

First, the authors would like to thank the referee for their highly detailed review of the paper as well as for having recommended its publication. Their useful comments and suggestions have guided us in making several changes we list below, which will improve and clarify the paper considerably.

As the issues pointed out by the referee are basically suggestions for explaining certain parts of the paper better, and we have been instructed not to upload the new version of the paper to the platform but only the reply to the referee, we will try to ensure this reply covers the changes to be made to the paper as thoroughly as possible.

\* First of all, at the suggestion of the reviewer, the introduction now emphasises the interest for Spain of our empirical application, in order to make it more appealing for non-Spanish researchers. At the same time, we have tried to strengthen the interest of the paper for the literature on fiscal federalism. Thus, the first two paragraphs of the introduction will read as follows:

“Historically, the study of tax effort at the sub-central level has related mainly to two issues. On one hand, the main subject of analysis in barely decentralised governments is the high degree of financial dependence on transfers from the central government, and the pernicious effects of the lack of fiscal accountability, as happened in Spain during the first two decades of the regional decentralisation model. On the other, the main subject of study in the literature associated with equalisation transfers is usually the analysis and construction of indicators of tax need and potential tax revenue, but not tax effort, even though this is an indicator sometimes considered in the formulas determining the amount of these transfers, as happened explicitly in the first stages of the Spanish regional financing model. We see, therefore, that the international literature rarely quantifies the real exercise of fiscal accountability at the sub-central level, unlike the high level of attention to this matter for central governments, and only occasionally does it propose to determine the real causes explaining the degree to which this sub-central tax autonomy is exercised.

In fact, as tax decentralisation progresses and important taxes are assigned to regional governments, giving them greater regulatory power over essential elements of those taxes (e.g., tax credits and tax rates), increasingly large differences are created between both tax rate levels and the configuration of many of these taxes. This process of increasing territorial differentiation in tax matters is concerning, insofar as it can mean a considerable increase in the costs of tax collection and tax compliance, it facilitates competition to attract mobile tax bases, it makes the tax differences between territories less transparent, and it makes it more difficult to calculate theoretical tax revenue and tax effort, and thus the necessary equalisation transfers. These concerns are also present in Spain, as the Informe de la Comisión de Expertos para la Revisión del Modelo de Financiación Autonómica (2017) warned.

Alongside this, in the current context of mutual reproaches between levels of government, caused by budget imbalances and the strict financial restrictions associated with the effects of the economic crisis, examining regional tax behaviour will let us test the veracity of the claims of this level of government to be the victim, or the central government’s accusations of a lack of regional fiscal accountability, an aspect which is also present in the Spanish case, with accusations of financial disloyalty flying between these levels of government.”

Comisión de Expertos para la Revisión del Modelo de Financiación Autonómica (2017): *Informe de la Comisión de Expertos para la Revisión del Modelo de Financiación Autonómica*, Ministerio de Hacienda y Función Pública. [http://www.hacienda.gob.es/Documentacion/Publico/CDI/Sist%20Financiacion%20y%20Deuda/Informaci%C3%B3nCCAA/Informe\\_final\\_Comisi%C3%B3n\\_Reforma\\_SFA.pdf](http://www.hacienda.gob.es/Documentacion/Publico/CDI/Sist%20Financiacion%20y%20Deuda/Informaci%C3%B3nCCAA/Informe_final_Comisi%C3%B3n_Reforma_SFA.pdf)

\* The referee suggests increasing the clarity of the conceptual explanations of section 2 and not jumping from the concept of fiscal capacity to tax effort and vice versa throughout the text. Following their suggestions, we have revised and rewritten section 2 (Review of the literature) thus:

- We will first explain the methods used in the literature to determine tax capacity, then review the papers which have calculated tax effort indices based on those methods. Thus, we avoid jumping from one concept to another throughout the text, and as the referee indicated, the explanation will be clearer.
- Also, as the referee suggests, we will explain in the text the concept of tax pressure used to calculate Frank's index, and explain Frank's index itself. We will also pay more attention to the construction of the indices of relative tax effort developed for the Spanish case by Zabalza and Lasheras (2000) and López-Casasnovas and Castellanos (2002), and which we have relocated in the papers which use the Representative Revenue System, as they are really based on tax bases.

