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Impact of ESG-Related Government Efforts On Economic Growth*

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Abstract

The subject of ESG and green economy is of high importance for most economists and policymakers around the world. It is, however, still debatable whether ESG efforts also add economic value and as governments are seen as the main driver in the quest of achieving ESG goals, I aim at studying what is the benefit of ESG-related governmental efforts for the economy. While the literature very well documents the general impact of public spending on economic growth and touches, on separate occasions, on environmental spending, few papers, to the best of my knowledge, this paper aims at filling a gap in the literature by studying the combined impact of different types of environmental- and social-related spending on economic prosperity. This analysis is performed on a macro level, using country-level data for the 27 European Union member states. By implementing a combined econometric analysis consisting of fixed-effects regression models, dynamic ordinary least squares and fully modified least squares, and Granger causality the results indicate mixed effects of ESG efforts towards economic growth. The findings suggest that increasing public spending on education and health has detrimental effect of economic growth whilst environmental protection government spending and taxation are not impacting growth in a significant way. The results can provide public policy advice as to how authorities should make use of their available resources to promote sustainability while retaining wealth creation.

Keywords: sustainability, economic development, ESG, public finance.

Introduction

There is little to no doubt that the industrial revolution brough unprecedented levels of economic growth and prosperity that all modern societies benefit from. This level of growth, mainly driven using fossil fuels and other natural resources, came with a trade-off in the form of environmental degradation. According to the Network for Greening the Financial System (NGFS, 2024) the global temperatures have risen by about 1.2°C compared to the pre-industrial revolution period and if measurable actions will not be taken climate change will have major consequences on ecosystems, health, infrastructure, and the economy.

The subject of Environmental, Social, and Governance (ESG) is now on the agenda of most major economies' governments, financial and non-financial corporates, and other agents. A strong debate among government officials is still ongoing on whether ESG-related efforts would reap any benefits, or they are unjustified spendings, with the United States of America, at the moment of writing this paper, being reluctant to commit to ESG efforts for fighting climate change. It is important to point out that greening the economy does not necessarily imply a win-win situation in which irreversible climate damage is avoided while ensuring robust economic growth and wealth creation, as some representatives of the Central Bank of Belgium were keen to point out (Boffa, 2024). Such a hypothesis does not necessarily mean that adhering to ESG measures is detrimental for the economy, but perhaps a change of paradigm on to how one measures economic welfare should be adopted. Instead of measuring economic welfare in the traditional way of quantifying gross domestic product (GDP) growth and personal wealth, agents could value higher other indicators such as the quality of the environment, education, health, public services, or the reduction of income inequality.

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Irrespective on which side of the fence one is, ESG goals cannot be met without sustained government implication and its role in attaining such goals is pivotal. Governments should be the main drivers of ESG efforts as they are in the best position to promote, support, finance, and develop mechanisms for a sustainable economy. Having this in mind, in this paper I aim at studying the impact of ESG-related government efforts, measured mainly by environmental- and social-related spending, on economic growth, in a try to answer some of the concerns regarding the use of significant public funding for sustainability purposes. Although climate change is the hot topic of discussion at this moment, the paper will not only focus on environmental aspects but will also considers the social dimension, as there is enough room for improvement in that area as well.

The paper seeks to shed light on the influence of ESG government efforts on economic development and underscore the crucial role of the public sector within this intricate framework. It aims to offer a comprehensive and pertinent viewpoint on this highly relevant topic, particularly in today's context where there is heightened global emphasis on sustainability and social responsibility.

Literature Review

Barro (1981) posits that during the initial stages of economic growth, government expenditures can stimulate economic activity by enhancing the efficiency of the private sector. However, as economies approach their peak, the expansion of government spending tends to impede the efficacy of the private sector.

