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# Environmental tax revenue and public health care expenditure

Prince Fosu
*Rockhurst University*

Kevin Sylwester
*Southern Illinois University*

## Abstract

This paper considers to what extent environmental taxes are associated with more public healthcare spending. The double-dividend hypothesis argues that these taxes not only lower pollution but generate revenue that can then be used to enhance welfare such as health care. Using a panel of countries and controlling for pollution to better distinguish between these two dividends, we find that countries with greater environmental tax revenue do, indeed, spend more on public healthcare although this result primarily holds for energy and transportation taxes. This finding arises for both high- and low-income countries but is stronger for democracies.

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**Contact:** Prince Fosu - Prince.Fosu@rockhurst.edu, Kevin Sylwester - ksylwest@siu.edu.
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# 1. Introduction

Recent health crises renew emphasis for countries to prioritize health care spending. However, the question then arises how to fund this spending and whether some types of taxes might be more effective than others at meeting medical needs. For example, taxes that discourage use of harmful goods could then be more advantageous for addressing health matters. Not only do they raise revenue (that could then offset the need to raise revenue through distortionary taxation of productive activities) but they lower consumption of the products that increase medical expenditures. Examples include taxes on alcohol and tobacco. Environmental taxes provide another example. They lower pollution and could provide other benefits such as cutting other taxes as in Glomm et al. (2008) or increase public welfare spending as in Oueslati (2015). These two accompanying effects are often referred to as a 'double-dividend' although the particular 'extra' benefit that these environmental taxes provide depends on the case in hand *(*Fullerton and Monti 2013*;* Metcalf 2009a, b*;* Freire-González, 2018*)*.

We examine a specific type of added benefit, namely whether revenues from environmental taxes lead are positively associated with increases in public healthcare spending. We focus on health care for three reasons. First, the primary aim of reducing pollution is to reduce the medical problems associated with it. A question then arises whether medical care can be improved from both ends: the decline in the need for medical care due to the fall in pollution as well as the potential of the expansion of medical care due to increased revenue. Second, aging populations in many countries and rising incomes increase demand for medical care thereby increasing expenditures and the required revenues to pay for them. Finally, a premise of the double-dividend is that revenues from environmental taxes fund a welfare enhancing endeavor. Although people can always debate how initiatives are prioritized, we presume that funding medical care would enjoy wide support and something that many would rank highly.

Whether the revenues from environmental taxes can be used to increase public healthcare spending is not clear a priori. Presumably, any source of revenue could be directed to public health concerns, especially from taxes with the purported aim of diminishing pollution that could cause health problems. On the other hand, a government could determine that the direct benefits on health from any cut in pollution suffice and so the revenues could be used for some other objective such as financing education or infrastructure. Even if the purported aim of revenues from a particular tax concerns some specific goal, revenues are fungible and so could cause reallocation of revenues from other sources. Moreover, revenues could be expropriated by government elites to foster their private interests. This ambiguity warrants an empirical analysis.

Past research has considered various aspects of the double dividend. The first aspect considers the effectiveness of such taxes in lowering pollution, including decreasing medical expenditures stemming from the lower pollution. Several theoretical and empirical studies find that environmental taxes lower pollution (Li et al., 2021; Hu et al., 2019; Bashir et al., 2020; Tuladher et al., 2015). This lower pollution then could reduce medical care spending. Yang and Zhang (2018), Chen and Chen (2021), and Narayan and Narayan (2008) all find that improvements in environmental quality lower medical care spending. Jerret et al. (2003) report that counties with higher pollution in Ontario have higher per capita health care expenditures while those that spend more on improving environmental quality have lower medical expenditures. Several papers such as Liu and Ao (2021) find that environmental degradation raises demand for health expenditures. Several studies have recently found a clear link between local air pollution and the number of COVID-19 deaths in China, Europe, and the US (Yao et al, 2021; Yao et al. 2020; Zhu et al, 2020; Lipsitt et al, 2021; Cheng, et al, 2022).

