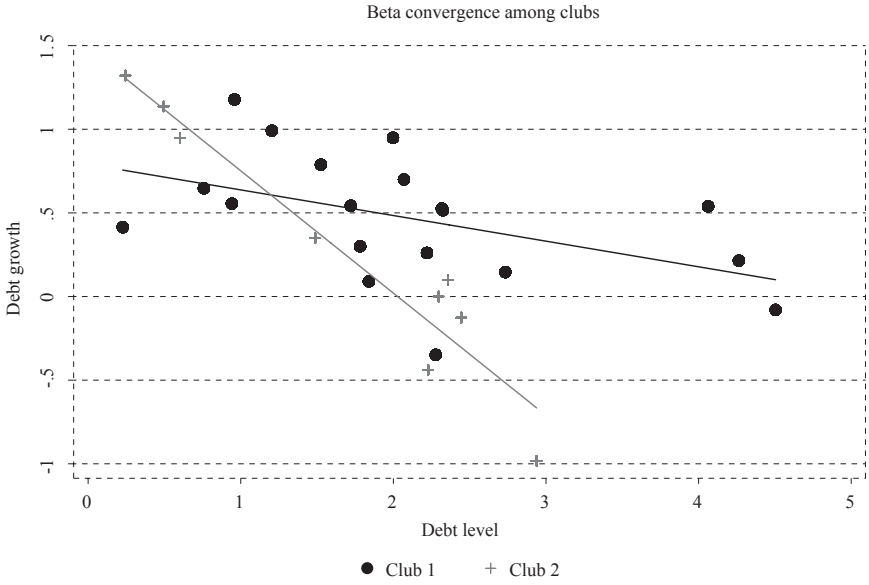
Endogenously identified clubs indeed show evidence of convergence, but this is not the case for *ad-hoc* exogenous clubs. First, we group countries into EU-15 and EU-13 and apply the log *t* regression to government debt, revenues, and expenditures data. The results reject convergence in all cases except for government debt in EU-13, where the γ coefficient is statistically equal to zero (0.042 with a *t*-statistic of 1.34). Next, we group countries into EU core and periphery[8] and use the log *t* test. Convergence is strongly rejected in both groups for all three fiscal variables. It seems that countries converge to some criteria other than simply geographical, political, or development similarities, or indeed multiple similarities.[9] These results could be compared with Kočenda, Kutan and Yigit (2008) who analyze fiscal convergence in the ten EU countries that joined EU in 2004. They do not find a systematic difference among all EU countries, EU core, and EU periphery when analyzing fiscal convergence. Delgado (2006) uses cluster analysis to group EU countries thus avoiding *ad-hoc* exogenous clubs, but the paper does not tackle the issue of fiscal club convergence.

[8] EU core countries are Austria, Belgium, Denmark, Finland, France, Germany, Luxembourg, Netherlands, Sweden, and UK. Other 18 countries form EU periphery.
[9] Analysis of factors and criteria to which countries converge is beyond the scope of this paper.

The log *t* regression improves upon the standard β-convergence tests, but results are compatible with such tests. In figure 4 we show a simple scatter plot of government debt level and a growth rate, which is a version of an unconditional β-convergence test. For government debt Clubs 1 and 2, we estimate the equation of the form $\log(d_{Ti}/d_{1i})=\alpha+\beta d_{1i}+\varepsilon_i$, where the dependent variable is the debt growth rate between the last and the first period, and the independent variable is a debt level in the first period. Club 1 is depicted with black circles, and Club 2 with grey pluses. As shown in the figure 4, regression lines for each club are negatively sloped indicating convergence within clubs according to the standard β-convergence test.

Figure 4

β-convergence in clubs



3.2 UNIT ROOT TESTS OF FISCAL CONVERGENCE

Table 2 presents results of fiscal convergence using unit root tests for the sample of 28 EU countries and within clubs identified by the clustering algorithm. For the government debt data, we analyze convergence to the average for the full sample of the EU 28, then for the 19 countries of convergence club 1, and then for the 9 countries of club 2 (table 2a). A similar analysis is done for government revenues and expenditure in table 2b and 2c, respectively. For each club, we compute a separate adjusted average. Unit root rejection rates at 10% significance level are presented for ADF, Lee and Strazicich (2003), and Enders and Lee (2012) test. Rejection of the unit root hypothesis is considered evidence of convergence.

Table 2

Club convergence using unit root tests

2a: Percent of countries converging to the average gov. debt (%)

	ADF	Lee & Strazicich	Enders & Lee
EU [28]	3.57	3.57	7.14
Club 1 [19]	0.00	5.26	5.26
Club 2 [9]	22.22	0.00	0.00

2b: Percent of countries converging to the average gov. revenues (%)

	ADF	Lee & Strazicich	Enders & Lee
EU [28]	35.71	85.71	46.43
Club 1 [19]	42.11	94.74	57.89
Club 2 [5]	40.00	100.00	40.00
Club 3 [2]	0.00	100.00	100.00

2c: Percent of countries converging to the average gov. expenditures (%)

	ADF	Lee & Strazicich	Enders & Lee
EU [28]	39.29	78.57	46.43
Club 1 [5]	40.00	100.00	40.00
Club 2 [11]	54.55	90.91	81.81
Club 3 [9]	33.33	77.78	55.56
Club 4 [2]	100.00	100.00	100.00

Notes: Rejection rates of unit root hypothesis at 10% level of significance are reported in the table. Number of countries in a club is in brackets. The rejection rate is calculated as (# of rejections/ # of countries within a club)×100.

We find neither absolute nor club convergence in government debt data because the difference of government debt against the average is stationary for just a few countries. For the full sample of EU 28, unit root rejection rates are only 3.5% in the case of ADF and the Lee and Strazicich test, and 7% for the Enders and Lee test. Rejection rates within two clubs are not much different, thus not supporting club convergence of government debt.

In the case of government revenues and expenditures, we do not find evidence of absolute convergence, but club convergence is supported. Almost half of countries in the EU 28 sample converge to the average. ADF test has low power in the presence of structural breaks, but the unit root is rejected in 35% to 40% of countries for both series. The Enders and Lee test has more power and rejects the unit root in 46% of countries. Finally, the Lee and Strazicich test with sharp structural breaks shows the biggest rejection rates of 78% and 85%. For both government revenues and expenditures, rejection rates within clubs are higher than in the full sample of EU 28, indicating stronger convergence within clubs. This is especially true for Lee and Strazicich (2003) test where rejection rates are mostly over 90% within clubs indicating strong club convergence. Enders and Lee (2012) test has rejection rates within clubs well over 50%, except in government revenues club 2 and government expenditures club 1. ADF test gives somewhat mixed results but does not reject the club convergence hypothesis. This confirms that convergence clubs using the Phillips and Sul (2007, 2009) clustering algorithm are robust,

except for government debt. As a comparison, De Bandt and Mongelli (2000) use cointegration techniques to analyze fiscal convergence in the Eurozone. Their findings support fiscal convergence in the Eurozone over the 1970-1998 period. Unit root tests which allow for nonlinearities have recently been a more popular way of analyzing convergence (see Raguž Krištić, Rogić Dumančić and Arčabić (2018) and references therein).

3.3 FISCAL (UN)SUSTAINABILITY

Next, we analyze if fiscal policy is sustainable in the European Union and within convergence clubs found in the previous section. In this respect, we use the policy response function from equation (9) which relates primary government surplus with public debt and the output gap. If surplus increases as a response to an increase in public debt, fiscal policy is considered sustainable, as discussed in the methodology section.

We analyze fiscal sustainability using seven different models (subsamples). Model 1 is the benchmark model, which includes 28 EU countries. Models 2 and 3 include subsamples of countries from government debt convergence clubs identified in the previous section. The first club consists of 19, and the second of 9 countries.[10] Next, we consider fiscal policy sustainability within exogenous clubs of EU-15 and EU-13 countries with Models 4 and 5. Finally, Models 6 and 7 use subsamples with government debt $\geq$ 90% (Model 6) and debt $<$ 90% of GDP (Model 7). This subsample analysis is motivated by the influential paper of Reinhart and Rogoff (2010) who argue that a public debt higher than 90% of GDP depresses economic growth. Maastricht criteria also require government debt below 60% of GDP. However, EU countries fought with the Great Recession and the sovereign debt crisis, which substantially increased the level of public debt in some countries. Our data show that 15 out of 28 EU countries had a government debt higher than 60% of GDP in 2017:Q2. Therefore, such subsample analysis is interesting from both an academic and a policy perspective. The 90% level of public debt can be considered as arbitrary, especially since Arčabić et al. (2018) show there is no single level of public debt associated with the decrease of GDP growth. However, in this paper, we are only interested in fiscal sustainability.

Fiscal policy is found to be unsustainable in the EU. We present the results of system GMM-CCE and FE estimators in tables 3 and 4, respectively. Different models are numbered in the first row of each table, and independent variables are in the first column. In table 3, the estimated coefficient β_1 next to the government debt is negative or insignificant. In other words, the government does not increase primary surplus as a response of higher government debt, and fiscal policy is not sustainable. We find weak evidence of fiscal sustainability for the EU-13 group countries and for the subsample with debt $\geq$ 90%. For these two models (Models

[10] We consider government debt convergence clubs only, but clubs are fairly homogeneous between fiscal variables, as discussed. In addition, some government revenues and expenditures convergence clubs include only a few countries, which is impractical for panel data analysis.

5 and 6), point estimates are positive with both system GMM-CCE and FE estimator. However, coefficients are insignificant for system GMM-CCE estimator, and point estimates are small in magnitude in both cases (tables 3 and 4).

Fiscal policy is countercyclical in the EU and in all subsamples considered. Balassone, Francese and Zotteri (2010), and Cassou, Shadmani and Vázquez (2017) use β_2 coefficient next to the output gap to analyze cyclicality of fiscal policy. As presented in tables 3 and 4, the coefficient next to output gap is positive and statistically significant in all models.[11] Positive output gaps are related to an increase in primary surplus, which can be interpreted as a countercyclical fiscal policy. This indicates that fiscal policy in the European Union tries to smooth business cycles.

Fiscal policy is fairly persistent because the coefficient ρ next to the lagged surplus is positive, statistically significant, and roughly 0.5.

[11] Only Model 6 in table 4 has a positive, but insignificant output gap.

Table 3

Results of fiscal sustainability analysis using system GMM-CCE model

Models	**Model 1 Benchmark**	**Model 2 Club 1**	**Model 3 Club 2**	**Model 4 EU-15**	**Model 5 EU-13**	**Model 6 Debt ≥ 90%**	**Model 7 Debt < 90%**
Variables	Surplus	Surplus	Surplus	Surplus	Surplus	Surplus	Surplus
Surplus (lagged) (ρ)	0.502***	0.415***	0.390***	0.547***	0.308**	0.573**	0.526***
	(0.08)	(0.09)	(0.10)	(0.06)	(0.11)	(0.21)	(0.10)
Debt (β_1)	-0.018	-0.009	-0.043	-0.029	0.040	0.036	-0.057*
	(0.01)	(0.01)	(0.12)	(0.02)	(0.03)	(0.08)	(0.03)
Output Gap (β_2)	0.286***	0.413***	0.435***	0.394***	0.388**	0.297**	0.305***
	(0.05)	(0.07)	(0.13)	(0.04)	(0.15)	(0.09)	(0.07)
Constant	0.776	0.122	2.030	1.879	-2.351*	-4.298	2.459*
	(0.76)	(1.06)	(5.63)	(1.23)	(1.15)	(8.69)	(1.44)
Observations	1,708	1,159	549	915	793	281	1,427
Number of countries	28	19	9	15	13	9	26
F-test	0	3.40e-06	0.00139	0	2.43e-05	0.00352	0
# of instruments	23	14	11	14	11	11	20
Hansen test	0.222	0.100	0.371	0.175	0.102	0.506	0.166

*Note: Standard errors in parentheses, ***, **, and * mark statistical significance at 1%, 5%, and 10% level. Model 1 is the benchmark model. Models 2 and 3 include countries from endogenous debt convergence clubs 1 and 2, respectively. Models 4 and 5 include EU-15 and EU-13 countries, and models 6 and 7 include subsamples with government debt ≥ 90% and debt < 90% of GDP, respectively.*

TABLE 4

Results of fiscal sustainability analysis using FE model

Models:	**Model 1 Benchmark**	**Model 2 Club 1**	**Model 3 Club 2**	**Model 4 EU-15**	**Model 5 EU-13**	**Model 6 Debt ≥ 90%**	**Model 7 Debt < 90%**
Variables	Surplus	Surplus	Surplus	Surplus	Surplus	Surplus	Surplus
Surplus (lagged) (ρ)	0.512***	0.515***	0.491***	0.637***	0.336***	0.248**	0.611***
	(0.06)	(0.07)	(0.12)	(0.04)	(0.07)	(0.10)	(0.09)
Debt (β_1)	0.006	0.004	0.025	0.003	0.029**	0.031**	-0.009
	(0.01)	(0.01)	(0.02)	(0.00)	(0.01)	(0.01)	(0.01)
Output Gap (β_2)	0.176***	0.172***	0.209**	0.226***	0.197***	0.213	0.133***
	(0.04)	(0.04)	(0.09)	(0.03)	(0.05)	(0.12)	(0.04)
Constant	-0.614*	-0.713	-0.998	-0.327	-1.831***	-3.951**	0.168
	(0.36)	(0.42)	(0.71)	(0.35)	(0.40)	(1.48)	(0.63)
Observations	1,708	1,159	549	915	793	281	1,427
R-squared	0.304	0.298	0.335	0.457	0.173	0.123	0.384
Number of countries	28	19	9	15	13	9	26

*Note: Standard errors in parentheses, ***, **, and * mark statistical significance at 1%, 5%, and 10% level. Model 1 is the benchmark model. Models 2 and 3 include countries from endogenous debt convergence clubs 1 and 2, respectively. Models 4 and 5 include EU-15 and EU-13 countries, and models 6 and 7 include subsamples with government debt ≥ 90% and debt < 90% of GDP, respectively.*

4 CONCLUSION

The Great Recession and the sovereign debt crisis in the Eurozone have shaken fiscal policies in the EU. Many European countries have breached public debt and deficit goals set by the Stability and Growth Pact. Therefore, the issue of fiscal policy convergence and sustainability is very important for the EU.

This paper analyzes fiscal policy convergence and tests for fiscal sustainability in 28 EU countries using data on government debt, revenues, and expenditures. We show absolute divergence in fiscal policies, which was further increased by the Great Recession and the sovereign debt crisis. However, we find strong evidence of club convergence. Club convergence is important to consider because the EU does not have a single fiscal policy and member state policies are heterogeneous. In general, convergence clubs are implicitly included in discussions on the EU core and periphery, and in the *two-speed* recovery idea which argues that different groups (or clubs) of European countries are characterized by faster and slower recoveries from the recession. We find two government debt convergence clubs, three government revenue clubs, and four government expenditure clubs. Endogenously identified clubs do not have simple geographical, political, or development similarities. They are heterogeneous within countries, but homogenous between fiscal variables. Exogenous grouping of EU countries into EU-15 and EU-13 or into EU core and periphery does not show evidence of fiscal convergence. Convergence clubs are related to multiple equilibriums within the EU, which makes a single fiscal policy difficult to achieve. More precise fiscal rules could be considered by policymakers together with corrective measures such as the Excessive Deficit Procedure. Fiscal rules instead of discretionary decision making might be a step toward similar fiscal policies and fiscal convergence in the EU.

Fiscal policy in the EU is found to be unsustainable, but countercyclical. We use a policy response function for the sustainability analysis where primary surplus is a function of government debt and the output gap. We show that surplus does not respond to an increase in government debt, which cannot be interpreted as sustainable. However, primary government surplus increases in expansions and decreases in recession, thus being countercyclical and aimed at smoothing business cycles. In this respect, the fiscal goals for public debt and deficit set by the Stability and Growth Pact may not be enough to ensure fiscal sustainability. More precise fiscal rules together with corrective measures would be helpful for both fiscal sustainability and convergence.

Disclosure statement

No potential conflict of interest was reported by the author.

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APPENDIX

DATA CONSTRUCTION AND SOURCES

For the convergence analysis, we use data on general government debt, revenues, and expenditures. Variables are in millions of euro, current prices. We divide all by nominal GDP to express fiscal variables in real terms and in a percent of GDP. The main data source is Eurostat and the International Financial Statistics database from the International Monetary Fund. All data span the period from 2000:q1 to 2017:q2, but some data have been reconstructed. For Germany, Estonia, Ireland, and Luxemburg we interpolate annual data for 2000 and 2001 since quarterly data start from 2002:q1. For Austria, we interpolate annual data for 2000 since quarterly data start from 2001:q1. For Croatia, we reconstruct monthly data on central government expenditure and revenue based on the old methodology. The data are provided by Croatian National Bank (CNB) and we use central government data as a proxy for the general government. Nominal GDP is taken from the Eurostat database except for Croatia, Malta, and Poland for which we take the data from IFS. Public debt data are entirely taken from the Eurostat database. Public debt is usually expressed as a percent of GDP on annual bases. Therefore, public debt is divided by a sum of GDP in a current and previous three quarters, or $d_t = (\$d_t / \sum_{i=0}^{3} \$y_{t-i}) \times 100$, where d_t is public debt in a percent of GDP, $\$d_t$, and $\$y_t$ are nominal debt and GDP in millions of euro. We use this approach for the sustainability analysis when the sample starts in 2002:q1. For the convergence analysis where the sample starts in 2000:q1, we divide public debt only by current quarter GDP to maximize number of observations, or $d_t = (\$d_t / \$y_t) \times 100$. For the sustainability analysis, we also use primary surplus and real GDP data from Eurostat. All the data span the period from 2002:q1 to 2017:q2 (balanced panel). Below we plot time series of government revenues and expenditures (figure A1), and primary surplus and government debt (figure A2) in a percent of GDP. Table A1 contains basic descriptive statistics.

FIGURE A1

Government revenues and expenditures as a percent of GDP

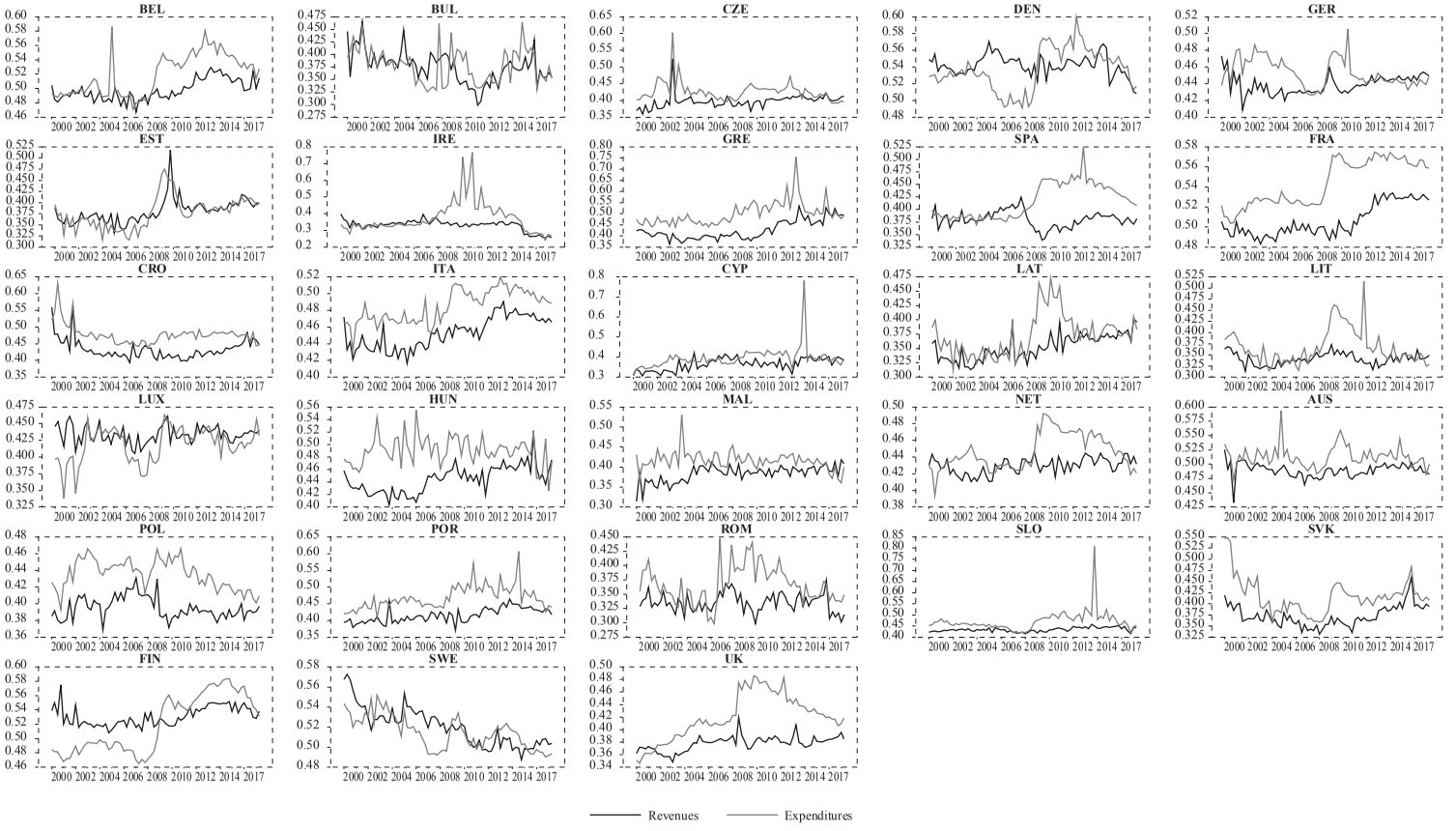

Figure A2

Primary surplus and government debt as a percent of GDP

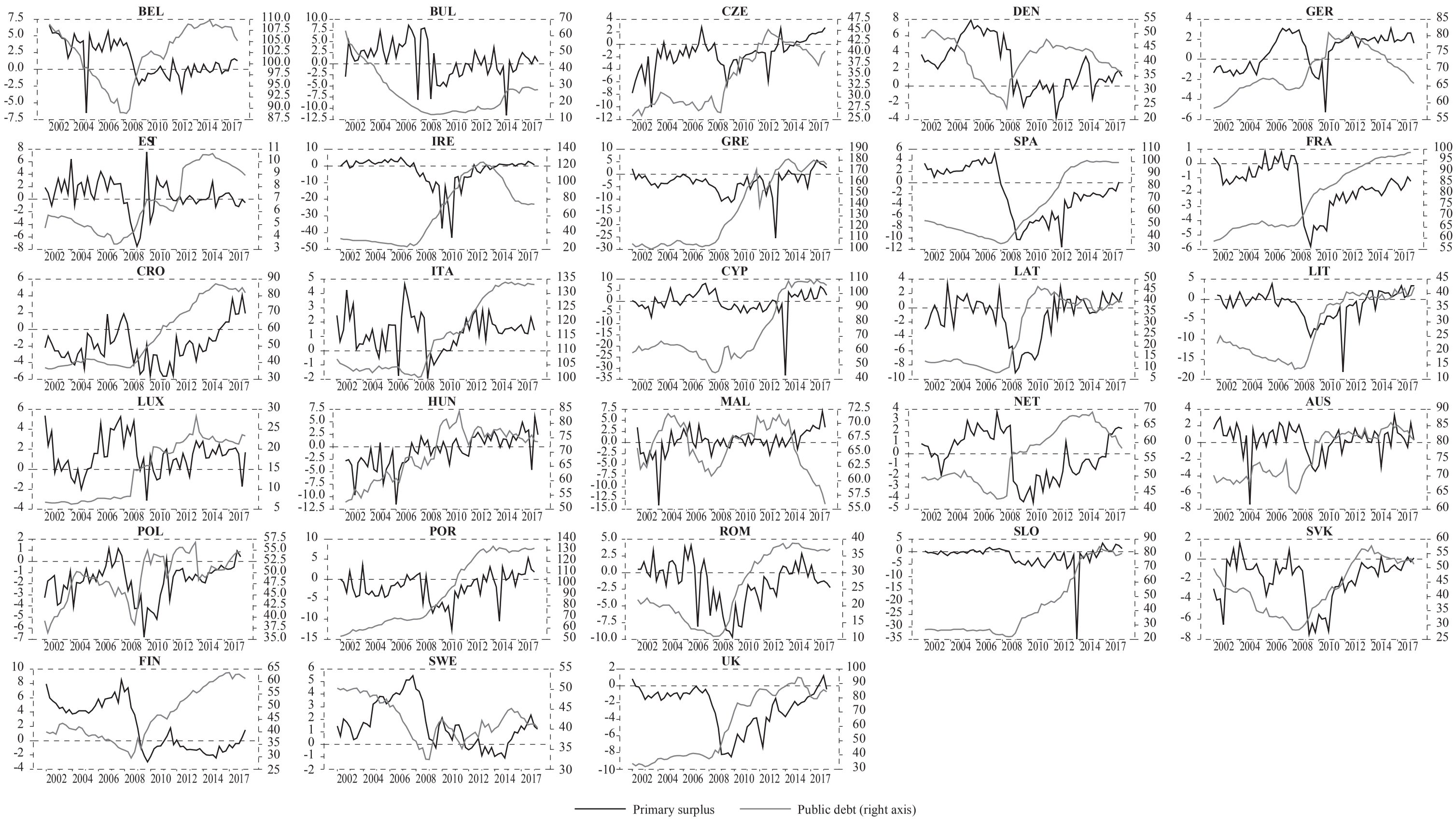

TABLE A1

Descriptive statistics

Country	Revenues		Expenditures		Debt		Surplus	
	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.
Belgium	0.498	0.014	0.519	0.029	102.371	6.191	1.489	2.662
Bulgaria	0.375	0.032	0.378	0.035	25.430	12.762	0.809	3.995
Czech R.	0.397	0.021	0.427	0.030	34.493	6.377	-1.570	2.538
Denmark	0.542	0.012	0.537	0.025	41.284	6.727	2.350	2.937
Germany	0.439	0.011	0.453	0.017	69.791	6.443	0.853	1.749
Estonia	0.380	0.027	0.376	0.035	6.770	2.386	0.605	2.605
Ireland	0.331	0.031	0.374	0.095	63.992	35.900	-3.019	8.925
Greece	0.427	0.042	0.501	0.052	135.084	31.814	-2.996	4.643
Spain	0.380	0.016	0.417	0.035	64.440	24.433	-1.729	4.398
France	0.506	0.016	0.544	0.023	78.400	13.788	-1.601	1.526
Croatia	0.433	0.030	0.478	0.030	56.491	19.248	-1.880	2.281
Italy	0.453	0.019	0.485	0.019	115.085	12.457	1.345	1.277
Cyprus	0.365	0.030	0.395	0.055	73.230	21.307	-0.192	5.510
Latvia	0.352	0.022	0.374	0.036	26.770	14.433	-1.088	3.003
Lithuania	0.341	0.013	0.367	0.039	28.502	10.293	-1.275	3.675
Luxembourg	0.434	0.013	0.418	0.026	14.941	7.215	1.360	1.821
Hungary	0.444	0.021	0.490	0.023	69.585	8.796	-0.745	3.255
Malta	0.384	0.020	0.416	0.023	66.048	4.001	0.266	2.870
Netherlands	0.429	0.009	0.446	0.021	56.298	8.245	-0.165	2.086
Austria	0.489	0.012	0.513	0.019	76.310	6.738	0.363	1.796
Poland	0.395	0.013	0.435	0.018	48.860	5.134	-1.724	1.608
Portugal	0.415	0.021	0.469	0.035	92.343	30.325	-1.906	3.499
Romania	0.335	0.016	0.367	0.033	25.756	10.096	-1.550	3.267
Slovenia	0.434	0.010	0.472	0.048	44.276	22.349	-1.759	4.888
Slovakia	0.373	0.024	0.417	0.039	43.263	8.989	-1.969	2.157
Finland	0.531	0.013	0.520	0.040	46.337	10.241	1.891	3.288
Sweden	0.520	0.019	0.515	0.016	42.539	4.814	1.568	1.730
UK	0.378	0.012	0.420	0.036	60.967	22.826	-2.558	2.478

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Efficiency vs effectiveness: an analysis of tertiary education across Europe

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Abstract

This paper deals with tertiary education efficiency and effectiveness across 24 European Union countries in four sub-periods between 2004 and 2015. The efficiency scores are computed using Data Envelopment Analysis (DEA). We try to raise awareness of the quality, and not of the quantity, of educational outputs and inputs by introducing quality-based correction of the DEA efficiency score, which we regard as effectiveness. Our results show that quality considerations affect the relative positions of countries regarding their efficiency scores. In other words, some less developed countries, which are efficient in the quantity-based model, fail to reach the defined efficiency border when considering some quality indicators of outputs. On the other hand, some inefficient developed countries increase their DEA-based ranking and achieve effectiveness (quality-based efficiency). The same is true for input quality considerations. Since tertiary education cannot be expected to provide the same quality of outcomes with different input qualities, efficiency improves (deteriorates) in the input-output quality-based model in many countries with low (high) quality student bases.

Keywords: tertiary education, data envelopment analysis, educational efficiency and effectiveness, EU

1 INTRODUCTION

It is a well-established fact that the quality of education matters more than quantity. Fortunato and Panizza (2015) argue that the sharp increase in cross-country average years of schooling might not accurately represent actual educational gains. According to Pritchett (2013), as cited in Fortunato and Panizza (2015), an increase in years of education in less developed countries, as opposed to developed countries, is not always transmitted into educational benefits. This view is also supported by many relatively recent papers such as Hanushek and Kimko (2000), Barro (2001), Wößmann (2006), Altinok, Diebolt and Demeulemeester (2014), Barro (2013) whereas Barro (2013) concludes that the "quality and quantity of schooling both matter for growth but quality is much more important". Additionally, Pritchett (2001), who was not able to prove a positive association between increasing educational attainment and per capita income growth, argues that it could be that the educational quality was so low that "years of schooling" have created no human capital.

Due to the importance of educational services for growth, attitudes and political and social awareness, they are provided and publicly financed, to a greater or lesser extent, by practically all governments around the world. Additionally, educational externalities are a textbook example of market failure and one of the most important motives behind government intervention in this sector. According to Szirmai (2015), after World War II, expansion and improvement of education were generally considered essential to development. The awareness about the role of education in the development process resulted in a far reaching education expansion. Over the course of time, increased government expenditures on education trans-

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lated into higher levels of education. Consequently, higher education enrolments have grown significantly over the last three decades. According to World Bank (2018) data, the world *gross enrolment ratio in tertiary education*[1] grew from 13% to 35% during the 1985-2015 period. Growth has been even more impressive in the European Union (EU) where the average annual growth rate of the gross enrolment ratio in tertiary education reached 3.5%. This has led to an increase in the gross enrolment ratio in tertiary education from 25% in 1985 to 68% in 2014.

