

Sustainable Development: An Ambitious Target to Be Achieved?

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Abstract

The aim of the present study is to substantiate the argument that funding the worldwide environmental efforts for eliminating air pollution from CO₂ emission requires transferring a huge amount of additional tax revenue from the budget of both developed and developing countries. To reach such a conclusion, a utility function for a sample of eleven countries is chosen to determine an optimal combination of direct and indirect taxes. This combination is estimated at different levels of budget constraints to determine an efficient allocation of resources. The environmental efforts under the general title sustainable development include ambitious targets, such as climate changes, environmental degradation, peace, justice and so on. This concept is defined as development that meets the needs of the present generation without undermining the ability of future generations to meet their own needs. Given the scarcity of reliable data measuring the influence of environmental and institutional changes on economic and social indices, the methodology employed in the present study is to overcome the problem arising from the complex environmental pillar of sustainable development and investigate the extent to which the economic and social pillars are financially compatible, that is if the current size of government budget can support the proposed reform bill. Since we demonstrate that such a support appears to be hardly attainable, it is redundant to include environmental issues in our analysis.

Keywords

Sustainable Development, Environmental Policy, Socio-Economic Policy, (In)Direct Taxation, Welfare Maximization

1. Introduction

Sustainable development is defined as the state of the society where living conditions and resources are used to meet human needs without undermining the in-

tegrity and stability of the natural system. The objective is to satisfy the needs of the present generation without causing a damage to the ability of the future generations to satisfy their own needs (see [Brundtland Report, 1987](#)).

The modern approach to the concept of sustainable development requires that we must lay great emphasis on the fields of economic development, social welfare and environmental protection for future generations, in an attempt to attain a fair, inter-generational re-allocation of resources. For example, the [UN Sustainable Development Goals \(2015-2030\)](#) address the global challenges, such as poverty, inequality, GDP growth, climate changes, environmental degradation, peace, justice [see, for example, [UN The 2030 Agenda \(2015\)](#), [World Conservation Strategy \(1980\)](#), [UN World Commission on Environment and Development \(Brundtland Report, 1987\)](#), the [UN Conference on Environment and Development \(1992\)](#), [Transforming Our World: The 2030 Agenda for Sustainable Development \(2015\)](#)]. In summary, the sustainable development concept binds together:

- 1) concern for improving social welfare, by reducing intertemporal income inequalities
- 2) the encouragement of rapid growth rates to finance social welfare programs and
- 3) the responsibility to regenerate and re-orientate planetary resources for use by future generations, via addressing the challenges from climate and environmental changes.

The need for the economic system and the welfare policy to fit themselves to the ecological system, through studying the complex relationship among economic growth, social welfare improvement and environment upgradation, is not considered to be an easily manageable issue to deal with.

In recent years, the concept of mutually depended economic (growth), social and environmental policies (see, for example, [Zhang & Song, 2022](#); [Mathieu-Bolh, 2017](#); [Yoshino et al., 2021](#); [Babatunde et al., 2017](#)) has extended beyond the initial intergenerational framework to include specific topics of discussion: the need to disintegrate the three pillars of sustainable development or to study serious underlying themes, such as the goal of socially and environmentally sustainable economic growth, the notion of sustainable welfare, that is the mutual independence between growth and welfare and the addition of broad public participation in decision making as a prerequisite for achieving sustainable development.

Researchers often argue over whether multifactorial intervention programs (economic growth, social justice and environmental protection), that include the risk of coordinating and harmonizing ideas and actions of a large number of private and government agents into a unified plan to attain usually contradictory objectives, can ever be effective. Especially, the description—provided by international organizations—of sustainable development as a system approach to productivity, environment and human development (education, public health

and standard of living) tends to reframe the debate through the lens of four interconnected domains: economies, ecology, politics and culture.

For additional studies dealing with fiscal, social and environmental issues see for example Baye (2021), Samour et al. (2022), Kouam and Asongu (2022), Vaqueiro García et al. (2020), Dzingirai and Tambudzai (2014), Adeosun and Adebowale (2022), Kwilinski et al. (2019), Trenta (2020), Munitlak Ivanović and Golušin (2012), Kalendienė and Pukelienė (2011), Tyuleneva and Moldazhanov (2020), Andrei et al. (2016), Moosavian et al. (2022), Wang (2022), McGill (2010), Kalkuhl et al. (2017), Halim and Rahman (2022), Yang et al. (2020), Xiao and Liu (2023), Ahmad et al. (2023), López and Figueroa (2016), Kaneva et al. (2022), O'Hare et al. (2022), Liu et al. (2023), Mosquera Valderrama (2020), Wang et al. (2023).