The second aspect of the double dividend examines the amounts and various uses of 'green tax' revenues. Most studies looking at this second aspect focus on how these revenues can fund environmental cleanup or for subsidizing research and development in cleaner technologies. (Fullerton and Monti 2013; Metcalf 2009a, b; Cadoret et al. (2020). Other studies consider how much taxes on pollution could raise. Carbone et al. (2013) estimate that imposing a $30/ton tax (held constant in real terms) is expected to raise $2.26 trillion in total revenue over the first 10 years of its implementation. A similar study by Marron et al. (2015) determines that a $25/ton carbon tax is expected to raise $1.6 trillion in gross revenue over 10 years. Other researchers demonstrate that environmental tax reforms are associated with changes in the structure of public spending (Oueslati, 2015). Nevertheless, a question remains as to whether these revenues fund greater spending on healthcare. This question could also be more nuanced in that environmental taxes could be used to increase health care spending in some types of countries but not others.

This paper makes two contributions. One, we examine an overlooked (in our opinion) aspect of the double dividend, namely the extent that revenues from environmental taxes go towards welfare enhancing good and, specifically, public health spending. If they do not, then perhaps governments are forgoing additional opportunities to undo negative effects from pollution. We do not argue that these environmental taxes have little impact on pollution and readily acknowledge that their effectiveness at lowering pollution could also create lower medical expenditures. Nevertheless, *given a pollution level* we examine if public health care spending is higher where environmental taxes are more greatly used. If so, then these green taxes could have two beneficial effects: they lower medical expenditures associated with pollution but provide funds for healthcare expenditures in other areas. In summary, many have described a possible double dividend, but to what extent has a double dividend arisen? Second, many studies focus on OECD countries, but we also examine developing countries since they have increasingly used environmental taxes as well. One can also then examine to what extent results differ between these two groups.

The rest of this paper is structured as follows. Section two focuses on methodology and data. Section three presents empirical results while the last section presents concluding remarks and policy implications.

# 2. Methodology

The empirical model is:

$$Public\ health_{it} = \xi_0 + \xi_1 envtax_{tot,it} + \rho X_{it} + \delta_i + \mu_t + \upsilon_{it} \quad (1)$$

where $Public\ health_{it}$ is the natural logarithm of public health expenditure per person. We focus on public expenditure since this is funded through tax revenue. $envtax_{tot,it}$ denotes total environmental tax revenues per person. We use a per capita measure so that units coincide with that of the dependent variable. We will later consider four specific types of environmental tax revenues (pollution taxes, energy taxes, resource taxes, and transportation taxes). $\delta_i$ and $\mu_t$ denote sets of country and year fixed effects and $\upsilon_{it}$ is the error term. $X_{it}$ is vector of control variables including the natural log of per capita income, $CO_2$ emissions (pollution), the natural log of total government revenues per person, the percentage of the population under 15 years,

and the percentage of the population aged 65 years and above. Very young and very old countries are predicted to spend more on healthcare.

The inclusion of the three other control variables in the above list better allows us to examine if a country imposes environmental taxes for the potential purpose of increasing public spending on health care. First, we control for income per person. Higher income countries spend more on healthcare and could have more strict environmental policies than do lower income countries, meaning they impose taxes to discourage emitting pollution. We control for total government revenues for a similar reason, namely a country could choose to enact high levels of taxation in order to provide a broad range of government services. The imposition of environmental taxes, then, might not arise from any specific purpose to allocate such revenues to medical care. Instead, a positive association could arise merely because the country imposes a wide range of taxes to provide a wide range of services. We include the level of pollution as a control variable to better disentangle the effects from the double-dividend. Higher taxes should lower pollution thereby lowering health expenditures. But by controlling for the level of pollution, then the coefficient on $envtax_{tot,it}$ should only capture the association with public health expenditures through the revenue channel.

