

RECENT SOCIAL UPHEAVALS AGAINST FUEL PRICE INCREASES: CASE STUDIES AND KEY FACTORS

Bruno Valle de Moura, National Agency of Petroleum, Natural Gas and Biofuels (ANP), +55 (21) 2112-8337, bmoura@anp.gov.br
Luis Eduardo Esteves, National Agency of Petroleum, Natural Gas and Biofuels (ANP), +55 (21) 2112-6387, lesteves@anp.gov.br

Abstract

This study investigates the dynamics of selected countries through an evolutionary methodology to shed light on additional risks in energy policies regarding motor fuel prices. The adoption of the evolutionary methodology enlarges the analysis, encompassing broad economic and social indicators influencing in the economic dynamics instead of the final equilibrium as the traditional methodology adopted by the cost-benefit analysis. Five countries (France, Brazil, Mexico, Chile, and India) were chosen as examples of social upheavals triggered by motor fuel price spikes, to some extent related to political decisions made by local governments or their controlled companies. Finally, we suggest for the regulatory cost-benefit analysis the incorporation of an availability heuristics perspective as a mechanism to evaluate the perception of risk in the society. Results indicate that these countries managed an energy policy increasing the hydrocarbons' prices disregarding the redistributive effects associated with the long and short term risks.

Introduction

Between 2017 and 2019, spikes in motor fuel prices originated social upheavals in democratic nations revealing a further hindrance to proceed with energy policies. Despite countries' diversity and different pricing policy background, the upheavals have been effective in avoiding the policy aims in the short term. The policy frustration reveals further obstacles that were not previously identified. The traditional regulatory cost-benefit analysis has been proving a net benefit to reduce the high carbon fuel consumption in the transport sector as a mechanism to avoid troubles connected with climate change. However, it has been proving its incapacity to identify that the price increase also intensifies other short term societal concerns.

Thus, this study investigates the dynamics of selected countries through an evolutionary methodology to shed light on additional risks in the motor fuel price case. On the one hand, the adoption of the evolutionary methodology enlarges the analysis, encompassing broad economic and social indicators influencing in the economic dynamics instead of the final equilibrium as the traditional methodology adopted by the cost-benefit analysis. On the other hand, the investigators' subjectivity influences this methodology since it is impossible to observe all the social and economic indicators. In this case, to avoid subjectivity, it is relevant to highlight that our perspective is strictly economic, an element that avoid this analysis to cover other social or cultural elements influencing the risks in this case.

Five countries (France, Brazil, Mexico, Chile, and India) were selected as examples of social upheavals triggered by motor fuel price spikes, to some extent related to political decisions made by local governments or their controlled companies. While France, Chile and Mexico participate in the Organisation for Economic Co-operation and Development (OECD), the other two, Brazil and India represent the emerging countries participating in the BRICS. Additionally, the objectives with the motor fuel prices increase are different among the countries. In France, the increase represents an energy policy aiming to reduce the consumption of hydrocarbons, clearly connected with an energy policy focusing on accelerating the energy transition through price mechanisms. In India and Mexico, the increase is a reduction in the fuel's subsidy, bringing the fuel's prices to parity with international prices and reducing their impacts in the government's budget. Finally, in Chile and Brazil, the increase is a consequence of two elements: first, their intention to keep the international parity, thus, reflecting the internacional fuel price's spike; second, a devaluation of the national currencies that intensifies the fuel price increase. Despite the difference between the objectives with the increase in the fuel's motor prices, all these countries observed social upheavals based on the price increase. Thus, there are some relevant elements that have been disregarded by all these governments when designing their policies, mainly the redistributive influence derived from the fuel price's increase.

Methods

We briefly overview the countries energy policies and its historical background, proceeding with a contextualization to introduce the circumstances before the social upheavals. In this case, we utilize a broad source of information like news, expert articles, as well as scientific articles. For the analysis of the key factors, we obtain data from specific sources, mainly the United Nations, the OECD, the International Organization of Motor Vehicle Manufacturers, Bloomberg as well as other specialized literature.

The core analysis consists basically of case studies in the light of the evolutionary methodology and behavioural economics insights along with macroeconomic concepts and microeconomics indicators. According to Witt (1992) and Nelson and Winter (1982) the evolutionary approach is an opposition to the equilibrium analysis, emphasizing the dynamics' exam encompassing a diversity of determinants influencing the results. Instead of analyzing the long-term equilibrium in the light of the traditional cost-benefit analysis, the evolutionary methodology allows us to exam several indicators amid the selected countries to identify points disregarded by the traditional exam. Observed the historical background among the countries, we discuss their energy policy background as well as their economic conjuncture to delineate the conclusions.

The work of Nelson & Winter (1982) is particularly insightful as it envisioned the challenges and dynamics of policies evolution, which can be easily applicable almost four decades later, to the political dilemmas faced nowadays. To the authors, policy making and revising is a complex multi-actor game. Public policies would evolve not only in response to changes in perceived demands and opportunities, resulting from the evolution of private technologies and market structures or from other identifiable shifts in objective conditions, but also due to shifts in values or understanding of the problems.

As a recommendation for conceiving and implementing reasonable policies, Nelson & Winter (1982) draw attention to the need of: assessing the existing institutional framework in detail; making tentative judgments about an uncertain future; considering the experience with related problems, and recognizing that new information will be coming in with time. Additionally, expert knowledge of the array of options and scenarios that characterizes the technological situation should be coped with sophisticated economic analysis and institutional understanding.

The way people and governments respond to social, economic and environmental threats is also subject to heuristics and biases. As Kahneman & Frederick (2002) pointed out: "*Heuristics typically work through a process of 'attribute substitution,' in which people answer a hard question by substituting an easier one*". In this field, Sunstein (2005) made important contribution on how behaviour economics interact with (intuitive) cost-benefit analysis, especially when it comes to climate change issues.