2. The Scope of the Present Study

The concept of sustainable development has been subject to severe criticism. A lot of researchers [see, for example, Brown, 2015; Williams & Millington, 2004; Hardin, 1968; Sachs, 2015; Georgescu-Roegen, 1971; Dyllick & Hockerts, 2002; Daly, 1990; Geissdoerfer et al., 2017; Ayong Le Kama, 2001; Endress et al., 2005; Heal, 2009] argue that:

- There is no such thing as a sustainable use of non-renewable resources, since any positive rate of exploitation leads to the exhaustion of earth's finite stock.
- The theory on sustainable development is based on the assumption that the governments have to manage three types of capital (economic, social and natural) which may not be substitutable. For instance, it may not be possible for economic or social capital to replace ecosystem services, such as the protection provided by the ozone layer.
- The Sustainable Development Goals (SDGs) which have already been adopted by the governments may predict concrete targets but, without realistic sanctions, it will be difficult to keep order in the ecological system.

As becomes evident from the preceding analysis, the third pillar (environmental protection) represents the weak link in modeling sustainable development, because the measures recommended by environmental entities cannot be easily affected by economic-policy prescriptions, except possibly for environmental taxes. This is so because most of the measurable variation in sustainable development is attributed to government intervention in the growth and income-equality spheres (fiscal, monetary and income policies).

The scope of the present study is to isolate the cause of the problem arising from a structural impediment to develop a clear and concise theory on sustainable development with explanatory power and the ability to generate novel and non-trivial outcomes. To do this, we shift away from the three-pillar welfare function that includes environmental issues towards a two-pillar welfare function. The proposed model concentrates on coordinating economic and social policies by determining welfare maximizing pairs of direct and indirect tax rates

which ensure optimal levels of both economic growth and income equality.

The model that will be built in section 3 has several new features:

1) The utility function consists of two arguments, the logarithm of GDP and the Gini coefficient. In evaluating the first-order conditions, the derivative of the logarithm of GDP gives the economic growth rate. Societies which experience high (low) growth rates benefit (suffer) from an increased (decreased) feeling of economic well-being, whereas the Gini coefficient is considered to be the authentic indicator of income (in)equality. A zero Gini coefficient implies a state of perfect income equality, while a Gini coefficient with a value equal to one is synonymous with a completely unfair distribution of income.

2) In the present text, GDP (or its rate of growth) as an index of a high (decent) standard of living is not taken to be a function of labour and capital. Treating GDP in the context of a neo-classical (or any other) growth model would not allow direct and indirect taxes to establish a broad framework of government intervention. Instead, GDP is derived from the National Accounts identity, according to which income is decomposed into an array of determinants, such as consumption, investment, government spending and balance of trade. Starting with an economy without taxes, direct levies can be imposed on personal, corporate or capital income, while indirect levies can also be imposed on consumption, imports or exports.

3) The Gini coefficient serves a useful function as an almost irreplaceable index of measuring income (in)equality. This coefficient is shown to be a function of a large set of determining factors, such as

- the level and structure of taxation, with tax incentives being very effective in encouraging (discouraging) people to work, consume, save, invest and produce,
- the level and quality of investment to make any production project a success,
- unemployment that drives workers over the edge of poverty,
- inflation that causes the cost of living to rise faster than purchasing power,
- years of schooling which draw a line between skilled or educated (high income levels) and individuals who place less importance on education,
- per capita GDP that determines the position of the population on average in the income scale,
- social security contributions which are scheduled to improve the standard of living of the poor,
- agriculture that is still largely based on traditional methods in most of the less-developed countries,
- median age, the evolution of which over time may indicate a population that grows younger (and more productive) or older,
- the rate of growth of GDP, with high rates ensuring for people a state of feeling healthy and happy.

4) The welfare function as specified above is then maximized with respect to direct/indirect tax rates, subject to a constraint that corresponds to the average

government budget constraint of the sample of the eleven countries, considered in our study. However, adopting estimates of budget constraint based on actual data from National Accounts has proved ineffective in providing the right conditions for promoting the ideal opportunity to achieve the sustainable development objective. This failure prompted us to carry out a number of experiments with higher and lower values of budget constraints bind acceptable tax structures.