We use panel data from 2000 to 2018 for 93 countries.[1] We begin in 2000 with the availability of data on healthcare expenditure. The World Health Organization (WHO) defines healthcare expenditure as all expenditures for the provision of health services, family planning activities, nutrition activities, and emergency aid designated for health. However, this definition excludes the provision of water and sanitation and so does not capture all factors influencing health outcomes. For the dependent variable, we use the natural log of domestic general government health expenditure per capita measured in current international dollars. Since our focus is on the effects of environmental taxes on government health spending, we do not consider private spending on health care although we acknowledge that the two could be substitutes. Data on environmental tax revenues comes from the OECD.[2] They are measured as a percentage of GDP. These revenues are further specified to come from the following taxes: a pollution tax, a resource tax, an energy tax, and a transportation tax. Data on real GDP per capita, pollution, domestic health expenditure, population under 15 years, and population aged 65 and above are obtained from the World Bank's *World Development Indicators*. Table 1 and 2 present the summary and descriptive statistics of the variables, respectively.

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[1] *Lower income countries*: Burkina Faso, Chad, Congo, Dem. Rep, Madagascar, Mali, Niger, and Rwanda, Togo, Uganda. Lower *Middle-Income countries*: Bolivia, Cameroon, Cote d'Ivoire, Egypt, El Salvador, Eswatini, Ghana, Honduras, India, Kenya, Mauritania, Morocco, Nicaragua, Papua New Guinea, Philippines, Senegal, and Tunisia. *Upper Middle-Income Economies:* Argentina, Botswana, Brazil, Bulgaria, China, Colombia, Costa Rica, Dominican Republic, Ecuador, Equatorial Guinea, Fiji, Guatemala, Kazakhstan, Malaysia, Mauritius, Mexico, Namibia, Panama, Paraguay, Peru, Romania, Serbia, South Africa, Turkey, and Venezuela. *High Income Countries:* Australia, Austria, Belgium, Canada, Chile, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea. Rep, Latvia, Lithuania, Luxembourg, Malta, Netherland, New Zealand, Norway, Poland, Portugal, Singapore, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Trinidad and Tobago, United Kingdom, United States, and Uruguay.

[2] https://data.oecd.org/envpolicy/environmental-tax.htm

The pollution tax refers to a tax imposed on emissions of polluting materials into the air or water as well as ozone depleting substances. Energy taxes comprise taxes on the use of energy products such fossil fuels, electricity, and fuel (petrol and diesel). Obviously, these fuels create pollution, but the tax is not directly levied on the pollution emitted but directly on the use of energy. Transportation taxes denote taxes on motor vehicles and transport services. Again, these activities use fuel and so create pollution, but the tax applies directly to the good or activity itself and not on the amount of energy consumed or the pollution emitted. Finally, resource taxes comprise taxes levied on activities that degrade land and water quality. For instance, mining activities use toxic chemicals such as cyanide and sulfuric acid to obtain the mineral from the ore thereby causing pollution and commensurate health problems. Another example is the application of fertilizer which can kill fish in polluted waters. Of note is that these different environmental taxes are not highly correlated (ranging between 0.07 to 0.25) thereby allowing us to examine how each could be tied to health expenditures.

As Gallet and Doucouliagos (2017) and Ke et al. (2011) discuss, environmental taxes could be endogenous, especially if health concerns which affect spending motivate their implementation. To partially address this concern, we follow Roffia et al. (2023) and include country fixed effects to capture all time invariant factors that could drive tax policy and public medical spending.

