Combining energy subsidies is not free: distributional effects and energy poverty

Milena Poggiese[1] and María María Ibáñez Martín[2]

[1,2]Universidad Nacional del Sur (UNS) - Instituto de Investigaciones Económicas y Sociales del Sur (UNS-CONICET)

April 2024

JEL: D31, H22, Q40
Keywords: Energy poverty, Energy subsidies, Distributional incidence

Abstract

In Argentina, energy subsidies play a central role in the National Treasury's expenditures. After the pandemic, changes were made to two of the most significant subsidy policies: the Zona Fria Law and the universal residential subsidy. The Zona Fria Law was extended in 2021, and residential tariffs began to be segmented in 2022. Both subsidies and their respective modifications have distributive effects on the population and have a substantial impact on energy deprivation. The primary objective of this study is to examine whether the changes in subsidy policies have contributed to alleviating energy poverty in Argentina and reducing territorial inequalities. By applying a distributive incidence analysis of energy expenditure using various indicators, it is found that the combination of subsidy policies—each with different motivations—creates distorting effects.

1 Introduction

Globally, the world is undergoing a new energy transition, which involves a shift in the energy system regarding the quantity, quality, and structure of both energy supply and usage (Grübler, 2007). This phenomenon is highly complex and can be studied from various perspectives and with emphasis on different dimensions. However, a fundamental aspect of the current energy transition is the concern about climate change (Singh et al., 2019). Consequently, international initiatives such as the Paris Agreement are gaining increasing relevance in shaping the global public agenda. The agreement aims to limit the global average temperature rise to below 2ºC above pre-industrial levels (OCDE/IEA, 2016).

Simultaneously, another aspect debated in the literature is equity in the energy transition process. This debate has led to the concept of a Just Energy Transition (JET), which refers to a pathway where there is a reconciliation between the material needs of the poorest sectors and the goal of achieving climate change mitigation objectives (Jakob and Steckel, 2016). In this context, a

transition can be considered just if it ensures environmental sustainability while generating decent employment and addressing social inclusion and poverty eradication (Op. Cit.).

The principles of JET are linked to the guidelines of the United Nations' 2030 Agenda and the definition of the Sustainable Development Goals (SDGs). The SDGs encompass various aspects, all closely related to poverty and environmental care. One of these goals, number seven, aims to ensure "Affordable and Clean Energy" to meet the energy needs of the population. When the population cannot afford energy costs and/or only has access to polluting energy, the issue of energy poverty arises. Energy poverty is defined as the lack of access to essential energy services required for human life, driven by a lack of access, insufficient quantity, and quality of both energy and equipment, which ultimately impacts the well-being of household members (Ibáñez Martín et al., 2019).

The SDGs are so significant that national public budgets must be evaluated based on indicators that reflect the impact of programs and policies on these objectives. Indeed, countries adhering to the 2030 Agenda can voluntarily produce Voluntary National Reviews (VNRs). The purpose of these reports is to facilitate the exchange of experiences between countries and strengthen government policies and institutions to accelerate the implementation of the 2030 Agenda.

Argentina is one of the countries in the region that has presented VNRs. The latest report indicates that in 2018, the SDGs and their indicators were linked to the Government Plan and the Public Budget to reflect the contribution of budget programs to the country's medium- and long-term objectives. The 2019 General Budget Law included 38 indicators for monitoring SDG goals, and 34 indicators were included for 2020 (Consejo Nacional de Coordinación de Políticas Sociales, 2020).

One of the tools available to the National Government to enhance energy affordability is the application of energy subsidies. As of 2023, energy subsidies account for 3% of Argentina's GDP. The history of energy subsidies in Argentina is extensive, with different subsidy regimes coexisting, often driven by opposing objectives. Two of the most significant energy subsidy policies are the Law of the Zona Fria and residential subsidies. In both cases, the end result is a reduction in the price households pay for the energy they consume (natural gas, electricity, and, in the case of the Zona Fria Law, bottled gas).

Both the Zona Fria Law and residential subsidies were modified following the COVID-19 period. The Zona Fria Law's geographic coverage was expanded in 2021 (among other changes), leading to increased expenditures by the National Treasury. Conversely, in 2022, a national decree introduced a tariff segmentation strategy based on households' socioeconomic conditions. The primary aim of the segmentation implemented in 2022 was fiscal.

Given the importance of the social dimension of energy access, there is substantial literature addressing energy poverty both globally (Boemi and Papadopoulos, 2019; Castaño-Rosa et al., 2019; Day et al., 2016 García Ochoa, 2014) and nationally (Bravo et al., 2008; Durán and Condori, 2019; Ibáñez Martín et al., 2019; Ibáñez-Martín et al., 2022; Zabaloy and Ibáñez Martín, 2020). Similarly, there are numerous studies evaluating the distributive incidence of various energy subsidy schemes (Wagner, 2010; Puig and Salinardi, 2015; Giuliano et al., 2020; Baez, 2022; Poggiese, 2023).

However, there are no studies that jointly evaluate two subsidy schemes and their impact on energy poverty. In this context, the aim of this work is to analyze how the Zona Fria Law and residential subsidies (with their modifications) affect energy poverty and the differences between provinces. To achieve this, a distributive incidence analysis is applied using data from the National Household Expenditure Survey (ENGhO) conducted by INDEC. The 2017-2018 version of the survey is used, as it includes a specific module on energy consumption.

The paper is structured as follows: After this introduction, the second section describes the issues related to energy poverty and the distributive effects of energy subsidies. The third section provides an overview of the two energy policies under evaluation and the modifications implemented in recent years, which will be part of the assessment. The fourth section details the database used, its relevance, the variables employed, and the mechanism for modeling household energy consumption, as well as the methodology applied and the micro-simulations performed. The fifth section presents the results obtained, and finally, the sixth section highlights the main findings of the study and the implications in terms of policy recommendations.

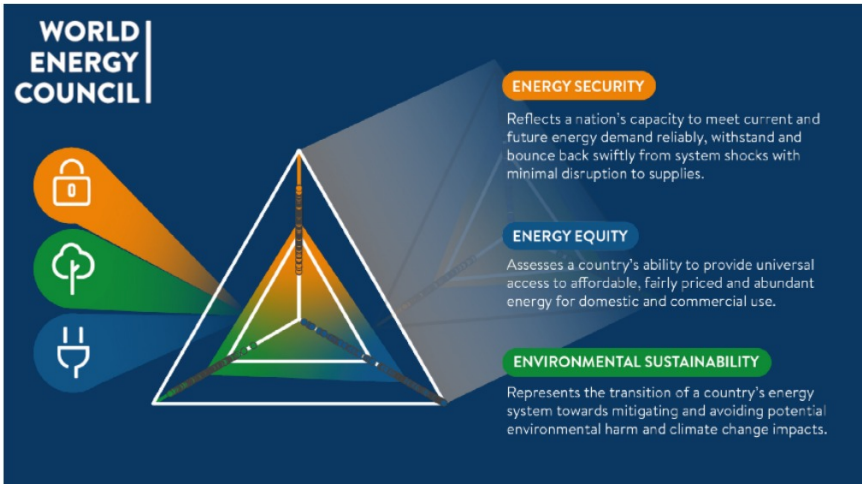
2 The two sides of energy subsidies: energy poverty and impact on welfare

2.1 Energy and wellbeing: energy poverty

Energy is considered a key resource for the economic and social organisation of a country; it constitutes a means to satisfy basic needs and therefore implies a social good (Bouille, 2004). According to the United Nations General Assembly (2012), energy can be characterised as the common thread between economic growth, social equity and environmental sustainability, thus occupying a central role in government policy agendas. Because of this role, it can be argued that timely access to energy is a necessary condition for achieving economic and social development.

The energy profile of an economy can be assessed through the dimensions that make up the Energy Trilemma, a tool designed by the World Energy Council (World Energy Council, 2018). The Trilemma is composed of the dimensions: energy security, energy equity and environmental sustainability. One of the great challenges for economies in the current Energy Transition process is to keep these dimensions in balance. The imbalance generates severe energy deprivation, which puts the population at risk. Thus, the problems of energy poverty, energy vulnerability and energy insecurity (among others) arise. Within the energy equity dimension, access (to electricity and clean cooking), quality of supply and affordability-competitiveness are assessed. Therefore, aspects related to energy poverty are relevant in this dimension.

Figure 1: Trilemma Index: energy security, energy equity and environmental. Taken from World Energy Council (2018)



In 2023, Argentina ranked 32nd out of 99 countries on this metric, with a score of 70 out of 100. Regionally, it ranks third, behind Uruguay and slightly below Chile. Argentina scores relatively high on energy access, because electricity coverage reaches almost the entire population and electricity and fuel prices were cheap in that year. In contrast, it loses some positions when it comes to energy security and environmental sustainability. In the first case, while Argentina is largely self-sufficient in energy, it is not as well positioned in diversification of electricity generation sources and energy storage. Regarding environmental sustainability, the share of clean energy in its energy matrix is lower than the average for the region. However, the irrelevance of coal and the predominance of gas in the energy matrix help to avoid a significant drop in this dimension (Aneise et al., 2024).

While the equity dimension may seem the least problematic for Argentina, at least 17% of households in the country suffer from energy deprivations (Lampis et al., 2022) and a non-negligible proportion of the population is deprived of access to reliable and clean sources of energy (Ibáñez Martín et al., 2022).

As mentioned above, energy deprivation makes up different energy phenomena: poverty, vulnerability, insecurity, destitution. Specifically, energy poverty is defined as 'the lack of satisfaction of energy services essential for human life, induced by a lack of access, quantity and quality not only of energy but also of equipment, which is caused by various factors, such as socio-economic, geographical, building and cultural factors; which ultimately impacts on the level of well-being of household members' (Ibáñez Martín et al., 2022. pp. 60).

As mentioned above, energy deprivation makes up different energy phenomena: poverty, vulnerability, insecurity, destitution. Specifically, energy poverty is defined as 'the lack of satisfaction of energy services essential for human life, induced by a lack of access, quantity and quality not only of energy but also of equipment, which is caused by various factors, such as socio-economic, geographical, building and cultural factors; which ultimately impacts on the level of well-being of household members' (Ibáñez Martín et al., 2022 pp. 60). In simpler terms, energy poverty is not simply about access to energy but about how energy is accessed, how much it costs to access and what type of energy is accessed. On the other hand, it is necessary to mention that individuals do

not demand energy per se, but energy is the means to satisfy energy services (which in essence is what individuals demand) (Dubois et al., 2023).

As with income poverty, fuel poverty is recognised as a phenomenon that is essentially multidimensional. However, there is still debate as to how it should be measured: unidimensional or multidimensional. The predominant method for assessing energy poverty has largely been through one-dimensional measurements. This preference can be attributed to various reasons, mainly the limited availability of comprehensive data that covers multiple factors such as the adequacy of energy services, affordability, availability of appliances, and housing conditions. Additionally, some definitions of energy poverty include subjective elements, complicating their integration into routine surveys in developing countries.

In recent years, there has been a rise in multidimensional approaches to measuring energy poverty (Falak et al., 2014; Mendoza Jr et al., 2019; Sokołowski et al., 2020; Wang and Lin, 2022; Liu et al., 2022; Abbas et al., 2022). However, these approaches are not frequently used in Latin American economies due to their demanding information requirements, with Chile being a notable exception. Studies in developing countries typically rely on single indicators to compare different economic contexts (Rocha and Schuschny, 2018; Calvo et al., 2021; Lampis et al., 2022; Soares et al., 2023).

Among the various methods used to assess energy poverty, one of the most common is the "10% indicator," derived from the concept of fuel poverty (Boardman, 1991). This indicator classifies a household as energy poor if it spends more than 10% of its total income on energy services, including various fuels such as natural gas, bottled gas, firewood, coal, kerosene, and electricity. This measure aims to reflect the household's ability to afford energy services (e.g., cooking, heating, hot water, refrigeration, and cooling). Like income-based poverty measures, this indicator assumes that income is a good proxy for well-being. Calvo et al. (2021) estimated representative energy expenditures for each country by weighting average energy consumption with energy prices, comparing this against household income by quintile. Criticisms of this indicator include its inability to fully capture the real-world context of each country, especially in places like Argentina where residential energy is heavily subsidized, making the 10% threshold too high and only capturing severe deprivation (Zabaloy et al., 2022).

