# The Other Side of the Boom

## Energy Prices and Subsidies in Latin America and the Caribbean During the Super-Cycle

Estefanía Marchán, Ramón Espinasa, and Ariel Yépez-García

IDB

Cataloging-in-Publication data provided by the
Inter-American Development Bank
Felipe Herrera Library

Marchán, Estefanía.
The Other Side of the Boom: Energy Prices and Subsidies in Latin America and the Caribbean During the Super-Cycle / Estefanía Marchán, Ramón Espinasa, Ariel Yépez-García.
p. cm. — (IDB Monograph; 567)

Includes bibliographic references.

1. Power resources-Latin America-Finance. 2. Power resources-Caribbean Area-Finance. 3. Petroleum products-Prices-Latin America. 4. Petroleum products-Prices-Caribbean Area. 5. Subsidies-Latin America. 6. Subsidies-Caribbean Area. I. Espinasa, Ramón. II. Yépez-Garcia, Rigoberto Ariel. III. Inter-American Development Bank. Energy Division. IV. Title. V. Series.

IDB-MG-567

JEL Codes: Q41, Q43, Q48

Keywords: energy prices, energy subsidies, fossil fuels, electricity, carbon taxes.

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Estefanía Marchán
Ramón Espinasa
Ariel Yépez-García

IDB

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# Abbreviations

| | |
|---|---|
| ANCAP | Administración Nacional de Combustibles, Alcoholes y Pórtland (Uruguay) |
| ANDE | Administración Nacional de Electricidad (Paraguay) |
| ANEEL | Agência Nacional de Energia Elétrica (Brazil) |
| ARCONEL | Agencia de Regulación y Control de Electricidad (Ecuador) |
| ARESEP | Autoridad Reguladora de los Servicios Públicos (Costa Rica) |
| ASEP | Autoridad Nacional de los Servicios Públicos (Panama) |
| BEC | Bahamas Electricity Company |
| BEL | Belize Electricity Limited |
| BL&P | Barbados Light & Power Company Limited |
| BNOC | Barbados National Oil Company Limited |
| CDEEE | Corporación Dominicana de Empresas Eléctricas Estatales |
| CEL | Comisión Ejecutiva Hidroeléctrica del Río Lempa (El Salvador) |
| CELEC | Corporación Eléctrica del Ecuador |
| CFE | Comisión Federal de Electricidad (Mexico) |
| CIDE | Contribuição de Intervenção no Domínio Econômico (Brazil) |
| CNE Chile | Comisión Nacional de Energía de Chile |
| CNE Honduras | Comisión Nacional de Energía |
| CNEE | Consejo Nacional de Energía Eléctrica (Guatemala) |
| CORPOLEC | Corporación Nacional Eléctrica S.A. (Venezuela) |
| CREG | Comisión de Regulación de Energía y Gas (Colombia) |
| Deocsa | Distribuidora de Occidente, S.A. (Guatemala) |
| Deorsa | Distribuidora de Oriente, S.A. (Guatemala) |
| EBS | Energie Bedrijven Suriname |
| EDH | Electricité D´Haiti |
| EEGSA | Empresa Eléctrica de Guatemala |
| EGEE | Empresa de Generación de Energía Eléctrica (Guatemala) |
| EGEHID | Empresa de Generación Hidroeléctrica Dominicana |
| ENAP | Empresa Nacional del Petróleo (Chile) |
| ENARSA | Energía Argentina S.A. |
| ENATREL | Empresa Nacional de Transmisión Eléctrica (Nicaragua) |
| ENDE | Empresa Nacional de Electricidad (Bolivia) |
| ENEE | Empresa Nacional de Energía Eléctrica (Honduras) |
| ENEL | Empresa Nicaragüense de Electricidad |
| ENRE | Ente Nacional de Regulación Eléctrica (Argentina) |
| ETCEE | Empresa de Transmisión y Control de Energía Eléctrica (Guatemala) |
| ETESA | Empresa de Transmisión Eléctrica Panameña |
| ETESAL | Empresa Transmisora de El Salvador |
| FACE | Fondo de Compensación Energética (Panama) |
| FEFE | Fondo de Estabilización del Fomento Económico (El Salvador) |

| | |
|---|---|
| FEPC | Fondo de Estabilización de Precios de los Combustibles (Colombia) |
| FEPCO | Fondo para la Estabilización de Precios de Combustibles (Chile) |
| FEPP | Fondo de Estabilización de los Precios del Petróleo (Chile) |
| FET | Fondo de Estabilización Tarifaria (Panama) |
| FINET | Fondo de Inversión Nacional en Electricidad y Telefonía (El Salvador) |
| FTC | Fair Trading Commission |
| FTO | Fondo Tarifario de Occidente (Panama) |
| GBPC | Grand Bahama Power Company |
| GPL | Guyana Power & Light |
| GST | General sales tax |
| GTAP | Global Trade Analysis Project |
| IBT | Increasing block tariff |
| ICE | Instituto Costarricense de Electricidad |
| IECC | Impuesto Específico Conglobado a los Combustibles (Nicaragua) |
| IEPS | Impuesto Especial sobre Producción y Servicios (Mexico) |
| IMESI | Impuesto Específico Interno (Uruguay) |
| INE | Instituto Nicaragüense de Energía |
| IO | Input-output |
| IPP | Independent power producers |
| JPS | Jamaica Public Service Company |
| LAC | Latin America and the Caribbean |
| LCOE | Levelized Cost of Energy |
| LPG | Liquefied petroleum gas |
| LyFC | Luz y Fuerza del Centro (Mexico) |
| MEPCO | Mecanismo de Estabilización de los Precios de los Combustibles (Chile) |
| MIEM | Ministerio de Industria, Energía y Minería (Uruguay) |
| NGC | National Gas Company (Trinidad and Tobago) |
| OPEC | Organization of the Petroleum Exporting Countries |
| OSINERGMIN | Organismo Supervisor de la Inversión en Energía y Minería (Peru) |
| OUR | Office of Utilities Regulation (Jamaica) |
| PDVSA | Petróleos de Venezuela S.A. |
| PEMEX | Petróleos Mexicanos |
| Petropar | Petróleos Paraguayos |
| PI | Producer income |
| PPA | Power purchase agreements |
| PUC | Public Utility Commission |
| RECOPE | Refinadora Costarricense de Petróleo |
| RIC | Regulated Industries Commission (Trinidad and Tobago) |
| SE | Superintendencia de Electricidad (Dominican Republic) |
| SHCP | Secretaría de Hacienda y Crédito Público (Mexico) |
| SIC | Sistema Interconectado Central (Chile) |
| SIGET | Superintendencia General de Electricidad y Telecomunicaciones (El Salvador) |
| SING | Sistema Interconectado del Norte Grande (Chile) |
| SIPCO | Sistema de Protección a los Contribuyentes (Chile) |
| SOE | State-owned enterprise |
| T&TEC | Trinidad & Tobago Electricity Commission |
| TGU | Trinidad Generation Unlimited |
| URSEA | Unidad Reguladora de Servicios de Energía y Agua (Uruguay) |
| UTE | Administración Nacional de Usinas y Trasmisiones Eléctricas (Uruguay) |
| VAD | Value-added distribution |
| VAT | Value-added tax |
| WTI | West Texas Intermediate |
| YPF | Yacimientos Petrolíferos Fiscales (Argentina) |
| YPFB | Yacimientos Petrolíferos Fiscales Bolivianos |

# Acknowledgments

We would like to thank many people for their help in the preparation of this report. Robert Gillingham and Rolando Ossowski were critical to the creation of the methodologies and country surveys used to estimate prices and subsidies in this study. Government authorities and in-country experts, who provided quantitative and sector-specific knowledge, were vital to our work. Specifically, we would like to thank Alberto Gonzales, Jed Bailey, Simon Cueva, Daniel Gerold, Igor Hernández, Jon Strand, and Energy Narrative for providing us with data, sector knowledge, and thoughtful assessments on the consequences of price subsidies in each of the countries studied.

Adrien Vogt-Schilb, Kuishuang Feng, and Klaus Hubacek dedicated enormous effort to estimating the distributive impacts of energy subsidy removal, offering a key perspective on the issue and showing that subsidy removal need not be divorced from equity concerns. This portion of the report would not have been possible without previous work by Raul Jimenez on household energy consumption in Latin America and the Caribbean, which he was kind enough to share with our team. We would also like to thank all those who provided invaluable comments and suggestions on this work, including many of those already included here as well as Roland Steenblik and Martin Walter. Finally, we would like to thank Guillermo Beylis, Barbara Cunha, and the World Bank Group. The addition of their subsidy calculations and pricing information allowed for us to gain a truly regional perspective of energy prices and subsidies that we hope serves to enlighten academics and policymakers on the economic, sectoral, and distributional aspects of this work.

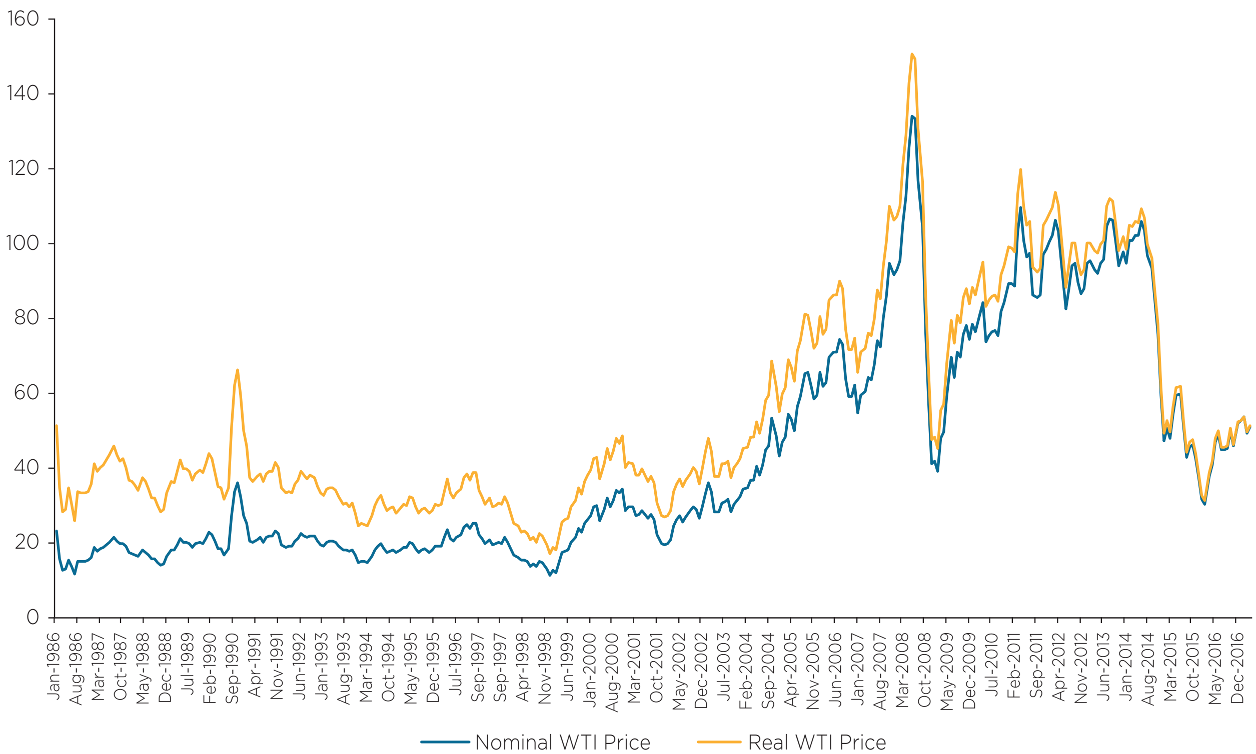
# Introduction

The price of oil has ridden a roller coaster in recent years. Starting in the early 2000s, oil prices witnessed significant volatility, reaching historic highs and tumbling back down to unanticipated lows. Oil prices peaked in 2008 only to fall sharply in 2009 at the height of the global financial crisis. They rose again until 2014, before plummeting and remaining around US$50 per barrel since. While the lows were indeed dramatic, it was the highs that were truly unprecedented.[1] Between 2002 and 2013, oil prices nearly tripled, reaching highs of more than US$100 per barrel. Dubbed a "super-cycle," the spike in oil prices was a boon for many governments in Latin America and the Caribbean (LAC).[2] Oil producers like Venezuela, Mexico, and others enjoyed wind-

[1] See, for example, Espinasa (2016), Espinasa and Sucre (2014), World Bank (2015a).

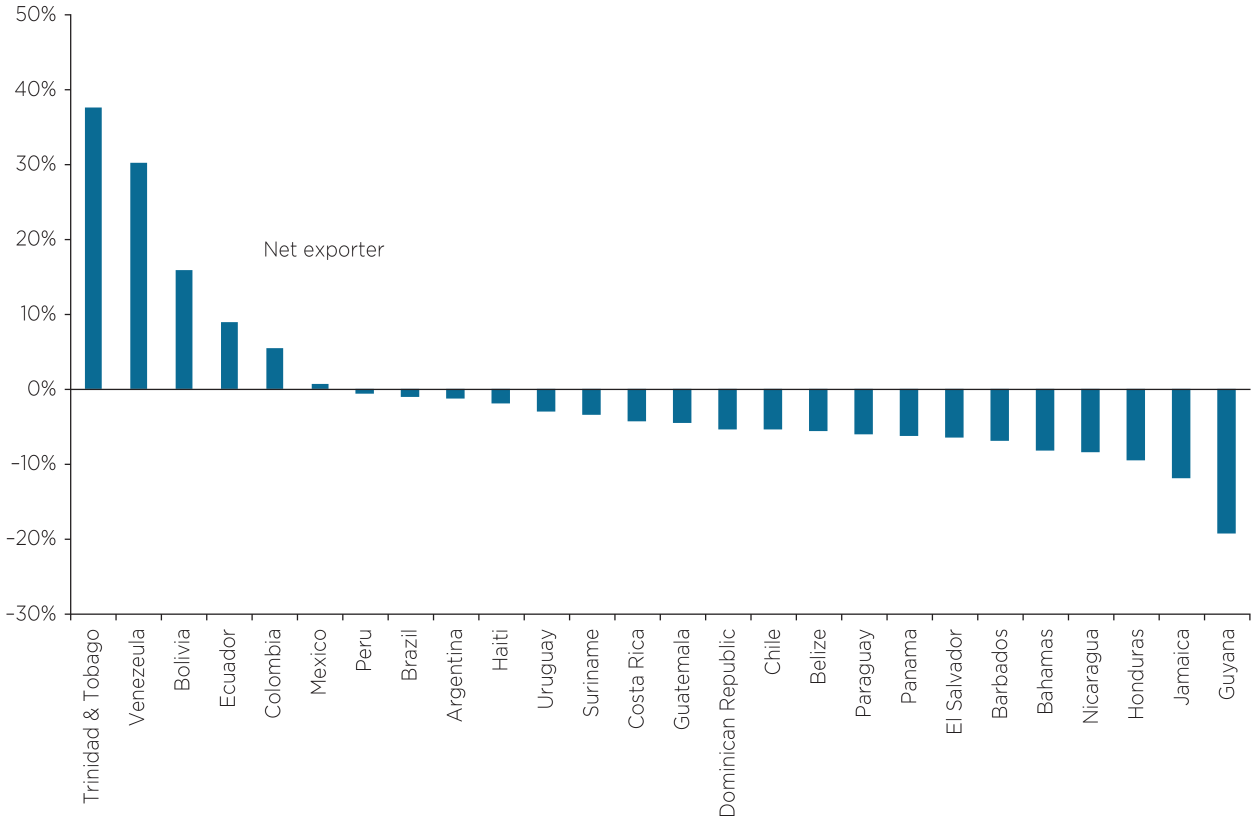
[2] See, for example, World Bank (2015a), Erten and Ocampo (2012), Espinasa and Sucre (2015), Hernández and Monaldi (2016).

