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Liberalization of gasoline prices and inflation in Mexico

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Abstract

The aim of this work is to measure the impact of a policy of deregulation of gasoline prices on inflation in Mexico, from a controlled price to an uncontrolled one determined by supply and demand. The hypothesis establishes that upon an increase in the gasoline price in a magnitude equivalent to the one needed to eliminate the fuel´s subsidy, the inflation would rise exceeding the limits established by the Central Bank of Mexico. The consumption and demand patterns of gasoline in the economic sectors and in the population are analyzed. The Input-Output price model is used. This model helps to analyze the impact on the industry of an increase in the gasoline price as well as to measure the impact on the price index.

Gasoline Prices, Inflation, Input-Output, IEPS.

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Introduction

The Mexican government operates a policy of oil prices-particularly from Magna and Premium gasoline and Diesel- in which they are administered, ie, are not determined by market supply and demand. Because the formula to calculate it, one of the taxes that form part of the price of gasoline-the Special Tax on Production and Services (IEPS) - has represented for some years, a transfer of resources from government to consumers to maintain prices for those fuels in the set level. In 2012, the transfer of resources for these fuels IEPS totaled 203,128.5 million pesos (SHCP, 2012). This has been considered to delineate the pricing policy of Magna and Premium gasoline and diesel, which consists of newspapers and gradual increases in fuel prices, which seeks to reduce expenditures for IEPS performing the government.

To eliminate the transfer of resources -subsidy-, the IEPS should have a value equal to or greater than zero. This is possible through politics or current prices through price increases made at once and subsequent liberalization of prices with which this tax can take positive values. The liberalization of gas prices involves changing its managed one free character, allowing the IEPS stop being negative and that its value is at least equal to zero. This would imply that prices, according to their calculation fluctuate according to the international reference price,[71] which it is characterized by high volatility and reaching record highs.[72]

Also, gasoline is one of the goods which is incorporated in the basic package and uses the National Institute of Statistics, Geography and Informatics (INEGI), to calculate the National Consumer Price Index (CPI). This index is used to measure the change in prices over time of this basket, which is representative of expenses by families in Mexico; that is used to measure inflation. Therefore, variations in gas prices directly impact on the NCPI through spending that makes the population for use primarily in private vehicles, and impacts indirectly on inflation to be used in industry or transport goods and passengers, although its use is to a lesser extent.[73]

The objective of this work is to estimate the impact that the liberalization of Magna gasoline prices on inflation in Mexico. Accordingly, this liberalization would have a positive potential effect on the overall price level, and therefore negative in the purchasing power of the population. To measure the effect of price liberalization through elimination of the subsidy, a simulation of an increase in the price of gasoline equivalent necessary to ensure that the IEPS is zero. For this, the input-output matrix of Mexico (2003) is used. One possible use for this is to encourage the implementation of measures, the pair can be taken to mitigate the potential positive impact that could have on inflation.

There have been studies for Latin America and the Caribbean that has proven this hypothesis (see, for example, Iraheta et al, 2008;. Rincón, 2011; Pincheira and Garcia, 2007). The results indicate that the impact on inflation of a clash of fuel prices is low and that the presence of such fuels subsidies could influence the resulting magnitude.

[71] Spot price of regular unleaded gasoline in force in the American Gulf Coast of Mexico.

[72] The price of Magna gasoline in December 2012 was 10.81 pesos per liter in Mexico and 12.49 in the US.

[73] While gasoline demand is primarily for use in private transport vehicles with internal combustion engine, also it has other uses that represent a small part of its total demand.

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However, the results of these studies are based on the method and the peculiarities of the country. In the methodology we used either an econometric model with vector autoregression (VAR), or the model input-output matrix and in general, the results of these studies show relatively low magnitudes compared with the obtained in this work.

The work is divided into three sections. In the following, the theoretical framework in which inflation is defined and approaches that explain their origins (as well as the instruments of monetary policy in Mexico) in paragraph three discusses background and discuss the determination is exposed price of gasoline. the fourth section presents the model that measures the impact of the elimination of the subsidy on gasoline prices and their results. The last part presents the conclusions.

Inflation: some notions

Inflation is defined as the continued rise, widespread and sustained (usually six months) prices of goods in an economy. Inflation is not a one-time increase in the general level of prices; also it refers to the increase in the price of one or a few products in the economy (Frisch, 1988). When talking about inflation, rising prices is sustained in representative goods household spending in a country.

Several types of inflation which can be classified according to different criteria. For example, according to the magnitude of inflation, this can be classified as creeping, moderate, galloping and hyperinflation (Frisch, 1988). The creeping inflation is one in which, besides the absence of high inflation expectations, its magnitude is not greater than 3%. For moderate inflation they were greater than 3% and reaches 30% (Cottarelli and Szapary, 1998).

Galloping inflation is one in which the general price level is higher than those recorded in moderate inflation and rising faster. Finally, hyperinflation occurs when the annual inflation rate is equal to or greater than 1000%. In this type of inflation, rising prices are on an accelerated, causing increasingly greater demand for currency by the population (Dornbusch et al., 2004).

Besides, to measure the change in the general level of prices over time the CPI, which is representative of spending on goods and services by households in an economy at a particular point in time is used. To measure this variation, the index is calculated using a base period or reference, used to allow comparison of the change in the general price level at two points in time. Goods used for calculating the CPI are grouped into concepts that are weighted according to the weight that within the total expenditure.

A method for calculating the consumer price index is (Frisch, 1988):

$$P_t = P_0 + 100 \sum_{i=1}^{n} g_i \frac{\Delta p_i}{p_i^0} \quad (1)$$

Where P_t is the index that represents the overall price level in period t, Δpi is the change in price of good i between period t and base period, PI0 is the price of good i in the base period, gi is the weight of price of good i in total goods consumed in the basket of goods, P0 represents the price level in the base period. The value of this index in the base period is equal to 100, while in period t can be represented by the sum of the price level in the base period plus a weighted sum of the rates of change in prices for each of the various goods (Frisch, 1988).

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To calculate the CPI in Mexico Laspayres index formula is used, whose main characteristic is to keep both goods fixed base period, as the weights of the groups of goods. Thus, in the comparison of price levels in two periods, only the change in price rather than the quantities of goods of the consumer basket it was observed. This gives you an advantage over other indices such as Fisher and Pasche. As Laspayres index is a method used worldwide, inflation in Mexico is comparable with that of other countries.