The 10% indicator also faces criticism for other reasons. Data collection often relies on household self-reports, which can be problematic if the respondent is not responsible for paying the bills or if electronic payments obscure detailed expenditure records (Cecchini et al., 2021). In households using firewood, coal, or kerosene, expenditures are often irregular and may not be captured accurately. This can lead to either underestimations or overestimations of energy costs, affecting the measurement of energy poverty. Additionally, income data is prone to inaccuracies, with lower-income households often overstating their income and higher-income households underreporting it (Gasparini et al., 2022; Maldovan Bonelli et al., 2021).

Another approach to measuring energy poverty involves analyzing the types of fuels used by households. Several studies have characterized households using highly polluting fuels for cooking, heating, and hot water as energy poor (Ibáñez Martín et al., 2019; Castelao Caruana et al., 2019; Lampis et al., 2022). Ibáñez Martín et al. (2022) suggest that reliance on traditional fuels indicates a lack of access to cleaner and generally less expensive energy sources, which could be associated with severe energy deprivation.

The European Union's Energy Poverty Observatory (EPOV) has proposed a set of primary and secondary indicators for measuring energy poverty. The primary indicators include two related to subsistence—double the median (2M) and half the median (M/2)—and two consensual

indicators—delays in utility bills and inability to keep homes adequately warm. The 2M indicator identifies households spending more than twice the national median on energy, while the M/2 indicator captures those spending less than half the national median, potentially reflecting energy-saving behaviors. However, this indicator has limitations, which are addressed in the next section with the introduction of the Hidden Energy Poverty (HEP) indicator. The secondary indicators focus on explaining the origins of energy deprivation, considering factors such as energy prices, household characteristics (e.g., size, floor area, energy efficiency), and macroeconomic indicators like poverty rates and winter mortality.

Among EPOV's indicators, the 2M and M/2 indicators are the most commonly used in empirical studies (Longo et al., 2020; Thema and Vondung, 2020; Stevens et al., 2022; Emre and Sozen, 2022). The 2M indicator is often adjusted for household size, resulting in the relative 2M (2Mr), due to its ease of calculation and comparability. In contrast, the secondary indicators are less frequently applied outside the European Union due to their extensive data requirements (Martín-Consuegra et al., 2020).

2.2 Energy Subsidies: distributional effects

Residential energy subsidies represent a substantial portion of public spending across Latin America, accounting for as much as 1% of the region's GDP (Jiménez Mori and Yépez García, 2020). Due to their significant impact, several studies have examined the distributional effects of these subsidies. The findings consistently point to considerable inefficiencies, with a large share of benefits disproportionately going to higher-income groups (Barrios and Morales, 2012; Izquierdo et al., 2013; Hernández Oré et al., 2017; Izquierdo et al., 2018).

In Argentina, similar patterns emerge. Wagner (2010) utilized microsimulations to explore the distribution of natural gas and electricity subsidies across different social strata, aiming to assess alternative allocation methods distinct from the Social Tariff program. Her research concluded that the current combination of a universal subsidy and a social tariff disproportionately favors wealthier segments, and that the social tariff alone does not adequately address the regressive nature of the universal subsidy.Puig and Salinardi (2015) applied the Benefit Incidence Analysis (BIA) to data from the 2012-2013 National Household Expenditure Survey (ENGHo) and found that, while the subsidy regime is regressive in absolute terms, it shows relative progressivity. Lakner et al. (2016) conducted a comparable study for 2014, modifying the subsidy estimation methods, and their results aligned with earlier research. They also evaluated potential reform scenarios for the existing system, considering their implications for welfare and fiscal outcomes, and identified possible enhancements through more targeted subsidies.

Giuliano et al. (2020) utilized data from the 2012-2013 ENGHo and various rounds of the Permanent Household Survey (EPH) spanning 2016 to 2019 to assess the distributional impact of gas and electricity subsidies in the Buenos Aires Metropolitan Area (AMBA). Baez (2022) examined the 2016 subsidy structure, distinguishing between the general subsidy and the Social Tariff component. His findings suggested that while the Social Tariff improved targeting towards low-income households, the overall policy remained regressive in absolute terms, though relatively progressive. Rossignolo (2023) analyzed the effects of natural gas network subsidies in Argentina, taking into account both personal and regional income distribution. Using the Commitment to Equity methodology, he evaluated various subsidy regimes, with a focus on the impact of the expanded Zona Fría Law. The author found that, although network gas subsidies tend to favor wealthier households at the national level, they are progressive and pro-poor in certain provinces. The extension of the

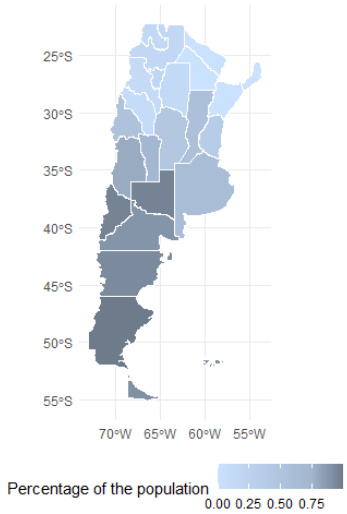
Zona Fria regime intensified the concentration of benefits in some regions while reducing it in others, with mixed effects on income inequality. Poggiese (2023) focused on the 2022 tariff segmentation, examining its impact on distributional outcomes and the emergence of energy poverty. The study concluded that segmentation has resulted in a more progressive effect compared to the universal subsidy system. However, two key disparities persist: the impact varies between natural gas and electricity, and middle-income households continue to receive subsidies for a significant portion of their energy expenses.

3 Zona Fria Law and Tariff Segmentation: policies to be evaluated

3.1 Zona Fria Law: promulgation and extension

In Argentina, considering the state's obligations and the critical role of energy in ensuring the well-being of its citizens, various initiatives have been developed to enhance energy access. These initiatives include the Home Programme, the Renewable Energy Project in Rural Sectors (PERMER), and differential tariffs programs, among others. A significant equity issue in Argentina is the disparity in households' ability to meet their energy needs, particularly due to unequal access to natural gas from the grid. For instance, the northern regions of the country, as illustrated in Figure 1, rely far less on natural gas for essential energy needs like cooking and heating.

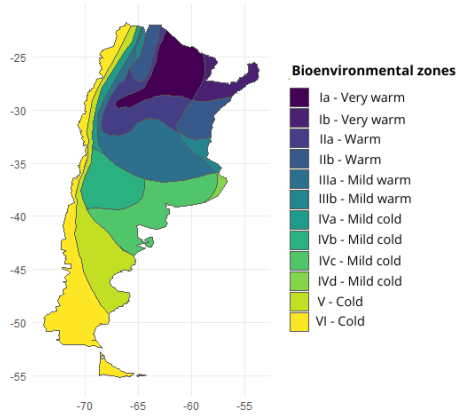
Figure 2: Percentage of the population that uses natural piped gas for cooking and heating by province



Among the various measures introduced, Law 25.565 of 2002—commonly known as the 'Zona Fria Law'—stands out. This legislation, grounded in principles of solidarity and horizontal equity, establishes a trust fund designed to subsidize residential consumption of natural gas (NG) and liquefied petroleum gas (LPG) in the coldest regions of the country (Law 25.565, 2002, art. 75).

The fund is financed through a surcharge on natural gas consumption nationwide, with the revenue allocated to NG and LPG distributors in the southern regions and the Malargüe department of Mendoza province. These funds are intended to subsidize residential gas consumption through differential tariffs and to lower the cost of gas cylinders and carafes in these cold regions.

Figure 3: Bioenvironmental Classification of Argentina

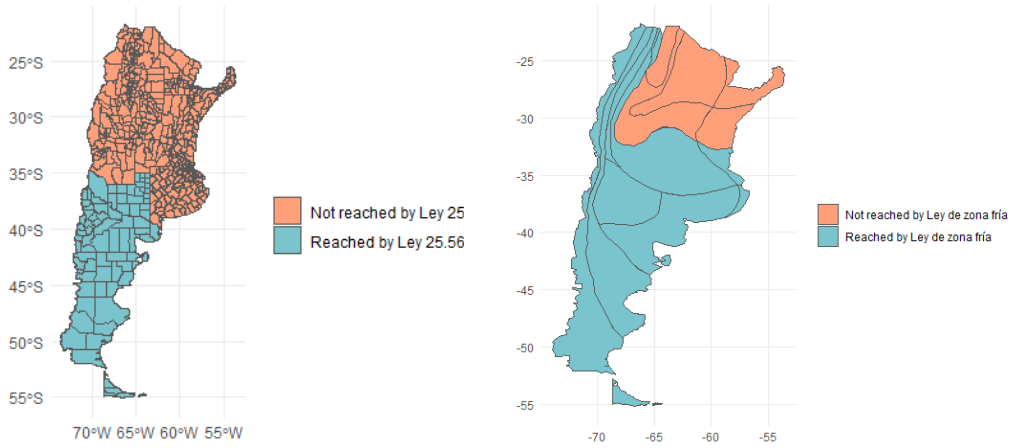


Argentina is geographically diverse, with distinct bioclimatic zones across its territory, as depicted in Figure 2. A single province can encompass multiple bioclimatic zones, each with different climatic conditions. The legislation justifies the collection and distribution of subsidies based on the significant temperature disparities across the country (Law 25.565, 2002, art. 75). The southern provinces, including Tierra del Fuego, Santa Cruz, Chubut, Río Negro, and Neuquén, as well as areas near the Andes and certain cities in La Pampa and Buenos Aires, endure prolonged winters and freezing temperatures, necessitating higher energy consumption for heating, as shown in Figures 3 and 4. In 2002, when this law was enacted, cities benefiting from it had average temperatures ranging from 4°C to 16°C. By 2022, the number of residential users benefiting from the Zona Fria Law had reached 908,117.

The law also introduces a tariff reduction strategy segmented into two groups. The first group receives a general 30% discount on total gas consumption, while the second group, comprising vulnerable populations, receives a 50% discount. This latter group also benefits from subsidies on bottled gas (Reyes Pontet and Ibañez Martín, 2022). Although this law segments tariffs based on geographic location, it is funded by an additional surcharge on the bills of users in other regions, who themselves benefit from subsidized tariffs under Law 25.561. This mechanism effectively redistributes costs among consumers according to their geographic location, potentially leading to unforeseen tariff imbalances and raising questions about fairness.

In 2021, Law 27.637 extended the Zona Fria Law until 2031 and expanded the regions classified as "cold," as shown in Figure 5. The revised law included additional cities along the maritime front, subzones of Buenos Aires province, and the provinces of Mendoza, San Juan, and Salta. While the primary justification for this expansion was the low temperatures in these regions, the law also invoked equity and access to basic services as key considerations. The amended legislation increased the surcharge on natural gas consumption to 7.5% per cubic meter but did not alter the subsidies provided to consumer families. The updated law maintains a general 30% subsidy on

Figure 4: Geographical extension of the Zona Fria



residential gas bills, with a 50% subsidy for low-income households, applicable to both piped and bottled gas.

With this extension, the subsidy's coverage at the residential level expanded significantly, reaching over 3 million households by 2022. This represents a 359% increase in coverage, which has substantially increased the fiscal burden on the national government's energy sector subsidies.

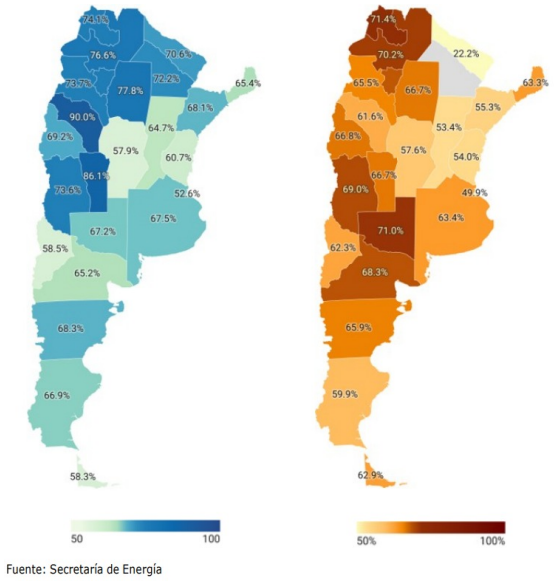
3.2 Tariff segmentation: first version

As highlighted by Navajas (2015), the universal subsidy scheme has played a pivotal role in recent years in diverting tariffs from their opportunity cost. By mid-2022, Argentina, burdened by the substantial impact of energy subsidies on its public expenditure—accounting for between 2% and 3% of the nation's GDP until 2022—initiated a critical reassessment of its widespread subsidy program and began adjusting tariffs accordingly. This shift in focus towards the energy sector was further exacerbated by the economic turmoil following the COVID-19 pandemic and Argentina's agreement with the International Monetary Fund (IMF) to address its foreign debt. The 2022 Russian invasion of Ukraine, which triggered sharp increases in energy prices, further strained the sustainability of the subsidy system.