**Oil Price Boom in a Historical Perspective (US$/Barrel)**




*Source:* U.S. Energy Information Administration (n.d.).

**Net exports of Oil, Natural Gas, and Petroleum Products (% of GDP), 2014**




*Source:* UN Comtrade (n.d.) and IMF (n.d.).

fall revenues without necessarily having to increase production.

The boom ended abruptly in the second half of 2014 when oil prices collapsed. Much of the related discussion has since been focused on the macroeconomic consequences for LAC of the rise and fall in oil and commodity prices. Yet there is another, less talked about side of the boom: with rising oil prices, the cost of supplying fuels and electricity to households and businesses also increased sharply across the region. In turn, many LAC governments adopted discretionary price control mechanisms to prevent the increases in oil prices from being fully passed through to final consumers.

A country's exposure to oil price shocks depends on the amount and share of oil products consumed, produced, and imported. Latin American and Caribbean countries are highly dependent on oil as a source of energy and therefore vulnerable to price shocks. Oil products represent more than 60 percent of the region's total energy consumption, though the share is even higher in Central America, the Caribbean, and Andean countries. Importers of oil, gas, and fuels within LAC face a greater vulnerability to rising oil prices as compared to exporters because they must bear rising energy expenditures without the ability to offset increasing costs with the higher income gained from exports. Nevertheless, oil- and gas-producing countries in LAC are not immune to price shocks.

Only a few resource-rich countries in Latin America and the Caribbean are net exporters of crude oil, natural gas, and fuels. In 2014, for example, only six countries—Bolivia, Colombia, Ecuador, Mexico, Trinidad and Tobago, and Venezuela—exported more oil, natural gas, and fuels than they imported.

On the other hand, for many Central American and Caribbean countries, energy imports represented a significant fiscal cost. In 2014, for instance, the value of energy imports in Central America and the Caribbean was 7 and 6 percent of GDP respectively.[3] For countries like Guyana and Jamaica, fossil fuel imports represented more than 10 percent of GDP.

The discretionary price controls for fuels and electricity introduced by many LAC governments during the oil price boom often resulted in expensive and inefficient energy subsidies. Energy subsidies are often associated with negative fiscal, sectoral, and environmental consequences for countries. When the cost of providing energy subsidies is high, for example, this can aggravate a country's fiscal position and divert spending away from other important sectors. Price controls often also reduce or erode energy companies' operating and profit margins, forcing them to cut spending on required investments to meet demand or operate at a loss, leading to a deterioration of the sector. To the extent that they encourage the consumption of fossil fuels, energy subsidies also increase greenhouse gas emissions, pollution, and traffic.

In this report, we seek to understand how different pricing policies give rise to fuel and electricity subsidies in Latin America and the Caribbean, their broader economic and sectoral implications, and whether they are, in fact, a good vehicle for delivering social protection to households when faced with price shocks. To do so, we examine the types of pricing mechanisms implemented for fuels and electricity in 26 LAC countries during the high-price environment experienced between 2008 and 2014 and quantify associated subsidies.[4] We then examine the economic and sectoral implications of energy subsidies during this time period. Finally, we assess how subsidies were targeted across the population, model the welfare impacts of increasing fuel and electricity prices on households across income categories, and offer some options for subsidy reform.

Our study reveals that energy subsidies are a particularly inefficient vehicle for transferring income to the poor. In fact, for every US$10 spent to support fossil fuels and electricity prices across several LAC countries, only US$1 reached the poorest 20 percent of households. Combined with the onerous fiscal, economic, sectoral, and environmental consequences often associated with energy subsidies, such policies become more difficult to justify. Instead, Latin American and Caribbean governments can redirect a portion of the savings from energy subsidy reduction—or increased taxation—to more targeted social programs. The recent fall in oil prices presents an opportunity for many Latin American and Caribbean governments to reform their pricing policies for fuels and electricity.

The report is organized as follows: Chapter 1 examines why getting energy prices right matters for an economy and reviews the unintended, adverse consequences of energy subsidies. Chapter 2 studies the fuel pricing mechanisms implemented across LAC from 2008 through 2014 for several fuels, including gasoline, diesel, liquefied petroleum gas (LPG), kerosene, and natural gas, and measures the cost of associated subsidies. Chapter 3 surveys the electricity pricing mechanisms implemented in LAC during our sample period and quantifies associated subsidies. Chapter 4 examines the overall fiscal and sectoral implications of energy subsidies in the region. Chapter 5 analyzes the distribution of subsidies across households in different income brackets, models the welfare impact on households across the income spectrum of raising fuel and electricity prices for a subset of countries in our sample, and assesses the impact of redirecting part of the savings gained from price increases to more targeted social protection programs. Finally, Chapter 6 presents our conclusions.

3 Excludes Mexico.

4 For nine countries in our sample, all price-setting information and subsidy calculations are taken from Beylis and Cunha (2017) with the World Bank's permission. These countries are: Bolivia, Brazil, Colombia, the Dominican Republic, El Salvador, Honduras, Haiti, Mexico, and Peru. All other country data comes from IADB calculations. Both institutions use the same method for calculating subsidies, with some exceptions. See Chapters 2 and 3 for more details.

# CHAPTER 1: **Why Do Energy Prices Matter?**

At a fundamental level, energy prices serve as a signal of the value and trade-offs associated with energy consumption in an economy. Prices may reflect the cost of production, the opportunity cost associated with an energy product, and the costs related to the externalities resulting from energy consumption. When right, energy prices can help to efficiently allocate goods and services in an economy. When wrong, they can incentivize undesirable behavior, such as over-consumption or depletion of scarce resources, or result in detrimental fiscal, economic, sectoral, and environmental consequences for countries.

Energy prices also exhibit important characteristics that may prompt policymakers to intervene in the price-setting process. Energy is a key input in most economic activities; therefore, energy prices impact the welfare of businesses and households directly and indirectly, by impacting the price of other goods and services. Energy prices can also be volatile, reflecting instability in the oil market, or, as is the case with electricity, prices can also be affected by other factors including the electric system's reliability and the costs and risks associated with the mix of technologies used to generate electricity. Many governments thus have strong incentives to manage their country's exposure to fluctuations in fuel and electricity prices in the short and long run.

Interventions in energy markets have a long history in both developed and developing countries. Governments use energy pricing policies to help mitigate the impact on consumers of high or volatile energy prices, curb inflation, restore economic competitiveness, and protect the standard of living of vulnerable segments of the population. Large oil and gas producers around the world have also tended to adopt price control mechanisms that keep energy prices low as a means of distributing the country's resource wealth to the broader public (Coady et al., 2015). In many Latin American and Caribbean countries, the use of price control mechanisms for fuels and electricity intensified following sharp increases in the international price of oil, which began in the early 2000s and lasted through mid-2014.

## Energy Pricing Mechanisms and Subsidies

In our study, pricing policies are classified as either discretionary or non-discretionary. Discretionary pricing mechanisms are those whereby governments set fuel prices at their own discretion, either by decree or through ad hoc approaches. Non-discretionary pricing mechanisms, on the other hand, are either depoliticized and respected regulations for setting final consumer prices or fully liberalized pricing schemes.[1]

Our study focuses on price subsidies. These emerge when the costs of supplying fuels or electricity, including appropriate taxes, are higher than final consumer prices.[2] Between 2008 and 2014, LAC countries that followed discretionary pric-

[1] See Kojima (2013), Coady et al. (2012), Coady et al. (2015), Beylis and Cunha (2017), and Di Bella et al. (2015) for discussion on types of energy pricing policies.

[2] For a detailed definition, see Chapters 2 and 3 and Appendix I.

ing mechanisms set consumer prices in an ad hoc manner, either through price fixing or by manipulating links along the price-formation value chain, including taxes. Often governments prevented changes in energy costs from being fully passed through to final consumers, though there was considerable variation across countries in the size, duration, and effect of resulting subsidies. On the other hand, countries that adhered to non-discretionary pricing mechanisms followed established regulations for price-setting, which often took the form of automatic pricing formulas; established price-smoothing schemes to buffer consumer prices from changes in energy costs; established, targeted subsidies or cross-subsidies; or liberalized pricing schemes which allowed energy costs to be fully passed through to final consumers.[3] Non-discretionary pricing mechanisms typically resulted in smaller or no subsidies.

In the case of fuels, subsidies were largest in LAC countries that are significant oil and gas producers. This set of countries tended to follow discretionary pricing mechanisms that fixed most fuel prices throughout or for most of the time period under study. Another larger set of countries implemented discretionary pricing mechanisms that were more limited in scope. This set of countries often manipulated taxes on fuels to influence final consumer prices. Resulting subsidies, if any, were present in a limited number of years and tended to come in the form of forgone tax revenue. Finally, only a small group of LAC countries chose to follow non-discretionary pricing mechanisms for fuels between 2008 and 2014. Fuel prices in these countries were set via established and respected regulations or were fully liberalized, resulting in smaller or no subsidies. Still, a subset of these countries also relied on established price-stabilization funds or other price-smoothing mechanisms that imposed fiscal costs at times of sustained increases in energy prices.

In the case of electricity, most LAC countries followed discretionary pricing mechanisms throughout the time period under study, consistently setting final consumer tariffs in an ad hoc manner or intervening in generation, transmission, or distribution markets to influence final electricity prices. This group comprised a diverse set of countries, representing small and large economies, importers and exporters of fuels, and countries with varied electricity production costs. Electricity subsidies were concentrated in this set of countries. Yet, the overall cost of electricity subsidies was lower when compared to fuel subsidies. Chapters 2 and 3 discuss in detail the link between a country's chosen pricing policies and the level of subsidies.

## Unintended Consequences of Energy Subsidies

A country's chosen pricing policies for energy can have far-reaching effects on its economy, the performance of the energy sector, the environment, and income distribution. If maintaining price controls requires that governments provide fiscal support to firms or consumers, for example, this could lead to budget shortfalls if expenditures are not offset by cuts in other areas or higher taxes (Yépez-García and Dana, 2012). Subsidies can also impose costs in the form of forgone tax revenues and complicate budget management if revenues become unpredictable. Subsidies contribute to debt accumulation and can put pressure on trade and balance of payment imbalances. Subsidizing energy also promotes smuggling to neighboring countries with higher domestic energy prices, increasing the cost for the subsidizing country while limiting the ability of the receiving country to tax domestic energy consumption (Di Bella et al., 2015). Furthermore, energy subsidies can divert government spending away from important sectors such as health, education, and infrastructure. The fiscal impact of subsidies is not always direct or transparently recorded.

Price control mechanisms can also result in lower profits, losses, or higher indebtedness for firms across the fuels and electricity value chain, making it difficult for companies to spend on maintenance

[3] Mechanisms described are not mutually exclusive and were sometimes used in tandem.

or invest in the new capacity needed to meet demand. Moreover, lower prices and regulatory instability can reduce the incentives for firms to invest in the sector all together. If entrenched, these policies can lead to a vicious cycle where losses to firms cause a deterioration in services, energy shortages, higher energy costs and a growing need for imports, and ultimately the need for more subsidies (Coady et al., 2015).

Subsidizing energy can also adversely affect the environment and public health. Cheap fossil fuels and electricity prices distort the efficient allocation of resources by boosting energy consumption, artificially promoting energy-intensive industries, and reducing the incentives to invest in clean, renewable energy (Clements, 2013). Excessive consumption of fossil fuels can also lead to elevated greenhouse gas emissions, cause more premature deaths from air pollution, and exacerbate road congestion and other negative externalities associated with increased vehicle use (Coady et al., 2015).

Finally, although governments often cite several reasons for providing energy subsidies, protecting low-income or vulnerable segments of society is typically chief among them. In practice, however, energy subsidies have proved to be an inefficient vehicle for providing economic protection to these groups. On the contrary, energy subsidies benefit the wealthy disproportionately (Arze del Granado, Coady, and Gillingham, 2014; Coady, Flamini, and Sears, 2015). As will be examined further in Chapter 5, higher-income groups—which typically consume more energy—tend to capture more of the benefits from subsidies.

Our study reveals that, in some Latin American and Caribbean countries, energy subsidies have already led to or worsened many of the detrimental, unintended consequences described above. Although eliminating subsidies for energy can be politically contentious, governments around the world have recognized the perverse outcomes associated with their adoption and committed to phasing them out (Rentschler and Bazilian, 2016). Assessing the impact of implementing as well as removing energy subsidies in LAC is thus an important step towards designing more effective pricing policies that benefit countries as a whole. Effective pricing mechanisms can reduce inefficient spending as well as energy use, and aid countries in reducing their carbon footprint. At the same time, they do not preclude governments from replacing poorly targeted energy subsidies with better-targeted compensation mechanisms for vulnerable populations.

# CHAPTER 2: **Fuel Prices and Subsidies in Latin America and the Caribbean**

## Price-Gap Approach for Measuring Fuel Subsidies

As discussed in the previous chapter, fuel prices matter. Large and persistent price distortions for fuels can have significant harmful effects on a country's economy, businesses, and the welfare of its population. Yet this discussion begs the question of what the correct fuel price should be. In the presence of complete and perfectly competitive markets, where resources can be redistributed without cost using lump-sum taxes and transfers, the marginal cost of a product is taken as the efficient supply cost. Marginal-cost pricing allows for supply and demand to be allocated efficiently. For commodities that are traded internationally, the supply cost is taken as the international price adjusted for quality and transport (Espinasa and Gillingham, 2013).

