

Automotive park, a focus from the environmental tax and vehicular pollution

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Abstract

The need to contribute to the environment allowed the environmental tax approach to be studied in vehicle pollution, which has developed sustainable alternative measures that identify the deficit of the mechanisms of tax collection, another of the aspects exposed are the indices of environmental control and its increase in the number of circulation units that start from the theoretical conceptions analyzed in the environmental indicators, for that reason the research has as a purpose to analyze the impact of the environmental tax in the vehicular contamination caused by the car park, also exemplifies the method for the use of the IACV formula considered as an indirect tax related to IVA. The article describes the literature about the importance of environmental tax and analyzes a long-term improvement approach. Moreover, it shows the results of the impact of the environmental tax in the vehicle pollution in the country. Finally, it was determined that the implementation of IACV does not cause reductions in the vehicle industry, where Guayaquil city, in fact, the introduction of this tax did not cause changes in the people behavior at the moment of register their automobiles.

Environmental tax, vehicle pollution, car industry

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Introduction

The growing concern about the environmental deterioration that the planet suffers has led many countries to develop policies within their tax regimes, in order to make "polluter, pay". Several instruments have been developed, one of which is the Pigouvian tax, also called an environmental tax considered as a tax collection mechanism, applied on an externality.

For these reasons, governments have the purpose of controlling and avoiding the level of environmental impact, using the collection of taxes to raise awareness of society, which is linked to the environment and the use of environmental resources.

It should be noted that one of the governmental priorities is the attention to the environment and in particular the collection of the environmental tax on vehicle pollution (IACV). In this sense, there are 1.5 million vehicle units throughout the country. Quito groups 28% of the total that exist at national level, Guayaquil 23% and Cuenca 6%. (MAE, 2010). On the other hand, but with the same approach, Ecuador's green tax reform includes environmental taxes focused on taxing the polluting action, which applies policies that seek to reduce the emission of CO₂ produced by the combustion of high-cylinder engines.

For this reason the analysis of the environmental tax and vehicular contamination shows a level of incidence in the growth of the automotive park of the country causing the environmental deterioration. According to the assessments of Carbonnel & Escalante (2013. P. 83) they exemplify the methods to implement instruments that allow to reduce the levels of pollution caused by the smog of the vehicles.

It should be mentioned once again that in the Latin American countries one of the sectors with high growth is the automotive sector, which means that the greater the demand, the greater the degree of pollution.

One of the weaknesses manifested by the National Air Plan "Ecuador" is that diesel vehicles and industrial companies are the main sources of particulate matter generation, unlike the gasoline vehicles that are the main carbon.

This means that there is evidence of the construction of an environmental problem that has negative effects on the human being and in some cases the impact on health, therefore, a balance must be struck between the cost that it represents for society and the Environmental cost, in such a way that the vehicle fleet constituted by: cars, buses, trucks among others of combustion should be inversely proportional to the impact achieved by the implementation of an environmental type tax.

Given the antecedent has been formulated as main objective: To analyze the impact of the environmental tax on the vehicular contamination of the Ecuadorian car park.

Supplemented by the following scientific tasks:

The rationale of the theoretical conceptions of the environmental tax to vehicular contamination.

The development of referential contributions in terms of the reduction of environmental pollution.

The article is structured as follows, the first section describes the basis of the environmental tax. In the second, the reference contributions of the contamination of the automotive fleet.

Finally, we conclude on the most important points of the investigation.

Theoretical conceptions of the environmental tax

Main economic instruments of environmental management

There are few theories of economic development that include natural resources within their parameters as a productive factor for the economy of a nation, but over the years these factors have been having relevance within the analysis and currently constitute as a variable importance for the economic development of countries. [2]

Because environmental damage can not be measured in a very precise way or quantified, it is very complex to determine a tribute that encompasses these characteristics. What we want to achieve is then an optimal Pareto rate, that is, the marginal cost of the private sector equal to that of the social sector. [3]

Pollution is a negative externality, since it is produced by individuals or companies in their productive activities but affects third parties who live around them.

