Original Article

The effects of green tax on Iran's economy

Masoumeh Soltaninejad [1], Sayyed Abdolmajid Jalaee [2*], Mohsen Zayandehroodi [1]
[1] Department of Economics, Kerman Branch, Islamic Azad University, Kerman, Iran.
[2] Department of Economics, Shahid Bahonar University of Kerman, Kerman, Iran.
***Corresponding author and reprints: Sayyed Abdolmajid Jalaee,** Professor, Department of Economics, Shahid Bahonar University of Kerman, Kerman, Iran.
Email: jalaee@uk.ac.ir
Received: 24 Aug 2022 **Accepted:** 06 Nov 2022 **Published:** 14 Nov 2022

Abstract

Background: This research was conducted with the aim of investigating the effects of green tax on Iran's economy.

Methods: This was analytical research using the Nordhaus economic model. The data relating to torques and statistical tests were used to compare actual and model data to determine how well the designed Nordhaus model corresponds to the data on Iran's economy, t and f statistical tests were designed to determine the degree of conformity of the Nordhaus model, and the first and second-order coefficients were used for the variables. Data analysis of the gross domestic product, investment, government spending and oil revenue was used with GAMS software.

Results: The values of the simulated and real characteristics did not differ significantly at the 95% confidence level(P-value=0.05), which shows the high compliance of the Nordhaus model with the real data of these variables. According to the Nordhaus model, green tax affects economic welfare. It reduces economic growth in the short term and increases it in the long term. By reducing production, the level of leisure increases and leads to compensate for the reduction in consumption due to reduced production and increased economic welfare.

Conclusion: One percentage of increase in the rate of tax on return of capital leads to a reduction in consumption and a reduction in capital. Increasing the rate of tax on return of capital leads to increased tax revenues and helps governments to compensate for pollution costs and improve the quality of the environment.

Keywords: Economics; Iran; Models, Economic; Taxes.

Cite this article as: Masoumeh SoltaninejadM, Jalaee SA, Zayandehroodi M. The effects of green tax on Iran's economy. *Soc Determinants Health*. 2022;8(1):1-14. DOI: http://dx.doi.org/10.22037/sdh.v8i1.39228

Introduction

Nowadays, environmental pollution has been become one of the main challenges for countries. A major part of these pollutants is related to the activities of factories, which in addition to the negative environmental impacts have a positive role in creating employment, increasing revenue and production (1).

Excessive environmental pollution results in high costs for society and the government (2).

To control these pollutions, governments use policies such as environmental taxes, Coase property rights, government regulations, and licenses, which primarily change the level of economic activities and improve the quality of the environment by targeting the pollutions. Monitoring the quality of the environment is one of the effective activities in protecting the environment (3).

The tax system can be useful for overcoming economic problems if it adheres to three principles of efficiency, being economical and fairness (4).

Economists found that green tax collection in addition to helping to protect the environment will lead to sustainable development through the interaction between the economy and the environment. One of the major consequences of economic growth is increased environmental pollution (5).

In countries such as the Netherlands and Denmark, environmental taxes account for more than 4% of GDP, and this figure is more than 1% of GDP for Canada. In Iran, the 1% environmental taxation significantly reduces pollution and fuel demand (6).

Green taxes or environmental taxes on a variety of environmental pollutants increase social benefits by reducing pollution costs (7) and can prevent the release of excessive pollutants. In Iran, there is a system of fines that is very different from taxes, but it is possible to determine the level of green taxes by providing a legal framework and conducting economic studies scientifically. In this study, the economic model of Nordhaus, which was first used by Nordhaus, was used to investigate the impact of green tax on the Iran's economy. The present study seeks to answer the question of what is the impact of green tax on Iran's economy with emphasis on the Nordhaus model. It was performed using the equations of the Nordhaus model, which was divided into four sectors: economy, geography, household and government.

Methods

The research method in this study is an analysis of an economic model of Nordhaus, in which the experimental analysis was also carried out by applying calibration in the necessary cases.

The statistical population includes the entire population that the researcher intends to investigate. In order to collect data, at first, a comprehensive review was done of documents, library resources such as books, student theses, scientific and research journals, and international scientific articles until the theoretical foundations of the research were formulated and from the results of the studies conducted in connection with the subject also be used. Then, in the field study section, in order to obtain the required information, a quantitative method was used in the form of mathematical equations as well as tests using time series data. Data analysis in this thesis was done through GAMS software.

Research model equations

Economic sector

This model optimizes a social welfare function, W, which is the sum of the per capita consumption discount and per capita consumption. The symbol V is a function of momentary social welfare, U is a function of utility, c (t) is per capita consumption, and L (t) is population. Time is in five-year periods. The discount factor in the future is R (t) = (1 + ρ) −t, where ρ is the net rate of social temporal preference or the rate of generational discount on welfare.

$$W = \sum_{t=1}^{T_{max}} V[c(t), L\,(t)R(t) = \sum_{t=1}^{T_{max}} U[c(t), L\,(t)R(t) \quad (1)$$

The utility function has a constant elasticity relative to per capita revenue in the form of $U(c) = c^{1-\alpha}/(1-\alpha)$. The parameter α is interpreted as generational risk aversion, which measures the relative importance of consumption levels of different generations. In the current version, the discount rate is 1.5 percent per year, and the inequality rate is 145. As described, these parameters are set to adjust the real interest rate in the model.

Net output increases gross output by reducing costs:

$$Q(t) = \Omega(t)[1 - \Lambda(t)]Y(t). \quad (2)$$

In this case, Q (t) is the net output of costs and reduction, Y (t) is the gross output, which is a Cobb Douglas function of capital, labor, and technology. **Ω** (t) and)Λ (t) are damage and cost reduction functions and defined below. Total output is divided between total consumption and total gross investment, labor is proportional to population, while capital is accumulated according to the optimal savings rate.