Because fuels are widely traded, their international price, adjusted for quality and transport costs, should serve as the basis for constructing domestic fuel prices. Appropriate domestic distribution and retail margins and taxes should then be added to arrive at final consumer prices. In practice, countries levy general consumption taxes—typically a value-added tax (VAT) or a general sales tax (GST)—to raise revenue, and levy excise taxes on some goods and services to raise revenue and correct for market failures. Like other goods and services, energy should be subject to at least the general consumption tax rate (Kojima and Koplow, 2015). Optimal energy taxation, however, requires an additional "Pigouvian," or corrective, tax to capture the negative externalities associated with energy consumption.[1]

Following the "price-gap" approach, this study defines a price subsidy as the divergence of domestic consumer prices from international reference prices (Koplow, 2009).[2] For countries that are net exporters of a given fuel product, the international reference price is the country's export parity price, adjusted for domestic distribution and retail margins and taxes.[3] For countries that are net importers of a fuel, the reference price is the import parity price,[4] also adjusted for domestic margins and taxes. The export parity price reflects the opportunity cost of pricing a fuel below international market levels, while the import parity price reflects the cost of supplying a fuel to domestic markets. Unlike petroleum products, natural gas does not have a single international price because it is not traded as easily. Nevertheless, a similar logic holds: reference prices for natural gas should reflect cost-recovery principles at minimum or export parity prices when appropriate, alongside domestic margins and taxes (Kojima and Koplow, 2015).

Given the great data demands and assumptions required to estimate optimal taxes for many individual countries, this study limits its scope only to the inclusion of general consumption taxes within reference prices for fuels. If fuels are taxed at a VAT or GST rate lower than the general rate on goods and services, or are exempt, then a "tax expenditure"

[1] See, for example, Parry and Strand (2011), Coady et al. (2015), Parry et al. (2014), and Box 1 for further discussion.

[2] See Appendix I for technical details.

[3] Typically referred to as the FOB price.

[4] Typically referred to as the CIF price.

arises, and this is akin to a subsidy. Box 1 provides a more detailed discussion on fuel taxation.

## Fuel Prices during the Oil Price Boom

Figures 2.1–2.5 show the evolution of maximum, minimum, and average final consumer prices paid for gasoline, diesel, LPG, kerosene, and natural gas in Latin America and the Caribbean during the high oil price environment experienced between 2008 and 2014.[5] Notably, there were large differences between the maximum and minimum prices paid for both petroleum products and natural gas. While consumers in some LAC countries faced very high fuel prices, others paid close to zero.

Apart from price differences due to transportation costs and quality, in large part price differences across the region reflect the result of the different pricing policies LAC countries chose to follow during this time period (Kojima, 2013). For countries that set fuel prices in a discretionary manner, large deviations from reference prices often resulted in high subsidy bills and many of the aforementioned negative sectoral and economic consequences as either companies or governments absorbed the losses that resulted from underpricing energy products.

It is important to highlight that transport costs may raise fuel prices by a considerable amount, affecting price differences. As an example, Figure 2.6 shows the average estimated reference prices for gasoline for net importers (CIF price) and net exporters (FOB price) in LAC, net of taxes.[6] Net importers paid an average of 30 percent more per liter of gasoline than net exporters during the sample period.

## Trends in Fuel Pricing Mechanisms

### How Are Fuel Prices Determined?

To understand how subsidies arise, it is important to highlight how fuel prices are typically determined in the market or through regulation. As mentioned in the previous section, fuel prices are made up of three key components that broadly reflect a fuel's supply chain: the import or export parity price, distribution and retail margins, and taxes. Fuel prices are either regulated or fully liberalized (in the latter case, prices are set freely along the supply chain). Many developing countries, including most Latin American and Caribbean countries, regulate fuel prices.

Countries that regulate fuel prices set price ceilings or levels for one or more of the components along a fuel's supply chain. Price ceilings and levels are imposed on import, ex-refinery, wholesale, and/or retail prices. They are set either uniformly across a country or regionally (Kojima, 2013). There are benefits and drawbacks associated with adopting price ceilings and levels. Price ceilings allow for price competition, while price levels do not. Instead, price levels offer greater control. Nevertheless, if price ceilings or levels are set too low, energy firms' operating and profit margins are reduced or eroded, making them financially unviable in some cases. If price ceilings or levels are set too high, on the other hand, there is little incentive for companies to increase their efficiency or pass on gains to consumers in the form of lower prices (Kojima, 2013). Taxes are another component of fuel prices. In practice, taxes can be ad valorem, specific, or both, generally taking the form of a VAT or an excise tax (see Box 1).

When prices are regulated, governments typically establish criteria for setting and adjusting prices and taxes, though regulations are not always followed. Non-discretionary pricing schemes require decisions on how import or export parity prices and margins should be calculated, how and when price components should be adjusted, and where and by how much fuels should be taxed. Government's often rely on formulas to set and adjust fuel prices. Formulas typically add the import or export price of a fuel, domestic distribution and retail margins, and taxes, among other com-

[5] For countries covered by Beylis and Cunha (2017)—Bolivia, Brazil, Colombia, the Dominican Republic, El Salvador, Honduras, Haiti, Mexico, and Peru—data is only available until 2013.

[6] Unless otherwise indicated, reference prices include the VAT.

## Box 1: Fuel Taxation

Countries levy taxes on fuels for several reasons. Fuel taxes can be an important source of revenue for many countries. Fuels enjoy widespread use and have relatively inelastic tax bases, making them a useful tool for raising revenue compared to other fiscal instruments that have relatively mobile bases (Coady et al., 2015). Moreover, fuel taxes may be easier to monitor and administer than other taxes, as they are levied in fewer, known locations.

From an economic efficiency standpoint, there are other reasons for taxing fuels. The "Ramsey Principle" in tax theory suggests that imposing higher tax rates on commodities that have a relatively inelastic demand with respect to price, such as fuels for example, results in fewer distortions in consumption, compared to taxing commodities with high elasticity in demand (Coady et al., 2010). And, in energy-importing countries, energy taxes can reduce rent transfers to producers outside of the country (Franks, Edenhofer, and Lessmann, 2015).

Equity considerations may also lead countries to levy fuel taxes. Tax theory suggests that if equity is an important consideration in the design of tax systems, goods and services that constitute a larger share of expenditures for high-income groups versus for lower-income groups should be taxed more heavily. Yet, there is a limit to the extent that tax differentiation amongst energy products can be maintained without distorting markets (Coady et al., 2010). Other fiscal and policy instruments, such as income taxes and targeted cash transfer programs, can achieve equity objectives more efficiently. Chapter 5 explains in detail how targeted interventions can correct these distributional impacts.

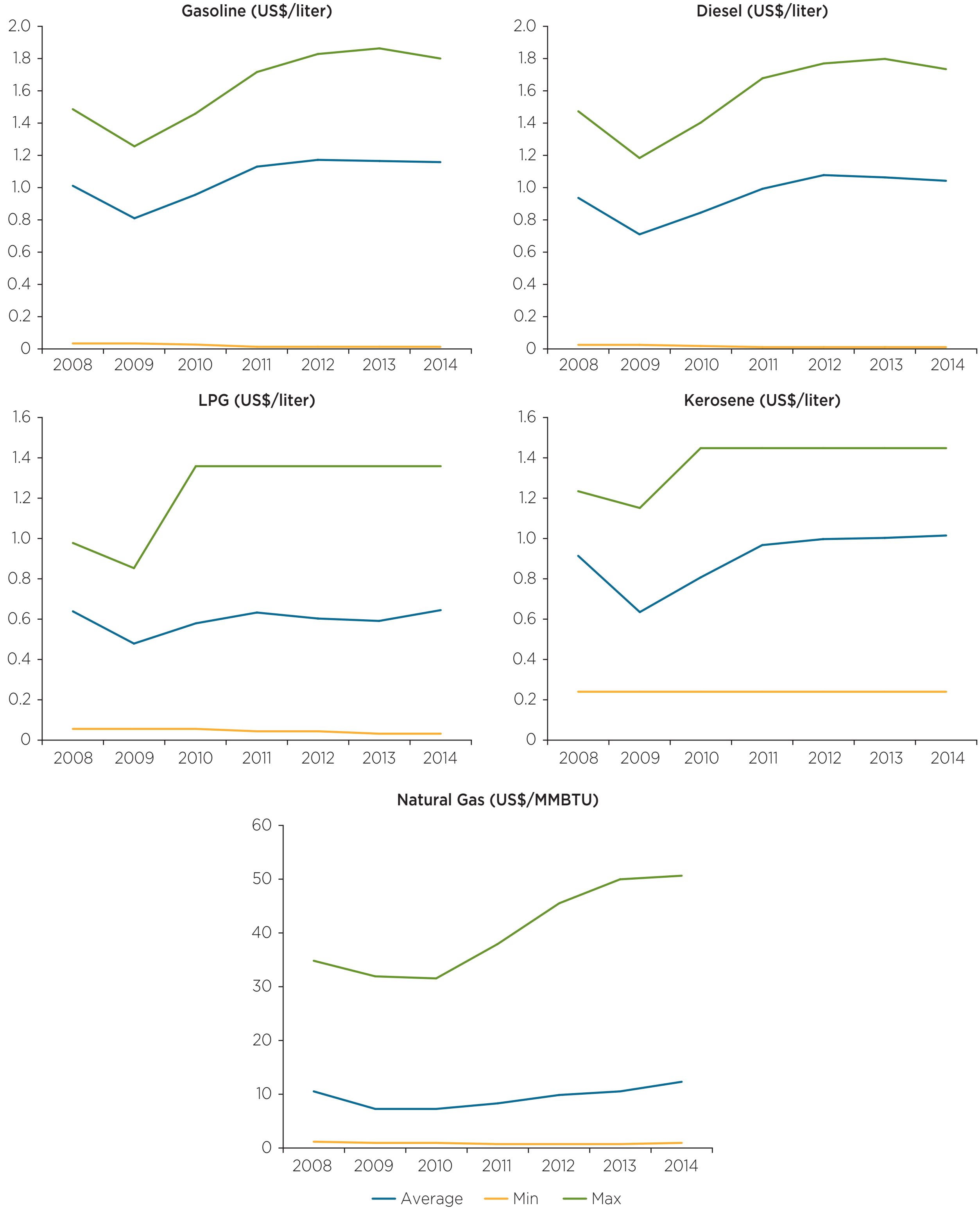
Finally, countries also levy taxes on fossil fuels to correct for the externalities associated with their consumption or production. Externalities are the costs or benefits of an activity that are not reflected in its price. In the case of energy, consumer prices rarely reflect the negative costs of increased emissions, local air pollution, and traffic, for example. Pigouvian, or corrective, taxes aim to change the relative price of a good in order to change consumer behavior and thereby internalize associated externalities. Correcting these externalities would justify taxes even in the absence of regulation or a need to generate fiscal resources because there is an inherent market failure that prevents the efficient allocation of resources at market prices (Parry et al., 2014). In principle, there's growing acceptance that direct taxation can achieve many of these goals (Heine, Norregaard, and Parry, 2012).

To achieve their aims, governments generally levy two types of taxes on energy products: a general consumption tax or an excise tax.[a] These taxes are not mutually exclusive; rather, they serve different purposes. The purpose of a general consumption tax such as the VAT, for example, is to generate revenues by taxing domestic consumption. Excise taxes, on the other hand, are employed to raise revenue, address equity concerns, and correct for externalities resulting from the consumption of certain goods and services.

There is widespread agreement in tax literature regarding some key points on the appropriate application of a VAT, which are relevant to energy taxation. In particular, it is advisable to: (i) ensure that the tax is levied on consumption and not capital goods, (ii) apply the VAT as a single rate (while zero-rating exports) in order to preserve relative prices and simplify administration, (iii) apply the VAT to a broad tax base and narrow the list of exemptions, and (iv) include excise taxes in the VAT base (Diamond and Mirrlees, 1971; Coady et al., 2015).

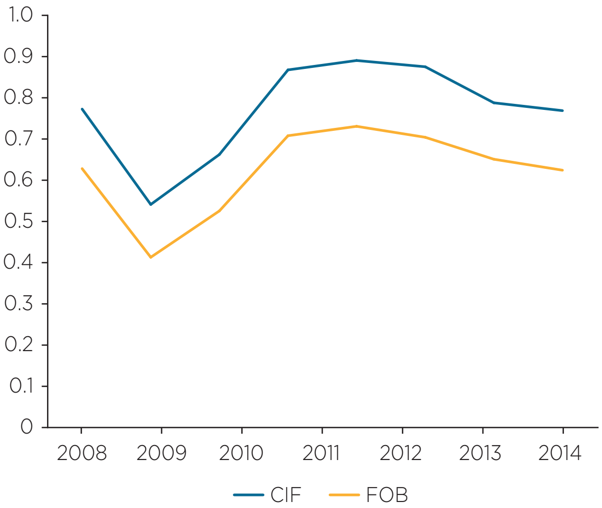
[a] If there is a state monopoly on refining, distribution, or retail, a special tax may also be imposed on the company, or its profits may be transferred in whole or in part to the government.

**Figures 2.1–2.5 Average Final Consumer Fuel Prices in LAC, 2008–14**




*Source:* IADB calculations.

**Figure 2.6 Average Import and Export Reference Gasoline Prices in LAC (US$/liter), 2008–14**




*Source:* IADB calculations.

ponents, to determine consumer prices. In some cases, regulations have more specific aims, such as setting automatic adjustment rules for formulas to avoid reliance on ad hoc approaches to fuel pricing (Coady et al., 2012).

Some governments prefer to avoid sharp increases and volatility in domestic fuel prices and thus include price-smoothing rules in their pricing mechanism. Although the full pass-through of international fuel prices is the goal in the medium term, price-smoothing mechanisms are included to prevent price shocks in the short term. Some governments choose to implement price bands, which set a ceiling and floor for allowed changes to domestic prices. Others use moving averages as smoothing mechanisms. Here, price adjustments are based on average changes in past international prices (Coady et al., 2012). Some LAC governments have combined price-smoothing tools with dedicated stabilization funds that absorb subsidies or retain funds to smooth out domestic fuel prices.

The adoption of pricing formulas for fuels—with or without price smoothing—does not necessarily mean that governments do not provide fuel subsidies. Explicit subsidies are sometimes introduced as part of the pricing formula, for example, or, price adjustments to formulas are made at inopportune intervals or in an ad hoc manner even if regulations state otherwise, resulting in subsidies. Price-smoothing tools can also fail in the presence of large and persistent increases in international fuel prices, either because political pressure prevents governments from maintaining higher retail prices when international prices fall (to make up for previously incurred subsidies) or because international prices rise more quickly and consistently than allowed in the pricing scheme.