Below is a list of economic instruments that represent the most outstanding and most used in the different countries of the world. [4]

- The charges.
- Environmental taxes.

- Tax incentives.
- The rates for non-compliance with the regulations.
- The economic obligation when legal responsibility for environmental damages is determined.
- The systems of tradable permits.
- Intervention at the level of final demand.
- Subsidies for activities related to environmental protection.

The charges represent payments that must be made to the state, for the use of resources and infrastructure of the environment. These values are set by a regulator that determines the true value of the environment. The main charges are: emissions, use and impact. [5] Environmental taxes are tax collection systems that generate funds so that the government can manage and control the entities in the care of the environment. [5]

Tax incentives are applied when a company chooses to use a technology that is greener, that is to say contaminate to a lesser extent, the costs of such implementation may be deductible from its tax payable. As well as reforestation processes and activities with positive externalities. [4] The rates for non-compliance with the regulations refer to the state granting them different levels of permissible contamination depending on the type of activity they are engaged in and also their size, and if they exceed that range they must pay fines for the offense committed. This encourages them to have a better environmental performance. [5]

The economic obligation when determining liability for environmental damage is to apply the phrase of the polluter pays. The law requires polluters to pay for damages to third parties for their work. [4]

In the tradable permit systems, we mainly talk about the creation of a carbon market, where pollution authorizations are negotiated. This is because each entity is given a specific level of pollution, some small companies do not consume their quota and choose to sell the permits to large companies to obtain an additional benefit to their activity. [4]

In the intervention at the level of final demand, it is focused when the companies due to their activity have contaminated in excess and their name is harmed in front of its clientele. Now they focus on cleaning up their image and conducting campaigns where they show that their behavior has changed and are worrying about the environment. [4]

Environmental Taxes.

An environmental tax is one that allows internalizing the social cost of environmental damages known as externality and promotes people to perform in a better way with the environment, this assumption has validity in the concept of Pigouvian tax. [6]

In addition to granting tax collection that allows the state to carry out its mandate.

An environmental tax is a mechanism that tries to enforce the polluter pays assumption. This type of tax enjoys the benefit of double dividend, which means that apart from raising also reduces pollution. [7]

Also what is wanted to achieve for a long term is the environmental taxes can replace the distorting taxes, which are those that in one way or another people try to avoid them. [8]

For many environmentalists the solution of environmental problems should be to completely eliminate pollution, but this is not a favorable solution economically speaking, since to comply with it should stop using vehicles, aircraft, ships, ban certain activities of industries, Among others, and all these factors contribute to the economy and development of a country. [9]

The main function of this type of taxes is not to obtain collection, but rather to reduce pollution and contribute to change in the behavior of individuals and become more aware when purchasing a vehicle.

The researchers Acquatella & Bárceno, (2005) highlight the tax reforms carried out in developed countries on environmental issues, which are based on three lines:

- A. The design of new taxes, applied on activities with environmental externalities.
- B. The restructuring of existing taxes on environmentally relevant sectors (eg transport and energy) to include an environmental component. This is the case of the carbon tax that applies to different types of fossil fuels.
- C. The modification or elimination of subsidies and tax exemptions on activities with potentially negative effects on the environment (eg agricultural subsidies, tax exemptions to the transport sector).

The role of government is not to choose a single instrument. The objective is to determine what type of environmental problem is to be addressed and to choose the most appropriate combination of instruments.

Ecuador as a development-enhancing country, has adopted certain measures that compensate or retro-feed to the environment, according to INEC data in 2012 there were 1,509,458 cars with an average growth of 100,000 units per year, considering that Guayaquil has Greater vehicular concentration, with an approximated 400,000 vehicles registered, that represents 27% of the total at national level.

For this reason, the "Law on Environmental Promotion and Optimization of State Income" created on November 24, 2011 and issued by the National Assembly of the Republic of Ecuador with the official registration 508, contributes to curb externalities due to contamination, Through the establishment of a tax that aims to improve social and environmental behavior of individuals in the national territory.