Lee, Won and Jei (2019) examine the relationship between government spending and economic growth in China and Korea. Their analysis reveals nuanced findings: In China, where governmental intervention is substantial and fosters economic factors, the impact of government expenditures on economic growth appears limited. Conversely, in Korea, there's a short-term positive correlation between functional government expenditure and economic growth, transitioning to a negative correlation in the long run. Additionally, they argue that while environmental spending is essential for daily life, excessive allocations in this area can detrimentally affect economic growth. Levytska and Romanova (2020) investigate the effects of government spending on environmental protection and various socio-economic variables on GDP growth in Ukraine. Their results confirm a relationship between government spending on environmental protection and GDP growth, with a 0.01% increase in public environmental protection spending corresponding to a 0.36% average increase in GDP.

The relationship between environmental taxation and economic growth presents dual perspectives. Ono (2003) suggests that when environmental taxation remains below an optimal threshold, increasing it can benefit the economy. Conversely, Hassan, Oueslati and Rousselière (2020) find that overall revenues from environmentally related taxes are negatively associated with short- and long-term economic growth, depending also on countries' redistributive mechanisms.

Khan et al. (2020) discover that increased public health spending and poor environmental performance impede economic growth, particularly in regions with low efficiency and labour productivity. On the other hand, improving environmental performance positively influences economic growth, while increased public health spending negatively impacts economic performance. Furthermore, they consider life expectancy as a proxy for population health and its positive correlation with economic growth, but they emphasize the importance of government health spending beyond this proxy.

Education spending can have redistributive effects, potentially mitigating inequalities and enhancing long-term growth through human capital accumulation. Hanushek and Wößmann (2007) illustrate a significant positive correlation between education expenditures and GDP growth, citing the potential for a substantial increase in GDP per capita by improving test results. However, Suwandaru, Alghamdi and Nurwanto (2021) argue that increasing public spending on education doesn't consistently yield economic benefits. Maitra and Mukhopadhyay (2012) find that while education spending positively impacts GDP in most cases, it's not uniform across all countries or instantaneous, as the development of human capital takes time to manifest in economic growth.

Laboure and Taugourdeau (2018) observe that the productivity of total public expenditure varies across income levels, being productive in low-income countries and less so in middle- and high-income countries. They emphasize the importance of reallocating expenditures, particularly in high-income countries, to favour more productive sectors like education.

The interaction between corruption, government spending, and economic growth is a subject of debate. D'Agostino, Dunne, and Pieroni (2016) argue that higher corruption levels necessitate larger military spending, impacting the real economy. Del Monte and Papagni (2001) suggest that increased corruption reduces the

efficiency of public expenditures and discourages private investments, further complicating the relationship between government spending and economic growth.

Methodology

The empirical study in this paper is based on a set of panel data for 27 European Union (EU) countries for the period 2000-2021, collected from the World Bank – World Development Indicators (WDI), Eurostat, and European Environmental Agency databases. A description of the variables can be found in Table 1.

Table 1. Description of the variables

Variables	Description	Source
GDPC	Gross domestic product per capita, annual rate of change (%)	World Bank
ENVTAX	Environmental taxes collected by general government, % of GDP	Eurostat
GEXENV	Government expenditure on environmental protection, % of GDP	Eurostat
GEXEDU	Government expenditure on education, % of GDP	Eurostat
GEXHEA	Government expenditure on health, % of GDP	Eurostat
GHG	Greenhouse gas emissions, annual rate of change (%). Calculated by author based on greenhouse gas emissions data expressed as kt. of CO2 equivalent	European Environmental Agency
CORR	Control of corruption, percentile rank, logarithmic values	World Bank
LE	Life expectancy, number of years at birth, logarithmic values	World Bank
CPI	Annual rate of inflation (%)	World Bank
CAP	Capital stock, net fixed assets per employed person, annual rate of change (%)	Eurostat
LP	Real labour productivity per person, annual rate of change (%)	Eurostat

Source: Author's computations

In order to quantify for the economic growth, the gross domestic product per capita growth rate (GDPC) has been used as the dependent variable. To capture environmental efforts made by governments, two distinct variables have been included in the model: environmental taxes (ENVTAX) and government expenditure on environmental protection (GEXENV). Although European countries made other efforts towards greening the economy and promoting sustainability, such as funding programmes and incentives, data for quantifying these efforts is not widely available at this point. Government efforts towards social goals are represented by expenditure on education (GEXEDU) and expenditure on health (GEXHEA). The model also takes into consideration a set of "effect" ESG variables, such as greenhouse gas emissions (GHG), control of corruption (CORR), and life expectancy at birth (LE). The reason for including these variables is to quantify the negative effects that ESG-unfriendly activities have on economic growth. Finally, as set of control variables have also been considered, naming the annual rate of inflation (CPI), capital stock (CAP), and labour productivity (LP). Table 2 presents a summary of statistics for the variables described so far.