Finally, governments also use discretionary or informal tools to influence the fuel price–setting process. For example, some LAC governments set fuel prices via presidential decrees, others use taxation in an ad hoc manner to smooth out changes in international fuel prices, while others adjust prices with irregularity or leverage their control over different segments of the oil and gas sector to affect fuel prices. The next sections explore in detail the pricing mechanisms chosen by LAC governments to set fuel prices between 2008 and 2014 and quantify resulting subsidies.

## Pricing Mechanisms for Fuels in LAC

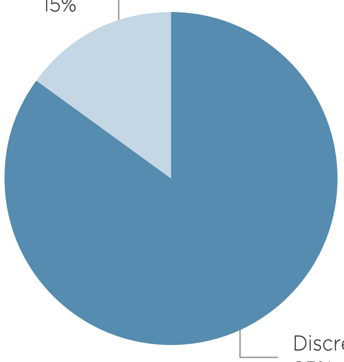
This study classifies pricing policies into two categories: discretionary and non-discretionary. Discretionary pricing mechanisms are those where one or more of the components of the pricing mechanism—including import or export prices, distribution and retail margins, and taxes—are set or adjusted in an ad hoc manner. Discretionary mechanisms also include schemes where retail fuel prices are fixed at the government's discretion. Non-discretionary pricing mechanisms, on the other hand, comprise a set of rules-based, respected criteria for setting and adjusting components of the pricing mechanism—including import or export prices, distribution and retail margins, and taxes. They also include fully liberalized pricing regimes (Table 2.1).

Between 2008 and 2014, most LAC countries in our sample followed discretionary pricing mech-

### Table 2.1 Typology for Fuel Pricing Mechanisms

| Pricing Mechanism | Definition |
|---|---|
| Discretionary | One or more of the components of the pricing mechanism—including import or export prices, distribution and retail margins, and taxes—are set or adjusted in an ad hoc manner. Or a pricing mechanism where retail prices are fixed at the government's discretion. |
| Non-Discretionary | Rules-based and respected criteria for setting and adjusting components of the pricing mechanism—including import or export prices, distribution and retail margins, and taxes. Or fully liberalized prices. |

### Figure 2.7 Distribution of Fuel Pricing Mechanisms in LAC, 2008–14




anisms (Figure 2.7 and Table 2.2).[7] That is, 22—or roughly 85 percent—of the 26 LAC countries in our sample chose discretionary pricing mechanisms,

[7] Countries can have different pricing mechanisms for different fuels, though this is rare, particularly for petroleum products. The mechanism chosen to represent a country in this study is the one used to regulate the majority of fuel products in that country. If available, however, the pricing mechanism for each fuel consumed is detailed in Table 2.2 and in the country summaries in the following sections. Discussions on fuel pricing mechanisms exclude fuels destined for electricity generation. The treatment of these fuels in each country will be discussed in Chapter 3.

### Table 2.2 Fuel Pricing Mechanisms by Country, 2008–14

| Country | Typology | Pricing Mechanism | Tax |
|---|---|---|---|
| Argentina | Discretionary | Liberalized but regulated informally. Imported fuels sold at wholesale below parity prices. No tariff adjustments for natural gas. | Excise and VAT. Ad hoc export tariffs to influence domestic prices. |
| Bahamas | Discretionary | Formula based on the import parity price | Excise. Ad hoc adjustments for price smoothing. |
| Barbados | Discretionary | Formula based on the import parity price. Retail prices capped occasionally. | Excise |
| Belize | Discretionary | Formula based on the import parity price | Excise and GST. Ad hoc adjustments for price smoothing. |
| Bolivia | Discretionary | Fixed crude oil and retail fuel prices | Excise and VAT |
| Brazil | Discretionary | Liberalized but regulated informally. Retail prices set indirectly by SOE. LPG retail prices fixed. | Excise. Ad hoc adjustments for price smoothing. |
| Colombia | Discretionary | Ad hoc setting of wholesale gasoline and diesel prices until 2011; automatic formula based on the import parity price thereafter. Prices allowed to fluctuate within a band. Subsidies covered partially by stabilization fund. Targeted LPG and natural gas subsidies. | Excise and VAT until 2012. Excise only thereafter. |
| Dominican Republic | Discretionary | Formula based on the import parity price temporarily frozen. Informal stabilization fund. Targeted LPG subsidies. | Excise |
| Ecuador | Discretionary | Fixed retail prices | VAT, with exceptions |

*(continued on next page)*

**Table 2.2 Fuel Pricing Mechanisms by Country, 2008–14** *(continued)*

| Country | Typology | Pricing Mechanism | Tax |
|---|---|---|---|
| El Salvador | Discretionary | Formula based on the import parity price. LPG prices fixed before 2011; then targeted LPG subsidies partially covered by stabilization fund. | Excise and VAT. Ad hoc adjustments for price smoothing. |
| Guatemala | Discretionary | Liberalized prices | Excise and VAT. Ad hoc adjustments for price smoothing. |
| Guyana | Discretionary | Liberalized prices | Excise and VAT. Ad hoc adjustments for price smoothing. |
| Haiti | Discretionary | Fixed retail prices | Excise. Ad hoc adjustments for price smoothing. |
| Honduras | Discretionary | Formula based on the import parity price. Formula occasionally suspended due to rising prices. | Excise. Ad hoc adjustments for price smoothing. |
| Jamaica | Discretionary | Formula for wholesale prices based on the import parity price. Liberalized retail prices. | Excise. Ad hoc adjustments for price smoothing. |
| Mexico | Discretionary | Formula based on the import parity price | Excise. Ad hoc adjustments for price smoothing; negative to provide subsidies. |
| Paraguay | Discretionary | Prices set by decree. Informally set following the import parity price. Retail prices influenced indirectly by SOE. | Excise. Ad hoc adjustments. |
| Peru | Discretionary | Formula based on the import parity price allowed to fluctuate within a band. Stabilization fund partially covered subsidies. Fund criteria applied ad hoc through decrees. | Excise and VAT |
| Suriname | Discretionary | Liberalized prices | Excise. Ad hoc adjustments for price smoothing. |
| Trinidad and Tobago | Discretionary | Fixed wholesale prices reimbursed by subsidy | Excise |
| Uruguay | Discretionary | Prices set by decree. Informally set following the import parity price. | VAT, with exceptions |
| Venezuela | Discretionary | Fixed retail prices | Excise |
| Chile | Non-Discretionary | Formula based on the import parity price allowed to fluctuate within a band. Stabilization fund covered subsidies. | Excise |
| Costa Rica | Non-Discretionary | Formula based on the import parity price | Excise |
| Nicaragua | Non-Discretionary | Liberalized prices | Excise |
| Panama | Non-Discretionary | Formula for wholesale prices based on the import parity price. Liberalized retail prices. Targeted LPG subsidies. | Excise |

*Source:* IADB calculations.

while four—or about 15 percent—chose non-discretionary schemes. Out of the countries that followed discretionary pricing mechanisms, Bolivia, Ecuador, Trinidad and Tobago, and Venezuela implemented pricing policies that effectively divorced domestic fuel prices from international prices. These four countries are all significant oil and gas producers that tended to follow long-standing price-fixing policies for fuels. Subsidies were concentrated in this set of countries, leading to high fiscal costs and even deep-rooted economic and sectoral imbalances that will be explored in depth in the sections to follow. Haiti also fixed fuel prices during part of the sample period. Before 2008, fuel prices in Haiti were regulated through a formula that reflected changes in international prices. In response to the spike in oil prices, however, the government began to prevent fuel prices from rising and eventually froze fuel prices in 2011.

Another subset of countries that followed discretionary pricing mechanisms during the sample period either suspended components of their pricing schemes or used informal tools like leveraging the market power of state-owned enterprises (SOEs) in the energy sector to influence fuel prices. Peru, for example, adopted a price stabilization fund meant to smooth out fuel price increases and be self-financing. This imposed subsidies during years when prices spiked. Subsidies should have been reversed during years with lower international fuel prices, yet political pressure to pass through price decreases resulted in a discretionary application of the fund's rules. The government enacted several emergency measures to avoid increasing fuel prices.

Brazil, on the other hand, is an example of a country that leveraged its de facto monopoly in the market to control fuel prices indirectly. State-owned company Petrobras regularly absorbed losses as a result of underpricing fuels. Argentina, conversely, is an example of a country that implemented a mix of policies to prevent full pass-through of international oil price increases to domestic consumers. State-owned company Energía Argentina S.A. (ENARSA), for instance, imported fuels at international prices and sold them domestically at subsidized prices. At the same time, tariff adjustments for natural gas were ignored and export duties were instituted for some fuels in order bring down domestic prices.

Furthermore, an even larger subset of Latin American and Caribbean countries that followed discretionary pricing mechanisms primarily adjusted taxes in an ad hoc manner to buffer retail prices from increases in international fuel prices. In many of these countries, import or export parity prices served as the official backbone for domestic prices, either through a formula for price-setting or because prices were fully liberalized. Yet, in the face of rising oil prices, these countries chose to reduce or adjust fuel taxes in order to lower retail prices. An extreme example of this practice was Mexico, where taxes on fuels often turned negative—in effect becoming a subsidy.

Notably too, many Caribbean countries also reduced taxes in order to temper the effects of fuel price increases on households and the economy. With the exception of Trinidad and Tobago, Caribbean countries are net importers of fuels, facing some of the highest energy prices in the region. At the same time, fuels are an important tax base for many governments. In some cases, such as in Suriname, for instance, the erosion of tax revenues from fuels only aggravated the country's vulnerable fiscal position at the time.

Finally, only four countries in the region followed non-discretionary pricing mechanisms between 2008 and 2014. In Nicaragua, fuel prices were fully liberalized and there was no evidence of discretionary price adjustments. In Chile, Costa Rica, and Panama, on the other hand, fuel prices were regulated through formal criteria that were respected throughout the sample period. Prices in all three countries were set and adjusted through a formula that adhered to import parity prices and included appropriate margins and taxes. Chile also had a price stabilization fund to help smooth out changes in international prices. In the first half of the sample period, sustained fuel price increases threatened the sustainability of Chile's stabilization fund. The government responded by introducing a new scheme with more suitable criteria, thereby preserving the rules-based principles of a non-discretionary regime. With the exception of Panama, this set of countries did not subsidize fuels. Panama offered an explicit subsidy for LPG targeted to low-income consumers.

## Fuel Subsidies and Pricing Mechanisms

A country's chosen mechanism to regulate domestic fuel prices affects the level of resulting subsidies. On the whole, countries that followed discretionary pricing mechanisms tended to prevent changes in international fuel prices from being fully passed through to domestic consumers through different tools that varied in scope and duration. As previously mentioned, subsidies were concentrated in this set of countries, particularly in some of LAC's largest oil and gas producers: Argentina, Bolivia, Ecuador, Mexico, Trinidad and Tobago, and Venezuela. The costs associated with underpricing fuels for this set of countries were particularly onerous and often had unintended, detrimental consequences for the energy sector and the economy as a whole—something that will be explored in more detail in the country summaries below. Countries that chose to

**Table 2.3 Fuel Subsidies by LAC Country (% of GDP), Average 2008–14**

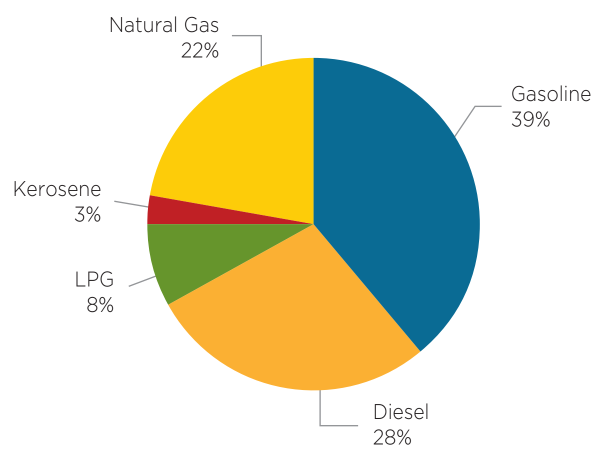
| Pricing Mechanism | Discretionary | | | | | | | | | | | | | | | | | | | | | | Non-Discretionary | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Subsidies (% of GDP) | 9.4 | 8.7 | 5.4 | 2.6 | 1.4 | 1.3 | 1.1 | 0.8 | 0.7 | 0.5 | 0.3 | 0.2 | 0.2 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 |
| Country | Bolivia | Venezuela | Ecuador | Trinidad and Tobago | Argentina | Haiti | Mexico | Colombia | El Salvador | Guyana | Peru | Honduras | Jamaica | Barbados | Dominican Republic | Paraguay | Bahamas | Belize | Brazil | Guatemala | Suriname | Uruguay | Panama | Costa Rica | Chile | Nicaragua |

*Source:* IADB calculations.

follow non-discretionary pricing policies subsidized fuels at lower rates or not at all. Table 2.3 shows the average yearly cost of fuel subsidies for each country in our sample as a share of GDP.[8]

Gasoline and diesel made up the lion's share of fuel subsidies between 2008 and 2014. As Figure 2.8 shows, on average, gasoline made up 39 percent of the value destined for fuel subsidies each year in Latin American and the Caribbean. Roughly 28 and 22 percent of fuel subsidies went to diesel and natural gas respectively. Although LPG subsidies made up only 8 percent of total fuel subsidies, a large share of LAC countries subsidized LPG. In other words, while the monetary value of LPG subsidies is small when compared to other fuels, there was a higher propensity for LAC countries to subsidize LPG because it is typically used by low-income households for heating and cooking. When taking into account the full sample size of 26 Latin American and Caribbean countries, roughly 70 percent offered some type of price support for LPG between 2008 and 2014.