Therefore, the environmental promotion law establishes the green tax reform carried out in Ecuador does not have a collection purpose, as it seeks changes in consumption patterns, complementing the need to make people have behaviors that are more environmentally friendly.

As guidelines complementary to the implementation of the IACV (Environmental Tax on Vehicle Contamination), the government managed the following strategies:

Renova Plan - Chatarrization Process, Improve Fuel Quality and Improve Public Transportation. However, no official information is available on the application of these guidelines.

An indicator of the relative importance and evolution of environmental taxation is its tax burden compared to the other taxes that make up the tax system. Likewise, the incidence of an environmental tax should be considered, which should have a certain impact on other taxes on products or consumption, in this case and, in some way, impacts the demand and supply of vehicles that are marketed in the country. For this purpose, the IACV formula is presented with its respective table showing the tax base of the tax.

$$IACV = [(b - 1500) t] (1+FA) \quad (1)$$

The equation is divided into two parts, the first that depends on a taxable base (b) measured by the cylinder of the vehicle and depending on this value is given an imposition rate (t) which will be shown in the following table; The second part that is given by an adjustment factor (FA), expressed in percentages depending on the age of the vehicle.

TRAMO CILINDRAJE - AUTOMÓVILES Y MOTOCICLETAS (B)*	\$/ CC. (T)*	TRAMO DE ANTIGÜEDAD (AÑOS) - AUTOMÓVILES	FACTOR (FA)
Menor a 1.500 cc	0.00	Menor a 5 años	0%
1.501 - 2.000 cc	0.08	De 5 a 10 años	5%
2.001 - 2500 cc	0.09	De 11 a 15 años	10%
2.501 - 3.000 cc	0.11	De 16 a 20 años	15%
3.001 - 3.500 cc	0.12	Mayor a 20 años	20%
3.501 - 4.000 cc	0.24	Híbridos	-20%
Más de 4.000 cc	0.35		

Table 1 Taxable Basis and Adjustment Factor for IACV application

Source: LORTI

According to the use of the table of the taxable base and the adjustment factor, the maximum and minimum values were used to determine the importance weight of each section of the formula. This calculation gives the relative weight given to each factor, considering that the $(b-1500) * t$ corresponds exclusively to the payment for the cylinder and that $(1+ FA)$ to the payment for the seniority. Under the assumption that you pay in tax 100% ie the value to pay is 1. You have the following:

ANTIGÜEDAD	BASE IMPONIBLE	FACTOR DE AJUSTE
menor a 5	100.00%	0.00%
5 a 10	95.24%	4.76%
11 a 15	90.91%	9.09%
16 a 20	86.96%	13.04%
mayor a 20	83.33%	16.67%

Table 2

Source: LORTI created by Authors

Taking into account the formula, it can be concluded that the factor that corresponds to the tax base is the one that gives greater weight to the calculation of the IACV, taking as an example the range greater than 20 years, it gives 83.33% While the adjustment factor has 16.67% of the weight, verifying that the highest value to cancel is generated by the cylinder and not by the number of years.

If the tax is less than 5 years, then the tax will depend solely on its taxable base and the tax rate that is established according to the rank. Thus, as the number of years increases, the participation of the adjustment factor increases. However, its relevance to the calculation does not exceed 20% of the tax payable.

This may lead one to believe that the objective is not to take older cars, since their contribution is not of greater weight for the calculation, but would be affecting the vehicles with larger cylinder capacity, ie those who consume more fuel and own An engine with greater power. Frequently, these cars with higher powers have a higher cost, thus affecting people with greater purchasing power.