López-Casasnovas, Guillem and Albert Castellanos. 2002. "Aproximación al concepto de esfuerzo fiscal", mimeograph, Centre de Recerca en Economia i Salut, Barcelona. <https://www.upf.edu/documents/%202911971/6885433/%20EsforxFiscal.pdf/700310c1-ab9d-4344-aadd-d717d0bdc27b>

Zabalza, A. and M.A. Lasheras (2000): "Índices territoriales de esfuerzo fiscal en el IRPF", *Revista de Economía Aplicada* 22 (volVIII): 95-129.

\* The referee doesn't understand the following sentence of page 4: "*another disadvantage [of the Representative Revenue System] is that if the decentralized tax bases are not closely linked to regional income, resources may be transferred from low-income regions to rich ones though equalization grants*", since using the RRS is specifically intended to overcome problems of using macroeconomic indicators such as the level of income per capita.

Although the RRS is indeed intended to correct some of the deficiencies stemming from using only per capita income to calculate tax capacity in jurisdictions, it also presents some problems. Insofar as the tax bases of the taxes reflect patterns of consumption or use of resources by the regions, rather than their available resources or purchasing power, these may not be valid factors for calculating their tax capacity, as they actually reflect the economic decisions of the citizens (Barro, 1986 and Bird, Martinez-Vazquez, and Torgler, 2008). For example, we think of two regions whose citizens present very similar income levels but which have different consumption habits, so that in one region there is a greater tendency to buy taxed products. Thus, the region which tends to

consume more taxed goods will present a larger tax base, and according to the RRS a greater tax capacity, when this is not really true. If this is the measurement used to determine how transfers to the regions are distributed, this may lead to what is described in the statement. To make the paragraph more understandable, we will redraft the text, and suggest further reading on these aspects in the papers of Mikesell (2007) and Costa (2008), in which there is an exhaustive review of the advantages and disadvantages of each method of estimating tax capacity.

Barro, S. M (1986): “State fiscal capacity measures: A theoretical Critique”, in H. Clyde Reeves (ed.), *Measuring fiscal capacity*, Cambridge, Massachusetts, Oelgeschlager, Gunn & Hain.

Bird, R.M., Martinez-Vazquez J. and Torgler, B. (2008): “Tax effort in developing countries and high income countries: The impact of corruption, voice and accountability”. *Economic analysis and policy*, 38 (1), 55-71.

Mikesell, J. (2007): “Changing state fiscal capacity and tax effort in an era of devolving government, 1981–2003”. *Publius: The Journal of Federalism*, 37 (4), 532-550.

\* Following the referee's warning, we have corrected the statement on page 7 that “the Spanish equalization system considers regions’ tax effort in order to allocate equalization payments”. It is true that this was done in the first stages, through the variables of distribution of resources in the financing system. However, as the reviewer points out, from 2002 tax capacity is the basis for the regional financing system. In other words, the contributions of the regions to the horizontal equalisation mechanisms and the state transfers they receive depend on 75% of their theoretical tax revenue, but not on their real revenue. This ensures that the regions approach the task of designing their tax policies with the right incentives, as they now enjoy all the additional revenue they obtain because their real taxes collected are higher than their theoretical taxes. We would like to thank the referee for pointing this out.

\* On page 8 we use the expression “central government” instead of “State” to refer to the level of federal government in Spain, because, as the referee correctly points out, although this expression is used in the Spanish context, it can be misleading for non-Spanish readers, insofar as in most federal countries regional governments are referred to as “states”.

\* The referee suggests we “further explain the interest of measuring the fiscal effort on those taxes for which sub-central governments do not have any margin for manoeuvre in order to increase or reduce collections”.

The reason for including all taxes (including those which the regional government has no decision-making power over) is to avoid, as suggested by the Advisory Commission on Intergovernmental Relations (ACIR, 1988), biases arising from possible substitutability and interdependence between the different ways of obtaining tax revenues. And although we think it is sufficiently justified in the text (on first paragraph of page 10), to make it clearer we will add a footnote (note 3) with the following example:

“If we do not include the revenues derived from a given tax base,  $x$ , and if that base were unevenly distributed among the regions, we would be undervaluing the real tax capacity of the regions with a relatively large base  $x$ , and overvaluing those in the opposite situation.”

In the Spanish case, it is also advisable to include all taxes because the system’s theoretical tax collection is far from satisfactory in its measurements of the concept it is intended to quantify, except for the IRPF, as shown by López-Laborda (2016) and De la Fuente (2016), so it seems reasonable to propose an alternative.