**Figure 2.8 Distribution of Subsidies in LAC by Fuel Type (% of Total Value in $US), Average 2008–14**



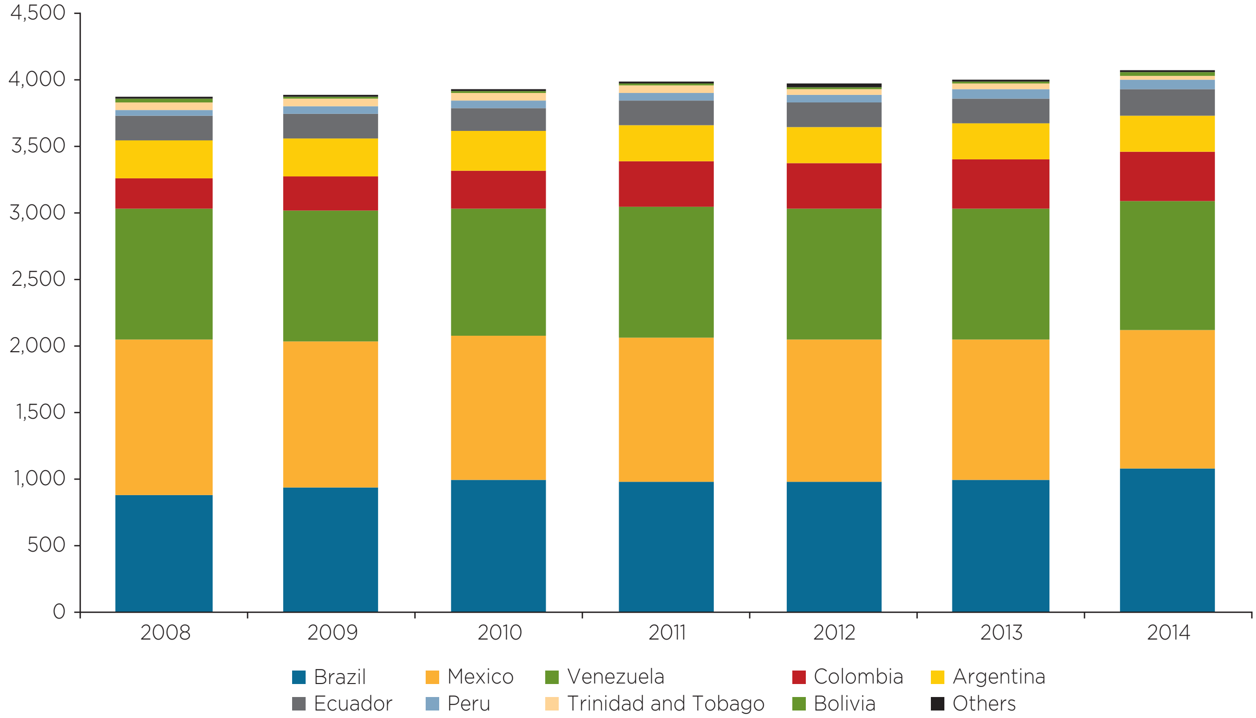

*Source:* IADB calculations.

## *Oil and Gas Wealth and Fuel Subsidies*

There is an important correlation between the pricing mechanism chosen by a country, the degree to which it subsidizes fuels, and its level of oil and gas wealth. Fuel subsidies—like oil and gas resources—are highly concentrated in a few LAC countries that tended to follow discretionary pricing policies during the sample period. Latin America and the Caribbean accounts for 20 percent of the world's proven conventional oil reserves and 4 percent of proven conventional gas reserves (Walter, 2016). Yet, more than 90 percent of the region's conventional oil reserves are located in Venezuela, while Brazil, Mexico, Ecuador, Argentina, and Colombia account for the rest. Similarly, Venezuela holds

[8] For countries covered by Beylis and Cunha (2017)—Bolivia, Brazil, Colombia, the Dominican Republic, El Salvador, Honduras, Haiti, Mexico, and Peru—data is only for 2008–13.

**Figure 2.9 Oil Production in LAC (Millions of bbls), 2008–14**




*Source:* International Energy Agency (2016b).

more than 66 percent of LAC's conventional gas reserves, while Mexico, Brazil, Peru, Trinidad and Tobago, Argentina, and Bolivia possess the rest.[9] As could be expected, oil and gas production in the region is concentrated in this set of countries (Figures 2.9 and 2.10).

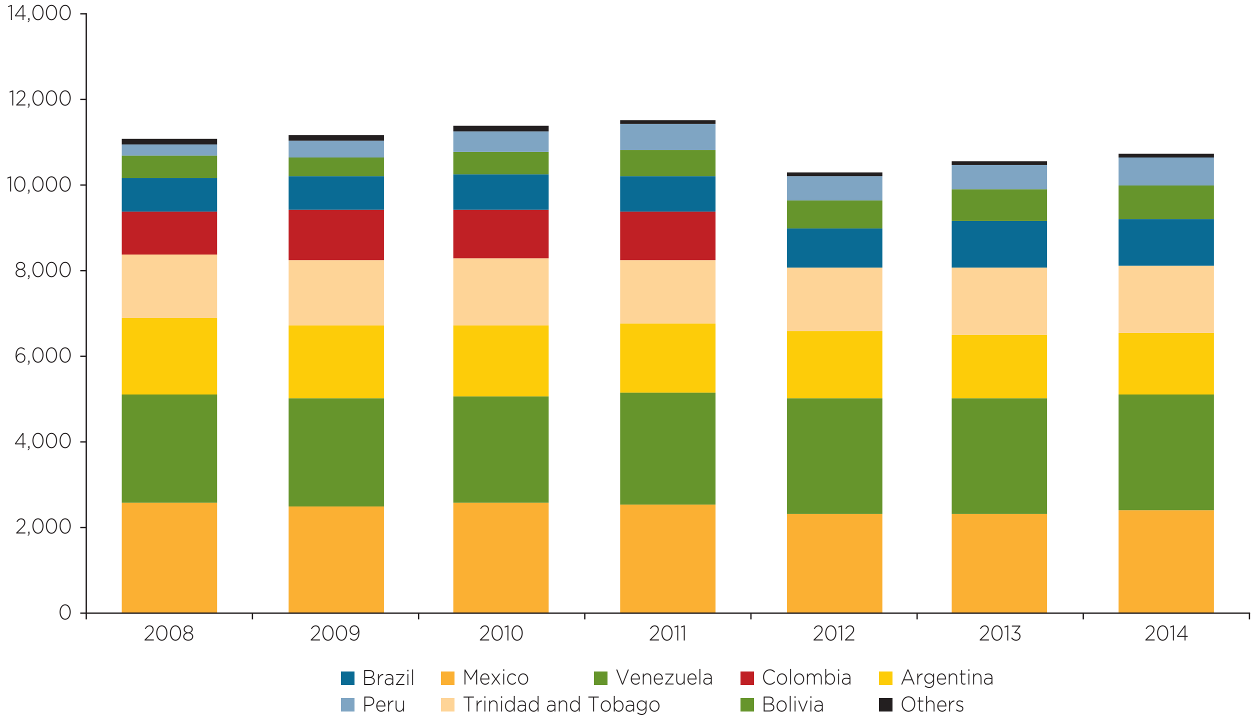
All large oil- and gas-producing countries in LAC followed discretionary pricing policies, not simply as a way to counteract fuel price volatility but often also as a way to distribute the country's resource wealth to the public. For this reason, price-setting tended to be politicized and price distortions present on a regular basis. This was particularly true for the region's net exporters of oil, gas, and fuels: Bolivia, Ecuador, Trinidad and Tobago, and Venezuela. On the other hand, when and if net importers of oil, gas, or fuels offered price supports, they tended to do so in response to price shocks and rarely resorted to fixing fuel prices or suspending adjustments continuously. This often resulted in more limited fuel subsidies, if any. Figure 2.11 shows the link between a country's net exports of hydrocarbons, its chosen pricing policy, and the associated cost of fuel subsidies.

### *State Participation in the Sector and Fuel Subsidies*

The market structure of the hydrocarbons sector in LAC countries rich in oil and gas also influenced the manner in which fuel-pricing policies were implemented during this time period. State-owned companies dominate the production of hydrocarbons in Latin America and the Caribbean and are present in every producing country except Guatemala (Table 2.4). Private participation in upstream activities is usually limited, although international oil companies are typically involved in more technically

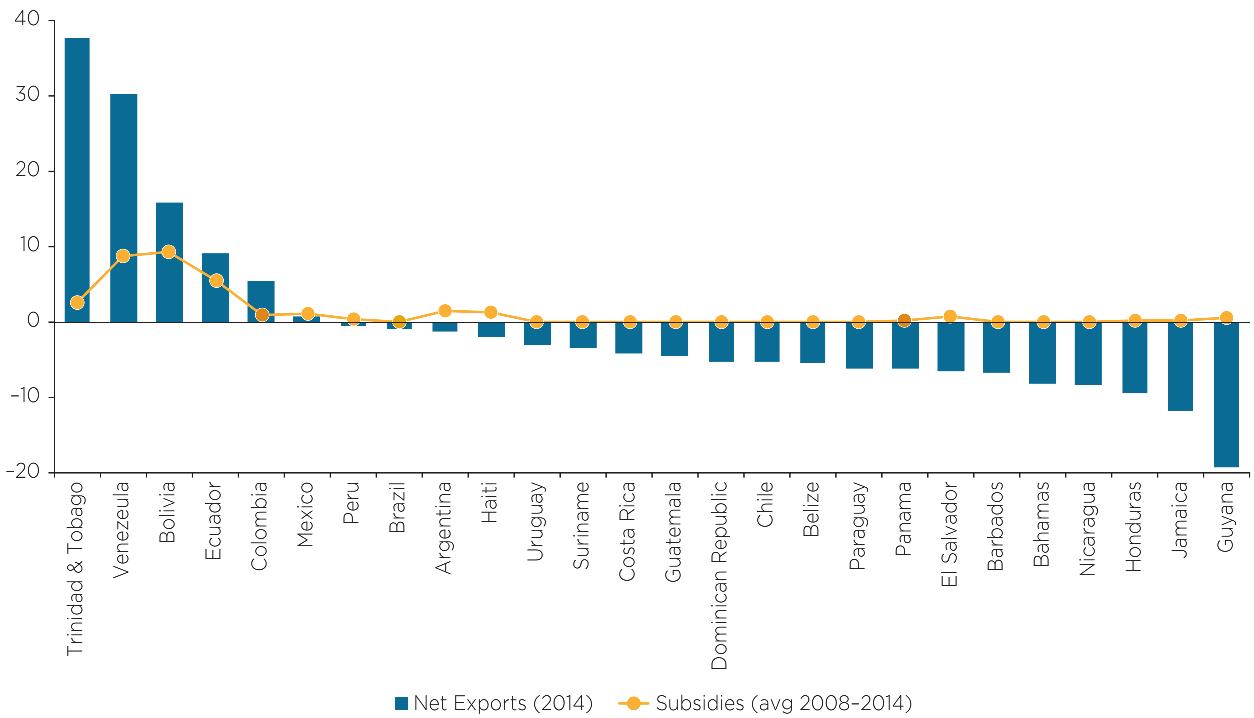
[9] To be sure, other LAC countries have oil and gas reserves, yet these make up a small fraction of the regional total.

**Figure 2.10 Natural Gas Production in LAC (Bcf), 2008–14**




*Source:* International Energy Agency (2016b).

**Figure 2.11 Net Exports of Oil, Natural Gas, and Petroleum Products vs Fuel Subsidies (% of GDP)**




*Source:* UN Comtrade (n.d.) and IADB calculations.

**Table 2.4 Market Structure of the Oil and Gas Sector in LAC**

| Country | Price Setting | Production | Refining | Import / Export | Distribution & Retail |
|---|---|---|---|---|---|
| Argentina | Discretionary | State (YPF) and private participation | State (YPF) and private participation | State (ENARSA) and private participation | State (YPF) and private participation |
| Bahamas | Discretionary | | | Private participation | Private participation |
| Barbados | Discretionary | State (BNOC) and private participation. Stopped producing natural gas in 2010. | | State monopoly (BNOC) | State (BNOC for oil derivatives and NPS for natural gas) and private participation |
| Belize | Discretionary | Private participation | | Private participation | Private participation |
| Bolivia | Discretionary | State (YPFB and Petrobras Bolivia) and private participation | State (YPFB and Petrobras Argentina) and private participation | State monopoly (YPFB) | State (YPFB) and private participation |
| Brazil | Discretionary | State (Petrobras) and private participation | State (Petrobras) and private participation | State (Petrobras) and private participation | State (Petrobras) and private participation |
| Colombia | Discretionary | State (Ecopetrol) and private participation | State (Ecopetrol) and private participation | State monopoly (Ecopetrol) | State (Grupo EPM) and private participation |
| Dominican Republic | Discretionary | | State monopoly (Refidomsa) | State (Refidomsa) and private participation | Private participation |
| Ecuador | Discretionary | State (Petroecuador until 2012, Petroamazonas, Operaciones Rio Napo) and private participation | State monopoly (Petroecuador) | State monopoly (Petroecuador) | State (Petroecuador) and private participation |
| El Salvador | Discretionary | | Private participation | Private participation | Private participation |
| Guatemala | Discretionary | Private participation | Private participation | Private participation | Private participation |
| Guyana | Discretionary | | | State (Guyoil) and private participation | State (Guyoil) and private participation |
| Honduras | Discretionary | | | Private participation | Private participation |
| Haiti | Discretionary | | | State monopoly | Private participation |
| Jamaica | Discretionary | | State monopoly (Petrojam) | State (Petrojam) and private participation | Private participation |
| Mexico | Discretionary | State monopoly (PEMEX) until recently | State monopoly (PEMEX) | State (PEMEX) and private participation | State (PEMEX) and private participation |
| Paraguay | Discretionary | | | State (Petropar) and private participation | State (Petropar) and private participation |
| Peru | Discretionary | State (Petroperu) and private participation | State (Petroperu) and private participation | State (Petroperu) and private participation | State (Petroperu) and private participation |
| Suriname | Discretionary | State (Staatsolie) and private participation | State monopoly (Staatsolie) | State monopoly (Staatsolie) | Private participation |
| Trinidad and Tobago | Discretionary | State (Petrotrin) and private participation | State monopoly (Petrotrin) | State monopoly (Petrotrin and NP) | State (NP) and private participation for oil derivatives; State monopoly (NGC) for natural gas |
| Uruguay | Discretionary | State (ANCAP) and private participation | State monopoly (ANCAP) | State (ANCAP) and private participation | State (ANCAP) and private participation |
| Venezuela | Discretionary | State (PDVSA) and private participation | State monopoly (PDVSA) | State monopoly (PDVSA) | State monopoly (PDVSA) |
| Chile | Non-Discretionary | State (ENAP) and private participation | State monopoly (ENAP) | State (ENAP) and private participation | State (ENAP) and private participation |
| Costa Rica | Non-Discretionary | | State monopoly (RECOPE); inactive since 2011 | State monopoly (RECOPE) | State (RECOPE) and private participation |
| Nicaragua | Non-Discretionary | | | Private participation | Private participation |
| Panama | Non-Discretionary | | | Private participation | Mixed companies and private participation |

*Source:* IADB calculations.

challenging or risky plays. For those oil-producing countries that have refining capacity, state-owned firms also have a large market presence or enjoy a monopoly in refining. The dominance of state-owned companies in production, refining, and often in distribution, facilitated selling or transferring oil, natural gas, or refined products at subsidized prices for those countries pursuing discretionary pricing mechanisms during the sample period.

In an environment with controlled fuel prices, either firms or governments have to absorb the losses resulting from selling fuels at subsidized prices. If companies are state-owned and there is a lack of separation between firms and government, there is often less pressure to ensure full pass-through of international prices because losses can be financed off-budget and ultimately borne largely by government. Other, more opaque mechanisms of value transfer can also include special tax rules or credit granted to state-owned firms (Koplow, 2009). In Venezuela, Ecuador, Bolivia, Argentina, Brazil, and Trinidad and Tobago, state-owned companies across the supply chain played an important role in the implementation of pricing policies and often incurred a large share of the losses resulting from underpricing fuel products.