To comply with the extended facilities agreement with the IMF, the government was compelled to scale back subsidies to 1.7% of GDP (Navajas, 2022). The combined challenges of the international price shock, the considerable proportion of public spending on energy subsidies, and the inefficiencies in targeting these subsidies led to a major overhaul of the subsidy scheme. This reform was formalized in August 2022 through the enactment of Decree 332/2022. The segmentation framework, introduced by the National Executive Power, sought to "achieve reasonable and applicable energy values with principles of justice and distributive equity" (Decree 332/2022 P.E.N.). Under this scheme, residential users were divided into three categories based on their purchasing power, with household income levels and asset ownership (including real estate, automobiles, and boats) serving as primary indicators of payment capacity.

The effects of this segmentation began to surface in early 2023, with the most significant impacts evident in the utility bills received in July 2023. Various media outlets underscored the substantial rate increases faced by consumers and the pronounced regional disparities. In December 2022, the Secretary of Energy published a report on the initial outcomes of the energy tariff segmentation policy, alongside strategies to deepen the process throughout 2023 Secretary of Energy (2023). The report revealed that the segmentation encountered significant implementation challenges, particularly with the self-registration process for subsidy eligibility by residential users. As the segmentation was phased in, reaching middle-income users proved problematic. Indeed, Poggiese (2023) found that the energy expenditures of households in this income bracket remained largely unchanged by the program.

Figure 5: Coverage of the population than remain subsidized by December 2023; electricity (blue) and natural piped gas (orange)



Fuente: Secretaría de Energía

The tariff segmentation was implemented alongside other energy subsidy policies, with the "Tarifa Social" (Social Tariff) standing out. Notably, the segmentation did not alter the conditions of this program. Despite adjustments to energy tariffs and the introduction of a new subsidy scheme through the creation of an "energy basket" by the new national government in December 2023, the precise methodology for energy subsidies remains uncertain. Although tariffs were scheduled to be updated and subsidies phased out for households across all socio-economic sectors by July, the national government reversed this decision. In July 2024, the tariff segmentation scheme underwent further modifications via a National Decree. For low-income households, the subsidized electricity consumption cap was set at 350 kWh, while the limit for middle-income households was reduced to 250 kWh. Households exceeding these limits must pay the full price of energy. As much as the announcements on changes in tariff segmentation have been made, some of them have not yet been implemented. Once the new conditions take effect, households have until the first week of August to register and maintain their subsidy. A new incidence analysis is planned to assess the outcomes

of the different stages of segmentation.

4 Data and methodology

4.1 Data and variables

This paper utilizes micro-data from the National Households' Expenditure Survey (ENGHo), which was collected by the National Statistics and Census Institute (INDEC) from October 2017 to December 2018. This survey provides detailed information on household income, consumption patterns, employment status, and socioeconomic characteristics. It was conducted nationwide in urban centers with populations exceeding 2,000, covering data from 21,547 households and 68,675 individuals. The survey's random sampling approach and extensive coverage make the data representative of the Argentine urban population. Additionally, the detailed breakdown of energy expenditure by category makes this dataset particularly suitable for the current analysis.

Although the ENGHo includes data on the amounts of kWh and m^3 consumed by households, it has been shown to underreport these figures when compared to administrative records (Navajas and Alejo, 2008). Consequently, the analysis relies on average energy prices from tariff charts for the period of October 2017 to December 2018 to estimate actual consumption levels. The modelling of electricity and natural gas consumption was carried out using the tariff tables for the period covered by the survey, respecting the categories of users according to their characteristics, taking into account the existence of social tariffs and provincial differences in the composition of energy tariffs. In the treatment it was necessary to consider the tax component, which also differs between provinces. This modelling was inspired by the methodology of Marchionni et al., 2008 and thanks to the instructions of Mg. Julián Puig.

Geo-referenced data used to create provincial estimates and map the country's bioenvironmental zones were provided by the National Geographic Institute (IGN). Regulatory information was sourced from the laws and decrees that govern the implementation of the subsidy schemes, specifically Law 25.565, Law 27.637, Executive Power Decree 332/22, and related regulations that modify or complement these laws.

For the analysis, three sets of variables were created from the ENGHo micro-data: those identifying household characteristics, those detailing monetary expenditure on energy by category, and those showing the monetary value of subsidies received by each household. Tables 1 and 2 provide a summary of this information and further detail the variables used.

Households' characteristics	
Variables	**Description**
High income	Dummy variable: 0 = The household has earnings lower than 3.5 BTB[1]. 1 = The household has earnings higher than or equal to 3.5 BTB.
Middle income	Dummy variable: 0 = The household has earnings lower than 1 BTB or higher than 3.5 BTB. 1 = The household has earnings higher than 1 BTB and lower than 3.5 BTB.
Low income	Dummy variable: 0 = The household has earnings higher than 1 BTB. 1 = The household has earnings lower than or equal to 1 BTB.
High vehicle	Dummy variable: 0 = The household owns fewer than 3 vehicles aged less than 5 years. 1 = The household owns 3 or more vehicles aged less than 5 years.
Middle vehicle	Dummy variable: 0 = The household owns no vehicle aged less than 3 years. 1 = The household owns at least one vehicle aged less than 3 years.
Low vehicle	Dummy variable: 0 = The household owns at least one vehicle aged less than 3 years. 1 = The household owns no vehicle aged less than 3 years.
Segment	Categorical variable: 1 = Household classified in high income segment (N1). 2 = Household classified in low income segment (N2). 3 = Household classified in middle income segment (N3).
Original Zona Fria	Dummy variable: 0 = Household located in a province not included in the original Zona Fria regime. 1 = Household located in a province included in the original Zona Fria regime.
New Zona Fria	Dummy variable: 0 = Household located in a province either included in the original regime or not included at all by the new one. 1 = Household located in a province included in the updated Zona Fria regime.

Table 1: Variables created to identify households' characteristics

[1]BTB stands for Basic Total Basket, a measure of the cost of living estimated by INDEC monthly.

Table 2: Variables created to identify households' energetic subsidies and expenditure

Energetic expenditure	
Variables	Description
Piped gas expenditure	Quantitative variable. Monthly monetary expenditure measured in Argentinean pesos ($) spent in piped gas consumption.
Electricity expenditure	Quantitative variable. Monthly monetary expenditure measured in Argentinean pesos ($) spent in electricity consumption.
Bottled gas expenditure	Quantitative variable. Monthly monetary expenditure measured in Argentinean pesos ($) spent in bottled gas consumption.
Kerosene, firewood and other fuels	Quantitative variable. Monthly monetary expenditure measured in Argentinean pesos ($) spent in kerosene, firewood or other fuels.
Total energetic expenditure	Quantitative variable. Monthly monetary expenditure measured in Argentinean pesos ($) spent in energetic services.
Total energetic expenditure Post ZF	Quantitative variable. Monthly monetary expenditure measured in Argentinean pesos ($) spent in energetic services after correcting by the Zona Fria Subsidy
Total energetic expenditure Post-Seg	Quantitative variable. Monthly monetary expenditure measured in Argentinean pesos ($) spent in energetic services after correcting by the Tariff Segmentation Subsidy
Total energetic expenditure Post-ZF/Seg	Quantitative variable. Monthly monetary expenditure measured in Argentinean pesos ($) spent in energetic services after correcting by the Tariff Segmentation and the Zona Fria Subsidy
Subsidies	
Variables	Description
Zona Fria Subsidy	Quantitative variable. Monthly monetary amount of subsidies measured in Argentinean pesos ($) received by the household due to the Zona Fria subsidy.
Tariff segmentation Subsidy - Electricity	Quantitative variable. Monthly monetary amount of subsidies measured in Argentinean pesos ($) received by the household due to the electricity subsidy
Tariff segmentation Subsidy - Piped natural gas	Quantitative variable. Monthly monetary amount of subsidies measured in Argentinean pesos ($) received by the household due to the piped gas subsidy

4.2 Methodology

The main objective of this paper is to analyse the impact of both subsidy policies mainly on the issue of energy poverty. As mentioned above, this paper measures energy poverty on the basis of households' energy expenditure in relation to their total income. The Benefit Incidence Analysis methodology is applied to evaluate the effect, but here the indicators used to make the distributive evaluation are: energy expenditure, energy expenditure in relation to total household income, the 10% ratio and the 2M indicator. The last two indicators were explained in section 2.1.

The database used contains information prior to the implementation of both the extension of Zona Fria and the Tariff Segmentation; hence, in order to account for them, a micro-simulation exercise was carried out. In the case of Zona Fria, two situations were considered: one in which the entire province was covered by the subsidy, and one in which only certain municipalities were. Households located in provinces whose entire territory was established as recipient of the subsidy were included directly among the beneficiaries of Zona Fria. For the second case, and since the database used reports all the information at the provincial level with no distinction for municipalities, the allocation wasn't as straightforward. Based on the proportion of users included in the regime within each province, reported by the National Gas Regulatory Entity (ENARGAS, 2022), households were ordered decreasingly according to their level of gas consumption. Following the proportion of users included in the province, the same proportion of households with the highest consumption was identified as included in the Zona Fria regime. For instance, if only 3% of the users in one of the provinces were included in the regime, then the 3% top users would be identified as belonging to it.

The quantities reported in the database were not used due to the fact that they tend to underreport the actual consumption levels (Navajas and Alejo, 2008). Instead, they were estimated using an average of the prices for each category of users reported in the tariff charts presented by each distribution company for the period covered by the survey, following the method proposed by Marchionni et al. (2008) and subsequently applied by Lakner et al. (2016).

As mentioned in Section 2, the 2021 Zona Fria Law provides a differential treatment for and within users reached by it. For households that reside in provinces included in the 2002 regime, a 50% subsidy on the price they pay for natural piped gas is established, indistinctly of their income level. On the other hand, households located in provinces included later in 2021 receive a uniform subsidy of 30%, with a possible extension to 50% if the household is classified as vulnerable.

The micro-simulation of the Tariff Segmentation was performed based on the *criteria* established in Decree 332/22, in essence:

- Total net monthly income.
- Number and age of vehicles owned by members of the household.
- Real estate holdings.
- Financial or real assets that demonstrate full economic capacity.
- Other conditions (having at least one house member that's a veteran of the Atlantic South War, having a community kitchen functioning in the house, etc.)

The information in the database doesn't include information about real estate or financial assets, hence the simulated segmentation was performed based on the remaining *criteria*. Based on households' characteristics, each of them were allocated in an income segment and the differential

treatment among them was simulated. For those belonging to the high income segment there would be no subsidized amount at all, whereas low income users would receive a subsidy accounting for around 45% of the generation cost (Secretaría de Energía, 2022). Finally, users allocated in the middle income segment would have a block of consumption subsidized at the same rate as those in the low income segment (each consumption block being defined differently for each month of the year and province) and would have to pay the full cost for the exceeding quantities consumed.

The subsidies' amounts were estimated as the difference between the total amount in Argentinean pesos ($) that users would pay had they not been included in the Zona Fria regime (or had they not been beneficiaries of the natural piped gas subsidy defined by the Tariff Segmentation) and the total amount that they actually paid for as reported in the survey.