Table 1: Summary of variables

| Variable | Description | Source |
|---|---|---|
| *Public Health* | log of domestic general government health expenditure per capita, PPP (current international $). It captures public expenditure on health from domestic sources per capita expressed in international dollars at purchasing power parity. | World Bank |
| *Environmental Tax* (*envtax*) | Log of Total environmental tax revenues. It comprises revenue from the pollution tax, resource tax, energy tax, and transportation tax. | OECD |
| *Pollution Tax* | Log of Pollution tax per capita. Pollution taxes include taxes on estimated emissions to air and water, ozone depleting substances, certain non-point sources of water pollution, waste management, and noise. | OECD |
| *Energy Tax* | Log of Energy tax per capita. It comprises of taxes on energy products such fossil fuels, electricity, and transport fuel (petrol and diesel). | OECD |
| *Resource Tax* | Log of Resource tax per capita. It includes taxes on management of water, land, soil, forest, biodiversity, wildlife, and fish stocks. | OECD |
| *Transport Tax* | Log of Transportation tax per capita. The transport taxes include taxes on motor vehicles and transport services. | OECD |

| | | |
|---|---|---|
| *Govt Tax Revenue* | Total government tax revenue less total environment tax revenue (% of GDP) | UNU-WIDER Government Revenue Dataset |
| *GDP* | log of real GDP per capita (Current international $) | World Bank |
| $CO_2$ | Log of CO2 emissions (metric tons per capita) | World Bank |
| *Young Population* | Population under 14 (% of total population) | World Bank |
| *Old Population* | Population aged 65 and above (% of total population) | World Bank |

Table 2: Summary statistics

| Variable | Mean | Std Dev | Min | Max |
|---|---|---|---|---|
| *Public Health* | 10.957 | 2.090 | 3.292 | 15.452 |
| *Environmental Tax* | 9.649 | 1.783 | 2.968 | 12.771 |
| *Pollution Tax* | 3.617 | 2.720 | 0.954 | 9.936 |
| *Energy Tax* | 3.723 | 3.113 | 1.335 | 10.214 |
| *Resource Tax* | 8.708 | 2.856 | 1.100 | 12.771 |
| *Transport Tax* | 7.605 | 2.777 | 0.079 | 11.367 |
| *GDP* | 3.011 | 0.563 | -1.955 | 3.879 |
| $CO_2$ | 8.355 | 1.775 | 1.322 | 11.725 |
| *Young Population* | 1.858 | 3.427 | -3.515 | 15.569 |
| *Old Population* | 3.201 | 0.410 | 2.477 | 3.923 |
| *Govt Tax Revenue* | 2.052 | 0.734 | 0.419 | 3.387 |

# 3. Results and Discussion

Before presenting regression results, Figure 1 reports how these different taxes compare for four groups of countries: high income, upper-middle income, lower-middle income, and low income. For all groups, energy taxes comprise the largest of the four components.

Figure 1: Environmental tax revenues across income groups (1994-2018)