Cross-cultural differences in both risk perception and in precautions are produced, in large part, by availability heuristics¹, which operates in the context of social influences and intuitive attention to both costs and benefits. Intuitive assessment of costs and benefits plays a large role in determining the level of precautions actually sought by people and governments (Sunstein 2005).

Sometimes social amplification may occur, being a result of the availability heuristic, operating alongside social processes. Some voices have more weight than others, especially when availability and salience are involved. For instance, the behavior and preoccupations of the media play a large role. The mass media focus on certain issues, then people communicate their fear and concern to each another, so the widespread sensation of fear and concern increases media attention and the spiral goes on and on (Sunstein 2005).

Results

In order to contextualize the countries particularities, exploratory data are presented, referring to demographic, macroeconomic, transport use and gasoline price variables. The key factor values for the selected countries are expressed schematically in Table 1.

¹ "*A cognitive heuristic through which the frequency or probability of an event is judged by the number of instances of it that can readily be brought to mind*" (Oxford 2021)
<https://www.oxfordreference.com/view/10.1093/oi/authority.20110803095436724>

	France	Brazil	Mexico	Chile	India
Population (2017)	64.842.509	207.833.823	124.777.324	18.470.439	1.338.676.785
GDP, million, current US\$ (2017)	2.582.501	2.053.595	1.150.888	277.076	2.650.725
GDP per capita (2017)	39.827	9.881	9.224	15.001	1.980
Passengers vehicles fleet (2015)	32.000.000	35.471.423	26.937.356	3.125.047	22.468.000
Commercial vehicles fleet (2015)	6.652.000	7.271.901	10.416.238	1.319.894	6.392.000
Carbon intensity of road transport energy consumption, gCO2/MJ	67,5	56,3	70,3	71,6	71,7
Gasoline Average Price, current US\$ (1Q 2017)	1,49	1,17	0,96	1,14	1,14
Gasoline Average Price, current US\$ (2Q 2018)	1,79	1,20	1,02	1,31	1,15
Gasoline Average Price, current US\$ (3Q 2018)	1,82	1,13	1,09	1,31	1,18
Gasoline Average Price, current US\$ (3Q 2019)	1,67	1,04	1,07	1,16	1,08
Affordability (1Q 2017)	1,43%	4,23%	4,03%	2,96%	21,29%
Affordability (2Q 2018)	1,55%	5,02%	4,04%	2,94%	20,49%
Affordability (3Q 2018)	1,56%	5,14%	4,01%	3,14%	22,24%
Affordability (3Q 2019)	1,50%	4,57%	3,86%	2,86%	17,79%
Income Spent (1Q 2017)	0,53%	2,54%	3,86%	1,89%	1,13%
Income Spent (2Q 2018)	0,58%	2,80%	3,94%	1,91%	1,27%
Income Spent (3Q 2018)	0,59%	2,86%	3,91%	2,04%	1,37%
Income Spent (3Q 2019)	0,57%	2,62%	3,97%	1,91%	1,18%
Gasoline Consumption per year per driver, liters (1Q 2017)	136,2	219,6	350,4	232,2	19,4
Last year of fixed gasoline retail prices	1981	2001	2016	1978	2010

Table 1 - Key factor values for the selected countries

Sources: United Nations, Department of Economic and Social Affairs, Population Division.
World Bank national accounts data, and OECD National Accounts data.
International Organization of Motor Vehicle Manufacturers
International Energy Agency – Data and Statistics
Bloomberg - Gasoline Prices Around the World: The Real Cost of Filling Up

France has one of the highest gasoline prices of the world, having a considerable fleet of light-duty vehicles. However, considering the high average income and the moderate gasoline individual consumption in France (compared to other countries), gasoline is affordable to a reasonable degree, and only a tiny share of income is spent in fuel consumption.

Brazil is a world leader in renewable energy, with predominant hydropower generation and a large share of biofuels in the energy matrix for transport, besides having huge oil reserves enhanced by the pre-salt major discoveries. Still, international fossil fuel prices dictate their domestic fuel prices, and acting together with heavy taxes, a weak currency, and a high fuel consumption, represent a big chunk of the Brazilian average income spent on fuel purchase.

Mexico has been gradually reducing its fuel subsidies. Even though domestic prices are not among the highest in the world, low incomes and high individual consumption result in a large portion of income being devoted to filling up vehicles.

For three decades, Chile has resorted to price-adjustment tools, including a self-adjusting tax that softens fuel price spikes for consumers. Through this period, the government implemented several modifications in the mechanism, adjusting it in different aspects. However, the policy could not avoid a turmoil related to energy prices.

In India, low income and limited infrastructure denote a broad energy poverty condition. A liter of gasoline in India corresponds to almost 20% of the country's average daily income. Light-duty vehicles have not reached a wide penetration and individual fuel consumption is low, so the expensive fuels do not represent a large share of consumer expenditures.

Graph 1 presents an overlook of the Brent crude daily closing prices, as reference prices of the barrel mentioned throughout the text.

Graph 1 - Brent Spot Crude Oil Prices (nominal US\$/bbl)



Source: EIA

France

In October 2018, the yellow vests (*gilets jaunes*), a spontaneous movement, began in France. This movement confronts two main elements that, from the manifesters' perspective, were connected: the consecutive increases in fuel prices and a tax on the energy sources (*Taxe intérieure de consommation sur les produits énergétiques* – TICPE). It is based on the European directive of 2020/262, allowing the tax of some products as tobacco, alcohol and energy (EU 2020).

The TICPE is the mechanism utilized by the government to tax the consumption of fossil fuels, mainly gasoline, diesel, and natural gas. It is the evolution of the petroleum tax, created in 1928 under the name of *taxe intérieure pétrolière* (TIP) that changed to *Taxe intérieure de consommation sur les produits pétroliers* – TIPP. This tax has been gradually increased since its creation, from 42.84 euro cents in 2014 for diesel and 60.69 for gasoline to 59.4 cents per liter and 68.29 in 2021 (France 2019; 2021a). Table 1 below demonstrates the progressive increase in TICPE between 2014 and 2021.