However, as Szirmai (2015) puts it "Since the 1970s, optimism about the contributions of education has been shaken and more emphasis is given to improving the quality of education." This author notices that not all educational investments are effective and efficient in the development process. Due to the potential ineffectiveness of educational inputs, the quality of education can be unsatisfactory. Thus, the rising educational coverage and duration of education, as well as government and even private educational expenditures, are not always efficiently transmitted into higher productivity and wages, growth rates and better institutions. Therefore, it can be argued, it is not quantity that underlies the successful exploitation of all forms of educational benefits, but the quality and the effectiveness of the educational inputs and investments. Although efficiency and effectiveness are similar concepts, they are not synonyms. Viljoen (cited in Kenny, 2008) defined efficiency as relating to "how well an activity or operation is performed." The term effectiveness relates to performing the correct activity or operation. In other words, "efficiency measures how well an organization does what it does, but effectiveness raises value questions about what the organization should be doing in the first place".

There is a significant body of literature which deals with the efficiency of all levels of the national educational systems in the EU. Many of those studies chose to use data envelopment analysis (DEA) in their methodological approach, because DEA, as a nonparametric method of mathematical programming, enables the calculation of the relative efficiency of quite homogenous and comparable units given multiple criteria. These criteria dictate the choice of certain input variables, whose values are preferred to be as small as possible, and certain output variables, whose values are preferred to be as great as possible. The choice of the criteria, and consequently the choice of the variables, defines the concept of the research.

Conclusions of various DEA-based studies sometimes differ significantly, which makes it impossible to draw general conclusions concerning tertiary educational efficiency at the EU level. Differences in conclusions mostly arise from the diverse selection of inputs and outputs considered within different studies. Additionally, some papers deal with a narrow sample of countries (e.g. Ahec Šonje, Deskar-Škrbić and Šonje, 2018; Yotova and Stefanova, 2017), i.e. homogenous countries with similar development levels, and others deal with a broader and more or less

[1] Total enrolment in tertiary education (ISCED 5 to 8), regardless of age, expressed as a percentage of the total population of the five-year age group following on from secondary school leaving.

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heterogeneous set of countries, which can also affect the difference in the results (Aubyn et al., 2009; Aristovnik and Obadić, 2011; and Toth, 2009).

Still, most of the papers that use the DEA approach make comparisons on tertiary education between countries considering only the definition of efficiency. Some papers deal with quality issues but mostly on the output side of the educational "production function". Therefore, questions regarding the quality of educational inputs and outputs and their effectiveness are usually covered only partially. In this paper, we argue that a greater focus on efficiency can give misleading results that could translate into flawed educational policy prescriptions.

The paper is organized as follows. The second section summarizes previous research findings. The third section gives the rationale for selected inputs and outputs as well as a glimpse of the educational inputs and outputs in the EU. The fourth section deals with the methodology and the fifth presents and discusses the main results. The last part of the paper provides comments on policy implications and future research recommendations.

2 LITERATURE OVERVIEW

DEA is a generally suitable method for a country-level public sector efficiency evaluation[2] and it is commonly used and widely accepted as an appropriate analysis approach in the tertiary education efficiency research. For example, to rank eleven Eastern European countries according to their tertiary education efficiency during the 2005-2013 period, Ahec Šonje, Deskar-Škrbić and Šonje (2018) use input-oriented DEA with variable returns to scale (VRS). The authors use expenditure on tertiary education per pupil in the percentage of GDP per capita as an input variable and the share of unemployed with tertiary education in the total number of unemployed (model 1) and World University Ranking list as an alternative output measure (model 2). However, the authors consider models with only one input and one output variable, which limits the possibility of making more general conclusions.

Yotova and Stefanova (2017) used the same method on a set of countries similar to that chosen by Ahec Šonje, Deskar-Škrbić and Šonje (2018). As an input variable, authors used total expenditures on tertiary education per student as a percentage of per capita GDP in 2012, while the set of educational outputs variables included three indicators: tertiary educational attainment (age 25-34), the employment rate of the population with tertiary education outside the risk of poverty and social exclusion and the mean monthly earnings of a person with tertiary education as a share in per capita GDP in 2014. Again, the analysis is limited to one input and one output. It should be noted that both studies include some educa-

[2] We won't go in any details regarding the broader usage of DEA in public sector efficiency evaluations. However, interested reader can refer to the following research in this area: Clements (2002), Afonso and St. Aubyn (2006), Aristovnik (2013a, 2013b), Aristovnik and Obadić (2014), etc.

tional output quality indicators, but they do not consider any educational input quality measures, which could lead to biased results and conclusions.

Toth (2009) analyzed the efficiency of tertiary education in 20 EU countries in 2006 using output-oriented DEA with variable returns to scale (VRS). The author used a ratio of expenditures spent on higher education to GDP as an educational input, and the ratio of people with a degree to the total population as well as the employment rate of people with a degree as educational output variables. Beside standard outputs and inputs, the author used two non-discretionary variables (parental educational attainment and public-to-total expenditure GDP per capita in current US$). However, Toth's (2009) results differ significantly from other, related, studies that include EU countries[3]. She found that, for example, Denmark and Italy (among others) share the first position regarding tertiary education efficiency in 20 analyzed EU countries, while Aristovnik and Obadić (2011) and Aubyn et al. (2009) rank these countries as relatively inefficient.

Aristovnik and Obadić (2011) used output oriented DEA with variable returns to scale (VRS) to assess tertiary education efficiency in a broad set of countries (selected group of EU and OECD countries) during the 1999-2007 period. The analysis included input data on expenditure per student (tertiary, % of GDP per capita), school enrolment (tertiary, % gross), and output/outcome data, i.e. school enrolment (tertiary, % gross), labor force with a tertiary education (% of total) and the unemployed with a tertiary education (% of total unemployment). To assess technical efficiency regarding different inputs and outputs/outcome, the authors tested three. Two out of three considered outputs are standard educational quantity output indicators, while the last can be regarded as a quality indicator. In the conclusion authors emphasize the need to consider some educational quality data

The most comprehensive study employing DEA methodology to assess the efficiency of the tertiary education in a broad set of countries is authored by Aubyn et al. (2009). The authors used two approaches: input and output-oriented DEA with variable returns to scale (VRS). The analysis is conducted over two subperiods: 1998-2001 and 2002-2005. In the first model, authors used a number of academic staff and students as inputs, while the second model considered spending in private government-dependent institutions (in % of GDP) as an input variable. A weighted number of graduates and a weighted number of published articles were used as output variables in both models. All educational inputs and outputs considered in this paper can be regarded as quantitative. However, the study includes a number of non-discretionary measures such as selection of students, budget autonomy, staff policy, output flexibility, evaluation, funding rules and PISA results[4], which can be seen as qualitative measures (mostly) of inputs.

[3] See table A1 in appendix.
[4] For detailed explanation of variables see Aubyn et al. (2009).

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It should be noted that conclusions differ in the abovementioned papers, which makes it impossible for us to draw any general conclusions on tertiary educational efficiency at EU level[5]. We suspect that differences in conclusions mostly arise from the diverse selection of inputs and outputs considered within different papers. However, the differences in the conclusions of the reviewed papers also arise because of the different samples of countries. That is, two papers deal with a narrow sample of countries, i.e. homogenous countries with similar development levels, and others deal with a broader and heterogeneous set of countries, which can also produce different results. Still, differences arise even if the samples are relatively similar. For example, Aristovnik and Obadić (2011), and Aubyn et al. (2009) use the same number and coverage of countries and even time periods in different model specifications (variables), but sometimes the results differ significantly. For example, the first model in Aristovnik and Obadić (2011) ranks the Czech Republic as the first and then as the 33rd in the second model. Similarly, in Aubyn et al. (2009) Cyprus is ranked number one in the first model (1998-2001) and then as 27th in the second model (1998-2001)[6].

3 DATA: TERTIARY EDUCATION INPUTS AND OUTPUTS

This paper differentiates between quantity and quality measures of educational inputs and outputs, which enables us to discriminate tertiary education efficiency and tertiary education effectiveness. Since there is no consensus regarding the appropriateness of available inputs and outputs, it seemed inappropriate to make an ad hoc decision to include some and to exclude other inputs and outputs that were used in the previous researches. Therefore, this paper uses a somewhat broader set of inputs and outputs than most of the papers presented in the literature overview. It also considers quality indicators on both side of the educational production function – the input and the output side. This decision comes with a cost, as the discriminatory power of the method becomes questionable with the increase of the variables due to the inappropriate degrees of freedom (Cooper, Seiford, Tone, 2006:106). However, any future research should try to detect key inputs and outputs in the tertiary education "production" process and try to synthesize them to get more information with fewer data/variables. This approach could lead to more robust and more consistent DEA-based conclusions regarding tertiary education efficiency.

To our knowledge, there is no precise definition and delimitation of quantitative and qualitative educational inputs and outputs. According to Lee in Bourguignon, Elkana and Pleskovic (2007), an outcome of education is composed of both the quantity and the quality of educational capital. According to him, the quantity of educational capital can be measured by the number of graduates. However, he emphasizes that it is rather difficult to measure the quality of education accurately. The author adds that the quality of education is reflected in the performance of

[5] Table A1 in appendix provides a table with the previous research results.
[6] See table A1 in appendix.

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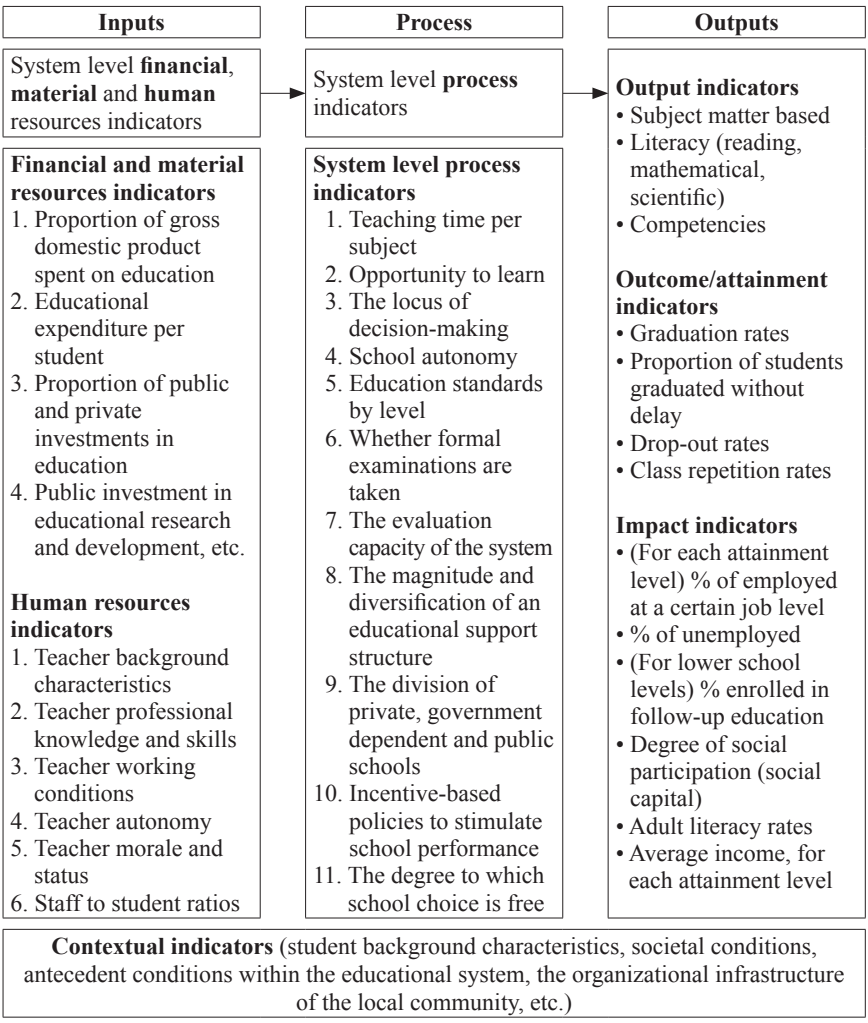
students and graduates, as the value added of schooling can be measured by labor market performance, such as extra earnings or employment, of educated workers. Due to the lack of official quantity vs quality definitions regarding educational inputs and outputs, in this section, we provide the basic rationale behind the choices made in this paper.

Before the provision of details regarding the selected inputs and outputs, figure 1 gives a synthetic overview of educational inputs and outcomes, as defined in Scheerens, Luyten and van Ravens (2011).

Figure 1

A synthetic overview of educational inputs, processes and outcomes



Source: Scheerens, Luyten and van Ravens (2011), adapted by the authors.

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The selection of quality and quantity educational input and output indicators was mostly dictated by data availability (on the system level). Additionally, some indicators that were considered as either inputs or outputs of the tertiary education system were highly correlated with other selected variables. Thus, we had to drop some of them. The following subsections link selected variables to the definitions of input, output and process indicators shown in figure 1. System-level process indicators have not been considered at all due to the lack of appropriate data.

3.1 QUANTITATIVE MEASURES OF EDUCATIONAL INPUTS

General government expenditures on tertiary education as a percentage of GDP (financial resources indicator) are chosen as the most common measure of tertiary education public investments/expenditures. Due to the correlation of this measure with similar measures of inputs, other measures are excluded. Data for this measure are available for the entire analyzed period.

Financial aid to students as a percentage of total public expenditure on education, at the tertiary level of education (financial resources indicator) is selected as an input since it indicates public expenditures pointed directly towards students. It is assumed that it adds new information regarding tertiary education financial inputs since it is not correlated with the previous financial resources indicator. Data for this measure are available for the 2004-2012 period.

One limitation should be noted here. Namely, both financial resources indicators contain only public spending on tertiary education. However, the structure of financing sources could also affect the efficiency since publicly financed education resources (see system level financial inputs and process indicators in figure 1) do not represent the total amount of educational spending. However, comparable data on private spending on education for all countries in our sample was not available.

The ratio of pupils and students to teachers and academic staff in tertiary education is selected as a human resource indicator in the last analyzed sub-period (2013-2015), which was dictated by data availability.

3.2 QUALITATIVE MEASURE OF EDUCATIONAL INPUTS

The percentage of underachieving 15-year-old students in the PISA survey (average of all fields) is an output indicator of secondary education. We assume it is a contextual indicator that measures human capital input quality at the tertiary level education since it contains information about the quality of the student population before entering the system of tertiary education. Data for this measure are available for the entire analyzed period.

3.3 QUANTITATIVE MEASURES OF EDUCATIONAL OUTPUTS

Tertiary education graduates (ISCED 5-6, per 1,000 of population aged 20-29) and graduates aged 20-34 (% of the corresponding population) are selected as outcome/attainment indicators that are the most important and commonly used meas-

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ures of tertiary education outputs. The first indicator is available for the 2004-2012 period, while the latter was used for the analysis in the last sub-period (2013-2015). Since both measures indicate only the number of students who successfully exit the tertiary education system and do not contain any information regarding their "quality", we regard them as quantitative indicators of educational outputs.

The population aged 15-64 with completed tertiary education is selected as a common quantitative output indicator since it only considers the number of tertiary educated people and provides no information regarding the qualitative features of the tertiary educated population. It should be noted that population with completed tertiary education also reflects past spending on education, while our analysis measures the outputs at the same time as inputs. However, if we considered only past spending on tertiary education we would still have a similar problem. Beside historical data availability problems, if we took (financial) inputs from previous periods, we would neglect the potential efficiency of current expenditures to "produce" a new tertiary educated population. This is because current financial resources devoted to tertiary education are spread across current students. In three-year periods (for which we take averages) some of those students become part of the tertiary educated population. Data for this measure are available for the entire analyzed period.

The ratio of unemployment rates (%, age 15-64) for all educational levels to unemployment rates (%, age 15-64) of the tertiary educated labor force is selected as an impact indicator of tertiary education outcomes. It measures tertiary education returns on the labor market. Due to its correlation with similar labor market outcomes measures, other measures are excluded. Data for this measure are available for the entire analyzed period. Even if this indicator could be seen as a qualitative tertiary education outcome measure, we included it in both the efficiency and the effectiveness analysis. We argue that a high ratio of unemployment rates for all educational levels and unemployment rates of tertiary educated labor force does not necessarily reflect the high efficiency of the tertiary education in terms of labor market outcomes, but could be also a result of low activity rates of the tertiary educated population. Therefore, we correct this measure with activity rates of tertiary educated population.

3.4 QUALITATIVE MEASURE OF EDUCATIONAL OUTPUTS

Following the preceding paragraph, the ratio of unemployment rates (%, age 15-64) for all educational levels to unemployment rates (%, age 15-64) of the tertiary educated labor force is multiplied by the activity rates of tertiary educated population. The resulting measure is selected as a qualitative impact indicator of the tertiary education outcomes. Data for this measure are available for the entire analyzed period.

An average overall score of Times Higher Education university rankings is chosen as an output indicator of the tertiary education quality in the last sub-period

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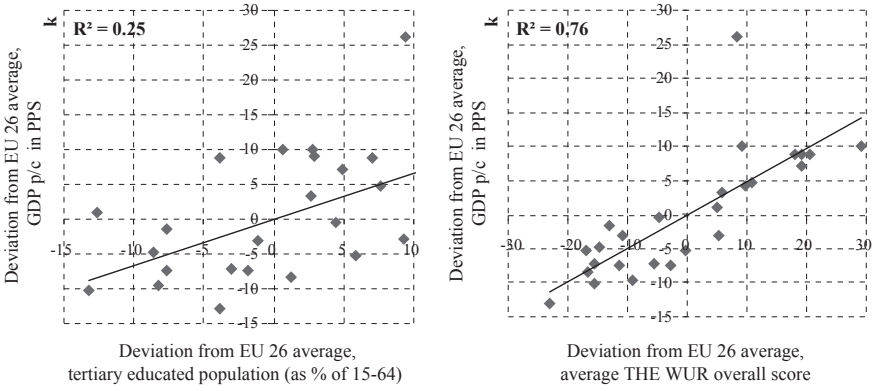
(2013-2015). We considered other ranking lists, but Times Higher Education was the only university rankings database which covered all countries in our sample in 2016. In previous sub-periods (2004-2012), we used the gross domestic product in PPS per capita (% of average) as a proxy for tertiary education outputs quality due to the incompleteness of the university rankings data and their correlation with university rankings (overall score). Anecdotal evidence presented in figure 2 justifies this choice. Namely, it seems that the correlation between the GDP per capita and the average university overall score (measure of the educational outcomes quality) using the ranking of the Times Higher Education (2017), significantly exceeds the correlation between the GDP per capita and the tertiary educated population as a percentage of 15-64 years aged population (typical measure of educational outcomes quantity).

Figure 2

Quantity versus quality of education as GDP per capita correlates



Source: Times Higher Education (2017), Eurostat (2018c, 2018d).

The analysis is performed on a sample of 24 EU countries[7] for which all the necessary data during the 2004-2015 period were available. The entire time span has been divided into four 3-years sub-periods for which comparable data and variables were available. Table 1 summarizes selected inputs and outputs in efficiency and effectiveness DEA models.

Figures 3, 4 and 5 show educational (quantity and quality) inputs and outputs trends within the EU countries during the analyzed periods (averages for sub-periods 2004-2006, 2007-2009, 2010-2012, 2013-2015). The figures reveal a lot of differences among EU member states regarding the educational inputs and outputs. However, a few conclusions can be drawn.

[7] Due to data shortages Cyprus, Greece, Malta and Luxemburg were excluded from the dataset.

Table 1

Inputs, outputs and quality indicators

Label	Definition	Used in period
Countries: Belgium, Bulgaria, Czech Republic, Denmark, Germany, Estonia, Ireland, Spain, France, Croatia, Italy, Latvia, Lithuania, Hungary, Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden, United Kingdom		
Inputs		
(I)EX2(% GDP)	General government expenditure (tertiary education, % GDP)	2004-2015
(I)FA(% EX)	Financial aid to students as % of total public expenditure on education, at tertiary level of education (ISCED 5 6, %)	2004-2012
(I)S/T	Ratio of pupils and students to teachers and academic staff (tertiary education, levels 5-8)	2013-2015
Outputs		
(O)GRAD(20-29)	Tertiary education graduates, (ISCED 5-6, per 1,000 of population aged 20-29)	2004-2012
(O)GRADT(20-34)	Graduates aged 20-34, tertiary education level (% of corresponding population)	2013-2015
(O)POPT	Population aged 15-64 with completed tertiary education (levels 5-8)	2004-2015
(O)U/UT	Unemployment rates (%, 15-64) all ISCED 2011 levels/unemployment rates (%, 15-64) tertiary education (levels 5-8)	2004-2015
Quality indicators of inputs and outputs		
(O)U/UT*ACTT	(O)U/UT * Activity rates (%, of 15-64, tertiary education (levels 5-8))	2004-2015
(O)GDP PC PPS	Gross domestic product at market prices, current prices, purchasing power standard per capita (% of average)	2004-2012
(O)UR_2016	Average overall score, university rankings – The Higher Education	2013-2015
(I)PISA	Underachieving 15-year-old students (%, PISA survey, an average of all fields)	2004-2015

Source: Authors.

Inputs – The more developed EU countries generally have greater direct investment in students (in %) (figure 3a). Something similar is true for general government expenditure (figure 3b). However, there are a few exceptions, like the UK on the low expenditures side and Poland, Estonia and Lithuania on the high expenditures side (figure 3c). Student to teacher ratio varies from 10.7 in Sweden to 22.5 in the Czech Republic.

Outputs – Graduation rates (figure 4a) have been increasing in all countries within the period of analysis, whereas a few post-transition economies, which have relatively low incomes, have relatively high graduation rates. Regarding the labor market outcomes (figure 4c), the tertiary educated labor force seems to have a somewhat lower unemployment rate relative to the overall unemployment rate in

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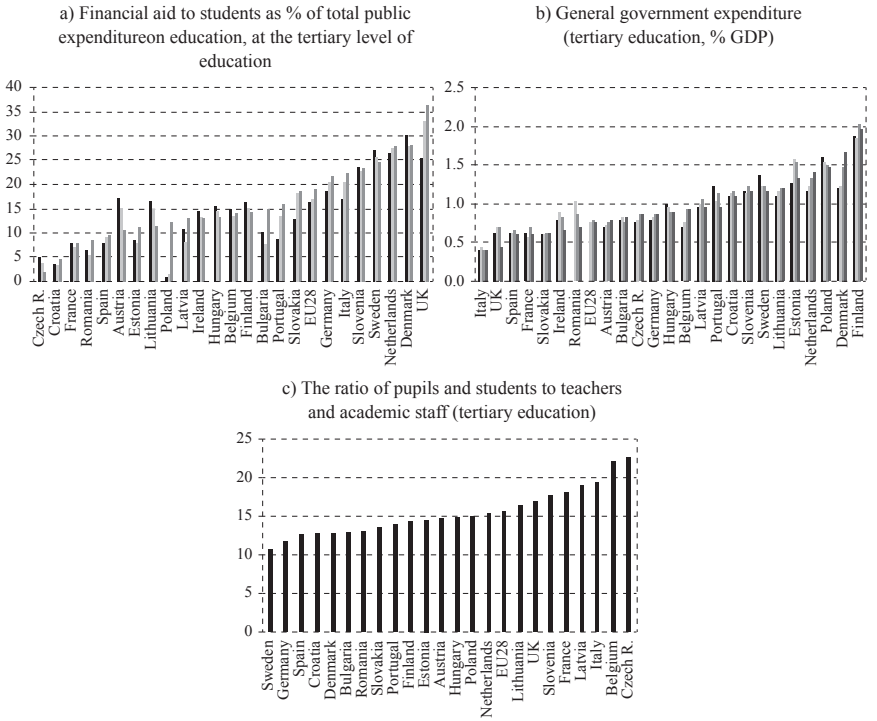
less developed EU countries. This could be due to the relative scarcity of tertiary educated labor in lower income countries, which provides them with a better labor market position (figure 4b).

Quality indicators of inputs and outputs – After correcting the above described labor market outcomes for the tertiary educated activity rates, some countries, like the Netherlands, Sweden, Germany, Ireland and Austria, improve their relative position, while the positions of Croatia, Slovakia and Romania positions deteriorate (figure 5a). The correlation between per capita GDP and university ranking overall score has already been commented on. As we have already emphasized, both of those outputs measure the quality of the tertiary education. Finally, figure 5c shows that the percentage of underachieving 15-year-old students (measured as the average of all fields in a PISA survey) is usually much larger in the poorest EU countries, while it is the lowest in the wealthiest ones (with a few exceptions). This means that poorer countries get students of "lower quality".

Figure 3

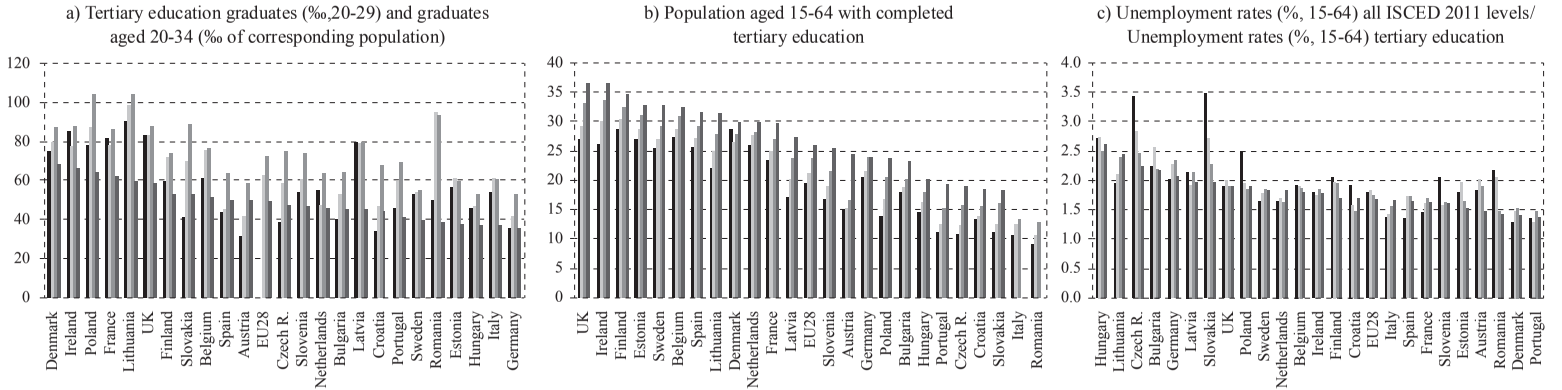
Tertiary education inputs (averages 2004-2006, 2007-2009, 2010-2012, 2013-2015)



Source: Eurostat (2018b, 2018c, 2018g).

FIGURE 4

Tertiary education outputs (averages 2004-2006, 2007-2009, 2010-2012, 2013-2015)



Source: Eurostat (2018d, 2018f, 2018g, 2018h, 2018j).

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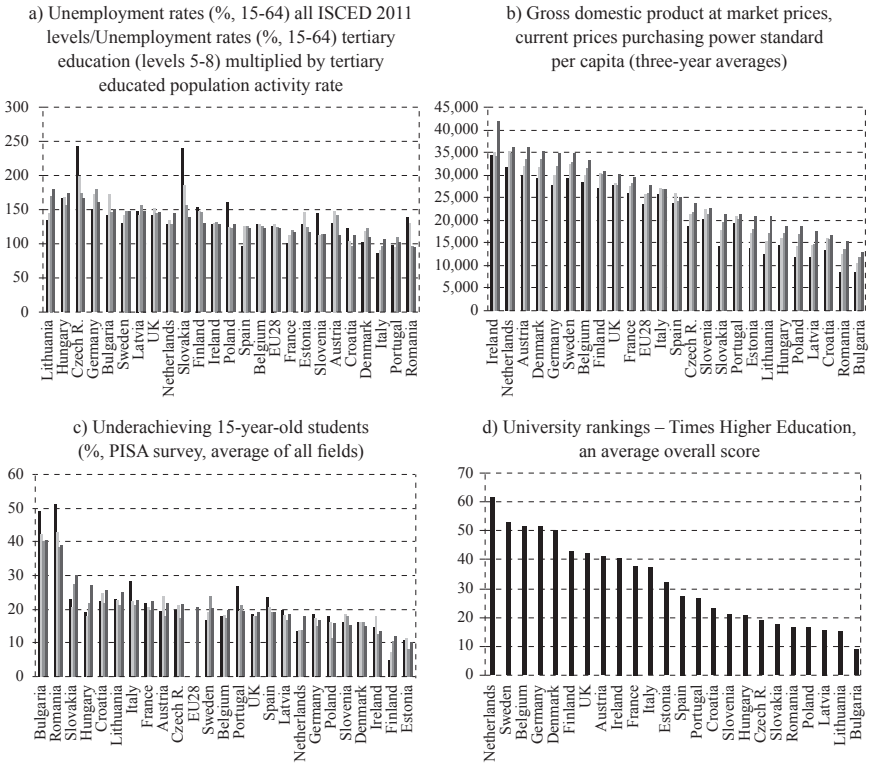
FIGURE 5

Tertiary education quality indicators (averages 2004-2006, 2007-2009, 2010-2012, 2013-2015)



Source: Eurostat (2018a, 2018e, 2018i, 2018j); Times Higher Education (2017).

4 METHODOLOGY

The efficiency and (what we later regard as) the effectiveness analysis of the tertiary education in 24 EU member states[8] is conducted using data envelopment analysis (DEA). DEA is a nonparametric method of mathematical programming, which is developed for evaluating the relative efficiency of units under assessment, usually called the decision-making units (DMUs). Since its introduction by the pioneering CCR model in 1978 (Charnes, Cooper and Rhodes, 1978), followed by the BCC model published by Banker, Charnes and Cooper in 1984, DEA has instantly been recognized as a modern tool for performance management. While the CCR model assumes constant returns to scale (CRS), the BCC model assumes variable returns to scale, which allows the use of DEA in problems where increases in inputs result in non-proportionate increases in outputs (and vice versa). The most appealing features of DEA are that it allows multiple criteria for determining efficiency to be used and appropriate variables to be selected, which are (in most models) unit-invariant, without the use of their pre-defined weights. In addition, all assessments are relative given the finite number of comparable DMUs. Follow-

[8] We excluded Cyprus, Malta, Luxemburg and Greece from the analysis due to the lack of data.

