Economia Politica (2019) 36:111–138
https://doi.org/10.1007/s40888-018-0136-0

ORIGINAL PAPER

Redistribution and stabilisation through the EU budget

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Received: 26 January 2018 / Accepted: 19 November 2018 / Published online: 27 November 2018

Abstract

This paper measures the capacity of the EU budget to operate two traditional functions of public finances: redistribution and stabilisation. It uses a large dataset covering all actual revenues and expenditures of the budget, over 16 years (from 2000 to 2015) in each Member State of the EU. It finds that, for every € 1000 difference in income per capita across the EU, € 9 is offset by lower contributions to the budget and € 3 is offset by higher expenditures by the budget; the overall equalising effect is small and mainly generated by the revenue side, in particular by the national contribution based on GNI and VAT. The budget is not particularly responsive to changing economic conditions: a fall in income per capita of € 1000 determines a reduction of € 8 in the per capita contribution paid to the common budget, while the expenditure side is irresponsive. The analysis also shows that the various corrections mechanisms applied over time to the revenue side of the budget have reduced its redistributive and stabilisation capacity.

Keywords European Union · Budget · Redistribution · Stabilisation

JEL Classification E61 · E62 · H11 · H61 · H77

The opinions expressed in this paper are the authors' alone and cannot be attributed to the European Commission. We are grateful to the editor and to two anonymous reviewers whose comments have improved the final version of this paper.

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1 Introduction

This paper studies to what extent the EU budget performs the functions of redistribution and stabilisation. Redistribution is considered here as net transfers operated through the budget, and it requires looking at both sides: revenues, in the form of contributions by the member states to the budget, and expenditures, in the form of payments by the common budget in each member state. Stabilisation is considered as the change in those transfers in relation to the change in income per capita. We use the concept of operating budgetary balance, however it is important to remember that this concept provides only a limited indication of all the possible benefits arising from EU policies, which go beyond the simple account of payments to and from the budget. It is just a proxy to perform a quantitative assessment of the redistributive and stabilisation capacity of the EU budget.

Some authors (Escolano et al. 2014) have explained that in most federations the functions of redistribution and stabilisation are primarily carried out by a federal budget through social security. In the EU this is not the case, since the common budget does not include social security, which remains mainly a national competence. It is important to acknowledge that redistribution and stabilisation are not primary objectives of the EU (Becker et al. 2017) and therefore of the EU budget, as only parts of it may have these specific aims; several policies financed by the EU budget do not have a redistributive or a stabilisation objective. Nevertheless, the budget does have a redistributive function, linked to the objective of promoting economic, social and territorial cohesion. This objective is explicitly defined in the Treaties[1] as the reduction of disparities between the levels of development of the various regions. It seems therefore relevant to study to what extent the budget performs this function, by analysing all items in the budget, in order to understand the main channels.

The normative discussion about how much redistribution a supranational budget in the EU should operate goes beyond the scope of this paper, as well as the discussion on how much macroeconomic stabilisation such a budget should provide, given the construction of the economic and monetary union. We limit our work to the assessment of the actual capacity of the current budget to perform these functions.

The analysis is based on the large dataset provided by the Directorate General for the Budget of the European Commission; it covers all 28 EU Member States, for a period of 16 years, spanning from 2000 to 2015, therefore including several multiannual financial frameworks (MFF). We use data for actual expenditures and revenues of the budget, not just the ex-ante committed figures, which are not the actual ones eventually paid. This is important, as much spending planned in a multiannual financial framework is actually spent later, in years which formally fall under another MFF.

In addition, this is the first analysis of this topic which disentangles the specific impacts of each component of the budget, on both the expenditure side and on the

[1] Articles 174–178 of the Treaty on the Functioning of the European Union (TFEU).

revenue side. We also provide the assessment of the net impact of the correction mechanisms applied to the budget (such as the famous British rebate and others) on its redistributive and stabilisation capacity. We do so by building a counterfactual EU budget, over the same period, without corrections applied to it, and then comparing the results.

The next section presents a review of the literature on the functions of redistribution and stabilisation performed by the EU budget. The paper then presents a quantitative assessment of the redistribution actually operated by the budget, as a share of EU's GDP, and shows its evolution over 16 years. It then compares the evolution of the redistributive capacity to the evolution of underlying divergences in the Union, and analyses how progressive this redistribution is, in terms of net operating balances compared to income per capita. In order to measure the net redistributive impact of the budget, then, the analysis measures the fiscal response of the EU budget to differences in income, analysing the contribution of both the revenue and expenditure sides. A detailed decomposition of both sides of the budget in their main components shows the exact contribution of each heading of expenditures and of each source of revenue to the overall redistributive capacity of the EU budget. The analysis then focuses on the responsiveness of the budget to changes in income, providing a first estimate of the actual stabilisation operated by the budget. The actual redistributive and stabilisation capacity of the budget is then compared with a counterfactual budget, as it would have been without the existing revenue correction mechanisms. This allows for a measurement of the net impact of the correction mechanisms on the redistributive and stabilisation capacity of the budget. The last section, finally, concludes.

2 Literature review

The role of public finances is linked to those functions that require an intervention by the public sector. As a subfield of public finance, the theory of fiscal federalism studied the vertical structure of the public sector, trying to define an appropriate division of functions among levels of government in order to align responsibilities and fiscal instruments with the proper level (Oates 1999). The traditional theory of fiscal federalism built on the notion of public goods, as developed by Samuelson (1954, 1955), on the definition of functions performed by public finances at different levels (Musgrave 1959), and on the so-called "decentralization theorem" suggesting that decentralized finance offers some potentially important opportunities for gains in social welfare (Oates 1972). A second generation of the theory on fiscal federalism included a broader consideration of the political conditions and of market incentives (Qian and Weingast 1997), of the evolution of federal structures over time, and of the stability and sustainability of institutions (Oates 2005).

The traditional functions of public finances (Musgrave 1959) refer to the capacity to correct various forms of market failure through a better resources allocation, to achieve an equitable distribution of income across the whole area, and to stabilize the macroeconomic system, while ensuring high levels of employment and price stability at the same time. The theories of fiscal federalism can be of some help to the

analysis of the EU budget, to the extent that they explore the roles of the different levels of government, the ways in which they relate to each other, and the criteria for allocating functions and instruments at the appropriate levels. However, it is also important to remind that there are important limitations in the application of these theories to the EU finances, given the extremely peculiar characteristics of the EU as a Union of countries that is not a federal state, where the degree of cohesiveness and of unity is much weaker than in other complete federations (Wyplosz 2016).

Because of the *sui generis* nature of the EU, the literature on the EU budget did not develop in light of the traditional theories of public finances and of fiscal federalism; however there are some attempts within this literature at studying the redistributive function of the budget. Studies have often focused primarily on the institutional analysis of the process of European integration (Laffan 2000; Laffan and Shackleton 2000; Benedetto 2017b). Scholars have often looked at the structure and at the evolution of the budget as a means to describe the political and institutional evolution of the EU (Enderlein et al. 2005; Lindner 2006; Benedetto and Hoyland 2007; Benedetto and Milio 2012; Bauer et al. 2016; Benedetto 2017a). As Citi (2015) notes, the marginal involvement of the EU in redistributive policies and its limited fiscal resources have led to a notable lack of attention towards the EU budget and its dynamics. Nevertheless, the recent availability of more detailed data on expenditures and revenues allows for studying and measuring general patterns of policy stability and change (Citi 2013).

Within this strand of literature, redistribution has been analysed mainly in terms of net balances vis-à-vis the common budget: most analyses focus on the redistribution operated between Member States, therefore on countries' net balances between payments to the EU budget and contributions received from it (Heinemann et al. 2008; Benedetto and Milio 2012; Citi 2017). Studies of the redistribution operated across countries then often find that the persistence in relative net positions has exasperated the cleavage between net contributors and net receivers of the budget (Lindner 2006), leading to "conflicts along distributional coalitions" (Bailer et al. 2015; Citi 2017). This concern is so strong that some have even proposed the introduction of a generalized correction mechanism (GCM) to avoid an excessively high burden for single countries by granting correction payments to the negatively affected countries through a partial reimbursement of their net contributions (Osterloh et al. 2009). The study of the capacity of the EU budget to provide some form of macroeconomic stabilisation, instead, is almost absent from this specific strand of literature.