In Mexico, the CPI is calculated in two stages (INEGI, 2011). First called generic rates, relatively homogeneous grouping together goods are calculated. These indices are a result of calculating a geometric mean:

$$I_j^{b:t} = \prod(\frac{p_i^t}{p_i^b})^{1/n} \quad (2)$$

Where I_j^{bit} is the index of the generic j in period t, pit represents the price of an i homogeneous group of goods and services (specific) at time t, and GDP is the price of a homogeneous group of goods i and (specific) services the base period. Second, generic indexes are used to calculate rates of aggregation, ie sub-indices, which are determined by applying the following formula weighted arithmetic mean:

$$I^{b:t} = \sum w_j^b I_j^{b:t} \quad (3)$$

Ibit where is the index of the generic j in period t is the weighting WJB generic information j expense in the period b; with Σwjb = 1. Finally, these sub-indices are grouped to lead to inflation. In Mexico, the INEGI calculates the weights using information from household spending nationwide, through an expense ratio of property and the total household spending. Each weighting corresponds to a "generic".

There are 283 generic concepts in the basket to calculate the CPI. In the case of Magna and Premium gasoline, its weight in the total household expenditure is 3.79 and 0.44 respectively; Magna gasoline is the third most heavily weighted generic product after homeownership, and snack bars, taverns, and taco torterías (Table 1).

Generic product	weighting
homeownership	141.493
Snack bars, taverns, and taco torterías	387.540
Low-octane gasoline	379.455
Restaurants and similar	342.580
Rent housing	338.020

Source: INEGI (2013).

Table 1 Generic products greater weight

Besides, in the literature are the main explanations for the causes that give rise to inflation. On the one hand, the inflation caused by "pressure demand", increased the general level of prices occurs when an increase in aggregate demand occurs so quickly that exceeds the speed of response of aggregate production of goods and services, which makes people pay increasingly high prices for relatively scarce goods (Slawson, 1981). Increases aggregate demand can be caused by several factors, such as increasing the propensity to consume and the levels of private investment, government spending increases and increases the money supply and exports (Frisch, 1988).

On the other hand, inflation for the "cost push" occurs when commodity prices rise, increasing the costs of production of other goods whose inputs are now more expensive, so the producers of these goods increase their Prices also (Slawson, 1981). According to Lindbeck (1980), three types of cost-push inflation.

The first is the exogenous cost inflation, in which the source of the increase in the general level of prices is a result of increases in the prices of imported intermediate goods and an increase either of the profit margins of producers or the wages. An example of the increases in prices of imported intermediates may be international oil prices.

The second is that in which the producers who have market power, maintain a fixed price of an input to another producer relationship, following the behavior of prices that they take as a reference. In this case, inflation can occur when aggregate producers to obtain higher levels of income at current prices.

The last type is the "inertial inflation" which occurs when firms increase their prices by providing an overall higher price level for the foreseeable future products; in order to maintain without actual variations of current income levels (Frisch, 1988).

Both inflation pressure of demand, such as push costs are the main reasons mentioned in the literature which cause the general increase in prices. However, its limitations, and the difficulty is also drawn empirically to distinguish which of the two sources causes an inflationary process. Also, the static nature of both approaches is an additional limitation, as the price increase is considered one-time, not continuous and dynamic (Frisch, 1988).

Of the exposed approaches, pushing cost is one that best fits the case of a clash of fuel prices, namely a combination of inflation rates exposed. Under it, a rise in fuel prices may cause inflation because oil fuels are not only a good end-use, but also intermediate products, affecting other industries. In addition, a significant proportion of the gasoline consumed in Mexico are imported, a factor that also influences inflation, if the price of these were assumed as an unmanaged price.

Also, inflation inertia, related to inflationary expectations are elements that have the potential to contribute to the spread of inflation once the inflationary process unleashed in response to a crash in the price of fuels and liberalization.

Besides, the importance of calculating the inflationary effect of volatility and high prices of both oil and gasoline has been considered in the literature. Iraheta et al. (2008) conducted a study that estimated the impact of higher domestic gasoline prices, inflation in the member countries of the Central American Monetary Council. The results show that the impact of oil prices on fuel prices has been moderate, given that fuel prices do not fully capture the effect of increases in international oil prices due to domestic rigidities associated with subsidies and involvement of public entities in the determination of fuel prices. It also found that inflation responds slightly to changes in fuel prices, have a significant impact on inflation when these vary substantially. It emphasizes that the low response of inflation is associated with the existence of subsidies.

Besides, Pincheira and Garcia (2007) analyzed the effect of rising oil prices on total inflation in Chile and a set of industrialized countries through direct and indirect effect. The first does not affect core inflation, as only captures the increase in energy costs; while the second considers the price adjustments throughout the economy. The latter is divided into two components: one relating to costs, in the sense that the oil price is transmitted to the cost structure of the rest of the goods; and one that could occur as a chain of events that starts with a shock of oil prices amending inflation expectations anticipating a decline in real wages, so the nominal wage is pressed on the rise along with prices end the whole economy, reflected in core inflation.

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The results indicate a moderate positive effect in the short term, all non-core and core inflation, but economic importance for Chile.

The International Energy Agency (2004) conducted a study to quantify the impact of medium-term macroeconomic variables (including the consumer price index) of an increase in oil prices, for two groups of countries: members Organization for Economic Cooperation and Development (OECD) and developing countries (including Argentina, Brazil and Chile). The results indicate a negative and statistically significant impact of short-term and limited in the medium term, the consumer price index for the OECD countries; while for developing countries, the impact on the index is higher.

Corner (2011) studied the pricing of fuels in Colombia and calculated the inflationary effect of the removal of subsidy applied. An annual increase of 20% gasoline and fuel oil engines as well as reach the international price in the medium term, and uses the corresponding index weightings producer prices. Through the use of input-output, it estimated that an increase in gasoline prices imply a 20% increase in inflation from 0.54% in gasoline and 0.1% from fuel oil engines.

In the case of Mexico, Vergara and Diaz (2010) study the behavior of the CPI, the purchasing power and prices of certain products including fuels in Mexico; They conclude that the increase in administered prices of fuels like gasoline and diesel, coupled with the volatility of food prices, among other factors contribute to inflation and loss of purchasing power. Furthermore, Rye (2010) mentions that rapid increases in gasoline do not necessarily imply inflation climbs.