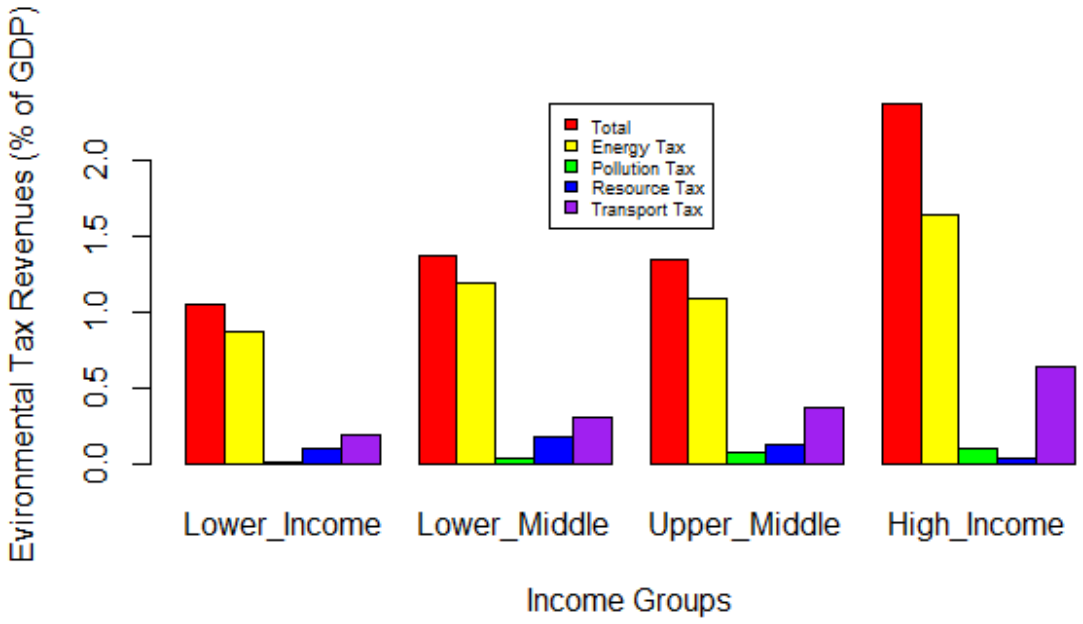


Figure 2 shows the cross-sectional relationship between total environmental taxes and domestic health care expenditure without controlling for other covariates. Both are measured as percentages of GDP. Not surprisingly, a positive association arises since higher income countries both spend more on healthcare and obtain tax revenue from a larger variety of sources, including environmental taxes.

Figure 2: Total environmental taxes and health care spending (averaged from 1994-2018)