De la Fuente, Ángel (2016): “El cálculo de la recaudación normativa de los tributos cedidos tradicionales: una propuesta provisional”, *Fedea Policy Papers*, no. 2016/02. <http://documentos.fedea.net/pubs/fpp/2016/02/FPP2016-02.pdf>

López-Laborda, Julio (2016): “La medición de la capacidad fiscal de las comunidades autónomas: algunas alternativas”, *FEDEA Policy Papers*, no. 2016-1, Madrid. [https://www.fedea.net/docs/hacienda-autonomica/WRFR\\_LopezLaborda-RecaudacionNormativa.pdf](https://www.fedea.net/docs/hacienda-autonomica/WRFR_LopezLaborda-RecaudacionNormativa.pdf)

\* Referee asks for the specification of TEND and ACTIVISM1 variables (of pages 11 and 12, respectively).

In fact, we have noticed that Table A.1 of the appendix does not show the specification of the variable TEND, so we will remedy the error, indicating that we have assigned values 1 to 11 to each of the years in the sample, 2002 to 2012, respectively, in order to capture the impact of the passage of time on tax revenue and the learning effect in the regions, which have seen their tax autonomy increase significantly from 2002 (the first year of our sample) when more taxes were assigned in line with Law 21/2001. We have also corrected an error in the data on the medium, maximum and minimum value of this variable in Table A.1 of the appendix, which will read as follows

**Table A.1 Definition of the variables used and their sources**

Variables	Description of the variable	Source of the information	Mean	Std. Dev.	Min	Max
...						
TEND	=1 in 2002 = 2 in 2003 ... = 11 in 2012		6	3.17	1.00	11
...						

With the variable ACTIVISM1, we tried to identify the regions which are most aware of the need for tax effort. To do this, we used the partial frontier technique Order- $\alpha$ , which as we explain in Section 2, lets jurisdictions be located beyond the estimated tax frontier (hence the name, partial frontier). As indicated in Table 3, Catalonia, Madrid, Andalusia, and Valencia are the regions showing atypical or super-efficient tax behaviour, and accordingly, they are located beyond the estimated potential tax revenue frontier, due to their specific fiscal characteristics: either because the territorial distribution of some tax bases is extremely uneven, or because there happens to be an especially intense taxable activity there (e.g., property sales in coastal tourist areas), among other possible causes. For this reason, the specification of this variable is the following, as we now explain in Table A1:

= Order- $\alpha$  tax effort for the regions that the Order- $\alpha$  technique places beyond the frontier (Catalonia, Madrid, Andalusia, and Valencia),

= 0 otherwise.

**Table A.1 Definition of the variables used and their sources**

Variables	Description of the variable	Source of the information	Mean	Std. Dev.	Min	Max
...						
ACTIVISM1	= Order- $\alpha$ tax effort for the regions that Order- $\alpha$ places beyond the frontier (Catalonia, Madrid, Andalusia, and Valencia), = 0 otherwise	Table 3	0.40	0.73	0.00	3.39
...						

We will try to clarify the definition in the expressed terms. We should also note that we have considered the alternative of working with a dummy variable which gives the value 1, to the four regions mentioned (Catalonia, Madrid, Andalusia, and Valencia), and 0 to the others. However, this gives worse results, as there are notable differences between these regions in terms of their atypical tax effort (showed in table 3), which is captured better with the now proposed approach.

\*Referee calls for “a deeper explanation of DENSITY and POPGROWTH as explanatory variables of the tax capacity”. Here, the first thing to remark is that we have considered these variables as explanatory of the regional tax effort [equation 2], not of tax capacity [equation 1], as the referee states. In any case, we can better justify the inclusion of these variables in the model as follows.

“Population density can influence tax effort in different ways. On the one hand, a higher concentration of people should make taxation easier (Cyan et al., 2014), and facilitate the use of economies of scale in tax management; but, on the other hand, larger population density could also encourage informal activities that are difficult to tax (Mkandawire, 2010)”

Cyan, Musharraf; Jorge Martínez-Vázquez and Violeta Vulovic (2014): “New approaches to measuring tax effort”, in Richard M. Bird and Jorge Martínez-Vázquez: *Taxation and Development: The Weakest Link?; Essays in Honor of Roy Bahl*, Edward Elgar: 27-68. ISBN: 9781783474325.

Kau, James B. and Paul H. Rubin (1981): “The Size of Government”, *Public Choice*, 37 (2): 261-74.

Mkandawire, Thandika (2010): “On Tax Efforts and Colonial Heritage in Africa”, *Journal of Development Studies*, 46 (10): 1647-69.