In the case of Ecuador and Venezuela, Petroecuador and Petróleos de Venezuela S.A. (PDVSA) have a monopoly in refining and distribution, allowing them to sell fuels below cost to retailers. Likewise, in Trinidad and Tobago and Bolivia, state-owned companies were also able to sell fuels below international prices. In Argentina, state-owned ENARSA imported many of the fuels—particularly natural gas—needed to satisfy domestic demand and sold them below cost, while refiner Yacimientos Petrolíferos Fiscales (YPF) influenced prices through its large market share. Similarly, in Brazil, state-owned company Petrobras possesses a de facto monopoly in refining and, through its close ties to government, controlled retail prices. The following sections will examine in detail the application and effect of chosen fuel pricing mechanisms for each of the 26 countries in our sample, in order from highest to lowest subsidies as a share of GDP.

## Discretionary Pricing Mechanisms

### *Bolivia*[10]

Bolivia is a large producer and exporter of natural gas. The country also produces crude oil, which is used to refine fuels primarily for domestic consumption. Like with many oil and gas producers, the country's energy matrix is highly dependent on hydrocarbons. In 2014, close to 85 percent of Bolivia's primary energy consumption came from oil and gas (International Energy Agency, 2016b). During the time period under study, Bolivia required imports to satisfy around 30 percent of its liquid fuels demand. The state plays a large role in the upstream and downstream sectors through Yacimientos Petrolíferos Fiscales Bolivianos (YPFB).

In 2004, the reference price for crude oil was set, by decree, equivalent to the West Texas Intermediate (WTI) average of the last 365 days minus US$6.29 per barrel and allowed to fluctuate within a band. The decree set the ceiling and floor price for crude at US$27.11 and US$24.53 per barrel respectively. The maximum price was used as the basis for calculating the retail price of all oil products. A special tax on hydrocarbons and fuels was considered in the pricing mechanism to help smooth retail prices. Yet, with the rise in oil prices experienced during the sample period, the ceiling price for domestic oil remained significantly below international prices and the special tax was not enough to absorb the price changes. Fuel prices were also fixed below international prices. The price of natural gas was also fixed by the government below its estimated opportunity cost. The VAT was levied on all fuels.

Over time, price distortions generated large subsidies and lowered the incentives for oil exploration and production in Bolivia. Companies preferred to invest in natural gas projects instead, given that a significant share of natural gas was being exported at higher prices. Low prices for oil and derivatives also increased smuggling to neighboring countries

[10] Information derived from World Bank (Beylis and Cunha, 2017).

where prices were higher. Yet, despite the elevated costs of subsidies, eliminating price distortions proved politically challenging in Bolivia. In 2010, the Bolivian government attempted to reduce subsidies to gasoline and diesel, increasing their price by more than 70 percent. Public protests ensued in response, which threatened political stability. The measures were reversed within days and prices returned to below-market levels.

### *Venezuela*

Venezuela has the largest proven reserves of conventional oil in the world and is among the top 10 countries with proven conventional gas reserves. It is also among the world's largest producers and exporters of crude oil and a founding member of the Organization of the Petroleum Exporting Countries (OPEC). During the time period under study, oil and natural gas made up roughly 90 percent of Venezuela's primary energy consumption (International Energy Agency, 2016b). The country is a net exporter of fuels. State-owned oil company PDVSA has a monopoly across the refining, distribution, and retail segments.

According to Venezuela's Organic Law of Hydrocarbons, all activities related to the distribution and selling of fuels are considered a public service. Moreover, by law, fuels are considered "essential goods" subject to price regulation. Fuel prices can thus be set in accordance with any mechanism that would prove adequate for the execution of the law. In 1997, gasoline and diesel prices were fixed through administrative resolutions enacted by the Ministry of Oil and Mining, at the behest of the executive branch, and remained so throughout the time period under study. Similarly, LPG prices were fixed starting in 2004.

In the case of natural gas, the Ministry of Oil and Mining and the Ministry of Production and Commerce set tariffs for final consumers according to the Gas Hydrocarbons Law. Formally, consumer tariffs were meant to reflect the acquisition price of gas at the dispatch center, the transport tariff, and the distribution tariff. Yet each of these components was fixed through resolutions. Moreover, hydrocarbons were exempt from the value-added tax but subject to a 30 percent consumption tax during the time period under study.

Throughout the sample period, fuel prices in Venezuela were set to the lowest levels in the world. Despite the country's oil and gas wealth, permanent price distortions and a lack of investment in exploration, production, and refining led to declines in output. PDVSA found itself in severe financial distress. The company's fiscal contributions and transfers to government programs plus exchange rate distortions, high inflation, and other debt and liabilities left it in a precarious financial position. Given the very low prices for fuels and crude oil prevailing in the country, smuggling to neighboring countries was also a serious issue during the sample period.

### *Ecuador*

Ecuador is a crude oil producer and a member of OPEC. Crude oil dominates the country's exports and is an important source of government revenue. In 2014, oil made up roughly 80 percent of the country's primary energy supply (International Energy Agency, 2016b). Despite the country's oil wealth, however, its fuel production was not enough to satisfy domestic demand during the sample period, particularly for diesel and LPG. Petroecuador has a monopoly over the country's refineries, which operated below capacity as a result of outdated infrastructure and technology. Between 2008 and 2014, fuel imports rose by roughly 50 percent.

According to Ecuador's Hydrocarbons Law, the executive branch has the authority to determine retail fuel prices. Between 2000 and 2005, the government typically increased fuel prices following changes in international prices and according to the country's fiscal needs. In 2005, fuel prices were frozen by decree, despite increasing international oil prices. Petroecuador financed the difference between the domestic selling price for fuels and import prices with revenues from crude oil exports, which the company managed before transferring to the government. Only the prevailing VAT is levied on fuels, though local fuel production is exempt.

Subsidized prices for LPG placed a particularly high burden on government given the fuel's extensive consumption. In response, the Ecuadorean government began encouraging the use of electricity in both the domestic and industrial sectors in order to reduce LPG use and eventually lift subsidies. In 2014, the government launched a new program to replace LPG cooking ranges with induction cooking ranges and LPG-based water heaters with electric heaters. Low prices also encouraged smuggling of fuels to neighboring countries, where the price of fuels was higher. In the case of diesel, there was an additional smuggling channel: local fishing ships that benefited from lower domestic prices sold the fuel offshore at international prices.

### *Trinidad and Tobago*

Trinidad and Tobago is unique in the Caribbean for its significant hydrocarbon resources, producing crude oil, natural gas, and refined products for both domestic use and export. In 2014, the country relied on natural gas for roughly 70 percent of its primary energy consumption, while oil made up the remaining 30 percent (International Energy Agency, 2016b).[11] The state has a strong presence in both the upstream and downstream segments for oil and gas. State-owned Petrotrin has an effective monopoly in oil refining and distribution, and state-owned National Gas Company (NGC) has a monopoly in natural gas distribution.

During the sample period, fuels were regulated according to a pricing formula. The formula included a reference price linked to international prices and a subsidy. The government calculated the reference price as the export parity price plus an excise duty, filling and handling fees, and a wholesale margin. Separately, the government set the regulated price, which was the price at which wholesalers were required to sell fuels to retailers. The difference between the reference price and regulated price was the government subsidy, which was paid to the wholesalers as a reimbursement. Regulated prices were neither linked to export parity prices nor targeted, but rather, applied as a blanket subsidy on all consumption. For natural gas, prices were partially linked to international prices and adjusted to reflect transport costs. Prices for large consumers were set through private contracts between consumers and NGC. The government did not apply the standard VAT to fuels, and excise taxes were different for each fuel.

During the sample period, fuel prices were consistently set below export parity prices, with the exception of natural gas, which remained above cost-recovery levels. Over time, the availability of low-cost energy in Trinidad and Tobago has led to a large share of energy-intensive industries. The industrial sector accounted for nearly three-fourths of Trinidad and Tobago's total energy consumption.

### *Argentina*

Between 2008 and 2014, close to 90 percent of Argentina's primary energy consumption came from oil and natural gas (International Energy Agency, 2016b). Traditionally, demand for fuels was satisfied largely with domestically produced hydrocarbons. Recently, however, declining production of both oil and gas forced Argentina to import a growing share of natural gas and petroleum products at higher prices. In 2010, Argentina became a net importer of energy products. The state plays a large role across the oil and gas sector through YPF, which is the largest refiner and marketer of fuels, and ENARSA, the state-owned importer of fuels.

In 2002, Argentina suffered a deep economic crisis and a large devaluation of the peso. In an effort to protect consumers from ensuing increases in fuel prices, the government suspended much of the sector's regulation through the Economic Emergency Law, which was still in place throughout the time period under study. Between 2008 and 2014, fuel prices were controlled through a system of discretionary regulations issued by various government agencies. Price controls were applied mainly to natural gas, which represented more than 50 percent

[11] Biofuels are also used in primary energy consumption but make up roughly 0.3 percent of consumption.

of Argentina's energy consumption, though prices for other fuels were also set in an ad hoc manner.

The average consumer price for natural gas remained consistently below the country's import parity price. For most consumers, natural gas prices were set indirectly by not authorizing necessary tariff adjustments. Moreover, as the need for imports increased, state-owned ENARSA began importing natural gas at higher prices and selling it domestically at lower prices. Prices for petroleum products, on the other hand, were technically free and allowed to increase modestly, but were still regulated in an ad hoc manner during the sample period. Prices for gasoline and diesel were controlled through different resolutions implemented by the Secretariat of Internal Commerce until 2012, and margins for refiners and retailers were subject to indirect and direct pressures. Since the partial nationalization of YPF in 2012, the government allowed YPF to increase the price of all fuels in order to boost investment in the sector. For most years in our sample, average prices for gasoline and diesel remained above reference prices, though diesel less so because it was favored by having lower excise taxes.

The tax system for fuels during the sample period was complex, with many different taxes imposed depending on the type of fuel. The VAT was applied to all fuels consumed domestically. Several excise taxes were levied on gasoline and diesel and varied by region. Export taxes have been a key tool to manage domestic fuel prices. Government increased export tariffs in order to isolate the country from international prices and lower retail prices (Di Bella et al., 2015). Notably, however, with the fall in oil prices starting in mid-2014, this resulted in gasoline and diesel prices that were higher than international prices.

During the period under study, subsidies resulted in significant financial burdens for firms and government, affecting Argentina's financial equilibrium and economy. Regulatory uncertainty and the dissociation between domestic and international fuel prices led to a decline in investment and a fall in oil and gas production. Low natural gas prices in particular caused some distribution companies to suffer losses, forcing financial defaults in many cases. In 2014, limited increases in transportation and distribution tariffs as well as wellhead costs for natural gas were authorized.

### *Haiti*[12]

Haiti is primarily reliant on biomass for energy. The country does not produce or import crude oil or natural gas, yet it imports all of the oil products it consumes. Although Haiti is not highly dependent on hydrocarbons for energy, it has the highest levels of poverty in Latin America and the Caribbean and is thus still vulnerable to oil price shocks. During the time period under study, a share of the country's fuel imports was financed through Petrocaribe—an alliance between Venezuela and many Caribbean nations to purchase oil and derivatives under preferential terms (Box 2). Yet the benefit was mostly channeled to fuels used in electricity generation. Haiti's retail sector for fuels is privatized, though the government has a monopoly over the import of petroleum products.

Despite Haiti's vulnerable economic position, fuel prices remained below import parity levels during the sample period and were frozen starting in 2011. Before 2008, fuel prices in Haiti were regulated through a formula that automatically adjusted domestic prices within a band to reflect changes in international prices. The formula incorporated import parity prices, distribution and retail margins, and customs and excise taxes to arrive at final consumer prices. If international prices increased or decreased by more than 5 percent, taxes would fall or rise to buffer end-user prices. Yet, with the increase in the price of oil in 2008, the government prevented automatic adjustments of margins, and tax revenues from oil products gradually eroded. In 2008 and 2009, excise taxes on fuels accounted for roughly 4 percent of total tax revenue. By 2013, fuel excise taxes practically disappeared as a source of tax revenues. There were large disparities in the taxation of the different fuel products, especially for customs duties, to promote diesel and

[12] Information derived from Beylis and Cunha (2017).

## Box 2: Petrocaribe

Petrocaribe is an agreement established in 2005 through which Venezuela exports oil and derivatives to Caribbean and Central American countries using concessional financing. In 2014, it was estimated that Venezuelan Petrocaribe exports reached roughly 45,000 bpd of crude oil and 76,000 bpd of oil products (Goldwyn and Gill, 2014). Current members include Antigua and Barbuda, the Bahamas, Belize, Cuba, Dominica, Dominican Republic, El Salvador, Grenada, Guyana, Haiti, Honduras, Jamaica, Nicaragua, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, and Suriname, though not all countries are active beneficiaries.

Bilateral arrangements between Venezuela and member countries specify import quotas and financing terms for each country, yet all agreements share basic characteristics. Petrocaribe allows countries to make up-front payments to Venezuela for a share of the total cost of imports. Up-front payments range from 30 percent to 95 percent of the cost, priced at market values. The higher the current oil price, the smaller the share the beneficiary pays up front. The remaining balance is loaned at 1–2 percent interest rates, with repayment periods ranging from 17 to 25 years.

The agreement does not require beneficiaries to pass on savings to consumers in the form of fuel or electricity subsidies. Indeed, few members used the financing to provide energy subsidies between 2008 and 2014, and instead channeled the savings into varied spending categories. Still, preferential financing did provide a significant benefit for fiscally constrained countries during periods of high oil prices. Between 2011 and 2013, for instance, it is estimated that deferred payments cost Venezuela an average of US$2.3 billion per year (*The Economist*, 2014).

At the same time, Petrocaribe also significantly increased the indebtedness of beneficiary countries. Financing from Venezuela has reached 10–20 percent of GDP in some cases, including 15 percent in Haiti and 20 percent in Nicaragua (Goldwyn and Gill, 2016). By making the financing to purchase fossil fuels cheaper, the agreement has also reinforced Central America and the Caribbean's already high dependence on expensive and polluting fossil fuels for power generation and transport.

Today, however, two factors decrease the relevance of the Petrocaribe agreement. First, lower oil prices mean that many member countries can pay for oil and derivatives imports without taking on additional debt. Second, Venezuela's dire economic situation makes Petrocaribe's future uncertain (Goldwyn and Gill, 2016).

kerosene consumption over gasoline. In 2011, prices on all liquid fuels were frozen below international parity levels.