Policy gasoline prices

Prices of goods and services produced and provided by the Federal Public Administration in Mexico are established and reviewed by the Secretariat of Finance and Public Credit (SHCP). Within these goods are petroleum products produced by the state company Petroleos Mexicanos (Pemex). Currently, retail prices of Magna and Premium gasoline and diesel are administered; that is, they are not determined by market supply and demand, but at a certain level set by the authorities, so there is a lag between their movements and market trends.

The pricing of petroleum aims to "issue appropriate mechanisms through prices that reflect the opportunity costs in an open economy (using the price of a particular product on the international market) economic signals; so that market conditions are simulated in the context of the presence of a state monopoly, in addition to pricing mechanisms that provide a quick response to the conditions of supply and demand and achieve transparency in the price integration " (Ministry of Economy, 2010).

Furthermore, the Regulations of the Federal Law of Parastatal Entities (2008) states that the prices and rates of the entities are determined according to criteria of economic efficiency and sanitation, for which: i) prices and tariffs for goods and services susceptible traded internationally are set considering prevailing in the international market; and ii) for those goods or not likely to be placed on the international market services, pricing and tariffs are set considering the cost of production resulting from a valuation of inputs to their actual opportunity cost.

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The types of gasoline are traded internationally are distinguished by their octane number. Regular Unleaded gasoline has an octane rating of at least 87; in the case of gasoline midgrade, the minimum rate is 89; Premium gasoline and a minimum rate of gasoline 92. Mexico called Magna and Pemex Premium Pemex produced. The first is equivalent to Regular Unleaded gasoline while premium gasoline is equivalent to the international market. According to the IEPS, the international reference price used for gasoline is the spot price of regular unleaded gasoline in force in the American Gulf Coast of Mexico.

Regarding the current structure of gasoline prices, it must consists of two prices: the producer and retail. The first is applied by Pemex to sell in their sales agencies or storage terminals and then are distributed to service stations, where it is marketed to the consumer. The producer price, unlike the retail price, it is unmanaged. It is determined as (Ministry of Energy, 2011):

Producer price = Reference price + Quality adjustment + Shipping Cost Price + Cost management (4)

The quality setting is one that is applied to the reference price depending on whether quality among domestic gasoline and considered that the international market is different; transportation cost is one that is considered to transport the product from the refinery to the terminal storage and distribution (TAR); Operating costs are costs incurred to maintain the product in the TAR. The retail price is one that applies to final consumers and their components are:

Retail Price = Producer price + Charter + Commerical Margin + Taxes + $IEPS_{federal}$ + $IEPS_{estatal}$ (5)

Freight is the cost of transport sales agency Pemex service station; the profit margin is set by Pemex authorized to sell gasoline at the pump outlets; VAT is the value added tax, which applies to the sale of goods and services, the rate is 16% inside the country; IEPS is the special tax on production and services. In the case of state IEPS, it is a flat fee, while the federal IEPS is a variable rate.

Of the elements making up the price of gasoline, those who are relatively variables are the reference price and the IEPS, given varying monthly while others are determined based on criteria involving more temporary, so it could be considered fixed in the short term. The IEPS is a tax that applies to petroleum, including gasoline sales (among others). According to Article 2 A of the Law on Special Tax on Production and Services, the tax is divided into two parts: state and federal tax. The state tax is a fee that applies to the final retail price of gasoline and diesel, and varies according to the fuel. In the case of Magna gasoline share is 36 cents per liter; Premium for gasoline are 43.9 cents per liter for diesel and 29.8.

State fees are a fixed tax in which the consumer pays a fixed amount determined for each unit consumed, that is, the amount corresponding to the state fee tax is not in price, but the amount the consumer purchases. The federal tax is calculated monthly according to Article 2ºA, Section I of the IEPS law:

$$IEPS = [\frac{(\text{PVP}*\text{factor}) - [(\text{PR}+\text{quality adjustment} + \text{CM}+\text{CNT}) + ((\text{MC}+\text{f})*1)]}{(\text{PR}+\text{quality adjustment} + \text{CM}+\text{CNT})}] * 100 \quad (6)$$

Then

$$IEPS = [\frac{(\text{PVP}*\text{factor}) - (\text{PP}+\text{MC}+\text{f})}{\text{PP}}] * 100 \quad (7)$$

Where PVP is the retail price, the producer price PP, PR the international reference price. Monthly average spot price of regular unleaded gasoline in force in the Gulf Coast of the United States of America, PRAC the reference price adjusted for quality, cost management CM, CNT net cost of transporting international benchmark a national sales agency, MC is the trading margin fixed Pemex authorized outlets, f is the cost of transporting freight or agency sales of Pemex service station factor: equal to 0.9091 if the VAT is 11% of the geographical area in which the product is disposed of, and equal to 0.8696 if the VAT is 16% and PVP * factor is the retail price before VAT.

Taking into account all elements of the formula for calculating the IEPS are fixed, except for the reference price which is calculated monthly, this tax is practically based on the variation of the reference price and its magnitude varies the difference between the retail price and the producer price plus the costs indicated in (7). If the reference price - including in the producer price is higher than the retail price (excluding VAT), the IEPS rate is negative, otherwise, the rate is positive. Therefore, the collection of this tax is inversely related to the price of gasoline in the relevant markets, and these in turn with the price of crude oil on international markets.

When the IEPS rate is negative, it stops being a tax which resources are raised and becomes a transfer to consumers, which is considered to become a subsidy. The magnitude of this benefit is determined by the difference between the retail price managed public (whose magnitude does not necessarily correspond to the sum of the elements of the actual price, and that the magnitude of administered price is lower, when it generates subsidy) and the actual price (which is the sum of each of the above components of the retail price) multiplied by the total sales in the country.

If IEPS rate is positive it will be paid by the end consumer of gasoline. However, when the rate is negative, according to Article 7, Section II of the Revenue Act of the Federation (2012), Pemex may credit the amount of IEPS in their favor with other taxes such as VAT or ordinary rights, receiving and the amount of gasoline sales as if they had sold the real price.

Considering the gasoline market in Mexico, production has to Magna and Premium gasoline has maintained a steady trend since 1995; however, as shown in Figure I, sales of such fuels have increased, mainly from Magna. From 2000 to 2011, the Magna demand increased 70%. Of the total demand for oil in Mexico, the transport sector is the increased participation occupies approximately 70%. The increase in demand in the period is explained by the increase in the number of cars given expansions and credit facilities. From 2002 to 2009 the average annual growth rate of the vehicle fleet nationwide was 7.4%. This increase mainly of private-vehicle fleet use has consumed an average of 86% gasoline Magna and Premium gasoline (Ministry of Economy, 2010) rest. Other factors have also affected the demand for gasoline is Magna performance car engines, replacement alternative private transportation by public transport, infrastructure and travel times.