The concept of global production, as measured by the International Monetary Fund, is purchasing power parity (PPP). The concept of growth is the weighted growth rate of the real GDP of different countries, in which the weights are the share of the countries of the world GDP using the current US dollar. The current version also significantly updates estimates of historical growth and per capita production growth. Future growth is mainly based on expertise conducted by Christensen, *Gillingham*, and Nordhaus in 2018. Climate change plans with the committee polices are additional variables in the above equation and (t) Ω and (Λ (t) represent the damage and cost reduction functions, respectively. The external cost function (Λ (t) in Equation (2) above is the output fraction assigned to CO2 emissions. The resulting reduction function has a slightly higher cost than previous estimates. This issue refers to reduction in the performance of cost of reducing other IAMs as the representative in the modelling uncertainty project (MUP et al). The resulting reduction function has slightly lower cost than previous estimates.

The damage function is defined as **Ω** (t) = 1-D(t), while

$$D(t) = \psi_1 T_{AT}(t) + \psi_2 [T_{AT}(t)]^2 \quad (3)$$

Equation (3) describes the economic impacts or damage caused by climate change. In the DICE model, the total air temperature (TAT) change is used as a sufficient statistic for damages. Equation (3) assumes that the costs can be reasonably approximated in the function by two degrees of change in temperature. Estimation of damage function coefficients is described below. The emission of industrial CO_2s emitted by a surface of carbon dioxide, which is given at the time of gross production, is in the form σ (t). Total CO2 emissions, E (t), reduction of total emissions by μ (t) plus exogenous land gas emissions:

$$E(t) = \sigma(t)[1 - \mu(t)]Y(t) + E_{land}(t). \quad (4)$$

This model has been revised to include a rapid reduction in CO2 emissions (or what is called decarbonization) to reflect the observations of the last decade.

Geography

The next section deals with the equations for the relationship between economics and climate change. Geographical equations link correlation between greenhouse gas emissions and carbon cycles and climate change. Equation 5 specifies the relationship between the carbon cycle for three inputs:

$$M_j(t) = \emptyset_{0j}E(t) + \sum_{i=1}^{3} \emptyset_{ij}M_i(t-1) \quad (5)$$

These three variables are equal to j = AT and LO, which are in the atmosphere, alongside the oceans and the Earth's atmosphere, and the lower surface of ocean. The variable $\emptyset_{ij}$ describes the parameters between the water tanks for each period. All reductions in the atmosphere will be explained.

The next relationship is between accumulated GHG and increased radiative force. Radioactive force causes heat on the earth's surface. The increase in radioactive force is due to the increase in the level of greenhouse gases as shown in Equation (6):

$$F(t) = \eta\{\log_2[M_{AT}(t)/M_{AT}(1.750)]\} + F_{EX}(t) \quad (6)$$

Here, F (t) describes the total change in radiative force at the CO_2 emission source for CO2, F_{EX} is the exogenous force. The DICE model also uses the expected values of variables such as.

Household

The household gains utility from consumption of goods and services, leisure and the pollution-free environment, so the household seeks to maximize its utility from the consumption of goods and services, leisure (1- L) and the quality of the environment Q over time. The utility function is strictly concave and increases in relation to the consumption of goods and services and the quality of the environment and decreases in relation to labor. The utility function and household budget constraint are specified in Equation (7), (8), (9), respectively:

$$\sum_{t=0}^{\infty} \beta^t U(c_t . I_t . Q_t) \quad (7)$$

$$U(c_t . I_t . Q_t) = \frac{[(c_t)^{\mu_1}(I_t)^{\mu_2}(Q_t)^{1-\mu_1-\mu_2}]^{1-\sigma}}{1-\sigma} \quad (8)$$

$$k_{t+1} - (1-\delta^k)k_t + c_t = y_t = (1-\tau_t^l)w_t n_t + (1-\tau_t^k)r_t k_t + \pi_t \quad (9)$$

The left side of the household budget represents household consumption and investment expenditures, and the right side represents household income after tax. In the budget constraint equation, k_t capital in period t and δ^k is the capital depreciation rate, w_t and r_t are labor wage and capital rent, respectively, and τ_t^l and τ_t^k are the rate of tax on return of capital, and πt is the amount of earnings obtained from the activity of the enterprise. The first-order conditions for a household are:

$$U_{c_t} = \Lambda_t \quad (10)$$

$$\frac{c_t}{1-n_t} = \frac{\mu_1}{\mu_2}(1-\tau_t^l)w_t \quad (11)$$

$$k_{t+1} - (1-\delta^k)k_t + c_t = y_t = (1-\tau_t^l)w_t n_t + (1-\tau_t^k)r_t k_t + \pi_t \quad (12)$$

Equation (9) is Euler's equation for capital, which states that along the optimization path, the ultimate utility of consumption at any point of time is equal to the opportunity cost of consumption. The environmental quality function is defined as follows, following Losifidi & Mylonidis (8).

$$Q_{t+1} = (1-\delta^q)\bar{Q} + \delta q Q_t - p_t + v g_t \quad (13)$$

$$p_t = \varphi A K_t^{\alpha} n_t^{(1-\alpha)} \quad (14)$$

In Equation (13), $\bar{Q}$ represents the quality of the pollution-free environment and $\bar{Q} \geq 0$, p_t represents the pollution caused by production activities and increases with increasing production. δ^q is the degree of environmental sustainability and is $\delta q \in [0.1]$. The environmental sustainability index measures the ability of nations to protect and preserve the environment. g_t also represents government expenditures and ν indicates what percentage of government expenditures is spent on the environment. This type of cost can be converted into units of renewable sources. Φ is also the pollution index, which represents the amount of pollution emissions per unit of production.