Table 1: gradual increase in TICPE between 2014 and 2021

Year	Diesel (c€/l)	Gasoline (c€/l)
2014	42.84	60.69
2015	46.82	62.41
2016	49.81	64.12
2017	53.07	65.07
2018	59.4	68.29
2019	59.4	68.29
2020	59.4	68.29
2021	59.4	68.29

Source: reproduction from France (2021a).

This continuous increase in tax on gasoline and diesel was intensified after 2014 when it incorporated an additional surcharge for carbon fuels. This tax was focused on accelerating the energy transition to fuels with a low carbon content based on the *Loi de la transition énergétique pour la croissance verte* (LTECV). Among other

instruments², the LTECV allowed the government to create a surcharge to incorporate the costs for carbon emissions from gasoline and diesel consumption, being scheduled to increase gradually³. This law aims to reduce the Greenhouse Gas (GES) emissions by 40% in 2030, taking as a basis the 1990 emissions. To achieve this target, the plan forecasts a net reduction in energy consumption of 20% in 2030, mainly derived from the reduction of 30% of the fossil fuels consumption (chiefly gasoline and diesel).

In these circumstances, from 7 €/tCO₂ in 2014, the tax progressively increased its value until it achieved 44.6 €/tCO₂ in 2018. This progressive increase is detailed in Table 2 below:

Table 2: progressive increase of the carbon content tax in France between 2014 and 2018

Year	€/tCO ₂
2014	7
2015	14
2016	22
2017	30.5
2018	44.6

Source: France (2019; 2021a).

This continuous increase in the fuels tax (TICPE) helped increase this tax's participation in the national budget. In 2019, the TICPE was the fourth most relevant tax for the national budget, achieving the total value in the year 33 billion euro⁴ (France 2021a).

However, since the yellow vests movement came up, the government froze the continuous increase in this tax as a mechanism to halt the constant increase in gasoline and diesel prices (France 2019; 2021a). Additionally, the last government document about the plan concerning the energy transition, the *Programmations pluriannuelles de l'énergie* (PPE), forecasts this tax's maintenance in 44.6 tCo₂ until 2030 (France 2021b). This element represents the difficulty of increasing fuel prices as previously scheduled (based on gradual increases in the carbon content tax in TICPE) to discourage gasoline and diesel consumption.

In other words, while between 2014 and 2018 the falling oil prices offset the increasing tax in fuels, since 2018 with the increasing international oil prices, the government started to face problems to keep its previous trajectory to discourage fuel consumption by increasing prices. According to Biotteau and Rioux (2019), between 2017 and 2018, France's gasoline and diesel prices increased 11% and 19%, respectively. In this context, the increasing international oil prices associated with a growing tax on fuels triggered a social movement against the progressive increase in prices that reduced the households' purchasing power.

Analyzing the effects of these different mechanisms redistributing the revenue among the households, Biotteau and Rioux (2019) demonstrated that the major impact on their purchasing power was derived from the increasing international oil prices and not the growing TICPE. In more detail, the effects of the rising TICPE were almost entirely offset by a reduction in the social contributions⁵. Although the decrease in the social contributions has different consequences according to the players activities, taking the average household, disregarding the effects from the growing international oil prices, the national purchasing power is constant in this period.

Incorporating the effects of the international oil prices in the households' purchasing power, the authors concluded that it reduced the average household budget by -0.5% compared to 2017. Additionally, this negative impact was mainly absorbed by households located in rural and small cities, given its higher dependence on fossil fuels for transport and heating, while the positive effects from the reduction in the social contribution were concentrated in the biggest cities of Paris and Lyon, notably where the population is less dependent of fossil fuels for transport and heating (Biotteau and Rioux 2019).

² This law also creates the multiannual energy programming ("*programmation pluriannuelle de l'énergie*" - PPE), The Low carbon national strategy ("*Stratégie Nationale Bas Carbone*" - SNBC). Both programs are complementary, establishing a strategy to develop a mobility based on fuels with low carbon emissions, reducing the atmospheric pollution and increasing the life quality in France (IEA 2019).

³ Based on the article 32 of the *loi de finances* in 2014 (France 2019; 2021a).

⁴ This tax is only overcome by the value added tax, the income tax and corporate income tax (France 2021a).

⁵ In the *contribution sociale généralisée* (CSG).

Finally, analyzing the general revenue, the most significant effect of the decreasing household purchasing power is mainly absorbed by the poorest households. Sharing the families between the 10% higher and lowest income (first and last percentile), while the purchasing power of the last percentile (the lowest income households) decreased by -0.6% in 2018, compared with the 2017 values, for first percentile (the households with higher income), there was a zero change in their purchasing power. This element demonstrates that the higher impact from the increase in international oil prices in France is focused on the households with the lowest income (Biotteau and Rioux 2019).

Consequently, any increase in fuel prices to accelerate the energy transition has a higher effect on households located in rural or small cities with the lowest revenues in the country. Additionally, if the energy transition program is based on increasing prices, the redistribution of this revenue has to be pondered by governments aiming to decrease the fossil fuel consumption. In this context, it is desirable a program aiming to transfer income focused on the poorest households of the country associated if the government keeps the program to reduce the fuel consumption. Additionally, assuming that the government aims to keep the current equality standards, even in the short term, to minimize the adverse effects of rising international oil prices in the poorest households, it is necessary to redistribute revenue to them.