5 Results

5.1 Zona Fria Law: the effects of its expansion on energy poverty, income and consumption

The application of both policies considered in the present paper have an effect of energy poverty through the way they modify the amounts of money that households destine to cover for their energetic consumption. Figure 6 exhibits the average percentage of income that households spend in order to have access to the energetic services they consume, before and after the extension of Zona Fria, dis-aggregated by per capita income decile. It can be seen that the effect is very modest in every single income segment considered; there's a reduction of around 0,2 points in the 50% poorer of the distribution, whereas this effect varies between 0,15 and 0,07 for the higher segments. Additionally, it's noteworthy to point out that the proportion of income that the first deciles spends on average in energy is particularly high; it almost doubles the proportion exhibited by the following decile, and it practically ensures that households allocated in the poorest 10% of the population suffer from energy poverty. Furthermore, their situation is nearly the same after the application of the Zona Fria extension. The average reduction in provinces benefited by the subsidy is also very modest: around 0,15 across all of them (Figure 7).

Figure 6: Ratio of energetic expenditure over total income, by income deciles, before and after Zona Fria

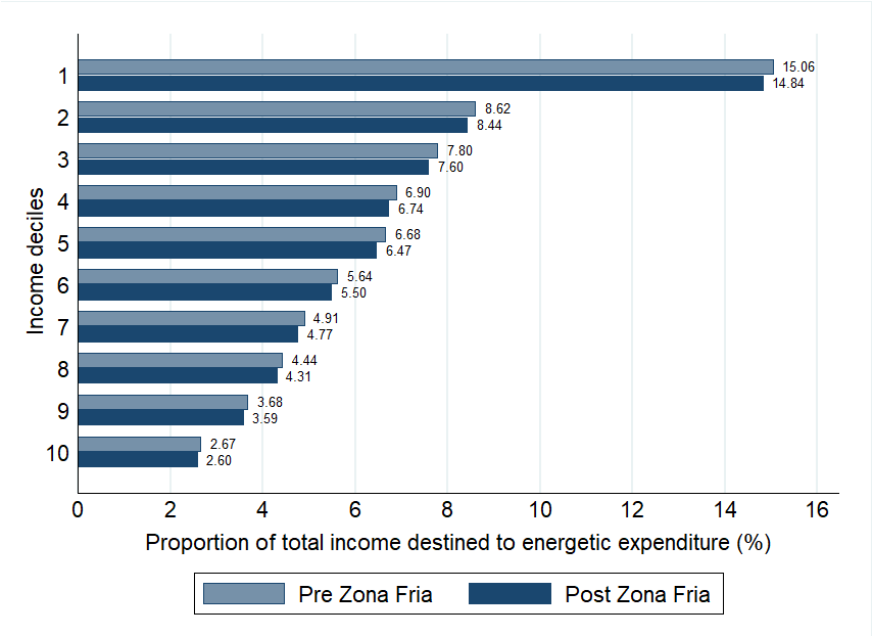
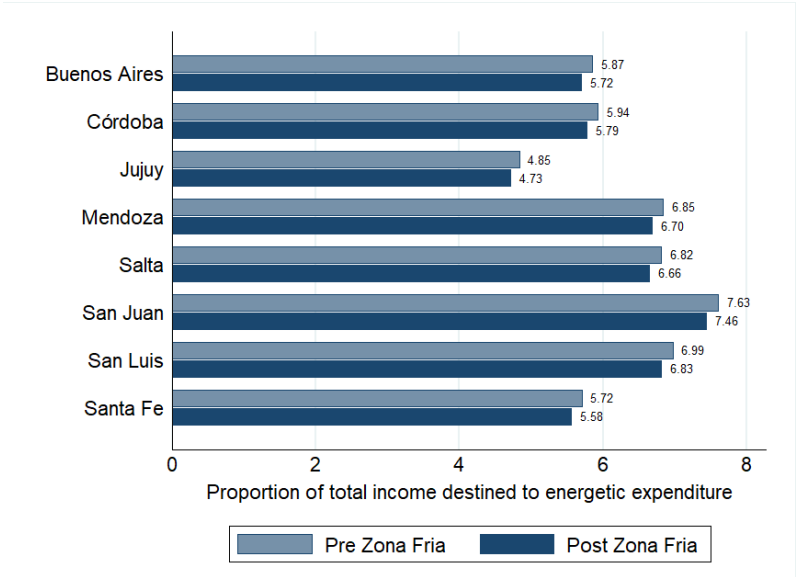
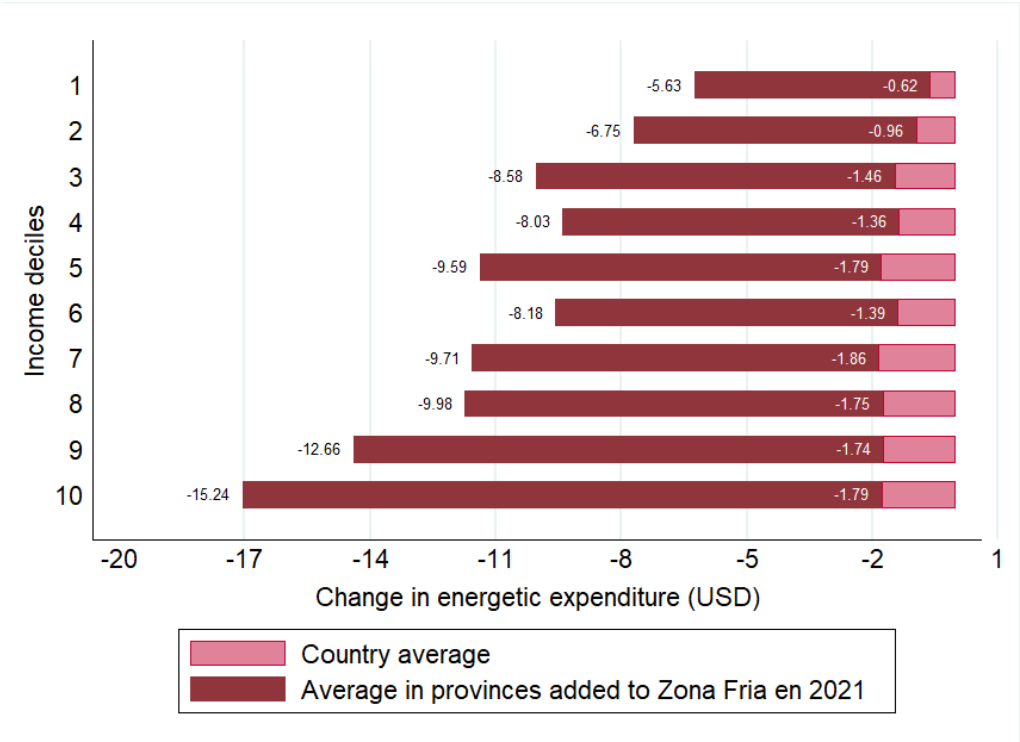


Figure 7: Ratio of energetic expenditure over total income, before and after Zona Fria, in provinces benefited by the extension



As measured in terms of US dollars, the extension of Zona Fria implies a reduction of around 62 cents and 1,80 dollars in the households' energetic expenditure on a country average (Figure 8). This reduction proves to be fairly uniform among upper income deciles; the 50% richer of the distribution perceives a reduction of approximately 1,80 USD, whereas the poorest 10% only get 62 cents. The uniformity disappears when considering the reduction dis-aggregated by income deciles but only for provinces that are beneficiaries of the subsidy. In this case, the reduction is quite staggered; the first deciles are the least favoured, with a decrease of only 5,63 and 6,75 USD in their energetic expenditure, while in contrast, the highest decile receives around 15,24. For those between the third and sixth decile, the decrease is once again fairly uniform.

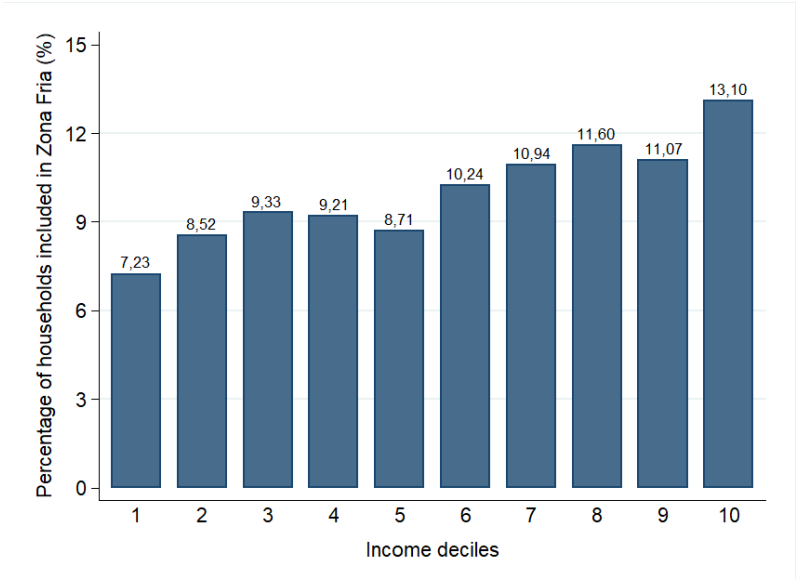
Figure 8: Change in energetic expenditure caused by Zona Fria, by income deciles



Given the fact that the extension of Zona Fria implies a rather significant discount in the price paid for natural piped gas, one of the main sources for energy used in the country, one would expect that there would be an impact on the energy poverty levels. Nevertheless, this proves not to be the case; when measured by the 10% indicator, the energy poverty rate lowers from 17,69% to 16,66% on a country level. The reduction is consistent with the one obtained when using the 2M indicator, which yields an initial energy poverty rate of 23,25% and 22,3% .The reason behind this is the fact that the geographical zone benefited by the extension of the subsidy doesn't have a high concentration of the energetically poor Argentinean population. Only around 1/4 of all those benefited by the expansion suffered from energy poverty. Figure 9 presents the distribution of all households benefited by the expansion among income deciles. 35,55% of them belong to the

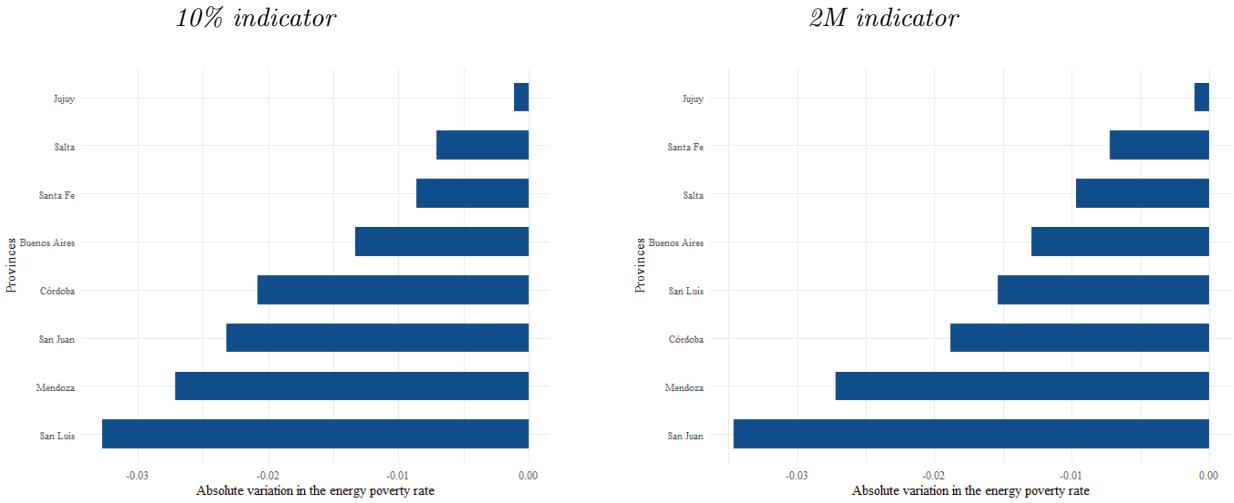
three highest income deciles, whereas only 25,08% belong to the three lowest ones. This, combined with the information about the proportion of their income households spend in energy displayed in Figure 5, explains the modest effect that the extension of the Zona Fria has on energy poverty.