Table 2. Descriptive statistics of the variables (raw data)

Variables	Obs.	Mean	Median	Std. Dev.	Min	Max
GDPC	557	2.0741	2.1333	4.0722	-14.4643	23.2009
ENVTAX	557	2.6593	2.5400	0.6668	1.1400	5.0000
GEXENV	557	0.7560	0.7000	0.3378	-0.3000	1.9000
GEXEDU	557	5.1190	5.1000	0.9382	2.8000	7.1000
GEXHEA	557	6.1386	6.4000	1.4442	2.5000	10.1000
GHG	557	1.0106	-0.2182	27.1082	-168.5852	442.8848
CORR	557	4.3407	4.3820	0.2133	3.7072	4.6052
LE	557	4.3629	4.3743	0.0420	4.2530	4.4288
CPI	557	2.2270	1.9561	2.2945	-4.4781	22.5399
CAP	557	1.3174	0.8000	3.4152	-7.7000	47.8000
LP	557	1.6190	1.3000	3.2199	-10.7000	20.3000

Source: Author's computations

Although there is a level of convergence between EU countries on many levels, ESG efforts differ from one country to another, as other factors such as the economic development and government priorities should be taken into consideration. Figures 1 to 4, presented below, provide a snapshot of ESG-related government efforts in 2021, at an EU-level. One can note that western economies seem to generally allocate a larger percentage of their GDP towards environmental, education, and health expenditure compared to countries in the Central and Eastern Europe.

To deploy a fixed-effects linear regression model one needs to first test for correlation within the sample of variables. In the correlation matrix presented in Table 3 no high correlations between the independent variables have been identified, thus avoiding multicollinearity issues, and allowing to use the full set of variables within the regression model.

Table 3. Correlation matrix

Variables	GDPC	ENVTAX	GEXENV	GEXEDU	GEXHEA	GHG	CORR	LE	CPI	CAP	LP
GDPC	1										
ENVTAX	-0.0729	1									
GEXENV	-0.1501	0.1111	1								
GEXEDU	-0.1387	0.2978	-0.1835	1							
GEXHEA	-0.3320	0.0990	0.1919	0.1925	1						
GHG	0.2038	-0.0146	-0.0925	0.0340	-0.1338	1					
CORR	-0.1672	-0.0598	-0.0742	0.4791	0.4435	-0.0458	1				
LE	-0.3687	0.0063	0.1895	0.0324	0.5467	-0.1326	0.5625	1			
CPI	0.1980	-0.0804	-0.0873	-0.1411	-0.2571	0.0398	-0.3066	-0.4680	1		
CAP	-0.0755	-0.1334	-0.1158	0.0350	-0.0628	-0.0452	-0.0309	-0.1871	0.0927	1	
LP	0.8379	-0.1406	-0.1852	-0.0817	-0.2847	0.1923	-0.1858	-0.4339	0.2517	0.2155	1

Source: Author's computations

The econometric modelling of data as well as the estimation of models was performed using the Eviews software. The panel data fixed effects model has the general specification, as follows:

$$Y_{it}=\alpha_0+\beta_1 X_{it}+\beta_2 Z_{it}+\varepsilon_{it} \quad i=1, 2, \ldots, 27, t=2000, 2001, \ldots, 2021 \qquad (1)$$

where Y denotes the dependent variable, namely the gross domestic product per capita, X signifies the explanatory variables in the form of environmental taxes, government expenditure on environmental protection, government expenditure on education, government expenditure on health, Z represents the control variables in the form of greenhouse gas emissions, control of corruption, life expectancy, inflation, capital stock and labour productivity, α is the intercept, β_1 and β_2 are parameters, ε is the error term, i is the subscript of countries, and t is the subscript of time dimension. In order to overcome omitted variable bias in the analysis I have adopted country-level fixed effects.