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ing the specific needs of the research environment, a vast number of models have been developed within DEA to fit and capture the nature of the research problem, thus providing a great tool for different kinds of efficiency analysis. Additionally, the popularity of DEA and the number of its applications are on the rise (Emrouznejad and Yang, 2018).

DEA was initially developed with the idea of measuring the efficiency of production units, such as factories, hospitals or banks, where one can unswervingly determine their inputs and their outputs. Such DMUs can manage their inputs and outputs to a certain degree (thus the name *decision-making units*). An additional assumption is that the aim of DMUs is to use their available inputs to achieve greater outputs or try to use fewer inputs for producing the desired level of output. In other words, they are assumed to aim for the efficiency in a production process. However, the application of DEA has spread outside the production processes and researchers are using it for evaluating the relative efficiency of different kinds of (relatively homogenous) units that need to be estimated given their undesirable (input) and desirable (output) characteristics. The examples are the portfolio selection, the performance of companies using their financial ratio data, performance of countries according to their macroeconomic indicators or different "processes", for example, fiscal policy or educational policy. As is obvious, such DMUs are not the "decision-making" units themselves and not all of them should aim for efficiency in terms of fewer inputs to greater outputs. Moreover, the selection of their inputs and outputs is arbitrary, but this allows a researcher to define the relevant aspects of the "efficiency" of DMUs.

The use of DEA for estimating the relative efficiency of education at different levels (primary, secondary, tertiary) has been very popular over recent years. The overview of some of these researches, previously mentioned in the literature overview, revealed that the most frequently used model is the BCC model (with input or output orientation), which is an appropriate approach given the nature of this research problem. Without questioning the great contribution and effort of past researches, what we argue is that their selection of inputs and outputs gives more importance to the greater quantity of the educational output. We strongly suggest that education should be assessed not only in terms of quantity but also in terms of quality. Figuratively speaking, a factory that manages to produce something using almost nothing should be seen as a role model, and a factory that invests a lot relative to others and achieves less than the others should be recognized as poorly managed. However, countries that have large investments in education should not be punished in such studies if they manage to provide a high quality of education. Likewise, the countries that have almost negligible inputs should not be rewarded just because they managed "to produce" any amount of outputs of low quality despite their low inputs. Therefore, we suggest that at the beginning of the study using DEA, the crucial question should be asked: "Are we really aiming at the quantity or the quality?" and the answer should be followed with the selection of the inputs and the outputs that are relevant for the study.

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In addition, just as the output of the production facility is determined with the quality of the inputs, which cannot be always controlled, certain levels of the educational process are determined by the outputs of the preceding processes. Figuratively, one cannot make a tasty cake using salt instead of sugar. For this problem, DEA allows the definition of non-discretionary inputs, which are relevant but they are not controllable and are defined by the environment (Banker and Morey, 1986). This approach was used in some previous studies of education using DEA. However, as we will explain in the following paragraphs, we will treat the non-discretionary variables as discretionary to provide results that are more informative.

DEA models can be output oriented, aiming at maximization of outputs for the given level of inputs, input-oriented, aiming at minimization of inputs for the given level of outputs, or non-oriented. Also, the models can assume constant, variable or generalized returns to scale. Following the nature of the problem we are analyzing, we decide to use the output-oriented model assuming variable returns to scale (BCC model). To explain the methodology, we first formulate the model. Let there be N decision-making units (DMUs): DMU_1, DMU_2, …, DMU_N which are homogenous and comparative. We assume that their efficiency should be estimated in terms of a certain number of *inputs* – the variables the values of which we want to be as small as possible, and a certain number of *outputs* – variables the values of which we prefer to be as big as possible. Let $x_{ij} \geq 0$ be an i-th input for some DMU_j, $i \in \{1,\ldots,m\}$ and $y_{rj} > 0$ its *r-th* output, $r \in \{1,\ldots,s\}$, $j \in \{1,\ldots,N\}$. Therefore, each DMU_j is represented by a vector of inputs $x_j = \left(x_{1j}, x_{2j}, ..., x_{mj}\right)$ and a vector of outputs $y_j = \left(y_{1j}, y_{2j}, ..., y_{sj}\right)$, so $X = \left[x_{ij}\right] \in \mathbb{R}^{m \times N}$ is an input matrix and $Y = \left[y_{rj}\right] \in \mathbb{R}^{s \times N}$ is an output matrix. To make the model stable, it is recommended that the number of DMUs (N) should not exceed $\max\left\{ms, 3\left(m+s\right)\right\}$. The BCC model (Banker, Charnes and Cooper, 1984) can be written in the following envelopment form:

$$\min_{\lambda,\theta} \theta_o - \varepsilon\left(\sum_{i=1}^{m} s_{io}^{-} + \sum_{r=1}^{s} s_{ro}^{+}\right) \tag{1}$$

$$s.t. \quad \theta_o x_{io} = \sum_{j=1}^{N} x_{ij}\lambda_j + s_{io}^{-}, \quad i = 1,...,m \tag{2}$$

$$y_{ro} = \sum_{j=1}^{N} y_{rj}\lambda_j - s_{ro}^{+}, \quad r = 1,...,s. \tag{3}$$

$$\sum_{j=1}^{N} \lambda_j = 1, \tag{4}$$

$$x_{ij}, y_{rj}, \lambda_j, s_r, s_i \geq 0, \forall i, j, r; \theta \text{ free in sign},$$

where $\varepsilon > 0$ and s_r^{+} and s_i^{-} are slack variables. If we denote the optimal solution as $\left(\theta_o^*, \lambda_o^*, s_o^{+*}, s_o^{-*}\right)$, a DMU_o is efficient if and only if the efficiency score $\theta_o^* = 1$ and all $s_{io}^{+*} = s_{ro}^{-*} = 0$. DMU_o is weakly efficient if and only if $\theta_o^* = 1$ but $s_{io}^{+*} \neq 0$ or $s_{ro}^{-*} \neq 0$ for some i and r in some alternate optima (Cooper, Seiford and Zhu, 2011). Otherwise, a DMU is inefficient. Resulting from the optimal solution of the program (1) – (4), an inefficient $DMU\left(x_o, y_o\right)$ can be projected to the BCC efficiency

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frontier as a combination of other DMU using the formulas: $\hat{x}_o = X\lambda^* = \theta_o^* x_o - s_o^{-*}$ and $\hat{y}_o = Y\lambda^* = y_o + s_o^{+*}$ (Cooper, Seiford and Zhu, 2011). Therefore, the lambdas allow us to identify the peer group of an inefficient DMU. By observing these efficient projections, we can analyze how a DMU should increase its outputs and/or decrease its inputs to become relatively efficient.[9]

The period of analysis is divided into four subperiods: 2004-2006, 2007-2009, 2010-2012 and 2013-2015. The selection of the periods is mostly dictated by the availability of the data and the change in the data methodology. As explained in table 1, subperiods within 2004-2012 and subperiod 2013-2015 are characterized by different variables due to the availability of the data. Therefore, a direct comparison of results between periods is not advisable.

To circumvent the problem of missing data, we decided to calculate the simple three – years averages of data as the closest representative of the period. However, even this procedure resulted in some countries having missing data, so our approach was to exclude countries that had more than one missing data item. In order to keep as many countries as possible in the sample, those countries that had only one missing data item were kept in the sample and missing inputs/outputs were assigned a pessimistic value which is large/small enough for an objective function not to be entered, as proposed by Kuosmanen (2009). We did this only for countries that had one missing data item because we did not want to affect the "technology set" and worsen the relative ranking of other DMUs that had complete data. Additionally, we checked that the objective function in the solution included a multiplier of 0 for inputs/outputs variables with an arbitrary set value.

After the correction of the sample, the analysis includes 24 EU countries: Belgium, Bulgaria, the Czech Republic, Denmark, Germany, Estonia, Ireland, Spain, France, Croatia, Italy, Latvia, Lithuania, Hungary, the Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden, and the United Kingdom.

In the first step, we run the quantity-based models using variables expenditures (I) EX2 and financial aid (I)FA(%EX) as inputs and as outputs we use the percentage of graduates (O)GRAD(20-29), the education returns on labor market (O)U/UT and the percentage of highly educated population (O)POPT for the period of 2004-2012. We performed a similar analysis for the period 2013-2015, except that variable (I)FA(%EX) is replaced by the ratio of students per teacher (I)(S/T) and variable (O)GRAD(20-29) with (O)GRAD(20-34). As is obvious, such a selection of variables led to rewarding the quantity of the educational output and reporting on the efficiency of the tertiary education.

The second step was to include quality corrections for the previously obtained efficiency analysis. Firstly, we take account of output-quality and then we intro-

[9] Some additional explanation on the BCC and other DEA models can be found in, for example, Cooper, Seiford and Tone (2006), or Cooper, Seiford and Zhu (2011).

duce the input-quality correction as well. For the output-quality control we replace the output variable (O)U/UT by the quality-corrected variable (O)U/UT*ACT ((O)U/UT multiplied with activity rates of the tertiary educated population). Also, variable (O)POPT was substituted for by (O)GDPpc in 2004-2012, and by (O)UR university ranking in 2013-2015 (as (O)GDPpc and (O)UR showed to be highly positively correlated). Afterward, the input-quality control was introduced by including PISA results in the analysis. Altogether we estimated 6 different models using inputs and outputs in certain subperiods as presented in table 2.

Table 2

Variables used in each DEA model, by period

Period	**2004-2012**		**2013-2015**	
Model	Inputs	Outputs	Inputs	Outputs
Quantity model	(I)EX2(% GDP) (I)FA(% EX)	(O)GRAD(20-29) (O)U/UT (O)POPT	(I)EX2(% GDP) (I)S/T	(O)GRAD(20-34) (O)U/UT (O)POPT
Output – quality model	(I)EX2(% GDP) (I)FA(% EX)	(O)GRAD(20-29) (O)U/UT*ACT (O)GDPpc	(I)EX2(% GDP) (I)S/T)	(O)GRAD(20-34) (O)U/UT*ACT (O)UR
Input – output quality model	(I)EX2(% GDP) (I)FA(% EX) (I)PISA [a]	(O)GRAD(20-29) (O)U/UT*ACT (O)GDPpc	(I)EX2(% GDP) (I)S/T (I)PISA	(O)GRAD(20-34) (O)U/UT*ACT (O)UR

[a] *Circled variables present quality correction measures.*

Source: Authors.

5 RESULTS: ANALYSIS OF THE EFFICIENCY AND EFFECTIVENESS OF TERTIARY EDUCATION IN THE EU

Figures 6a-6c present our results for the period of 2004-2012 whereas figure 6d shows the results for the last period of 2013-2015 which is analyzed using different variables. Therefore, we do not make ready comparisons between them. However, the results from the period of 2013-2015 mostly support our conclusions, and what we also conclude is that the choice of the variables for this period is rather robust and findings can be drawn that are similar to those from the period of 2007-2012.

The tables with exact DEA scores for the analyzed period are given in table A5 in appendix, and here we present the rankings resulting from these scores. The dark bars in figures 6a-6d indicate the rankings of the countries calculated by the quantity model. For the sake of clarity, we present the higher ranking with a higher bar. In addition, we rank all efficient units as 24th and a unit with the highest inefficient score as the 23rd (or the second best), etc. By generally observing the results, we see that approximately a similar number of countries (9 to 14) remains efficient throughout the years within each model. The relatively large number of efficient countries within each period is the result of the total number of input and output variables: decreasing the number of inputs and outputs would decrease the number of efficient countries. However, we aimed to include most of the variables that

were used in the previous studies and this comes at a cost. Quantity-based efficiency results show that some of the most developed countries in the sample, like Austria and the Netherlands, are not efficient while some less developed countries like Hungary, Estonia and Bulgaria define the efficient frontier in some periods. The change of ranking reported by the output-quality model is shown with a striped bar. When output-quality control is included, most of the efficient countries retain their position, but a significant number of them decrease in rank and the rank of some of rises. Overall, the number of efficient countries decreases, and the overall average efficiency score decreases.

Afterward, we take account of the quality of the inputs. In the input-output quality model, we add PISA as an input. In this way, if underachieving PISA results are relatively low, it will increase the efficiency score. If the opposite, PISA will decrease the score. In figures 6a-6d, we use a dark black bar to indicate the difference between rank in output-quality and input-output-quality model. If the difference is positive, it means that countries' tertiary education produces relatively higher quality outputs given the relatively low quality of students (inputs) measured by PISA results. If the difference is negative, the opposite is true. In this way, we get an insight into how the quality of the students, measured by PISA, can influence educational efficiency.

When we consider educational output quality in our model, it becomes obvious that countries which were inefficient in the quantity-based model, and which are usually perceived as countries with solid educational systems, improve their rank significantly. Namely, output-quality based efficiency results in almost all analyzed periods (figures 6a-6d) show that Austria and the Netherlands reach the efficient frontier. Austria and Netherlands are the most obvious examples, but the same is true for Germany (2007-2009), Denmark (2007-2009, 2010-2012), Sweden (2007-2009, 2010-2012) and Belgium (2013-2015), which also experience efficiency gains in output-quality model. On the other hand, less developed countries (like Hungary, Estonia and Bulgaria) lose their efficiency in all periods in the quality-based model in comparison to the quantity model.

The correction for the input-quality generally shows that, at a given level of PISA results, for many countries, the tertiary education efficiency ranking should actually be increased. This is noticeable for Austria, Italy, France and the Netherlands within developed countries, and in Bulgaria (all periods), Croatia and Hungary (slight increase in all periods except 2007-2009) within the group of the less developed countries.

For example, during the period of 2007-2012, Croatia's relative position is slightly degraded when an output-quality control is introduced. Therefore, when considering the relatively poor quality of students in Croatia, tertiary education effectiveness is greater than the output-quality model results imply. Generally, Croatia has one of the lowest indicators of (O)U/UT*ACT and (O)GDPpc but, according to

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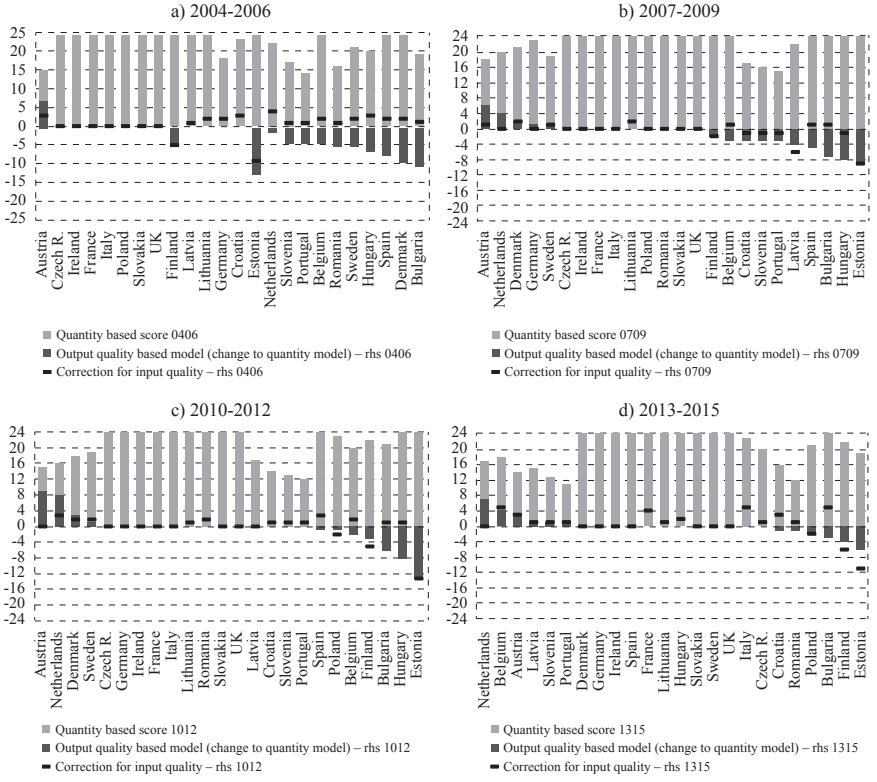
our results, it is not the worst ranked country in the EU concerning tertiary education efficiency and effectiveness. By observing the reference set of efficient countries for Croatia (identified by $\lambda^*>0$ from the model (1)-(4), results shown in tables A2-A4 in appendix) for the period 2004-2012, the BCC model projects Croatia using the input/output vectors of the efficient Czech Republic (among others). For the purpose of comparison, the Czech Republic has lower inputs in expenditures and PISA, and all outputs greater than Croatia.

Poland and Estonia are less developed countries that could achieve greater tertiary education effectiveness given the relatively high-quality students. The same can be concluded for Finland, a developed country that ineffectively uses its high-quality students.

FIGURE 6

Results of the DEA analysis



Source: Authors.

The question is what could a country do to be relatively better in the area of educational quality in the future and what its closest quality-led efficient role models should be. The optimal results of the BCC model provide the values of the slack variables for inefficient countries. The slacks indicate the shortfalls in the data of a certain country and possible suggestions for future improvements in the quality

aspect. However, the findings are related to a certain country and the analysis is beyond the scope of this paper. Interested readers can find the results in appendix (figure A1), where the figures indicate the greatest shortfalls in the % of the original data for each country.

We chose not to analyze the scale of suggested corrections for each country within each model, but we give some general observations and comments on the individual results: (1) periods of 2007-2009 and 2010-2012 show rather similar patterns, where output quality corrections are noticeable for Bulgaria, Estonia and Denmark; (2) in the period of 2007-2015 Austria and the Netherlands improve their rating after both output and input-output quality corrections; (3) Poland, and especially Finland and Estonia, are the only countries able to utilize their high-quality students (measured by PISA results) more effectively (in terms of educational outputs/outcomes quality). Finally, the overall best-ranked countries after both input and output quality control for the whole period of 2004-2015 are the UK, Slovakia, Italy, France, Lithuania, Ireland and Finland.

6 POLICY IMPLICATIONS AND FUTURE RESEARCH RECOMMENDATIONS

This paper has dealt with tertiary education efficiency and effectiveness in the EU. It is a well-established fact that the quality of education matters more than the quantity. Still, most of the papers which use the DEA approach make tertiary education comparisons between countries considering only the definition of efficiency. Some papers deal with quality issues but mostly on the output side of the educational "production function". Therefore, the questions regarding the quality of educational inputs and outputs and the effectiveness are usually covered only partially. In this paper, we argue that a greater focus on efficiency can give misleading results which could translate into flawed educational policy prescriptions.

We performed DEA over available educational inputs and outputs during four non-overlapping periods from 2004 to 2015 in 24 EU countries. DEA allowed us to rank countries regarding their tertiary education efficiency/effectiveness in achieving favorable educational and labor market outcomes. However, we argued that DEA results should be interpreted with a great deal of caution and should not serve as important educational policy and strategy inputs due to the lack of the quality of educational inputs and outputs considerations, as well as the decreasing returns on higher education in countries with broad coverage of the population by tertiary education. To avoid a potential bias towards the low input units within the DEA, educational inputs and outputs were adjusted for the quality of education indicators. Specifically, we differentiated the quantity and quality measures of educational inputs and outputs, which enabled us to distinguish tertiary education efficiency from tertiary education effectiveness, since the latter seems to matter more for growth.

Our results show that many less developed EU countries achieve efficiency but not effectiveness in tertiary education. The opposite is true for some developed countries. This is possible due to the low (high) educational inputs in less (more) devel-

oped countries. However, when we consider some quality indicators of outcomes/outputs, a few less developed EU countries, which were characterized as efficient in the quantity model, fail to reach defined efficiency border. On the other hand, some of the inefficient developed countries increase their DEA based ranking and achieve effectiveness (quality-based efficiency). It is not only that the quality of educational outputs matters for the results, but the same is true for input quality considerations. It turns out that some countries which were downgraded (upgraded) in the output quality DEA model have a lower (higher) quality student base as measured by PISA results. Since it could not be expected that tertiary education provides the same quality of outcomes with different input quality, efficiency improves (deteriorates) in the input-output quality-based model in many countries with a low (high) quality student base. Therefore, the results confirmed our hypothesis that quality considerations could significantly affect standard tertiary education efficiency analysis results. Any future research in this area should not evaluate tertiary education efficiency only in terms of the quantity measures of educational inputs and outputs. As already emphasized, the literature on economic growth and convergence long ago acknowledged educational quality as being more important than quantity. DEA based efficiency/effectiveness research should follow this example.

Future research should dig deeper into the rich set of models and results which DEA provides. Questions like: "what induces inefficiency in inefficient countries" (see figure A1 in appendix) and "which countries define the reference sets (role-models) for inefficient countries" (see tables A2-A4 in appendix) are especially important for countries like Croatia, which proved to be inefficient and ineffective regarding tertiary education. Research into the first question should illuminate potential financial black holes, while the answers to the second question could shed some light on good practices which could be (easily) implemented in Croatian education and customized for its needs. From the methodological point of view, any future research should address the issues of large numbers of variables, which result in too many efficient decision units (countries), as well as some timing and variable selection issues.

The key policy implication of our results suggests that greater emphasis should be put on the convergence of tertiary education effectiveness (and not efficiency) within the EU to enhance transmission of tertiary education outcomes into higher productivity and growth rates. However, since primary and secondary education define the "quality" of inputs at higher educational levels, such a policy task requires comprehensive educational reform in countries which are lagging behind. Nevertheless, it should be emphasized that the major limitations of the study follow from the limited data resources and some concerns about the quality of the data reported by Eurostat. The inclusion of data that do not properly represent the situation might significantly change the relative results of the analysis.

Disclosure statement
No potential conflict of interest was reported by the authors.

APPENDIX

Table A1

Previous research rankings (DEA)

Paper	Ahec Šonje, Deskar-Škrbić and Šonje (2018)		Toth (2009)	Aristovnik and Obadić (2011)			Aubyn et al. (2009)								Yotova and Stefanova (2017)		
Year	2005-2013 (avg)		2006	1999-2007 (avg)			1998-2001	2002-2005	1998-2001	2002-2005	1998-2001	2002-2005	1998-2001	2002-2005	2012 and 2014		
Model	1	2	1	1	2	3	1	1	2	2	3	3	4	4	1	2	3
No. of EU countries	11		17	22	22	22	25									9	
Austria			15				13	9	11	9	10	6	9	8			
Bulgaria	3	3	1				10	8	10	8	24	20	23	25	6	5	5
Belgium							21	21	26	25	8	8	7	9			
Cyprus				37	27	1	1	10	27	23							
Czech Republic	1	1	11	1	33	7	17	18			14	17	22	24	3	3	1
Germany			13				15	16	12	10	9	11	10	11			
Denmark			1				11	1	9	1	11	10	8	7			
Estonia	8	2		21	16	19	27	28	17	22	18	15	17	16	7	7	6
Greece			18	19	10	31	18	22	28	27	19	24	24	23			
Spain			1	32	17	34	26	27	20	20	21	18	18	15			
Finland			12	1	1	20	1	7	1	7	1	7	1	5			
France			9	34	24	32	19	17	16	11	12	13	12	14			
Croatia	9	8		26	32	23											
Hungary	4	7	16	12	28	9	23	23	24	26	23	22	21	22	8	8	8
Ireland				17	21	14	1	1	1	1	1	1	1	1			
Italy			1	18	23	22	12	12	13	14	13	12	13	12			

Paper	Ahec Šonje, Deskar-Škrbić and Šonje (2018)		Toth (2009)	Aristovnik and Obadić (2011)			Aubyn et al. (2009)								Yotova and Stefanova (2017)		
Year	2005-2013 (avg)		2006	1999-2007 (avg)			1998-2001	2002-2005	1998-2001	2002-2005	1998-2001	2002-2005	1998-2001	2002-2005	2012 and 2014		
Model	1	2	1	1	2	3	1	1	2	2	3	3	4	4	1	2	3
Lithuania	1	1		1	12	1	28	26	21	19	17	16	16	17	1	1	1
Latvia	1	1					20	13	23	17					1	1	1
Malta							16	15	19	16	7	9	11	10			
Netherlands			10				1	1	1	1	1	5	1	6			
Poland	5	1	17	1	22	13	22	20	18	15	16	19	15	18	5	6	4
Portugal			14				25	25	22	21	22	21	20	21			
Romania	2	6		13	35	10			1	13					2	2	2
Sweden			8	23	8	27	1	1	1	1	1	1	1	1			
Slovenia	7	5		1	13	12	9	14	15	18	25	25	25	20	4	4	4
Slovakia	6	4	1	1	36	1	24	24	25	24	15	14	19	19			
United Kingdom			7	22	19	17	1	1	1	1	1	1	1	1			

Source: Authors.

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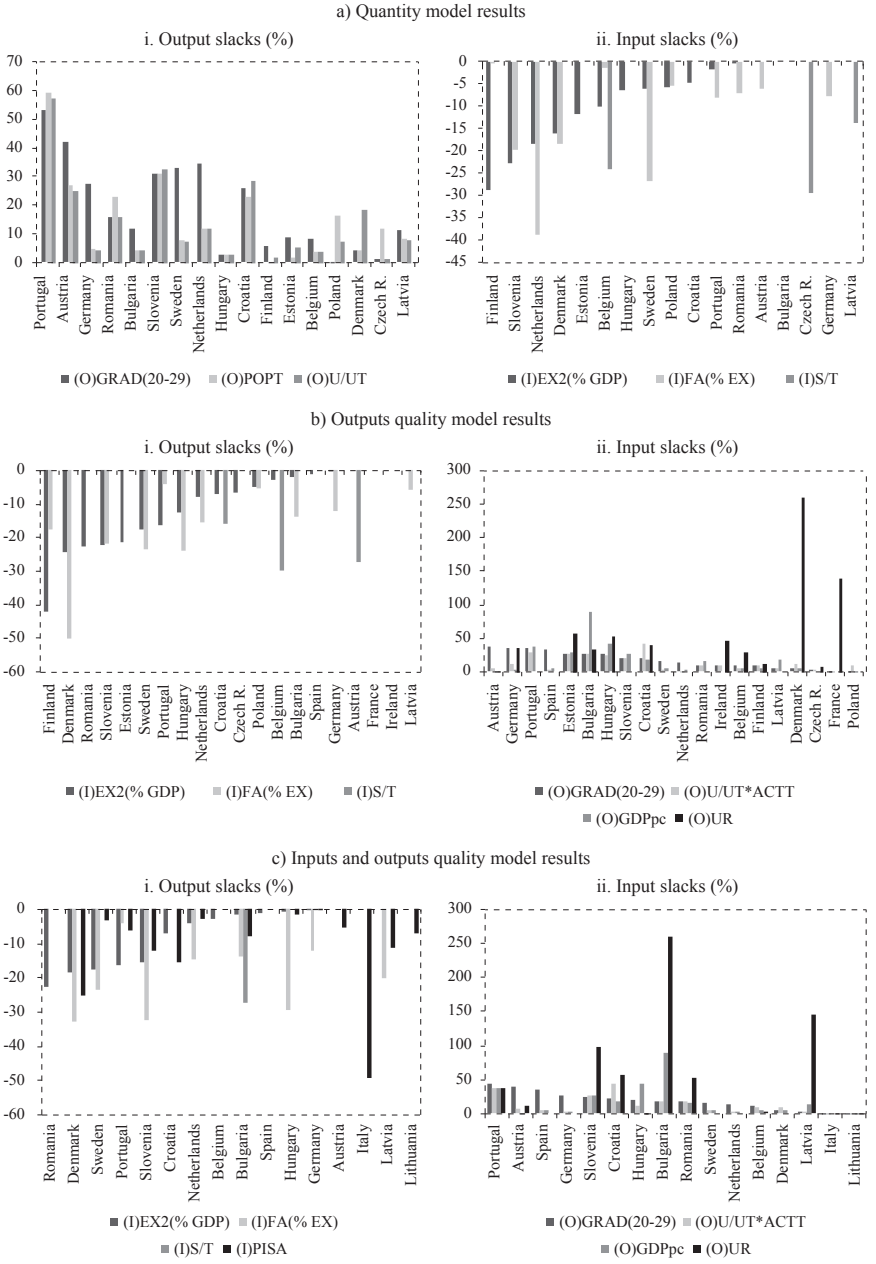
FIGURE A1

Input and output slacks of inefficient countries



Source: Authors.

Table A2

Reference set of a DMU from the quantity-based DEA model, by period

		2004-2006	2007-2009	2010-2012	2013-2015
1	Belgium	Belgium	Belgium	Belgium	Ireland-Lithuania
2	Bulgaria	Bulgaria	Belgium-Czech Rep.-Estonia-Finland	Bulgaria	Czech Rep.-Germany-Slovakia-UK
3	Czech Rep.	Czech Rep.	Czech Rep.	Czech Rep.	Czech Rep.
4	Denmark	Denmark	Denmark	Ireland-Lithuania-UK	Ireland-Lithuania
5	Germany	Germany	Belgium-Slovakia-Finland	Bulgaria-Hungary-Finland-UK	Germany
6	Estonia	Estonia	Estonia	Estonia	Estonia
7	Ireland	Ireland	Ireland	Ireland	Ireland
8	Spain	Spain	Spain	Spain	Spain
9	France	France	France	France	France
10	Croatia	Croatia	Czech Rep.-Spain-Croatia-Poland	Czech Rep.-France-Poland	Czech Rep.-Lithuania
11	Italy	Italy	Italy	Italy	Italy
12	Latvia	Latvia	Latvia	Czech Rep.-France-Lithuania-Poland-Romania	Czech Rep.-Germany-Ireland-Lithuania-UK
13	Lithuania	Lithuania	Lithuania	Lithuania	Lithuania
14	Hungary	Hungary	Ireland-Slovakia-Finland-UK	Hungary	Hungary
15	Netherlands	Netherlands	Belgium-Denmark-Finland	Ireland-Finland-UK	Ireland-Lithuania
16	Austria	Austria	Belgium-Slovakia-Finland	Bulgaria-Spain-Slovakia-UK	Czech Rep.-Spain-Slovakia-UK
17	Poland	Poland	Poland	Poland	Lithuania
18	Portugal	Portugal	Ireland-Lithuania-Poland-Slovakia	France-Lithuania-Romania-UK	Lithuania-Slovakia
19	Romania	Romania	Poland-Slovakia	Romania	Romania
20	Slovenia	Slovenia	Lithuania-Slovakia-UK	Bulgaria-Lithuania-Hungary-UK	Ireland-Lithuania
21	Slovakia	Slovakia	Slovakia	Slovakia	Slovakia
22	Finland	Finland	Finland	Finland	Ireland-Lithuania
23	Sweden	Sweden	Belgium-Denmark-Finland	Ireland-Finland-UK	Ireland-Lithuania
24	UK	UK	UK	UK	UK

Note: Efficient countries are a projection of themselves.