The net balance approach, although useful, neglects some effects of the EU budget. First of all, there may be "positive sum effects" to the extent the allocation of the EU budget tackles public goods, achieves economies of scale and threshold effects, or addresses cross-border externalities (Le Cacheux 2012; Heinemann 2015; Monti et al. 2016). Secondly, it does not account for indirect effects and spillovers of actual spending operated in one country which may benefit economic agents based in other countries (Cipriani and Pisani 2004; Cipriani 2014; D'Apice 2015). Nevertheless, the operating net balances remain the main quantitative indicators to approach any analysis of the redistributive capacity of the EU budget.

In our work, we illustrate these balances as well, and we start our analysis from this indicator. However, in order to study the effective redistributive and stabilisation

capacity of the budget, it is not sufficient to simply describe the operating net balance of each country vis-à-vis the budget, as this does not take adequately into account income levels. If we intend to measure the net capacity of the budget to equalise income levels across the Union, we should look at per capita levels of income too, as changes in relative income matter in order to assess the net redistributive effect of the budget, each year in each country. The same applies to the analysis of the stabilisation capacity of the budget over time, which should be studied in relation to the changes in per capital levels of income. In other words we should analyse how much the common budget is able to reduce difference in income per capita among EU citizens and to smooth per capita income variation over time.

While the traditional literature on the EU budget has mainly focused on the description of net operating balances at country level, the general macroeconomic literature on redistribution and on stabilisation has instead used levels and changes of income per capita compared to net flows from the budget to study more precisely these functions. The literature on fiscal redistribution and stabilisation has generally taken the US as a reference to understand how a federal budget operates to perform those functions; it developed as a way to provide a reference in view of the establishment of the economic and monetary union in Europe (see for example Sachs and Sala-i-Martin 1992; Von Hagen 1992; Bayoumi and Masson 1995; who propose different approaches to quantify the role of fiscal transfers in the US for both redistribution and stabilisation).

We join this strand of literature by analysing the redistributive function of the EU budget, touching also upon its stabilisation properties, as previous research has attempted in the case of the US and of the EU (de la Fuente and Doménech 2001; Asdrubali and Kim 2008; Feyrer and Sacerdote 2013). These studies of the redistributive and stabilisation capacity of the EU budget based their empirical analyses on more limited datasets, therefore limiting the capacity to describe general patterns in the functioning of the EU budget. We can use now a larger one, spanning over several cycles, to perform the analysis.

Studies that base their assessment of the redistributive capacity of the EU budget on the description of the net operating balances at country level tend to suggest that the redistribution operated is actually important (Bauer 2001; Benedetto and Milio 2012; Citi 2017), while studies that go beyond and take into account the evolution of levels of income per capita tend to find lower net redistributive impacts (Asdrubali and Kim 2008; Feyrer and Sacerdote 2013).

By looking at the description of the net balances for each countries, Citi (2017) concludes that the EU budget operates significant redistribution and that despite the contrasts in the decision making process about the so-called "*juste retour*", this function has not been altered. Others have argued that the redistribution operated through the expenditure side of the EU budget, however, reflects more the relative voting power in the Council than the actual differences in relative prosperity (Groot and Zonneveld 2013).

D'Apice (2015) goes a bit beyond the description of net balances and complements the net national contributions to the budget with the total amount of resources that flow from net payers to net receivers for the EU as a whole. This way he provides an overview of the cross-border flows operated through the EU budget. He

finds that net flows are significant for the main beneficiaries of cohesion policy, but negligible for the EU as a whole; cross-border flows for the EU as a whole are low and amount to a quarter of a percentage point of the EU GDP, for each euro paid by an average net creditor, 75 cent are paid back and only 25 cent flows to other EU members states. de la Fuente and Doménech (2001) use a dataset which covers the years 1986–1998 and regress budget items on relative per capita income, finding a net redistributive effect of 5.76% of the difference between the gross per capita income of a typical European citizen and the EU average.

Asdrubali and Kim (2008) use a VAR approach to estimate the redistributive and stabilising capacity of the EU budget over the period 1976–2001; they find a lower redistributive effect than de la Fuente and Doménech (2001) at 2.5% of changes in country-specific GNP and a stabilisation capacity of 2.6% of shocks to Member States' GNP, achieved mainly through the agricultural fund. They also highlight that despite an increasing trend in both stabilization and redistribution, the period 1984–1993 witnessed a 'perverse' pattern, with funds accruing to countries whose GNP had relatively risen. Feyrer and Sacerdote (2013) find that transfers between countries within the EU are small, differences in EU spending levels are not significantly related to income (as also suggested by Mattila 2006) and that given the small size the EU budget is incapable of significant macroeconomic stabilisation.

To sum up, redistribution through a common budget is inherently conflictual, but at the same time it is one of the most politically salient policies (Citi 2017). The degree of redistribution operated through the EU budget has often been studied through the simple measurement of the net financial position of each country vis-à-vis the common budget, leading to the pervasive logic of "*juste retour*" (Benedetto 2017a). However, in order to draw a more precise picture of the redistributive capacity of the EU budget as a supranational budget, it is useful to analyse also its capacity to reduce difference in income per capita among EU citizens. This is the purpose of this paper, which looks also at the capacity of the budget to smooth variations in per capita income over time, i.e. its stabilisation capacity.

Our results, obtained by applying a similar methodology to de la Fuente and Doménech (2001) and to Feyrer and Sacerdote (2013), but with a considerably larger dataset in terms of time and countries covered, confirm that the net redistribution and stabilisation achieved by the EU budget in terms of equalisation and smoothing of income per capita are low.

3 How much does the EU budget redistribute?

The EU budget accounts for roughly 1% of the Union's GDP. Almost 80% of it, on average, returns back to each country in the form of various allocated expenditures,[2] and only a limited part is actually redistributed among countries. On average over the past 16 years, the redistribution operated by the budget at the level of the EU was equal to 0.2% of the Union's GDP. As a matter of comparison, the average yearly

[2] Data available at: http://ec.europa.eu/budget/figures/interactive/index_en.cfm.

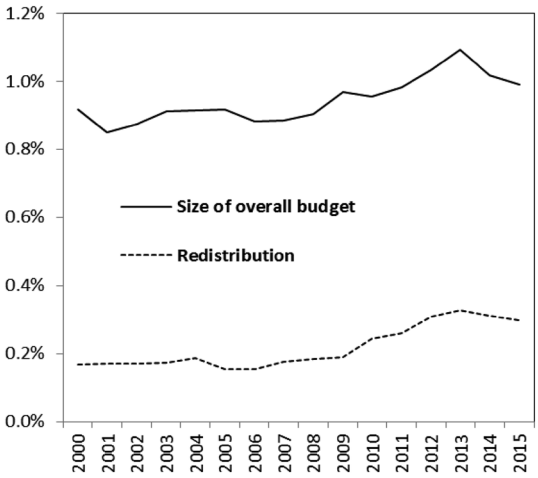

Fig. 1 Redistribution operated by the EU budget in % of EU GDP Source: Own elaboration on European Commission data

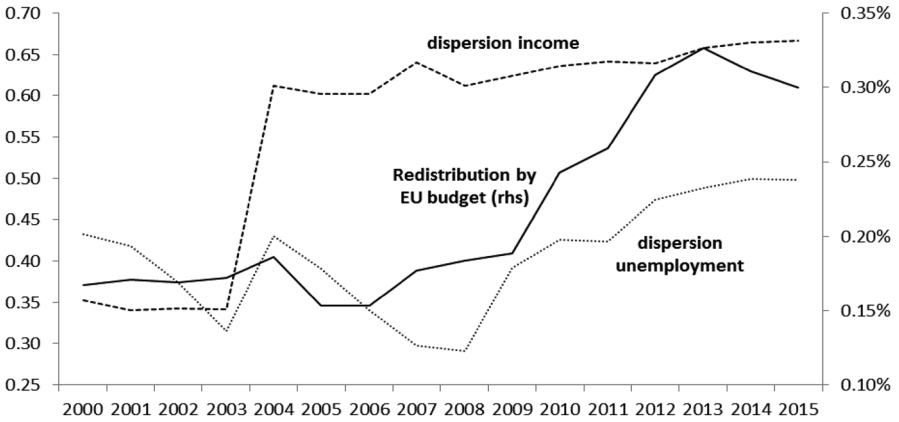

Fig. 2 Divergences and redistribution in the EU Source: Own elaboration on Eurostat and DG Budget data

cross-border flows operated through the federal budget in the US[3] is equal to 1.5% of GDP (D'Apice 2015).