Government

The government is the main provider of expenditures to reduce pollution and

Table 1. The share of each fossil fuel in the emission of air pollutants in 2019 (percentage)

Fuel	CO_2	NOx	So_2	CO	CH	SPM
Furnace oil	14.3	14	60.9	Very small figure	0.6	7.2
Gas oil	21	40	30.9	2.3	30.5	80.2
Kerosene	8.2	0.8	3.8	0.2	0.1	0.1
Gasoline	14.5	26.2	4.3	97.3	68.3	10
natural gas	42	19	0.1	0.2	0.5	2.5
Total	100%	100%	100%	100%	100%	100%

Source: Research Findings (The coefficient of this increase has been determined according to the energy balance sheet of 2019.)

convert it into renewable sources, and to finance these expenditures, it uses labor tax and tax on return of capital. Therefore, the government budget constraint in equilibrium is defined as follows:

$$g_t = AK_t^{\alpha} n_t^{(1-\alpha)} \left[\alpha \tau_t^k + (1-\alpha)\tau_t^l\right] \quad (15)$$

Results

Share of each fossil fuel in the emission of air pollutants

Based on Table 1, with increasing fuel consumption, the emission of air pollutants also increases and consequently air pollution increases. Thus, they have a linear relationship with each other. The coefficient of this increase has been determined according to the information of the energy balance sheet in 2019. Change in the consumption of fossil fuels (oil products and natural gas) cause changes in the production of air pollutants, which in turn causes environmental problems such as increased greenhouse gases and its consequences (including global warming and other climate change). It is obvious that the occurrence of greenhouse impacts and the hazards causing by it can be prevented by reducing greenhouse gases by eliminating or limiting the sources of its production. Pollutant changes with green tax are calculated according to the production coefficients of each of the above pollutants per unit of fuel consumption. CO2, NOX and CH pollutants account for about 97%, 0.3% and 0.45%, respectively, of the total pollutant emissions in different sectors. As a result, the positive impacts of reducing pollutants in the welfare function are considered based on the share of each of these pollutants.

Change in demand for fossil fuels and air pollution due to green taxation

Demand for fossil fuels (gas and oil products) is the total domestic supply of fuel (domestic production minus foreign exports) plus its imports from abroad. Green taxation reduces the demand for fuel both as a final commodity by the consumer and as an intermediate input in the production of other sectors.

Welfare changes due to green tax

Green tax decreases the consumption of fossil fuels, resulting in reduced welfare. To examine welfare, equivalent changes in income are calculated for the representative consumer as a measure of the welfare impacts resulting from different tax policies in two cases, with and without considering the environmental impacts. In the first case, welfare is considered only as a function of consumption of goods (energy and non-energy), while in the second case, welfare or utility is a function of consumption of

Table 2. Changes in fuel demand and air pollutants due to green tax (percentage)

Fuel	Gas demand	Oil demand	CO_2	NOx.	CH
0.5% tax	-0.7	-2	-0.7	-0.8	-2
1% tax	-3.8	-2.2	-2.1	-1.6	-2.2
1.5% tax	-6.4	-5.9	-5.3	-2.3	-4.2
2% tax	-8.8	-6.1	-5.5	-3.4	-6.1

Source: Research findings (The coefficient of this increase has been determined according to the energy balance sheet of 2019)

Table 3. Welfare changes resulting from green tax (percentage

Fuel	Welfare without considering environmental impacts	Welfare with considering environmental impacts
0.5% tax	-0.2	2.2
1% tax	-0.3	2.1
1.5% tax	0.4	3.6
2% tax	0.8	5.4

Source: Research findings (The coefficient of this increase has been determined according to the energy balance sheet of 2019.)

goods and environmental impacts (especially air pollution) due to fuel consumption.

Model calibration

Calibration was used to obtain the model parameters. Table 4 presents the results of the calibrated simulation show the parameters and variables related to the Iran's economy.

Simulation of Nordhaus model

The results of simulation of the model in Diagrams 1 and 2 show the impact of one percentage of increase in the tax rate on return of capital in the Nordhaus model. According to the results, one percentage of increase in the rate of return of capital has led to a reduction in consumption and a reduction in capital. Increasing the rate of return of capital increases tax revenues and helps governments pay for pollution, thereby improving the quality of the environment. Based on the results, government expenditure along with the quality of the environment has increased. In other words, with increasing the rate of tax on return of capital, government expenditures also increase. Also, one percentage of increase in the rate of tax on return of capital has led to a reduction in consumption and a reduction in capital in a stable status relative to the initial balance, and an increase in quality of environment and government expenditures in a stable status relative to the initial balance. The results of the Nordhaus model show the same results of Kuznets theory. In the early stages of growth, environmental degradation increases, but after reaching a certain level of economic growth, environmental awareness increases over time and more effective laws are enacted and enforced, and government expenditures to protect environment and improve the environment increase.

Also, based on Kuznets environmental theory, increasing the quality of the environment following a decrease in capital indicates the direction of capital flow to increase the scale of production and ultimately increase the volume of pollution emissions. Thus, capital formation has not been consistent with increasing bio-friendly technology, and government expenditures have also increased to protect and improve the environment. Changes in environmental parameters of ν and φ also affect the quality of the environment. An increase in

Table 4. Parameters and variables related to the Iran's economy

Descriptions	Value	Parameter
Discount rate	0.98	B
Capital share of production	0.4	A
Capital depreciation rate	0.07	δ^k
Rate of tax on return of capital	0.28	T^k
Rate of tax on labor revenue	0.18	T^l
Productivity of production factors	0.35	A
Environmental performance	0.42	Δ^q
share of utility from consumption	0.35	μ_1
share of utility from employment	0.48	μ_2
pollution-free environmental quality	1	Q
rate of changes in pollution to production	0.07	Φ
rate of environmental protection expenditures	0.02	N

Source: Research findings (The coefficient of this increase has been determined according to the energy balance sheet of 2019.)

consumption weight (u_1 relative to u_2) or an increase in β increases the amount of consumption and capital in a stable status. Different types of taxes should be applied to have the least disruptive impacts on other sectors Diagrams 3 and 4.