According to the Organization of Petroleum Exporting Countries (OPEC), oil demand in the transport sector only represents 50% of total demand, with a potential increase by developing countries; 2030 is estimated to increase in Latin America to 162 cars per 1,000 inhabitants.

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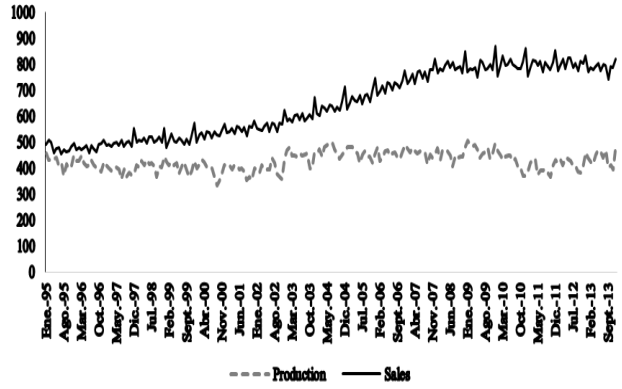
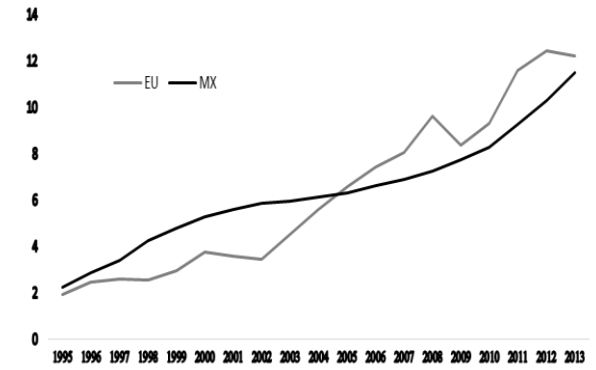


Source: Prepared with data from the Ministry of Finance, Bank of Mexico and Pemex.

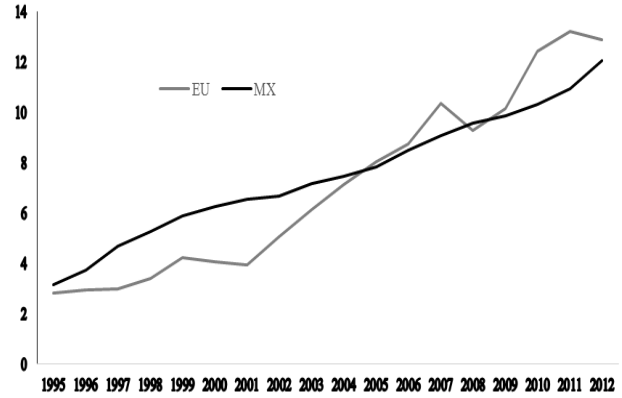
Graph 1 Production and sales of gasoline, Mexico 1995-2013)

As for prices of Magna and Premium gasoline, national and international, who have seen a shortfall in recent years; however, it has not happened since early mechanism IEPS as a tax variable rate. From 1995 to 1996 is the relatively long period in which the Magna gasoline prices in Mexico and the United States were very similar (Figure II); the balance indicates that Mexican prices were very little- - for higher prices in the US. Condolences to the Premium gasoline, since 1996 the differential was positive to a considerable extent (1.96 pesos / liter on average in 1996), which implies that domestic prices were higher than prices in the US.



Source: Prepared with data from the Ministry of Finance, Bank of Mexico and Pemex.

Graphic 2 Magna gasoline prices in Mexico and the United States



Source: Prepared with data from the Ministry of Finance, Bank of Mexico and Pemex.

Graphic 3 Premium gasoline prices in Mexico and the United States

From 1997 to 2004, prices in the US continue to rise, but at a slower pace than in Mexico. In this period, the average monthly growth rate of prices of Magna and Premium gasoline in the US was 0.4% respectively, while in Mexico the average growth rate was 0.8% for Magna gasoline and 0.9% for Premium . Relatively low gasoline prices in the US reflected the behavior of the price of crude oil West Texas Intermediate which remained relatively low and stable in this period (Energy Information Administration, 2012). While US prices were increasing, the levels were lower than in Mexico, where pricing policy responding to updates for inflation, which was reflected in a positive differential higher than in the previous period between domestic and international prices . On average, from 1997 to 2004 national Magna gasoline prices were higher than prices in the US at 1.11 pesos per liter; while domestic prices of premium gasoline were higher in 3.70 pesos per liter. This resulted in a positive revenue IEPS throughout this period and until 2005 (Figure IV).

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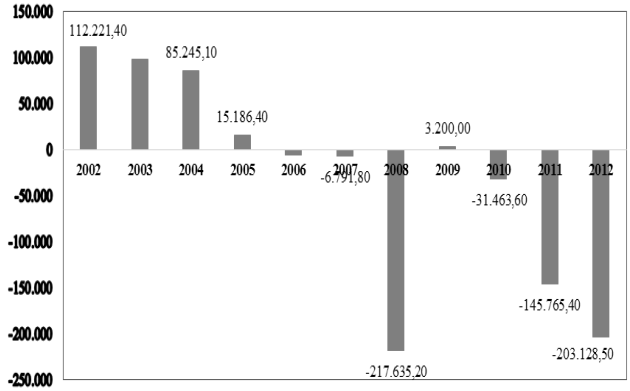

Source: Prepared with data from the Ministry of Finance.

Graphic 4 IEPS Collection

From 2005 to 2006, gasoline prices in the US show volatility, and from January 2007 to October 2008 international prices increased in greater magnitude than that observed. This period marked a different trend that was observed in the price of gasoline in the US was relatively low. In July 2008 the price of Magna gasoline in that country reached a record high of four dollars per gallon, equivalent to 10.8 pesos per liter and the value implied a negative differential from the national price of 3.63 pesos per liter. In the case of Premium gasoline prices in the US it will hit $ 4.41 per gallon (12.58 pesos per liter). This increase in the international price responded to increases in the price of crude oil increased 146% from 2007 to June 2008.

After reaching the maximum in US gasoline prices, this trend changed and entered a period of decline that lasted from August to December 2008. At this stage there was a period -January 2008 to April 2009- in which the Magna gasoline price in the US was less than the national rate. In the case of premium gasoline, the period lasted from October 2008 to February 2011. However, the step of lowering the price in the US was short and since January 2009 US gasoline prices started another upward step. Magna prices from that date to December 2011 increased by 82% gasoline, while premium gasoline by 76%.