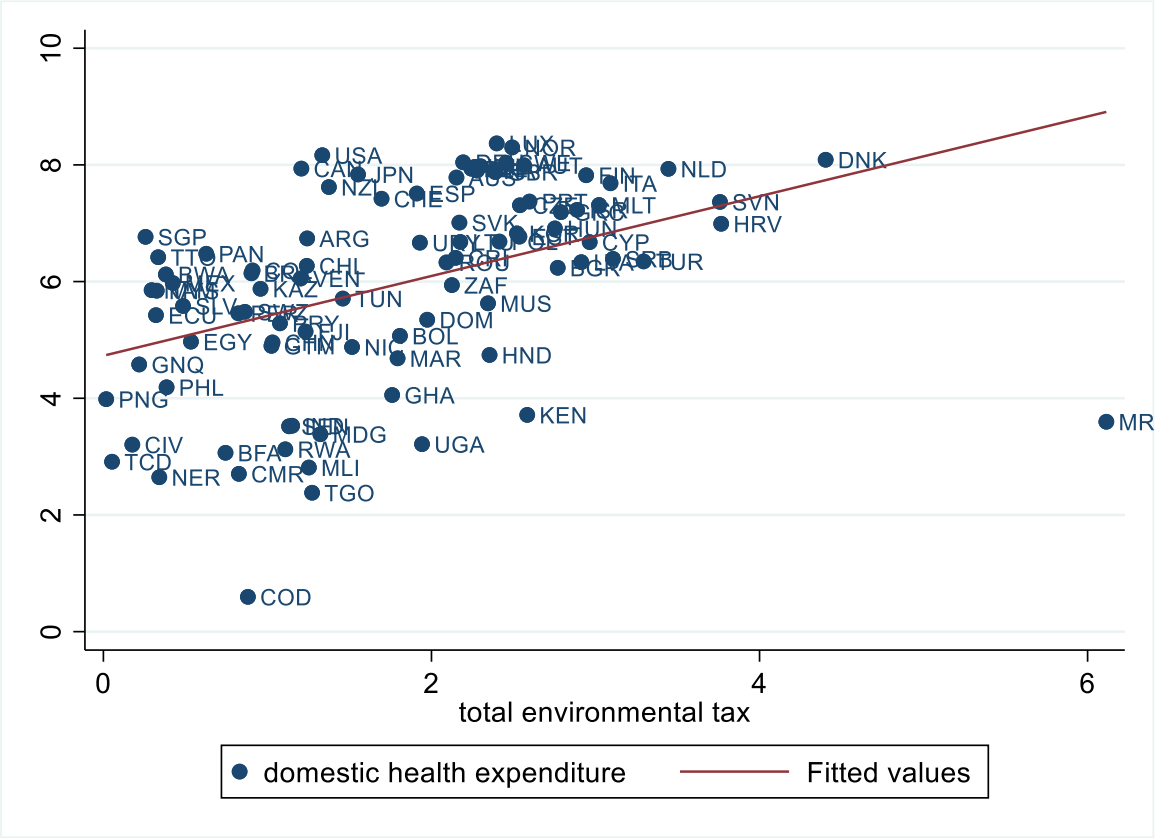


Table 3 presents FE estimates. Columns 1 and 2 present OLS estimates without country FE whereas columns 3 to 7 include the country FEs.

The coefficient on *Environmental Tax* in column 3 is 0.093, significant at the 1% level. The size of this coefficient suggests that a 1% increase in revenue from environmental taxes is associated with an increase in per person public spending on health care by 0.093%. The result suggests that countries with greater tax revenue spend more on public health care, thus, supporting the Double-Dividend hypothesis. Our results support Fullerton and Monti (2013), Metcalf (2009a, b); Cadoret et al. (2020), and Oueslati (2015) who suggest that revenues from environmental taxes can raise funds for government spending.

Columns 4 through 7 consider the association between specific types of environmental taxes and public health spending. The coefficients on all four tax variables are positive, but energy and transport taxes are most strongly associated with public health spending. A one percent increase in energy tax and transport tax is associated with increases in healthcare spending of 0.066% and 0.053%, respectively. From figure 1, these taxes comprise the largest proportions of environmental taxes.

Many of the control variables have the expected signs. Higher income countries spend more on public health. As found in Boachie et al., (2014) and Xhindi et al. (2020), health care is a normal good. Older populations spend more on public healthcare but younger populations spend less. CO2 emission, our proxy for pollution, is positively correlated with public health

spending, likely due to the added costs of treating those negatively impacted by pollution. We find that a percentage increase in pollution increases healthcare spending by 0.21%.

Table 3: Regression results

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| | | | | Panel A: Revenue Variables Measured Per Capita | | | |
| *Environmental Tax* | 0.902*** | 0.366*** | 0.093*** | | | | |
| | (0.019) | (0.026) | (0.016) | | | | |
| *Resource Tax* | | | | 0.001 | | | |
| | | | | (0.008) | | | |
| *Pollution Tax* | | | | | 0.003 | | |
| | | | | | (0.009) | | |
| *Energy Tax* | | | | | | 0.066*** | |
| | | | | | | (0.013) | |
| *Transport Tax* | | | | | | | 0.053*** |
| | | | | | | | (0.014) |
| *Govt Tax Revenue* | | 0.585*** | 0.128*** | -0.017 | -0.025 | 0.093*** | 0.100*** |
| | | (0.063) | (0.030) | (0.031) | (0.061) | (0.031) | (0.031) |
| *GDP* | | -0.096*** | 0.376*** | 0.292*** | 0.329*** | 0.394*** | 0.347*** |
| | | (0.021) | (0.029) | (0.035) | (0.030) | (0.030) | (0.031) |
| *$CO_2$* | | 0.234*** | 0.210*** | 0.241*** | 0.265*** | 0.210*** | 0.240*** |
| | | (0.008) | (0.037) | (0.046) | (0.049) | (0.038) | (0.039) |
| *Young Population* | | -1.874*** | -0.759*** | -0.955*** | -0.383** | -0.826*** | -0.813*** |
| | | (0.203) | (0.158) | (0.194) | (0.153) | (0.166) | (0.161) |
| *Old Population* | | -0.255* | 0.409*** | 0.413*** | 0.831*** | 0.430*** | 0.449*** |
| | | (0.134) | (0.102) | (0.144) | (0.139) | (0.107) | (0.107) |
| R-Squared | 0.595 | 0.836 | 0.790 | 0.821 | 0.852 | 0.784 | 0.794 |
| F-Stat | 2372.25 | 307.323 | 213.658 | 140.840 | 157.52 | 188.213 | 201.842 |
| Obs | 1617 | 1472 | 1472 | 814 | 732 | 1352 | 1362 |
| | | | | Panel B: Revenue Variables Measured as Percentages of GDP | | | |
| Tax Variable | 0.978*** | 0.633*** | 0.108** | 0.005 | 0.016 | 0.077* | 0.058* |
| | (0.076) | (0.148) | (0.048) | (0.013) | (0.015) | (0.040) | (0.029) |