The impact of green tax on the economy based on the Nordhaus model

The impact of green tax on the total economy based on the Nordhaus model

Based on the Nordhaus model, green tax reduces economic growth in the short term and increases it in the long term. This contradiction arises from the fact that these revenues are spent on current government expenditures and the fight against

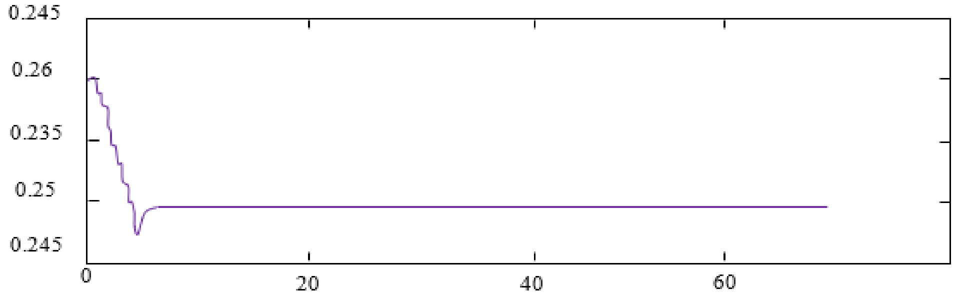

Diagram 1. The direction of movement of consumption towards a stable status based on the Nordhaus model

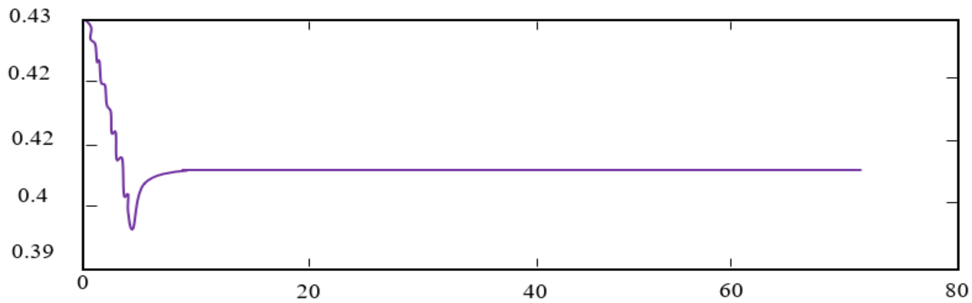

Diagram 2. Direction of capital movement towards a stable status based on the Nordhaus model

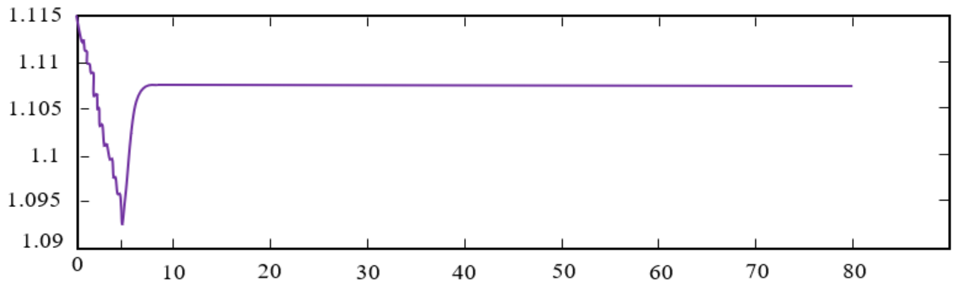

Diagram 3. Direction of quality of the environment movement towards a stable status based on the Nordhaus model

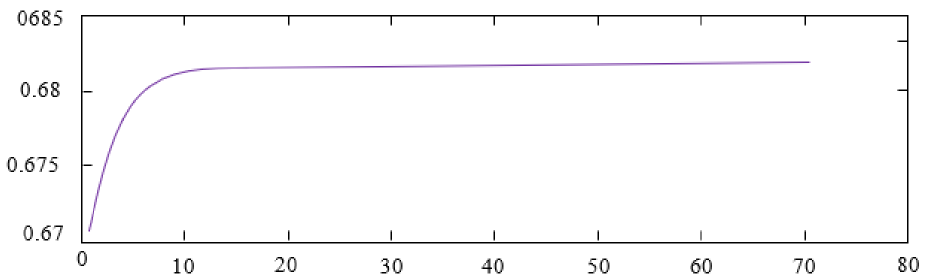

Diagram 4. To government expenditures movement towards a stable status based on the Nordhaus model

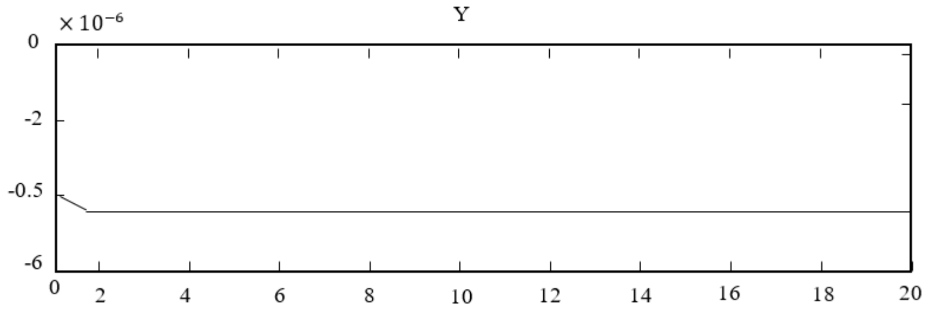

Diagram 5. Impact 0.5% green tax on the total economy based on the Nordhaus model