Figure 9: Distribution of households benefited by Zona Fria's extension over income deciles



Even when considering only those provinces benefited by the extension, the total effect on energy poverty is very mild. With some slight variation across indicators Mendoza, San Luis, San Juan and Cordoba are the provinces that experience the highest reduction in their energy poverty rates. Even there, the decrease is very mild. If measured by the 10% indicator, there's a fall in the energy poverty rate of around 3 percentage points in the case of San Luis, which represent approximately 4000 households and 2 percentage points in Cordoba (roughly 20.000 households). If the index utilized is the 2M, then the decrease in the rate is 3,5 percentage points for San Juan and 1,6 for San Luis. None of the other provinces newly included in the Zona Fria have a very significant impact on their energy poverty rates, even though some of them exhibit some of the higher concentration of energetically poor population of the country. This will be discussed further on in the following subsections.

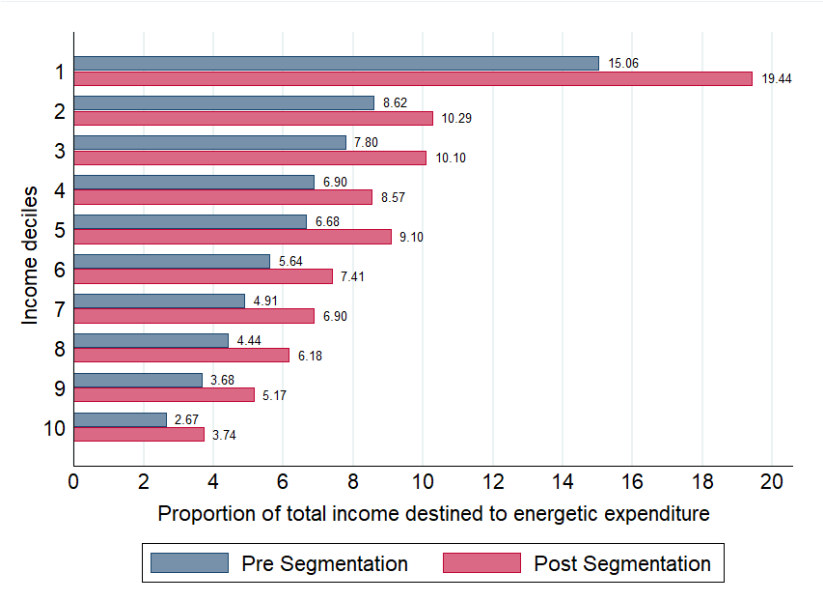
Figure 10: Variation in the energy poverty rate caused by Zona Fria, by province.



5.2 Tariff segmentation: the effects of its application on energy poverty, income and consumption

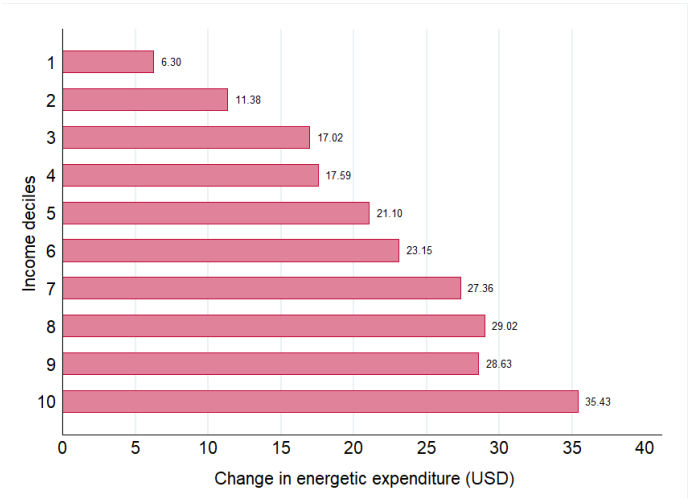
The following subsection presents the results of the application of the Tariff Segmentation on energetic expenditure and energy poverty if the extension of Zona Fria is overlooked; essentially, what would had been the results of it had the extension not taken place prior to the Segmentation. Figure 11 presents the proportion of income that households destine to their energetic expenditure dis-aggregated by income deciles. Since the Segmentation consisted fundamentally on a reduction of subsidies to energetic expenditure, one would naturally expect an increase in the amount of money that users spend in energy. Nevertheless, if the criteria used in it were appropriate to allocate households in segments according to their economic capacity, the result would be a higher impact on the energetic expenditure of the richer portion of the distribution than on the poorer one. This proves not to be the case; the Segmentation leads to a sharp increase in the percentage of income that people spend on energy in each of the deciles considered. Furthermore, it leads households on the first decile to spend on average almost 20% of their income to pay for energetic services. Given some time, and according to the price elasticities corresponding to natural piped gas and electricity consumption, households would eventually adapt their habits through a reduction in their consumption or a substitution for the energy sources utilized. However, even though this would lead to a lower proportion of their income destined to pay for energy, it can also imply a deepening on the level of deprivation, by forcing substitution to non-clean fuels or underconsumption and hence less energetic need satiated.

Figure 11: Ratio of energetic expenditure over total income, by income deciles, before and after the Tariff Segmentation



As expressed in US dollars, the variation in the energetic expenditure caused by the Segmentation is presented in Figure 12. The rise of the spending is increasing over per capita income; after the application of the policy, a household belonging to the first decile would have to pay on average 6,3 USD more than it did before, whereas users in the 10th decile would have to pay 35 USD more.

Figure 12: Change in energetic expenditure caused by the Tariff Segmentation, by income deciles



The national energy poverty rate rises from 17,69% to 24,75% according to the 10% indicator, and from 23,25% to 32,36% when measured by the 2M index. Figure 13 and 14 exhibit the variation in the provincial energy poverty rate resulting from the Tariff Segmentation. Unless for some minor variations, the results hold for both indicators. Some of the northern provinces like Tucuman, La Rioja, Formosa, San Juan and Salta are the ones that are hit the most, having the highest increases in their energy poverty rates (between 10 and 15 percentage points). On the other side, some of the Southern provinces face the lowest impact, having very moderate rises in the energy poverty rate, and even a decrease for the case of Tierra del Fuego (that only holds when considering the 10% indicator).

Figure 13: Variation in the energy poverty rate caused by the Tariff Segmentation, by province. 10% indicator

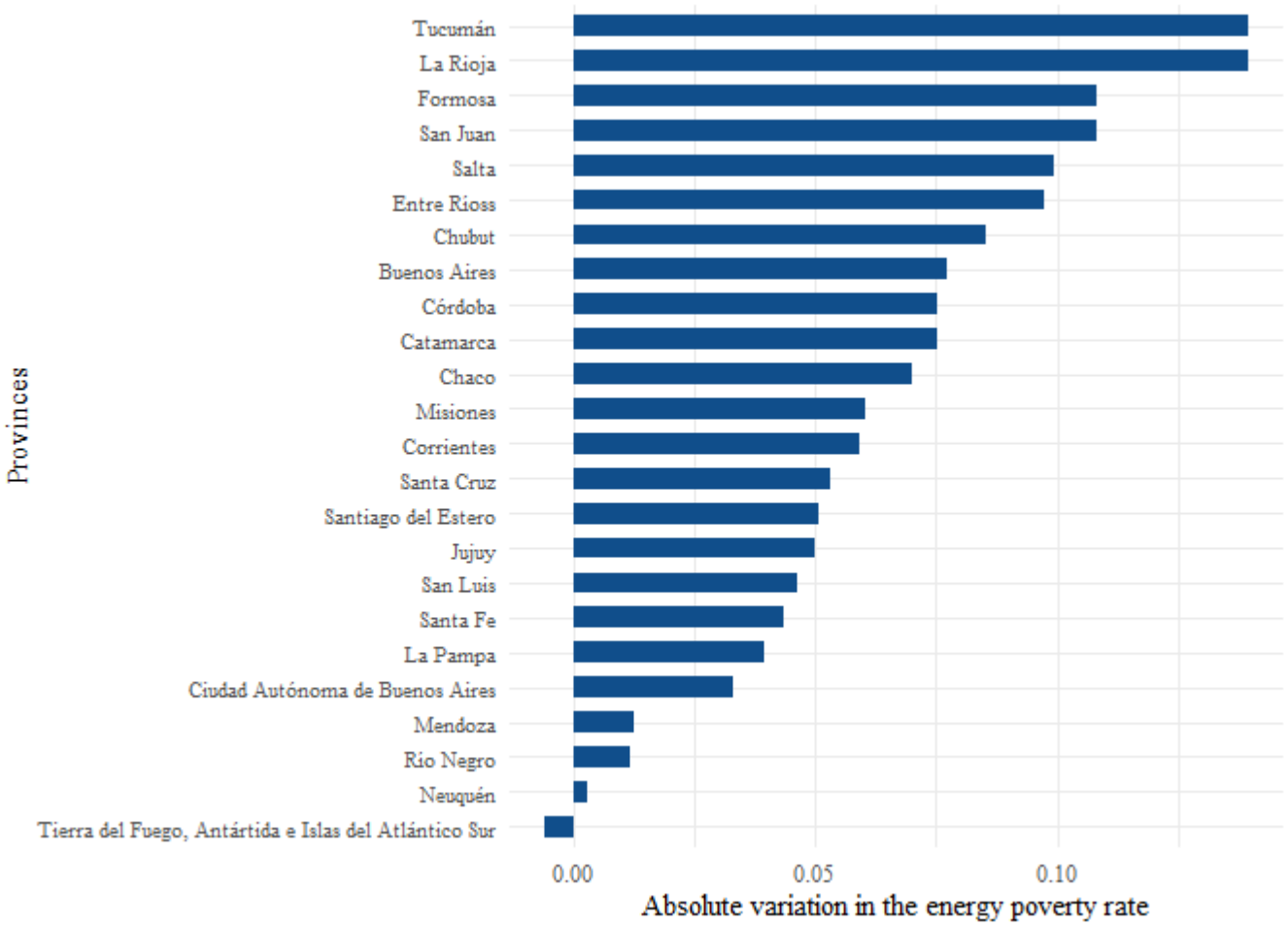
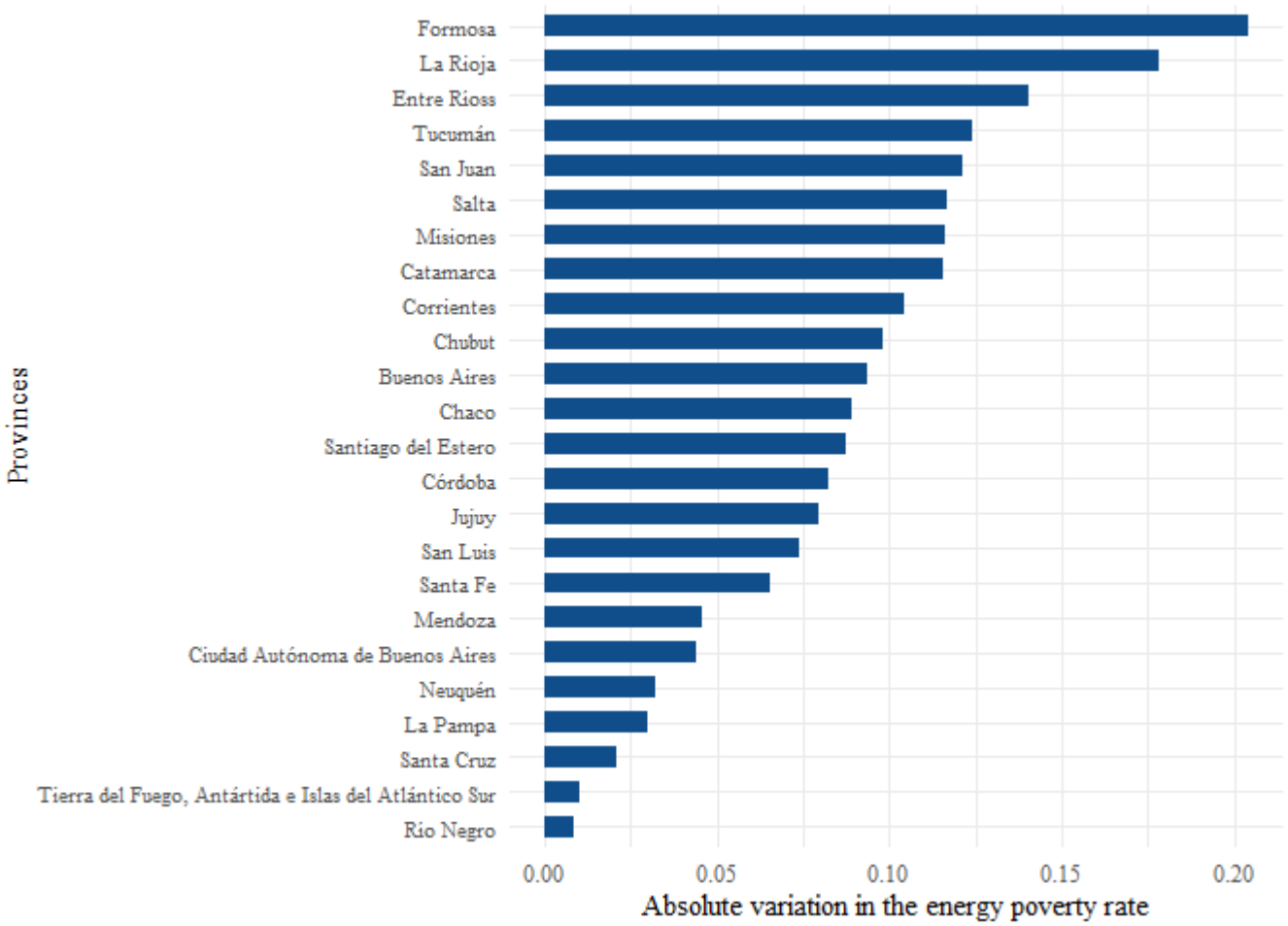