The amount redistributed in the EU, however, has increased over time, reaching 0.3% in the recent years. Out of a total amount of expenditures of 145 billion euros in 2015, the sum of all negative net operating balances (a measure of actual redistribution operated by the net contributors to the budget towards the net beneficiaries) amounted to 43.5 billion euros, i.e. 30% of the budget, or 0.3% of EU GDP (Fig. 1).

[3] Over the period 1980–2005.

The increase in cross-country flows operated by the EU budget has gone in parallel with an increase in divergences[4] within the Union. Figure 2 shows that divergences have increased within the EU in terms of income per capita and unemployment rates. As one would expect, the sharp increase in the dispersion of income per capita was determined by the large accession in 2004 of ten new member states, with a lower level of income per capita. The increasing dispersion in unemployment rates, instead, is rather a consequence of the economic crisis, and it started in 2009 with a more gradual although constant path.

The redistribution operated by the EU budget through cross-country flows (right scale in the figure) did not increase immediately after the accession of new member states, but it is rather the effect of the first multiannual financial framework (2007–2013) established after the enlargement.

4 How progressive is this redistribution?

Countries transfer a certain amount of resources to the budget, in various forms of contributions, and receive in turn payments, in various forms of expenditures. Our dataset covers the entire period of 16 years, from 2000 to 2015, and provides a detailed breakdown of countries' contributions to the budget and of expenditures by the budget in each country. This allows for a calculation of the so-called net operating balance for each country, each year.

The first step in this analysis is to calculate for each country the net operating balance per capita. Then, in order to assess how progressive this system is, we can compare the per capita net operating balance of each country with its level of income per capita. Full progressivity would imply a perfect negative correlation between the two measures, i.e. countries with higher income per capita having a lower net operating balance.

The relation is indeed negative, implying a certain degree of progressivity; in order to measure it more precisely we should look at the coefficients of correlation. Since we want to measure the progressivity of the net balances of the budget, we should look for a negative correlation with the levels of income per capita; a perfect progressivity would imply a coefficient of -1.

The Pearson coefficient[5] shows that the relation becomes stronger from 2004 onwards, reflecting the big enlargement to ten new member states, whose relative income was lower than those already in. This tendency towards a stronger correlation and higher progressivity, however, stops in the recent years.

[4] Measured by the Coefficient of Variation (C_V) which is defined as the ratio of the Standard Deviation (σ) to the Mean (μ): $C_V = \sigma/\mu$.

[5] Pearson coefficient: $= \frac{\sum obby - \frac{(\sum obb)(\sum y)}{16}}{\sqrt{\left(\sum obb^2 - \frac{(\sum obb)^2}{16}\right)\left(\sum y^2 - \frac{(\sum y)^2}{16}\right)}}$, where *obb* is the net operating balance per capita and *y* is income per capita, of each country in each year.

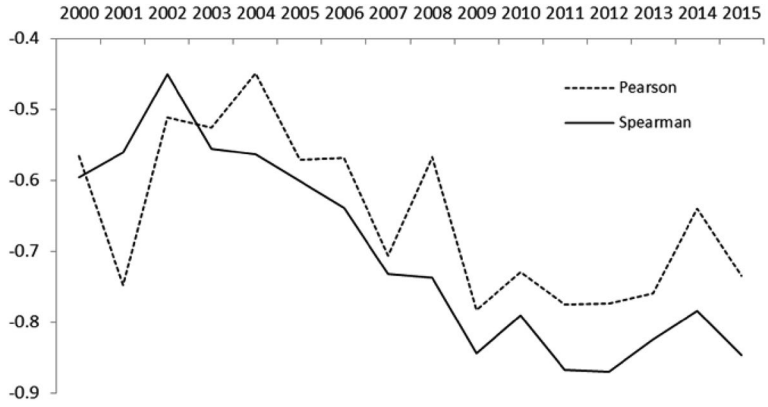

Fig. 3 Evolution of correlations: per capita income and operating budget balance per capita Source: Own elaboration on Eurostat and DG Budget data

A more in depth observation, though, suggests that this reduced progressivity of the last years is driven by an outlier, Luxemburg,[6] which in 2014 becomes a net beneficiary. Therefore, we can use a non-parametric coefficient, the Spearman coefficient,[7] which is less sensitive about the outliers. In this case, in fact, the correlation is stronger (Fig. 3).

We can conclude that the net balance between expenditures by and contributions to the budget was moderately progressive before the big enlargement of 2004; the inclusion of new member states with significantly lower levels of income per capita changed this situation, making the budget more progressive; but this trend towards more progressivity has however stopped in recent years. If we stopped our analysis here, we could conclude that the fact that richer countries have a negative net financial position vis-à-vis the budget indicates that the budget operates a certain degree of redistribution.

5 What is the overall redistributive impact of the EU budget?

In order to properly measure the redistributive capacity of the EU budget, however, it is worth looking beyond the accounting of how much it redistributes, and trying to measure its net impact. In order to do so, we have to consider both the revenue side and the expenditure side, since each of them plays a role in the actual redistribution operated.

[6] Luxembourg's net position fluctuates quite significantly over time because, given its small size, a significant payment to or from the EU budget can substantially affect the resulting net balance (this is the case of expenditures linked to the "Galileo" project in 2014).

[7] Spearman coefficient: $= 1 - \frac{6\sum b_i^2}{16(16^2-1)}$, where b is the difference between the ranks of corresponding values *obb* and *y*.

Table 1 Levels of expenditures and contributions per capita on income per capita

	Expenditures p.c.	Revenues p.c.
Levels of income per capita	− 0.0027** (0.001)	0.0085*** (0.000)
Constant	294.6*** (24.9)	13.9** (5.0)
Observations	381	381
Rsq	0.028	0.752

The panel is composed by annual data per country per year from 2000 to 2015. Robust standard errors are in brackets. Significance levels: ***p < 0.001; **p < 0.01; *p < 0.05

Following an analysis done for the US, by Feyrer and Sacerdote (2013), we apply a similar methodology, by reducing all variables to per capita levels, and then comparing them. The larger and more detailed dataset of expenditures and revenues of the EU budget allows for a more comprehensive analysis over a longer time period compared to previous studies in the literature (de la Fuente and Doménech 2001; Asdrubali and Kim 2008; Feyrer and Sacerdote 2013).

A first step of the analysis consists in estimating two similar equations, in order to disentangle the redistributive effect of the revenue side of the budget and of the expenditure side. The first set of equations to be estimated is:

$$\mathrm{EXP}_{ct} = \alpha - \eta \mathrm{Y}_{ct} + \varepsilon_{ct} \tag{1}$$

$$\mathrm{REV}_{ct} = \alpha + \theta\, \mathrm{Y}_{ct} + \varepsilon_{ct} \tag{2}$$

The independent variable is income per capita, and the analysis tests to what extent expenditures and revenues per capita are responsive to it. All variables are expressed in euros per capita. *EXP* indicates expenditures per capita, *REV* indicates revenues per capita paid by each country to the budget, and *Y* indicates income per capita. We chose income per capita as regressor in order to measure how expenditures and revenues of the EU budget relate to relative living standards, as in Feyrer and Sacerdote (2013).