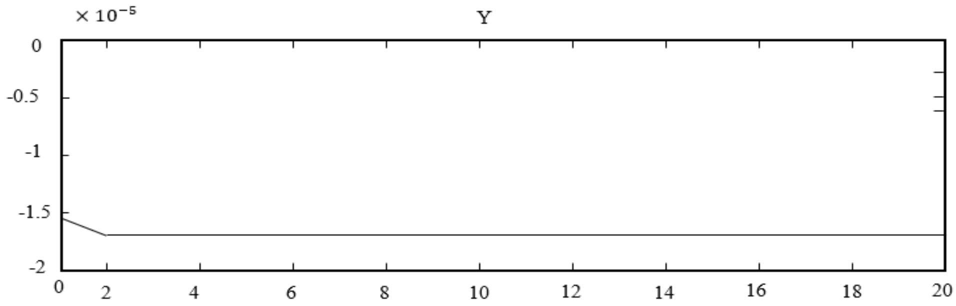

Diagram 6. Impact 0.5% green tax on the total economy based on the Nordhaus model

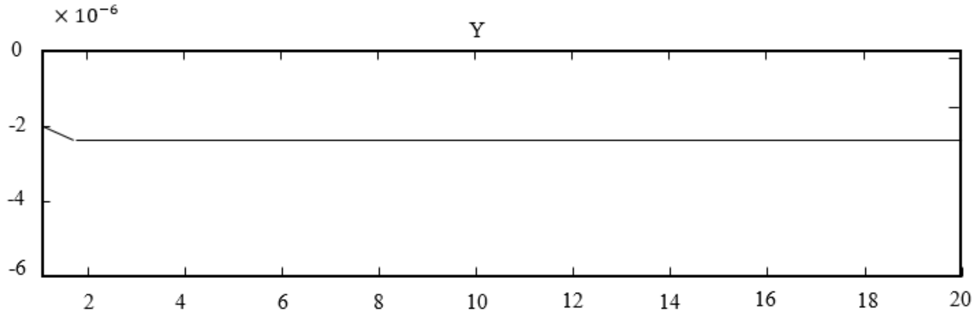

Diagram 7. Impact 2% green tax on the total economy based on the Nordhaus model

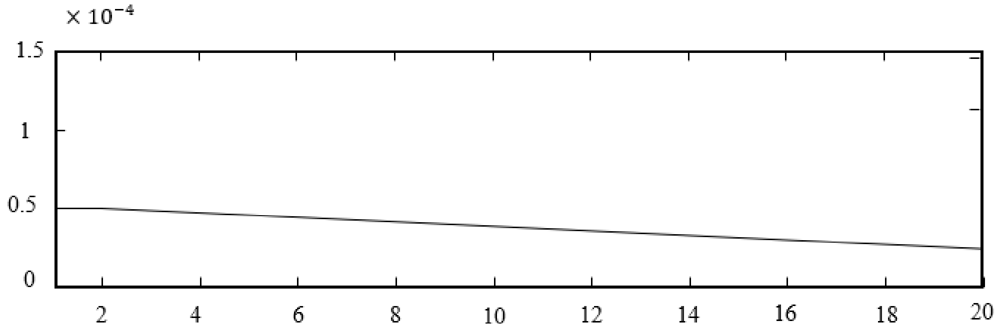

Diagram 8. Impact of 0.5% tax on economic welfare based on the Nordhaus model

pollutants. In the long term, due to investment in human capital, economic growth is strengthened Diagrams 5-7.

The impact of green tax on economic welfare based on the Nordhaus model

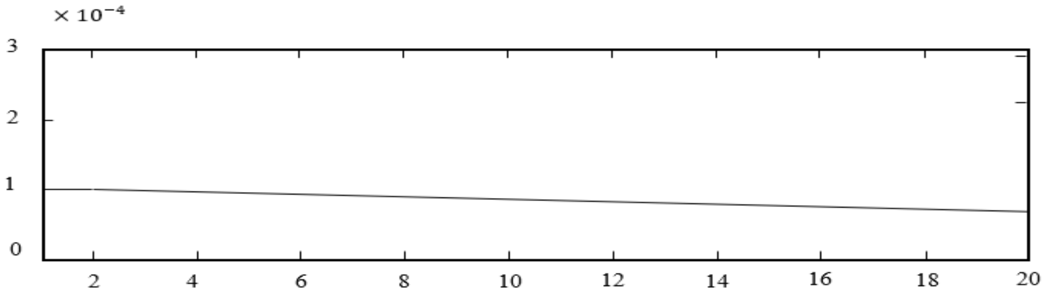

Diagram 9. The impact of 1% green tax on economic welfare based on the Nordhaus model

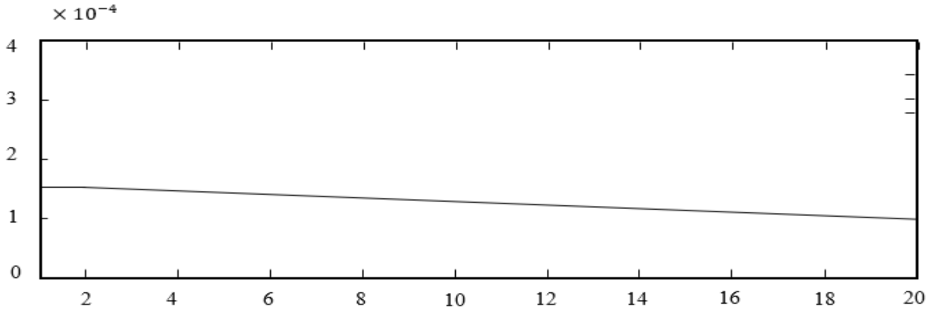

Diagram 10. The impact of green tax on economic welfare based on the Nordhaus model