Brazil

Law No. 2004, of 1953, among other provisions: (i) defined as a monopoly of the Brazilian State the activities of oil refining and maritime and pipeline transportation of oil products produced in Brazil; (ii) formed the state-owned company Petrobras - acronym for *Petróleo Brasileiro* - as the executor of this monopoly. The exclusive execution of the state monopoly by this company was made more flexible by means of Law No. 9478, of August 6, 1997. However, the assets that the company set up to exercise a monopoly on these activities remained owned by the company or its subsidiaries, which remain under State control⁶, so that the market structure remained highly concentrated, with the state-owned company holding 98% of refining capacity and high participation in imports of oil products until 2016 (ANP, 2018c).

Thus, from 2002 onwards, by law, the free pricing regime in Brazil applies to all segments of the fuel and oil products market: production, wholesale (distributors) and retail (service stations). This means that there is no price fixing, control mechanisms or requirement for prior government authorization for adjustments (ANP 2018b).

Since then, the adherence between diesel oil prices in national refineries and the price in the international market alternated between positive and negative periods, as the adjustments in local prices did not keep up with the speed of changes in the market (ANP 2019a).

However, starting in 2011, there was a prolonged period in which the domestic price was kept below the international price with an implicit objective delimited by the government to contain the inflationary pressure presented by the potential adjustment of the fuel prices. This led the Brazilian state company to bear with a waiver of revenue in diesel and gasoline refined in the country (opportunity cost) and financial losses in fuel imports (ANP 2019a).

The lag in the Petrobras' prices lasted until the second half of 2014, when oil prices fell sharply due to the oversupply of oil in the international market, thus impacting the prices of oil products, which also declined sharply. In the following period, the scenario was reversed and national prices started to be above international prices, allowing Petrobras to recover part of the accounting losses from previous years (ANP 2019a).

Nonetheless, keeping prices at national refineries consistently above international prices, as well as the reduction in the supply of fuels by Petrobras at certain delivery spots, generated an arbitrage opportunity for private importers in the fuel sector. These importers increased their participation in national supply from less than 5% in January 2016 to approximately 25% in December of the same year (ANP 2019a).

In reaction to the growing volume of imports and the reduction of its market share, in October 2016 Petrobras announced the adoption of a new pricing policy for diesel and gasoline based on import parity plus a risk remuneration margin, on a monthly basis for readjustments. Although, in an environment of falling prices in the international market, as observed in the first half of 2017, the practice of a fixed monthly price, based on the average prices of the previous

⁶ Since 2015, Petrobras has been accelerating its divestment process aimed at reducing leverage, preserving cash and concentrating on priority investments, notably oil and gas production in Brazil in areas of high productivity and return. It sold shares in subsidiaries companies and other kinds of assets in different activities such as mature oil fields, gas transport, fuel distribution, biofuels production, thermoelectric generation etc. Additionally Petrobras planned to sell half of its refining capacity (Moura, Siqueira and Torres, 2019)

month, resulted in the maintenance of a differential in relation to international prices, supporting import arbitrage opportunities (ANP 2019a).

This policy was in effect throughout the first half of 2017, after what, on June 30, Petrobras announced the revision of the pricing policy with the aim of increasing the frequency of adjustments. Such change allowed greater adherence of domestic prices to the international market in the short term, increasing the agility and efficiency of the company in the face of competition in the domestic market (ANP 2019a).

Taking advantage of the scenario of falling external prices observed in the first half of 2017 and with the objective of increasing the collection to meet the fiscal deficit target for the current year, on July 20, 2017, the Presidency of the Republic published Decree No. 9101 / 17 increasing diesel federal tax rates from R\$ 0.2480 / liter to R\$ 0.4615 / liter, resulting in a 4.7% increase in the national average retail price of diesel (ANP 2019a).

As of the second half of 2017, the price of diesel oil in the international market started to show a strong increase, following the recovery of the price of a barrel of oil after an agreement to cut OPEC production and influenced by events such as the Hurricane Harvey in Texas coast. Thus, diesel price quoted on the Gulf Coast, in the United States, increased by 35% in the first half. In 2018, the international price of diesel oil kept its upward trend, showing an accumulated increase of more than 15% up to the month of May (ANP 2019a).

Thus, following the evolution of prices in the international market, the price on the national producer increased by 44% in the second half of 2017 and by 23% from January 2018 to mid-May 2018. For the final consumer, the national average retail price of high-sulfur diesel increased by 13.5% and 8% respectively (ANP 2019a).

On May 21, 2018, a large-scale strike was led by the movement of autonomous truck drivers, who protested against the frequent readjustments that led to the rise in fuel prices observed since the second half of 2017, among other elements that negatively impacted the category, such as: the collection of highways tolls on “raised axles”, the low value of freight and the high value of taxes. The stoppage lasted 10 days and had nationwide coverage. The interruption of the main national logistical modal generated the unavailability of essential goods and services, such as food, fuel and urban transport (ANP 2018a).

The federal government and the protesters signed an agreement on May 24, 2018, which among other items created an economic subsidy for diesel oil, reduced federal tax rates and set minimum freight parameters. The subsidy took part of a temporary program, with optional membership by producers and importers, scheduled to last until December 2018 or until the end of resources destined for the program (R\$ 9.5 billion). The member producers / importers who fulfilled the requirements received up to R\$ 0.30 / liter of diesel, in order to favor greater stability of prices for consumers (ANP 2019a).

In summary, the union of the autonomous truckers' class – in a country where road transport is predominant in cargo transportation –, in the face of social dissatisfaction around fuel prices to consumers, led to a large-scale demonstration, with deep implications and extensive impacts on product supply and people's commute. This event politically pressured the federal government to take emergency measures which included subsidizing diesel prices, in an attempt to protect the freedom of companies in determining prices.

After the due process of studies and discussions with society, ANP – the Brazilian Federal regulator of oil, gas and biofuels sector – issued a regulation in 2019⁷, forcing refineries and importers to publish their prices in detail (by delivery spots and condition) and determining the disclosure of pricing criteria within contracts between refineries and wholesale distributors, approved by the regulator.