Source: Authors.

Table A3

Reference set of a DMU from the output quality-based DEA model, by period

		2004-2006	2007-2009	2010-2012	2013-2015
1	Belgium	Ireland-Italy-Slovakia-UK	Ireland-France-Lithuania-Slovakia-UK	Czech Rep.-Germany-Ireland-Austria	Germany-Netherlands-UK
2	Bulgaria	Czech Rep.-Latvia-Lithuania-Slovakia	Czech Rep.-Slovakia	Czech Rep.-Germany-Slovakia	Germany-Lithuania-Slovakia-Sweden
3	Czech Rep.	Czech Rep.	Czech Rep.	Czech Rep.	Lithuania-Hungary-UK
4	Denmark	Ireland-Lithuania	Ireland-Lithuania	Ireland-Lithuania	Denmark
5	Germany	Czech Rep.-Ireland	Germany	Germany	Germany
6	Estonia	Czech Rep.-Ireland-Poland-UK	Czech Rep.-Ireland-Lithuania-Romania	Czech Rep.-Germany-Ireland-Lithuania	Denmark-Lithuania-Netherlands-Sweden
7	Ireland	Ireland	Ireland	Ireland	Ireland
8	Spain	Czech Rep.-Ireland-France	Czech Rep.-France-Austria-Slovakia	Czech Rep.-Spain-France-Italy	Spain
9	France	France	France	France	France
10	Croatia	Czech Rep.-Croatia-Poland	Czech Rep.-Poland	Czech Rep.-Lithuania	Denmark-Lithuania-Slovakia-Sweden
11	Italy	Italy	Italy	Italy	Italy-UK
12	Latvia	Latvia	Czech Rep.-Lithuania-Romania-Slovakia	Czech Rep.-Germany-Lithuania	Lithuania-Hungary-UK
13	Lithuania	Lithuania	Lithuania	Lithuania	Lithuania
14	Hungary	Lithuania-Poland-Slovakia-UK	Czech Rep.	Czech Rep.-Germany	Hungary
15	Netherlands	Czech Rep.-Ireland	Netherlands	Netherlands	Netherlands
16	Austria	Ireland-Italy-Slovakia-UK	Austria	Austria	Denmark-Netherlands-Sweden-UK
17	Poland	Poland	Poland	Lithuania	Denmark-Ireland-Lithuania-UK

		2004-2006	2007-2009	2010-2012	2013-2015
18	Portugal	Czech Rep.-Ireland-France	Ireland-Lithuania-Romania	Germany-Ireland-Lithuania	Denmark-Lithuania-Slovakia-Sweden-UK
19	Romania	Lithuania-Poland-Slovakia	Romania	Romania	Denmark-Spain-Slovakia-UK
20	Slovenia	Czech Rep.-Ireland-UK	Czech Rep.-Ireland-Lithuania-UK	Ireland-Lithuania	Denmark-Ireland-Lithuania-UK
21	Slovakia	Slovakia	Slovakia	Slovakia	Slovakia
22	Finland	Czech Rep.-Ireland	Czech Rep.-Ireland-UK	Czech Rep.-Germany-Ireland-Austria	Denmark-Lithuania-Netherlands-Sweden
23	Sweden	Czech Rep.-Ireland	Germany-Ireland-Netherlands	Germany-Netherlands-Austria	Sweden
24	UK	UK	UK	UK	UK

Source: Authors.

Table A4

Reference set of a DMU from the input and output quality – based DEA model, by period

		2004-2006	2007-2009	2010-2012	2013-2015
1	Belgium	Ireland-France-Italy-Slovakia-UK	Belgium	Czech Rep.-Germany-Ireland-Austria	Germany-Netherlands-UK
2	Bulgaria	Czech Rep.-Latvia-Lithuania-Slovakia	Czech Rep.-Slovakia	Czech Rep.-Germany-Slovakia	Germany-Lithuania-Slovakia-Sweden
3	Czech Rep.	Czech Rep.	Czech Rep.	Czech Rep.	Czech Rep.
4	Denmark	Ireland-Lithuania	Denmark	Ireland-Lithuania	Denmark
5	Germany	Czech Rep.-Ireland	Germany	Germany	Germany
6	Estonia	Estonia	Estonia	Estonia	Estonia
7	Ireland	Ireland	Ireland	Ireland	Ireland
8	Spain	Czech Rep.-Ireland-France	Czech Rep.-Germany-France-Austria-Slovakia	Spain	Spain
9	France	France	France	France	France
10	Croatia	Croatia	Czech Rep.-Poland	Czech Rep.-Lithuania	Denmark-Lithuania-Slovakia-Sweden
11	Italy	Italy	Italy	Italy	Italy
12	Latvia	Latvia	Latvia	Czech Rep.-Lithuania-Poland-Finland	Germany-Ireland-Lithuania-Finland-UK
13	Lithuania	Lithuania	Lithuania	Lithuania	Lithuania
14	Hungary	Czech Rep.-Ireland-Poland-UK	Czech Rep.-Slovakia-Finland	Czech Rep.-Germany	Hungary
15	Netherlands	Czech Rep.-Ireland-Finland	Netherlands	Netherlands	Netherlands
16	Austria	Ireland-Italy-Slovakia-UK	Austria	Austria	Denmark-Sweden-UK
17	Poland	Poland	Poland	Poland	Poland
18	Portugal	Czech Rep.-Ireland-France	Ireland-Lithuania-Poland-Romania	Germany-Ireland-Lithuania	Denmark-Spain-Lithuania-Slovakia-Sweden-UK

		2004-2006	2007-2009	2010-2012	2013-2015
19	Romania	Lithuania-Poland-Slovakia	Romania	Romania	Denmark-Spain-Slovakia-UK
20	Slovenia	Czech Rep.-Ireland-Poland-Finland	Czech Rep.-Ireland-Lithuania-UK	Ireland-Lithuania	Denmark-Estonia-Ireland-Finland-UK
21	Slovakia	Slovakia	Slovakia	Slovakia	Slovakia
22	Finland	Finland	Finland	Finland	Finland
23	Sweden	Czech Rep.-Ireland	Germany-Ireland-Netherlands	Germany-Netherlands-Austria	Sweden
24	UK	UK	UK	UK	UK

Source: Authors.

Table A5

Efficiency scores obtained from all models, by period

		Quantity model				Output quality model				Input and output quality model			
		2004-2006	2007-2009	2010-2012	2013-2015	2004-2006	2007-2009	2010-2012	2013-2015	2004-2006	2007-2009	2010-2012	2013-2015
1	Belgium	1	1	0,954	0,905	0,94	0,973	0,929	0,989	0,961	1	0,929	0,989
2	Bulgaria	0.879	1	0.964	1	0.707	0.879	0.864	0.986	0.707	0.879	0.864	0.986
3	Czech Rep.	1	1	1	0.951	1	1	1	0.98	1	1	1	1
4	Denmark	1	0.932	0.912	1	0.877	0.996	0.993	1	0.877	1	0.993	1
5	Germany	0.876	0.954	1	1	0.93	1	1	1	0.93	1	1	1
6	Estonia	1	1	1	0.931	0.77	0.837	0.739	0.748	1	1	1	1
7	Ireland	1	1	1	1	1	1	1	1	1	1	1	1
8	Spain	1	1	1	1	0.92	0.943	1	1	0.92	0.952	1	1
9	France	1	1	1	1	1	1	1	1	1	1	1	1
10	Croatia	1	0.803	0.806	0.873	1	0.808	0.806	0.821	1	0.808	0.806	0.821
11	Italy	1	1	1	1	1	1	1	1	1	1	1	1
12	Latvia	1	0.943	0.905	0.857	1	0.919	0.904	0.862	1	1	0.955	0.924
13	Lithuania	1	1	1	1	1	1	1	1	1	1	1	1
14	Hungary	0.898	1	1	1	0.811	0.847	0.879	1	0.816	0.909	0.879	1
15	Netherlands	0.929	0.916	0.853	0.878	0.947	1	1	1	0.957	1	1	1
16	Austria	0.719	0.805	0.841	0.843	0.977	1	1	0.9	0.977	1	1	0.9
17	Poland	1	1	1	0.995	1	1	1	0.975	1	1	1	1
18	Portugal	0.591	0.628	0.679	0.725	0.742	0.713	0.74	0.733	0.742	0.713	0.74	0.737
19	Romania	0.768	1	1	0.748	0.751	1	1	0.725	0.751	1	1	0.725
20	Slovenia	0.811	0.735	0.741	0.768	0.81	0.763	0.789	0.752	0.824	0.763	0.789	0.833
21	Slovakia	1	1	1	1	1	1	1	1	1	1	1	1
22	Finland	1	1	0.995	0.997	0.935	0.99	0.967	0.924	1	1	1	1
23	Sweden	0.903	0.906	0.914	1	0.908	0.969	0.98	1	0.908	0.969	0.98	1
24	UK	1	1	1	1	1	1	1	1	1	1	1	1

Source: Authors.

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Dynamics and determinants of emigration: the case of Croatia and the experience of new EU member states

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Abstract

This paper analyzes the emigration flows from Croatia and other new EU member states to the core EU countries after their EU accession. In order to assess the magnitude and dynamics of the recent emigration wave properly, we construct the series of indirect emigration flows, resorting to the national statistical offices of the selected core EU destination countries. We compare the Croatian experience with that of other NMS and show that the intensity of Croatia's emigration flows after EU accession is proportional to that of the Romanian and Bulgarian cases. Finally, we empirically analyze the economic and non-economic drivers of emigration from NMS to the core EU in the 2000-2016 period. Results show that both economic (measured by different GDP and labour market indicators) and non-economic factors (capturing the EU accession, the level of corruption in the economy and demographic characteristics of the origin country population) are relevant for emigration decisions.

Keywords: emigration, EU accession, new member states, gravity model

1 INTRODUCTION

In mid-2013 Croatia joined the European Union (EU) and as a member state (MS) gained access to the EU single market. By becoming a part of the single market, the country benefits from "the four freedoms" – the free movement of goods, services, capital and labour, which enable more efficient reallocation of domestic factors of production, resulting in new business and trade opportunities and ultimately increasing MS growth prospects. At the same time, EU accession triggered implementation of temporary, transitional provisions restricting free labour mobility from Croatia to the labour markets of other MS.[1] Despite that, one of the direct effects of EU accession and the related reallocation of domestic factors of production was also a significant emigration outflow from Croatia to other states in the EU.

Such developments raised emigration-related issues to the forefront of public debate in Croatia. Drawing on a mixture of anecdotal evidence, *ad hoc* surveys and social network posts, the media predominantly engaged in painting and propagating a bleak picture of the "Croatian exodus". At the same time, no proper estimate of the magnitude and nature of this emigration wave has been made, due to inaccurate migration statistics. Official migration statistics collected by the Central Bureau of Statistics in Croatia are published with a disclaimer that the numbers of emigrants are based on the self-reporting of emigration by emigrants themselves, a process clearly discouraged by a relatively burdensome procedure that results in a loss of domestic social security benefits.

[1] Transitional provisions do not apply on cross boarder movements of citizens for reasons other than work, but only restrict free movement of citizens for work purposes. According to the Accession Treaty for Croatia transitional provisions can apply for a maximum period of seven years (2+3+2 formula). More details are given in table A1, appendix 1.

Therefore, in this paper we try to assess the characteristics of the recent Croatian emigration wave to EU countries. We present a comprehensive analysis of the dynamics and the main determinants of emigration from Croatia to core EU countries following EU accession, comparing the Croatian case with the experience of other new member states.[2]

To our knowledge, there are few analyses of the impact of the free mobility of labour on Croatian emigration flows. Potential migration flows from Croatia after EU accession are ex-ante estimated in Strielkowski, Šárková and Żornaczuk (2013), Fertig and Kahanec (2013), and Vidovic and Mara (2015). Strielkowski, Šárková and Żornaczuk (2013) find that around 220 thousand residents from Croatia were expected to live in the EU15 by 2016. The Fertig and Kahanec (2013) estimates vary between negative net migration balance and 360 thousand residents from Croatia in the EU14 by 2020, while the Vidovic and Mara (2015) estimates are between 160 and 220 thousand residents from Croatia in the EU by 2019.

Effective emigration outflows from Croatia following the EU accession are analyzed in Vidovic and Mara (2015), and Župarić-Ilijić (2016). Vidovic and Mara (2015) integrate several data sources (CBS data, Eurostat employment data, data about the stock of Croatian citizens in EU member states and various surveys). They show that emigration patterns from Croatia in 2014 intensified significantly, due to higher economic development and better quality of life in other MS, as perceived by Croatian emigrants. However, their paper analyses emigration outflows only up to 2014, due to data availability. Another overall analysis of emigration trends from Croatia is given in Župarić-Ilijć (2016). This author emphasized that Croatian net migration balance significantly worsened with the onset of the global financial crisis and in particular after the accession to the EU, and argued that official Central Bureau of Statistics migration data are underestimated and should be compared with destination country data, but provided no such estimate. Thus, in this paper, we extend existing literature in time, referring to the broader period, integrating several data sources and analyzing the movements that were effectively observed after Croatia had joined the EU in 2013. The main contributions of our paper are threefold.[3]

First, we construct indirect emigration flows from Croatia, following the EU accession. Currently, the Central Bureau of Statistics (CBS) in Croatia collects the

[2] Due to data availability, core EU countries are represented by 11 countries: Austria, Belgium, Denmark, Finland, Germany, Ireland, Italy, Luxembourg, Netherlands, Sweden and United Kingdom. New EU member states are represented by 10 countries: Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia.

[3] In addition, several authors implement partial analyses of emigration flows from Croatia following the EU accession. Šonje (2018) estimates family emigration by using primary school enrolment data and shows that in 2009-2016 period around 50 thousand young citizens with children left Croatia. The Croatian Employment Service uses the annual employers' survey to examine the extent of migration among the employed, and shows that in 2016 around 20 thousand employed persons emigrated from Croatia. Finally, Jurić (2017) did a detailed on line survey among Croatian emigrants in Germany and showed that although economic factors are relevant for emigration decision, there is a prevalence of non-economic factors among the motives of emigration for Croatian emigrants.

data about migration flows from the Ministry of the Interior, which records only persons that have registered the change in their country of usual residence with the Ministry. Following related literature contributions (Izquierdo, Jimeno and Lacuesta, 2014; Bertoli, Brücker and Moraga, 2013) we assume that there are no clear incentives and benefits of registering in home country offices when emigrating, while on the other hand immigrants have an incentive to register when they arrive in the destination country, given that access to some basic social services in a destination country (i.e. education and health) generally requires registration. Therefore, we assume that official emigration numbers from CBS could be underestimated and resort to the European Union destination countries national statistical offices to collect numbers of registered immigrants coming from Croatia. The differences are striking. Our indirect emigration estimates show that emigration from Croatia to the core EU countries following the accession is on average around 2.6 times higher than the officially registered numbers in Croatia, with around 230 thousands people having left Croatia and settled in one of the analyzed core EU countries in the 2013-2016 period.

Secondly, we show that although emigration flows in Croatia following the accession are sizeable, they are not an isolated case. Bulgaria and Romania also experienced proportionally similar population outflows after they became member states in 2007. CEE countries that joined the EU in 2004 also saw an increase in emigration rates towards the core EU countries, though to a lower extent. Time series of indirect emigration flows from NMS show that higher emigration rates recorded after the EU accession persisted over the years. In other words, average emigration rate from NMS to the core EU countries in 2016 is on average equal to or higher than the emigration rates in the four years following accession to the EU, which corroborates the strong persistency of higher emigration rates.[4] Such trends raise several serious sustainability concerns for Croatia, which will become relevant in the medium term, since the current population outflow to the core EU countries, according to the indirect emigration flows constructed, is around 2% of population each year.

The third contribution of our paper consists of empirical analyses of the main economic and non-economic determinants of emigration flows from Croatia and other NMS to the core EU countries. We believe that their evaluation provides insights that are highly important for policymakers in order to shape and implement adequate and targeted policies to mitigate emigration flows. In our analysis of relevant emigration determinants we employed a gravity model. Results obtained under alternative specifications and estimation strategies of the gravity model show that the access to the single EU market (after transitional provisions were lifted) has been a main driver of emigration flows in Croatia since 2013. However, current economic conditions and labour market indicators, together with demographic factors and prevalence of the corruption in the country also

[4] That is 12 or 8 years following EU accession.

turned out to be significant in the determination of emigration flows among NMS and core EU countries, implying that there is a room for policymakers to alleviate the intensity of emigration pressures in Croatia.

The remainder of the paper is structured as follows: in section 2 we describe in detail the major characteristics of recent Croatian emigration flows, firstly by discussing Croatia's official emigration figures and secondly by comparing official data with data on indirect emigration from Croatia collected from national statistical offices of the core EU destination countries. In section 3 we present a comparative overview of the emigration experiences of other new EU member states following their EU accession. In section 4 we provide a basic overview of gravity models and their applicability in studying migration issues and describe the variables used in the model. In section 5 we present different specifications of the gravity models and discuss the results of the econometric analysis together with robustness checks. In section 6 we emphasize the main conclusions.

2 DEMOGRAPHIC AND GEOGRAPHICAL CHARACTERISTICS OF CROATIAN EMIGRANTS

2.1 EMIGRATION FLOWS FROM CROATIA ACCORDING TO THE CENTRAL BUREAU OF STATISTICS DATA

As a starting point, we take a deeper look at the official Croatian migration statistics, in order to improve our understanding of the migration dynamics in Croatia. Notwithstanding existent methodological issues, and, while accepting the claim that official Croatian migrations are under-reported, we nevertheless believe that they could be under-reported systematically, which means that they still might contain some useful information about the underlying migration trends.

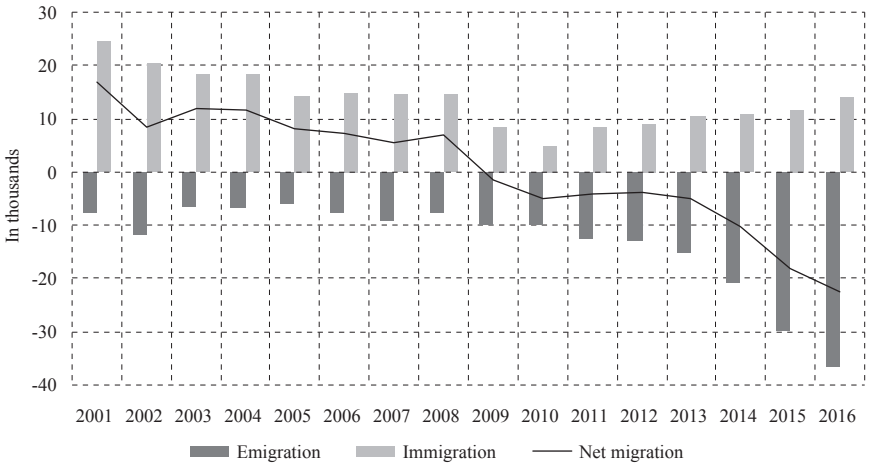
Looking at the big picture, we can see that prior to the global financial crisis Croatia had a positive net migration balance. However, migration flows reversed at the onset of the global financial crisis (net migration balance turned negative). Until the EU accession, negative net migration remained relatively low and stable. After Croatia became a full member of the EU in July 2013 migration flows clearly intensified (figure 1).

Figure 1 also shows that EU accession had no significant effect on the number of immigrants, while emigration outflows intensified significantly with the accession. Thus, in the remaining part of the paper we concentrate exclusively on gross emigration outflows and analyze emigrants' main characteristics.

Available data provide a basis for a simple demographic analysis of Croatian emigrants. Numbers suggest that there is an almost equal share of male and female emigrants throughout the period, with the share of male emigrants slightly increasing at times of high migration (figure 2).

FIGURE 1

Net migration balance of Croatia between 2001 and 2016, Central Bureau of Statistics data, net migration

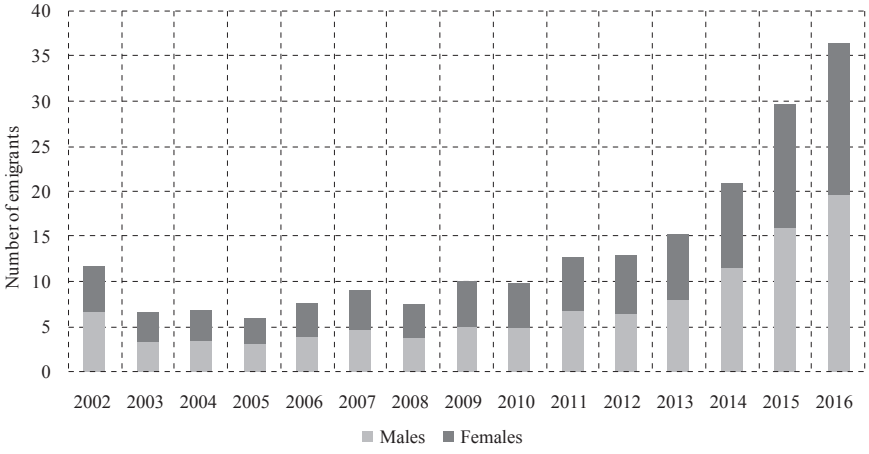


Note: Net migration = number of immigrants – number of emigrants, in thousands

Source: CBS.

FIGURE 2

Structure of emigrants from Croatia by sex between 2002 and 2016, Central Bureau of Statistics data, gross emigration flows



Note: In thousands.

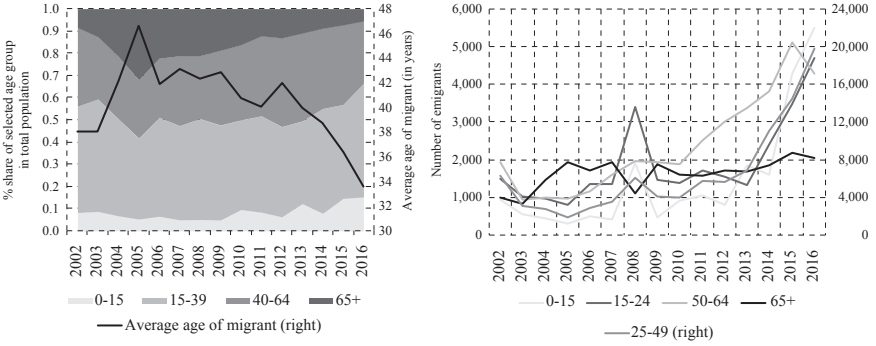
Source: CBS.

The age structure of emigrants suggests that there was a structural shift towards younger emigrants in the last emigration wave. Firstly, there is a striking increase in the number of youngest emigrants (age 0-15), and secondly it appears that the decrease in the average age of the emigrants is accelerating. Our estimates show that the average age of emigrants in the period between 2001 and 2013 was 41.5

years, but dropped sharply over next three years and reached 33.6 years in 2016 (figure 3). These results are in line with Šonje (2018). The author estimates that in 2009-2016 period around 50 thousand young citizens with children left Croatia permanently.[5]

Figure 3

(a) Relative share of different age groups of emigrants and average age of emigrant between 2002 and 2016, (b) Number of emigrants by different age groups between 2002 and 2016, Central Bureau of Statistics data, gross emigration flows



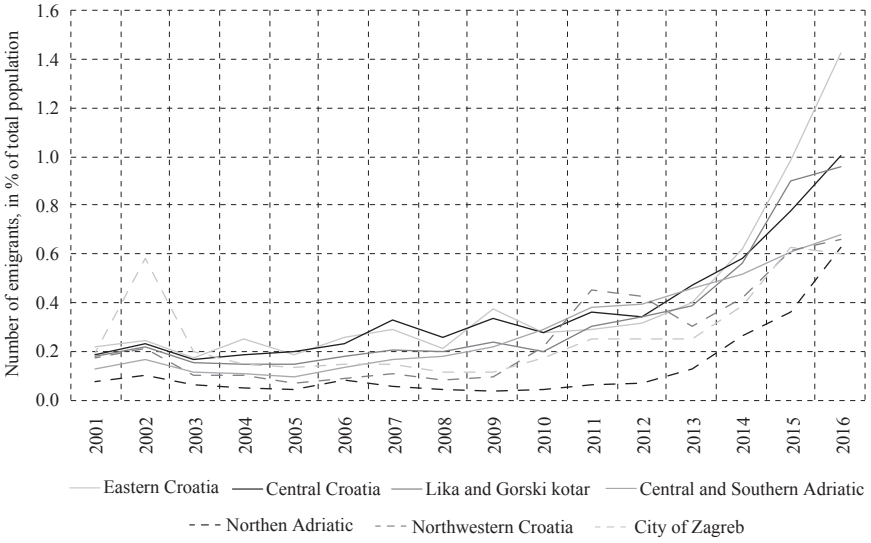
Source: CBS.

Turning to the distribution of emigrants across Croatian regions, again there is a very clear compositional change, towards the end of the analyzed period, with a growing proportion of emigrants from less-developed regions. Following the relatively stable situation during the 2000s, the deep and prolonged domestic recession pushed up emigration more or less gradually in almost all regions. After the EU accession, there was a rapid and pronounced growth of emigration from all regions, albeit at a different pace. Emigration flows were much stronger in the regions with the highest unemployment. As a result, looking at the share of migrants in their population in 2016, Croatian regions can be broadly divided into two groups: one with the ratio of migrants to domestic population close to or above 1% (Eastern Croatia, Central Croatia, Lika and Gorski Kotar), and other, economically more advanced regions with the ratio of around 0.66% (figure 4). Therefore, even though emigration is a country-wide problem, the intensity of emigration flows (as a percentage of total population) is a much stronger phenomenon in the economically less developed regions (figure 5).

[5] Estimates are based exclusively on households with children (obtained by comparison of expected and effective primary school enrolment) and are considered to represent irreversible emigration, based on the assumption that child integration in system of destination countries strongly disincentives return-migration.

FIGURE 4

Structure of emigrants from Croatia by region between 2001 and 2016, Central Bureau of Statistics data, gross emigration flows

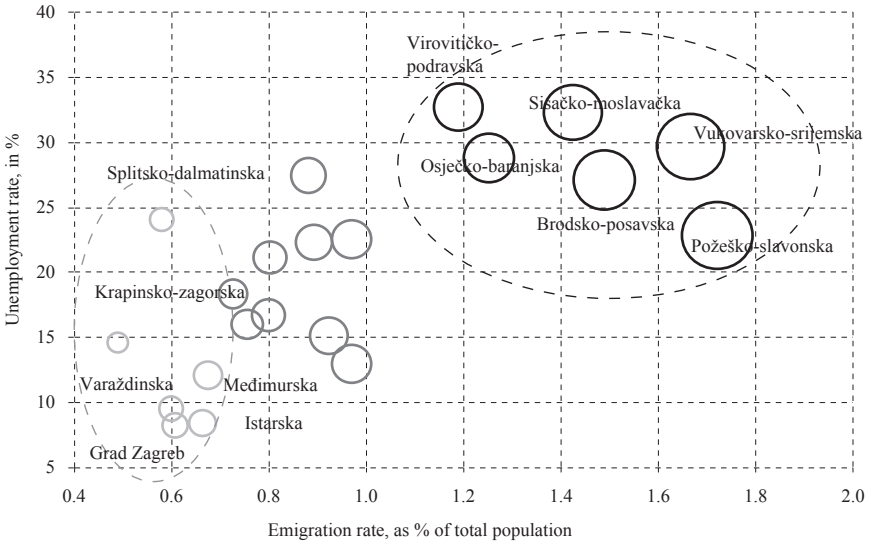


Notes: Eastern Croatia encompasses Virovitičko-podravska, Požeško-slavonska, Brodsko-posavska, Osječko-baranjska and Vukovarsko-srijemska counties. Central Croatia encompasses Zagrebačka, Sisačko-moslavačka, Karlovačka and Bjelovarsko-bilogorska counties. Lika and Gorski kotar encompass Primorsko-goranska and Ličko-senjska counties. Central and Southern Adriatic encompass Zadarska, Šibensko-kninska, Splitsko-dalmatinska and Dubrovačko-neretvanska counties. Northen Adriatic refers to Istarska County. Northwestern Croatia encompass Krapinsko-zagorska, Varaždinska, Međimurska and Koprivničko-križevačka counties.

Source: CBS.

FIGURE 5

Unemployment rate and share of emigrants by county in 2016, Central Bureau of Statistics data, gross emigration flows



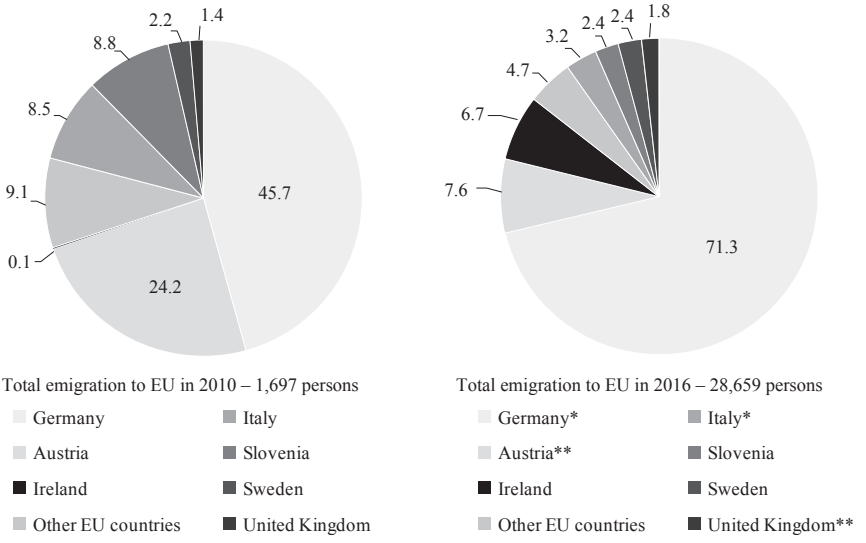
Note: The size of the circles correspond to the emigration rate, as % of total population of the county.

Source: CBS.