### *Mexico*[13]

Mexico is a large producer and exporter of oil and gas. Like with many large producers, hydrocarbons represent a significant share of the country's energy matrix. During the sample period, more than 80 percent of Mexico's primary energy consumption came from oil and gas. While the country produced a large share of the refined products it consumed, it was also reliant on imports to satisfy demand. State-owned company Petróleos Mexicanos (PEMEX) had a monopoly in refining for most fuels.

The Mexican government used a price formula based on the import parity price to determine fuel prices. Yet, in the case of gasoline and diesel, authorities used taxes to smooth changes in final retail

[13] Information derived from Beylis and Cunha (2017).

prices. This policy led to occasional gaps between the cost and final retail price of fuels. A pricing formula set the wholesale price of gasoline and diesel equal to the international reference price, adjusting for quality, transport, insurance, and other necessary costs. Distribution and retail margins and taxes were added to make up the final price. Taxes included state duties, the VAT, and an excise tax—the Impuesto Especial sobre Producción y Servicios (IEPS)—that served as a price-smoothing mechanism.

At the same time, the government set target retail prices for gasoline and diesel in a discretionary manner and updated the IEPS taxes monthly to achieve that target. Thus, when international prices increased faster than the monthly tax adjustment, subsidies arose. The IEPS compensated for this difference by becoming negative, working as a subsidy rather than a tax. Discretionary price adjustments led to growing gaps between domestic and international prices, imposing subsidies mostly in the form of foregone tax revenue.

On the other hand, the prices for natural gas, kerosene, and fuel oil were aligned with international prices during the time period under study. LPG prices, however, were often set below international prices through presidential decrees. The Mexican government embarked on an ambitious reform of the energy sector in 2013 and 2014, in part with the goal of reducing subsidies. The transition from a discretionary pricing system to one where fuel prices would be determined by the market is detailed in the final section of this chapter.

### *Colombia*[14]

Colombia is an important producer and exporter of hydrocarbons in Latin America and the Caribbean. During the sample period, the country relied on oil and gas for roughly 67 percent of its primary energy consumption (International Energy Agency, 2016b). The state plays a large role in the upstream and downstream segments through state-owned company Ecopetrol.

Retail fuel prices have historically been subsidized. However, in 2007, the Colombian government created the Fondo de Estabilización de Precios de los Combustibles (FEPC), a price-stabilization fund, for gasoline and diesel to phase out subsidies and buffer prices from future volatility. The fund calculated a reference price called the Producer Income (PI), which corresponded to the wholesale cost of fuel, taking into account local production and imports. The PI was meant to approximate import parity prices and was allowed to change at a rate of up to ±3 percent for gasoline and ±2.8 percent for diesel in order to smooth changes in retail prices. Taxes and margins were added to reach final retail prices.

If the regulated PI did not fully reflect export parity prices, the fund covered the costs to producers of underpricing fuels and vice versa. Until 2011, however, the Ministry of Mines and Energy set the PI in a discretional manner each month, with no formal or strict relationship to correlate the two values. This led to the depletion of the FEPC's resources. This weakness in the scheme led to the inclusion of an automatic pricing mechanism for the PI in 2011. The PI was then calculated taking into account the historical market price of gasoline and diesel over the last 60 days. Although the fund was intended to be self-sustaining, it imposed large fiscal costs at times of price volatility. In 2013, the Constitutional Court repealed regulations that permitted negative differences between international parity prices and the PI to be funded by the FEPC, making the need for recurring subsidies to be financed from the national budget more acute. The Ministry of Mines and Energy fixed distribution margins and allowed retailers to set end user prices freely, though they were monitored regularly.

Colombia also provided targeted subsidies for LPG and natural gas. In the case of LPG, the government established a cross-subsidy pricing structure that ensured lower prices for lower-income households. As contributions from higher-income groups were not enough to cover subsidies, the government made up the difference. Average prices for natural gas generally reflected the cost of supply,

[14] Information derived from Beylis and Cunha (2017).

transportation, and distribution. After 2012, the VAT and an excise tax on fuels were replaced by a single national tax, adjusted annually for inflation. A regional tax was also levied on fuels. LPG was exempt from taxes.

### *El Salvador*[15]

Until 2012, El Salvador imported crude oil to be refined domestically. Today, the country imports all of the oil products it consumes, making it vulnerable to price shocks; fuel imports make up roughly 6 percent of the country's GDP. El Salvador has a fully privatized downstream sector for fuels.

Before 2011, the price of LPG had been fixed for over a decade and thus resulted in universal subsidies for LPG users. LPG subsidies were then reformed and targeted to lower-income households. After the reform, only low-income households and small businesses were eligible for the subsidy. A formula that included the import price of LPG plus appropriate margins was used to calculate reference prices before taxes. The resulting subsidy was calculated as the difference between the price determined by the formula and the final retail price applied to specific groups. The Fondo de Estabilización del Fomento Económico (FEFE), a stabilization fund, covered part of the cost, with the rest being made up by the government. Targeting the subsidy helped to reduce the cost of fuel subsidies.

The government also followed an import price parity formula for diesel and gasoline, which added distribution costs, margins, and corresponding taxes to wholesale fuel prices. The VAT and excise taxes are imposed on fuels. However, in order to cushion domestic prices from oil-price volatility, the government occasionally suspended excise taxes. In 2011, some excises taxes were suspended for six months.

### *Guyana*

Guyana does not currently produce oil or gas, although the country has two basins that are considered to be highly prospective. Guyana also does not have any refineries, so must import all of the oil products that it consumes. During the time period under study, biomass and imported oil products each accounted for roughly half of the country's total energy supply. Guyana's fuel imports represented between 15 and 25 percent of the country's GDP, making the country highly vulnerable to oil price shocks. Guyana importers, distributors, and retailers include a mix of state-owned and private companies.

Guyana is a part of the Petrocaribe agreement with Venezuela (Box 2). Between 2009 and 2011—the years for which there is official data—Petrocaribe accounted for between one-quarter and one-third of Guyana's fuel imports. Guyana's debt with Venezuela as a result of the agreement was estimated to be US$198 million at the end of 2013. Guyana used its domestic production of paddy rice to pay its Petrocaribe debts. Yet, while a large share of Petrocaribe imports were made under favorable long-term financing, Guyana's savings seem to not have been transferred directly into lower domestic pump prices. Between 2008 and 2014, domestic fuel prices were generally higher than their pre-tax import parity reference price. Domestic fuel prices were set freely.

At the same time, government did influence retail prices by adjusting excise taxes on fuels, particularly on gasoline and diesel. Excise taxes were calculated as an ad valorem tax, with a lower rate for diesel than for gasoline. Guyana's government periodically adjusted the excise tax rates through regulations passed by Parliament. According to the Guyana Energy Agency, excise taxes on gasoline and diesel were reduced in response to rising oil prices, such that the retail prices increased by less than the increase in import parity prices. The variation in timing and size of the adjustments to excise taxes suggest that they were done in an ad hoc fashion, with no predetermined time frame for adjustments. Fuels were also subject to the VAT. There were no taxes on LPG or kerosene. In addi-

[15] Information derived from Beylis and Cunha (2017).

tion, large consumers that directly imported fuels for their own consumption had tax-exempt status.

### *Peru*[16]

Peru is a producer and exporter of hydrocarbons. During the sample period, more than 70 percent of the country's primary energy consumption came from oil and natural gas. Though Peru produced most of the oil products it consumed, it relied on imports of crude oil to satisfy roughly 40 percent of its domestic demand (International Energy Agency, 2016b). Both private and state-owned firms participate in the upstream and downstream segments of the sector.

By law, activities related to crude oil and derivatives production were to be governed by competitive market principles. In the face of increasing international fuel prices, however, the Peruvian government adopted a price stabilization fund for fuels. The fund was created with the goals of mitigating the effect of increasing fuel prices on inflation and the economy, ensuring that future fuel prices would be more predictable, and incentivizing more stable economic policies without negatively affecting fuel producers and importers.

A reference price was set based on import parity prices reported by producers and importers. The reference price was allowed to fluctuate within a price band. Producers and refiners set wholesale prices freely and added appropriate taxes and wholesale margins. If the reference price rose above the fund's ceiling, the fund compensated firms for the difference and vice versa. Given the sharp increases in oil prices that took place during this time, however, the amount withdrawn from the fund could not be replenished and led to a growing gap between import parity prices and final consumer prices.

The level of subsidies should have been reversed during years with lower international fuel prices, yet political pressure to immediately pass through price decreases resulted in a discretionary application of the stabilization fund's rules. The state enacted several emergency measures to avoid increasing fuel prices. Transfers from the Treasury to the fund were needed in order to cover debt accumulated to producers and importers. The state levied two excise taxes and a VAT on fuels.

### *Honduras*[17]

Honduras does not produce or import crude oil or natural gas. Instead, the country imports all of the fuels it consumes, which amounted to more than 10 percent of GDP during the time period under study. More than 50 percent of the energy consumption in Honduras was derived from oil products, making the country vulnerable to oil price shocks. The country's distribution and retail sector are privatized. Venezuela was a major exporter of fuels to Honduras, prompting the country to join Petrocaribe (Box 2) for a short time in 2008. However, following a political conflict between the two nations in 2009, Venezuela cancelled all fuel shipments to the country.

Since 1992, Honduras followed a pricing mechanism based on a formula linked to the import parity price. Yet, over time and into the sample period, the government often deviated from the price-setting formula in response to political pressure or sudden increases in the price of oil. At times, the government amended the formula to reflect explicit fuel subsidies; renegotiated a temporary reduction in margins for importers, distributors, and retailers; unilaterally modified the formula to the detriment of importers; and, lastly, resorted to the temporary suspension of the formula altogether to avoid sharp price increases. Ad hoc adjustments led to deviations from international reference prices for all fuels in 2008, but prices generally followed import parity levels in other years included in the study. Kerosene was the exception, priced below its import parity price across all the years in the study.

Honduras applied an excise tax to fuels, which represented an important share of the fiscal revenue. According to the Dirección Ejecutiva de Ingresos, fuel taxes represented 15 percent of total tax rev-

16 Information derived from Beylis and Cunha (2017).

17 Information derived from Beylis and Cunha (2017).

enue in 2013. Yet taxes were also adjusted in an ad hoc manner. The fuel tax was revised by Congress several times. However, the executive branch also adjusted the pricing formula that, in practical terms, resulted in changes to the tax. Honduras levied a lower excise tax on kerosene and LPG.

### *Jamaica*

Jamaica imports crude oil and oil products. During the time period under study, Jamaica was reliant on oil for close to 70 percent of its primary energy consumption (International Energy Agency, 2016b). Given its limited refining capacity, the country relied on imports for the majority of its fuel consumption. As the operator of Jamaica's only refinery, state-owned Petrojam is Jamaica's only crude oil importer. Refined products, however, are imported by a number of companies besides Petrojam, including bauxite companies that use refined products directly and marketing companies that sell refined products to retail customers.

Jamaica is a member of the Petrocaribe agreement (Box 2), which allowed the country to import up to 21,000 barrels of oil per day from PDVSA under favorable financing. In 2014, Jamaica's debt with Venezuela was assessed at US$2.5 billion (Government of Jamaica, 2009). The country used cement by-products as partial payment for its Petrocaribe debts.

During the time period under study, wholesale fuel prices were set using a pricing formula that calculated the appropriate import parity price, a special consumption tax, and other charges and fees. Retail providers then set final retail prices freely, and these were tracked by government through weekly surveys. Jamaica applied the special tax on fuels at the wholesale level. The tax was an ad valorem tax for gasoline, diesel, and kerosene, but was a fixed rate per volume for LPG and fuel oil. The tax increased significantly on gasoline, diesel, and kerosene during some years under study, but it remained fixed for LPG. The percentage of the special consumption tax was adjusted down in 2011 and 2012 over concerns with rising fuel prices. The VAT was not applied to fuels.

### *Barbados*

Barbados produces a small volume of crude oil and, until recently, also produced natural gas. As the country does not have any domestic refineries, all crude oil is exported and refined products are imported. During the time period under study, Barbados relied on fuels to meet the vast majority of its energy demands. State-owned Barbados National Oil Company Limited (BNOC) operates as a monopoly in the fuel distribution segment.

Retail prices for petroleum products were regulated by the government and adjusted periodically to track international parity prices during the sample period. Between 2008 and 2010, price adjustments were made ad hoc. In 2008 and 2009, gasoline and diesel prices were capped in order to shield consumers from rapidly increasing oil prices. After 2010, fuel prices were adjusted monthly and included charges to replenish losses incurred by the previous price caps. Price-setting also involved some ad hoc adjustment in excise taxes to help smooth retail prices. Although fuel prices were not subsidized in the later periods of the study, the government retained the right to influence retail prices in the event of high oil prices. Retail prices for gasoline and diesel were calculated each month based on each fuel's average import parity price in the previous month.

### *Dominican Republic*[18]

The Dominican Republic does not produce hydrocarbons and thus relies on imports of both oil and gas. While the country does have refining capacity, it nevertheless imports more than 70 percent of the oil products consumed. During the time period under study, the Dominican Republic was a member of the Petrocaribe agreement and could import up to 30,000 barrels per day of crude or refined products from Venezuela. Refidomsa, a refinery partially owned by the state, has a monopoly over refining, while distribution and retail are fully privatized.

The mechanism used to set fuel prices in the Dominican Republic was based on a formula that

[18] Information derived from Beylis and Cunha (2017).

added regulated margins and taxes to the import price parity of fuels. The Ministry of Industry and Commerce published corresponding parity prices every week. Thus, during the time period under study, fuel prices generally reflected fluctuations in international market prices and the exchange rate. However, the government has also deviated at times from the pricing formula, freezing fuel prices to final users in response to spikes in international prices. In the face of increasing international oil prices, the government used an informal stabilization fund to absorb sharp fuel price increases, compensating with smaller price reductions in periods of falling prices. The compensation fund was not considered in any law or regulation. Losses resulting from pricing fuels below their cost were covered by profit shares in Refidomsa or by fuel tax revenues.

In 2008, the Dominican Republic adopted a pricing formula for LPG, which linked its domestic price to the import parity price. At the same time, explicit LPG subsidies were instituted for specific consumers. One program—BONOGAS—targeted low-income households through an existing social safety program, and another program targeted the public transport sector. BONOGAS provided qualifying households with six gallons of subsidized LPG per month. The transport program allocated 90 gallons of LPG per month to more than 19,000 vehicles. LPG was tax exempt, as were fuels used in electricity generation, mining, and some government roadwork projects. The VAT was not levied on fuels. Instead, fuels were subject to varied specific and ad valorem taxes.