Standard errors clustered at the country level in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All specifications including country and year fixed effects.

We further explore the association between environmental tax and health care spending by country income (columns 1- 4) and by regional subsamples (columns 5-10). Our results show that environmental taxes are positively associated with public health spending for all income groups but lower-middle income. For regions, our results are strongest for Western Europe but weaker for sub-Saharan Africa and the Middle East.

The results in Panel A measure the tax revenue variables in per capita terms. Panel B takes the same specification as that in Panel A but measures the tax revenue variables as percentages of GDP. Although slightly weaker the same general results hold. Evidence arises that environmental tax revenues are associated with greater public spending on healthcare but more strongly for energy and transport taxes.

Table 4: Regression results across income levels and regions

| | (1) High Income | (2) Upper Middle Income | (3) Lower Middle Income | (4) Least Income | (5) North &Latin America | (6) Western Europe | (7) Eastern Europe | (8) Asia and Oceania | (9) Sub Saharan Africa | (10) Middle East |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Panel A: Revenue Variables Measured Per Capita | | | | | |
| *Environmental tax* | 0.216*** | 0.111*** | -0.089** | 0.240*** | 0.084*** | 0.416*** | 0.193*** | 0.066** | -0.020 | 0.229 |
| | (0.025) | (0.023) | (0.034) | (0.088) | (0.024) | (0.041) | (0.042) | (0.032) | (0.041) | (0.353) |
| *Govt Tax Revenue* | 0.453*** | 0.323*** | -0.048 | 0.300 | 0.432*** | -0.692*** | -0.103 | 0.407*** | 0.033 | 0.698 |
| | (0.082) | (0.076) | (0.045) | (0.270) | (0.085) | (0.110) | (0.124) | (0.135) | (0.054) | (0.486) |
| *GDP* | 0.290*** | 0.301*** | 0.458*** | 0.498** | 0.338*** | 0.179*** | 0.311*** | 0.172*** | 0.502*** | -1.311** |
| | (0.034) | (0.049) | (0.080) | (0.233) | (0.063) | (0.050) | (0.055) | (0.053) | (0.094) | (0.559) |
| *$CO_2$* | 0.458*** | 0.022 | 0.743*** | 0.100 | 0.321*** | 0.130** | 0.055 | 0.674*** | 0.176 | -0.771* |
| | (0.050) | (0.082) | (0.129) | (0.206) | (0.094) | (0.052) | (0.107) | (0.119) | (0.108) | (0.355) |
| *Young Population* | -0.574*** | 0.012 | -2.672*** | -5.222*** | 0.518 | -0.695*** | -0.090 | 0.091 | -4.276*** | -12.050*** |
| | (0.144) | (0.300) | (0.534) | (1.509) | (0.410) | (0.174) | (0.262) | (0.342) | (0.744) | (2.831) |
| *Old Population* | 0.042 | 0.346 | 0.674*** | 0.330 | -0.300 | 0.032 | 1.341*** | 1.368*** | -0.010 | -7.898** |
| | (0.130) | (0.214) | (0.259) | (0.557) | (0.190) | (0.163) | (0.305) | (0.327) | (0.298) | (2.736) |
| R-Squared | 0.890 | 0.877 | 0.769 | 0.654 | 0.892 | 0.878 | 0.940 | 0.920 | 0.644 | 0.977 |
| F-Stat | 203.058 | 103.441 | 34.073 | 7.324 | 104.663 | 101.635 | 121.691 | 53.512 | 21.905 | 21.074 |
| Obs | 664 | 397 | 286 | 125 | 349 | 385 | 221 | 144 | 335 | 38 |
| | | | | | Panel B: Revenue Variables Measured as Percentages of GDP | | | | | |
| *Environmental Tax* | 0.295** | 0.123* | -0.094** | 0.214 | 0.112*** | 0.520*** | 0.109*** | 0.035 | -0.005 | -0.161 |
| | (0.119) | (0.064) | (0.040) | (0.151) | (0.035) | (0.109) | (0.042) | (0.076) | (0.069) | (0.283) |