5) Finally, the first-order conditions derived from the maximization process are manipulated to yield a reliable combination of direct/indirect tax rates that would justify a pragmatic and reliable approach to the problem of meeting both targets of equity and efficiency. The research findings on the basis of the relevant econometric analysis suggest that moving within the range of the current budget constraints given by the National Accounts of the sample of countries considered leads to the barely encouraging conclusion that sustainable development could ever become a successful story. Probably, such a conclusion is a direct result of our failure to follow fiscal policies that allow for drastic re-adjustments in the size and structure of direct/indirect tax rates. We show that introducing major changes in the structure of the tax systems makes it possible to be on track to achieve the sustainable development target.

The rest of the paper is organized as follows. In section 3, we outline the important considerations that may have been ignored by the conventional analysis of sustainable development by using econometric techniques and simulations to underline the practical implications of incorporating our theoretical work to the sphere of applied fiscal policy management. The empirical investigation of the model is presented in Section 4. Section 5 concludes the discussion laying out directions for further work.

3. The Model

Consider an economy with two discrete time periods. In the first period, $t = 0$, there is no public sector. Therefore, no taxes are levied on income and consumption and no budget is drawn up to provide for government expenditure. Consequently, in the absence of taxation, the National Accounts identity is given by

$$Y_0 = C_0 + I_0 + X_0 - M_0 \quad (1)$$

where Y represents GDP, C is private consumption, I is private investment, and X and M stand for exports and imports, respectively.

In the second period, a public sector is introduced in the analysis, with direct taxes being imposed on personal income and corporate profits, at a composite tax rate t_y . In addition, commodity taxes are initiated which reduce private consumption and restrict imports at a composite tax rate t_i , whereas investment and exports are assumed to be tax-free.

Thus, the National Accounts identity (1) would, at first sight, be approximated by

$$Y_0(1-t_y) = (1-t_i)C_0 - (1-t_i)M_0 + I_0 + X_0 + G \quad (2)$$

However, the relation (2) is actually an inequality because the terms on the right-hand and left-hand sides are multiplied by different tax rates or they do not change at all. To transform inequality (2) into a post-tax National Accounts identity, we re-define the variables as follows:

$$Y(1-t_y) = (1-t_i)cY - (1-t_i)mY + Z + G \quad (3a)$$

where $Y = \frac{Y_0}{1-t_y}$, $C = \frac{C_0}{1-t_i}$, $M = \frac{M_0}{1-t_i}$, $Z = I_0 + X_0$, $G =$ government spending, $c = \frac{C}{Y}$ with $c =$ average propensity to consume, and $m = \frac{M}{Y}$ with $m =$ average propensity to import.

Thus, Equation (3a) takes the form

$$Y(1-t_y) = C - M - t_i(c+m)Y + Z + G \quad (3b)$$

or

$$Y[1-t_y + t_i(c+m) - c + m] = Z + G \quad (3c)$$

Note that, in (3c), the total tax revenue, T , is given by the sum of direct and indirect taxes, i.e.

$$T = t_y Y + t_i C + t_i M = [t_y + t_i(c+m)]Y \Rightarrow \bar{\tau} = \frac{T}{Y} = t_y + t_i(c+m) \quad (4)$$

It is assumed throughout that it is the tax revenue alone (without government borrowing) that is used to finance government spending, G , so that

$$G = T = [t_y + t_i(c+m)]Y \quad (5)$$

Equation (3c) may be re-written

$$Y = \frac{Z + G}{1-t_y + t_i(c+m) - c + m} \quad (6)$$

The term $\frac{1}{1-t_y + t_i(c+m) - c + m}$ in Equation (6) may be interpreted as the tax-induced income multiplier that measures the extent to which a one-percentage point change in the (in)direct tax rate affects GDP.

Remember that the National Accounts identity (3a) and the balanced-budget multiplier (5) verify two important theorems of Walras Law:

1) Competitive equilibrium in the economy is attained when aggregate supply $[= Y(1-t_y)]$ is equal to aggregate demand $[=(1-t_i)cY - (1-t_i)mY + Z + G]$,

2) In a two-sector economy with private and public sectors, if the government budget constraint is in equilibrium ($T = G$), then the private budget constraint will also be in equilibrium, so that it is redundant to include the latter in our analysis.