Regarding the variable POPGROWTH, we have also taken into account the referee’s comment that only until 2009 the Spanish funding system set the population at the level of the base year considered, and this will be stated in the redrafted text:

“Population growth rate is associated with higher inefficiency in the tax system because it is difficult administer a rapidly rising population of taxpayers (Bahl, 2004 and Le et al, 2008), so the tax system may lag behind the ability to capture new taxpayers (Bird et al, 2008). Until 2009, the effects of the variable POPGROWTH may have been reinforced by the fact that the Spanish funding

system set the population at the level of the base year considered, obliging jurisdictions with faster demographic growth to make a greater tax effort.”

Bahl, R. W. (2004): “Reaching the Hardest to Tax: Consequences and Possibilities”, *Contributions to Economic Analysis*, 268: 337-354.

Bird, R.; J. Martínez-Vazquez and B. Torgler (2008): “Tax effort in developing countries and high income countries: The impact of corruption, voice and accountability”, *Economic Analysis & policy*, 38 (1):55-71

Le, T. M.; B. Moreno-Dodson and J. Rojchaichanthorn (2008): “Expanding Taxable Capacity and Reaching Revenue Potential: Cross-Country Analysis”, *World Bank Policy Research Working Paper Series*, no. 4559.

\* Although the use of budget management quality variables is not new (see, for example, Dirección de Evaluación y Normas Presupuestarias, 2014), it is new to include it in empirical studies of regional tax behaviour, so that, as referee suggests, it seems necessary to give a better explanation of the specification of the variable QMANAGE on page 13. For this reason, we propose redrafting the explanation as follows:

“Regional differences in tax behaviour may arise from inefficiency in the tax collection and management process, which could be due to poor management, the use of obsolete technology, a lack of suitable human resources, corruption, tax evasion, etc. To capture this inefficiency, we have included the variable QMANAG, which we have constructed as the quotient between the non-financial current revenues the region really receives and the revenues it budgets for. Thus, the closer the real revenues comes to the revenues budgeted by the regional government, and therefore the greater the value of this relationship or quotient, the greater will be the tax collection efficiency, or the control of revenues by the regional government, which will favour a higher value of tax effort. On the other hand, real revenues which are very different from the initially budgeted revenues could be a symptom of inefficiency in the tax collection and management process.”

Dirección de Evaluación y Normas Presupuestarias (2014): *Indicadores de gestión presupuestaria. Un resumen de la teoría aplicada a la gestión pública*, Subsecretaría de Hacienda Ministerio de Economía. <http://www.ec.gba.gov.ar/areas/hacienda/Presupuesto/Doc/Indicadores%20de%20gesti%C3%B3n%20presupuestaria.pdf>

\* Regarding the variable CRISIS, referee points out several things:

1st. “*In spite of the fact that 2008 was a crisis year, regional governments did not suffer from the fall of resources until 2010, when transfers were negatively adjusted by the central government*”. The referee is right, but we are already capturing that idea with the *TRANSFREV* variable. What we intend to measure with the variable CRISIS is simply the economic cycle. For this reason, we constructed the variable CRISIS assigning it the value 1 from 2008, which is when the crisis began to affect the Spanish economy, and value 0 before then.

2nd. Referee also suggests we “*explain the specification of the variable*” CRISIS “*to adequately evaluate the results*”. The reviewer may be confused here, and

suggests explaining this variable by the error which, prompted by their suggestion, we found in the definition of the variable CRISIS in Table A.1 of the appendix. As we remarked above, the variable takes the value 1 in the period 2008-2012, and value 0 otherwise.

3rd The CRISIS variable “*could have different outcomes depending on its specification*”. We obviously agree with this consideration; the outcomes of the CRISIS variable will depend on its specification. For this reason, we have tried measuring the variable CRISIS with other specifications, without significant variance in the results obtained. Specifically, as the referee suggests, we have tried considering the crisis period 2010-2012, although thanks to the reviewer’s comment, we think that the most appropriate option is to measure the economic cycle as the variation rate of GDP in each region, which allows us to consider the different amount and intensity of each region’s reactions to the cycle. The results can be seen in the following table.