In order to investigate the linkages between the independent variables and the GDP per capita, a Granger causality test based on a panel vector error correction model (PVECM) was deployed. The first step is to assess the stationarity of the variables, for which the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests were performed. The results of the unit root tests presented in Table 4 indicate that ENVTAX, GEXHEA, CORR, and LE are non-stationary in levels, however, by applying first difference, one can notice that all variables are first order stationary.

Table 4. Panel unit root tests results

Variables	Level		Variables	First Difference	
	ADF	PP		ADF	PP
GDPC	176.245 ***	322.550 ***	**ΔGDPC**	344.350 ***	1646.77 ***
ENVTAX	58.9485	53.7914	**ΔENVTAX**	166.317 ***	315.135 ***
GEXENV	94.9302 ***	121.764 ***	**ΔGEXENV**	265.703 ***	631.985 ***
GEXEDU	80.0834 **	75.1241 **	**ΔGEXEDU**	227.574 ***	500.049 ***
GEXHEA	46.2683	43.7797	**ΔGEXHEA**	132.717 ***	282.843 ***
GHG	212.417 ***	417.016 ***	**ΔGHG**	383.002 ***	3134.45 ***
CORR	46.0889	66.0892	**ΔCORR**	180.781 ***	524.356 ***
LE	63.2978	88.1217 ***	**ΔLE**	108.264 ***	325.957 ***
CPI	151.916 ***	204.353 ***	**ΔCPI**	327.948 ***	912.539 ***
CAP	140.105 ***	195.096 ***	**ΔCAP**	290.516 ***	1061.45 ***
LP	180.625 ***	578.632 ***	**ΔLP**	393.047 ***	2666.30 ***

*Source: Author's computations. Notes: ** p < 0.05, *** p < 0.01*

This allows to investigate the cointegration of the variables by performing the Fisher panel cointegration test. The outcome, presented in Table 5, allows to reject the null hypothesis of no-cointegration therefore indicating the presence of a long-run equilibrium between the dependent and independent variables.

Table 5. Pedroni (Engle Granger based) test results

Within dimension						
Cointegration test	**Individual Intercept**		**Individual Intercept and Individual Trend**		**No Intercept or Trend**	
	Statistic	**Weighted Statistic**	**Statistic**	**Weighted Statistic**	**Statistic**	**Weighted Statistic**
Panel v-Statistic	2.748 ***	0.796	0.512	-1.404	1.243	-0.409
Panel rho-Statistic	-2.125 **	-1.351 *	0.051	0.278	-2.502 ***	-1.521 *
Panel PP-Statistic	-10.326 ***	-9.014 ***	-9.835 ***	-9.665 ***	-9.653 ***	-7.894 ***
Panel ADF-Statistic	-3.765 ***	-4.141 ***	-3.260 ***	-3.802 ***	-4.619 ***	-4.752 ***
Between-Dimensions						
	Statistic		**Statistic**		**Statistic**	
Group rho-Statistic	0.090		2.115		-1.674 **	
Group PP-Statistic	-12.786 ***		-12.870 ***		-16.411 ***	
Group ADF-Statistic	-4.002 ***		-2.752 ***		-6.787 ***	

*Source: Author's computations. Notes: * p < 0.1, ** p < 0.05, *** p < 0.01*

Table 6. Kao (Engle Granger based) test results

ADF (t-Statistic)	**Residual Variance**	**HAC Variance**
-2.752 ***	17.529 ***	4.825 ***

*Source: Author's computations. Notes: *** p < 0.01*

Table7. Fisher (combined Johansen) test results

Hypothesized No. of CE(s)	**Fisher Stat. (From Trace Test)**	**Fisher Stat. (From Max-Eigen Test)**
None	612.6 ***	421.8 ***
At most 1	270.9 ***	189.6 ***
At most 2	131.6 ***	86.1 ***
At most 3	87.04 ***	75.29 **
At most 4	79.99 **	79.99 **