Then, α is the constant, η is the coefficient we want to measure in the case of expenditures and has a negative sign because redistribution occurs if expenditure is inversely correlated with income per capita, θ is the coefficient we want to know in the case of revenues and has a positive sign because redistribution occurs if revenues paid are positively correlated with income per capita, *c* indicates countries, *t* indicates years, and finally ε is the error term.

The equations are estimated by weighted least squares, weighting the observations by population size[8] in order to give to each per capita level the appropriate weight, as in de la Fuente and Doménech (2001). The similar methodology applied to the study of the US budget by Feyrer and Sacerdote (2013) did not account for this specific control, but given that the heterogeneity of EU countries

[8] Population weights are the shares of countries' population in the total EU population, and they are updated every year for every country.

in terms of population size is significantly higher than in the US, this step is particularly important to obtain reliable results. The specific case of Luxemburg, in fact, would jeopardise the credibility of the results: Luxembourg is a very small country, which in spite of having the highest income per capita in the EU is also a big recipient of EU expenditures, of administrative ones in particular, because it hosts several offices of the institutions. Its position as an outlier would alter the results, if we did not control for the dimension of the countries.

Table 1 presents the results of the two first equations:

First of all, we observe that the explanatory capacity of the model is much lower for the expenditure side, which implies that income is not a very relevant variable in the allocation of expenditures of the budget. The revenue side, instead, can be explained to a large extent by levels of income, which is certainly due to the fact that its largest component is actually based on GNI.

Interestingly, both expenditures and revenues of the EU budget are significantly related to per capita income levels, although with small coefficients. In particular, for every euro in level difference in income per capita across EU countries 0.85 cent is offset by lower contributions paid to the common budget and 0.27 cent is offset by higher expenditures paid by the budget. Overall, the total equalising effect of the EU budget is 1.12 cent per each euro difference, i.e. in percentage terms 1.1%. As a matter of comparison, Feyrer and Sacerdote (2013) find that in the US the equalising effect of the federal budget is 40%, i.e. 35 times higher.

Our dataset allows for a greater level of detail in this analysis, by decomposing this overall effect into the different categories of expenditures and revenues. The expenditure side of the budget is composed by five main headings, the revenue side by two broad categories. On the basis of the following identity:

$$\mathrm{EXP} - \mathrm{REV} = (\mathrm{H1a} + \mathrm{H1b} + \mathrm{H2} + \mathrm{H3} + \mathrm{H4} + \mathrm{H5}) - (\mathrm{TOR} + \mathrm{NC}) \tag{3}$$

A set of parallel equation for each side of the budget can be estimated, disentangling the specific contribution of each of them to the overall redistributive effect of the budget.

5.1 The expenditure side

The expenditure side is composed by five headings, the first of which can be further broken down into two main categories. The Headings are:

- Heading 1a: Competitiveness for growth and employment
- Heading 1b: Cohesion
- Heading 2: Preservation and management of natural resources
- Heading 3: Citizenship, freedom, security and justice
- Heading 4: EU as global player
- Heading 5: Administration
- other

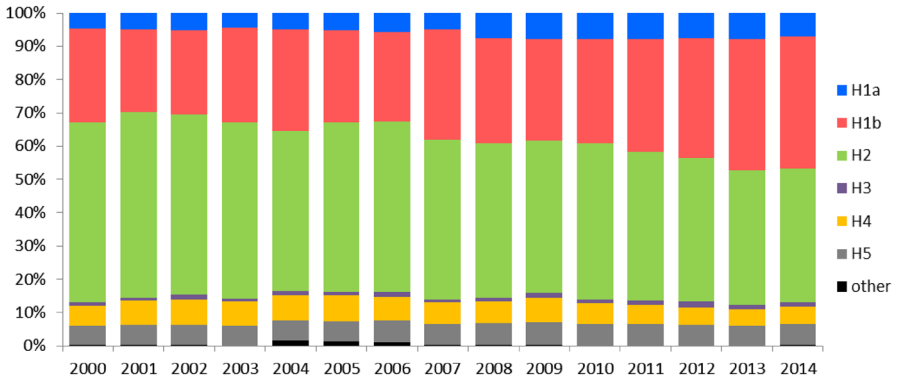

Fig. 4 Total expenditures per Heading (2000–2014) Source: European Commission, DG Budget data

The largest part of the heading "Competitiveness for growth and employment" is used to finance the framework programme for research and innovation, currently known as "Horizon 2020", which is allocated through competitive tendering without any predefined allocation across countries. This heading also includes large infrastructure projects[9] and the "Connecting Europe Facility" programme.[10]

The heading "Cohesion" includes all the funds for cohesion policy, namely the European Regional Development Fund, the European Social Fund, as well as the Cohesion Fund, and is one of the largest in the budget. These funds are managed in conjunction with national and regional authorities, by means of agreed operational programmes which are negotiated at the beginning of each multiannual financial framework by the Commission and the national and regional governments.

The heading "Preservation and management of natural resources" includes the funds related to the Common Agricultural Policy, namely the European Agricultural Fund for Rural Development and the European Agricultural Guarantee Fund, which is composed by market related expenditures and direct payments. This is the other major heading of the budget.

The heading "Citizenship, freedom, security and justice" is a relatively smaller one, but includes important categories such as the funds for asylum and migration policies, those for internal security, and for justice, rights, citizenship, culture. These funds are managed in different ways, part in conjunction with the member states through operational programmes, part through decentralised agencies, and part directly by the European Commission.

The heading "EU as global player" mainly finances external relations and development aid devoted to third countries. Most of the expenditures under this heading are directed towards third countries, outside the EU; however a small amount is also dedicated to help pre-accession countries achieve a minimum degree of convergence with EU countries. In the equivalence between past financial framework and the

[9] Such as Galileo, ITER and Copernicus.

[10] More info at: https://ec.europa.eu/inea/en/connecting-europe-facility.

present one, those funds have also been included under this heading. This is relevant in explaining our results because the member states which joined the EU in 2004 (and 2007) still benefitted by some expenditures under this heading after the accession. These expenditures eventually phased out after some years. This explains why this heading is relevant to our analysis.

Finally, the fifth heading finances all administrative expenditures related to the functioning of the institutions. In each multiannual financial framework (MFF), which covers 7 years, the name and the content of the headings may change, so that there might be apparently no precise correspondence of each heading with those of the previous MFF. In reality, however, there is a correspondence of the types of expenditures at a lower level of disaggregation. In order to ensure perfect comparability of each heading over time, we have used the correspondence that the Directorate General for the Budget of the European Commission uses. This way we are able to present the evolution of the expenditures over time for all types of expenditures of each heading, under the current denomination. The yearly following figure then shows the distribution of the total expenditures per heading (Fig. 4).

The category "other" is a temporary heading which includes reserves and compensatory payments relating to the expansion of the EU; it is basically insignificant for our analysis. The set of parallel equations to be estimated therefore becomes:

$$\mathrm{H1a}_{ct} = \alpha - \eta_{1a}\mathrm{Y}_{ct} + \varepsilon_{ct} \tag{4}$$

$$\mathrm{H1b}_{ct} = \alpha - \eta_{1b}\mathrm{Y}_{ct} + \varepsilon_{ct} \tag{5}$$

$$\mathrm{H2}_{ct} = \alpha - \eta_{2}\mathrm{Y}_{ct} + \varepsilon_{ct} \tag{6}$$

$$\mathrm{H3}_{ct} = \alpha - \eta_{3}\mathrm{Y}_{ct} + \varepsilon_{ct} \tag{7}$$

$$\mathrm{H4}_{ct} = \alpha - \eta_{4}\mathrm{Y}_{ct} + \varepsilon_{ct} \tag{8}$$

$$\mathrm{H5}_{ct} = \alpha - \eta_{5}\mathrm{Y}_{ct} + \varepsilon_{ct} \tag{9}$$

where H indicates each heading of the budget, c indicates countries, t indicates years, α is the constant, η is the coefficient we want to measure in the case of each heading and has a negative sign because redistribution occurs if expenditure is inversely correlated with income per capita, and ε is the error term.