Finally, CBS data show that slightly more than 85% of emigrants from Croatia after the EU accession was directed to three EU countries; Germany, Austria and Ireland. Figure 6 compares main emigration destinations of Croatians in the EU before and after Croatian accession. Although total emigration flows towards the EU increased significantly, the composition of the main destinations remained almost unchanged from the period before accession. The only exception is Ireland, since emigration to Ireland before the EU accession was almost non-existent in Croatia, while in 2016 Ireland become third biggest destination for Croatian emigrants. In addition, EU accession caused a change in relative position between Germany and Austria, two main emigration destinations, with even more emigrants going to Germany. This is a direct consequence of Austria's decision to extend the application of transitional provisions for Croatian citizens until June 2018. After 2018 we expect the share of Croatians heading towards Austria to increase, unless Austria prolongs the application of the transitional provisions until 2020.[6]

Figure 6

(a) Main EU emigration destinations for Croatians in 2010, (b) Main EU emigration destinations for Croatians in 2016, Central Bureau of Statistics data, gross emigration flows



*Note: * Germany and Italy lifted transitional provisions for Croatia in 2015. ** UK and Austria are applying transitional provisions until June 2018, with possible extension until 2020.*

Source: CBS.

[6] Prolongation of application of transitional provisions in the period from June 2018 until June 2020 is possible only in the case of serious disturbances for the Austrian labour market that would otherwise occur.

2.2 EMIGRATION FROM CROATIA ACCORDING TO NATIONAL STATISTICAL OFFICES OF CORE EU COUNTRIES

The Croatian Central Bureau of Statistics detailed data about emigration presented so far are useful for an analysis of some main characteristics of Croatian emigrants. However, as previously explained in the Introduction, the official number of emigrants published by the Central Bureau of Statistics in Croatia is based on the people who voluntarily registered their departure with the authorities, while standard migration theory predicts that migrants are much more likely to register in the country of destination than in the country of origin.[7] Therefore, in addition, we construct an indirect emigration flow taking as a starting point the immigration statistics from the national statistical offices of the following core EU countries: Germany, Denmark, Austria, Ireland, Belgium, Netherlands, Italy, Finland, Sweden, Luxembourg and United Kingdom. For UK and Ireland, immigration statistics are not available, so we use the individually appointed national insurance numbers (NINo) in the UK and personal public service numbers (PPS) in Ireland that are commonly used in the literature (Hazans and Philips, 2011). We analyze the period from 2000 until 2016 and for each year in the sample, we consult official immigration statistics of the selected core EU countries and take the number of immigrants coming from Croatia.

Where available, our preferred choice is statistics that register immigrants from Croatia according to the country of birth principle (as in Netherlands, Italy, UK and Belgium) or country of previous residence principle (as in Germany and Denmark).[8] Immigration flows registered according to citizenship principle (as in Sweden, Finland, Luxembourg and Austria) could be inaccurate since they also include migrants from Bosnia and Herzegovina (and other countries) having Croatian (or dual) citizenship.[9] According to Jurić (2017) in a survey of Croatian emigrants to Germany, around 20% of emigrants registered as Croatian citizens in Germany actually emigrated from Bosnia and Herzegovina. This is the reason why we have avoided using migration numbers based on the citizenship principle, if the country of birth principle or country of previous residence principle was also available among migration statistics. Nevertheless, given that for some countries migration statistics are available only based on the citizenship principle, indirect emigration flows constructed with resort to the national statistical offices of core EU countries and presented in the remaining part of the paper should be interpreted as an upper bound for emigration outflows from Croatia. Detailed information about the construction of indirect emigration flows is given in appendix 1. Comparison between constructed indirect emigration flows from Croatia based on

[7] Illustrative case in point is a Polish example. Following the EU accession Poland experienced a strong emigration flows. At some point policymakers realized that the official statistics grossly underestimate the extent of emigration. As a result, research project has been initiated in Poland in order to properly estimate the true numbers. The upgraded and consolidated sources raised the official emigration numbers by a factor ten (Statistics Poland, 2011).

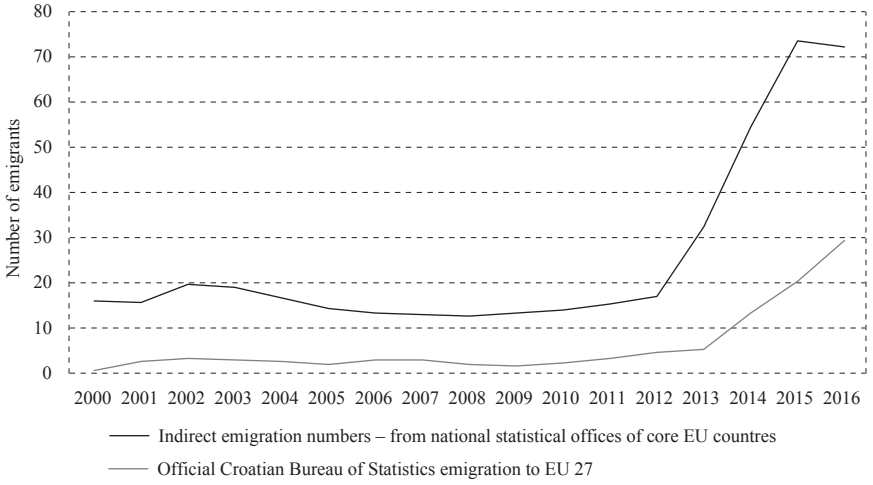
[8] Destination country can register immigrants according to the following principles: country of birth principle, country of previous residence principle and citizenship principle. Registration of immigrants according to the different principles is defined by Eurostat International Migration Statistics.

[9] For Ireland personal public service number the principle for registration of immigrants is not denoted.

data published by national statistical offices of the core EU countries and official Central Bureau of Statistics data are represented in figure 7. [10,11]

Figure 7

Indirect emigration flows from Croatia to the core EU countries according to national statistical offices of core EU countries, compared to the official emigration numbers to EU 27 countries according to Central Bureau of Statistics, gross emigration flow



Note: Official Central Bureau of Statistics emigration number for emigration in EU 27. Core EU countries are represented by 11 countries, due to data availability: Austria, Belgium, Denmark, Finland, Germany, Ireland, Italy, Luxembourg, Netherlands, Sweden and United Kingdom, in thousands.

Source: CBS, national statistical offices of the core EU countries.

The differences in emigration outflows between the two sources are striking. According to the indirect estimates of emigration, 230 thousand persons emigrated from Croatia to the core EU countries in the period from 2013-2016. On the other hand, official data report 61 thousand emigrants in 2013-2016 period directed towards the selected core EU countries, and 102 thousand emigrants in total during the same time period. However, the difference between the mirror statistics of Croatia and core EU destination countries is expected to decrease in the future. This would reflect the fact that by the end-2016 the Croatian Tax Administration encouraged Croatian migrants to change their residency status with authorities in order to

[10] According to the Central Bureau of Statistics, national statistical offices of the selected core EU countries represent broadly around 90% of total emigration to the European Union from Croatia over the entire sample period, which makes them a valid and representative indicator of total emigration flows towards the EU.

[11] We have also estimated total emigration flows from Croatia, by putting together (1) indirectly constructed emigration flows to the core EU countries and (2) Central Bureau of Statistics official emigration data for all other emigration destinations, i.e. "the rest of the world". The same approach is followed in order to construct an approximation of total immigration flows in Croatia. Calculation details of total net emigration are given in appendix 2. According to our discretional combination of different data sources, net emigration from Croatia is estimated to be around 155 thousands person in the 2013-2016 period.

avoid double taxation of their income.[12] The threat of double taxation of income probably incentivized migrants to be more prompt in registering their departure and changing their residence in their origin country offices.[13]

Overall, the discrepancies between the mirror statistics of origin and destination countries are common in migration statistics and most other countries are also faced with similar challenges. Thus, in our analysis we will adopt the same principle for other NMS: Bulgaria, Romania, Poland, Czech Republic, Slovakia, Slovenia, Hungary, Latvia, Lithuania and Estonia and construct indirect emigration flows for these countries referring to the immigration statistics of national statistical offices of the core EU countries.

3 MIGRATION FLOWS IN OTHER NEW EU MEMBER STATES AFTER THE EU ACCESSION

In this section, by looking into the emigration experience of other new EU members, we tried to gain additional insight about some additional characteristics of emigration flows caused by EU accession, such as the average structure of emigrants (according to main demographic attributes), stability of the flows, number of years after the accession needed to reach a plateau, the likely duration of an emigration wave and possible reversal points.

Detailed migration data from national statistical offices of the new EU member states, allow us to analyze the main attributes of emigrants from NMS in order to look for some substantial differences or similarities in migration flows between countries. According to figure 8, data about the age structure of emigrants does not follow any single path across countries. However, for all countries in the sample, the average age of emigrant in 2016 is similar, ranging broadly from the low to the mid-thirties. At the same time, the median age of the total population is rapidly increasing, which in most countries widens the gap between the average population and average emigrant age. This situation makes the emigration outflows of relatively younger citizens even more concerning in terms of the long-term sustainability of social services (such as public pensions and health).

Comparison of top emigration destinations for emigrants coming from NMS reveals that Germany is ranked among the top three emigration destinations for all countries in the sample. The Croatian main emigration destinations, Austria and the United Kingdom, are also the second most frequent EU destinations for emigrants from NMS in 2016 (table 1).[14]

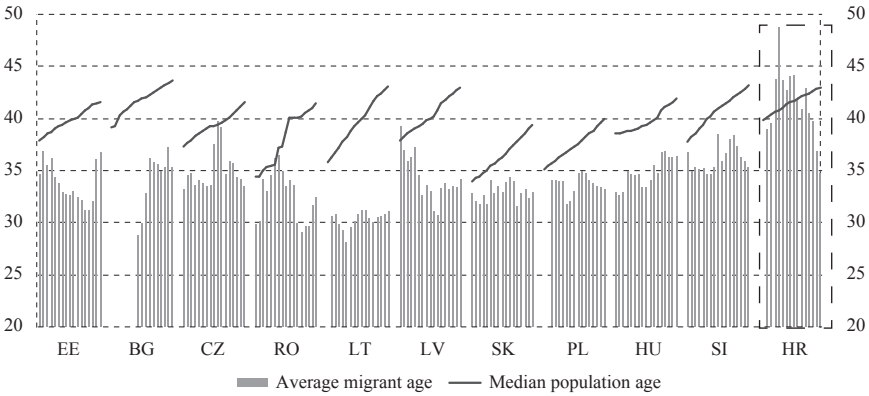
[12] At the beginning of 2017 Croatian government adopted the Ordinance for the implementation of the General Tax Act (OG 30/17) that clarified the process of determination of residency status for tax purposes and induced migrants to register their change of residency within authorities to avoid double income taxation.

[13] CBS is constantly working on improving migration data sources, so part of the observed developments might reflect underlying methodological changes. For example, in 2011 the CBS changed its definition of migrants from people who registered their departure/arrival to people who are absent from their usual place of residence in a one year period.

[14] Nevertheless, there are some peculiarities among main emigration destinations between NMS. Finland was the main destination for emigrants from Estonia, and Spain for emigrants from Romania in 2016, reflecting their cultural and historical linkages.

Figure 8

New MS emigrants' average age and median age of population, 2000-2016, national statistical offices of NMS countries, gross emigration flows



Sources: CBS, national statistical offices and Eurostat; authors' calculations.

Table 1

Main EU emigration destinations for NMS in 2016 (in % of total EU emigration), national statistical offices of NMS countries, gross emigration flows

Origin country	Top 3 emigration destinations in EU, as % of total EU emigration		
Bulgaria	n/a	n/a	n/a
Croatia	Germany, 71	Austria, 8	Ireland, 7
Czech Republic	Slovakia, 60	Germany, 9	Poland, 6
Estonia	Finland, 63	United Kingdom, 8	Germany, 7
Hungary	Germany, 32	Austria, 27	United Kingdom, 17
Latvia	n/a	n/a	n/a
Lithuania	United Kingdom, 60	Ireland, 11	Germany, 10
Poland	Germany, 43	United Kingdom, 28	Netherlands, 8
Romania[a]	Spain, 24	Germany, 17	Italy, 16
Slovakia	Czech Republic, 38	Austria, 27	Germany, 10
Slovenia	Germany, 27	Austria, 27	Croatia, 12

[a] *Percentage of total emigration.*

Sources: CBS, national statistical offices and Eurostat.

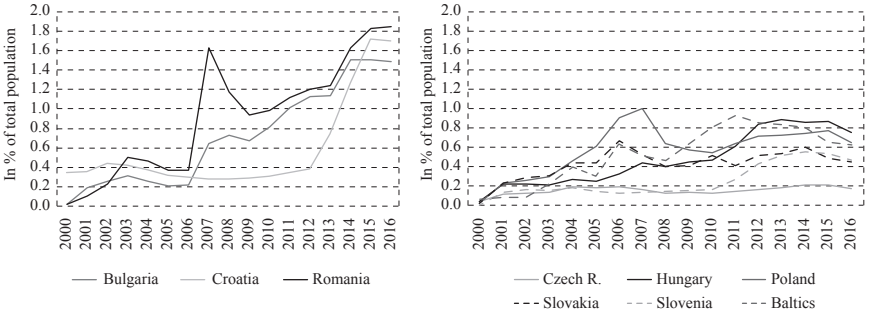
Given that similar core EU countries dominate as the main emigration destinations to Europe for NMS, this corroborates our decision to construct indirect emigration flows for NMS by resorting to the national statistical offices of core EU countries, as we did for Croatia. Thus, in the remaining part of this section we use data about indirect emigration flows from NMS to the core EU countries and employ them to compare the dynamics and intensity of migration outflows among the NMS.

Comparison of the indirect emigration flows from other NMS to core EU countries shows that the intensity of emigration flows from Croatia following the accession is not unique in its size, given the experience of other economically less

developed member states (Bulgaria and Romania), but also that emigration flows from NMS following the EU accession in 2004 were significantly lower (figure 9). Another important pattern arises from the analysis of NMS emigration flows, since it is visible that a rise in the average migration rate towards the core EU countries following EU accession is not a temporary, one-off reaction to accession to the common EU market. According to figure 10, the average emigration rate in 2016 is equal to, or higher than the average emigration rate in four years following the EU accession, pointing to the persistence of intensive emigration flows.[15]

Figure 9

Indirect emigration flows from NMS to the core EU countries, national statistical offices of core EU countries, gross emigration flows

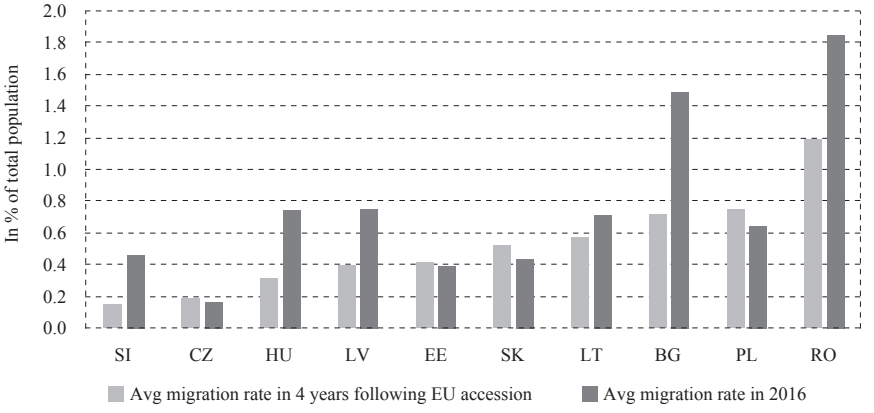


Note: Dashed lines denote the years of EU accession.

Source: National statistical offices of the core EU countries.

Figure 10

Indirect emigration flows of NMS in time, national statistical offices of core EU countries, gross emigration flows



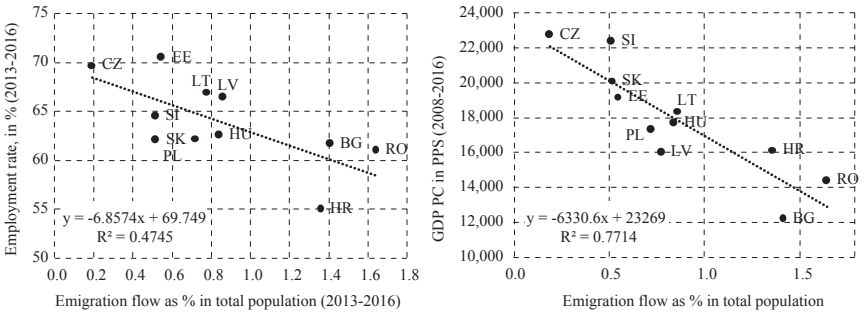
Source: National statistical offices of the core EU countries.

[15] However, all member states but Croatia gained access to the common EU market prior to the onset of the global crisis. Only Croatia joined the EU after six consecutive years of economic distress. This might have created an additional pressure on migration outflows from Croatia. However, proper evaluation of this phenomenon will be possible only with some time delay.

A careful consideration must also be given to the influence of the economic cycle on emigration. Persistence of increased emigration flows from NMS to core EU countries in the decade following EU accession could reflect the impact of the economic crisis that started in 2009 on emigration decisions. Figure 11, in both panel (a) and (b), shows that economic conditions are indeed related to intensity of emigration.

Figure 11

Average emigration flow, as % in total population from 2011 to 2016, compared to average unemployment rate (a) and average GDP PC in PPS, (b) national statistical offices of core EU countries, gross emigration flows



Source: Eurostat and national statistical offices of the core EU countries.

The NMS had rather different crisis and post-crisis experiences. Poland experienced no recession but faced sizable emigration flows, some countries recovered rather quickly after the initial shock (the Baltics, Slovakia), while others experienced a double-dip recession (Slovenia) or a very deep and prolonged recession (Croatia). In addition, the economic slack was global in nature, i.e. the worsening of economic conditions was not restricted only to NMS but was also present in most of the core EU countries, thus altering to some extent the relative benefits between origin and destination countries. As a result, a simple comparison of various economic performance indicators and the intensity of emigration flows can provide only a partial and limited insight into the relative importance of different economic and non-economic determinants of migration flows. In the next section we thus resort to formal econometric analysis using a gravity model to examine the main determinants of emigration in Croatia and other new EU member states to the core EU countries in the 2000-2016 period.

4 GRAVITY MODEL OF MIGRATION

The application of Newtonian physics in economics started with Tinbergen (1962), who used a gravity model to explain international trade flows. Flowerdew and Salt (1979) introduced the gravity model in the context of migration analysis, and it soon become widely used to analyze different migration determinants. However, some authors claim that the first application of a gravity model to explain migration patterns goes back to Ravenstein who used it to analyze migration patterns in 19th century Britain (Anderson, 2011).

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Notwithstanding their long history, gravity models have experienced a revival since the early 2000s, due to much improved bilateral migration data (Ramos, 2016) and the emergence of statistical theories appropriate for studying spatial interaction. The reasons for the popularity of gravity models in migration analysis are trifold: intuitive consistency with migration theories; ease of estimation in its simplest form; goodness of fit in most applications (Poot et al., 2016). Gravity models assume migration flows (M) between the origin country *i* and destination country *j* in time *t* are proportional to the product of their populations (P) (which are in migration contexts used as proxies for the concept of mass from standard gravity model) and inversely proportional to the distance (D) between them.

$$M_{ijt} = \alpha_0 P_{it}^{\alpha_1} P_{jt}^{\alpha_2} D_{ijt}^{\alpha_3} \quad (1)$$

Gravity models in their original form are purely non-theoretical, so they are usually enriched with different variables capturing traditional pull and push factors of migration following human capital theory approach to migration developed by Sjaastad (1962), and Harris and Todaro (1970). The authors consider migration decision as a complex form of investment in human capital that is influenced by future expected income levels and the relative probability of employment opportunities in destination and origin countries.[16] More formal arguments for the use of an extended vector of explanatory variables in migration analysis can be derived from the Random utility model introduced in migration literature by Borjas (1987), and Grogger and Hanson (2011) that provided micro foundations in the context of migration analysis. Reflecting these considerations, the gravity model used in this paper is augmented by an additional set of explanatory variables covering different economic, demographic and educational factors, as well as the level of corruption in the country.

The dependent variable is the gross flow of emigrants from NMS to the core EU country in each year for 2000-2016 period. In order to trace emigration flows accurately, we rely on immigration statistics of the selected receiving countries as available from national statistical offices of the core EU countries, as explained in section 2.

Explanatory variables used in the analysis are related to traditional pull and push factors of migration presented in literature. The basic specification of our model contains GDP per capita in purchasing power parity of origin and destination country, relative size of populations between countries based on Eurostat data and geographical distance between capitals of destination and origin countries downloaded from CEPII's geo-distance database. Moreover, our basic specification also contains the variable capturing the effect of EU accession. The variable is based on transitional provisions on the free movement of workers from new EU

[16] Income levels are usually approximated by GDP per capita in PPP terms given that wage data are not comparable across countries.

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member states following the EU enlargement in 2004, 2007 and 2013, as reported by the European Commission. Following the EU enlargement, several core EU states decided to apply transitional provisions on the free movement of workers from NMS, and effectively postpone the full liberalization of their labour markets. Thus for each pair of origin and destination countries in the sample, the dummy variable associated to transitional provisions takes the value 1 in the year that the core EU country lifted its restrictions on the free movement of workers coming from the respective NMS.

In the extended version of our model we include additional variables accounting for some additional characteristics of origin and destination countries. Following Lamberty (2015) we use data from the World Governance Index (WGI) database and include a corruption index for origin and destination country as explanatory variables in our analysis, to evaluate if differences in corruption between countries are a relevant factor in explaining observed emigration patterns. From among the different WGI indexes evaluating the quality of governance and institutions from different aspects, we have opted for the inclusion of the corruption index in our main specification following Poprawe (2015) who shows that corruption increases emigration, since it retards the economic development of the country and creates an insecure living and economic environment.[17,18] We also evaluate the impact of origin country population attributes on migration outflows. Following Sprenger (2013) we include the share of persons educated to tertiary level in total population of origin country to test whether higher emigration flows are associated with higher skill levels. The impact of demographic characteristics of origin population on emigration flows is measured through the share of young people (persons aged 20-34) in total population of origin country as an approximation of the potential emigration pool.

Finally, we include alternative variables for economic performance of the country. We find this relevant since Bertoli, Brücker and Moraga (2013), and Beine et al. (2017) argue that relative difference in GDP per capita in purchasing power standard represents a difference in level of economic development between two countries, which is relevant for emigration decisions, but that current and future economic prospects, not captured by relative GDP per capita in PPS, are also important. Bertoli, Brücker and Moraga (2013), and Beine et al. (2017) argue that differences in GDP per capita in PPS are already captured by the inclusion of origin and destination fixed effects. Additionally, economic distress arising during the crisis period causes changes in future economic prospects that not reflected in a timely way in the level of GDP per capita in PPS. Therefore, in the extended specification of our model we substitute for GDP per capita in PPS with short-

[17] Vukovic (2017) shows that the Croatian economy is permeated by corruption since the political system is characterized by systematic corruption, on national and local levels. Also, WGI corruption index data point to a substantial gap in corruption incidence between most NMS and core EU countries in general.

[18] As a main alternative to the corruption index we could have used the governance index from the same database. Estimation results obtained with the governance index as independent variable are shown in appendix 3.

term indicators of economic activity – employment rate and output gap of origin and destination country.[19] These variables capture how changing growth prospects and labour market opportunities affect emigration across countries.

Detailed descriptions of all variables and respective data sources are provided in appendix 1.

In order to evaluate the main determinants of migration flows from NMS into the core EU countries we apply the Poisson pseudo maximum likelihood estimator. Numerous literature contributions examine the main drivers of migration by using a fixed effects model as a baseline methodology.[20] However, a fixed effect model does not allow for the estimation of variables that are constant in time (such as the distance between two countries). Moreover, Santos-Silva and Tenreyro (2006) in their paper show that parameters in log-linearized models estimated by OLS in the presence of heteroscedasticity could lead to biased estimates. The authors alternatively propose application of the Poisson pseudo maximum likelihood (PPML) estimator and argue that the PPML estimator is more suitable, given its consistency in presence of heteroscedasticity. Moreover, the PPML estimator will allow us to properly account for zero migration flows between two countries since the dependent variable in PPML is not in logarithmic form but is assumed to take positive integer values. Given this advantages of the PPML estimator over the standard panel fixed effects estimator we transform our basic gravity model from equation (1) and extend it by additional explanatory variables:

$$m_{ijt} = \beta \log(X_{it}) + \gamma \log(Y_{jt}) + \delta_i + \vartheta_j + \varepsilon_{ijt} \qquad (2)$$

where m_{ijt} represents migration from origin country i into destination country j in a year t, x_{it} is a vector of explanatory variables characteristic for origin country economic, political, geographical and demographic factors, y_{jt} is vector of explanatory variables representing destination country characteristics in time and δ_i and ϑ_j are respectively origin and destination country specific effects.

5 RESULTS – MAIN DETERMINANTS OF EMIGRATION

The main results of the estimation of equation (2) using the PPML estimator are presented in table 2. As a robustness check, estimates obtained by the application of the fixed effect model are also presented in table 2 but are not discussed explicitly. According to the results of the baseline model (Model 1), population and distance parameters are in line with gravity model predictions. An increase in distance between destination and origin country by 1% will decrease emigration flows by 1.5%, all other factors being equal, confirming the theoretical predictions of the

[19] We opt for the exclusion of GDP per capita in PPS from the extended model specification since inclusion of GDP PC in PPS and short term economic indicators could result in multicollinearity. Instead, differences in level of economic development are captured by origin and destination fixed effects.

[20] A detailed overview of different estimation strategies and models used in assessment of impact of EU accession for CEE countries in 2004 is given in Brücker et al. (2009).

standard gravity model implying that migration flows between two countries are inversely proportional to the distance between them. This interesting result suggests that importance of transportation and information costs that are approximated with physical distance between countries still remains relevant in migration decisions irrespective of the decrease in transportation costs and the development of the internet since the rather different world around the time of the pioneer application of gravity models in migration analysis in the late 1970s. The positive coefficient associated with the relative difference between population of destination and origin country suggests that countries with bigger populations have more intensive migration flows. However, this result is not statistically significant. Secondly, our baseline model shows GDP per capita in PPS in destination country increases migration flows directed toward the country, confirming the theories arguing that a positive difference in the level of economic conditions will increase emigration flows from origin to destination country. Estimated parameters show that an increase in GDP per capita in PPS in a destination country of 1% will lead to an increase in emigration flows from origin to destination country by 2.2%, assuming all other factors remain unchanged. On other hand, the coefficients associated to GDP PC in PPS in origin country are not statistically significant.

Finally, the variable transitional provisions, measuring the impact of the accession to the principle of free movement of persons across borders going from new EU member states (origin countries) to the core EU (destination countries) is statistically significant and large in its value, increasing migration flow by 40%.[21]

The results of the extended model specification (Model 2) show that short-term economic indicators represented by different labour market indicators and cyclical position of the economy of origin and destination countries are statistically significant and thus affect emigration decisions. An increase in employment opportunities in a destination country by 1% will increase emigration flows from origin to destination countries by 8.2%, all other factors being equal. At the same time, an increase in employment opportunities in origin country by 1% will decrease emigration flows by 5%. Results indicate that cyclical position of the economy is also important for migration decisions. An improvement in cyclical position of a destination country by 1 percentage point (i.e. positive output gap) will increase emigration flows from origin to destination countries by 2%, if all other factors remain constant.

[21] Changes in the predicted emigration flow for dummy variable representing transitional provisions are calulated according to the formula $e^{\beta_{tp}}$-1.

Table 2

Determinants of emigration flows from new EU member states to the core EU countries between 2000 and 2016, Fixed effects estimator (FE) and Poisson pseudo maximum likelihood estimator (PPML).

	Model 1 (Baseline) FE	Model 1 (Baseline) PPML	Model 2 FE	Model 2 PPML
Distance	– –	-1.48*** (0.00)	– –	-1.54*** (0.00)
Population	0.59 (0.17)	1.41 (0.35)	0.99** (0.02)	5.85*** (0.00)
GDP PC in PPS (origin)	0.11 (0.59)	0.27 (0.46)		
GDP PC in PPS (destination)	1.55 (0.00)	2.15** (0.01)		
Transitional provisions	0.54 (0.00)	0.34*** (0.00)	0.46*** (0.00)	0.46*** (0.00)
Employment rate (origin)			-1.45*** (0.00)	-5.04*** (0.00)
Employment rate (destination)			1.2* (0.06)	8.15*** (0.00)
Output gap (origin)			-2.27*** (0.00)	3.07 (0.2)
Output gap (destination)			3.74*** (0.00)	2.03** (0.04)
Corruption index (origin)			0.03 (0.89)	-1.66*** (0.00)
Corruption index (destination)			3.78*** (0.00)	2.46* (0.09)
Share of youth (20-34) origin			1.5*** (0.00)	0.19 (0.8)
Share of tertiary educated (origin)			0.25 (0.14)	0.58* (0.07)
Cons	-11.91	0.23	-13.65	5.51
Number of observations	1,958	1,972	1,958	1,972
R^2	0.46	0.78	0.53	0.82

*Note: *, ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. P-values are in parenthesis. All specifications include origin and destination fixed effects dummies. Parameters associated to output gap for origin and destination country are multiplied by 100 since the output gap enters the model specification in levels instead of being transformed into logarithms, due to negative values.*

Source: Authors' elaboration based on national statistical offices of the core EU countries immigration data and on the data presented appendix 1.

Moreover, we find an importance in the level of education of the workforce in the origin country, since the coefficient associated to the variable denoting the share of those with tertiary education in the total population of origin country assumes a positive, significant value. The estimates imply that an increase in the share of the tertiary educated in an origin population will increase migration flows from

the origin country by 0.6%. The share of young population in an origin country is also found to be positively correlated with the intensity of migration from the origin country but the results are not statistically significant. Finally, the difference in corruption between destination and origin countries is also significant for emigration decisions. An increase in the corruption index in the origin country by 1% (an increase in WGI corruption index represents a decrease of level of corruption in the economy, given the construction of corruption index) will lead to lower emigration from origin country by 1.7%. At the same time, an increase in the corruption index of destination country by 1% (implying a lower corruption level in destination country) will increase emigration flows from origin to destination country on average by 2.5%, all other factors being equal.

As a final step in our analysis, we compare results of the extended model specification with the baseline model specification and confirm the relevance of gravity model predictions for migration flows. The importance of EU accession, measured through the transitional provisions dummy variable again proved statistically significant and large in its value, suggesting that EU accession could raise emigration flows by 60%, if all other factors remain unchanged. Overall, baseline and extended model specification results show that the possibility of free movement of people across borders gained with EU accession is the main trigger of intensification of emigration flows from NMS to the core EU countries. However, the new, higher level of emigration flows from NMS towards the core EU countries following EU accession differs among countries, ranging from 0.2% of the population as in the Czech Republic to almost 2% of population in Romania. According to the estimates of the gravity model, apart from the EU accession, significant determinants in explaining the magnitude of migration outflows are represented by the characteristics of origin country population itself, economic development and performance of short term economic indicators and level of institutional quality assessed through the corruption incidence of both origin (NMS) and destination countries (the core EU).