Figure 14: Variation in the energy poverty rate caused by the Tariff Segmentation, by province. 2M indicator



The regional pattern exhibited by the provincial energy rates following the application of the Segmentation raises some concerns given the fact that the Northern provinces tend to have higher multidimensional poverty rates (Gasparini et al., 2019), lower per capita income (Garrido et al., 2002; Quinteros, 2009) and have restricted access to natural piped gas due to the limited extension of the networks (which can be seen in Figure 2 when observing the proportion of households that use natural gas for both heating and cooking).

5.3 The cost of combining conflicting policies

Finally, Figure 15 and 16 present the effect that both policies have on both the proportion of the income destined to cover for energy and the total amount of energetic expenditure. The impact

of the Tariff Segmentation broadly offsets the effect of the Zona Fria extension and hence the final results are determined, essentially, by the effect of the former. Even though the the average energetic expenditure in the first decile only raises by 6,87 USD, this leads to an enormous rise in the proportion of income households belonging to it destine to pay for energy. Another noteworthy result is the fact that, after the segmentation, deciles 2 and 3 spend on average more than 10% of their income in energetic consumption, implying that the poorest 30% of the distribution spends on average enough to be classified as energetically poor due to the Segmentation. Furthermore, the Zona Fria subsidy barely doesn't absorb none of the effect of the Segmentation, which can be seen when comparing Figure 15 and Figure 11.

Figure 15: Combined effect of policies on the ratio of energetic expenditure over total income

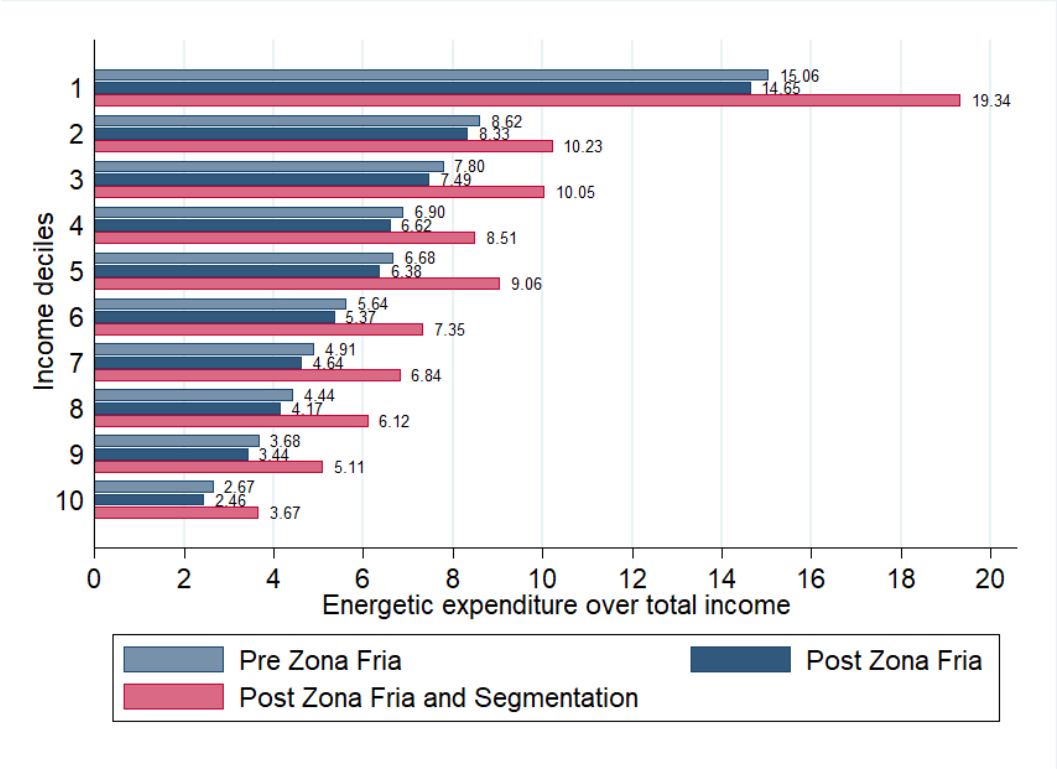
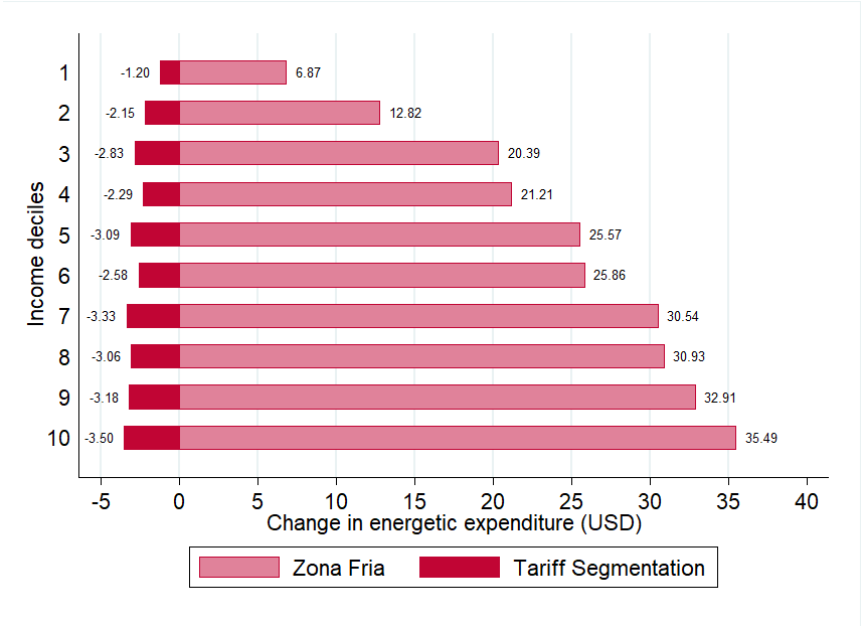


Figure 16: Combined effect of policies on the energetic expenditure



In the prior subsections, the differential impact of the energetic subsidies was assessed through the study of the variation in the energy poverty rates and energetic expenditure as a proportion of total income. This can also be done through analyzing which are the households that are mostly benefited by the subsidies. In order to do so, concentration curves are constructed, in an attempt to understand how the subsidies distribute among the population when this is ordered according to their per capita income.

Figure 17 presents the concentration curves dis-aggregating the effects of the Segmentation in two: on the one side, the subsidy corresponding to electricity consumption, and on the other, the one that's granted through natural piped gas consumption. It can be seen that the Zona Fria subsidy [2](green solid line) is clearly regressive; the richest 30% receives around 40% of the subsidy, whereas the poorest 40% only gets around 20% of it. This is consistent with the previous findings reported in Section 5.1, in which it was shown a bigger presence of higher income deciles households among those benefited by the extension. Furthermore, it contributes to explain why the effect of the extension on energy poverty is so mild.

In the case of the Tariff Segmentation, the behaviour of the subsidies differ from one another. The electricity subsidy is progressive as the lower segments of the distribution are favoured by it more than proportionally. The natural piped gas subsidy, on the other hand, is regressive throughout most of the distribution, turning proportional when surpassing 70% of the total. Both of these results could be caused by the fact that households located in the outskirts of the urban areas or in some Northern provinces tend to have lower income and limited access to natural piped gas, which users might substitute by using electricity instead (Poggiese, 2023).

[2]The concentration curve was constructed considering the entirety of the subsidy and not only the amounts caused by the extension

Figure 17: Concentration curves for energetic subsidies

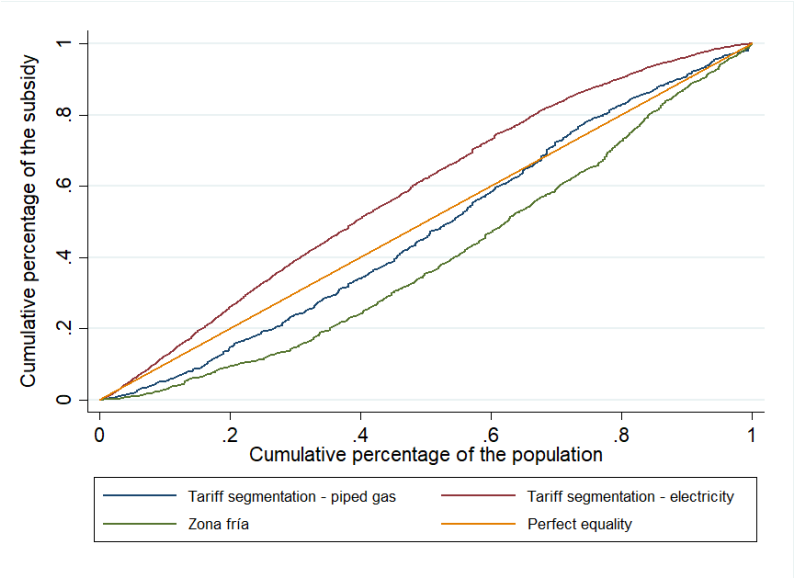
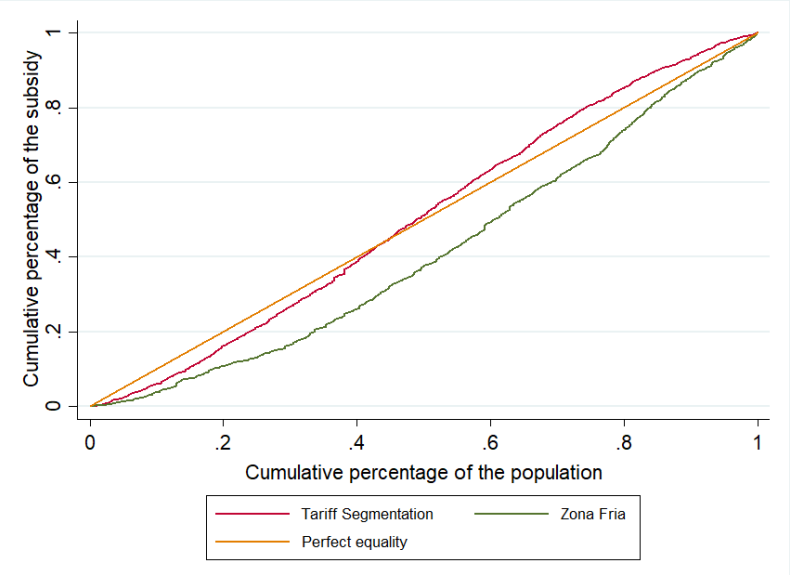


Figure 18 presents the concentration curves but condenses the electricity and piped gas together in order to assess how the Segmentation, when considered as a whole, allocates the subsidies it provides with. It can be seen that the progressivity of the electricity subsidy doesn't offset the regressivity of that granted to natural gas consumption. Throughout half of the distribution, the subsidy is regressive, turning progressive after that point. In any case, the distributional effect is very moderate; for instance, the poorest 20% of the distribution receives slightly less than 20% of the subsidy.