If the analysis is correct, then the sum of all significant specific coefficients η_i of each heading should equal the overall coefficient η found for the total expenditures, in formula:

$$\eta_{1a} + \eta_{1a} + \eta_2 + \eta_3 + \eta_4 + \eta_5 = \eta \tag{10}$$

The following table shows the results (Table 2).

First of all we can see that only Heading 1a, Heading 1b, Heading 4 and Heading 5 are significantly correlated with income levels. This means that Heading 2 and Heading 3 spending have no significant relation with levels of income per capita, which in fact has an almost zero explanatory power in these two cases. Interestingly, Heading 2 which is the largest one has no redistributive impact. The reason is probably that funds for "preservation and management of natural resources", mainly

Table 2 Per capita expenditures per heading on income per capita

	H1a p.c. Competitiveness	H1b p.c. Cohesion	H2 p.c. Natural Resources	H3 p.c. Internal Policies	H4 p.c. Global Europe	H5 p.c. Administration
Level of income per capita	0.0008*** (0.000)	− 0.0052*** (0.001)	− 0.0001 (0.000)	0.0000 (0.000)	− 0.0003*** (0.000)	0.0021*** (0.001)
Constant	− 4.1** (1.3)	211.6*** (17.4)	114.5*** (9.2)	2.0*** (0.4)	8.7*** (1.6)	− 41.8*** (10.4)
Observations	381	381	381	381	381	381
Rsq	0.264	0.313	0.000	0.007	0.239	0.045

The panel is composed by annual data per country per year from 2000 to 2015. Robust standard errors are in brackets. Significance levels: ***$p < 0.001$; **$p < 0.01$; *$p < 0.05$

including the Common agricultural policy and the funds for rural development and fisheries, operate a sectoral redistribution. In any case, they are not a significant source of equalisation of per-capita income across countries.

Income levels, instead, seem to have certain relevance for the other four headings, which have a statistically significant redistributive impact. The first thing to notice is that this impact does not go in the same direction for the four headings. As previously mentioned, redistribution occurs when expenditures are inversely related to income levels, therefore Heading 1b and Heading 4 have a positive redistributive effect, but this effect is partially offset by Heading 1a and Heading 5, which have a negative redistributive effect.

More in detail we can see that, as one would expect, Heading 1b, which finances cohesion policy, has a redistributive effect of € 0.0052 per each euro difference, in per capita terms. This effect is reinforced by Heading 4, which adds another € 0.0003. It is worth remembering that expenditures under Heading 4 are mainly directed to third countries, outside the EU. However, a small amount is also dedicated to help pre-accession countries achieve a minimum degree of convergence with EU countries; this is relevant to explain our results because the member states which joined the EU in 2004 (and 2007) still benefitted by some expenditures under this heading after the accession. Such delayed disbursement of aid under Heading 4 explains why it has a significant correlation with income per capita in the period considered.

The two positive effects of Heading 1b and 4 are partially counteracted by Headings 1a and 5. These have in fact a significant but positive correlation with income levels, which means they actually redistribute from lower incomes to higher ones, although to a very limited extent. Heading 1a, in particular, per each euro difference in income per capita exacerbates this difference by € 0.0008, and Heading 5 by € 0.0021. It is worth remembering, however, that the objective of these two heading is not the one of cohesion, equalisation, or redistribution. This is particular evident from the very low explanatory capacity of the regression model for Heading 5. These headings fund different policies, not related to the objective of cohesion, which have as a side effect a small but significant distributional impact.

The sum of all the effects of the various headings perfectly equals the estimated overall impact of the expenditure side of the budget, i.e. € 0.0026 per each euro difference of income per capita.

5.2 The revenue side

The revenue side of the budget can be decomposed in two broad categories[11]: the traditional own resources and the national contributions. The first category mainly consists

[11] The different types of own resources and the method for calculating them are set out in a Council Decision on own resources (http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32007D0436). It also limits the maximum annual amounts of own resources that the EU may raise during a year to 1.23% of the EU gross national income (GNI). For a careful review of the system of own resources and of its evolution over time, see Benedetto (2017a).

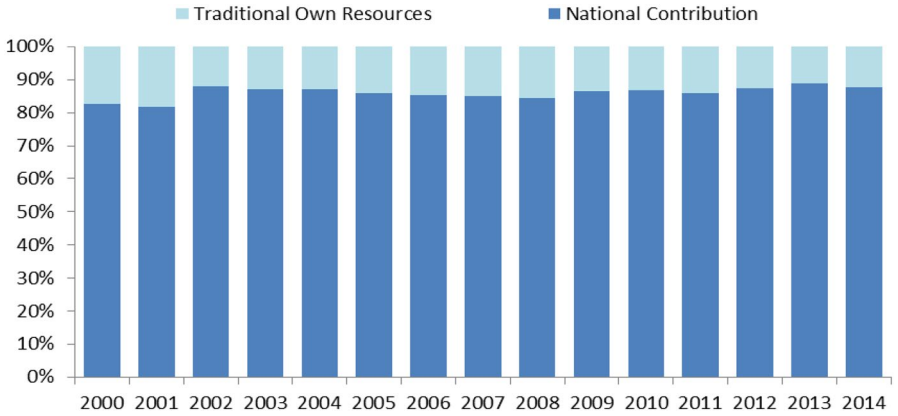

Fig. 5 Sources of revenues (2000–2014) Source: European Commission, DG Budget data

Table 3 Redistributive impact of the sources of revenue

	National contribution p.c.	Own resources p.c.
Levels of income per capita	0.0070*** (0.000)	0.0015*** (0.000)
Constant	21.1*** (4.9)	− 7.3*** (1.8)
Observations	381	381
Rsq	0.701	0.316

The panel is composed by annual data per country per year from 2000 to 2015. Robust standard errors are in brackets. Significance levels: ***p < 0.001; **p < 0.01; *p < 0.05

of customs duties on imports from outside the EU and sugar levies; member states keep 25% of the amounts as collection costs. The second category consists of resources based on the value added tax (VAT), whereby a uniform rate of 0.3% is levied on the harmonised VAT base of each member state, and a national contribution based on their gross national income (GNI), whereby each country transfers a standard percentage of its GNI to the EU. Although originally designed to cover the balance of total expenditure not covered by the other own resources, the GNI-based resource has become the largest source of revenue of the EU budget. The following figure shows the evolution of these two broad categories over the past 15 years (Fig. 5).