The last note that should be made is that the relationship (6) represents the reduced-form equation for GDP and states that the long-run equilibrium level of income depends upon the value of the multiplier effect, i.e. upon the size and the structure of the (in)direct tax-rate system: appropriate tax-rate adjustments can

result in an infinite number of competitive equilibrium settings which can be Pareto efficient. This note will have far-reaching implications for policy makers, if they find out that the lack of affordable tax schemes may ruin their plans for meeting the sustainable development target. Such a possibility will be explored in section 4, when the estimates of the econometric model will be available.

Let us now turn to the establishment of the appropriate welfare function. Consider a sample of eleven countries indexed $h = 1, \dots, 11$. Each country has a utility function

$$U^h = U^h(\ln Y^h, GIN^h) = a \ln Y + \beta GIN \quad (7)$$

where $\ln Y$ is the logarithm of Equation (6) and GIN is the Gini coefficient, which is taken to be a function of eleven social and economic variables, as described above, i.e.

$$GIN = g_0 + g_1 t_y + g_2 t_i + g_3 ENVTAX + g_4 r + g_5 MED + g_6 AGR + g_7 RI + g_8 UN + g_9 INF + g_{10} SC + g_{11} RP + g_{12} RSSC \quad (8)$$

where t_y and t_i are the direct and indirect tax rates respectively, $ENVTAX$ are environmental taxes, r is the rate of growth of GDP, MED represents the median age of the population, AGR is the employment in the agricultural sector as a percentage of total population, RI stands for the ratio of investment to GDP and UN for the unemployment rate, INF is the annual inflation rate, SC stands for the years of schooling, RP is the income per capita and $RSSC$ represents the ratio of real social security contributions to GDP.

In preliminary tests, environmental taxes in (8) proved to be statistically insignificant; this was a good reason to incorporate them into consumption taxes, instead of completely ignoring them.

The welfare function (7) is then maximized with respect to direct and indirect tax rates, subject to the budget constraint, as defined by Equation (5).

The Lagrangian for this maximization problem is written

$$L = U(\ln Y, GIN) + \lambda [G - t_y Y + t_i (c + m) Y] \quad (9)$$

The necessary conditions describing the optional choice of the growth rate with respect to both the direct tax rate - closely connected with (dis)incentives to work effort and capital formation - and the indirect tax rate - closely connected with consumption and social-economic indicators - are

$$\frac{dL}{dt_y} = \frac{dU}{d \ln Y} \frac{d \ln Y}{dt_y} + \frac{dU}{dGIN} \frac{dGIN}{dt_y} + \lambda \left[Y + t_y \frac{dY}{dt_y} + t_i (c + m) \frac{dY}{dt_y} \right] = 0 \quad (10a)$$

$$\frac{dL}{dt_i} = \frac{dU}{d \ln Y} \frac{d \ln Y}{dt_i} + \frac{dU}{dGIN} \frac{dGIN}{dt_i} + \lambda \left[(c + m) Y + t_i (c + m) \frac{dY}{dt_i} + t_y \frac{dY}{dt_i} \right] = 0 \quad (10b)$$

Equations (10a) and (10b) can be simplified as follows:

$$\frac{dU}{d \ln Y} = a \quad \text{and} \quad \frac{dU}{dGIN} = \beta, \quad \text{from (7)}$$

$$\begin{aligned} \frac{dGIN}{dt_y} &= g_1 \quad \text{and} \quad \frac{dGIN}{dt_i} = g_2, \text{ from (5)} \\ \frac{dY}{dt_y} &= -\frac{Z+G}{[1-t_y+t_i(c+m)-c+m]^2}, \text{ and} \\ \frac{dY}{dt_i} &= -\frac{(Z+G)(c+m)}{[1-t_y+t_i(c+m)-c+m]^2} \text{ from (6)} \\ \frac{d \ln Y}{dt_y} &= -\frac{1}{1-t_y+t_i(c+m)-c+m} \\ \text{and } \frac{d \ln Y}{dt_i} &= -\frac{c+m}{1-t_y+t_i(c+m)-c+m} \text{ from (6a)} \end{aligned}$$

To complete the analysis of the structural characteristics of the first-order conditions (10a) and (10b), the following steps should be taken:

- 1) move the third terms of (10a) and (10b) from the left-hand side to their right-hand side,
- 2) divide (10a) by (10b) in order to eliminate the Lagrange multiplier λ ,
- 3) substitute the solutions of the partial derivatives of the (utility, Gini and income) functions of (10a) and (10b), as given above, for the corresponding general partial derivatives.