5.1. ROBUSTNESS CHECKS

In addition to static estimation models, as a robustness check we also estimate a dynamic model. We apply the Arellano and Bond (1991), and Blundell and Bond (1998) generalized method of moments estimator, which is suitable for datasets characterized by short-time periods and large cross sectional dimension with endogenous independent variable and in presence of fixed effects and heteroscedasticity and autocorrelation within observations. Inclusion of a lagged dependent variable is also relevant for assessment of network effect on emigration decisions, since lagged migration flow can be interpreted as network approximation. Controlling for network effect is important since networks offer support and an additional information set for migrants, reducing migration costs and associated risks (Beine, Docquier and Ozden, 2009). In line with previous model specifications, the dynamic model also contains origin dummies and destination dummies to take into account all unobservable time invariant origin and destination specific varia-

bles that were not captured by the set of variables included in the model but are relevant for migration decisions and the intensity of migration flows. The results of the dynamic model corroborate the main findings from the previous section. The estimates confirm the importance of gravity model variables in the determination of emigration flows. Moreover, EU accession assessed through the transitional provisions variable again resulted as sizable and significant, increasing average emigration flows by 30%. Finally, we confirm the importance of short-term economic conditions – employment opportunities in origin country and changes in cyclical economic position in destination country as determinants of migration flows. Contrary to the static model specification, the impacts of the educational level of population in the origin country and the degree of corruption in the economy have the expected signs, but are not statistically significant. The results of dynamic model specification are presented in appendix 3.

6 CONCLUSION

This paper aimed to clarify some basic facts about the dynamics and main determinants of emigration from Croatia following EU accession. To that purpose, extensive data analysis was conducted, capturing and comparing different emigration data sources. Further, the application of panel gravity model to Croatian and other NMS indirect emigration data enabled us to detect and discuss the main determinants of emigration from Croatia and other NMS to the core EU countries and their importance in making decisions about emigration.

As a first contribution to the discussion of the issue of the current emigration wave in Croatia, we use mirror statistics from core EU national statistical offices and compare them to the official emigration numbers of CBS. Construction of an alternative emigration dataset using immigration data from the national statistical offices of the core EU countries showed that emigration flows from Croatia following EU accession are on average 2.6 times as high as those recorded in official statistical data, amounting to 230 thousand people leaving Croatia in the 2013-2016 period. If we relate our results to a priori projections of emigration from Croatia after EU accession, our estimates can be placed in between Vidovic and Mara (2015), and Strielkowski, Šárková and Żornaczuk (2013)[22]. Similar proportional population outflows were observed in less developed new member states following their EU accession (Romania and Bulgaria), while new member states from the initial wave of enlargement experienced less pronounced rises in their emigration flows.

Analysis of detailed migration data available at national statistical offices of the new EU member states statistical offices showed that average characteristics of emigrants from NMS are similar across countries and point to a balanced emigration with respect to the sex of the emigrants. The main destination country for most countries in the sample was Germany. Finally, data also show that the average emigrant from NMS in 2016 was between 31 and 37 years old, indicating that emigration affects the young part of the population. Emigration of mostly young

[22] Direct comparison is not possible since the aforementioned authors estimate net migration potential while our analysis is based on gross emigration flows.

citizens is indisputably a human capital loss for origin countries. However, long-term overall effects of emigration flows on origin countries should be interpreted with caution. Emigration leads to improvement of knowledge and skills of emigrants, given that their skills increase due to exposure to international competition, instead of gradually deteriorating in the low capacity domestic labour market. In the case of reverse migration, this can result in a brain-gain for origin economies. Moreover, the effect of migration on the labour markets of origin countries is also twofold. According to the extensive migration literature (Thaut, 2009), the employment opportunities and wages of those who stay in origin countries increase and the unemployment rate decreases, causing the activation of long-term unemployed people. On other hand, labour market shortages in some sectors inevitably arise, and sustainability of public pensions and other social service are threatened. The overall effects will depend on synchronization of educational policies with origin country labour market requirements, overall degree of economic development and future economic performance in origin country.

In fact, the analysis of main determinants of migration showed the most significant factor in explaining emigration flows between NMS and the core EU countries is the accession to the principle of free movement of workers obtained by EU accession, which increased emigration flows in the range from 30% to 60%. This is in line with other relevant studies about labour mobility within the EU, where EU membership is found to increase labour mobility significantly.[23] However, estimation of the gravity model revealed that there exist other significant determinants in explaining migration outflows, such as: the characteristics of origin country populations itself, economic development, performance of short-term economic indicators and level of institutional quality assessed through the corruption incidence of both origin (NMS) and destination countries (the core EU). These findings imply that policies that promote broad and solid economic development can influence emigration flows, which raises several implications for policymakers.

Emigration phenomena will probably have a strong impact on the Croatian economy in the medium-run. Accordingly, we would like to emphasise the importance of further research in this field. Potential research topics encompass the assessment of the impact of the last emigration wave on the potential growth prospects of the Croatian economy, the effect of increasing remittances on the Croatian economy, sustainability of the current setup of social policies (pension funds, health system, new infrastructure investment, existing infrastructure maintenance), required immigration flows in order to alleviate negative emigration consequences, and finally the implications of emigration flows for the conduct of monetary, fiscal and structural policy in the broadest sense.

Disclosure statement

No conflict of interest.

[23] For more details about relationship between EU membership and labour mobility see Arpaia et al. (2016).

APPENDIX 1

TABLE A1

Data sources and details, independent variables

Data sources and details for set of independent variables

Variable	Description	Source	Estimation details
GDP PC in PPS	Gross domestic product at market prices, current prices, PPS per capita	Eurostat online statistical database	Destination and origin country, in log
Unemployment rate	Yearly unemployment rates, from 15 to 64 years, percentage	Eurostat online statistical database	Destination and origin country, in log
Population	Population on 1 January, total	Eurostat online statistical database	Relative values between destination and origin country, in log
Distance	"Distance between two countries is calculated based on latitudes and longitudes of the most important cities/agglomerations (in terms of population) Mayer and Zignago (2011)".	CEPII database	In log
Youth population number	Population on 1 January, from 20 to 34 years	Eurostat online statistical database	Origin country, as a share in total population, in log
Tertiary educated	Population by educational attainment level, from 15 to 64 years, tertiary education (levels 5-8)	Eurostat online statistical database	Origin country, as a share in total population, *1000, in log
Corruption index	Control of corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests (http://info.worldbank.org/governance/WGI/#doc)	Worldwide Governance Indicators (WGI), The World Bank	Destination and origin country, in log

Data sources and details for set of independent variables

Variable	Description	Source	Estimation details
Governance index	"Government effectiveness captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies (http://info.worldbank.org/governance/WGI/#doc)"	Worldwide Governance Indicators (WGI), The World Bank	Destination and origin country, in log
Output gap	Output gaps (% of potential output), HP filter	European Commission CIRCAB, II. autum forecast	Destination and origin country
Employment rates	Yearly employment rates, from 15 to 64 years, percentage	Eurostat online statistical database	Destination and origin country, in log
Transitional provisions	Variable representing the access to common free EU market for BG and RO takes value 1 for FI, SE from 2007, for DK from 2009, for IT and IE from 2012 and for all other countries from 2014. Variable representing the access to common free EU market for HR takes value 1 for DK, FI, IR, SE from 2013, for BE, IT, DE, LU from 2015, while NL, AT and UK apply transitional provisions for HR during the entire sample period (sample is ending in 2016, while transitional provisions applied by NL, AT and UK should be lifted by June 2018). Variable representing the access to common free EU market for CZ, SK, SI, PL, HU, LV, LT, EE takes value 1 for UK, SE, IE from 2004, for IT, FI from 2006, for NL, LU from 2007, for BE, DK from 2009 and for AT, DE from 2011	European Commission	Set of dummy variables

TABLE A2

Data sources and details, dependent variable

Data Sources and details for set of independent variables

Variable	Description	Source	Estimation details
Emigration flows	Data for IR, NL, FI, SE, IT, AT, LU, DK avaliable on line. Data for DE, BE, UK obtained on email request. Data for UK and IE refers to immigration numbers and not to official migration statistics	National statistical offices websites of core EU countries	For static models – emigration from origin country *i* into destination country *j* in time *t*, for dynamic model – share of emigrants in total population of origin country, in log
Data for Germany and Denmark are based on country of previous residence principle. Data for Netherlands, Italy, United Kingdom, and Belgium on country of birth principle, while data for Sweden, Finland, Luxemburg and Austria are based on citizenship principle.			
Core EU countries are represented by 11 countries, due to data availability: Austria, Belgium, Denmark, Finland, Germany, Ireland, Italy, Luxemburg, Netherlands, Sweden and United Kingdom. Usually Portugal, Greece, Spain and France are also included in core EU countries. Required immigration data are not publicaly available on their website. Statistical office of Portugal delivered the data from our customized request. Since data are starting in 2008 we do not include them in main specifications. Upon conclusion of this paper we have not managed to receive required data from customized requests sent to other statistical offices.			

TABLE A3

Total migration flow in Croatia – approximation based on discretional combination of different data sources

Emigration from and to Croatia following the EU accession	**2013**	**2014**	**2015**	**2016**	**2013-2016**
(1) Emigration to core EU countries from national statistical offices of core EU countries	31,655	53,666	72,528	71,314	229,163
(2) Emigration to "rest of the world" according to CBS	11,220	9,049	11,116	9,238	40,623
(3) Total emigration = (1) + (2)	42,875	62,715	83,644	80,552	269,786
(4) CNB total emigration	15,262	20,858	29,651	36,436	102,207
(5) Emigration coefficient	2.8	3.0	2.8	2.2	2.6
(6) Immigration from core EU countries according to national statistical offices of core EU countries	14,164	19,346	23,261	23,422	80,193
(7) Immigration from "rest of the world" according to CBS	8,676	8,540	8,512	9,705	35,433
(8) Total immigration = (6) + (7)	22,840	27,886	31,773	33,127	115,626
(9) CBS total immigration	10,378	10,638	11,706	13,985	46,707
(10) Immigration coefficient	2.2	2.6	2.7	2.4	2.5
(11) Net emigration = (3) – (8)	20,035	34,829	51,871	47,425	154,160
(12) CNB net emigration	4,884	10,220	17,945	22,451	55,500
(13) Net emigration coefficient	4.1	3.4	2.9	2.1	2.8

Note: UK and Ireland not included in immigration numbers.

Source: CBS and national statistical offices of the core EU countries.

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APPENDIX 3

TABLE A4

Determinants of emigration flows from new EU member states to the core EU countries between 2000 and 2016, dynamic estimation, Arellano-Bond GMM estimator

	Model 3 Dynamic Model (GMM)
Distance	-0.49***
	(0.00)
Population	0.29
	(0.59)
Transitional provisions	0.25***
	(0.00)
Employment rate (origin)	-2.01***
	(0.00)
Employment rate (destination)	0.53
	(0.47)
Output gap (origin)	3.72
	(0.36)
Output gap (destination)	2.18***
	(0.00)
Corruption index (origin)	-0.37
	(0.40)
Corruption index (destination)	0.57
	(0.55)
Share of youth (20-34), origin	-0.32
	(0.59)
Share of tertiary educated (origin)	0.35
	(0.12)
ln(m t-1)	0.66***
	(0.00)
Cons	7.4

*Note: *, ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. P-values are in parenthesis. All specifications include origin and destination fixed effects dummies. Parameters associated to output gap for origin and destination country are multiplied by 100 since the output gap enters the model specification in levels instead of being transformed into logarithms, due to negative values.*

Source: Authors' elaboration based on national statistical offices of the core EU countries immigration data and on the data presented in appendix 1.

TABLE A5

Determinants of emigration flows from new EU member states to the core EU countries between 2000 and 2016, Poisson pseudo maximum likelihood estimator, extended specification Model 4

	Model 4 FE	Model 4 PPML
Distance	–	-1.52***
	–	(0.00)
Population	1.69***	6.63***
	(0.00)	(0.00)
Transitional provisions	0.47***	0.42***
	(0.00)	(0.00)
Unemployment rate (origin)	0.19**	0.69***
	(0.03)	(0.00)
Unemployment rate (destination)	-0.03	-1.09***
	(0.66)	(0.00)
Output gap (origin)	2.18**	1.53
	(0.01)	(0.34)
Output gap (destination)	4.64***	2.52*
	(0.00)	(0.09)
Governance index (origin)	-0.22	-2.29***
	(0.52)	(0.00)
Governance index (destination)	0.89	-2.71
	(0.11)	(0.40)
Share of youth (20-34), origin	1.71***	1.34
	(0.00)	(0.11)
Share of tertiary educated (origin)	0.41**	0.69**
	(0.02)	(0.01)
Cons	-1.04	42.2**
Number of observations	1,958	1,972
R^2	0.51	0.82

*Note: *, ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. P-values are in parenthesis. All specifications include origin and destination fixed effects dummies. Parameters associated to output gap for origin and destination country are multiplied by 100 since the output gap enters the model specification in levels instead of being transformed into logarithms, due to negative values.*

Source: Authors' elaboration based on national statistical offices of the core EU countries immigration data and on the data presented in appendix 1.

APPENDIX 4

Table A6

Number of emigrants from Croatia by region (as % of total population of the region) between 2001 and 2016, Central Bureau of Statistics data, gross emigration flows

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Eastern Croatia	0.2	0.2	0.2	0.3	0.2	0.3	0.3	0.2	0.4	0.3	0.3	0.3	0.4	0.6	1.0	1.4
Central Croatia	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.3	0.5	0.6	0.8	1.0
Lika and Gorski kotar	0.2	0.2	0.2	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.6	0.9	1.0
Central and Southern Adriatic	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.4	0.4	0.5	0.5	0.6	0.7
Northen Adriatic	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.5	0.4	0.3	0.4	0.6	0.7
Northwestern Croatia	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.3	0.4	0.6
City of Zagreb	0.2	0.6	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.3	0.3	0.3	0.4	0.6	0.6

Notes: Eastern Croatia encompasses Virovitičko-podravska, Požeško-slavonska, Brodsko-posavska, Osječko-baranjska and Vukovarsko-srijemska counties. Central Croatia encompasses Zagrebačka, Sisačko-moslavačka, Karlovačka and Bjelovarsko-bilogorska counties. Lika and Gorski kotar encompass Primorsko-goranska and Ličko-senjska counties. Central and Southern Adriatic encompass Zadarska, Šibensko-kninska, Splitsko-dalmatinska and Dubrovačko-neretvanska counties. Northen Adriatic refers to Istarska County. Northwestern Croatia encompass Krapinsko-zagorska, Varaždinska, Međimurska and Koprivničko-križevačka counties.

Source: CBS.

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Determinants of subnational budget/fiscal transparency: a review of empirical evidence

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Abstract

This paper provides a review of empirical research on the factors determining the budget/fiscal transparency of subnational governments. It focuses on academic online databases by conducting keyword searches that take in papers published in the period 2000-2017. Three important observations can be made: (1) there is a lack of a unique definition of budget/fiscal transparency; (2) the different definitions lead to disharmonised budget/fiscal transparency measurements; (3) there is a heterogeneity of the definition and measurement of some explanatory variables that can lead to apparent contradictions and inconsistencies in the results obtained. However, the paper provides a balanced account of core explanatory factors, emphasizing variables that, despite heterogeneity in definition and measurement, have a significant impact on the levels of subnational government budget/fiscal transparency. Since the review involves mainly online disclosure, future studies might want to extend the observation period, or implement systematic reviews and meta-analyses to gain additional insights on this topic.

Keywords: subnational governments, budget transparency, empirical review, main determinants

1 INTRODUCTION

It can be said that in the past two decades, and especially in the aftermath of the financial crisis, enormous pressure has been put on governments to improve their communication with citizens by being more open, transparent and accountable. In this sense, more and more attention is being paid to fiscal and budgetary issues. Some of the most prominent initiatives that advocate for these issues are the International Budget Partnership (IBP), the Global Initiative for Fiscal Transparency (GIFT) and the Open Government Partnership (OGP). Due to the OGP's strong advocacy, a total of 75 countries have endorsed the Open Government Declaration and announced their country action plans. More recently, OGP was opened to subnational governments. In 2016, a total of 15 subnational governments signed the declaration and submitted their action plans to be implemented throughout 2017, as part of a pilot program.

Thus, the discourse of budget transparency seems to be changing, giving ever more importance to subnational governments (SNGs). Accordingly, subnational budgets are becoming a ubiquitous topic in the field of public financial management. Their importance also stems from the fact that public goods and services are particularly tangible at the subnational and especially the local level. Therefore, citizens may have more interest in participating in local budget processes, where they can see their direct impact on local development. Furthermore, subnational budget transparency enables ordinary citizens and civil society organizations to evaluate government services and facilities and suggest possible changes and needs in the future.

The internet has provided an additional incentive for proactive publishing, enabling large-scale publication of budget data, as well as constantly improving gov-

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ernment consultation processes. It can be said that the rise of the internet has furthered budget transparency by allowing rapid and inexpensive proactive disclosure (Darbishire, 2010). Consequently, SNGs have increasingly resorted to proactive budget disclosure, thus not only reducing demand-side pressures, but also changing their attitude and way of communicating with citizens. Despite the widespread availability and bidirectionality of the internet, SNG websites vary greatly in the amount of information available, comprehensiveness, timeliness and interactiveness (Caba-Pérez, Rodríguez Bolívar and López Hernández, 2008). While some SNGs run open budget policies, others oppose the practice and rarely use the low cost benefits of online proactive publishing.

The aim of this study is, hence, to review the development of research conducted previously in order to understand the factors that could influence SNG budget/fiscal disclosure. In other words, it aims to produce a balanced account of the set of variables that significantly affect SNG budget/fiscal transparency. Some previous studies reviewed the various types of public sector disclosure (Bakar and Saleh, 2015). However, this study explores studies published in the 2000-2017 period, focusing explicitly on budget or fiscal transparency. The paper is organized as follows. Section 2 provides the methodological framework. Section 3 presents different definitions and measurements of budget/fiscal transparency. Section 4 offers a balanced account of core determinants of SNG budget/fiscal disclosure. Section 5 concludes with recommendations for future research.

2 FRAMEWORK FOR ANALYSIS

This review focuses on identifying explicitly quantitative studies on the determinants of SNG budget/fiscal transparency. The decision for quantitative studies is because they allow for rapid analysis and replication, which increases reliability, validity and the greater probability of obtaining unambiguous results, which contributes to better decision-making. Subnational governments include all levels below the national government, i.e. local, regional, state and provincial. To identify eligible articles, this study used the Summon discovery service – a unified search for all electronic sources of academic publications, including search interfaces such as ProQuest, EBSCO Host, Web of Science and Scopus. In addition, Google Scholar and hand searches were also used. This review includes studies published from 2000-2017, thus the focus is inherently on online disclosure. Only studies in English are taken into consideration. Search terms used were "causes of budget/fiscal transparency", "subnational government transparency", "budget/fiscal transparency determinants", "local government transparency" or just "government transparency". Since only a few studies focused solely on budget or fiscal transparency, it should be noted that this review includes all studies that, in their transparency measure, have at least one dimension concerning the budget, i.e. revenues and expenditures. Although books were initially included in the search, no relevant sources were generated on the determinants of subnational budget/fiscal transparency. This is probably due to it being an insufficiently researched topic, which is why journals take the lead, while books are still outdated as sources of information.

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However, the eligibility criteria were designed to ensure that high-quality relevant work is included, specifically referring to empirical quantitative studies that employ budget/fiscal transparency as the dependent variable. Finally, 20 studies are included in the review. All studies are peer-reviewed and published in journals, with the exception of Ma and Wu's (2011) paper which remained as part of the 1st Global Conference on Transparency Research held at Rutgers University.

Although it is unquestionable that every paper has made a contribution, this review highlights four papers on account of their narrow focus on budget/fiscal transparency, strong and credible evidence, and rigorous methodology used. The first is a paper by Alt, Lassen and Rose (2006), who used a unique panel data on the evolution of transparent budget procedures in the U.S. states over the past three decades. They used both case studies and quantitative analysis, presenting robust results. Serrano-Cinca, Rueda-Tomás and Portillo-Tarragona (2009) used multivariate logistic regression, focusing exclusively on the availability of budget-related documents. Although their results showed different levels of robustness, they proved that size of the municipality, political will, and residents' income all affect budget disclosure. Similarly, Guillamón, Bastida and Benito (2011) examined the determinants of budget and financial transparency using both OLS and 2SLS regression analysis. After controlling for endogeneity, they confirmed the robustness of the model employed. Like them, Esteller-Moré and Polo Otero (2012) remained focused on budget information disclosures. They applied their analysis to a large sample of municipalities, using a logit regression analysis for panel data, covering a seven-year period. These four papers are emphasized on the basis of measurements of the dependent variables, and the credibility and quality of the evidence and method used for determining the factors of budget/fiscal transparency. With this in mind, all the papers included in the review are presented in the following chapters, first by measuring the dependent variables and then by the established budget/fiscal transparency factors.

3 BUDGET/FISCAL TRANSPARENCY – FROM DEFINITION TO MEASUREMENT

3.1 DEFINITION

In the literature, budget transparency and fiscal transparency are often used interchangeably, which may point to the equivalence of these two concepts. However, budget transparency is a narrower concept, focusing on the budget reports within the budget cycle. On the other hand, fiscal transparency also includes fiscal activities undertaken outside the budget sector, aiming at reducing off-budget transactions (IMF, 1997). It often includes information on all stocks as well as flows, which can hardly be found in the budget documents. Still, it is difficult to make a strict division between these two concepts, since they are intertwined and sometimes even used synonymously. Therefore, this paper will use both terms. One of the most comprehensive definitions of fiscal transparency was offered by Kopits and Craig (1998:1):

> "Fiscal transparency implies an openness toward the public at large about government structure and functions, fiscal policy intentions, public sector accounts, and projections. It involves ready access to reliable, comprehensive, timely, understandable, and internationally comparable information on government activities – whether undertaken inside or outside the government sector – so that the electorate and financial markets can accurately assess the government's financial position and the true costs and benefits of government activities, including their present and future economic and social implications".

In accordance with this definition, Alt, Lassen and Skilling (2002) stressed that financial documents should be informative and comprehensive, but at the same time easily understandable, leaving the option of independent scrutiny. In order to facilitate this inspection and monitoring of economic policies by national authorities, financial markets and international institutions, the IMF has developed a Code of Good Practices on Fiscal Transparency (IMF, 1998). The Code consisted of four main principles:

1) clarity of roles and responsibilities;
2) public availability of information;
3) open budget preparation, execution, and reporting; and
4) independent assurances of integrity.

Although this Code has helped practitioners in understanding basic concepts of fiscal transparency practices, it did not contain clear guidelines or standards that would facilitate the way and approach to measuring fiscal transparency. However, the Code was revised in 2007, pointing out that fiscal data (budget forecasts and updates, annual budget and final accounts, fiscal reports) should meet accepted data quality standards. Similarly, the OECD has developed best practices for budget transparency, although their definition of budget transparency refers to broader concept of fiscal matters: "full disclosure of all relevant fiscal information in a timely and systematic manner" (OECD, 2002:7). The best practices are divided into three parts – budget reports, specific disclosures, and integrity assurance (table 1). It is evident that only the first section corresponds to pure budget disclosure, while the other two represent wider fiscal matters. Still, the first section can be considered the first internationally recognized standard for budget reporting.

Table 1

The "three pillars" of the OECD's best budget transparency practices

Budget reports	Specific disclosures	Integrity, control and accountability
The budget	Economic assumptions	Accounting policies
Pre-budget report	Tax expenditures	Systems and responsibility
Monthly reports	Financial assets and liabilities	Audit
Mid-year report	Non-financial assets	Public and parliamentary scrutiny
Year-end report	Employee pension obligations	
Pre-election report	Contingent liabilities	
Long-term report		

Source: OECD (2002).

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It could be said that a number of authors have defined budget/fiscal transparency not only as the availability of budget/fiscal information, but also in terms of openness and public accountability. This can best be seen in Kopits and Craig (1998) who argue that fiscal transparency does not only imply access to fiscal reports but, rather, the openness of fiscal policies and procedures. Similarly, Andreula, Chong and Guillén (2009) state that fiscal transparency, apart from open budget preparation and availability of fiscal information, also implies assurances of roles and responsibilities. In this sense, the IMF has indicated the difference between fiscal reporting and fiscal transparency. While the first refers to the production and availability of fiscal information, the second relates to the "clarity, reliability, frequency, timeliness and relevance of public fiscal reporting and the transparency of the government's fiscal policy-making process" (IMF, 2012:5).

One can conclude that there is no uniform definition of budget/fiscal transparency, which indicates a complex understanding of this topic. In other words, while there are certain standards and guidelines, different definitions and interpretations directly affect the approach and the way of measurement. Certainly, the methods and scope of measurement also depend on the context in which the research is carried out. Since this review is based on the causes rather than the effects of budget/fiscal transparency, the next section provides an empirical overview of different measurements in which the budget/fiscal transparency measure appears as a dependent variable.

3.2 VARIOUS APPROACHES TO MEASURING SUBNATIONAL BUDGET/FISCAL TRANSPARENCY

> "Conceptually, a statistical measure of transparency is the precision of the information that is obtained, i.e. a function of its relevance and quality"
> (Vishwanath and Kaufmann, 1999:4).

Given the specificities of different countries' laws, standards, procedures and contexts, one should be careful while summing, comparing and interpreting different definitions and measures of budget/fiscal transparency. In other words, subnational comparisons may be most important within, rather than across countries. Accordingly, this section seeks to present the first studies from Spain and USA – since most papers on this topic are focused on the SNGs of these two countries. Then, individual studies with samples from other countries were presented.

Spain

The largest body of research comes from Spanish local governments. Gandía and Archidona (2008) presented an extensive local government online disclosure index, which consists of five sub-indices, two of which provide comprehensive budget and financial information. The other three dimensions include general government information, web presentation and navigation, and relational web to address interactivity and functionality of the web. Unlike them, Serrano-Cinca, Rueda-Tomás and Portillo-Tarragona (2009) explicitly explored budget and

financial disclosure which they measured by sending questionnaires to municipalities regarding their online publication of nine items (based on Spanish legislation regarding local government financial disclosure), including consolidated and unconsolidated budgets, budget and annual accounts of dependent entities. Like Gandía and Archidona (2008), Caba-Pérez, Rodríguez Bolívar and López Hernández (2008) have also offered an extensive web financial disclosure index, hoping to contribute to a more harmonized framework for the structure of budget and financial information in Spanish local governments. Although the numbers of items observed are different, the main sections of their disclosure indexes are quite the same, including budget and financial information and web navigability. The main difference is that Caba-Pérez, Rodríguez Bolívar and López Hernández (2008) included non-financial information, such as indicators of economy, efficiency and effectiveness and paid more attention to the characteristics of information such as timeliness, understandability or comparability rather than content of information provided. Several authors used the government transparency measure calculated by Transparency International (TI) Spain (Guillamón, Bastida and Benito, 2011; del Sol, 2013; De Araújo and Tejedo-Romero, 2016). This index consists of five government transparency areas: (a) information about the municipal corporation; (b) social transparency; (c) financial transparency; (d) services contracting transparency; (e) urban development and procurement transparency. Among these studies, Guillamón, Bastida and Benito (2011) have contributed most to the field of budget/fiscal transparency, by focusing explicitly on TI's financial transparency section. In other words, their dependent variable was based solely on financial transparency indicators, including accounting and budget, transparency on revenues and expenditures, and information on municipal debt. Their study inspired others to use the same transparency measure for Spanish municipalities (del Sol, 2013; De Araújo and Tejedo-Romero, 2016).

A significant study was presented by Esteller-Moré and Polo Otero (2012) who employed a panel analysis by using a large sample of Catalan municipalities in the period 2001-7. They constructed their fiscal transparency index by addressing the timeliness of the mandatory disclosure of municipalities that need to submit their budget information to the Public Audit Office for Catalonia. The budget information consisted of the following: budget approval, final budget, budget balances, closed settlement budgets, treasury statement, treasury surplus, net wealth statement, income statement and indebtedness. Similarly, Caamaño-Alegre et al. (2013) have investigated Galician municipalities. They based their budget transparency measure on the IMF's revised Code of Good Practices on Fiscal Transparency and sent the questionnaires to government officials by using a Likert-type survey on open budget process, public availability of information and assurance of integrity. However, unlike Esteller-Moré and Polo Otero (2012) who offered a large number of observations and time variation, this study remained limited in this sense.

A slightly different approach to measuring government transparency was provided by Gandía, Marrahí and Huguet (2016) who looked at the presence of Web 2.0 in

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Spanish city councils. In this way, they wanted to examine the existence of participative and social web with the possibility of user-generated content. Accordingly, their disclosure index contained not only information disclosure, but also relational web. Similar to del Sol (2013), they observed the total index, as well as three subindices – ornamental index (general and citizen information), relational index, and information index, which includes budgetary and financial disclosure.

United States

Shortly after the OECD and the IMF implemented Codes of Best Practice for Fiscal Transparency, Alt, Lassen and Rose (2006) published one of the most prominent and influential studies on the causes of fiscal transparency. They examined the determinants of U.S. States both conceptually and empirically. A conceptual section included case studies of the states that managed to make significant progress towards higher transparency levels within a short time frame. On the other side, the transparency measure was not based on the availability of fiscal documents, but rather on transparency of state government budget procedures. Using the 1990s cross-sectional data from the National Association of State Budget Officers and the National Conference of State Legislatures, they extended the data to the beginnings of transparent budget procedures of US states, covering the period 1972-2002. This enabled them to use panel analysis which, to the best of my knowledge, was used for the first time in analyzing the causes of subnational fiscal transparency. Although this study offers a unique data set, comprising survey responses to a questionnaire sent to the budget officers of all fifty states, because of the period covered, it could not address e-government practices.