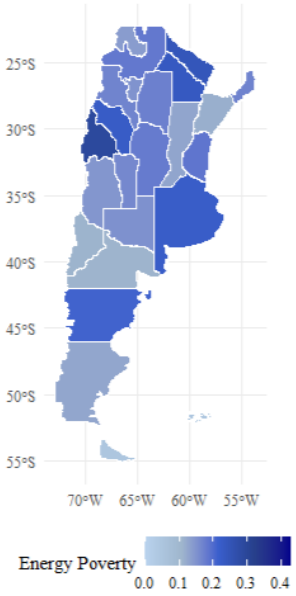
Figure 18: Concentration curves for energetic subsidies



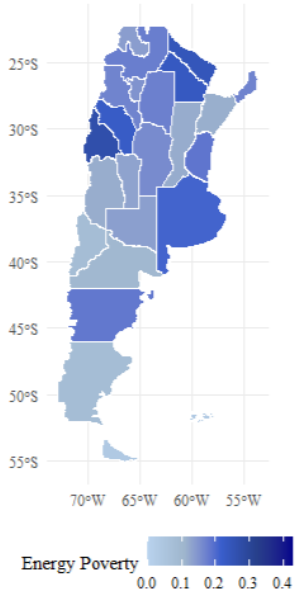
Lastly, Figure 19 and 20 exhibit the way in which the provincial energy poverty rates vary throughout the application of the successive policies. A concerning result arises from the observation of the maps: not only does the change in the subsidies' allocation not alleviate the energy poverty situation in provinces that had an *a priori* higher concentration en energetically poor households, but they actually worsen the situation even more in those provinces. In other words, they don't lower the energy poverty rates nor they provoke a shift in its regional pattern; quite on the contrary, they cause a rise in it that is even sharper in provinces that already had a high poverty rate. Furthermore, the more affected regions are those that have some of the highest chronic poverty rates, as can be seen in Figure 21 (Gasparini et al., 2019).

Figure 19: The energy poverty map throughout the application of energetic subsidies' policices. 10% indicator

Pre Zona Fria and Pre Segmentation



Post Zona Fria



Post Zona Fria and Post Segmentation

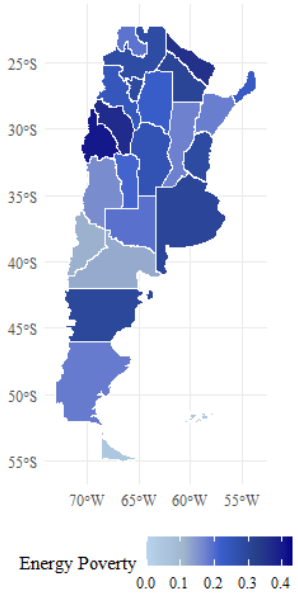


Figure 20: The energy poverty map throughout the application of energetic subsidies' policies. 2M indicator

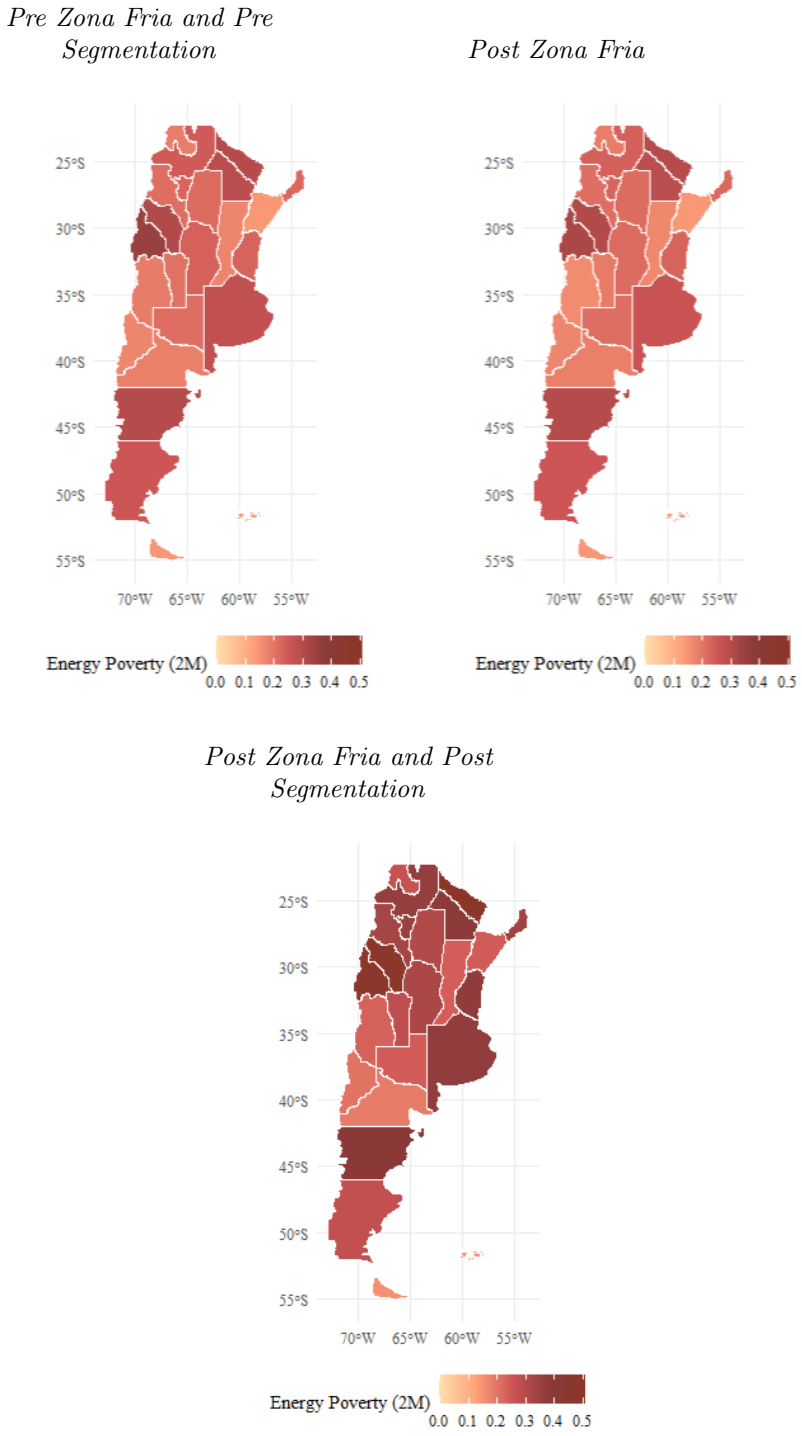
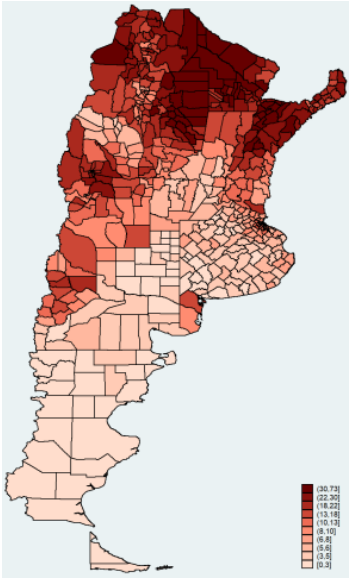


Figure 21: Cronic poverty estimates by department. Taken from Gasparini et al. (2019)



6 Final Remarks

The findings of this study highlight the significance of energy poverty across Argentina. Moreover, the empirical exercises conducted indicate that the impact of subsidy policies on energy deprivation is varied, with regional differences in their effects.

Regarding the Zona Fria Law, its impact appears negligible in terms of reducing energy deprivation among vulnerable populations, both at the national and provincial levels. This suggests that the policy's focus on climatic and territorial factors involves a trade-off with equitable outcomes. Concerning affordability, the Zona Fria Law and its expansion do not seem to alleviate energy poverty for affected households, with a significant portion of the subsidy benefiting high-income households. This indicates a pro-rich policy. Given this pattern and the varying impacts of the law within provinces and its distributive effects, a feasible policy recommendation could be to implement greater segmentation among households within the law's benefits and reduce the benefits received by non-vulnerable households. The expansion of the Zona Fria Law not only disproportionately subsidizes high-income households but also benefits those living in less adverse climatic conditions compared to those originally covered. Additionally, it is worth noting that a significant portion of northern Argentina lacks access to natural gas and, by definition, does not benefit from the law due to climatic conditions. Many households in areas without natural gas access do not meet their energy needs with bottled gas, as shown in the corresponding figure. This pattern in energy service satisfaction, coupled with the conditions defining the Zona Fria Law's reach, excludes areas that concentrate the majority of the country's poor population, where economic poverty is most severe.

The tariff segmentation implemented in 2022 in relation to the universal subsidy worsens the situation for families in the lowest income decile at the national level, as well as for those living in provinces with energy access deficiencies, which house the majority of multidimensionally poor

households. Evaluating the distributive impact of the segmentation reveals that while it reduces the subsidy burden on higher-income households, the distribution is proportional. In other words, tariff segmentation has a regressive effect on one side and a progressive effect on the other. The main issue with the observed proportional effect is the high fiscal cost. The findings suggest that the tariff segmentation implemented in 2022 fails to make energy more affordable for vulnerable households while imposing a greater burden on middle- and high-income households. In fact, the results suggest that the major flaw of the implemented scheme lies in its treatment of middle-income households.

When analyzing the combined impact of both policies, it is observed that the effect of the Tariff Segmentation significantly outweighs the impact of the Zona Fria Law's expansion, with final outcomes determined primarily by the former. Applying segmentation, even to households under the Zona Fria Law, leads to a significant increase in the proportion of income spent on energy by the poorest households. Furthermore, segmentation causes the first three deciles to have excessive energy expenditures, exceeding the 10% threshold, meaning that under segmentation, 30% of the population would be in a state of energy poverty. This is particularly relevant in the current context, as the conditions under which tariff segmentation is applied are being debated, and the National Government has announced changes to the maximum consumption limits for subsidized energy for low- and middle-income households (previously, there were no limits under the 2022 segmentation).

The results of this study ultimately have significant implications for energy and fiscal policy: subsidy policies cannot be reviewed in isolation, as the coexistence of policies can lead to outcomes contrary to those intended. The partial programming and analysis of energy subsidy policies not only have a substantial fiscal cost but also a social one. Therefore, one of the main recommendations emerging from the empirical exercise is that the discussion on segmentation must involve a parallel review of the Zona Fria Law and an analysis of the regional and social inequalities it generates, not only at the national level but also within each province (especially in the case of the Province of Buenos Aires).

References

Abbas, K., Butt, K. M., Xu, D., Ali, M., Baz, K., Kharl, S. H., & Ahmed, M. (2022). Measurements and determinants of extreme multidimensional energy poverty using machine learning. *Energy*, *251*, 123977.

Aneise, A., Möhle, E., & Schteingart, D. (2024). El trilema energético en argentina en 2023 [Accessed: 2024-08-31]. https://argendata.fund.ar/notas/el-trilema-energetico/

Baez, M. J. (2022). *Incidencia distributiva de subsidios energéticos al consumo residencial general y con tarifa social federal en argentina* [Master's thesis, UNLP].

Barrios, D., & Morales, J. R. (2012). Rethinking the taboo: Gasoline subsidies in venezuela. [Harvard University].

Boardman, B. (1991). *Fuel poverty: From cold homes to affordable warmth*. Belhaven Press.

Boemi, S. N., & Papadopoulos, A. M. (2019). Energy poverty and energy efficiency improvements: A longitudinal approach of the hellenic households. *Energy and Buildings*, *197*, 242–250.

Bouille, D. (2004). *Manual de economía de la energía*. IDEE/FB.

Bravo, G., Kozulj, R., & Landaveri, R. (2008). Energy access in urban and peri-urban buenos aires. *Energy for Sustainable Development*, *12*(4), 56–72.

Calvo, R., Álamos, N., Billi, M., Urquiza, A., & Contreras, R. (2021). *Desarrollo de indicadores de pobreza energética en américa latina y el caribe* (Technical Report No. 207) (LC/TS.2021/104). Comisión Económica para América Latina y el Caribe (CEPAL). Santiago.