It is important to notice, for the purpose of this analysis, that "traditional own resources" in spite of being by definition resources of the EU budget can also be ascribed to the member state that collects them, as our database actually does. This allows including them into the analysis. In order to test the contribution that each of the two main components to the overall redistributive impact of the revenue side of the budget, two parallel equations are estimated:

$$\mathrm{TOR}_{ct} = \alpha + \theta_{tor}\mathrm{Y}_{ct} + \varepsilon_{ct} \tag{11}$$

$$\mathrm{NC}_{ct} = \alpha + \theta_{nc}\mathrm{Y}_{ct} + \varepsilon_{ct} \tag{12}$$

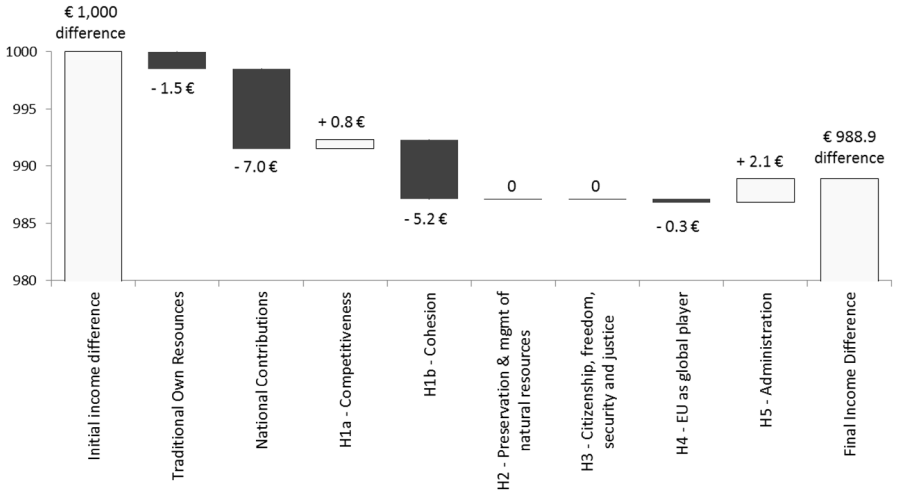

Fig. 6 Decomposition of the net redistributive impact of the EU budget Source: Own elaboration. Explanatory note: figures are expressed in € per capita, per each 1000 euro difference in levels of income per capita. Expenditures are composed by the five Headings. National contribution plus own resources compose the total revenues. The panel is composed by annual data per country per year from 2000 to 2015

where *TOR* indicates the traditional own resources ascribed to each country in per capita terms, *NC* indicates the national contributions paid by each country in per capita terms, *c* indicates countries, *t* indicates years, α is the constant, θ is the coefficient we want to measure in the case of each source of revenue and has a positive sign because redistribution occurs if revenues paid are is positively correlated with income per capita, and ε is the error term.

If the analysis is correct, then the sum of the two specific coefficients θ_i of each source of revenue should equal the overall coefficient θ found for the total revenues, in formula:

$$\theta_{tor} + \theta_{nc} = \theta \tag{13}$$

The following table shows the results (Table 3).

First of all we see that both sources of revenues are significantly and positively correlated with income levels, and this means that both have a positive redistributive impact. The national contribution in particular has the strongest redistributive impact (€ 0.0070 per each euro difference). Even if we compare with each of the headings on the expenditure side, the national contribution stands out as the most important source of redistribution in the budget. The own resources have a much smaller equalising potential. The sum of these two effects perfectly equals the estimated overall impact of the revenue side of the budget, i.e. € 0.0085 per each euro difference of income per capita.

Table 4 Changes of expenditures and revenues per capita on income per capita

	Δ Expenditures p.c.	Δ Revenues p.c.	Δ National contribution p.c.	Δ Own resources p.c.
Change in income per capita	0.0019 (0.001)	0.0087** (0.003)	0.0072** (0.003)	0.0015*** (0.000)
Constant	4.5* (2.3)	0.3 (2.4)	0.9 (2.4)	− 0.6 (0.4)
Observations	353	353	353	353
Rsq	0.003	0.133	0.099	0.102

National contribution plus own resources compose the total national contribution. The panel is composed by annual data per country per year from 2000 to 2015. Robust standard errors are in brackets. Significance levels: ***p < 0.001; **p < 0.01; *p < 0.05

5.3 The aggregate effect

We can finally obtain the figure of the overall redistributive effect of the EU budget by aggregating all components on the expenditure and revenue sides. The following figure shows the redistributive effect of each component, per each 1000 euro difference in levels of income per capita (Fig. 6).

For every € 1000 difference in levels of income per capita the EU budget offsets only €11, i.e. an equalising effect of 1.1%. As a matter of comparison, Feyrer and Sacerdote (2013) find that in the US the equalising effect of the federal budget is 40%, i.e. 35 times higher. The main source of redistribution comes from the revenue side and is the national contribution. This is quite consistent with the notion that the contribution based on GNI and VAT is the most related to income levels.

On the expenditure side, the main contribution to redistribution comes from cohesion policy, as one would expect, although to a lesser extent than the national contribution. Still on the expenditure side, the largest item of the budget, Heading 2, has no significant redistributive impact in terms of equalisation of income levels across countries; this is probably due to its nature of sector-specific instrument. Finally, some categories of expenditures, such as those for competitiveness and administration, have a negative, although small, redistributive impact, partially offsetting the positive impacts of the other components.

6 How responsive is the budget to changes in economic conditions?

In order to answer to this question, the analysis must focus on changes, rather than levels, of revenues and expenditures per capita of the EU budget and test to what extent they are related to simultaneous changes in income per capita over time. This allows testing the responsiveness of the budget to changing economic conditions. The equations to be estimated for the comparison of changes become the following:

$$\Delta \mathrm{EXP}_{ct} = \alpha - \eta' \Delta \mathrm{Y}_{ct} + \varepsilon_{ct} \tag{14}$$

$$\Delta \mathrm{REV}_{ct} = \alpha + \theta' \Delta \mathrm{Y}_{ct} + \varepsilon_{ct} \tag{15}$$

where Δ indicates the changes, and the other elements are the same as above. The results show that the expenditure side of the budget is not at all responsive, while revenues are. We then replicate the analysis at a more detailed level to test the behaviour of each component, and find that none of the Headings on the expenditure side is responsive to changing in income per capita, while both sources of revenue are. The following table shows the detailed results (Table 4).

First of all, the whole model in all specifications has a much lower explanatory capacity compared with the analysis of levels, as proved by the very low R squared. This is consistent with the notion that the EU budget in general is not very responsive to changes in income.

Second, changes in expenditures per capita are not at all significantly correlated with changes in income per capita, only changes in contributions are. A one euro fall in per capita GDP determines a € 0.0087 reduction in the per capita contribution by a country to the common budget. As a matter of comparison, the same reduction in taxes paid by states to the federal budget in the US, associated to a one dollar reduction in income per capita, is $ 0.253 (Feyrer and Sacerdote 2013), i.e. the responsiveness of the US federal budget is 30 times higher.

Third, when assessing separately the responsiveness of each of the two components in which total contributions can be broken down, we observe that both are significantly associated to changes in income per capita, and the above mentioned € 0.0087 reduction in per capita contribution, linked to a one euro fall in income per capita, is composed by a € 0.0072 reduction of the "national contribution" and a € 0.0015 reduction in the "traditional own resources" per capita, across the EU. This confirms the intuition that the "national contribution", being based on GNI and on VAT, is more responsive to cyclical conditions than the traditional own resources, and is the single most responsive component of the whole budget.

Overall the results of this analysis confirm the notion that the EU budget is rather irresponsive to changing economic conditions, so its capacity to perform macroeconomic stabilisation is extremely low. The expenditure side is the least flexible one, due to its structure. The only source of stabilisation is on the revenue side, and it is mainly due to the national contribution based on GNI and VAT.

7 What is the net impact of the correction mechanisms?

The EU budget has a number of correction mechanisms granted to some member states. The first correction mechanism was introduced in 1985 to correct the imbalance between the UK's share in payments to the budget and its share in the expenditures.[12] The cost of the UK rebate is divided among EU Member States in proportion

[12] This mechanism has been modified on several occasions to take account of changes made to the system of EU budget financing, but the essential principles remain the same. The idea is that the UK is to be reimbursed by 66% of the difference between its contribution and what it receives back from the budget. However, expenditure under Heading 4 and non-agriculture expenditure (primarily Heading 1b) in Member States which joined the EU after 2004 are not included in its calculation. Excluding these, the rebate is 66% of the difference between the UK share of expenditure and the UK's share of the EU's VAT take. For a complete explanation of the correction mechanisms applied to the EU budget, see Benedetto (2017a) and Citi (2017).