That is, since 2007 there have been important stages of increases and decreases in US prices that respond to the volatility of crude oil WTI. Meanwhile, prices in Mexico since 2007, have shown a different behavior. Until 2007, gasoline prices in Mexico were restated for inflation and levels generally remained above the EU price. However, from that same year, while prices of both WTI crude oil and gasoline in the United States increased considerably; in Mexico the price of Magna gasoline and diesel froze. From 2008 they began to implement landslides prices, replacing the monthly updates in line with inflation, in order to reduce the difference between the administered price and real, and the consequent change in the collection of the IEPS positive to negative, ie, a change in which they were allowed to receive resources and began to disburse steadily in 2007 on account of this tax.

The aggressive increase in gas prices in the US caused the landslide of fuel prices, implemented in 2008, are insufficient to reduce the gap. However, while this year in Mexico was continued with the policy of increases, the international price began a period of decline, which helped to reduce the difference in prices in Mexico and the US, as even domestic prices were higher that international. In 2008, the negative IEPS collection was the largest with an expenditure of 223.716 million pesos.

In the context of low international prices and economic crisis in Mexico again they froze gasoline prices in most of 2009. In the same year, international prices and increased again in May 2009 reversed the difference between prices Magna gasoline in Mexico and the US. Landslides prices in Mexico resumed from December 2009 to this situation. Since 2010 the reduction in the spread of international and domestic prices declined compared to 2008 not only by landslides, but by the relative stability of the exchange rate in that year.

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However, in 2011 the differential increased compared to 2009 and 2010, which was reflected in a greater transfer of resources IEPS concept.

Also, the total final energy consumption is divided in final energy consumption and not final energy consumption. The first is the energy consumption of the residential, commercial and public transportation, agricultural and industrial satisfied fuels sector. While the final non-energy consumption, according to the Energy Department, "records the consumption of primary and secondary energy feedstock. This consumption occurs in processes using raw materials for the production of non-energy goods, for example. Pemex Petrochemical uses dry gas and petroleum to produce plastics, solvents, polymers, rubbers, among others "(Ministry of Energy, 2011).

Considering the final energy consumption, demand for oil can be distinguished by these sectors (residential, commercial and public; the transportation sector, the industrial sector and finally agriculture). With information from 2010, the transportation sector is the largest energy consuming (48%), measured in petajoules. Demand for oil in the transport sector is mainly gasoline (66.4%). This high level of consumption is because, of all existing means of transport, 92% represents the trucking and this need by 72% the use of gasoline, diesel and 26% LPG 2%. Diesel is the second most important in the transport sector (26.3% of total consumption), and the most important fuel in the agricultural sector.

The industrial sector is the second largest energy consumption sector, with a share of 29% in total of sectors. In this sector the dry gas, LPG, diesel and fuel oil are some of the main fuels used in this sector to meet its energy demand.

Finally, agriculture is the sector that has lower energy consumption, but to a greater extent using diesel; 74% of its energy demand for this fuel. In the residential sector, the energy consumption is 20% of the total between sectors, LPG is mainly used, which has a stake of 38.4% in total energy.

66.4% of the consumption of gasoline is intended for consumption in transportation. While 29.1% of the total final consumption of gasoline is not directed to the final energy consumption, that is, the fuel is used as raw material in production processes to manufacture goods.

Residential, commercial and public		Transport		Industrial		Agricultural	
Liquid gas	38,40%	petrol	66,40%	dry gas	37,70%	Diesel	74,10%
Firewood	28,50%	Diesel	26,30%	Electricity	28,50%	Electricity	21,50%
Electricity	27,80%	kerosene	5%	Coke	10,10%	Liquid gas	4,40%
dry gas	4,10%	Liquid gas	1,80%	chaff	6,80%	Kerosene	0,05%
Solar	0,70%	Fuel	0,20%	Fuel	6,50%		
Diesel	0,40%	Electricity	0,20%	Diesel	4%		
Kerosene	0,10%	dry gas	0,05%	Carb coke.	3,20%		
				Liquid gas	3,10%		
				Carbon	0,50%		
				Solar	0,05%		

Source: Ministry of Energy, National Energy Balance, 2010

Table 2 Final energy consumption by sector, 2010

On the other hand, inflation in Mexico has stabilized in relation to the levels of the 80s is currently 4%. Inflation has been influenced by various measures of economic and monetary policy, so that, when trying to relate the evolution of Magna gasoline prices, the apparent relationship between the two variables appears (Figure V) void. However, consider that gasoline is not the only well-regarded for building the basic basket in measuring inflation, although this has a relatively significant weight in the total household spending. In addition, gasoline is not only an input used in production processes, but also input to the transport sector, giving it the potential to significantly influence inflation.

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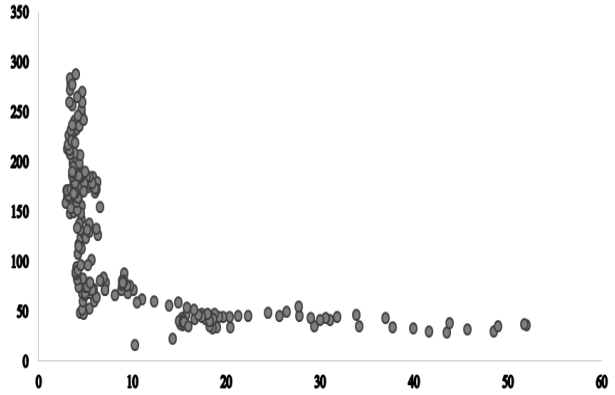

Source: Prepared with data from the Ministry of Finance.

Graphic 5 Gasoline Prices Magna-Inflation, 1995-2012

It is noteworthy that both the fact that the price of gasoline is given as the formula of IEPS influence so that when the international reference price rise significantly, this tax goes from being positive to a negative tax or transfer of resources. The price policy is supported by the above described law, and while newspapers and gradual increases in gas prices contribute to decrease transfer of resources, it is possible to eliminate the subsidy reaching the price to actual government of gasoline and leaving This fluctuate according to the components described in equation (5). However, this carries the risk of an inflationary impact, which aims to measure this work.

Inflationary impact of the liberalization of gasoline prices

In the input-output matrix that performs financial transactions with another industry, that is, cross sales and purchases are recorded in a period, which gives you an advantage that is reflected in its various practical applications. One is that, through this matrix information, you can calculate the production sector needed to address certain level of final demand.