Manipulating (10a) and (10b) as suggested above leads to the following equation that allows us to express the optimal levels of (in)direct tax rates in terms of the basic parameters of our model:

$$\begin{aligned} &\frac{\frac{a}{1-t_y+t_i(c+m)-c+m} + \beta g_1}{\frac{a(c+m)}{1-t_y+t_i(c+m)-c+m} + \beta g_2} \\ &= \frac{\frac{-ct_i}{(1-t_y+t_i(c+m)-c+m)^2} - \frac{1}{1-t_y+t_i(c+m)-c+m} - \frac{t_y}{1-t_y+t_i(c+m)-c+m}}{\frac{c(c+m)t_i}{(1-t_y+t_i(c+m)-c+m)^2} - \frac{c}{1-t_y+t_i(c+m)-c+m} + \frac{(c+m)t_y}{(1-t_y+t_i(c+m)-c+m)^2}} \end{aligned} \tag{11}$$

The parameters of (11), i.e. c , m , t_b , t_y , are estimated on the basis of the data set that is provided by the National Accounts of the countries considered (see Appendix). The parameters of the utility function are derived from (10a) and (10b); they are two equations with two unknowns, $\frac{dU}{d \ln Y} = a$ and $\frac{dU}{dGIN} = \beta$. Solving these equations simultaneously with respect to a and β , the parameters of the utility function can be easily determined.

For models dealing with maximization of utility from the improvement of the environmental protection see, for example, Jaimovich and Rebelo (2017), Din et al. (2022), Khan et al. (2019), Andrei et al. (2016), Tyuleneva and Moldazhanov (2020), Moosavian et al. (2022), Mpofu (2022), Liu et al. (2023), Hartono et al. (2023), Ahmad et al. (2023), Yang et al. (2020), Munitlak Ivanović and Golušin

(2012), Xiao and Liu (2023), Rao et al. (2023), Alińska et al. (2018).

4. Estimation Results

In section 3, social welfare was shown to be a function of two (out of the three) pillars-components of sustainable development, i.e. growth (efficiency) and income distribution (equity). Environment protection was not considered due to the lack of crucial measurable data on the effects of environmental distortions on economic activity. The welfare function was then maximized, subject to the government budget constraint, with the manipulation of the first-order conditions leading to Equation (11).

In this section, we will solve Equation (11) in terms of the direct-indirect tax rates, with the values of the parameters and constants α , β , m , c , g_1 , g_2 , Z , G estimated from the National Accounts of eleven developed and developing countries which represent by assumption a suitable sample of countries with high an interest in promoting the ideal of sustainable development.

The eleven countries are presented on **Table 1**, together with the average values of the parameters and constants. The data set covers a 32-years period (1990-2021) for each country thus making up a broad set of 352 observations,

Table 1. Average values of estimated parameters.

Country	α	β	g_1	g_2	t_r	t_i	$C = C/Y$	$M = M/Y$	C^*	M^*	$Z^* = I + X$	G^*	Y^*
Australia	-	-	-	-	0.16	0.08	0.52	0.19	219.86*	85.04	181.33	71.72	387.43
Canada	-	-	-	-	0.16	0.08	0.52	0.29	393.93	225.25	382.14	144.71	698.55
Chile	-	-	-	-	0.06	0.11	0.65	0.17	23.44	6.29	17.07	4.60	38.14
Israel	-	-	-	-	0.11	0.12	0.55	0.33	20.18	11.80	19.46	8.80	36.75
Mexico	-	-	-	-	0.05	0.05	0.68	0.21	22.00	6.94	13.16	3.19	32.26
Spain	-	-	-	-	0.10	0.09	0.59	0.23	307.84	123.35	239.05	96.43	523.12
France	-	-	-	-	0.10	0.12	0.56	0.29	756.15	400.19	703.64	323.89	1390.67
Germany	-	-	-	-	0.11	0.10	0.55	0.32	1093.49	671.41	1186.03	388.93	1998.25
Italy	-	-	-	-	0.14	0.11	0.58	0.22	507.73	195.60	376.91	162.52	851.19
United Kingdom	-	-	-	-	0.12	0.10	0.64	0.30	619.62	292.71	440.84	183.76	951.44
United States	-	-	-	-	0.12	0.04	0.62	0.13	5322.77	1130.26	2520.31	1189.33	7936.75
Average dataset	0.81	0.19	-0.68	0.22	0.11	0.09	0.59	0.24	844.27	286.26	552.72	234.35	1349.51