However, with the rapid adoption of the internet, more recent studies are mainly focused on online fiscal/budget transparency, usually examining transparency levels on governments' official websites. While Alt, Lassen and Rose (2006) offered a transparency measure with a considerable time variation, more recent studies looked at the budget/fiscal transparency at one point in time or with small time periods. Bernick et al. (2014) dropped to a lower level, exploring the fiscal transparency practices of U.S. counties in 2014. They measured the online availability of a comprehensive annual financial report (CAFR) and availability and comprehensiveness of budget information (no exact document or information is indicated). Similarly, Lowatcharin and Menifield (2015) investigated county website transparency in 2010. However, their county transparency measure (conducted by the Sunshine Review) included not only fiscal disclosure but a wider spectrum of government transparency such as permits and zoning, contracts, lobbying, etc. Relying on Groff and Pitman's (2004) description of internet financial reporting for the 100 largest U.S. municipalities, Styles and Tennyson (2007) extended the findings by examining the online availability and accessibility of CAFR data for a sample of U.S. municipalities of various sizes.

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Other countries

When it comes to pioneers in dealing with voluntary internet financial reporting in subnational governments, the paper by Laswad, Fisher and Oyelere (2005) deserves highlighting. They observed New Zealand's district, city, and regional councils, by constructing the financial transparency measure as a dichotomous variable indicating whether or not the local authority publishes financial information on the web. However, their definition of what is considered published may be somewhat confusing, since they had four disclosure categories: financial highlights only, annual reports only, annual plan only, and combinations of annual reports, plans and financial highlights together. In other words, it is not clear whether there is any council that has published, for example, both annual plan and report, in which case the analysis could change considerably. García-Tabuyo, Sáez-Martín and Caba-Pérez (2016) investigated online proactive disclosure of the 40 largest municipalities in each of the five countries of Central America – El Salvador, Nicaragua, Panama, Guatemala and Honduras. This was a valuable study, since the same transparency measure was employed for local government transparency in different country contexts. However, their measure consists of five transparency areas, where economic and financial transparency (including enacted and executed consolidated and individual budget and budget amendments) accounts for 20% the total index.

On the other hand, some studies focused explicitly on fiscal transparency, either on a sample of Brazilian states (Zuccolotto and Teixeira, 2014) or Chinese provincial government (Ma and Wu, 2011). While Ma and Wu (2011) used the data collected from the first two years of the four-year survey by the Public Policy Research Center in Shanghai, Zuccolotto and Teixeira (2014) employed a fiscal transparency measure developed by Biderman and Pottomatti (2010)[1]. Tavares and da Cruz (2017) used TI Portugal's index of municipal transparency to assess a disclosure of Portuguese municipalities. The index is a comprehensive measure of local governemnt transparency, comprising seven dimensions one of which is economic and financial transparency. However, unlike other extensive measures, it only monitors the availability of a set of information items on a municipality's website, not taking into account accessibility, navigability, reliability or the quality of the information. A study presented by Gesuele, Metallo and Longobardi (2017) analyzed website disclosure of Italian and Spanish municipalities. Although their contribution is valuable (very few studies with an international context), they did not sufficiently address budget/fiscal transparency, except for financial statements and information about municipalities' assets, such as values, location and revenue.

3.3 THE CHALLENGE OF SUBNATIONAL BUDGET/FISCAL TRANSPARENCY MEASUREMENT

This review will outline several budget/fiscal transparency measurement challenges and opportunities. First, the use of the same transparency measure within a

[1] A study available only in Portuguese.

country would allow for a comparison of the results of different studies, which could contribute to a greater understanding of inconsistent results and to the reduction or explanation of the ambiguity in the previous findings. The review shows that only a few studies used the same transparency index within a country, as with the TI Spain index used by De Araújo and Tejedo-Romero (2016), del Sol (2013), and Guillamón, Bastida and Benito (2011). Second, the transparency measure mainly involved one year of observation, and only a few studies have had a long dataset of the dependent variable, such as Alt, Lassen and Rose (2006) or Esteller-Moré and Polo Otero (2012). The longer time span of the dependent variable opens the door to many methodological approaches, enables a better quality analysis, and gives an opportunity to observe the progress of SNG budget/fiscal transparency. Third, in order to improve the observation of the causes of budget/fiscal transparency, it is necessary to have more studies focusing solely on budgetary and fiscal indicators.

Although strong efforts have been made to standardize fiscal transparency measures at the national level, this remains an empirical and contextual challenge at the local level. However, some studies have already examined cross-country analyses by introducing their own index on a sample of municipalities (García-Tabuyo, Sáez-Martín and Caba-Pérez, 2016; Gesuele, Metallo and Longobardi, 2017). Nonetheless, to facilitate these efforts, analogously to the IBP Open Budget Survey, one of the biggest challenges (given the diversity of the local self-government system) is to create a harmonized budget/fiscal transparency index capable of being applied to the subnational governments of various countries. Results of these studies could provide more comprehensive insights into the contextual sensitivity, but also generally in examining the causes of budget/fiscal transparency.

4 DETERMINANTS OF SUBNATIONAL BUDGET/FISCAL TRANSPARENCY – EMPIRICAL OVERVIEW

4.1 HETEROGENEITY OF DEFINITION AND MEASUREMENT OF VARIABLES

This review discusses the different definitions and measurements of some variables. While different measurements are not unexpected in different countries (bearing in mind different types of data), the main issue is when these arise within a single country, which can lead to confusion and "false" variability in the results. However, when concluding and interpreting results of previous studies, attention has to be paid to the definitions and the way of measuring variables, regardless of whether they are in-country or cross-country comparisons. According to the literature, some of the most frequently used variables that can cause confusion are leverage, debt, and political competition. Although the definition of leverage is quite unambiguous, several studies have used different measures. Laswad, Fisher and Oyelere (2005) have measured it in two ways, as a ratio of long-term liabilities in total assets, and in total public equity. On the other hand, some studies have used financial expenses per capita as a proxy for leverage (Gandía and Archidona, 2008; Gandía, Marrahí and Huguet, 2016). Gandía and Archidona (2008) have equated leverage with indebtedness, making it more confusing by stating that they have

used the cost of debt as a proxy of indebtedness, which is measured as municipal financial expenses per capita. At the same time, Caba-Pérez, Rodríguez Bolívar and López Hernández (2008) used funding costs of current year budget expenditure per capita as a proxy for the cost of debt, not assigning it to leverage, but rather to debt. Gesuele, Metallo and Longobardi (2017) have not even described their leverage measure. They defined it simply as a value of leverage per capita, while the measure was described just as natural logarithm, thus leaving it unexplained.

A unique measure for debt issuance was presented by Serrano-Cinca, Rueda-Tomás and Portillo-Tarragona (2009), who used a dichotomic variable which assigns the value of 1 if the town hall has municipal bonds in circulation, denoting a debt issuance. On the other side, some debt measures are more straight-forward, such as debt level as a percentage of the total budget (del Sol, 2013) or the often-used municipal public debt per capita (Alt, Lassen and Rose, 2006; Styles and Tennyson, 2007; Guillamón, Bastida and Benito, 2011; Caamaño-Alegre et al., 2013).

While some authors argue that a government's decision to disclose or retain information is inherently political (Wehner and de Renzio, 2013), others claim that political competition is a major driver of transparency reforms (Berliner and Erlich, 2015). However, the mode of measurement of political competition imposes the greatest variability among political determinants. There are various measures introduced for this variable. Some studies observe it as a margin of victory, measured by the difference between the percentage of votes obtained by the parties coming in first and second place (De Araújo and Tejedo-Romero, 2016, 2017; Tavares and da Cruz, 2017). Others see it as a measure of dispersion, i.e. the standard deviation of the percentage of votes received by each political party (Caba-Pérez, Rodríguez Bolívar and López Hernández, 2008; Esteller-Moré and Polo Otero, 2012). Caamaño-Alegre et al. (2013) applied the measure developed by Laakso and Taagepera (1979) – an effective number of political parties, whose calculation also contains each party's proportion of all votes. Several studies focused explicitly on competition in the municipal council. Laswad, Fisher and Oyelere (2005), and Serrano-Cinca, Rueda-Tomás and Portillo-Tarragona (2009) measured almost the same thing. While the first used the ratio of candidates to council positions available, the latter defined it as the ratio of candidates to councillors elected. However, despite the different definitions, it could be said that their measure is the same, since it seldom happens that available council positions are not filled.

By using different measures for one variable, results may vary within one study, let alone comparing different studies, contexts or subnational international comparisons. In this sense, one should be careful while summing and interpreting results because the measure always speaks more than the variable name.

4.2 MAIN DETERMINANTS

In order to provide the centrality of each variable in the literature, table 2 presents the most frequently used explanatory variables. It shows how many studies that

are included in the review used a particular independent variable. The complete classification and measurements of variables can be seen in the appendix.

Table 2

Most frequently used explanatory variables

Financial	**%**
Debt	40
Government's wealth	35
Budget (im)balance	35
Leverage	20
Intergovernmental transfers	15
Municipal size	10
Political	
Political competition	55
Political ideology	55
Voter turnout	45
Executive features	35
Governance type	20
E-government achievements	15
Citizens and the media	
Population size/density	60
Citizens' characteristics (education, age, gender)	45
Citizens' wealth	35
Internet access	30
Unemployment	25
Media use and visibility	25

Source: Author.

However, this overview aims to analyze the most frequently used variables that have shown a significant influence, with particular emphasis on those that, despite heterogeneity in definition and measurement, show a significant effect. In this way, the review strives to produce a balanced account of core variables that greatly affect the level of subnational fiscal/budget transparency (table 3). To produce this account, the rule is that only variables that were used in at least two papers and which show a significant result in more than 50% of cases were included. Accordingly, three basic variable categories are distinguished: financial, political, and citizens and the media. The following section reveals these variables and focuses on the explanation of the results obtained, based on some underpinnings in previous studies.

4.2.1 FINANCIAL VARIABLES

Financial leverage and debt levels are the most important financial factors determining subnational budget/fiscal transparency. Leverage refers to the use of borrowed funds to finance public activities. In this sense, it can represent the amount of debt of the government, showing the close relation of these two terms. According to Zimmerman (1977), governments want to reduce the cost of debt by increas-

ing resources available for other activities that are more efficient in increasing government's welfare than the payment of high interest rates. Accordingly, politicians are encouraged to publish government information, which in turn facilitates monitoring by creditors. This can be achieved easily and at low-cost by online proactive reporting, which is confirmed in several studies, even if they have different leverage measurements (Laswad, Fisher and Oyelere, 2005; Gandía, Marrahí and Huguet, 2016; Gesuele, Metallo and Longobardi, 2017).

Table 3

Main determinants of subnational budget/fiscal transparency

Category	Variable	Different measurements
Financial	Leverage	Ratio of long-term liabilities to total assets
		Ratio of long-term liabilities to total public equity
		Total executed expenses per capita
	Debt	Percentage of debt in total budget
		Public debt per capita
		Funding costs of the current year budget expenditure per capita
Political	Political competition	Divided government; gubernatorial competition; legislative competition
		1 if city council is governed by one of the majority political parties in the country
		Measure of dispersion, i.e. the standard deviation of the percentage of votes received by each political party
		Effective number of political parties
		Margin of victory, measured by the difference between the percentage of votes obtained by the parties coming in first and second place
	Executive features	Mayor's gender
		Number of incumbent's consecutive terms (tenure)
	Governance type	1 if district councils, 0 regional or city councils
		1 if provincial capitals
		Form of government (1 if council-manager, 0 commission and council-elected executive)
Citizens and the media	Population	Number of inhabitants
		Population density
	Internet access	Percentage of households with home internet access
		Fixed internet access connections over 200 kilobits per second in at least one direction per 1,000 households
		Internet penetration
	Unemployment	Unemployment rate
	Media	Intensity of use of social media, measured by the number of tweets
		Press visibility
		Internet visibility

Source: Author.

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Moreover, politicians are incentivized to reduce debt levels because it allows for lower property taxes that will increase their probability of re-election (Gore, Sachs and Trzcinka, 2004). In this way, incumbents are encouraged to use internet reporting and disclose more information as this helps lenders to regularly monitor governments activities (Debreceny, Gray and Rahman, 2002). In other words, the greater the dependence on external funding sources the greater the disclosure (Ingram, 1984). Severel studies have confirmed this, finding a positive relationship between debt levels and budget/fiscal reporting (Styles and Tennyson, 2007; Caba-Pérez, Rodríguez Bolívar and López Hernández, 2008; Caamaño-Alegre et al., 2013; De Araújo and Tejedo-Romero, 2017). However, Alt, Lassen and Rose (2006) found a negative association, concluding that higher debt reduces fiscal transparency. But it should be pointed out that they employed debt variable only as a control variable. Finally, given the different leverage and debt measures used, the significance of these variables in determining fiscal/budgetary transparency is even greater.

4.2.2 POLITICAL VARIABLES

Political competition

When it comes to political determinants, there are three variables that contribute to explaining different levels of subnational budget/fiscal transparency – political competition, different executive features, and type of government. Stronger political competition encourages incumbents to bear higher monitoring costs, because if they do not keep pre-election promises, they are exposed to the long-term costs of re-election failure (Evans and Patton, 1987). Esteller-Moré and Polo Otero (2012) stressed the importance of political competition in times in which an incumbent's re-election is uncertain. With a strong competition, agents use fiscal disclosure as their strategic instrument to have a greater chance of being re-elected. However, when it comes to the degree of fiscal information they wish to provide, agents face a trade-off. According to Ferejohn (1986) higher levels of fiscal transparency allow politicians to have higher wages, since principals are now ready to pay more taxes. At the same time, greater information disclosure diverts agents from rent extraction. Accordingly, in the cases of strong competition, higher transparency becomes agents' instrument only if a trade-off is solved in favour of higher salaries. In cases of low competition, transparency becomes less important for politicians, as they in this case have high expectations of staying in power (Piotrowski and Bertelli, 2010).

It is argued that parties in power have greater benefits from divulging information in both a low and a high political competition environment. In the case of high competition, they have the incentive to show their current actions and good management (Caba Pérez, Rodríguez Bolívar and López Hernández, 2014), while low competition makes them more confident of their position in power and so willing to reveal more information (Grimmelikhuijsen and Welch, 2012). By contrast, other competing parties in a high competition environment abstain from the risk of disclosure, as this may reduce their ability to control their message (Caba Pérez, Rodríguez Bolívar and López Hernández, 2014).

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In this context, the empirical results on political competition are mixed. While several authors proved that competition fosters subnational fiscal transparency (Caamaño-Alegre et al., 2013; Gandía and Archidona, 2008; Tavares and da Cruz, 2017), others disputed this, showing a negative correlation (Alt, Lassen and Rose, 2006; De Araújo and Tejedo-Romero, 2016; Gandía, Marrahí and Huguet, 2016). Generally, it is hard to report the true effect of political competition, since the context, data used, and different country characteristics may greatly affect this variability in the results. However, even with wide range of measurements used, political competition proved to be a significant predictor of subnational fiscal transparency.

Executive features

Different incumbent characteristics and features also affect government's decision on divulging or withholding fiscal information. The mayor's gender is the first of those features, showing a significant influence on subnational transparency levels. Many studies have investigated the differences between women and men officials, mostly favouring women's leadership style and its effect on decision-making in the public sector. It is argued that female mayors are more likely than their male counterparts to actively engage citizens in the decision-making, thus fostering participation, communication and different inputs (Fox and Schuhmann, 1999). Some studies are concerned with gender and ethics, suggesting that women are less likely to behave unethically in the workplace in order to achieve greater financial rewards (Bernardi and Arnold, 1997; Krishnan and Parsons, 2008). In addition, female mayors may be less likely to experience the principal-agent dilemma, since they are more ethically minded than men (Khazanchi, 1995). Some authors stress that the critical representation of women in governance structures can affect the way of government functioning, making it more socially responsive and transparent (Rodríguez-Garcia, 2015). Several authors have empirically confirmed these underpinnings, finding a positive relationship between a female mayor and budget transparency (De Araújo and Tejedo-Romero, 2017; Tavares and da Cruz, 2017). However, Gesuele, Metallo and Longobardi (2017) proved the opposite, but showing the significance in only one of the three models presented.

It is also argued that longer tenure in office reduces pressure on the officials to disclose information. Tavares and da Cruz (2017) found that the number of an incumbent's consecutive terms in office is one of the factors most detrimental to transparency. This is consistent with the findings by Berliner (2014), who claimed that turnover in executive office fosters the adoption of freedom of information laws, which are associated with increased transparency. By contrast, Ma and Wu (2011) showed a positive correlation, stressing that governments need more time to achieve the support needed for the implementation of administrative reforms so as to foster transparency and openness. It could also be argued, however, that much more research is needed, as only few studies have employed this variable, thus limiting a better insight into the true effects of this variable.

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Governance type

There has been a tendency for researchers to include a dummy variable that addresses the type or form of the government, thus pointing to the governance structure. This could be an important argument, especially in the context of implementation of the new public management (NPM). Namely, within this approach, citizens are viewed as customers and public servants as public managers, while transparency and accountability are perceived as fundamental elements of good governance (Caba Pérez, Rodríguez Bolívar and López Hernández, 2008). Laswad, Fisher and Oyelere (2005) were among the first to use the variable "form of local authority" by distinguishing between district, city and regional councils. They found that regional and city councils are more transparent than district councils. However, it is not clear why they have not used a nominal variable, rather than a dichotomous, to address all three council types separately. It should be noted, though, that the governance type may vary greatly among countries, thus depending on the setting of the public administration of a country. In some cases, the central government has administration delegations across the country, which are assigned to the several subnational units. In Spain, for example, these are provincial capitals where the central government holds offices to provide efficiently and effectively some additional services to citizens. These political capitals proved to be less transparent than other Spanish cities (del Sol, 2013). Since this is a specific country context, it would be difficult to find theoretical underpinnings that support this evidence. In spite of that, the author indicated that the reason for low transparency could be the capitals' privileged treatment by the central government. Lowatcharin and Menifield (2015) on a sample of US counties found that council-manager governments tend to be more transparent than their mayor-council counterparts. It could be argued, however, that council-managers are more prone to the adoption of web technologies and e-government solutions, rather than mere transparency (Moon, 2002). In other words, higher transparency in these governments is not a goal by itself, but comes as a result of their propensity for web technology implementations.

4.2.3 CITIZENS AND THE MEDIA

Population

One of the variables most often used in explaining SNG fiscal transparency is the number of inhabitants. It is widely discussed that larger SNGs have the extra resources and capacities to adopt technical and managerial innovations faster (Smith and Taebel, 1985; Norris and Kraemer, 1996). This is explained by the greater pressure they face in finding different ways for a better supply of public services. In addition, they may have a better trained stuff, a larger budget, and an established IT department, which helps them to embrace e-government practices (Moon and Norris, 2005). These underpinnings were strongly confirmed by several authors (del Sol, 2013; Guillamón, Bastida and Benito, 2011; Lowatcharin and Menifield, 2015; Serrano-Cinca, Rueda-Tomás and Portillo-Tarragona, 2009). However, a study presented by Esteller-Moré and Polo Otero (2012) has revealed new insights into the population variable. Given the heterogeneity of the sample

with a wide range of population size, they split the sample into a large and small population. They found a negative relationship in the small sample, but a positive in the larger sample (for the very big municipalities), pointing to a non-linear relationship between the number of inhabitants and fiscal transparency. They stressed that unlike small municipalities, very large units have greater capacity to fulfil their legal obligations, which could more than compensate for their potential propensity to be less transparent.

Internet access

According to Debreceny, Gray and Rahman (2002), the rise in the use of the internet has brought different views to fiscal transparency. From the user's perspective, it is recognized as a facilitator in the demand for fiscal transparency, while from the supplier's perspective it is perceived as a tool for more effective dissemination of information. Internet take-up has affected the behaviour of governments, which are now divulging additional information and services online. Thus, its rise has brought about an improved transparency and financial accountability, reducing the costs of dissemination (Pina, Torres and Royo, 2010). Several studies that investigated online (mainly website) transparency reported that greater and better internet access in the SNGs positively affects their fiscal transparency (Caba-Pérez, Rodríguez Bolívar and López Hernández, 2008; Gandía and Archidona, 2008; De Araújo and Tejedo-Romero, 2017). García-Tabuyo, Sáez-Martín and Caba-Pérez (2016) found a positive association with mandatory disclosure, but surprisingly, the relationship with voluntary reporting proved to be negative. Although the argument may be somewhat shallow, they explained this by saying that voluntary information disclosure could be larger in municipalities with higher internet penetration and political commitment because by increasing the transparency levels, politicians aim to attract the votes of inactive citizens.

Unemployment

It has been argued that lower economic development and associated higher unemployment rates are damaging to civic engagement, i.e. the demand for greater opportunities to participate in the decision-making is lessened. Some studies used unemployment as a proxy for SNG economic status and found that higher economic status (lower unemployment) positively affects transparency in public administration (Piotrowski and van Ryzin, 2007). In accordance with these underpinnings, the results largely indicate that higher unemployment rates are detrimental to fiscal transparency (Caamaño-Alegre et al., 2013; De Araújo and Tejedo-Romero, 2016; del Sol, 2013; Tavares and da Cruz, 2017).

Media

Various authors have stressed the importance of public media visibility in a government's divulging of information (Zimmerman, 1977; Ingram, 1984; Laswad, Fisher and Oyelere, 2005). It is argued that greater visibility and frequency of press reporting on a government's activities and work contributes to resolving the principal-agent dilemma by reducing information asymmetries between citizens and author-

ities. However, it should be noted that the media, citizens and politicians often have different interests. In this context, public media may be more interested in publishing exclusive information, such as corruption scandals. This, in turn, affects the government's behavior, for it will limit the disclosure of information so as to avoid them being "misused" in the media (Laswad, Fisher and Oyelere, 2005; García and García-García, 2010; Cuadrado-Ballesteros et al., 2017). Nevertheless, studies have found that press and public media visibility as well as frequency of social media usage by SNGs have a positive impact on their fiscal transparency (Laswad, Fisher and Oyelere, 2005; Gandía and Archidona, 2008; Gandía, Marrahí and Huguet, 2016; Gesuele, Metallo and Longobardi, 2017).

5 DISCUSSION AND CONCLUSION

This paper has provided a review of empirical studies on the determinants of subnational government's budget/fiscal transparency in the period 2000-2017. Several important observations should be emphasized. First, in order to determine the factors involved, it is necessary to have a clear definition of budget/fiscal transparency. However, there is no consensus about this. Moreover, different definitions are interwoven, leading to budgetary and fiscal transparency being used interchangeably. The lack of a clear definition conduces to an inadequate measurement of budget transparency, which can significantly affect the credibility of the results of such research. Thus, instead of having effective transparency, this lack of clarity leads to opaque, fuzzy, or zombie transparency (Fox, 2007; Michener, 2015), where there is a lack of disaggregation or better descriptive details. Without parameters, as Michener (2015) stressed, the quality and comparability of transparency is compromised. Secondly, different approaches to measuring budget transparency, especially within the same country, reduce the effective comparison potential and lead to ambiguity. Thirdly, heterogeneity of the definition and measurement of explanatory variables can lead to apparent contradiction and inconsistency of the obtained results.

In this paper three basic categories that determine subnational government budget/fiscal transparency are established: (1) financial (leverage and debt), (2) political (political competition, executive features and governance type), and (3) citizens and the media (population, internet access, unemployment, and the media). This conclusion is based on the review of 20 selected papers, following the abovementioned methodology. Looking at the wider literature, some of the findings can be related to findings at the national level, where the main factors of fiscal transparency are political, namely political (electoral) competition, and the level of governmental democracy (Hollyer, Rosendorff and Vreeland, 2011; Wehner and de Renzio, 2013). Although citizens and the media, and financial factors determine SNG fiscal transparency, at the national level its effect seems negligible. This may be due to the reduced participation opportunities and pressures of citizens on the national government, or different structures and sources of funding of national and SNGs. Moreover, Wehner and de Renzio (2013) have concluded that external initiatives might not play a great role in strenghtening fiscal accountabil-

ity at the national level when the internal demand (citizens, media) is weak. However, when it comes to a wider literature on other types of public sector transparency, all findings are highly correlated (Bakar and Saleh, 2015), including all three established categories.

A vast majority of studies tend to focus on local governments, thus neglecting other types of public sector organizations such as federal and state governments, or quasi-government bodies. Very few studies involved different countries in an investigation of subnational international comparisons. In this sense, the challenge would be to create a harmonized budget transparency measure that could be applied to subnational governments of different countries. Further such research could offer a more comprehensive insight into the factors implicated in budget/fiscal transparency, including different country characteristics and contexts. Furthermore, greater consistency in selecting proxy measures for certain variables could contribute to a clearer interpretation of results, while the greater time span of budget transparency data would allow for richer methodology solutions and observations.

Like any other studies, this study has a few limitations. It does not take into account research before 2000, as the focus is rather on online disclosure. Future studies may extend observation time. Furthermore, no meta-analytic studies were included. However, this paper can serve as the basis and motivation for implementing systematic reviews and meta-analyses on this topic. In spite of these limitations, it is believed that the study may provide rich insights for both interested researchers and practitioners.

Disclosure statement

The author does not have any conflict of interest.

APPENDIX

TABLE A1

Budget/fiscal transparency measurements

Author(s)	Sample	Dependent variable		Type of disclosure	Method for estimating determinants	Main results (determinants)
		Measurement	Time period			
		United States				
Alt et al. (2006)	50 States	Based on Alt, Lassen and Skilling (2002). They measured state government budget procedures by sending questionnaires to the budget officers of all 50 states on nine dichotomous items regarding budget procedure issues, based on the data from the National Association of State Budget Officers and the National Conference of State Legislatures.	1972-99	Survey responses	Panel data regression analysis	Political competition; Political polarization; Partisan composition of government; Debt; Budget imbalance
Styles and Tennyson (2007)	300 municipalities	They used only one indicator – a comprehensive annual financial report (CAFR). In addition, they developed an accessibility index to measure the ease of CAFR access, i.e. how many steps are required to locate the report.	n/a	Online mandatory	Logit Regression Analysis for provision model and OLS Regression Analysis for accessibility model	Population size; Income per capita; Accounting disclosure
Bernick et al. (2014)	400 counties	Like Styles and Tennyson (2007), they looked at a comprehensive annual financial report (CAFR) and availability and comprehensiveness of budget information (no exact document or information is indicated).	2014	Online mandatory	Ordered logit analysis	Counties with appointed county manager; size of county board; counties required to submit an audit to the federal government; Economic stress; Population age; Democratic and minority residents; Heterogeneity of the county

Author(s)	Sample	Dependent variable		Type of disclosure	Method for estimating determinants	Main results (determinants)
		Measurement	Time period			
Lowatcharin and Menifield (2015)	816 counties in twelwe US Midwestern states	Categorical data, taking the numbers from 0 to 4 with regard to the release of the following 10 items: budget, meetings, elected officials, administrative officials, permits and zoning, audits, contracts, lobbying, public records, and local taxes.	2010	Online proactive	Ordered Logistic Regression Analysis	Governance type; Population density; Citizens' education; Total land area; Minority population (most extensive model results)
			Spain			
Gandía and Archidona (2008)	130 municipalities with more than 50,000 inhabitants	Web disclosure index, consisting of 88 items grouped into five sections: general information, budget information, financial information, navigation and presentation, relational web.	2006	Online voluntary	Multivariate Regression Analysis	Political competition; Public media visibility; Internet access; Citizens' education
Serrano-Cinca et al. (2009)	92 local governments, including all provincial capitals and all town halls with over 70,000 inhabitants	Dependent variable based on web availability of nine documents: individual budget of the council, consolidated budget of the council, budget of dependent entities, budget disaggregated by economic, functional or organic classification, budget information regarding investment, borrowing or revenue and expenditure, individual annual accounts, consolidated annual accounts, annual accounts of dependent entities and audit report.	2006	Online voluntary	Multivariate Logistic Regression	Population size; Budget revenues; Political will (measured by councils' experience with e-democracy); Disposable family income per inhabitant
Caba-Pérez et al. (2008)	65 Spanish city councils, including large cities, provincial capitals, autonomous region capitals and municipalities with central offices of the autonomous regions' institutions.	Disclosure index divided into three sections: (1) content of information supplied, including budget and financial information; (2) characteristics of the information disclosed, i.e. completeness, timeliness, comparability, understandability, relevance and reliability; and (3) navigability, design and accessibility of public financial information on the web site.	2007	Online voluntary	Multivariable Linear Regression	Cost of debt; Internet access

Author(s)	Sample	Dependent variable: Measurement	Dependent variable: Time period	Type of disclosure	Method for estimating determinants	Main results (determinants)
Guillamón et al. (2011)	100 largest Spanish municipalities	The financial transparency index based on the data of Transparency International (TI) Spain 2008 and partly from the questionnaire created by the authors. They observed three dimensions: accounting and budget, municipal revenues and expenditures, and municipal debt.	2008	Proactive, print and online	OLS and 2SLS regressions	Municipal wealth; Intergovernmental transfers; Political ideology; Population size
del Sol (2013)	110 local governments that participated in 2010 TI Spain survey	TI Spain disclosure index, including five transparency areas: fiscal (accounting and budget information, information on revenues and expenditures, information on debt), corporate, social, procurement and contracting.	2010	Online voluntary	OLS and censored regression models	Population size; Political ideology; Governance type (provincial capital); Tourist activity; Political ideology
De Araújo and Tejedo-Romero (2016)	109 municipalities	TI Spain disclosure index, including 80 indicators grouped into six transparency areas. Five areas used already by Albalate (2013) and additional category on urban development/public works transparency.	2012	Online voluntary	OLS and IV/2SLS regression analysis	Voter turnout; Political ideology; Political competition
Esteller-Moré and Polo Otero (2012)	691 Catalan municipalities	A dichotomous variable measuring budget/fiscal transparency by looking at the nine budget information: budget approval, final budget, budget balance, closed settlement budgets, treasury statement, treasury surplus, net wealth statement, income statement and indebtedness. These informations are part of annual accounts that Catalan local governments have to deliver to the Public Audit Office for Catalonia.	2001-2007	Mandatory	Logit regression analysis	Political competition; Population size (measuring the degree of decentralization)

Author(s)	Sample	Dependent variable		Type of disclosure	Method for estimating determinants	Main results (determinants)
		Measurement	Time period			
Caamaño-Alegre et al. (2013)	33 Galician municipalities	Budget transparency index containing information on the open budget process, public availability of information and assurance of integrity. Questionnaires are sent to government officials by using a Likert-type survey questionnaire based on the IMF's revised Code of Good Practices on Fiscal Transparency.	n/a	Proactive	OLS regression analyis	Debt per capita; Budget (im)balance; Ratio of municipal public expenditure to GDP; Political competition; Political ideology; Coalition incumbent; Voter turnout; Unemployment rate
Gandía et al. (2016)	145 Spanish local governments with more than 50,000 inhabitants	Web 2.0 disclosure index, consisted of: (1) an ornamental disclosure index, which contains general and citizen information; (2) information disclosure index, including the information on public procurement, administrative agreements, government subsidies and aid, staff, and budget and financial information; (3) relational disclosure index, which represents the presentation, navigability and interaction abilities of the web.	n/a	Online voluntary	Multivariate regression analysis	Leverage; Municipal wealth; Political competition; Political ideology; Citizens' education; Social media use; Press visibility; Internet visibility
De Araujo and Tejedo-Romero (2017)	100 largest Spanish municipalities	TI Spain disclosure index	2008-2010, 2012, 2014	Online voluntary	Balanced panel data regression analysis	Mayor's gender; Woman's representation in municipal council