It is also useful to measure the effect on the general price level, caused by changes in the price of a particular input used in the production of goods that are contemplated within the matrix; application that is useful for the purpose of this paper (United Nations, 1993).

To measure the effect of the elimination of subsidies for fuels in Mexico in the general price level, an expanded version suggested by Valadkhani and Mitchel (2002), the pricing model of input-output matrix of Leontief was used in this work, which will be discussed below.

The input-output matrix has n economic transactions of economic sectors. In each row sales ia n each industry sectors appear; while in each column are registered purchases sector i made the rest of the economic sectors. It also records information of value added by economic sector. Thus, the pattern recorded on the one hand, industrial production each conducted for a period of time; on the other, records purchases made by each sector in each of the sectors covered in the same period. The latter can be denoted comoz_ij, purchases made by the sector j to sector i (ie, requirements or inputs by industry j). In the model input-output is assumed that this demand of sector j to sector i, depends on the extent of production of sector j, that is, sales of sector i to sector j depend on the production sector j (Miller and Blair , 1985). With flow information industry sector i to j can calculate the technical coefficients, a_ij:

$$a_{ij} = z_{ij}/X_j \qquad (8)$$

Where Xj is the total output of sector j. aij represents the proportion of the required i sector to the total production of sector j inputs.

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When the flows recorded in the input-output matrix are monetary values, the interpretation of these serious coefficients "ij" monetary units (eg, weights) of inputs required in the sector i by a monetary unit of the total production of sector j. The calculation of all the technical coefficients results in the matrix of these coefficients:

$$A = \begin{bmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \vdots & & \ddots & \vdots \\ a_{m1} & a_{m2} & \dots & a_{mn} \end{bmatrix}$$

These technical factors are considered fixed or constant, which means that by varying the production sector j, sales of sector i to sector j (ie, those required by the sector j inputs) will also vary in the same proportion.

This is one of the most important assumptions of the input-output model. This because it certain implications are derived. One is that by assuming that sales of sector i to sector j depend entirely on the production sector j is assumed that the production of sector i is coded to other factors such as technological changes or input substitution. Also, he alleged lack of economies of scale and presence of constant returns to scale (Miller and Blair, 1985) are released.

As mentioned, the technical coefficients are interpreted as "so many dollars needed for a dollar of production," which means that "the price of a unit of production (for each sector) is a dollar" (Miller and Blair, 1985). We have the following equation:

$$P_j = \sum_{i=1}^{n} P_i a_{ij} + v_j \quad (9)$$

Where Pj is the price per unit of production for each sector, are the technical coefficients aij, and vj is the ratio of value added per production level.

Considering the case of existence of n sectors, disaggregating and representing the above equation in matrix, it is obtained:

$$\begin{bmatrix} P_1 \\ P_2 \\ \vdots \\ P_n \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \vdots & & \ddots & \vdots \\ a_{m1} & a_{m2} & \dots & a_{mn} \end{bmatrix} \begin{bmatrix} P_1 \\ P_2 \\ \vdots \\ P_n \end{bmatrix} + \begin{bmatrix} V_1 \\ V_2 \\ \vdots \\ V_n \end{bmatrix}$$

That is to say

$$P = A'P + V \quad (10)$$

Solving for P:

$$P = (I - A')^{-1} V \quad (11)$$

Where P is the vector of prices per unit of production for each sector, the matrix of technical coefficients, V the vector ratio of value added per unit of production for each sector, and I the identity matrix.

Equation (11) is the Leontief price model in which prices depend on the technical coefficients and value added. The price vector is set to 1. Considering a given exogenous level of value added, you can get the higher prices in the period of one year (the period in which the cash flows are made to the input matrix product). The price change is reflected in the vector P as percentage changes for each sector.

On the other hand, an important feature of this version of the model is that prices are considered as endogenous and fluctuate to a change either value added or wages, or gross operating surplus. In this sense this version is limited to the case under which the price of one of the inputs is considered exogenous; such as the price of petroleum products, whose value (as in the case of gasoline) is supposed fluctuates according to international market (Valadkhani and Mitchel, 2002).

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Therefore, the previous model modifications are made following the methodology of Valadkhani and Mitchel (2002), in order to distinguish between two types of prices: exogenous (corresponding to that of refined petroleum products sector) and endogenous (corresponding to other sectors); in order to calculate the imp The price distinction between exogenous and endogenous prices can be seen in the followingmatrix representation (Valadkhani and Mitchel, 2002):act on the general level of prices in response to changes in the price of fuels. It was part of the original price model (equation 10) to make the distinction between endogenous and exogenous prices:

$$P_E = A'_{EX}P_X + A'_{EE}P_E + V_E \quad (12)$$

The price distinction between exogenous and endogenous prices can be seen in the following matrix representation (Valadkhani and Mitchel, 2002):

$$\begin{bmatrix} P_X \\ P_E \end{bmatrix} = \begin{bmatrix} a_{XX} & A'_{XE} \\ A'_{EX} & A'_{EE} \end{bmatrix} \begin{bmatrix} P_X \\ P_E \end{bmatrix} + \begin{bmatrix} V_X \\ V_E \end{bmatrix}$$

Where PX is the price of petroleum products (determined exogenously), PE is the vector of endogenous prices of economic sectors of the input-output matrix (except that which represents PX), A'XE is the transposed vector (1 xn -1) requirements by the industry exogenous prices[74], exogenous tough, of their own production, VX is the ratio of value added

$$P_E = A'_{EX}P_X + A'_{EE}P_E + V_E$$
$$P_E - A'_{EE}P_E = A'_{EX}P_X + V_E$$
$$P_E(I - A'_{EE}) = A'_{EX}P_X + V_E$$

Is obtained:

$$P_E = (I - A'_{EE})^{-1}A'_{EX}P_X + (I - A'_{EE})^{-1}V_E \quad (13)$$

[74] Manufacture of petroleum and coal.