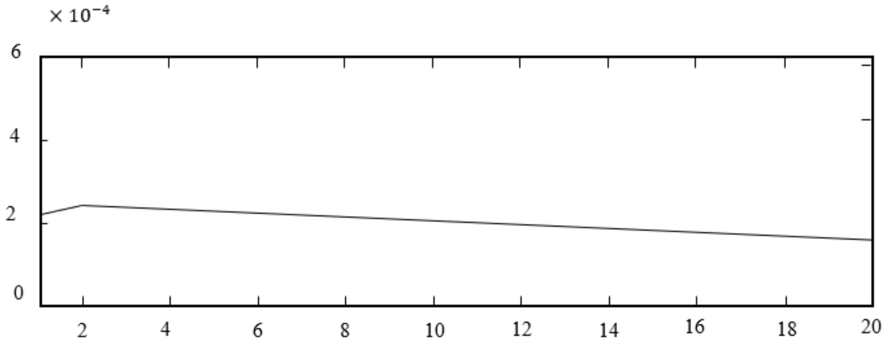

Diagram 11. The impact of 2% green tax on economic welfare based on the Nordhaus model

Green tax affects economic welfare and reduces total production. Welfare increases in the post-tax period. As production decreases, the amount of waste and pollution increases, leading to compensating a reduction in consumption due to reduced production and increasing economic welfare Diagrams 8-11.

Evaluating the validity of the Nordhaus model using statistical tests

In this study, we used data of moments and statistical tests to compare real data and model data to determine to what extent the designed Nordhaus model is consistent with Iranian economic data. Table 2 shows the first- and second-order moments for the variables of GDP, investment, government expenditures, and oil revenue, indicating the high consistency of the Nordhaus model with the real data of these variables. In Table 5, the values were compared using t and f statistical tests and the results were expressed.

Table 5. Real data moments and Nordhaus model data

Variable	Mean		SD	
	Real data	Model	Real data	Model
GDP	0.98	0.94	0.850	0.798
Consumption	0.86	0.79	0.708	0.645
investment	2.18	1.95	0.875	0.639
Government Expenditure	0.73	0.69	0.382	0.367
Oil revenue	2.82	2.93	0.461	0.447

Table 6. Statistical tests to compare the characteristics of variables

Variable		GDP	Consumption	Investment	Government expenditure	Oil revenue
*Mean equality test	Test statistic	0.22	0.38	1.25	0.30	-0.48
**SD equality test	Test statistic	1.78	1.25	1.33	1.34	1.47

* Variable (Critical value (GDP: 1.98, Consumption: 1.98, Investment: 1.98, Government expenditure: 1.98, Oil revenue: 1.98)
**SD equality test (Critical value (GDP: 1.84, Consumption: 1.84, Investment: 1.84, Government expenditure: 1.84, Oil revenue: 1.84)

Comparing the value of test statistics and critical values in Table 6 shows that the value of test statistics is less than the critical value* at the 95% level for all variables and the null hypothesis is not rejected. Therefore, the values of simulated and real characteristics are not significantly different at the 95% confidence level. Therefore, it can be claimed that the model has acceptable fit power and accuracy.

Discussion

Based on the results, green taxation showed that the total economic production will decrease slightly in both the short and long terms. Thus, economic welfare increases in the short term, but decreases over time and in the long term. However, at a level higher than the level of welfare before the green tax, the 0.5% tax has the lowest decrease in economic production and the lowest increase in welfare at the 2% tax rate has the highest decrease in economic production and the highest increase in welfare. Based on the obtained results, it can be concluded that if the government's approach is to increase the quality of the environment, reduce pollutants and, consequently, sustainable development and increase welfare, we should accept the reduction of economic production. Based on the Nordhaus model, the green tax reduces economic growth in the short term and increases it in the long term. This contradiction arises from the fact that these revenues are spent on current government expenditures and the fight against pollutants. In the long term, due to investment in human capital, economic growth is strengthened Diagrams 5-7. The results of a study conducted by Fiddaman, to examine the policy options with a behavioral-economic model show that climate policies using a system dynamics model that includes many of the missing characteristics of economic models are almost all policy options are net profit, and the outlook for choosing the policy is gentler than previously thought (10).

Green tax affects economic welfare and reduces total production. Welfare increases in the post-tax period. As production decreases, the amount of waste and pollution increases, leading to compensating for a reduction in consumption due to reduced production and increasing economic welfare Diagrams 8-11. William has provided a dynamic model for the economic climate. This model can be used to explore alternative methods for slowing down climate change. The evaluation of the five policies suggests that a low-carbon tax is an effective approach to reducing air warming, while greenhouse gas stabilization approaches will have significant net economic costs (11). Kaufmann evaluated the DICE model in 1997. The results of the DICE model show that nothing should be done to reduce greenhouse gas emissions, since climate change at 2105 has very little impact on economic activity. Without any policy intervention, climate change would reduce the net present value of consumption by less than 1% between 1995 and 2105 compared to a world where climate does not change. Even without considering the serious impacts, climate change reduces the prediction for global GDP per capita by about 2% (12).

It is clear that not all models are fully integrated to describe the desired characteristics. Among the well-known models, the original DICE model (Nordhaus) is probably the purest example of the standard model used in this study (11). Based on Nordhaus, study, many areas of the natural and social sciences involve complex systems that integrate multiple parts. Integrated assessment models (IAMs) are methods that integrate knowledge from two or more areas into a single framework, and this is crucial for climate change. The difficulty in assessing IAMs is the inability to use standard statistical tests due to a lack of possible structure. In the absence of statistical tests, he conducted a study to find the extent to which the DICE model has been revised over a quarter of a century. In particular, serious revisions to global production increase carbon losses and social costs. These results suggest that economic predictions are the least accurate parts of IAMs and further study is needed at current for a more accurate investigation of long-term economic growth (up to 2100 and beyond) (12). Therefore, it can be claimed that the model has acceptable fit power and accuracy. Also, studies related to green tax are as follows:

Bovenberg & De Mooij investigated the intervening effect of an environmental tax within the framework of general equilibrium. In their model, consumers maximize their utility over a household budget constraint and a government budget constraint. Utility depends on the consumption of clean and polluting goods, leisure, environmental quality and government expenditures. To solve it, they assume that public goods (government expenditures on public goods and environmental quality) are less separable than private goods (13). In a study entitled “Introducing environmental taxes in Russia”, Orlov & Grethe, reported that the relationship between the interactions of carbon tax alternative taxes on labor tax can lead to increased export tax revenue, import tariffs, tax value added, and some indirect taxes due to the expansion of tax bases. An increase in tax revenues and tariffs reduces the cost of environmental tax reform (14) which are consistent with the results of the present study.