Continuing with the analysis, it is important to cite the most relevant concepts obtained from research proposed by OECD countries, where Bárceolo (2005) states that there are principles to consider when applying a tax of an environmental nature, taking into account other Complementary factors such as:

1. Before implementing an environmental tax, existing ones should be reformulated as a measure of "clearing the land" thus avoiding unnecessary tax burden. Failure to evaluate existing ones could make the mistake of raising a tax, which would have an effect on people.
2. When an environmental tax is formulated, it is said to be "efficient" (considering that this efficiency is measured by its collection), because it has greater importance in its participation in the total collection. But this increase must be accompanied by a reformulation of other distorting taxes. In order for the well-known double dividend of the environmental tax to be effective, at least it is required that the introduction of this tax be accompanied by the reduction of others, in such a way as to ensure that revenue is neutral.

In other developed countries, the participation of this type of taxes is approximately 6%, where the collection of other taxes is assumed, which places the individual in an equal fiscal vector.

3. In another context, this type of taxes are immersed within the category of the well-known Piguvian taxes, considered corrective taxes, reason why it would be expected that its collection is reduced, and therefore, its objective would be fulfilled. In this case, people would not buy large-capacity cars and the older ones would leave the vehicle fleet.

In addition, a gradual reformulation of green taxes should be considered, maintaining a strategy of temporary adjustment of rates and other aspects of design so that they do not lose their ability to (un) encourage the change of behavior of people.

4. It can often be the case that the tax is a way to pay to pollute. However, an environmental tax is considered efficient if in the long term, the tax base of this tax is eroded, given the change in production or consumption patterns.

Therefore, to complement the study is defined as an indicator of the relative importance and evolution of environmental taxation is its tax burden compared to other taxes that make up the tax system. It should be considered, economically speaking, that the incidence of an environmental tax should have a certain impact on other taxes on products or consumption, in this case somehow impacts the demand and supply of vehicles that are marketed in the country. To do this, the following table with data exist since the creation of the IACV, in our country:

YEAR	IACV COLLECTION	TOTAL COLLECTION	Percentage
2012	95.770.093,68	10.760.320.205,91	0,89%
2013	114.809.077,02	10.267.759.532,98	1,12%
2014	115.137.984,12	11.285.450.776,55	1,02%
2015	113.198.301,97	12.069.462.647,65	0,94%

Table 3

The development of referential contributions based on the reduction of environmental pollution

For the application of environmental tribute, it should be considered that pollution reduction processes have significant costs within a country's production system, and should be included with long-term visions, without affecting complex economic systems, in this case the Transport system. (Larraguibel & Raúl, 2000, p.20)

The main function of an environmental tax is not to collect, but to contribute to change in the behavior of individuals in a society, which is why it is considered a regulatory tax based on the principle of "polluter pays." (Brailovsky, 2012)

The existing standards for vehicles in use are set according to the year of the model and type of engine, and this comes in conjunction with inspection and maintenance programs, where periodic maintenance is performed on vehicles in use, removing very polluting vehicles from the circulation. (Onursal, 1998, p.74). For example, in countries such as Argentina and Brazil manufacturers are required to certify that their units comply with emission standards for at least 5 years and 8,000 km. In Ecuador since 1996, the importation of used vehicles is prohibited. (Onursal, 1998)

In other countries, such as Singapore, a minimum number of passengers were imposed on vehicles and trucks. In addition to the imposition of staggered schedules where the inhabitants have hours of different entrances and exits when it comes to work, student and commercial. (Acquatella & Bárceno, 2005, p. 116)

With respect to vehicular contamination and based on the points made above, the OECD countries (1998) adopted certain measures to induce the reduction, especially in critical points such as Mexico, Brazil and Colombia. Emission standards for new vehicles were adopted, along with certification requirements, assembly line testing, recall and warranty. In addition the Emissions system was implemented during a time or mileage.

The Development of referential contributions in function of the reduction of the environmental contamination.