Equation (13) can calculate the impact on PE, that is, the variaciónporcentual price for each sector (n-1), under varying PX. The baseline scenario is one in which there is no increase in ΔPX (PX = 0) and, therefore, the price of each sector in the EP vector, is one. The resulting effect in PE of a percentage increase of PX, is the sum of the direct and indirect effects for each sector. "The direct effect shows the immediate response in the price of a sector, while the total effect determines the price changes after considering sectoral interdependencies" (Valadkhani and Mitchel, 2002). To calculate the direct effect of each sector (.alpha..sub.i), the ratio of the price change of sector i (ΔPi) with respect to the change in fuel prices (ΔPX) is estimated:

$$\alpha_i = {}^{\Delta P_i}/_{\Delta P_X} \quad (14)$$

To measure the effect of a change of PX in the consumer price index (π), it follows:

$$\pi = \sum_{i=1}^{n} P_E({}^{c_i}/_{C_i}) \quad (15)$$

Where it measures the total effect or change in the price of sector i, ci is private consumption in the sector i Ci the total private consumption. Using the latest available information from the input-output matrix of 2003 Mexico obtained from INEGI, the direct and indirect effects of a crash in the price of gasoline was calculated by obtaining the results in Table 3. The results reflect the percentage increases price of each of the 78 industries as a result of a price increase of 27.56%[75] Manufacturing of petroleum products and coal sector.

[75] This magnitude fulfills one of the scenarios described in section 3.2 to calculate the impact on inflation, and the justification is that with this increase, the IEPS would be zero.

Considering the total effect of rising prices, the most affected sectors (in descending order) are the tourist transport (whose answer is a price increase of 5.9%); air transport; generation, transmission and supply of electricity; land passenger transport, except by rail; and the area of fishing, hunting and trapping. That is, the sectors whose response to the price shock is more vulnerable and prone to raise their prices, are the sectors related to transportation. Also, the sectors that have a lower response to price increases (in ascending order) are the rental service trademarks, patents and franchises (the answer is a price increase of 0.003%); creation and dissemination of content exclusively through Internet; and real estate services; that is, the impact is less in those areas less directly related to the use of petroleum fuels.

Calculating the total effect in each of the economic sectors, in response to a crash of prices provides an overview of the responses of these sectors.

For the impact on inflation will be resorted to the use of different scenarios representing different magnitudes of price shock, which are presented in the following section.

Besides, to measure the inflationary effect of the liberalization of gasoline prices, the input-output matrix of total economy of Mexico 2003, in which 79 economic sectors are recorded and imports include was used.

Manufacturing sector oil products and coal as one that will trigger the price shock because it houses the Magna and Premium gasoline was chosen.

ΔPx = 27.56%			
Sector	Total efect	Direct efect	Indirect efect
Farming	1,226	0,044	1,181
Cattle raising	0,794	0,029	0,765
Forestry	0,707	0,026	0,682
Fishing, hunting and trapping	4,368	0,158	4,209
Related to farming and forestry services	1,429	0,052	1,377
Oil and gas	0,308	0,011	0,297
Mining of metal and non-metallic minerals except oil and gas	1,895	0,069	1,826
Services related to mining	1,717	0,062	1,655
Generation, transmission and supply of electricity	4,598	0,167	4,431
Water and gas supply pipeline to the final consumer	1,151	0,042	1,109
Edification	1,036	0,038	0,999
Construction of civil engineering or heavy work	1,601	0,058	1,543
Specialty Trade Contractors	1,304	0,047	1,257
Food Industry	1,014	0,037	0,977
Beverage industry and snuff	0,850	0,031	0,819
Textile manufacturing inputs	1,368	0,05	1,318
Production of textiles, except apparel	0,946	0,034	0,912
Manufacture of clothing	0,842	0,031	0,812
Manufacture of leather, fur and substitute materials	0,642	0,023	0,619
Timber industry	1,014	0,037	0,977
Paper Industry	1,373	0,050	1,324
Printing and related industries	0,879	0,032	0,847
CHEMESTRY INDUTSTRY	1,173	0,043	1,130
Industry Plastic and rubber	1,008	0,037	0,971
Product Manufacturing Nonmetallic minerals	1,841	0,067	1,774
Basic metal industries	2,640	0,096	2,544
Fabricated metal products	1,471	0,053	1,417
Manufacture of machinery and equipment	1,034	0,038	0,996
Manufacture of computer, communication, measurement and other equipment	0,926	0,034	0,892
Manufacture of electricity generation and electrical appliances and accessories	1,266	0,046	1,220
Manufacture of transport equipment	0,837	0,03	0,806
Manufacture of furniture and related products	0,870	0,032	0,839
Other manufacturing	1,251	0,045	1,206
Trade	0,261	0,009	0,252
Air transport	5,598	0,203	5,395
Rail transport	3,348	0,121	3,226
Water Transport	1,853	0,067	1,786
Trucking	3,832	0,139	3,693
Land passenger transport, except by rail	4,477	0,162	4,315
Pipeline	0,968	0,035	0,933
Tourist transport	5,936	0,215	5,720
Services related to transport	0,502	0,018	0,483
Postal services	0,671	0,024	0,647
Package delivery services	2,013	0,073	1,940
Storage Services	0,784	0,028	0,756
Editing publications and software, except through Internet	0,342	0,012	0,329
Film and video industry, and sound industry	0,492	0,018	0,474
Radio and television, except through Internet	0,334	0,012	0,322
Creation and dissemination of content exclusively through Internet	0,041	0,001	0,039
Other Telecommunications	1,288	0,047	1,242
Internet access providers, search services on the network and information processing services	0,398	0,014	0,384
Other information services	0,523	0,019	0,504
Central banking	0,157	0,006	0,152
Institutions of credit and financial intermediation-exchange	0,204	0,007	0,197
Currency and equity financial investment activities	0,244	0,009	0,235
Surety companies, insurance and pensions	0,222	0,008	0,214
Real Estate Services	0,147	0,005	0,142
Rental services of movable property	0,490	0,018	0,472
Rental services of trademarks, patents and franchises	0,003	0,000	0,003
Professional, scientific and technical services	0,486	0,018	0,468
Management of companies and enterprises	0,586	0,021	0,564
Support services to business	0,311	0,011	0,300
Waste management and remediation services	1,517	0,055	1,462
Educational Services	0,129	0,005	0,124
Outpatient medical services and related services	0,373	0,014	0,359
Hospitals	0,440	0,016	0,424
Residences of social assistance and health care	0,653	0,024	0,629
Other social services	0,641	0,023	0,617
Artistic and sports services and other related services	0,167	0,006	0,161
Museums, historical sites, botanical gardens and similar	0,313	0,011	0,302
Entertainment services in recreational facilities and other recreational services	0,697	0,025	0,672
Temporary accommodation services	0,802	0,029	0,773
Preparation Services Food and Beverage	0,623	0,023	0,600
Repair and maintenance	0,770	0,028	0,742
Personal services	0,375	0,014	0,362
Associations and organizations	0,635	0,023	0,612
Households	0,000	0,000	0,000
Government activities	0,760	0,028	0,733

Source: Authors

Table 3 Percentage increase in prices by economic sector

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Using this matrix and the methodology set is possible to measure the impact of increased fuel prices on inflation mentioned. The magnitude of this increase in price is equivalent to that required to cover the amount of IEPS negative I disbursed, with which it is possible to approach the price, unlike the administered price, provides the actual value of each of its components, within which is the international reference price. Considering the price as the base price of Magna gasoline to February 2013 (11.03 pesos per liter), three scenarios to consider the magnitude of price increases once settled: the first considers the amount of IEPS (negative) was disbursed in 2012; in this case the amount disbursed was 203,000 million pesos, so to cover this amount, the price should increase 2.9 pesos.