In this research, demand for fossil fuels (gas and oil products) is the total domestic supply of fuel (domestic production minus foreign exports) plus its imports from abroad. Green taxation reduces the demand for fuel both as a final commodity by the consumer and as an intermediate input in the production of other sectors. Moghimi Feyzabadi et al. used the data-output table of 2001 and the calculable general equilibrium model to examine the welfare and environmental impacts of the two policies of green taxation and reduction of fuel subsidies. For this purpose, using the MCP technique and GAMES software, welfare changes with and without considering the environmental impacts, changes in energy demand and changes in the share of pollutants were evaluated in the form of five tax scenarios.

The obtained results show that fuel taxation reduces the intermediate demand and consumption of fossil fuels. In all scenarios, considering the positive impact of pollution reduction, welfare changes are positive and their amount increases with the increased tax rate. In both policies, the highest welfare growth rate, when environmental impacts are considered, is the 10% tax rate of the third scenario (15), Jafari Samimi & Alizadeh Malafeh showed that green taxation on gasoline and diesel fuel can reduce consumption and reduce the level of environmental pollution. After taxation, the greatest dependency of consumption to price in the long term in the variance analysis table will be for gasoline. The impact of the price shock of the consumption on the variable itself in the first to third period is sharply decreasing, but from the middle of the third to the fourth period, it is increasing again and it is completely moderated in the long term (16). Among the types of taxes, environmental taxes impose the least inefficiency on society (17). Governments in developed countries are very supportive of receiving green taxes because they believe that by transferring part of the burden of taxes on the shoulders of those who pollute the environment, they can contribute to the growth and development of cleaner technologies. Try to encourage and promote the use of green industry (18), which is in line with our research.

In this study, we used data of moments and statistical tests to compare real data and model data to determine to what extent the designed Nordau's model is consistent with Iranian economic data, that shows the first- and second-order moments for the variables of GDP, investment, government expenditures, and oil revenue, indicating the high consistency of the Nordhaus model with the real data of these variables. The green tax or environmental taxes that are applied to all types of environmental pollution, not only does not harm efficiency but also increase the social benefit due to the reduction of costs caused by pollution. To give (19). Receiving this type of tax from factories and those who cause environmental pollution (20). It can be considered a source of income for the government in this field, on the other hand, collecting this type of tax reduces environmental costs and economic stability (21). If the production unit causes environmental pollution in the production process, it has actually maximized its benefits by reducing costs, and the mentioned process indicates that the economic unit receives a kind of subsidy, which is provided by society with it pays to bear the negative effects of pollution (22). In fact, a win-win strategy and mutual synergy are established and this process accelerates the economic growth and development of the country in the long run (23). In addition to green taxes, training should be carried out to closely monitor the implementation of relevant laws in order to prevent tax evasion, because receiving these taxes can facilitate many environmental problems (24). It seems that by expanding the culture of paying taxes at the community level and recognizing its importance in income distribution, creating social justice and eliminating class gaps, it will replace the oil-based economy and create platforms for partial taxation. It should be considered as one of the important duties and tasks of members of society. The continuation of such movements will lead to the prosperity of the resistance economy and, as a result, the all-around improvement of the system in all fields (25).

Recommendation

Based on the obtained results, the following recommendations are presented:

Given the importance of environmental impacts and the need to reduce air pollutants, the use of green tax system in the framework of the Iran's tax system can be significantly effective in reducing pollution, so green tax as one of the indirect taxes is essential in this regard.

Tax on fossil fuels should be considered as a strategic policy by legislators due to the reduction in consumption and demand of fuel and also indirectly the reduction of air pollutants.

Since the highest rate of increase in welfare with environmental impacts is the 2% tax rate and this rate can be emphasized as the optimal rate of green tax (fuel tax), so it is recommended that in the application of the law on targeting energy subsidies, 2% of the elimination of subsidies should be considered as a green tax and a percentage should be added every year to bring the price of fuel closer to its real price on destructive inputs and specify the importance of taxation on destructive environmental inputs, including fuel.

Conclusion

Nowadays, environmental pollution has become one of the main challenges for countries. An important part of these pollutants is related to the activities of factories, which in addition to the negative environmental impacts have a positive role in creating employment, increasing income, and production. The importance and role of tax in achieving sustainable economic growth and stability, employment, reducing inflation, stabilizing the general level of prices and also as the most important source of government revenue after oil is obvious and important for all economic and political officials. Green (environmental) taxes, as one of the components of sustainable development in countries, is one of the effective policies in controlling environmental factors using economic tools. Nowadays, the current methods of pollution control, which rely mainly on tolls and fines, have not been very effective in protecting the environment and other tools, such as green taxes, should be used to control pollution. In this regard, the experiences of recent decades in leading countries in the area of green taxes should be used.

Author's contribution

Masoumeh Soltaninejad and Sayyed Abdolmajid Jalaee developed the study concept and design. Mohsen Zayandehroodi acquired the data. Masoumeh Soltaninejad and Sayyed Abdolmajid Jalaee analyzed and interpreted the data, and wrote the first draft of the manuscript. All authors contributed to the intellectual content, manuscript editing and read and approved the final manuscript.

Informed consent

Questionnaires were filled with the participants' satisfaction and written consent was obtained from the participants in this study.

Funding/financial support

There is no funding.

Conflict of interest

The authors declare that they have no conflict of interests.