It is remarkable that in the country, even after almost twenty years of free prices, the notion that the government is the main responsible for setting fuel prices is still common sense among Brazilian people and press news concerning price adjustments put in place by the players in the market are frequent. In a feedback mechanism, consumer concern and exposure of the subject in the media may be generating the bias known as a availability heuristic, in which there is a human tendency to think that examples of things that come readily to mind are more representative than they really are.

Mexico

From 1938 to 2017, gasoline and diesel in Mexico had regulated retail prices and were sold under the Pemex brand – acronym for *Petróleos Mexicanos*, the Mexican national oil company (NOC). Until January 2015, the Mexican finance ministry defined those prices in a discretionary action. Between 2015 and 2016, the ministry set a national

⁷ Resolução ANP nº 795/2019 (ANP 2019b).

maximum price each month, which in practice functioned as fixed prices, as few service stations charged prices below the maximum.

Between 2006 and 2014, Mexican retail prices were below the US average's prices. However, after a sharp fall in crude oil prices, Mexican gasoline prices were kept above US retail prices, in part due to budgetary challenges faced by both Pemex and Mexican Federal government.

In late December 2016, the Mexican government announced the beginning of the process to deregulate gasoline prices. On January 1st 2017, the gasoline price increased by 20.1% and diesel price spiked 16.5%, leading the country to a turmoil (Murtry, 2017). The announcement of the price increase came after long queues of cars were already forming at service stations because national oil giant Pemex was unable to supply the domestic market due to problems with oil refining and fuel shortages caused by theft (Agren 2017). Demonstrations spread throughout Mexico during the following days, reportedly occurring in 28 of the country's 32 states, with Mexicans from political parties, labor unions, and other groups mounting sit-ins, roadblocks, and other protests (Business Insider 2017).

President Enrique Peña Nieto stated publicly that avoiding the price increase would be more damaging to the country's economic stability in the long term. He also denied that the price increase is a result of the energy reform. Rather, he said that, the increase came in response to the rise international prices — a point echoed by Finance Minister Jose Antonio Meade. The fixed fuel prices had been increased in the previous period but otherwise gradually (Business Insider 2017).

During 2017, in the final months before price deregulation, the ministry set maximum prices each day for 83 different regions in Mexico. Price controls for retail gasoline and diesel began to be removed in March, 2017. By the end November 2017 prices were officially liberalized nationwide (Davis et al. 2018).

Even in the liberalized gasoline market, Mexico adopted a price stabilization mechanism. The finance ministry varies the excise tax on gasoline each week. Changes in the excise tax absorb approximately 90 percent of the weekly change in international gasoline prices. The excise tax applies to gasoline sold by both Pemex and independent importers⁸.

The wholesale terminal prices charged by Pemex, however, continued to be regulated. Regulation issued by the energy regulatory commission (CRE), in force from December 2018 until December 2019, had forced Pemex to follow a methodology to determine its wholesale prices. The methodology was based on US Gulf coast reference prices — including renewable volume obligations — plus adjustments for quality, logistics, a premium for imported product, and Mexico's crude-price adjustment factor known as the K-factor. It softened international price volatility and essentially restricted Pemex from selling below cost or far above market prices (Argus, 2019). This price stabilization mechanism also provided flexibility to decrease (or increase) retail gasoline prices by varying the excise tax formula, without resorting to administrative price controls.

Regulators decided on December 2019 to end the rule (A/057/2018), which also required Pemex to post publicly its daily wholesale prices for its 77 distribution terminals. This regulation was meant to be temporary, until companies other than Pemex supplied at least 30% of the market⁹ (Argus 2021).

Nevertheless Pemex continued to publish its discounts and prices and to follow pricing guidelines from the CRE, as the restrictions were still referenced in Mexico's hydrocarbons law. In May 2021, Mexico Federal Government enacted a reform of the hydrocarbons law, removing the legal basis for requirements over Pemex (García 2021).

Davis et al. (2018) asserted very appropriately: *“There is perhaps no price in an economy as salient as the price of gasoline.”* Differently from the Brazilian scenario in 2018, Mexican consumers had no experience of searching for low gasoline prices, after almost 80 years of uniform national pricing. So, in order to reduce search costs, the regulator began to publish prices for all Mexican fuel stations on its website and through a smartphone app (“Gasapp”).

The authors also properly note that from the economic perspective, one should not try to assess the success of deregulation based on the performance over the first few years, backed by previous experience, as deregulation is best viewed through a long time horizon (many decades), and it is critical that the market be given an opportunity to work. Nonetheless, quite often social dynamics does not show such patience (Davis et al. 2018).

Chile

⁸ From April 1, 2016, independent companies have been allowed to import, transport, store, distribute, and sell petroleum products in Mexico.

⁹ Actually, by September 2019, Pemex still controlled 87% of the gasoline market. But for diesel, Pemex supplied only 57% of the country's demand in the same month.

Until 1973 the Chilean oil industry was heavily regulated. The exploration, production and refining of hydrocarbons, by legal norm, could only be carried out by the State through its NOC, ENAP. The import and commercialization of petroleum products were subject to total state control, thus inhibiting any possibility of competition. The distribution of petroleum products market was subject of a concession granted by the State of Chile to three companies: Copec, Shell and Esso.

Since the mid seventies, Chile started a progressive liberalization in the petroleum industry, achieving the full liberalization in 1991. In 1975, all the exclusive conditions of the State for refining were repealed, allowing any person or private company to operate facilities of this type in the country.

In 1978, imports of oil and its products were liberalized. Additionally, in this year, the legal barriers limiting the entry of new companies in the wholesale and retail sales of petroleum products were replaced by new norms, equipping the oil imports to the, practically, the same rules applied for the other industrial activities.

Between 1978 and 1982 the free prices regime was introduced for all petroleum products (Agostini and Saavedra, 2009). By allowing oil imports and free market prices, the government expected to foster competition.