Among the great measures adopted by the Latin American countries, two strategies are highlighted such as gasoline taxes, present in most Latin American countries (Gómez & Dalmiro, 2013) and the hydrogen converter, which has been a measure adopted in countries European countries. (Carbonell & Escalante, 2013)

Within the study formulated by Gómez & Dalmiro (2013) can also be expressed gasoline taxes applied in countries of the region, as detailed below:

Argentina has taxes on liquid fuels with the exception of gas. In Bolivia there is a Special Tax on Hydrocarbons and its Derivatives (IEHD) in the domestic market. Chile has exploitation rights policies; Automotive Gasoline; Diesel oil; Automobiles with liquefied gas and others. In Colombia, there is a Global tax that establishes a fixed tax in national currency for Gasolines and ACPM, a 25% surcharge on the reference retail price per gallon for gasoline and 6% for diesel (ACPM). Mexico, Special Tax on Production and Services (IEPS) for gasoline and diesel oil. Paraguay, Selective Tax on Fuel Consumption. Peru, Selective Consumption Tax (ISC).

As it is known by microeconomic theory, the demand is characterized by having a negative slope, which also happens for the case of the fuel demand, where it is indicated that the greater the fuel price the smaller the quantity that will be demanded. However, this is not 100% efficient economically speaking, because the welfare of society is not maximized. The use of vehicles produces externalities such as pollution, congestion, traffic accidents, noise, among others and these effects are not captured in the cost of fuel commercialization.

Thus, in several countries of the region as mentioned above, measures have been implemented such as fuel taxes, as a complementary instrument to other measures aimed at the reduction of polluting vehicles.

Over the last twenty years, revenues from environmental taxes (around 90% on average) have come almost exclusively from taxes levied on gasoline, diesel and motor vehicles in general. (Gómez & Dalmiro, 2013)

The application of gasoline quotas is also applied by the city of Zulia, in Venezuela, so that the consumption can be controlled. It was established that the vehicles consumed only 42 liters of intermediate fuels, this was determined by the competent authorities such as the Ministry of Petroleum and Mining and the Government of Zulia. In recent years, the Ecuadorian government has made reforms aimed at improving tax collection mechanisms and avoiding tax evasion. According to official registration 583 issued by the National Assembly of the Republic of Ecuador, on November 24, 2011, the creation of a law to establish social and environmental behavior in the national territory, known as the "Law of Environmental Development Y Optimization of State Income", within which the environmental taxes in force since the year 2012 are defined.

The funds raised by the payment of taxes are used to finance the state's annual budget and allow to provide public goods and services such as education, health, defense, among others. For the application of environmental tribute, it should be considered that pollution reduction processes have significant costs within a country's production system, and should be included with long-term visions, without affecting complex economic systems, in this case the Transport system. (Larraguibel & Raúl, 2000, p.20)

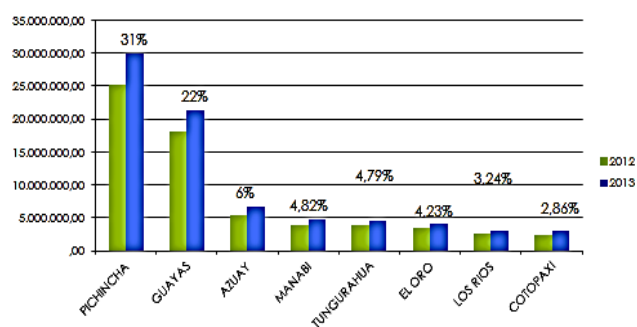
The main function of an environmental tax is not to collect, but to contribute to change in the behavior of individuals in a society, which is why it is considered a regulatory tax based on the principle of "polluter pays." (Brailovsky, 2012) The existing standards for vehicles in use are set according to the year of the model and type of engine, and this comes in conjunction with inspection and maintenance programs, where periodic maintenance is performed on vehicles in use, removing very polluting vehicles from the circulation. (Onursal, 1998, p.74) As a result, Ecuador has implemented green tax reforms that allow mainly the displacement of part of the current tax burden on capital and labor factors (for example, through the reduction or elimination of taxes on income, Capital, labor contributions etc.) towards environmentally harmful activities through the introduction of new taxes on the latter, taking care not to increase the total tax burden on the productive apparatus. Contamination problems are complications, since the majority of causes are the high degree of demographic and industrial growth, and the large increase of vehicles in circulation. Studies carried out in the city of Buenos Aires concluded that cities that are more populated are contaminated more than those that do not have much population. (Salas, Gonzales, 2012).