*Source: Author's computations. Notes: ** p < 0.05, *** p < 0.01*

At this point one can employ the heterogeneous panel cointegration test developed by Pedroni (1999) that permits for cross-section interdependence with different individual effects:

$$GDPC_{it}=\alpha_i+\delta_i t+\gamma_{1i}ENVTAX_{it}+\gamma_{2i}GEXENV_{it}+\gamma_{3i}GEXEDU_{it}+\gamma_{4i}GEXHEA_{it}+\varepsilon_{it}, \quad i=1, 2, \ldots, 27, t=2000, 2001, \ldots, 2021 \tag{2}$$

Following this, the next step of the analysis is estimating a fully modified ordinary least squares (FMOLS) and a dynamic ordinary least squares (DOLS) in order to identify the long-run connection between the variables of interest. To the best of my knowledge, a limited number of studies so far approach the impact of ESG on economic growth both from a short-run and a long-run perspective, one study doing so being the one of Lee, Won and Jei (2019). Finally, I estimate the PVECM, in order to perform the Granger-causality test, based on the following error correction models:

$$\Delta GDPC_{it}=\alpha_{1j}+\sum_{k=1}^{q}\varphi_{11ik}\Delta GDPC_{it-k}+\sum_{k=1}^{q}\varphi_{12ik}\Delta ENVTAX_{it-k}+\sum_{k=1}^{q}\varphi_{13ik}\Delta GEXENV_{it-k}+\sum_{k=1}^{q}\varphi_{14ik}\Delta GEXEDU_{it-k}+\sum_{k=1}^{q}\varphi_{15ik}\Delta GEXHEA_{it-k}+\vartheta_{1i}\varepsilon_{it-1}+u_{1it} \tag{3}$$

$$\Delta ENVTAX_{it}=\alpha_{2j}+\sum_{k=1}^{q}\varphi_{21ik}\Delta GDPC_{it-k}+\sum_{k=1}^{q}\varphi_{22ik}\Delta ENVTAX_{it-k}+\sum_{k=1}^{q}\varphi_{23ik}\Delta GEXENV_{it-k}+\sum_{k=1}^{q}\varphi_{24ik}\Delta GEXEDU_{it-k}+\sum_{k=1}^{q}\varphi_{25ik}\Delta GEXHEA_{it-k}+\vartheta_{1i}\varepsilon_{it-1}+u_{1it} \tag{4}$$

$$\Delta GEXENV_{it}=\alpha_{3j}+\sum_{k=1}^{q}\varphi_{31ik}\Delta GDPC_{it-k}+\sum_{k=1}^{q}\varphi_{32ik}\Delta ENVTAX_{it-k}+\sum_{k=1}^{q}\varphi_{33ik}\Delta GEXENV_{it-k}+\sum_{k=1}^{q}\varphi_{34ik}\Delta GEXEDU_{it-k}+\sum_{k=1}^{q}\varphi_{35ik}\Delta GEXHEA_{it-k}+\vartheta_{1i}\varepsilon_{it-1}+u_{1it} \tag{5}$$

$$\Delta GEXEDU_{it}=\alpha_{4j}+\sum_{k=1}^{q}\varphi_{41ik}\Delta GDPC_{it-k}+\sum_{k=1}^{q}\varphi_{42ik}\Delta ENVTAX_{it-k}+\sum_{k=1}^{q}\varphi_{43ik}\Delta GEXENV_{it-k}+\sum_{k=1}^{q}\varphi_{44ik}\Delta GEXEDU_{it-k}+\sum_{k=1}^{q}\varphi_{45ik}\Delta GEXHEA_{it-k}+\vartheta_{1i}\varepsilon_{it-1}+u_{1it} \tag{6}$$

$$\Delta GEXEDU_{it}=\alpha_{5j}+\sum_{k=1}^{q}\varphi_{51ik}\Delta GDPC_{it-k}+\sum_{k=1}^{q}\varphi_{52ik}\Delta ENVTAX_{it-k}+\sum_{k=1}^{q}\varphi_{53ik}\Delta GEXENV_{it-k}+\sum_{k=1}^{q}\varphi_{54ik}\Delta GEXEDU_{it-k}+\sum_{k=1}^{q}\varphi_{55ik}\Delta GEXHEA_{it-k}+\vartheta_{1i}\varepsilon_{it-1}+u_{1it} \tag{7}$$

where Δ denotes the first-difference operator, q is the lag length set at one according to likelihood ratio tests, and u reveals the serially uncorrelated error term.