The National Energy Commission (CNE), created by Decree-Law No. 2224 in 1978, is the regulatory body in charge of analyzing prices, tariffs and technical standards applicable to companies operating in the Chilean energy sector, aiming efficiency, safety and quality service.

Chile is a net importer of crude oil and its products. The share of national oil production in Chile's total consumption is very small (around 2%), with almost the entire demand for its products being satisfied through imports. The main company operating in the oil production and refining segments in the country is state controlled ENAP. Regarding the refining activity, this dominance of ENAP may be related to the low attractiveness of the sector due to the existence of sunk costs, economies of scale and the regulatory risk observed in a sector in which the NOC stands alone (OECD 2013).

Since 1991, fuel prices in Chile have been subject to some sort of smoothing mechanism. Initially, Law No. 19.030 created the Oil Price Stabilization Fund (FEPP, in Spanish acronym). The FEPP was a mechanism that defined the percentage of increases in imported crude prices which should be passed on to the public. The objective was to maintain a certain stability in the prices of petroleum products in the domestic market, mitigating the variations in the sale prices of petroleum products in the domestic market. But it did not completely avoid them.

For the purposes of the FEPP, CNE determined weekly the parity prices of fuels and periodically their reference prices, calculated on the basis of the expected medium and long-term price of the oil market (Márquez, 2000). The mechanism established that when the import parity price was below the lower reference price – 12.5% below the intermediate reference price – the product will be taxed by 60% of the difference between both prices per cubic meter sold (or imported). On the contrary, if the parity price exceeds the higher reference price – 12.5% higher than the intermediate reference price –, a tax credit equal to the difference between the two prices will operate, per cubic meter sold (or imported). The FEPP creation was motivated by the prices shock originated from the Gulf War.

In such mechanism, prices of gasoline (93, 95 and 97 octane); naphtha for use in the manufacture of piped gas; domestic kerosene; diesel; fuel oil and Liquefied Petroleum Gas (LPG) were determined by the Parity Import Price (PPI_m, in Spanish), that incorporate the corresponding transportation and storage fees, distributors costs and margins, the corresponding value added taxes and, in some cases, specific taxes. The distribution margin was freely determined by private distributors. Only after the determination of such prices, the FEPP was applied, depending on the case, in which the role of ENAP and the regulatory authority was relevant.

Until mid-July 2000, the dedicated resources by the state were estimated at US\$ 250 million. However, in order to calculate the total costs with the FEPP, one should include the financial costs and others related to maintenance and compliance (Márquez 2000).

From the point of view of the economy as a whole, the benefit of the fund must consider the cost avoided by “smoothing” or mitigating the pass-through of increases in international crude prices. In general, the increase in energy prices, due to the wide use and application that energy has in all human activities, strongly affects the levels of economic activity. Such effects may be directly correlated to the dependence on oil, as it stands out in the case of Chile.

Márquez (2000) estimated the impacts on the economy derived from an increase in oil prices without FEPP using a computable mathematical model (General Equilibrium Model for Economy). The exercise consisted of inputting to the model a 30% increase in international crude prices, and fully passing it through to final consumers. Some of the results: i) The Gross Domestic Product at Market Prices (GDPMP) shows a significant decrease of roughly 1%.; ii) income decrease by around 1%, with higher decrease in the poorest quintiles; iii) decreases in production for the

domestic market in several sectors, and significant in the case of oil products and the transport sector; iv) impacts on the inflation .

In July 2000, the FEPP was reformed by Law No. 19,681 and its regulations. Two main reasons were alleged to promote the changes. First, the decrease in available resources. Second, the fund virtual exhaustion. These two reasons are connected with the increase in international oil prices, which in March 2000 represented a monthly expense of around US\$ 30 million. The changes introduced to the mechanism included: improvements in the models used to determine the reference prices, in order to avoid the depletion of the fund's resources; the creation of sub-funds destined to correct the transfer of cross subsidies.

FEPP operated until 2005, when it was replaced by the Fund for the Stabilization of Oil Products Prices (FEPCO, in Spanish), established by Law No. 20.063/2005. Its objective was to mitigate the variations in the domestic sales prices of automotive gasoline, diesel, LPG and domestic kerosene, caused by variations in international oil prices . The latter was created in response to the effects of Hurricane Katrina on gasoline prices, whose increases could not be limited by the FEPP, and lasted until June 30, 2010 (Dipres, 2021).

According to BCN (2021), Fepco was too comprehensive and benefited consumers who did not need them. Another problem detected was that in the face of sudden and significant changes in international prices, the funds tended to run out in response to price fluctuations. In July 2010, FEPCO was replaced by the Taxpayer Protection System against Variations in International Fuel Prices (SIPCO). Like the stabilization funds that preceded it, this system established a rule to limit changes in wholesale fuel prices based on a price band. Unlike the precedent funds, the instrument to guarantee the wholesale price varied within the band were adjustments in the Specific Fuel Tax.

SIPCO sought to limit the government's discretion to adjust the values of the parameters that defined the intermediate reference price. During SIPCO's period of operation, this mechanism operated effectively in about 21% of the weeks. Official analysis by the legislative concluded that the mechanism failed to provide effective protection against sudden changes in fuel prices (BCN 2014).

Regarding price transparency, in March 2012, the Chilean government implemented a fuel price disclosure policy, in accordance with CNE Resolution No. 60, of January 30, 2012. All fuel stations started to inform their prices within 15 minutes after the prices change at the pump. The information is posted on a public website¹⁰, which also provides a map with the location of each fuel station and its characteristics.

The initiative had two objectives: (i) to allow the regulatory body (CNE) to have real-time price information that would be used to assess market performance and forecast prices; (ii) to allow consumers to access georeferenced information on prices for all fuel stations in the country, as well as information on their characteristics.