*In billion US dollars. Source: Organisation for Economic Co-operation and Development (OECD) database. Note: The marginal propensities to consume and import, i.e. $c = \frac{C}{Y}$ and $m = \frac{M}{Y}$ respectively, are estimated on the basis of the transformed values of income, consumption and imports, as they are defined in Equation (3a). Note that the parameters g_1 and g_2 on **Table 1** correspond to the coefficients of direct and indirect tax rates, respectively, in Equation (8), in which the Gini coefficient is shown to be a function of a set of independent variables. The results of regressing this coefficient on its determinants for the sample of the eleven countries, employing a cross section time series method, are displayed on **Table 2**.

and the estimation method employed is the time-series cross-section analysis.

The final step is to introduce the parameter values of **Table 1** into both Equation (11) and the budget-constraint (4). These relationships comprise a system of two equations with two unknowns, t_y and t_b , and can be solved simultaneously to provide the optimal tax structure, i.e. the combination of direct-indirect tax rates, that is assumed to achieve a fiscally acceptable sustainable development status.

Substituting the numerical values of the parameters displayed on **Table 1** for the corresponding parameters of Equation (11) and the budget constraint (4) results in the set of optimal direct/indirect tax rates. These estimated optimal direct-indirect tax rates are set against the corresponding average actual values (derived from the National Income Accounts of the sample of the eleven countries) in **Table 3**.

Table 2. Parameter values for the Gini coefficient-function.

Variable	Coefficient values	t-statistic	Probability
g_0 , constant	0.46	13.0	0.00
g_1 , direct tax rate	-0.68	-8.54	0.00
g_2 , indirect tax rate	0.22	1.38	0.17
g_3 , environmental tax rate	0.29	0.78	0.44
g_4 , rate of growth of GDP	0.11	1.26	0.32
g_5 , median age	-0.00	-0.50	0.34
g_6 , employment in agriculture as a percentage of population	0.71	6.56	0.00
g_7 , investment to GDP	-0.22	-2.90	0.00
g_8 , unemployment rate	0.08	1.76	0.31
g_9 , inflation rate	0.05	0.17	0.26
g_{10} , years of schooling	0.03	0.27	0.29
g_{11} , GDP per capita	1.21E-06	1.69	0.09
g_{12} , social security contributions to GDP	-0.60	-7.31	0.00
R ² = 0.86, F-statistic = 189.3 (0.00)			

Source: Organisation for Economic Co-operation and Development (OECD) database and the “Our World in Data” database (Global Change Data Lab, Charity Number 1186433).

Table 3. Optimal vs. actual tax rates.

	actual	optimal
Direct tax rate, t_y	0.11	0.41
Indirect tax rate, t_i	0.09	-0.22
Total average tax rate, $\bar{\tau}$	0.20	0.20

It becomes evident from **Table 3** that there is a visually striking performance that no one would ever expect to see from a maximization process: The optimal indirect tax rate bears a negative sign which means that the government must subsidize private consumption expenditure, eliminating indirect taxation, with these subsidies being funded by an excessively high income tax rate. This in turn implies that a tax system with high (positive) direct tax rates of an anti-growth nature would co-exist with an ever-expanding negative indirect taxation of a pro-proverty profile: a perfect recipe for reaching fiscal-economic deadlock.

The question that arises from the solution of the maximization problem is whether the model developed in Section 3 is really representative of the conditions that should exist in economies, whose main focus of interest is on investing in sustainable development. The alternative question could be the following: how strong an assumption would be to lay the blame on the inadequacy of the government-budget items to finance the ambitious plan of transforming the current fiscal-economic system into a durable, successful sustainable development route.

A high priority task is to investigate whether the tax schedules in the range of 15% - 25% of GDP adopted by policy makers nowadays in the eleven countries considered are “too weak” to bear the burden of meeting the requirements of promoting the transition to sustainable development. To address this issue, we can experiment on alternative levels of taxes (and public expenditure) employing the model of section 3. The results are presented on **Table 4**.