Author(s)	Sample	Dependent variable		Type of disclosure	Method for estimating determinants	Main results (determinants)
		Measurement	Time period			
		Other countries				
Laswad et al. (2005)	86 local governments in New Zealand	A dichotomous variable, indicating whether or not the local authority publishes financial information on the web. It is considered that local authority delivers information if at least one of four documents that represent voluntary internet financial reporting was published. Four documents are: financial highlights, annual reports, annual plan, and combinations of annual reports, plans and financial highlights.	n/a	Online voluntary	Multivariate logit regression	Leverage; Municipal wealth; Press visibility; Type of council
García-Tabuyo et al. (2016)	40 largest municipalities in each of the five Central America countries – El Salvador, Nicaragua, Panama, Guatemala and Honduras	Index of mandatory and index of voluntary disclosure based on 94 items grouped into four transparency categories: municipal government, relations with citizens and society, economic-financial transparency and service-procurement transparency. The ratio of voluntary and legal items differs depending on the observed country.	Salvador (2010), Guatemala (2008), Honduras (2006), Nicaragua (2007), Panama (2002)	Online proactive	Tobit Regression Analysis	The maturity of the FOI law (mandatory disclosure); Internet access; Voter turnout (voluntary disclosure)
Zuccolotto and Teixeira (2014)	26 Brazilian states	State transparency index developed by Biderman and Pottomatti (2010), consisting of three parameters: content, time series and update frequency, and usability.	2010	Online proactive	Multiple linear regression analysis	Socioeconomic factors: education, employment and income, and health indicators; Fiscal factors

Author(s)	Sample	Dependent variable		Type of disclosure	Method for estimating determinants	Main results (determinants)
		Measurement	Time period			
Ma and Wu (2011)	31 Chinese provinces	Disclosure index based on resposiveness and information completeness as two basic dimensions. It is measured by governments' responses to 113 open fiscal information requests of citizens, including 66 items for government accounts, 30 items for social security accounts and 17 items for state owned enterprises accounts.	2008-2009	Reactive	Seemingly Unrelated Regressions (SUR) model with random effects	Economic openness; Marketization; Budget (im)balance; Incumbent's tenure
Gesuele et al. (2017)	287 municipalities, 142 Italian and 145 Spanish municipalities	Two indexes: (a) e-disclosure website index, which measures interaction level among citizens and municipalities using official or mandatory disclosure channel by looking for the 13 items, including the publication of financial statements from the municipality and from the controlled company and municipalities' assets and revenues; (b) social media usage index, which measures the voluntary disclosure via social media such as Facebook and Twitter.	2013	Online proactive	Tobit regression (stepwise approach)	Leverage; Internet visibility; Citizens wealth (measured by economic activity per capita)
Tavares and da Cruz (2017)	278 Portuguese municipalities	TI Portugal disclosure index, consisting of 76 indicators, grouped into the seven dimensions: (1) Organizational information, social composition and operation of the municipality; (2) Plans and planning; (3) Local taxes, rates, service charges, and regulations; (4) Relationship with citizens; (5) Public procurement; (6) Economic and financial transparency; and (7) Urban planning and land use management.	2013	Online proactive	OLS regressions	Financial autonomy; Mayor's gender; Tenure; Political competition; Unemployment rate; Population age

Source: Author

Table A2
Financial variables

Variable name	Variable measurement	Correlation of determinants: Positive	Negative	Non-significant
Municipal size	Average total assets; average total revenues	–	–	Laswad et al., 2005
	Budget revenues	Serrano-Cinca et al., 2009	–	–
Leverage	Ratio of long-term liabilities to total assets; ratio of long-term liabilities to total public equity	Laswad et al., 2005	–	–
	Total executed expenses per capita	Gandía et al., 2016	–	Gandía and Archidona, 2008
	The level of leverage (not specified)	Gesuele et al., 2017	–	–
Govern-ment's wealth	Municipality's own revenue per capita	Gandía et al., 2016; Laswad et al., 2005	–	Gandía and Archidona, 2008
	Budget revenue per capita	–	–	Ma and Wu, 2011
	Tax revenues per capita	Guillamón et al., 2011	–	Caamaño-Alegre et al., 2013
	GDP per capita	–	–	Ma and Wu, 2011 (positive for completeness, but insignificant for provision of information)
	Dichotomous variable (1 if the city hall has municipal bonds in circulation)	–	–	Serrano-Cinca et al., 2009
Debt	Percentage of debt in total budget	–	–	del Sol, 2013
	Public debt per capita	Caamaño-Alegre et al., 2013; De Araújo and Tejedo-Romero, 2017; Styles and Tennyson, 2007	Alt et al., 2006	De Araújo and Tejedo-Romero, 2016; Guillamón et al., 2011
	Funding costs of the current year budget expenditure per capita	Caba-Pérez et al., 2008	–	–
Intergovern-mental transfers	Ratio of total transfers to the total amount of non-financial revenues. They have also observed current and capital transfers separately	–	–	Esteller-Moré and Polo Otero, 2012
	Regional and central transfers per capita	Guillamón et al., 2011	–	–
	Total current and capital transfers	–	–	Caba-Pérez et al., 2008

Variable name	Variable measurement	Correlation of determinants		
		Positive	Negative	Non-significant
Budget im(balance)	Fiscal imbalance, i.e. higher surpluses and deficits	Alt et al., 2006	–	–
	Budget balance per capita (lowering deficit)	Caamaño-Alegre et al., 2013	–	–
	Budget deficit, natural logarithm	Ma and Wu, 2011	–	–
	Deficit per capita	–	–	Esteller-Moré and Polo Otero, 2012; Guillamón et al., 2011
	Deficit or surplus as a percentage of total budget	–	–	del Sol, 2013
Other financial variables	Investment pc; tax burden pc; ratio of the tax revenues to operating revenues; ratio of financial to total expenses; ratio of operating to total expenses	–	–	Serrano-Cinca et al., 2009
	Capital investment per capita	De Araújo and Tejedo-Romero, 2016	–	–
	Fiscal pressure, measured by per capita tax and non-tax revenue, and the sale of goods and services of the public administrations	–	–	Caba-Pérez et al., 2008
	Fiscal pressure, measured by total direct and indirect taxes per capita	De Araújo and Tejedo-Romero, 2017	–	–
	Index of financial autonomy (derived from taxes and fees)	Gesuele et al., 2017 (significant in one of three models)	–	–
	Financial position, measured by the ratio of primary government's unrestricted net assets to total expenses	Styles and Tennyson, 2007	–	–
	Financial autonomy (proportion of local taxes, fees and other charges)	Tavares and da Cruz, 2017	–	–
	Ratio of municipal public expenditure to GDP	Caamaño-Alegre et al., 2013	–	–
	Municipalities with a certificate of achievement for excellence in accounting reporting	Styles and Tennyson, 2007	–	–

Source: Author.

Table A3
Political variables

Variable name	Variable measurement	Correlation of determinants		
		Positive	Negative	Non-significant
Political competition	(a) Divided government – dichotomous variable taking the value 1 if different parties control the executive and legislature, 0 otherwise; (b) Gubernatorial competition, measured by the share of Democratic votes in the gubernatorial election, capturing absolute deviatians from one half; (c) Legislative competition – Democratic seat shares in the upper and lower houses	–	Alt et al., 2006	–
	Ratio of candidates to council positions available	–	–	Laswad et al., 2005
	Number of political parties in the city council	–	–	Gandía and Archidona, 2008
	Dichotomic variable, 1 if city council is governed by one of the majority political parties in the country	Gandía and Archidona, 2008	Gandía et al., 2016	–
	Ratio of candidates to councillors elected	–	–	Serrano-Cinca et al., 2009
	Ratio of councillors elected for the party in power to the total number of elected councillors	–	–	Caba-Pérez et al., 2008
	Measure of dispersion, i.e. the standard deviation of the percentage of votes received by each political party (the greater the dispersion of votes among political parties, the smaller the electoral competition)	Esteller-Moré and Polo Otero, 2012 (non-significant for big municipalities)	–	Caba-Pérez et al., 2008
	Effective number of political parties, according to Laakso and Taagapera's (1979) calculation	Caamaño-Alegre et al., 2013	–	–
	Margin of victory, measured by the difference between the percentage of votes obtained by the parties coming in first and second place. The lower the difference the higher the electoral competition	Tavares and da Cruz, 2017	De Araújo and Tejedo-Romero, 2016	De Araújo and Tejedo-Romero, 2017

Variable name	Variable measurement	Correlation of determinants		
		Positive	Negative	Non-significant
Political ideology	Political orientation of the municipal majority and/or mayor	–	–	Esteller-Moré and Polo Otero, 2012; García-Tabuyo et al., 2016; Gesuele et al., 2017; Serrano-Cinca et al., 2009; Tavares and da Cruz, 2017
	1 if left-wing municipal majority	Gandía et al., 2016; Guillamón et al., 2011	–	–
	1 if left incumbent	Caamaño-Alegre et al., 2013; del Sol, 2013	De Araújo and Tejedo-Romero, 2016, 2017	–
Executive	Mayor's gender (1 if female)	De Araújo and Tejedo-Romero, 2017; Tavares and da Cruz, 2017	Gesuele et al., 2017 (significant in one of three models)	De Araújo and Tejedo-Romero, 2016; Guillamón et al., 2011
	1 in the case of coalition incumbents	–	Caamaño-Alegre et al., 2013	–
	Mayor's age and education	–	–	Tavares and da Cruz, 2017
	Number of incumbent's consecutive terms	Ma and Wu, 2011	Tavares and da Cruz, 2017	–
Governance type	1 district councils, 0 regional or city councils	–	Laswad et al., 2005	–
	1 provincial capitals	–	del Sol, 2013	–
	Form of government (1 council-manager, 0 commission and council-elected executive)	Lowatcharin and Menifield, 2015	–	–
	1 city-manager governance structure	–	–	Styles and Tennyson, 2007
Voter turnout	Percentage of citizen participation in local elections	Caamaño-Alegre et al., 2013; De Araújo and Tejedo-Romero, 2017 (simplified model)	García-Tabuyo et al., 2016 (voluntary disclosure); De Araújo and Tejedo-Romero, 2016; De Araújo and Tejedo-Romero, 2017 (extensive models)	García-Tabuyo et al., 2016 (mandatory disclosure); del Sol, 2013; Guillamón et al., 2011; Serrano-Cinca et al., 2009; Tavares and da Cruz, 2017

Variable name	Variable measurement	Correlation of determinants		
		Positive	Negative	Non-significant
Voter turnout	Voter abstention, representing the percentage of population who did not vote	–	Esteller-Moré and Polo Otero, 2012 (big municipalities)	Esteller-Moré and Polo Otero, 2012 (whole sample and small municipalities)
E-government achievements	Number of e-democracy actions implemented	Serrano-Cinca et al., 2009	–	–
	E-government development, measured by the score in open information, online business, user satisfaction, properties and design, and daily operation	–	–	–
	Institutional capacity variable, measured by Open Government Information (OGI)	–	–	Ma and Wu, 2011 (positive for fiscal completeness)
	Municipal IT capacity, measured by the number of IT employees	–	–	Tavares and da Cruz, 2017
Other political variables	Counties with appointed county managers; size of county board; counties required to submit an audit to the federal government	Bernick et al., 2014	–	–
	Political polarization (for measurement see Hanssen, 2004)	Alt et al., 2006	–	–
	Two-party and multi-party coalition in the city council	–	–	Serrano-Cinca et al., 2009
	Woman's representation in municipal council, measured as a percentage of female members in municipal council	De Araújo and Tejedo-Romero, 2017	–	–
	1 if incumbent's party does not hold a majority of seats in the council	–	–	Tavares and da Cruz, 2017
	The maturity of the FOI law, i.e. how long has it been in force; number of sanctions stipulated in the FOI law	–	García-Tabuyo et al., 2016 (mandatory disclosure)	–

Source: Author.

Table A4

Citizens and the media

Variable name	Variable measurement	Correlation of determinants		
		Positive	Negative	Non-significant
Population	Number of inhabitants	De Araújo and Tejedo-Romero, 2016; del Sol, 2013; Guillamón et al., 2011; Serrano-Cinca et al., 2009; Styles and Tennyson, 2007	Esteller-Moré and Polo Otero, 2012 (non-linear relationship)	Caamaño-Alegre et al., 2013; Caba-Pérez et al., 2008; Gandía and Archidona, 2008; García-Tabuyo et al., 2016; Tavares and da Cruz, 2017
	Population density, measured in persons per square mile	Lowatcharin and Menifield, 2015	–	–
Internet access	Percentage of households with home internet access	Gandía and Archidona, 2008 (budget disclosure); Caba-Pérez et al., 2008; De Araújo and Tejedo-Romero, 2017	–	Gandía and Archidona, 2008 (financial disclosure)
	Fixed internet access connections over 200 kilobits per second in at least one direction per 1,000 households	Lowatcharin and Menifield, 2015 (simplest model)	–	Lowatcharin and Menifield, 2015 (most extensive models)
	Internet penetration as a measure for the development of ICT infrastructure	García-Tabuyo et al., 2016 (mandatory disclosure)	García-Tabuyo et al., 2016 (voluntary disclosure)	–
	Percentage of netizens	–	–	Ma and Wu, 2011
Citizens' characteristics	Citizen education attainment	Gandía and Archidona, 2008 (budget disclosure); Gandía et al., 2016; Lowatcharin and Menifield, 2015	–	Gandía and Archidona, 2008 (financial disclosure); Caba-Pérez et al., 2008; De Araújo and Tejedo-Romero, 2017; Ma and Wu, 2011; Serrano-Cinca et al., 2009; Tavares and da Cruz, 2017
	Citizens' age, measured by the percentage of the population aged 65 and over	Esteller-Moré and Polo Otero, 2012 (whole sample and big municipalities); del Sol, 2013	–	Esteller-Moré and Polo Otero, 2012 (small municipalities); Ma and Wu, 2011

Variable name	Variable measurement	Correlation of determinants		
		Positive	Negative	Non-significant
Citizens' characteristics	Citizens' age, measured by the average age of the municipal population	–	Tavares and da Cruz, 2017	–
	Citizens' age, measured by the median age of population	–	–	Lowatcharin and Menifield, 2015
	Gender, measured by the percentage of men over the total local population	–	–	del Sol, 2013
Citizens' wealth	Disposable family income per inhabitant	Serrano-Cinca et al., 2009	–	–
	Personal income per capita	Lowatcharin and Menifield, 2015; Styles and Tennyson, 2007	–	Lowatcharin and Menifield, 2015 (after controlling for state effects); Guillamón et al., 2011
	Percentage of population below the poverty level	–	–	Lowatcharin and Menifield, 2015
	The value of economic activity per capita	Gesuele et al., 2017	–	del Sol, 2013
	Purchase power index	–	–	Tavares and da Cruz, 2017
Unemployment	Unemployment rate	De Araújo and Tejedo-Romero, 2017	Caamaño-Alegre et al., 2013; De Araújo and Tejedo-Romero, 2016; del Sol, 2013; Tavares and da Cruz, 2017	–
Media	Having Twitter and/or Facebook accounts	–	–	Gandía et al., 2016
	Intensity of use of social media, measured by the number of tweets	Gandía et al., 2016	–	–
	Intensity of use of social media, measured by the Facebook likes	–	–	Gandía et al., 2016

Variable name	Variable measurement	Correlation of determinants		
		Positive	Negative	Non-significant
Media	Press visibility	Gandía and Archidona, 2008; Gandía et al., 2016; Laswad et al., 2005	–	Gesuele et al., 2017
	Internet visibility	Gandía and Archidona, 2008; Gandía et al., 2016; Gesuele et al., 2017	–	Serrano-Cinca et al., 2009
Other variables	Degree of community involvement, measured by the number of civic associations divided by the number of inhabitans	–	–	Serrano-Cinca et al., 2009
	Total land area	Lowatcharin and Menifield, 2015 (most extensive model)	–	–
	Percentage of population change over the years	Lowatcharin and Menifield, 2015 (more simplified models)	–	–
	Minority, measured by the percentage of nonwhite population	Lowatcharin and Menifield, 2015	–	–
	Index of tourist activity per capita	–	del Sol, 2013	-

Source: Author.

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Working Together: Integration, Institutions and the Sustainable Development Goals, World Public Sector Report 2018

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In the current world, although there has been a significant progress in the reduction of poverty and inequality, a persistent problem is the lack of improvement in integration, which causes social exclusion. Furthermore, modern economic development is often not sustainable of the long-term, while institutions are not fully adapted to the needs of social challenges. A newly published release by the United Nation *World Public Sector Report 2018*[1] using a holistic approach very nicely sheds light on the additional measures that are needed to the collaborative efforts of various stakeholders in the inclusion of those that are left out. This excellent report was prepared by many authors using mixed methods that combined literature reviews and expert contributions. The team composed of United Nations personnel was led by David Le Blanc under the responsibility of Marion Barthélemy.

The United Nations in 2016 adopted the 2030 Agenda for Sustainable Development (the successor to its Millennium Development Goals), which should eliminate poverty and achieve sustainable development by 2030. (Steven Pinker in *Enlightenment Now* states that not even Jesus was that optimistic: he told the indignant disciples, "The poor you will always have with you.") The Agenda underlines the importance of the interlinkages and integrated nature of the sustainable development goals (SDGs). Achieving possible synergies and strengthening trade-offs between the sustainable development goals and targets will enable much easier achievement of the SDGs. This should boost the allocation of resources and help avoid the adverse side effects of actions aiming to hasten progress in one area on the realisation of targets in other areas.

One of the goals of the report is to present the positive experience of many countries with the intention of transferring the best practice in policy integration for the attainment of SDGs. The authors are fully aware that different types of existing interlinkages among the SDGs can be addressed and improved from an institutional perspective. Thus, the report aims to define areas where public institutions need to work more closely together; the types of measures that can be involved in this process, and the broader implications for and consequences of collaboration between public institutions and public service.

Improving integration involves finding ways to strengthen cooperation and common approaches among institutions at various levels dealing with closely interrelated issues. Policy integration comprises the management of crosscutting actions and measures in a policy-making process that transits the boundaries of established policy fields. Such measures very often do not correspond to the institutional responsibilities of individual units and departments.

In the modern literature, the term *integration* is used in various slightly different meanings. The most common usage defines integration as a dimension variable, with policies in specific issue areas being more integrated than before. Otherwise,

[1] The report is available at http://workspace.unpan.org/sites/Internet/Documents/UNPAN98152.pdf.

integration can be deemed as the more coherent process of defining and implementing policy related to a specific issue. Finally, integration can also denote the ideal of policies that achieve a higher degree of coherence. In this report, the term *integration* is considered in a broad sense, while the potential challenges, shortcomings and gains of integrated policy-making are clear. The challenges in the past were the lack of political legitimacy of sustainable development as a paradigm and insufficient attention of various levels of government to the issue of sustainable development. Shortcomings are an inability to mainstream sustainable development principles in the work of available institutions on one hand and resistance to achieve the degree of coordination among institutions that are needed for sustainable development on the other. Gains of the integrated approach are socially superior solutions that cannot be achieved by focusing only on sector-specific policies, and shared visions across sectors and various actors. Positive changes in relevance and legitimacy are supported by progress in the scientific researchers that fully understand the interlinkages among sustainable development topics on the one hand, as well as by the development of tools, analytical methods and information systems that support integration of different stakeholders in public and private sector on the other.

The report is organized around three broad principal questions. First, what are from the institutional perspective, the challenges to and prospects for policy integration at various policy cycle phases at the national level? Second, are there any positive cases of institutional and administrative organisations that can support integrated approaches to the 2030 Agenda, and if so, what are they? Finally, what are the opportunities and challenges for public administration and public institutions to ensure integrated approaches in diverse SDG or groups of closely related goals?

The report consists of two main parts. In the first part, chapter one explains the reasons and case for integration and introduces the methodological framework. The second chapter focuses on horizontal integration, chapter three on vertical integration, while chapter four deals with successful engagement of stakeholders. The second part of the publication applies the relevant framework of integrated approaches to international migration: health and integration of peace, security and development in post-conflict situations.

Forms of integration are explained in chapter one. The modern literature distinguishes three dimensions of integration. *Horizontal integration* encompasses integration across sectors or institutions. *Vertical integration* expresses how the actions of various (national and sub-national) levels of government can be adjusted to achieve coherent outcomes. The third dimension is *engagement of all stakeholders* in the integrated realisation of shared objectives. Taken together, these three dimensions of integration encompass all the relevant categories proposed by the literature, primarily partnerships, participation and coherence. The approach and content of the initiatives can be formal or informal. The latter refers to joint activities that involve various stakeholders from the non-state sector, in addition to the whole of

government, with the state usually having a coordinating role. When analysing policy integration, there is a need to consider different aspects, like the institutional efforts made by governments to promote integrated policy-making and policy coherence; activities related to collaboration and coordination; and measures of achieved integration and policy coherence regarding achieved outcomes.

As the SDGs makes high demands for horizontal integration on institutions at all levels, chapter two analyses the importance of effective horizontal integration for the implementation of the SDGs. Such integration is critical for resolving the interconnected nature of the SDGs, including synergies and trade-offs across different goals and targets. It is, however, well known that overcoming sectoral boundaries in the attainment of horizontal integration is a demanding and complex task. In such a process, governments have concrete measures and opportunities to improve integration in their structures and processes. A growing number of countries around the world are including SDGs into their national policies and putting in place adequate institutional frameworks. While some countries have given new mandates to existing mechanisms or institutions, others are establishing new coordination bodies and mechanisms for the implementation of the SDGs. Among many vital measures and instruments, the five most important are examined. The first are national strategies and plans because they define the overall direction and priorities. The second is the budget process that helps in implementation and realisation of national strategies at the level of programmes and activities. The third group consists of public services responsible for the implementation of government actions on the SDGs. This group has a critical role in achieving effective collaboration across institutions and sectors. Monitoring, evaluation and review processes for the SDGs are part of the fourth group that enables governments to assess progress in the activities of integration. Finally, different oversight institutions, parliaments and Supreme Audit Institutions (SAIs) have a crucial role in insuring integration. The report contains many examples of integration from different countries, so this chapter presents the experiences from the Sierra Leone implementation of the Agenda for Prosperity, particularly the Poverty Reduction Strategy. The Budget Statement nominates the responsible stakeholders and the scope of their reporting responsibilities on the SDGs within the various government ministries and offices where resources were allocated.

The realisation of the SDGs requires the coordination of actions and measures of different levels of government. There are many reasons for such coordination. In most cases, the achievement of specific targets in each national context depends on the aggregation of local and regional outcomes, making coherent action a stipulation. Vertical integration may be an important step in promoting a shared vision and commitment to sustainable development across levels. It can enhance synergies and improve consistency across levels of government through mutually reinforcing and supportive actions. The third chapter examines current efforts in ensuring effective vertical policy integration during the implementation and follow-up and review of the SDGs. Vertical integration enables an opportunity for

political dialogue among the various parts of government, providing a possibility to generate trust and a more long-term vision across the public sector. The chapter analyses the potential benefits of vertical integration and some of its challenges and barriers. It also studies approaches and tools that different countries have implemented with the goal of enhancing vertical integration at different stages of the policy process, underlining innovative approaches and experiences. Potential challenges to vertical integration include the gap between the abstract and universal nature of SDGs and the specificity of local initiatives and policies, unawareness of SDGs by local governments; organizational, cultural and/or ideological differences between national and local governments; institutional weaknesses or poor coordination mechanisms between the different levels of government. Colombia can be mentioned as a positive example of successful and advanced vertical integration. With support from the Colombian national government, 32 departments and 31 capital cities have adopted and implemented local development plans that include SDG localized targets.

The fourth chapter presents the adoption of mechanisms for efficient stakeholder engagement, at both the systemic and the sector levels. It also looks at how it can affect outcomes in terms of integration. Many experiences have been observed regarding processes and mechanisms for stakeholder engagement in different sectors, at different levels of decision-making, and with various constituencies. Having in mind such examples, governments have become fully aware of the importance of stakeholder engagement in order to strengthen ownership of the SDGs and ensure their successful implementation and monitoring at all levels. Included stakeholders can enhance policy performance by helping in defining problems in ways that are more accurate. They can also provide information and insights relevant for identifying policy solutions and evaluating the implementation process. Enabling policy-making process to the inclusion and interaction with non-governmental actors helps governments better to understand people's needs and demands. Furthermore, non-governmental actors can be directly included in solving policy problems and contribute additional resources through the common generation of skills, knowledge, policy and technology. Of course, there are always some problems and costs. Wide stakeholder engagement usually takes time and can be an obstacle to the quick policy responses that some sustainable development challenges may need. While including the ideas and opinions of multiple stakeholders helps gain a more comprehensive and legitimate understanding of demanding policy problems, engagement can make it more difficult to reconcile divergent and even opposite views in commonly agreed policy solutions. It seems that the combination of different engagement strategies and collaboration of multiple stakeholders is more effective for increasing responsiveness and accountability than the use of one single engagement mechanism. The positive Finnish example of the government-led Finnish National Commission on Sustainable Development with many stakeholders included from public and private sector and civil society, illustrates a possible way of mobilizing non-state actors that is fully consistent with government actions for SDG implementation. Investing time and resources in the

selection process, and having clearly defined procedures and criteria for selecting stakeholders without doubt contribute to the effectiveness and efficiency of the engagement as well as its outputs and outcomes in terms of integration.

Sustainable development demands policies that are systematically oriented towards the strengthening of linkages between different economic, social and environmental issues. The fifth chapter shows how national public institutions and administrations have used integrated approaches to respond to the needs of migrants and refugees the flows of whom have been increasing across the world. The way in which the multiple linkages between migration and the SDGs are transformed into national policies and realised in practice by public institutions and public administration reflects political processes of reconciling opposite opinions and demands of different stakeholders, including governments, civil society, and migrants themselves. The authors examine how public institutions and different stakeholders can better support integrated approaches to migration. How can they sustain the integration of the mentioned approaches in sustainable development measures, policies and institutional processes? Where and how can development policies make the most impact when it comes to serving those in the worst positions among international migrants? How can policy-makers and policy communities connect migration and socio-economic development through innovative services? No single model appears intrinsically better in terms of effective and efficient policy integration. Elements that might perhaps impact horizontal and vertical policy integration include the type of public administration system, the level of decentralisation and local governance, institutional capacity, previous experience and institutionalization of cooperation between various bodies of government, development of leadership, prevalence of modern technology usage including the capability and vigour of communication platforms, and, finally, the characteristics and the numbers of actors involved in policy-making. Morocco is a positive example of a country that undertook several waves of regularization of migrants in an irregular situation, followed by the opening of its public services to all migrants and refugees. Migrants in an irregular situation have access to public health services and can send their children to public schools. Additionally, regular migrants can participate in professional training and assistance with job search. This chapter concludes with an important statement: that integration of migration and development at all levels of public administration is not only a technical or rational process but also has to encompass cultural awareness, politics and perceptions. As migration and refugee issues are likely to remain a significant problem in the near future, there is a need for the proposal and implementation of efficient awareness and communication strategies and accountability systems in public administration.

Integrated approaches to health and well-being are the subject of analysis in the sixth chapter. Health is a crucial human right and an important characteristic of personal well-being. Health outcomes are impacted by many factors that are usually outside the health sector itself. At the national level, a vast array of policies and institutional settings have been developed to support the multiple linkages

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between health and other SDG areas, with the intention to support integrated approaches. However, researches show that the focus of many efforts at integrated health initiatives has largely remained within the health care sector itself. Attempts at integration have been oriented to finding ways to enable non-health sectors and actors to serve the goals of the health sector, without necessarily considering the impact of health on those sectors and their principal objectives. Thus, in many countries the potential of integrated approaches to achieve synergies and minimise trade-offs across sectors and government levels may remain often unused. Universal healthcare for all migrants in Thailand is mentioned as a positive experience of interlinkages of health with other sectors. Migrants represent more than 6 percent of the Thai population. It is currently the only country in the world where illegal migrants have the same health care rights as nationals.

This very nice report finishes with chapter seven, which deals with the implementation of the SDGs in post-conflict situations and their implications for integrated approaches that enable improvements in sustainable development and peace. Conflicts annually lower a country's gross domestic product growth on average by two percentage points. Trends in the world show that the gap between conflict-affected countries and other developing states is widening. Countries emerging from conflict are the ones where the SDGs probably may not be obtained without some radical and innovative departures. An integrated context for SDG implementation involves ensuring that interventions aimed at preserving peace (including protecting human rights) and development are interlinked and mutually reinforcing. As countries in post-conflict situations face many pressing problems, for them the achievement of long-term development goals is much more difficult. In the face of many short and long-term priorities, efficient integrated approaches become even more important than in peaceful circumstances. Post-conflict situations mostly vary in the nature and degree of devastation, but often there is a need to mitigate the consequences of substantial physical, institutional and organizational destruction. Conflicts usually ruin national public administration and public institutions and they have to be rebuilt, often from scratch. Using recent examples, the authors in this chapter explore how this can be done. Sustainable development aspirations can be an inspiration for a common vision for the future. Such a vision needs to be transformed into coherent and integrated national policies that are future-looking, inclusive and endorse partnership between the government and society and support by various stakeholders. The policy integration and inclusion in Colombia achieved by the National Development Plan are provided as an example. The Colombian government made efforts to provide an inclusive platform for policy-making at the local level, giving a voice to earlier marginalized groups, and supporting their participation in local elections as candidates. The government also established the legal and institutional architecture for a territorial peacebuilding process. The coordination between central and local levels of government was achieved through the Inter-institutional Post-conflict Council.

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The report presents country efforts to foster policy integration for SDGs. It provides examples of measures and ways by which linkages among SDGs can be achieved from an institutional perspective, and underlines the importance of integration challenges and opportunities for public institutions and public administration. This interesting and valuable report also explains the role and importance of budgets in tracking support to specific goals. The reader can only enjoy the final product and the incredible richness of the additional (more than 500) sources used in the preparation of the report.

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