In order to verify the performance of this tax at the stage of implementation is significant, since it would be expected that as a result of the application of the environmental tax should reduce the vehicle fleet by the inverse relationship they have.

The purpose of this tax is to tax the pollution produced by motor vehicles of land transport, it would be expected that this measure will have effects and help those involved to become aware of the damage they cause to the environment and the possible problems they will have to face in A future if it is not about controlling in time, denoting that individuals use their vehicle in a more efficient way thus changing their polluting behavior and decreasing negative effects on the environment.

A paper published by ECLAC (1998) shows that in most urban centers in Latin America, motor vehicles are the main cause of the deterioration of air quality. They represent 99% of total CO emissions, 54% of hydrocarbons and 70% of NOx in Mexico City.

Materials and Methods



Graphic 1

Environmental Tax on Vehicle Pollution (IACV)

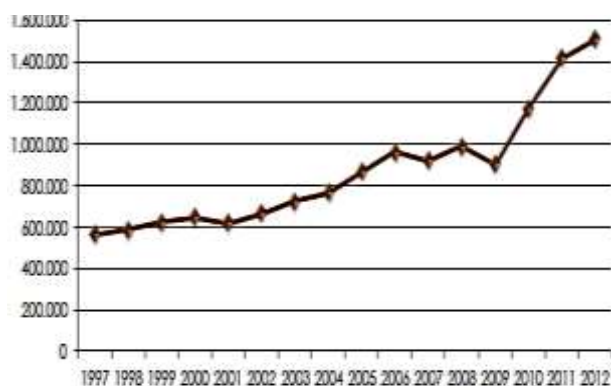
According to official registration 583 issued by the National Assembly of the Republic of Ecuador, on November 24, 2011, the "Law on Environmental Promotion and Optimization of State Revenues" was approved and the implementation of the IACV was also approved as of January 2012.

Efficiency Collection of the Environmental Tax to the Vehicle Contamination (IACV)

According to the Ministry of Environment of Ecuador (MAE - 2012) Quito is the city with the highest collection of IACV in the country and Guayaquil is the second most collected.

This is because both cities have the most population and this is one of the factors for which they have a higher influx of vehicles. Also, both Quito and Guayaquil, are the main cities of the country, since one is the capital and the other is the main economic power of the country.

The graph below shows the cities that contribute in a greater amount in the collection of IACV.



Graphic 2 Collection of IACV by major cities

In order for an environmental tax to be considered tax-efficient, it should have an importance in total tax collections, but only if it is accompanied by a reformulation of distorting taxes

So that in this way, there is no excess tax burden on individuals. Taxes that are to be restructured must have a high tax burden, for example reducing the ICE to be assumed by the IACV.

Given the definition of an environmental tax, the IACV should not be considered of this type, since despite increasing its collection and gaining relevance within the total collections of the overall taxes of the country, it has not been accompanied by a restructuring of Distorting taxes, that is, their growth has depended only on their individual collection.

At the same time, the IACV is presenting distorting symptoms, which means that people are trying to avoid it in one way or another to avoid paying it.

Ecuador's Automotive Park.

Over the years there has been a trend towards the increase of vehicles registered in the country, as can be seen in the chart below:

The fleet is concentrated in the provinces of Pichincha and Guayas, who capture 32.36% and 25.28% respectively.

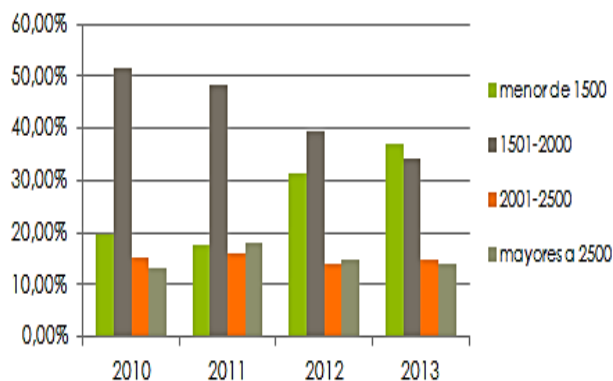
Given this information, it can be determined that from 1997 to 2012 the vehicle fleet of Ecuador has been growing at a rate of 168.65%, that is, in the last 15 years vehicles have more than doubled, Which was reflected by the different changes that occurred in the economy as a result of the crisis that occurred since 2000 that affected many countries of the world.