	SFA
<b><i>Tax frontier</i></b>	
INCOME	0.77** 7.37
POP	0.29** 4.87
IP0911	-0.16** -14.36
CAN	-0.42** -11.40
DPROV	-0.04 -1.51
STOCKP	-0.05 -0.54
GAMBLINGEXP	-0.05 -1.33
TEND	0.03** 10.63
CONS	8.16** 13.46
<b>Tax Effort</b>	
DENSITY	0,001** 3.13
POPGROWTH	-0,008** -2.21
QMANAG	0,001 0.05
TRANSFREV	0.0005** 4.67
PATREV	-6,862** -2.22
ACTIVISM1	-0,275** -2.55
ACTIVISM2	-2.99E-06** -2.57
dPOLITCOLOUR	0,095 1.41
dSINT	0,049 0.94

NFEXP	-0.0003** -2.69
CRISIS	0.017* 1.7
FEXP	-0.0004 -1
CONS	0,201 0.52

\* As the reviewer suggests, we have tried to clarify the role of inefficiency (page 14). The text now would say:

“In light of the hypotheses described above, we used panel data (2002-2012) to estimate equations [3] and [4] of the stochastic frontier model proposed by William Greene (2005). This is a time-varying model, the True Random Effect (TRE) model (although the fixed effects approach gives similar results), estimated by applying the maximum likelihood procedure, with the following econometric specification:

$$TAX_{it} = \alpha_i + f(INCOME, POP, STOCKP, GAMBLINGEXP, CAN, DPROV, IP09-11, TEND) + v_{it} - u_{it} \quad [3]$$

$$u_{it} = g(dPOLITCOLOUR, dSINT, ACTIVISM1, ACTIVISM2, TRANSFREV, PATREV, NFEXP, FEXP, DENSITY, POPGROWTH, QMANAG, CRISIS) + w_{it} \quad [4]$$

Estimation using *stochastic* frontier analysis (SFA) lets us solve the main problem presented by the conventional approach to tax effort through a mean behaviour regression, by avoiding, as Rao (1993) indicates, letting tax effort become part of the random residue. We must also take into account that the goal of the paper is not only to determine the tax frontier, but also to simultaneously examine the determinants of the regions’ tax effort relating to the observed heterogeneity.

The original approach of Aigner et al. (1977) and the initial model (*true-random effects model*) of Greene (2005) assume that  $v_{it}$  and  $u_{it}$  are homoscedastic. Ignoring heteroscedasticity in the context of SFA leads to skewed estimates, so that following Greene (2007), Hadri et al. (2003) and Wang (2002), we must simultaneously include the determinants of tax effort in the inefficiency function. Formally, this specification is given by equation [4], so that we apply a system combining the one-stage method within the true-random effects framework, allowing us to control for both observed and unobserved heterogeneity of tax effort in the regions. Therefore, this specification considers that inefficiency,  $u_{it}$ , may vary over time, and the inefficiency term excludes unobserved and time-invariant heterogeneity (Belotti et al, 2012)....”

Aigner, D.; K. Lovell and P. Schmidt (1977): “Formulation and Estimation of Stochastic Frontier Production Function Models”, *Journal of Econometrics*, 6: 21-37.

Belotti F.; S. Daidone; G. Ilardi and V Atella (2012): “Stochastic frontier analysis using Stata”, *The Stata Journal*, 10 (2): 1-39.

- Greene, W. (2007): *LIMDEP Version 9.0 Reference Guide*, Vol. 2, Econometric Software Inc: New York.
- Hadri, K., Guermat, C. and Whittaker, J. (2003): “Estimation of Technical Inefficiency Effects Using Panel Data and Doubly Heteroscedastic Stochastic Production Frontiers”, *Empirical Economics*, 28 (1): 203-222.
- Rao, H. (1993): “Taxable Capacity Tax-efforts and forecasts of tax-yield of Indian States”. *ISEC*. Available at: [http://203.200.22.249:8080/jspui/bitstream/123456789/9760/1/Taxable\\_capacity\\_f\\_or\\_tax\\_efforts\\_and\\_forecast-Content.pdf](http://203.200.22.249:8080/jspui/bitstream/123456789/9760/1/Taxable_capacity_f_or_tax_efforts_and_forecast-Content.pdf).
- Wang, H.-J. (2002): “Heteroscedasticity and Non-Monotonic Efficiency Effects of a Stochastic Frontier Model”, *Journal of Productivity Analysis* 18: 241-253.