The second scenario considers the amount of negative IEPS which is due in the Revenue Act of the Federation of 2013, of 48.895 million pesos; in this case the price would have to increase 0.7 pesos. Finally, the third scenario is an amount equal to the average IEPS this tax disbursed from 2006 to 2012, equal to 101.433 million pesos, and to cover the amount of IEPS that amount, the price would have to rise by 1.45 pesos . To simulate the increase in domestic gas prices with the above scenarios, it can eliminate the negative IEPS and this tax is zero; that given the negative price difference and really I -administrado resulting in a value of negative IEPS.

The results of the application of the methodology and the three scenarios are shown in Table 4. The percentage increases in domestic gasoline prices are based on the price February 2013, ie 11.03 pesos. An increase of 2.90 pesos in gasoline prices (representing a price shock equal to 27.56%), could have covered the negative IEPS amount of 203,000 million pesos disbursed in 2012. The first scenario is the one that reports a higher total impact on inflation, an increase of 2.03%.

Stage	IEPS	Price increases pesos	Price increase %	Rising Inflation
1	-203,000	2.9	27.56	2.03
2	-48,895	0.7	7.4	0.54
3	-101,433	1.45	14.28	1.05

Table 4 Impact on inflation of the elimination of the negative IEPS of gasoline prices

On the other hand, the Revenue Act of the Federation of 2013 provides that at the end of 2013 IEPS erogue 48,895,000 pesos for; ie the difference between the administered price and the actual price is such that 48.895 million pesos were incurred for IEPS.

At the end of the year if the amount of IEPS spends, it means that the actual price was 0.70 pesos higher than the administered price, therefore, a measure to prevent that amount of IEPS are incurred is administered price increase by 0.70 pesos, whereby the amount of expected negative IEPS cover and end the IEPS would be zero. In this scenario, the shock magnitude is 7.4% and its total impact on the increase of inflation is 0.54%.

Finally, the goal of a scenario with average amounts of negative IEPS, is to approach a hypothetical amount that could be spent on IEPS 2013 (based on actual amounts disbursed in the past IEPS) and with that amount, calculate the administered price increase required to cover that amount of tax. Under this scenario, the shock of magnitude equal to 14.28% leads to an increase in inflation of 1.05%.

The results are relatively high considering the level of inflation expected for 2013, set in 3% plus a variable interval of + 1%, so that in the given case scenario 1, inflation could settle on 5%.

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While it is relatively low, the risk of inflation inertia present and may come into play also inflationary expectations. Similarly they considered high in relation to the results of other studies, such as Pincheira and Garcia (2007), who estimated the inflationary impact of an oil price shock of 10% and a maximum response is increased price index of 0.17% in the case of Chile, and 0.29% for Canada. In the case of the study by Rincón (2011), the rise in inflation to a price shock 10% of petrol and diesel in Colombia, is 0.85%. Wu et al. (2011) measured the impact on inflation of an oil price shock; their results indicate that doubling the fuel price increase in inflation 1.39%. Finally, the study of Valadkhani and Mitchel (2002), a crash in the price of petroleum products equivalent to 100%, inflation would increase by 1.8% Australia.

Conclusions

Prices of Magna and Premium gasoline prices are administered and their current policy is applying newspapers and gradual increases in such prices, in order to reduce the negative IEPS disbursed from about five years. The mechanism for determining the price of these fuels and the IEPS makes the international reference price is an important consideration in the design of pricing, because if it shows a high volatility factor and increases steadily, then policy gasoline prices have to be readjusted, as happened in 2008 when prices of these fuels went updated in line with inflation, to do with the current policy mentioned above. Thus, due to higher international reference prices registered in recent years, the price to actual government of gasoline began to lag relative to the price that applied public, leaving the door open to the IEPS take negative values and conduct the transfer of resources to consumers is now known as grant price of gasoline.

The elimination of this subsidy represents an improvement of public finances and that the resources allocated for this purpose would be reduced. However, there are other aspects to consider in assessing the elimination of the subsidy, as the inflationary impact; this impact was measured using a variation of the price of the input-output matrix in which they are considered as exogenous the manufacturing sector petroleum products and coal, which represents the fuel gas.

To simulate the elimination of the subsidy (which is the first step to release the price of gasoline, ensuring that the IEPS not take negative values) of this price shock of different magnitudes simulated: 27.56%; 0.7% and 14.28%. These percentages reflect the increases would have to be the price of Magna gasoline in Mexico to make the IEPS is zero.

Considering the methodology of input-output matrix, the shock of greater magnitude (the most aggressive scenario: an increase in price of gasoline at 27.56%), would lead to an increase in inflation of 2.03% per annum.

The results of rising inflation are considered high compared with the inflation target of 3% of the Bank of Mexico, as well as in relation to the results of other authors. However, it can be said that an increase in gasoline prices, equal to the need to eliminate the fuel subsidy and the consequent liberalization of the price of gasoline has the potential to increase inflation beyond the limits set by the Banco de Mexico.

While the elimination of the subsidy implies an improvement in public finances, there is also an impact on inflation of major magnitude reflected in the population with fixed incomes. This can serve as a tool to reflect on the possible uses of the resources currently earmarked to cover the subsidy for petrol.

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That is, a better use of the resources currently earmarked to subsidize gasoline, reflected in the improvement of environmental quality and quality of life of the population, could counteract the adverse effects of rising inflation, as a result of the liberalization of gasoline prices and the elimination of subsidies. An example of a better use of these resources could be the expansion and improvement of public transport system with low polluting means, favoring the use of this, instead of private transport; and the construction of transport infrastructure such as cycling.

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