If we carry the results of **Table 4** to their logical conclusion, we realize that further investing in promoting sustainable development is not a good idea, as the cost of the relevant project seems to be disproportionately high. There are three points in our findings that attract a lot of attention:

- 1) The total tax burden must rise up to 60% of GDP to provide small-scale positive indirect tax rates.
- 2) As one moves from the break-even point of the tax to GDP ratio - being equal to 60%, where the ratio of indirect tax revenue to GDP starts taking on positive signs - to the highest possible ratio of 99%, the direct tax rate is being continuously raised and so does the indirect tax rate. However, the direct tax rate remains 3 - 90 times as high as the indirect tax rate, throughout the budget-constraint scale.
- 3) The general conclusion that can be drawn from the inspection of **Table 4** is that the total tax burden and, especially, the average direct-tax rates, should be

Table 4. Alternative tax structures maximizing social welfare.

Total average tax rate, $\bar{t} = t_y + t_i$	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	0.57
Direct tax rate, t_y	0.42	0.46	0.50	0.54	0.59	0.63	0.68	0.72	0.76	0.57
Indirect tax rate, t_i	-0.22	-0.16	-0.10	-0.04	0.01	0.07	0.12	0.18	0.24	0.00

set at unprecedentedly high levels, which policy makers would rather be unwilling to adopt without impinging upon market efficiency through “confiscating” a large portion of the private-sector wealth.

Note that the argument of the present study, that attaining the sustainable-development objective proves to be rather unaffordable, is independent of the fact that environmental considerations have not been introduced in our econometric model. Even if it could be shown that environmental factors are fiscally compatible with the social and/or economic pillars, the serious financing problems arising over the size and variability of an optimal socio-economic schedule would possibly negate the prospects of successfully launching a sustainable-development policy initiative.

5. Conclusion

In the present paper, an attempt is made to formulate the argument that the integration of economic policy (growth), social policy (income distribution) and environmental policy (ecology) into the single objective of sustainable development is a hardly attainable fiscal target. The reason is that a successful path to sustainable development requires massive transferring of scarce resources from the private sector to the public sector, in the form of an extremely heavy tax burden and, especially, a disproportionate large increase in average direct tax rates with adverse effects on incentives and growth.

In the conceptual framework, it is assumed that utility depends on the notions of economic growth and the degree of income (in)equality, given the government budget constraint. The solution of the maximization problem results in two equations which are manipulated to yield the optimal combination of direct and indirect tax rates.

In order to substantiate our argument, eleven developed and developing countries were chosen and National Accounts data were used over the period 1990-2021. The econometric findings demonstrate that the world’s acute environmental problems cannot be effectively addressed so long as the average tax revenue oscillates between the conventional narrow 15% - 25% range of options, whereas a normal (though unpopular) funding program for optimal sustainable development must have at least quadruple number of the above range.

Taking into account the reservations regarding the financing aspects of drawing up an optimal sustainable-development plan, the main contribution of the present study is that it provides an econometric device for transforming society’s preferences into guidelines to policy makers, with an aim toward helping them to select from a set of welfare maximizing sustainable development schedules, taking into account their effects on growth prospects and/or on income (in)equality.

With these properties in mind, the proposed theoretical-empirical structure may at least be thought of as deserving careful consideration by future researchers, especially in the direction of extending the model to include environmental issues capable of being dealt with on the basis of reliable data.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Appendix

Data sources

The annual data cover the period 1990 to 2021.

Private final consumption expenditure, Final consumption expenditure of general government, Gross fixed capital formation, Net exports, Imports, Gross Domestic Product (GDP), Direct tax revenue, Indirect tax revenue, Environmental tax revenue, Employment in agriculture, Population, Unemployment rate, Inflation rate and Social Security Contributions come from the Organisation for Economic Co-operation and Development (OECD) database. Data extracted on 2022 from OECD Statistics (OECD.Stat).

Gini Index comes from the World Bank Database. Data extracted on 2022 from the World Bank Data.

Median Age and Years of Schooling come from the “Our World in Data” database. This database is a project of the Global Change Data Lab (Charity Number 1186433).

The original data have been deflated by the GDP deflator (1990 = 100) taken from the OECD database. Data extracted on 2021 16:46 UTC (GMT) from OECD Statistics (OECD.Stat).