\*We have explained the significance of  $\lambda$ ,  $\gamma$  and  $\theta$  in the text, as well as their relevance or involvement in the SFA model used, as follows:

“The results of estimating the model above, for which we took variables in logs and used the STATA statistical package, are shown in the second column of Table 2. The estimated  $\lambda$  is the ratio between the inefficiency and measurement error variability (the so called signal-to-noise ratio  $\sigma_u/\sigma_v$ ), providing information on the relative contribution of both error components in total error term. Thus, as the estimator  $\lambda$  is significant and very high, it is indicating the presence of technical inefficiency, and SFA is confirmed as a suitable method for the study, in other words, the need to include unrealised tax effort,  $u$ , in the tax capacity function. Thus, approaching tax capacity through a conventional mean behaviour function estimated by ordinary least squares (OLS) is not suitable, as  $\lambda$  is indicating that the deviations from the frontier are not only due to the estimation error, but that many of the disparities in terms of tax collection depend on the decisions made by the regional governments themselves, and on inefficiency. In fact, if we divide the variance of  $u$  by total variance ( $\gamma=\sigma_u^2/\sigma_\varepsilon^2$ ), we obtain that 98.54% of the error term is due to unrealised tax effort. Additionally, as indicated by Belotti et al (2012), the significance of the parameter  $\theta$ , which measures the estimated standard deviation of the unobserved heterogeneity, validates the Greene (2005) approach, in which the unobserved heterogeneity of regions must be separated from the inefficiency effects. ...”

\* We have included in the text the suggestion of the referee that the lower tax capacity of the Canary Islands shown by the model might be because the Canary Islands present some important peculiarities within the common funding system, insofar as VAT and most of the excise taxes are not applied - instead a regional-unique indirect tax is applied, usually with much lower tax rates, as can be seen in De la Fuente (2016) or the Comisión de Expertos para la Revisión del Modelo de Financiación Autonómica (2017).

The referee also asks “where those regional taxes are considered in the estimation?” The regional-unique indirect tax and the corresponding excise taxes collected in the Canary Islands are included in the endogenous variable TAX, in the same way as VAT and all excise taxes are included for the other regions. As we explain on page 10, the dependent variable TAX covers all taxes (direct, indirect and levies) gathered in the territory of each region.

De la Fuente, Ángel (2016): “El cálculo de la recaudación normativa de los tributos cedidos tradicionales: una propuesta provisional”, *Fedea Policy Papers*, no. 2016/02. <http://documentos.fedea.net/pubs/fpp/2016/02/FPP2016-02.pdf>

Comisión de Expertos para la Revisión del Modelo de Financiación Autonómica (2017): Informe de la Comisión de Expertos para la Revisión del Modelo de Financiación Autonómica, Ministerio de Hacienda y Función Pública. [http://www.hacienda.gob.es/Documentacion/Publico/CDI/Sist%20Financiacion%20y%20Deuda/Informaci%C3%B3nCCAA/Informe\\_final\\_Comisi%C3%B3n\\_Reforma\\_SFA.pdf](http://www.hacienda.gob.es/Documentacion/Publico/CDI/Sist%20Financiacion%20y%20Deuda/Informaci%C3%B3nCCAA/Informe_final_Comisi%C3%B3n_Reforma_SFA.pdf)

\* Following the suggestion of the referee we have rewritten the second paragraph of page 17, to make it easier to understand. It now reads:

“To check the robustness of our results, we have also calculated the regional tax effort with the Driscoll-Kraay robust errors method and with some of the non-parametric frontier methods explained in the section 2 (i.e., Order- $m$  and Order- $\alpha$  partial frontier methods and the Free Disposal Hull). The results are displayed in columns 3-6 of Table 3, and show that the average tax effort of the regions ranges from 86.09% to 106.6%, depending on the technique used. These results confirm that hardly any tax room for manoeuvre margin is available, and reveals a highly responsible use of tax autonomy by the Spanish regions. As suggested by Badunenko et al (2012), the high value of  $\lambda$  could mean that both the SFA estimates and the non-parametric techniques are good, ratifying the similarity of the results”

Badunenko, O.; D. J. Henderson and S. C. Kumbhakar (2012): “When, where and how to perform efficiency estimation”, *Journal of the Royal Statistical Society: Series A (Statistics in Society)* 175 (4): 863-892.

\*Finally, the referee asks if our results could be pointing to the fact the tax effort measures are sensitive to size?

To control the possible effect of the size of the regions on tax effort, we initially proposed relativising all the variables according to regional income, both in the frontier equation and in the function explaining tax effort. However, when estimating the two equations with a one-stage estimation procedure, we get better results from placing the variables on the tax frontier in absolute values, incorporating elements that capture differences in size (POP) or wealth (INCOME), and introducing all the variables of the function explaining tax effort in relative terms. Thus, we understand that the results are not sensitive to size.

Thanks again for taking time out to read the paper. We really appreciate your feedback and suggestions.