Castaño-Rosa, R., Solís-Guzmán, J., Rubio-Bellido, C., & Marrero, M. (2019). Towards a multiple-indicator approach to energy poverty in the european union: A review. *Energy and Buildings*, *193*, 36–48.

Castelao Caruana, M. E., Méndez, F. M., Rosa, P. C., & Wild, G. (2019). Aportes para la medición de la pobreza energética: Diagnóstico y propuestas para la intervención desde una cooperativa de la provincia de santa fe [Available online]. *Revista de Ciencias Sociales*, *10*(35), 45–62. http://ridaa.unq.edu.ar/handle/20.500.11807/1719

Cecchini, S., Villatoro, P., & Mancero, X. (2021). El impacto de las transferencias monetarias no contributivas sobre la pobreza en américa latina. *Revista Cepal*.

Consejo Nacional de Coordinación de Políticas Sociales. (2020). *Segundo informe voluntario nacional de la argentina 2020* (Primera, tech. rep.). Ciudad Autónoma de Buenos Aires.

Day, R., Walker, G., & Simcock, N. (2016). Conceptualising energy use and energy poverty using a capabilities framework. *Energy Policy*, *93*, 255–264.

Dubois, F., Zabaloy, M. F., & Ibañez Martin, M. M. (2023). Modeling energy consumption to measure energy poverty in households in buenos aires, argentina. *Regional Statistics*, *3*.

Durán, R. J., & Condori, M. A. (2019). Evolución de la pobreza energética en argentina durante el período 2002-2018. *Oportunidades para las energías renovables*.

Emre, T., & Sozen, A. (2022). Energy poverty clustering by using power-cut job order data of the electricity distribution companies. *International Journal of Energy Economics and Policy*, *12*(3), 401–409.

ENARGAS. (2022). *Ampliación del régimen de zona fría: Ley n° 27.637, evolución de beneficiarios y facturas medias estimadas con niveles de ahorro respecto a rtt 2020 y rti 2016/17* (tech. rep.) (Informe Técnico - Julio 2022). Análisis Técnico.

Falak, S. H. E. R., Abbas, A., & Awan, R. U. (2014). An investigation of multidimensional energy poverty in pakistan: A province level analysis. *International Journal of Energy Economics and Policy*, *4*(1), 65–75.

García Ochoa, R. (2014). Pobreza energética en américa latina (no. 36661). [Naciones Unidas Comisión Económica para América Latina y el Caribe (CEPAL).].

Garrido, N., Marina, A., & Sotelsek, D. (2002). Dinámica de la distribución del producto a través de las provincias argentinas (1970-1995). *Estudios de Economía Aplicada*, *20*(002), 123–140.

Gasparini, L., Gluzmann, P. A., & Tornarolli, L. (2022). Caracterización de la población vulnerable: Una propuesta con estimaciones para argentina. *Económica*, *68*.

Gasparini, L., Gluzmann, P., & Tornarolli, L. (2019). *Pobreza crónica en datos de corte transversal: Estimaciones para argentina* (tech. rep. No. 252). Documento de Trabajo.

Giuliano, F., Lugo, M. A., Masut, A., & Puig, J. (2020). Distributional effects of reducing energy subsidies: Evidence from recent policy reform in argentina. *Energy Economics*, *92*.

Grübler, A. (2007). An historical perspective on global energy transitions. In D. L. Greene (Ed.), *Modeling the oil transition: A summary of the proceedings of the doe/epa workshop on the economic and environmental implications of global energy transitions* (pp. 53–59).

Hernández Oré, M. A., Sousa, L. D., & Tornarolli, L. (2017). Fiscal and welfare impacts of electricity subsidies in central america [World Bank Publications].

Ibáñez Martín, M. M., Zabaloy, M. F., & Guzowski, C. (2019). Una primera exploración de la situación de pobreza energética en argentina: ¿es la pobreza energética un fenómeno inde-

pendiente de las privaciones multidimensionales? [Available online]. *Anales de la Reunión Anual de la Asociación Argentina de Economía Política*. https://aaep.org.ar/anales/works/works2019/iban%CC%83ez.pdf

Ibáñez Martín, M. M., Zabaloy, M. F., & Guzowski, C. (2022). Privación y pobreza energética: Cocción limpia en argentina. *SaberEs*, *14*(1), 53–84.

Ibáñez Martín, M., Zabaloy, M. F., & Guzowski, C. (2019). Una primera exploración de la situación de pobreza energética en argentina: ¿es la pobreza energética un fenómeno independiente de las privaciones multidimensionales? [LIV Reunión Anual de la Asociación Argentina de Economía Política, Bahía Blanca, noviembre 2019]. https://aaep.org.ar/anales/works/works2019/iban%CC%83ez.pdf

Ibáñez-Martín, M. M., Melo, Y. E., & Zabaloy, M. F. (2022). Analyzing energy deprivation for cooking in argentina and brazil. *Iberoamerican Journal of Development Studies*, *11*(1). https://doi.org/10.26754/ojs_ried/ijds.603

Izquierdo, A., Loo-Kung, R., & Navajas, F. (2013). Resistiendo el canto de las sirenas financieras en centroamérica: Una ruta hacia un gasto eficiente con más crecimiento [Inter-American Development Bank].

Izquierdo, A., Pessino, C., & Vuletin, G. (2018). Mejor gasto para mejores vidas: Cómo américa latina y el caribe puede hacer más con menos [Inter-American Development Bank].

Jakob, M., & Steckel, J. C. (2016). The just energy transition [Background Paper for the WWF].

Jiménez Mori, R. A., & Yépez García, Á. (2020). *How do households consume energy?: Evidence from latin america and the caribbean* (tech. rep.). Inter-American Development Bank.

Lakner, C., Lugo, M. A., Puig, J., Salinardi, L., & Viveros, M. (2016). *The incidence of subsidies to residential public services in argentina: The subsidy system in 2014 and some alternatives* [CEDLAS Working Paper].

Lampis, A., Martín, M. M., Zabaloy, M. F., Soares, R. S., Guzowski, C., Mandai, S. S., & Bermann, C. (2022). Energy transition or energy diversification? critical thoughts from argentina and brazil. *Energy Policy*, *171*.

Liu, J., Jain, V., Sharma, P., Ali, S. A., Shabbir, M. S., & Ramos-Meza, C. S. (2022). The role of sustainable development goals to eradicate the multidimensional energy poverty and improve social wellbeing's. *Energy Strategy Reviews*, *42*, 100885.

Longo, D., Olivieri, G., Roversi, R., Turci, G., & Turillazzi, B. (2020). Energy poverty and protection of vulnerable consumers. overview of the eu funding programs fp7 and h2020 and future trends in horizon europe. *Energies*, *13*(5), 1030.

Maldovan Bonelli, J., Goren, N., & Corradi, F. (2021). ¿nuevos problemas o profundización de desigualdades prexistentes? *Trabajo y sociedad*, *22*(36), 55–79.

Marchionni, M., Sosa-Escudero, W., & Alejo, J. (2008). *La incidencia distributiva del acceso, gasto y consumo de los servicios públicos* [CEDLAS working paper].

Martín-Consuegra, F., Giménez, J. G., Alonso, C., Hernández, R. C., Aja, A. H., & Oteiza, I. (2020). Multidimensional index of fuel poverty in deprived neighbourhoods. case study of madrid. *Energy and Buildings*, *224*, 110205.

Mendoza Jr, C. B., Cayonte, D. D. D., Leabres, M. S., & Manaligod, L. R. A. (2019). Understanding multidimensional energy poverty in the philippines. *Energy Policy*, *133*, 110886. https://doi.org/10.1016/j.enpol.2019.110886

Navajas, F., & Alejo, J. (2008). *Tarifa social: En los sectores de infraestructura en la argentina.* Fundación de Investigaciones Económicas Latinoamericanas (FIEL).

Navajas, F. (2015). *Subsidios a la energía, devaluación y precios* (tech. rep. No. 122). FIEL.

Navajas, F. (2022). *Los subsidios a la energía en 2022. fundación de investigaciones económicas latinoamericanas* [FIEL report].

OCDE/IEA. (2016). Energy, climate change and environment 2016 [Disponible en: https://www.iea.org/publications/freepublications/publication/ECCE2016.pdf]. https://www.iea.org/publications/freepublications/publication/ECCE2016.pdf

Poggiese, M. (2023). Energy tariff segmentation and distributive incidence in argentina. the link with energy poverty [LIIX Annual Meeting of the Argentinean Association of Political Economy].

Puig, J. P., & Salinardi, L. H. A. (2015). Argentina y los subsidios a los servicios públicos: Un estudio de incidencia distributiva [CEDLAS working paper].

Quinteros, M. (2009). *Convergencia económica en las provincias argentinas entre 1953 y 2003* [Tesis de grado, Serie Tesis de Graduación Documento, (1), Universidad [Nombre de la universidad]].

Reyes Pontet, M. D., & Ibañez Martín, M. M. (2022). Energy poverty, energy subsidies and the cold zone law. lessons learned in bahía blanca: Population and issues [Economic Activity Indicators 175, section: Complementary contributions. Regional Centre for Economic Studies of Bahia Blanca (CREEBA)].

Rocha, J. D., & Schuschny, A. (2018). Una propuesta de indicadores para medir la pobreza energética en américa latina y el caribe.

Rossignolo, D. (2023). Impact of taxes, transfers and subsidies on income distribution and poverty in argentina. *Economia*, *46*(92), 62–124.

Secretaría de Energía. (2022). *Plan de segmentación de subsidios a la energía* (Informe). Ministerio de Economía. https://www.argentina.gob.ar/sites/default/files/2022/12/plan_de_segmentacion_de_tarifas_energeticas.pdf

Singh, H. V., Bocca, R., Gomez, P., Dahlke, S., & Bazilian, M. (2019). The energy transitions index: An analytic framework for understanding the evolving global energy system. *Energy Strategy Reviews*, *26*, 100382. https://doi.org/10.1016/j.esr.2019.100382

Soares, R. S., Weiss, M., Lampis, A., Bermann, C., & Hallack, M. (2023). Pobreza energética en los hogares y su relación con otras vulnerabilidades en américa latina [Publicación].

Sokołowski, J., Lewandowski, P., Kiełczewska, A., & Bouzarovski, S. (2020). A multidimensional index to measure energy poverty: The polish case. *Energy Sources, Part B: Economics, Planning, and Policy*, *15*(2), 92–112.

Stevens, M., Raat, H., Ferrando, M., Vallina, B., Lucas, R., Middlemiss, L., & van Grieken, A. (2022). A comprehensive urban programme to reduce energy poverty and its effects on health and wellbeing of citizens in six european countries: Study protocol of a controlled trial. *BMC Public Health*, *22*(1), 1578.

Thema, J., & Vondung, F. (2020). Epov indicator dashboard: Methodology guidebook.

United Nations General Assembly. (2012). Resolution adopted by the general assembly on 27 july 2012 [Sixty-sixth session, Agenda item 19, Distr.: General]. https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_RES_66_288.pdf

Wagner, L. A. (2010). *Incidencia distributiva de subsidios a los servicios públicos a partir de esquemas alternativos de tarifa social: El caso de capital federal* [Undergraduate Thesis]. Universidad de San Andrés (UDESA).

Wang, Y., & Lin, B. (2022). Can energy poverty be alleviated by targeting the low income? constructing a multidimensional energy poverty index in china. *Applied Energy*, *321*, 119374.

World Energy Council. (2018). World energy trilemma index 2018 [Accessed: 2024-08-31]. https://www.worldenergy.org/wpcontent/uploads/2018/10/World-Energy-Trilemma-Index-2018.pdf

Zabaloy, M. F., Ibañez Martin, M. M., & Martinez, C. (2022, November). Una primera exploración de la situación de pobreza energética en argentina: ¿es la pobreza energética un fenómeno independiente de las privaciones multidimensionales de la población? [Disponible en: https://bd.aaep.org.ar/anales/buscador.php].

Zabaloy, M. F., & Ibáñez Martín, M. M. (2020). The relevance of cooking fuel in energy poverty: The case of argentina [Documento de trabajo n°13. IIESS CONICET, Bahía Blanca].