Table 5 Net impact of corrections on the redistributive capacity Source: Own elaboration

	Actual budget	Budget without corrections	Net impact of corrections	% Change
Cross-border flows (% of EU GDP)	0.21%	0.22%	− 0.01%	− 5
Equalising effect (in € cents per capita)	1.12	1.25	− 0.13	− 10
Responsiveness (in € cents per capita)	0.87	0.97	− 0.10	− 10

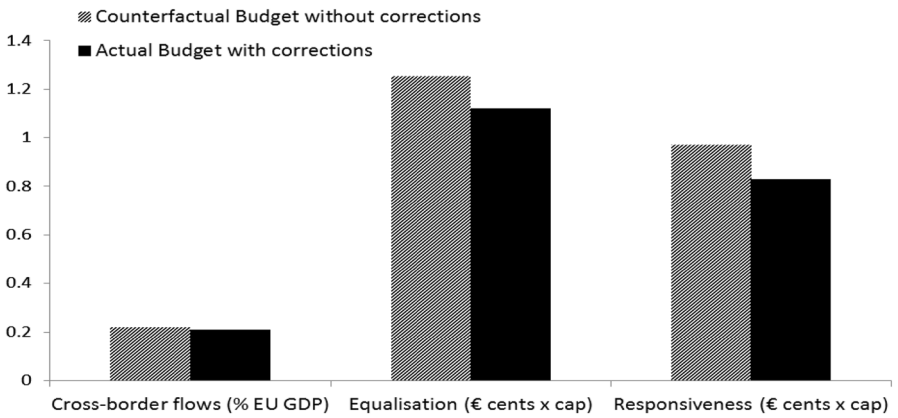

Fig. 7 Redistributive capacity of the budget with and without correction mechanisms Source: Own elaboration

to the share they contribute to the EU's GNI. However, Germany, The Netherlands, Austria and Sweden, who considered their relative contributions to the budget to be too high, pay only 25% of their normal financing share of the UK correction.

Denmark, Ireland and the UK have also an exemption from financing certain specific parts of freedom, security and justice policies. The Netherlands and Sweden benefit from gross reductions in their annual GNI contribution through lump-sum payments. Finally Germany, The Netherlands, Austria and Sweden benefit from reduced rates of call for the VAT own resource.[13]

Altogether these correction mechanisms tend to reduce the contributions some countries pay to the budget. It is possible to measure their impact on the redistributive and stabilisation capacity of the budget by building a counterfactual budget, without these corrections, and comparing its effects to the actual one. First of all, the counterfactual budget is constructed by subtracting all corrections granted each year to each country, with the respective contributions paid by the others. As a second

[13] Reduced VAT call rates for Austria (0.225%), Germany (0.15%), the Netherlands and Sweden (0.1%), with the Own Resources Decision of 2014, lump sums are since 2014 payable to Netherlands, Austria, Sweden, and Denmark, while Netherlands, Austria, Sweden and Germany also pay VAT call rate of 0.15%. There is also the so-called "rebate on the rebate", whereby Germany, the Netherlands and Sweden are exempted from 75% of their contribution towards the UK's rebate. For a complete explanation of the correction mechanisms applied to the EU budget, see Benedetto (2017a) and Citi (2017).

step, the same analysis as above is repeated, calculating the redistributive capacity of the new counterfactual budget as well as its responsiveness. Finally, the results obtained this way are compared with the previous ones, based on the actual budget. The results[14] show that indeed the corrections have a significant net impact in reducing the redistributive and stabilisation capacity of the budget, on the revenue side (Table 5).

The actual cross-border flows in percentage of EU GDP operated by the budget decrease by 0.01%; the equalising effect of the budget is reduced by 0.13 € cents per each euro difference; the responsiveness to changes in income is reduced by 0.10 € cents per each euro change over time (Fig. 7).

The redistributive and stabilisation capacity of the budget are therefore reduced by the mechanism of corrections applied to it. Given the already limited capacity of the budget previously illustrated, these small impacts have a non-negligible effect: cross-border flows are diminished by 5%, the equalising effect (redistribution) is diminished by 10%, and the overall responsiveness (stabilisation) is reduced by 14% compared with a scenario without corrections.

8 Conclusion

This analysis has provided a detailed estimation of the redistributive and stabilisation capacity of the EU budget. The starting point is that over the past 15 years on average about 20% of the budget has been redistributed through cross-country flows, while 80% has returned to the same member state. The redistribution operated corresponds to 0.2% of EU GDP; however, this has increased up to 0.3% in the most recent years. The increase in redistribution, although limited, corresponds to a parallel increase in divergences within the EU, both in terms of income per capita and unemployment rates.

The difference between what each country contributes to the budget and what it gets from its expenditures, the so-called operating budget balance, has become more correlated with levels of relative prosperity, as measured by income per capita. The big enlargement of 2004 to new member states, with significantly lower levels of income per capita, considerably increased the progressivity of the budget; this trend towards more progressivity has however stopped in most recent years.

The analysis then provides an estimation of the net redistributive impact of the EU budget: for every € 1000 in level difference in income per capita across EU countries, € 9 is offset by lower contributions paid to the common budget and € 3 is offset by higher expenditures paid by the budget. Overall, the total equalising effect of the EU budget is very small, around 1.1%. As a matter of comparison, in the US the equalising effect of the federal budget is 40%, i.e. 35 times higher.

The main source of redistribution comes from the revenue side and is the national contribution based on GNI and VAT. On the expenditure side, the main source of redistribution comes from cohesion policy, the largest item (Heading 2) has no

[14] For the detailed results of the regression analysis see the appendix.

significant redistributive impact, and some categories, such as competitiveness and administration, have a negative, although small, redistributive impact, partially offsetting the positive impacts of the other components.

As for the stabilisation capacity, we observe that the EU budget is not particularly responsive to changing economic conditions; changes in expenditures per capita are not significantly correlated with changes in income per capita over time, only revenues are. A fall in income per capita of € 1000 determines a reduction of € 8 in the per capita contribution paid to the common budget. As a matter of comparison, the responsiveness of the US federal budget is 30 times higher. The most responsive part of the budget is on the revenue side, and it is the national contribution based on GNI and VAT. This is the most responsive component to changes in income, therefore the main source of stabilisation in the EU budget.

The analysis has also shown that the various corrections mechanisms applied to the budget reduce its redistributive and stabilisation capacity. The net impact is quite small, but non negligible given the already limited capacity of the budget, both in terms of equalisation of income levels and of responsiveness to income changes.

The extent to which these results suggest policy recommendations depends on the extent to which the redistributive and stabilisation function of the EU budget are considered relevant. The recent debate on the future of the EU budget has focused on options to reform the system of revenues, in particular the system of own resources (Heinemann et al. 2008; Monti et al. 2016) and on possible new types of expenditures, pursuing new priorities (Heinemann et al. 2010; Tarschys, 2011; Becker et al. 2017).

On the revenue side, one of the key proposals discussed is to reduce the relative importance of the GNI resource to include new revenues with steering effects on key policy priorities (Monti et al. 2016). This can certainly help to reorient the budget towards political goals and probably also to reduce national concerns about net balances. However, such a reform should also carefully assess the possible substitution of the national contribution based on GNI with another source of revenue: the results of our analysis show that the national contribution based on GNI is the main source of redistribution (and also of stabilisation) of the budget, its reduction could reduce the already minimal capacity of the budget to perform these functions. The key parameter to consider, then, would become the tax base chosen for the new source: if it is a highly cyclical base, the loss of redistributive and stabilisation capacity could be mitigated.

On the expenditure side, the evolution of the budget towards new emerging priorities may imply also a shift from pre-allocated expenditures, towards non-pre-allocated ones. This possible shift brings significant redistributive effects: our analysis in fact shows that a pre-allocated part of the budget (such as Heading 1b) has the most significant redistributive effect, while some non-pre-allocated parts (such as Heading 1a) have negative redistributive effect. So far the non-pre-allocated part of the budget is considerably smaller than the pre-allocated one, so shifting the relative balance between the two could also determine a reduction of the overall redistributive effect.