During the year 2012 in the city of Guayaquil were enrolled around 168,519 automobiles while for the following year were about 198,148 vehicles.

In 2010 the variation of vehicles that were registered with respect to the previous year was 25,555 vehicles, while for 2011, 2012 and 2013 were 25,583, 24,421 and 30,008 respectively.

This means that the number of vehicles registered in 2012 declined very little and is believed to have been due to the implementation of the IACV, but this factor did not prevent the next year from enrolling more vehicles.

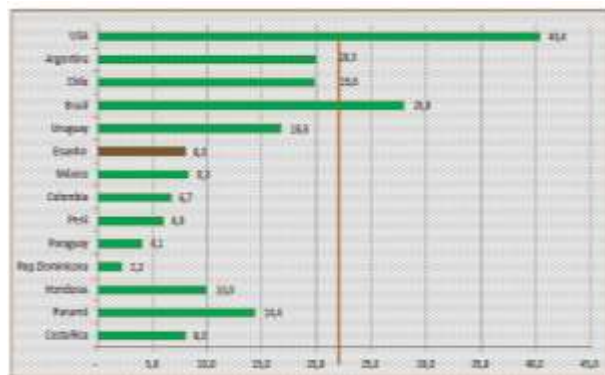
The following table shows the vehicles registered in the years 2010 to 2013 and are classified according to their size.



Graphic 3 Participation of vehicles according to their cylinder capacity 2010 – 2013

As can be seen, vehicles with a cylinder size lower than 1500cc are the ones that have had the most increase and those of 1501cc - 2000cc have been gradually decreasing. While the larger vehicles have not had greater variations in quantity.

Regarding the antiquity of the car park in the city of Guayaquil, it is considered relatively young, because the majority represented by 54.42% have 5 to 10 years, 38.20% are under 5 years And the remainder is within the range of over 10 years.



Graphic 4 Antiquity of the car park in the city of Guayaquil

Ecuadorian Automotive Sector

The automotive sector in Ecuador consists mainly of assemblers, either fully assembled vehicles (CBUs), or parts to be assembled (CKD), auto-parts firms and distributors. [10] Ecuador has 3 assembling companies, 33 companies in auto parts and the commercialization of motor vehicles is through authorized dealers.

In our country, the automotive sector represents 0.34% of GDP and is made up of one part of the manufacturing sector and another part of the trade sector. The manufacturing sector is broken down into four sub-accounts that are:

1. Manufacture of motor vehicles.
2. Manufacture of bodies for motor vehicles.
3. Manufacture of parts and accessories for motor vehicles and their engines.
4. Manufacture of other types of transport equipment.

The trade sector has four classifications that are:

1. Sale of motor vehicles.
2. Maintenance and repair of motor vehicles.
3. Sale of parts, parts and accessories of motor vehicles.
4. Retail sale of motor vehicle fuels.

Important Indices

Motorization Index (ALADDA)

The Latin American Association of Automotive Distribution (ALADDA) reflects periodic measurements on the automotive market in Latin America.

This ratio is found by dividing the number of new vehicles sold in a year for the number of inhabitants of the country multiplied by a thousand, that is to say, this ratio says how many new vehicles there are per thousand inhabitants. [eleven]

Here it is stated that the lower this ratio is the better, Ecuador is with approximately 8 new vehicles per thousand inhabitants and is at a normal level. The countries that are in the worst situation are the United States and Brazil, with 40.4 and 28 new vehicles per thousand inhabitants.