In the two years after the price disclosure policy, oligopolized gasoline retail markets have become increasingly organized. This was reflected in faster responses to changes in wholesale prices, faster convergence to equilibrium and greater likelihood of an orderly sequence of price adjustments, which facilitates the identification of price leaders. In addition, margins were higher and price dispersion was minor in markets with leaders than in markets without them (Luco 2019; Lemus and Luco 2018). However, this relationship between leadership and margins collapsed after the implementation of two additional reforms reducing the coordination gains: mitigating uncertainty in wholesale prices and increasing penalties for collusion.

The first reform was implemented in August 2014 and changed the price stabilization mechanism to limit the weekly variation in wholesale gasoline prices. Since then, the CNE determines the parity and reference fuels prices on a weekly basis, for the purposes of applying the Fuel Price Stabilization Mechanism (MEPCO) created by Law No. 20,765; and the Oil Price Stabilization Fund of Law No. 19,030 and its respective amendments (CNE 2021).

The second reform, approved in July 2016, amended the Chilean Competition Law and implemented tougher punishments for collusive behavior, with the reinstatement of the prison sentence for cartels (3 to 10 years in prison) and a significant increase in fines. Lemus and Luco (2018) point out that these measures were effective in making fuel price transparency beneficial to the final consumer.

According to Rodrigues and Losekann (2018), the Chilean experience indicates that more stable wholesale prices, achieved with variable taxes that cushion short-term variations in oil prices, and more severe penalties for cartels contribute to price transparency resulting in greater well-being for society.

The trigger for the October 2019 protests was the increase in subway ticket price in Santiago (to approximately US\$1.17), a measure later revoked. The revocation did not calm the demonstrations, leading the government to declare a state of emergency and a curfew, unprecedented measure in the democratic times (the last curfew was in the military

¹⁰ <http://www.bencinaenlinea.cl>

regime, in the 1980s). Although fuel prices were not the main apparent focus of public dissatisfaction, subway transportation costs are linked to energy prices, and the electric matrix in Chile relies primarily on fossil sources.

According to data from the Household Budget Survey, after feeding, transportation is the second greatest household spending, followed by housing and basic services. But since the wages of most of the population are not enough to cover normal expenses (which also include health, education and others), 60% of households spend more than they receive as income, which explains why there are so many families in debt (Barría 2019).

India

India is the fastest growing major economy in the world and it is forecasted to increase its energy demand for the next two decades, being responsible for the biggest share of the growing demand for energy in the world. Nonetheless, the government has been subsidizing the economy in two main sectors: energy and food. While food subsidies are shared between agriculture (through a direct subsidy destined to fertilizers) and food and non-food items (in this case, focused on reducing food cost for poor households), energy subsidies are mainly directed to petroleum products. According to the Indian Petroleum & Natural Gas Statistics of 2017-18, between 2011-12 these subsidies corresponded to more than 90% of the whole subsidies in India (India 2018).

In 2008, facing an economic slowdown associated with the world financial crisis, the government appointed a committee¹¹, named Chaturvedi Committee, to analyze its economic issues and providing a holistic view to face their hard constraints establishing a gradual path based on reforms, mainly focused on its subsidies. As the main subsidies are directed to food and energy, both sectors were the core of the report. Concerning the economic crisis, we emphasize two main economic issues driving the government reforms. First, its incapacity to keep subsidizing fuels, an element connected with the fiscal sustainability. Second, the increasing current account deficit connected with the increasing fuel demand (Fattouh, Sen, and Sen 2013).

As India is a net importer of oil, affordable fuel prices increase the growing demand for fuels, deepening the oil external dependency and the current account deficit. Actually, India imports over than 70% of all its oil requirements. Thus, reducing fuel subsidies has a double effect in the Indian case. Firstly, it reduces the government budgetary deficit, improving the fiscal sustainability. In 2008, petroleum subsidies reached 3.4% of the India GDP, producing a major impact in the federal budget. Secondly, it reduces the growing demand for fuels, also reducing the pace at which the current account deteriorates (Fattouh, Sen, and Sen 2013).

In this complex context, the report recommended a gradual reduction in petroleum subsidies associated with a rationalization of food subsidies, in the latter case, moving subsidies from products to households below national poverty line. In this regard, the committee proposed to change transfers from products subsidies to cash transfers or other kinds of transfers to avoid the existing Public Distribution System, based on a system of retail outlets managed by government (Fattouh, Oliveira, and Sen 2015). Based on this report, the government implemented a new process to deliver subsidies, identifying and collecting the biometric information from beneficiaries and direct transferring subsidies to the eligible consumers, thus bypassing the Public Distribution System for the food subsidies.

For the petroleum sector, responsible for more than 30% of the total subsidies of the Indian government (India 2018), the report recommended a gradual process of liberalization of fuel prices. This gradual process had as its main objective to reduce the governmental subsidies and alleviate the current account deficits concerning oil imports.

In June 2010, aiming to implement this progressive process, the subsidies for gasoline were completely removed, starting the deregulation on diesel prices in September 2012 (Sen 2020; Fattouh, Sen, and Sen 2013). We emphasize that the main consumption of oil products in India is concentrated in kerosene and diesel, in this context, the beginning of the subsidies reduction by gasoline is a government strategy to examine their influences in the economy and the

¹¹ It is important to highlight that between 2006 and 2010 there were three high-level committees that had been recommending to change the subsidies destined to petroleum products to improve the welfare of the poor in a more effective way. In 2006, the Rangarajan Committee analyzed both pricing and taxation of petroleum product prices, aiming to rationalizing them. The main conclusion is to finish the government interference in the market, allowing the participants to determine the prices through an interaction in the market between supply and demand. In 2008, the Chaturvedi Committee also analyzed the issue. In 2010, the Parikh Committee recommended a market based pricing mechanisms. Additionally, the third committee also studied the reason most commonly accepted for the petroleum subsidies, the increasing inflation associated with price volatility that could affect the poor. For this committee, the petroleum products (gasoline, diesel and kerosene) are largely consumed by households being considered as an item of final consumption, thus, reducing its impacts on further inflation and mitigating the most influential fear against the fuel's prices liberalization (Shenoy 2010). Despite these three high-level committees indications, the government actions have been basing on the Chaturvedi Committee report to proceed with reforms in the fuel's prices (Fattouh, Oliveira, and Sen 2015).

population reaction. To address the issues concerning the economy problems (fiscal sustainability associated with current account deficit), the liberalization process has to be concentrated on diesel instead of gasoline.