References

1. Payehkti Oskooi SA, Nahidi MR. Environmental Taxes (Green Taxes) Theoretical Foundations, Experiences. 6th National Conference of Agricultural Economics;2014.
2. Abasi H, Shahmoradi A, Kavand H. Estimation of a Real Business Cycle Model for the Iran's Economy: Applying Kalman Filtering Approach and Maximum Likelihood Method. Journal of Economic Research (Tahghighat- E- Eghtesadi). 2010;44(4):185-214. https://jte.ut.ac.ir/article_20346.html?lang=en
3. Dadgar Y, Nazari R, Siami Eraghi E. Optimum government and tax in public sector economics and in Iran. Journal of Applied Economics Studies in Iran. 2013;2(5):1-27. https://doi.org/20.1001.1.23222530.1392.2.5.2.9
4. Jalalian K, Pajoyan J. The relationship between government policies on environment, expenditures and Good Governance. Financial Economics. 2009;3(7):37-55. https://doi.org/20.1001.1.25383833.1388.3.7.3.6
5. Bae JH, Shortle James S, The welfare consequences of green tax reform in small open economies, 2005 Annual meeting, July 24-27, Providence, RI 19165, American Agricultural Economics Association (New Name 2008: Agricultural and Applied Economics Association);2005. https://doi.org/10.22004/ag.econ.19165
6. Pajouyan J, Amin Rashti N. Green taxes, with emphasis on gasoline consumption. Economic Research Journal. 2017;7(1):15-44. https://www.sid.ir/fa/journal/ViewPaper.aspx?id=59462
7. Dessus S, Bussolo M. Is There a Trade-off Between Trade Liberalization and Pollution Abatement?: A Computable General Equilibrium Assessment Applied to Costa Rica. Journal of Policy Modeling. 1998;20(1):11-31. https://doi.org/10.1016/S0161-8938(96)00092-0
8. Losifidi M, Mylonidis N. Relative effective taxation and income inequality: Evidence from OECD countries. Journal of European Social Policy. 2017;27(1):57-76. https://doi.org/10.1177/0958928716672182
9. William D. Rolling the 'DICE': an optimal transition path for controlling greenhouse gases. Resource and Energy Economics. 1993;15(1):27-50. https://doi.org/10.1016/0928-7655(93)90017-O
10. Fiddaman T. Exploring policy options with a behavioral climate–economy model. System Dynamics Review. 2002;18(2):243-267. https://doi.org/10.1002/sdr.241
11. Nordhaus W. Projections and Uncertainties about Climate Change in an Era of Minimal Climate Policies. American Economic Journal: Economic Policy. 2018;10(3):336-360. https://doi.org/10.1257/pol.20170046
12. Kaufmann RK. Assessing the dice model: uncertainty associated with the emission and retention of greenhouse gases. Climatic Change. 1997;35(1):435-448. https://doi.org/10.1023/A:1005372513452
13. Bovenberg AL, De Mooij RA. Environmental Levies and Distortionary Taxation. The American Economic Review. 1994;84(4):1085-1089. http://www.jstor.org/stable/2118046

14. Orlov A, Grethe H. Introducing Carbon Taxes in Russia: The Relevance of Tax-Interaction Effects. The B.E. Journal of Economic Analysis & Policy. 2014;14(3):723-754. https://doi.org/10.1515/bejeap-2013-0006
15. Moghimi Feyzabadi M, Shah Nooshi Foroushani N, Danesh Sh, Akbari Moghadam B, Daneshvar Kakhki M. The Survey of Welfare and Environmental Effects on the Green Tax & Decline Subsidy on Fuels in Iran by Using a Computable General Equilibrium Model. Agricultural Economics and Development. 2011;19(3):79-108. http://aead.agri-peri.ac.ir/article_58758.html?lang=en
16. Jafari Samimi A, Alizadeh Malafeh E. Simulation of Green Tax on Economic Growth in Iran: Application of Computable General Equilibrium (CGE) Approach. Economic Growth and Development Research. 2016;6(22):70-57. https://egdr.journals.pnu.ac.ir/article_2259.html?lang=en
17. Afonso A, Jalles JT. Economic Performance and Government Size (October 28, 2011). ECB Working Paper;1399. http://dx.doi.org/10.2139/ssrn.1950570
18. Zakari Z, Esfandiari M, Pasha Zanos P. Development of tax revenues through collecting green tax from polluting industries; based on data-data approach. The 5th National Iranian Economics Student Conference, Mazandaran University;2013.
19. Li JC. Is There a Trade-Off Between Trade Liberalization and Environmental Quality? A CGE Assessment on Thailand. The Journal of Environment & Development. 2005;14(2):252-277. http://dx.doi.org/10.1177/107049650527669
20. Garami M, Karmi M. Green taxes in developed countries. Monthly Economic Journal Reviewing Economic Issues and Policies. 2015;11(3):125-134. http://ejip.ir/article-1-149-fa.html
21. Hadian E, Ostadzad A. Estimating the Optimal Pollution Tax for Iranian Economy. Economic Growth and Development Research, 2013;3(12):74-57. http://dx.doi.org/20.1001.1.22285954.1392.3.12.4.8
22. Rasouli Shemirani R, Shabani M. The position of environmental taxes in Iran's economy. Office of Tax Studies and Research;2012.
23. Haj Mohammadi F. Tax bases in the countries of Sind vision of the Islamic Republic of Iran, Office of Tax Studies and Research;2012.
24. Noorian A, Khaleghi Rekhneh Z. An Integrated System for the Taxation of Real Estates Rental Income. Iranian National Tax Administration. 2009;17(4):99-132. http://taxjournal.ir/article-1-149-fa.html
25. Ameli A. Explaining and presenting the appropriate model of the service marketer in order to increase the efficiency of the country's tax affairs organization. Journal of Economic Research. 2010;12(1):57-92. https://joer.atu.ac.ir/article_3439.html