And the countries that have the lowest level of this index are Dominican Republic, Paraguay and Peru with 2.2, 4.1 and 6 new vehicles per thousand inhabitants respectively.

Index of number of vehicles per inhabitant

This index is calculated as the quotient of the total number of vehicles for the total population of the year of study. That is, it allows us to know how concentrated a country's car park is in relation to its inhabitants.

This indicator makes it possible to compare Ecuador's fleet with other countries in the region, and the greater the ratio, the country is in a better condition compared to its fleet.

It can be concluded from the chronological chart (2011 to 2013) that Ecuador has not had significant variations, and has been maintained in approximately 1 vehicle per 8 inhabitants.

The accompanying chart shows the variations of this index in different countries of the region and it is determined that there have been no major changes. The countries with the highest index correspond to the United States, Mexico and Brazil, it should be emphasized that these last two countries are considered by ECLAC as countries with high concentrations of pollutants.

Peru is the country with a better result of this indicator since it has approximately 14 inhabitants for each vehicle.

Conclusions

It was possible to determine that the implementation of the IACV does not cause reductions in the automotive fleet in the city of Guayaquil. The introduction of this tax does not cause changes in the behavior of individuals at the time of enrolling or not their vehicle.

Given the application of the environmental tax, it is expected that there will be fewer vehicles registered, but there are no changes in the fleet, corroborated by ALADDA, (for every 1000 inhabitants there are 8 new vehicles every year), which has remained Changes since the year 2011.

For an environmental tax to be efficient it should be accompanied by other fiscal instruments that support its application, support and contribute to achieve the environmental purpose for which it was created. One pro of this tax is that it affects other sectors of the economy.

In Guayaquil there is a close positive relationship between GDP in terms of income and car sales, since this indicates that both variables have similar behaviors. If it is a question of reducing the number of vehicles, the productivity of a country will also be reduced, since they are related. What should be done is to try to change the consumption patterns of people and opt for less polluting cars.

The calculation formula of the IACV gives a greater weight to the cylinder of the vehicle, and to seniority gives a weight that does not exceed 20%.

Within the enrollment process data could be obtained to verify that there was a year-on-year growth of 17% of the Guayaquil vehicle fleet; And, through a cross-check, it was determined that 92% of the cars registered in 2012 were re-registered in 2013.

References

Carbonell, J., & Escalante, R. (2013). *Política Fiscal y Contaminación Ambiental*. Lima: UNALM - Revista Natura.

[2] Oliva, N., & Serrano, A. (2010). *Es posible un impuesto ecológico socialmente progresivo*. Guayaquil: Centro de Estudios Fiscales - SRI.

[3] Brailovsky, A. (2012, Mayo). *Impuestos Ambientales - Pagar para contaminar*. Santiago de Chile.

[4] Acquatella, J. (2001, enero). *Aplicación de instrumentos económicos en la gestión ambiental en América Latina y el Caribe*. Santiago de Chile.

[5] Programa de las Naciones Unidas para el Desarrollo. (2000, 10 de enero). *Desafíos y propuestas para una implementación más efectiva de instrumentos económicos en la gestión Ambiental de América Latina y el Caribe*. Lima: CEPAL.

[6] Rivadeneira, A. (2011, noviembre). *Fiscalidad ambiental en Ecuador*. Centro de Estudios Fiscales - SRI.

[7] Mena, J., & Yanez, A. (2006). *Impuestos Ecológicos y la discusión del doble dividendo*. Santiago de Chile: Universidad de Chile.

[8] Stiglitz, J. E. (2003). *La Economía del Sector Público*. Antoni Bosch.

[9] Barry, F. (2003). *Economía Ambiental*. McGraw-Hill.

[10] Ortega B., Jaime (2005). *Análisis del Sector Automotor Ecuatoriano*. Apuntes de Economía – BCE.

[11] Asociación latinoamericana de Distribuidores de Automotores. (2014). *Índice de Motorización*. Obtenido de www.aladda.com

[12] Palacios, F. (2008). *Cadena de Markov*. Barcelona - España.