In more detail, considering total fuel consumption in India in 2011, diesel represented 49%, while gasoline reached only 14% (India 2018). The liberalization process started with gasoline, as it is more directly related to the use in passenger cars. Of the total diesel consumption, only 15% corresponds to passenger cars, the remainder divided into: 37% for trucks, 12% for agriculture, 12% for buses, industry with 10%, energy generation with 8% and railways with 6% (Sen 2020; Fattouh, Sen, and Sen 2013³).

Once the gasoline prices liberalization was overcome through the reduction of subsidies and the authorization to follow international prices, in 2012 the government gradually began to replicate the gasoline model in diesel. Despite the government efforts, the reduction in diesel subsidies accelerated since 2014, when the government seized the opportunity from the falling oil prices (Sen 2020; Fattouh, Sen, and Sen 2013). In this context, considering the whole government expenses with subsidies, between 2011 and 2013, instead of falling, the petroleum subsidies increased from 31.4% to 37.6%, demonstrating that the lion's share of the petroleum subsidies were connected with diesel instead of gasoline.

Since 2014, seizing the oil prices falling from values over US\$ 100 per barrel to values near to US\$ 50 per barrel in 2017, the government intensified its policy to end with the subsidies. Thus, proportional and total expenses with petroleum subsidies fell, reaching only 8.5% of the whole expenses with subsidy in 2018 (India 2018). In monetary values, the total subsidies to petroleum reduced from US\$ 24.6 billion in 2013 to less than US\$ 1.16 billion in 2017 (Jain 2018). This movement revealed the success of the gradual process to reduce its subsidies destined to the petroleum in the country.

It is important to note that the liberalization of diesel is connected with an increase on subsidies to LPG, mainly to reduce or even completely avoid the consumer's reaction. Despite this increase on LPG subsidies, the net effect on the whole petroleum subsidy is a reduction, thanks to the additional policy to limit the number of subsidized LPG cylinders (Sen 2020; Fattouh, Sen, and Sen 2013; Jain 2018). Additionally, this price liberalization established a permission to increase diesel prices only once per month, gradually reducing the time to twice a month and, finally, fully liberalized in 2017 (Dutta 2017).

Despite all these measures to reduce the subsidies and liberalize the fuel's prices, when the international oil's prices changed the direction, from falling between 2014 and 2017 to an increase in 2018, it was the first time that the population in India observed the increasing prices in fuel stations. In the capital, the fuels' prices increased 14%, mobilizing the public opinion. This element associated with the further elections influenced political parties to organize protests against the government, triggered a nationwide strike against the increase in fuels prices. After several clashes between population and the provincial governments, in several states the police imposed prohibitory orders (Saberin 2018). In India, prohibitory orders are issued by competent authorities to prohibit several societal liberties as, for the case, manifestations and the assembly of 5 or more persons (The Times of India 2015).

General comments

The analysis of the several countries data following an evolutionary approach demonstrates a converging point among them. The increasing of motor fuel prices in these years neglected the redistributive effects of the measure associated with the affordability in the fuel's price.

Findings suggest that a converging point among the countries is the society incapacity, in the short term, to replace hydrocarbons, mainly in the lower household revenues. Without any other policy to redistribute the revenue and to reduce the negative influences of the price increase in the households' purchasing power, the net effects have been demonstrating to be regressive. In this case, from the lower households' point of view, the previous investment in technologies locked their fuel consumption in hydrocarbons, generating inflexibility in the short term.

The historical investigation among the different countries demonstrates a net reduction in the hydrocarbons' fuel affordability, pressing the households' budget and signaling the necessity to change the fuels. However, as they are locked-in, the price increase in carbon fuel is absorbed by families, deteriorating the income distribution, outbreaking a social upheaval.

Closing Remarks

Despite the society's concern with climate change and fossil fuels dependency, other issues such as income redistribution impacts and fuel affordability have to be pondered in energy policy design and implementation. When implementing the phase-out of fuel subsidies or introducing a carbon tax, the redistributive effect is one that deserves special attention. In these circumstances, an improvement in the traditional cost-benefit analysis is the incorporation of the assessment of risks perceived by society as higher or more critical.

Regarding the risks perception by society and threats emerged from a economic policy or the political environment, sometimes social amplification may occur, being a result of the availability heuristic, operating alongside social processes. When the cognitive heuristic is present, the weight of an event is judged by the number of instances of it that can readily be brought to mind.

On the macroeconomic perspective, developing countries (such as Brazil, Mexico, Chile and India) often have volatile currencies, which jointly with oil dependency (as in the case of Chile and India), generates a perverse exposure to volatile oil prices. As an alternative, effective price smoothing mechanisms have been proving to be quite difficult to maintain over a long period of time, because they frequently lead to (or widen) fiscal problems in the long run. Depending on the design of the price policy, the state intervention on prices may also drive off private investments in domestic petroleum industry – which could help solving the dependency problem – ends up generating a vicious circle.

Developed countries also observed social reaction during periods of rising fuel prices, as the French case showed. Despite the country has a high average income associated with affordable fuels prices, the disparity between regions exacerbated the redistributive effects from price increases. Additionally, the different households dependency on fuels also increased the redistribution effects reducing the purchasing power of the poorest families.

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