Results and Discussions

Table 8 presents the results of the country-level fixed effects panel regression models. Six models have been estimated, as it follows: one model only considers "effect" ESG indicators in order to capture the effects of not making ESG efforts, one model considers ESG-related government efforts indicators only, one model combines the two previous approaches, while three additional models, similarly specified with the previous ones, take into consideration two-period lags for the independent ESG variables. In line to other studies in the relevant literature, such as Maitra and Mukhopadhyay (2012), Laboure and Taugourdeau (2018), and Lee, Won and Jei (2019), the findings of the fixed effects panel regressions indicate mixed results when it comes to the relationship between government ESG efforts and economic growth.

Equations (1) and (4) depict ESG "effect" variables only and the results suggest that, when accounting for a two-period lag, improving the control of corruption would lead to a 2.65% increase in GDP per capita growth, making one argue that government efforts against corruption pay significant economic benefits, thus reinforcing the findings of Del Monte and Papagni (2001). Equations (2) and (3) produce similar results between them concerning ESG-related government efforts, so an interpretation will be provided only for the later one. An increase in government expenditure on education of 1% of GDP seems to lead to an approximately 1.47% decrease in GDP per capita, results which can be backed up by the previous work of Suwandaru, Alghamdi and Nurwanto (2021). These results can partially be attributed to the specifics of some of the countries in my dataset, in particular Central and Eastern European countries, as public spending on education may relate mostly to the teaching staff's wages and administrative expenses. Moreover, Eastern and Southern European countries are facing the "brain-drain" phenomenon and the investment in education made by their home country is not properly reflected in the labour productivity. It should also be noted that the EU 27 context poses some challenges when assessing the impact of

various factors on economic growth, as these differ between the advanced, Western economies, and the "catching up" economies in the East.

In line with Khan et al. (2020), a 1% of GDP increase in government expenditure in health is associated with an approximately 0.48% decrease in GDP per capita, results which could also be justified by the fact that in some countries most of these spending go on wages. On the other side, these results can be positively look at, in the way that improving living standards and working towards a cleaner environment could be associated with fewer diseases and hospitalization cases, thus reducing the need for government spending on health matters. Country specifics could also play an important role in obtaining these results, as in developing EU countries the lack of proper hospital infrastructure makes government spending on health rather inefficient. When considering lags for the independent ESG variables, the results of the equation (6) also indicate that increasing health expenditure has a negative effect on economic growth. The results of the same equation suggest that, when accounting for a two-period lag, increasing environmental taxes by 1% of GDP would lead to a 0.5% increase in GDP per capita, confirming the previous work of Hassan, Oueslati and Rousselière (2020). However, the results should be taken with a pinch of salt as they are statistically significant only at the 10% level.

Regarding the control variables, the results indicate that labour productivity has a significant effect on economic growth, as a 1% increase in labour productivity leads to an increase in GDP per capita by approximately 1.1% in all six ordinary least squares regression models. Contrary to the economic theory, the results suggest that an increase in capital stock is associated with a decrease in GDP per capita between 0.31%-0.36%, which could also be explained by some economic -disparities between the countries in my dataset.

