EFFECTIVENESS OF LOCAL AIR POLLUTION AND GHG TAXES ON CHILEAN INDUSTRIAL SOURCES

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Overview

In 2017, green taxes began to be applied to CO_2, PM, NO_X and SO_2 emissions in Chile to reduce the negative environmental effects of fossil fuels burned in industrial and thermoelectric sources with a thermal power greater than or equal to 50 megawatts. In this context, the present study generates an optimization model to simulate how different tax scenarios would modify the behavior of regulated industrial sources considering the alternatives they have to minimize their costs (tax payment, fuel change and/or installation of abatement technologies). The main results show that, under the current tax scenario, CO_2, PM and SO_2 emissions would decrease by 11%, 48% and 49% respectively, while NO_X emissions would increase by 5%. By extending the tax to all industrial and thermoelectric sources regardless of their thermal power, CO_2, PM and SO_2 emissions would decrease respectively by 14%, 98% and 66%, while NO_X emissions would increase by 7.1%.

Methods

To model the alternatives of industrial sources must face by the introduction of green taxes, an optimization model is developed considering the different costs associated with fuels replacement, the installation of abatement technologies and the payment of taxes for non-abated emissions. In this form, it is assumed that each industrial source evaluates in a decentralized way different possibilities as doing nothing and simply paying taxes, install abatement technologies, change their fuel, and also, both change their fuel and install abatement technologies to reduce taxes to be paid. Thus, the following optimization model is proposed:

The data to calibrate the model were obtained from the latest ENIA survey of 2015 (INE, 2017), which includes records of 3,167 industrial sources, of which it is estimated that 425 have burners and / or boilers with thermal power greater than or equal to 50 MW. Based on fuel consumption and emission factors in the scenario without taxes, 6.6 million tons of CO_2, 33,369 tons of PM, 10,577 tons of NO_X and 28,152 tons of SO_2 were estimated.

Results

The simulations of the model show that when applying the current regulatory scenario (in which green taxes are established only to sources with a thermal power greater than or equal to 50 MW), CO_2, PM and SO_2 emissions would decrease, respectively, to 5.9 million, 17.233 and 14.469 tons, while NO_X emissions would increase to 11,089 tons. Based on these results, it can be concluded that the taxes currently applied in Chile to reduce CO_2 emissions as a global pollutant and PM, NO_X and SO_2 as local air pollutants do not generate large changes in the behavior of industrial sources with respect to their consumption fuels, emissions and installation of abatement technologies.

However, if the same current tax rates are maintained but the application of the tax is extended to all industrial sources, it would be observed that 1,452 sources would change fuel and 287 would install abatement technologies. In this case, CO_2, PM and SO_2 emissions would be reduced by 13.9%, 97.8% and 66.3% respectively, while NO_X emissions would increase by 7.1%.

Table 1. Behavior of industrial sources under different tax scenarios

		Without taxes	With current tax rates	
			Sources ≥ 50 MW	All sources
Fuel [N° sources]	Coal	62	59	11
	Fuel oil N°2	1,579	1,578	178
	Fuel oil N°6	789	788	856
	Gas Natural	591	591	1,863
	Biomass	146	151	259
abatement technology [N° sources]	PM	0	57	242
	NO_x	0	0	0
	SO_2	0	5	45
	Total	0	62	287
Emissions [Ton / year]	CO_2	6,585,643	5,866,646	5,664,113
	PM	33,369	17,233	717
	NO_x	10,577	11,089	11,331
	SO_2	28,152	14,469	9,476
Tax collection [USD / year]	CO_2	0	15,084,363	28,319,571
	PM	0	5,345,539	12,056,920
	NO_x	0	3,636,287	5,872,432
	SO_2	0	181,941	1,695,726
	Total	0	24,188,130	47,944,649

Source: Own elaboration

Conclusions

It is concluded that the application of green taxes should be extended to all emission sources and the tax rates currently applied should be modified in order to observe substantial improvements in the emissions of these local and global pollutants. Moreover, it could be mentioned that modifications in the tax rate of a single pollutant does not generate substantial changes in the level of emissions of the other pollutants. Therefore, it is more efficient to modify the tax rates together so that they approximate the social cost of each pollutant.