Appendix I: Sensitivity

We repeat the whole analysis with time fixed effects, in the formulas we therefore introduce $\gamma\ T$, a factor controlling for time trends. The results are basically the same, leading to the same conclusions.

First, we analyse the redistributive impact of the expenditure and revenue sides (Tables 6, 7, 8):

$$\mathrm{EXP}_{ct} = \alpha - \eta\ \mathrm{Y}_{ct} + \gamma\ \mathrm{T} + \varepsilon_{ct} \tag{16}$$

$$\mathrm{REV}_{ct} = \alpha + \theta\ \mathrm{Y}_{ct} + \gamma\ \mathrm{T} + \varepsilon_{ct} \tag{17}$$

Second, we analyse in detail the contribution of each heading of expenditures:

$$\mathrm{H1a}_{ct} = \alpha - \eta_{1a}\mathrm{Y}_{ct} + \gamma\mathrm{T} + \varepsilon_{ct} \tag{18}$$

$$\mathrm{H1b}_{ct} = \alpha - \eta_{1b}\mathrm{Y}_{ct} + \gamma\mathrm{T} + \varepsilon_{ct} \tag{19}$$

$$\mathrm{H2}_{ct} = \alpha - \eta_{2}\mathrm{Y}_{ct} + \gamma\mathrm{T} + \varepsilon_{ct} \tag{20}$$

$$\mathrm{H3}_{ct} = \alpha - \eta_{3}\mathrm{Y}_{ct} + \gamma\mathrm{T} + \varepsilon_{ct} \tag{21}$$

$$\mathrm{H4}_{ct} = \alpha - \eta_{4}\mathrm{Y}_{ct} + \gamma\mathrm{T} + \varepsilon_{ct} \tag{22}$$

$$\mathrm{H5}_{ct} = \alpha - \eta_{5}\mathrm{Y}_{ct} + \gamma\mathrm{T} + \varepsilon_{ct} \tag{23}$$

Then, we look at the two components on the revenue side:

$$\mathrm{TOR}_{ct} = \alpha + \theta_{tor}\mathrm{Y}_{ct} + \gamma\mathrm{T} + \varepsilon_{ct} \tag{24}$$

$$\mathrm{NC}_{ct} = \alpha + \theta_{nc}\mathrm{Y}_{ct} + \gamma\mathrm{T} + \varepsilon_{ct} \tag{25}$$

Then, in order to measure the stabilisation effect, we repeat the analysis by comparing changes, instead of levels. We look again at the two side of the budget, revenues and expenditures, and since only the revenue side has an impact, we closely analyse the two sources of revenues (Table 9):

$$\Delta\mathrm{EXP}_{c\,t} = \alpha - \eta'\Delta\mathrm{Y}_{c\,t} + \gamma\ \mathrm{T} + \varepsilon_{c\,t} \tag{26}$$

$$\Delta\mathrm{REV}_{c\,t} = \alpha + \theta'\Delta\mathrm{Y}_{c\,t} + \gamma\ \mathrm{T} + \varepsilon_{c\,t} \tag{27}$$

Table 6 Levels of expenditures and contributions per capita on income per capita

	Expenditures p.c.	Revenues p.c.
Levels of income per capita	− 0.0031*** (0.001)	0.0084*** (0.000)
Constant	277.0*** (31.1)	29.3* (11.6)
Observations	381	381
Rsq	0.058	0.784
Time fixed effects	YES	YES

The panel is composed by annual data per country per year from 2000 to 2015. Robust standard errors are in brackets. Significance levels: ***p < 0.001; **p < 0.01; *p < 0.05

Table 7 Per capita expenditures per Heading on income per capita

	H1a p.c.	H1b p.c.	H2 p.c.	H3 p.c.	H4 p.c.	H5 p.c.
Level of income per capita	0.0007*** (0.000)	− 0.0055*** (0.001)	0.0001 (0.000)	0.0000 (0.000)	− 0.0003*** (0.000)	0.0021*** (0.001)
Constant	− 7.3*** (1.9)	194.4*** (15.4)	120.5*** (16.2)	1.2 (0.7)	7.3*** (1.3)	− 41.3** (13.4)
Observations	381	381	381	381	381	381
Rsq	0.359	0.390	0.011	0.040	0.296	0.045
Time fixed effects	YES	YES	YES	YES	YES	YES

The panel is composed by annual data per country per year from 2000 to 2015. Robust standard errors are in brackets. Significance levels: ***p < 0.001; **p < 0.01; *p < 0.05

Table 8 Redistributive impact of the sources of revenue

	National contribution p.c.	Own resources p.c.
Levels of income per capita	0.0068*** (0.000)	0.0015*** (0.000)
Constant	26.2* (11.5)	3.1 (5.0)
Observations	381	381
Rsq	0.340	0.746
Time fixed effects	YES	YES

The panel is composed by annual data per country per year from 2000 to 2015. Robust standard errors are in brackets. Significance levels: ***p < 0.001; **p < 0.01; *p < 0.05

Table 9 Changes of expenditures and revenues per capita on income per capita

	Δ Expenditures p.c.	Δ Revenues p.c.	Δ National contribution p.c.	Δ Own resources p.c.
Change in income per capita	0.0015 (0.002)	0.0118*** (0.003)	0.0109*** (0.003)	0.0009*** (0.000)
Constant	−13.1 (10.6)	− 29.5 (14.4)	− 26.8 (14.5)	− 2.7*** (0.3)
Observations	353	353	353	353
Rsq	0.055	0.329	0.597	0.304
Time fixed effects	YES	YES	YES	YES

National contribution plus own resources compose the total national contribution. The panel is composed by annual data per country per year from 2000 to 2015. Robust standard errors are in brackets. Significance levels: ***p < 0.001; **p < 0.01; *p < 0.05

The results are pretty much the same.

Appendix II

Appendix to Sect. 6

The estimations for the counterfactual budget constructed in the hypothesis of zero correction mechanisms are based on the same kind of equations estimated for the actual budget. In order to measure the equalising effect we compare levels, therefore estimate Eqs. (16) and (17). For the two components of the revenue side, I run again Eqs. (24) and (25) in the case of the counterfactual budget. The results are the following (Tables 10, 11).

In order to measure the responsiveness of the counterfactual budget we compare changes in the same variables, through the same equation used for the actual budget (26) and (27). The results are the following:

Table 10 Equalising effect of a counterfactual budget without corrections

	Expenditures p.c.	Revenues p.c.	National contribution p.c.	Own resources p.c.
Levels of income per capita	− 0.0027** (0.001)	0.0098*** (0.000)	0.0082*** (0.000)	0.0016*** (0.000)
Constant	− 9507.9** (3281.1)	− 5811.7*** (1009.4)	− 6488.8*** (861.0)	696.3 (509.0)
Observations	353	353	353	353
Rsq	0.042	0.896	0.926	0.316

Explanatory note: National contribution plus own resources compose the total national contribution. The panel is composed by annual data per country per year from 2000 to 2015. Robust standard errors are in brackets. Significance levels: ***p < 0.001; **p < 0.01; *p < 0.05

Table 11 Responsiveness of a counterfactual budget without corrections

	Δ Expenditures p.c.	Δ Revenues p.c.	Δ National contribution p.c.	Δ Own resources p.c.
Change in income per capita	0.0017 (0.001)	0.0097*** (0.002)	0.0080*** (0.002)	0.0017*** (0.000)
Constant	− 694.0 (1092.2)	− 2041.0 (1101.3)	− 1547.0 (1069.6)	− 526.9* (252.6)
Observations	325	325	325	325
Rsq	0.004	0.153	0.116	0.118

National contribution plus own resources compose the total national contribution. The panel is composed by annual data per country per year from 2000 to 2015. Robust standard errors are in brackets. Significance levels: ***p < 0.001; **p < 0.01; *p < 0.05

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