Table 8. Fixed effects estimations

Variables	Equations					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
ENVTAX		0.0364 (0.1620)	0.0160 (0.0673)			
ENVTAX(-2)					0.3288 (1.3188)	0.5008 * (1.9151)
GEXENV		-0.0608 (-0.1428)	0.0503 (0.1131)			
GEXENV(-2)					-0.7082 (-1.5473)	-0.7405 (-1.5485)
GEXEDU		-1.3692 *** (-6.3489)	-1.4729 *** (-5.9410)			
GEXEDU(-2)					-0.0338 (-0.1374)	0.2045 (0.6930)
GEXHEA		-0.5291 *** (-4.3405)	-0.4768 *** (-3.3178)			
GEXHEA(-2)					-0.1495 (-0.8764)	-0.3622 * (-1.6777)
GHG	0.0041 (1.2898)		0.0031 (1.0270)			
GHG(-2)				0.0073 ** (2.2708)		0.0069 ** (2.1144)
CORR	1.0343 (0.7381)		0.8118 (0.6194)			
CORR(-2)				2.6554 * (1.6569)		3.2157 ** (1.9816)
LE	0.5648 (0.1101)		-4.1063 (-0.7270)			
LE(-2)				6.1829 (1.2080)		12.0334 (1.9113)
CPI	0.0395 (0.8877)	0.0400 (1.2462)	0.0350 (0.8233)	0.0357 (0.7476)	0.0212 (0.5117)	0.0451 (0.9300)
CAP	-0.3574 *** (-13.4737)	-0.3065 *** (-12.3584)	-0.3138 *** (-12.2072)	-0.3473 *** (-12.6873)	-0.3486 *** (-13.1636)	-0.3377 *** (-12.3003)

LP	1.1017 *** (37.5287)	1.0581 *** (39.5311)	1.0549 *** (37.4176)	1.1157 *** (37.4788)	1.1087 *** (38.0020)	1.1081 *** (37.0538)

*Source: Author's computations. Notes: * p < 0.1, ** p < 0.05, *** p < 0.01. Values in parentheses represent t-statistic.*

The long-run effects of ESG-related government efforts on economic growth, depicted through the results of the FMOLS and DOLS models, are presented in Table 9. Some of the long-run results reinforce the short-run findings presented above as an increase in government expenditure as percentage of GDP directed towards education, on one hand, and towards health, on the other, leads to a decrease of GDP per capita of about 1.1%, respectively 0.95%, in the FMOLS model. It must be noticed that only for GEXHEA the results are statistically significant for both type of models, as the economic downturn, corresponding to an increase in government spending on health, is of approximately 1.66%, in the DOLS model. These results consolidate the view that reducing the need of government spending on health, potentially by reducing the risk of hospitalization caused by a harmful environment, would be highly beneficial for the economic growth. The FMOLS model predicts a 3% decrease in GDP per capita, in the long-run, when increasing government spending on environmental protection by 1% of GDP. Such results can be backed up by NGFS transition scenarios (Mehrhoff, 2023), which argue that although the green transition comes at a high cost it mitigates even costlier economic and financial losses caused by climate change and predicted extreme weather events. These results could add further weight on the scepticism towards greening the economy, particularly at the level of the European Union, whose economy has been underperforming in the last decades when compared to its peers. Lastly, long run results (FMOLS) suggest that a 1% increase in environmental tax revenue would lead to almost a 0.09% decrease in GDP per capita, confirming the long-run results of Hassan, Oueslati and Rousselière (2020). As economic agents are making efforts towards reducing their carbon footprint, increasing environmental tax revenues would be associate with an increase in taxation level. Such a measure would penalise important economic agents that act in traditionally polluting industries such as oil & gas, agriculture, transport, or construction, which are still pillars of many EU economies, thus compromising economic growth.

Table 9. Panel fully modified OLS (FMOLS) and dynamic OLS (DOLS) estimations

Variables	FMOLS	DOLS
ENVTAX	-0.0875 *** (-0.1866)	-0.0248 (-0.0318)
GEXENV	-2.9978 *** (-3.3122)	-1.2421 (-0.8070)
GEXEDU	-1.1056 ** (-2.5187)	-0.5357 (-0.6980)
GEXHEA	-0.9498 *** (-3.6985)	-1.6560 *** (-3.4598)

*Source: Authors' computations. Notes: * p < 0.1, ** p < 0.05, *** p < 0.01. Values in parentheses represent t-statistic.*

Lastly, short-term and long-term causality between GDPC, ENVTAX, GEXENV, GEXEDU, and GEXHEA, depicted in equations (3) to (7), is analysed though the results of a PVECM Granger causality test presented in Table 10 below. The causal relationship indicated in the first column indicates that government health expenditure would positively cause gross domestic product per capita in the short term. Government expenditure on education has a slightly positive causality on the environmental tax in the short run, while the government spending on health implies a negative causality. Government spending does not seem to be impacted by the other variables in the short run, while negative causality has been found from the GDP per capita towards government spending on education and health. In the case of the later, the bidirectional causality between GDP per capital and health expenditure must be noted. In the long run, the output suggests for a unidirectional causality running from environmental tax revenue, government expenditure on environmental protection, and government expenditure on education towards both gross domestic product per capital and government expenditure on health, while there is a bidirectional relationship between the latter two.