Standard errors clustered at the country level in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All specifications including country and year fixed effects.

Table 5 allows results to differ by the type of political regime where the strength of democracy classification comes from Economist Intelligence. The coefficient on environmental taxes decreases monotonically across these four subsamples and becomes insignificant for authoritarian regimes. These results suggest that political checks and balances could be important in channeling the revenues from these taxes to more welfare-enhancing endeavors as democratic governments – especially in 'strong' democracies – could be more responsive to societal preferences.

Table 5: Regression results across political regime

| | (1) Full Democracy | (2) Flawed Democracy | (3) Hybrid Regime | (4) Authoritarian |
|---|---|---|---|---|
| | Panel A: Revenue Variables Measured Per Capita | | | |
| *Environmental tax* | 0.361*** | 0.087*** | 0.061** | 0.017 |
| | (0.036) | (0.025) | (0.025) | (0.067) |
| *Govt Tax Revenue* | 0.292*** | 0.232** | 0.064* | 0.345* |
| | (0.075) | (0.090) | (0.039) | (0.189) |
| *GDP* | 0.078 | 0.395*** | 0.457*** | 0.497*** |
| | (0.048) | (0.040) | (0.065) | (0.116) |
| $CO_2$ | 0.609*** | 0.184*** | 0.410*** | -0.099 |
| | (0.069) | (0.066) | (0.076) | (0.155) |
| *Young Population* | -0.048 | -0.473** | -1.231*** | -1.276 |
| | (0.219) | (0.218) | (0.356) | (0.922) |
| *Old Population* | 0.001 | -0.169 | 0.117 | 0.994** |
| | (0.157) | (0.192) | (0.182) | (0.414) |
| R-Squared | 0.901 | 0.885 | 0.798 | 0.619 |
| F-Stat | 133.632 | 142.991 | 52.801 | 10.753 |
| Obs | 400 | 498 | 365 | 195 |
| | Panel B: Revenue Variables Measured as Percentages of GDP | | | |
| *Environmental Tax* | 0.481*** | 0.095*** | 0.057* | 0.012 |
| | (0.151) | (0.026) | (0.027) | (0.114) |

Standard errors clustered at the country level in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All specifications including country and year fixed effects.

# 4. Conclusion and policy recommendations

Recent health crises renew emphasis for countries to prioritize healthcare spending. However, the question then arises of how to fund this spending. We examined how revenues from environmental taxes are associated with public healthcare expenditure using panel data from 96 countries from 2000 to 2018. We find a positive and statistically significant association between total environmental tax revenue and government health expenditures, mainly driven by energy and transport taxes. Results hold for different political regimes except for authoritarian ones. They are also strongest for Western Europe and hold for most regions with Africa and the Middle East as exceptions. Nevertheless, our results generally support this aspect of the double dividend and support policy recommendations to rely more on environmental taxes. Of course, endogeneity concerns remain and addressing them is subject for future work.

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