Table 10. Granger causality for Panel Vector Error Correction Model (PVECM)

Variables	Short-Run Granger Causality					Long-Run Granger Causality
	ΔGDP	**ΔENVTAX**	**ΔGEXENV**	**ΔGEXEDU**	**ΔGEXHEA**	**ECT**

ΔGDP	-	0.0010	-0.0002	-0.0131 ***	-0.0187 ***	-0.6738 ***
ΔENVTAX	0.4924	-	-0.0065	0.0419	-0.1562	0.0060 **
ΔGEXENV	-0.1512	0.0067	-	0.0779	0.2063 *	0.0030
ΔGEXEDU	-0.6531	0.0701 **	0.0057	-	0.0572	0.0159 ***
ΔGEXHEA	2.6722 ***	-0.0459 **	-0.0216	0.0537	-	-0.0185 ***

*Source: Authors' computations. Notes: * p < 0.1, ** p < 0.05, *** p < 0.01*

Conclusions

The aim of this paper was to assess the impact of ESG-related government efforts towards economic performance in a try to bring valuable arguments into the very topical debate of whether ESG efforts are justified from an economic point of view.

The main added value of this paper is embracing multiple facets of ESG-related government efforts and studying their impact on growth, by utilizing both short-term and long-term estimation instruments. Generally, the literature shows that ESG-related public spendings have mixed influences over economic growth and the results of the current paper reinforce those findings.

Even though current climate scenarios indicate that significant financial efforts deployed in a timely and well thought manner would mitigate the harshest future negative effects of climate change, there are difficulties in establishing a clear causal relationship between ESG and economic development, and the need for global coordination to address climate challenges is evident. Results in this direction will be difficult to quantify if major global economies, such as, for example, the United States of America, stand on different sides of the fence on this matter.

In this paper, multiple econometric techniques have been employed to study the impact of environmental tax revenue, government expenditure on environmental protection, government expenditure on education, and government expenditure on health towards gross domestic product per capita. Generally, increasing government spending towards education and health does not seem to have positive economic benefits, both in the short- and in the long-run. For the case of education, if spendings are aimed at covering teaching staff's wages that would not necessarily reflect a positive impact towards economic growth, although this could allow for higher disposable income for a part of the employed population, which in turn could reflect into higher consumption. Moreover, for the case of some economies, increasing spending on education without solving the "brain-drain" and early leaving school problems would not reflect towards higher labour productivity and would only pose a burden for economic growth. Concerning government spending on health, the results, although counterintuitive at a first glance, offer a positive perspective on economic growth. Increasing spending towards health, unless strictly directed towards infrastructure and medical equipment would not reap positive effects towards the economy. Investing in a cleaner, greener, and more socially equal economy could result in lower hospitalization cases, thus reducing the need for government spending on medication and disease treatment and benefiting the overall economy. From an environmental perspective, the results suggest insignificant impacts of environmental tax revenues and spending towards economic growth. However, governments play a crucial role in fighting climate change and in the transition towards that a green economy and efforts towards the green transition made at an early stage would reap the highest benefits in terms of climate change cost mitigation.

cknowledgments should also extend to the limitations of this paper, encompassing both the datasets utilized and the technical models implemented. As sustainability considerations have recently gained prominence in economists' discussions, there are challenges to be faced by researchers regarding data availability. Additionally, the model's assumptions carry their own constraints, with concerns about endogeneity potentially arising from unobserved variables that might explain the relationship between gross domestic product per capita and government efforts related to ESG factors. Addressing these concerns through an instrumental variable approach or a dynamic generalized method of moments (GMM) approach could enhance the development of this study in the future.

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