### *Paraguay*

Paraguay imports all of the oil products it consumes. Between 2008 and 2014, regulation called for fuel prices to be set through presidential decrees. In practice, the executive branch set the maximum prices at which fuels could be sold without following an explicit formula, though the Ministry of Industry and Commerce advised the executive branch on price-setting taking into account import parity costs and margins. At the same time, the state could further influence retail prices through state-owned company Petróleos Paraguayos (Petropar), which is the country's largest importer. With respect to gasoline, for example, decrees established maximum prices at the pump and the government required that a minimum 50 percent of gasoline be imported by Petropar in order to influence the price.

A specific excise tax was levied on fuel products in Paraguay, with varied taxes for different fuels and also for different types of the same fuel. During the time period under study, the tax was modified by the government through decrees and was periodically adjusted, particularly if import parity prices experienced significant variations. Adjustments also reflected variations in the exchange rate and the need for increased tax collection. Gasoline faced the highest nominal tax, while diesel and jet fuel had the lowest taxes. Paraguay did not levy a VAT on fuels.

### *Bahamas*

The Bahamas imports almost all of its energy needs in the form of oil products. In 2014, fuel imports represented roughly 8 percent of the country's GDP, though this figure was much higher when oil prices were increasing. Although the Bahamas is an important storage and trans-shipment site for international oil and derivatives trade, the country does not have an operating refinery. The country's distribution and retail segments for fuels are privatized. The Bahamas was among the original members of the Petrocaribe accord (Box 2) but, unlike other member countries, it did not sign a specific supply agreement.

Between 2008 and 2014, final fuel prices in the Bahamas were consistently above import parity prices, yet the government used excise taxes in an ad hoc manner to stabilize fuel prices. Officially, the government was meant to levy specific and ad valorem excise taxes on gasoline and diesel. However, the government applied a number of discretionary exemptions to these taxes during the time period under study. The Bahamas does not levy a VAT on goods and services.

### *Belize*

Belize produces small volumes of crude oil, which it mostly exports because the country has no refining capacity. During the time period under study, a small share of LPG consumed was produced alongside crude oil and sold domestically. All other fuel demand was met with imports. The upstream and downstream segments of the oil sector are privatized.

Belize is a member of the Petrocaribe accord (Box 2), but imports from Venezuela under the agreement were limited during the time period under study. Retail fuel prices were set based on a formula that included the import parity price plus additional margins and taxes. Belize levied a number of taxes on imported fuels during the time period under study, including an environmental tax and a general sales tax. Combined, these taxes represented a large share of the final retail price of fuels. Excise taxes were levied at different rates for each fuel, but generally rose as a percentage of import costs until 2008. After 2008, taxes steadily declined as the cost of each fuel rose. Gasoline taxes in particular fell significantly during the price spike in 2008. Taxes remained steady as a percentage of the import cost of fuels from 2011 until late 2014. Overall taxation rates on gasoline were much higher than taxation of diesel and kerosene. Kerosene is used by rural populations for cooking and lighting, so it received a favorable tax treatment. LPG was exempt from the general sales tax.

### *Brazil*[19]

Brazil is among the largest producers of hydrocarbons in Latin America and the Caribbean. During the sample period, more than 50 percent of the country's primary energy consumption came from hydrocarbons, primarily crude oil (International Energy Agency, 2016b). Although Brazil has a large refining capacity, in 2014 the country imported roughly 20 percent of the oil products and 40 percent of the natural gas that it consumed. State-owned company Petrobras has a strong presence throughout the sector, including a de facto monopoly in refining for most fuels.

Price-setting for fuels was theoretically free of regulation during the sample period, but prices were indirectly controlled by government through Petrobras. Brazil's Minister of Finance served as the President of the Board of Petrobras alongside other members appointed by the government, who together held a majority of votes on the Board. Government was thus able to influence price-setting for fuels. In practice, prices were set ad hoc, without following a pre-determined formula. Between 2008 and 2014, full pass-through of international prices was avoided several times in response to rising domestic inflation and large increases in the price of oil. The burden of any resulting price distortions, primarily for gasoline and diesel, was absorbed by Petrobras.

The refinery price of LPG was fixed since 2003. Kerosene, on the other hand, remained above its import parity price during the sample period. Petrobras was also able to influence the price of natural gas through its market share. During the time period under study, prices for natural gas varied depending on whether it was locally produced gas, imported gas, or gas for power generation. Brazil used fuel taxes as a mechanism for smoothing increases in fuel prices. A regional consumption tax and several excise taxes were levied on fuels, including the Contribuição de Intervenção no Domínio Econômico (CIDE), an excise tax exclusive to fuels that was implemented to buffer retail prices from changes in international prices. With the increase in oil prices, CIDE's tax rate was gradually reduced until it was ended 2013.

### *Guatemala*

Guatemala is a small oil producer. The country has limited refining capacity and must import most oil products consumed domestically. Both the upstream and downstream oil segments are fully privatized, with multiple companies engaged in the marketing, distribution, and oil production. In 2008,

[19] Information derived from World Bank (Beylis and Cunha, 2017).

Guatemala joined Petrocaribe (Box 2), however, no imports under the agreement were registered during the time period under study.

Between 2008 and 2014, prices were freely set by private actors throughout the supply chain. Retail fuel prices remained consistently higher than reference prices. Nevertheless, taxes were altered in an effort to regulate final consumer prices. Fuels in Guatemala were subject to the VAT and an excise tax on the Distribution of Crude Oil and Petroleum-Derived Fuels, though there were several subjective exceptions of both taxes. There is no adjustment mechanism for these taxes.

### *Suriname*

Suriname produces crude oil and refines its production locally but must still import a large share of oil products to meet demand. During the time period under study, close to 95 percent of the country's primary energy consumption came from crude oil. Crude oil exports represented one of the main pillars of Suriname's economy. Staatsolie, the state-owned oil company, is the country's sole producer and refiner of oil. However, given the lack of refining capacity, a large share of refined petroleum products had to be imported.

Suriname liberalized domestic fuel prices in 2005 and adopted an automatic pricing mechanism that was linked to international parity prices. Suriname did not have a VAT during the years included in this study, but did charge an excise tax on fuels that was subject to discretionary implementation. In response to increasing international prices for fuels, the government often lowered taxes to below market levels. Authorities are presently considering plans to reinstate fuel taxes and allow international prices to be fully reflected in domestic prices, particularly as the country faces onerous fiscal constraints. The authorities raised taxes on gasoline and diesel sales in September 2015 and November 2016. In addition, in the context of a Stand-By Arrangement with the International Monetary Fund, the government is planning further fuel price increases to reflect international prices and exchange rate fluctuations.

### *Uruguay*

Between 2008 and 2014, close to 50 percent of Uruguay's primary energy consumption came from hydrocarbons, primarily crude oil (International Energy Agency, 2016b). Uruguay imports all of the crude oil it refines, and it is also a net importer of fuels. The country's state-owned Administración Nacional de Combustibles, Alcoholes y Pórtland (ANCAP) has a monopoly on refining, and has a large presence in other downstream segments.

Through ANCAP, the government established maximum prices for fuels at various points of sale during the time period under study. In practice, ANCAP submitted suggestions for prices for various fuels to Uruguay's Ministry of Industry and Energy considering import parity costs, fees and taxes, as well as distribution and retail margins, though there were no pre-established regulations that set forth pricing criteria. There was no mandatory timing for issuing prices, though it was customary to publish them biannually. ANCAP verified its suggested prices against non-binding reference prices calculated by Unidad Reguladora de Servicios de Energía y Agua (URSEA), the country's regulatory agency for energy and water. ANCAP's suggestions were then adopted by decree.

Natural gas tariffs were also established through decrees authorizing adjustments to the different categories of consumers at each distribution company. Private participation was fully allowed throughout the natural gas value chain. Natural gas prices were the highest in LAC because very high distribution margins were needed to cover investments in the distribution grid.

Taxes made up a large portion of the pump price for fuels. A VAT was levied on all fuels except gasoline and jet fuel. A specific tax, the Impuesto Específico Interno (IMESI), was also levied on sales of many different products in Uruguay, including fuels. The government did not levy the IMESI on diesel oil and instead only applied the VAT. The IMESI was adjusted on an annual basis, based on the evolution of the Consumer Price Index. However, some additional adjustments were added in recent years to reduce the fiscal deficit.

Throughout the time period under study, fuel prices remained consistent.

## Non-Discretionary Pricing Mechanisms

### *Panama*

Panama does not have an operating refinery and is thus reliant on imports to cover all of its fuel consumption. Panama has a free-trade zone for storage and commercialization of oil and derivatives. During the time period under study, all fuels that were consumed domestically were imported through the country's free-trade zone, meaning they were exempt from import duties. The downstream sector has a combination of mixed public-private companies and private companies.

Domestic prices were set in accordance with import parity prices, appropriate margins, and taxes. The government offered explicit targeted subsidies for LPG and diesel used in public transport. According to the Ministry of Commerce and Industry's hydrocarbons policy, the import parity price for fuels was defined as the maximum price that distribution companies could pay for imports in order to sell them in Panama. To obtain this value, a series of variable and fixed costs were considered, including an average of the US FOB price, plus or minus quality adjustments, transport, and operational and profit margins. The government defined the import parity price for all fuels and prices were revised every 14 days. Panama did not impose a VAT on fuels, but levied excise taxes that varied by product. Prices for all fuels except LPG were consistently above import parity prices including taxes. Diesel subsidies were targeted to public transport via special coupons that could be redeemed at participating service stations.

### *Costa Rica*

In the past, Costa Rica imported crude oil for refining, but was also forced to import the majority of the oil products that it consumed. Since 2011, Costa Rica's only refinery—Refinadora Costarricense de Petróleo (RECOPE)—has been shut down for upgrades and thus all fuels have to be imported. During the time period under study, RECOPE was still active in other downstream segments.

Between 2008 and 2014, fuel prices were regulated following a formula linked to import parity prices, which was automatically updated monthly. The government set maximum prices at two levels of the supply chain: wholesale and retail. In order to set the wholesale price, the average FOB price for the past 15 days was taken for each fuel product and multiplied by a percentage to cover RECOPE's distribution margins. RECOPE's margins were also revised regularly to reflect necessary adjustments in the company's costs and investment needs. If applicable, the difference between this reference price and the actual price paid by RECOPE for imports was added or subtracted. Taxes and margins were then added to this price to make up the maximum final retail price.

Fuels were exempt from import duties and the VAT but charged a single specific excise tax, which varied by product. In 2013, average taxes levied on fuels as a percentage of the net price were 46–52 percent for gasoline, 26 percent for diesel, 13 percent for kerosene, and 28–31 percent for LPG and fuel oil. The amount of the excise tax was adjusted quarterly according to the variation of the Consumer Price Index. The formula has been respected.

### *Chile*

During the sample period, Chile imported more than 90 percent of the oil and gas it consumed as well as a large share of fuels. Moreover, hydrocarbons made up more than 40 percent of primary energy consumption, making Chile's economy and households susceptible to price changes. The state-owned Empresa Nacional del Petróleo (ENAP) has a de facto monopoly on refining, while private companies also participate in the retail and distribution segments.

Since 1991, Chile has implemented price stabilization policies for fuels that sought to protect households from excessive but transitory price changes and allow households to adjust gradually to more permanent price changes. Chile has implemented four price stabilization funds to meet this goal. In 1991, the Fondo de Estabilización de los Precios del Petróleo (FEPP) was created to mitigate the effects of fuel price arising from the first Gulf War. Between 2005 and 2011, the Fondo para la Estabilización de Precios de Combustibles (FEPCO) served as the country's stabilization fund. In 2011, the FEPCO was replaced with the Sistema de Protección a los Contribuyentes (SIPCO), which was altered in mid-2014 and became the Mecanismo de Estabilización de los Precios de los Combustibles (MEPCO). During the time period under study, Chile's pricing policies were able to smooth out fluctuations in retail prices while generally remaining above calculated reference prices.

The FEPCO was created in response to the effects of Hurricane Katrina on fuel prices, as price increases following the hurricane could not be fully absorbed by the FEPP. The FEPCO set retail prices based on a price band that could fluctuate ±5 percent around a reference price. The reference price was set as the import parity price. The fund would subsidize domestic fuel prices whenever the parity price exceeded the price ceiling set by the band and charge higher taxes if prices dropped below the floor set by the band. Yet, in the face of significant increases in international fuel prices, the FEPCO was not able to recoup sufficient resources to cope with price fluctuations. Moreover, it was discovered that a large share of the subsidy outlay was benefiting large consumers that were exempt from a specific tax levied on fuels and had more capacity to absorb higher prices.

Thus, in 2011, the FEPCO was replaced with the SIPCO. The SIPCO followed a similar logic as the earlier price mechanisms but targeted price supports for households and other consumers that paid the specific fuel tax. Moreover, the SIPCO's price band was expanded to ±10 percent. Because the SIPCO's band was larger, the mechanism still allowed for significant pass-through of prices to end consumers. During the period under study, ENAP set weekly reference prices for fuels following an import price parity formula. The final retail price reflected the import parity price, the VAT and the specific tax on fuels, a price stabilization measure that could be positive or negative, and distribution and retail margins. In mid-2014, the SIPCO was replaced with the MEPCO, which, among other things, changed the width of the price band to ±5 percent and added a second band in Chilean pesos around the first band.

### *Nicaragua*

Between 2008 and 2014, Nicaragua imported all the crude oil and most of the refined products consumed domestically. Oil represented just over 20 percent of the country's primary energy consumption (International Energy Agency, 2016b). Biomass, on the other hand, represented more than 60 percent of the total. Nicaragua's only oil refinery had limited refining capacity, meaning that the country imported roughly 85 percent of the fuels that it consumed. Nicaragua was a member of Petrocaribe (Box 2) and imported all its crude oil from Venezuela. The downstream segment is privatized.

With the exception of LPG, liquid fuel prices were fully liberalized and set by individual companies competing for market share. Government set retail fuel prices for LPG based on the import parity price, wholesale and retail margins, and taxes. Nicaragua exempted fuels from the VAT and instead imposed two excise taxes on fuels. The Impuesto Específico Conglobado a los Combustibles (IECC) was levied on all fuel consumption except for fuel oil for power generation. The IECC was applied at different rates for each fuel type, and was also regionally differentiated for kerosene, diesel, and some gasolines. The second excise tax was for road maintenance. For the time period under study, retail fuel prices remained consistently higher than reference prices, margins, and taxes.

## Reforming Discretionary Fuel Pricing Mechanisms: The Case of Mexico

The Mexican government embarked on an ambitious reform of the energy sector in 2013 and 2014, in part with the goal of reducing energy subsidies. One of the goals of the energy reform was to open the hydrocarbons sector to private participation and to gradually move from a discretionary fuel pricing scheme to one where energy prices were fully liberalized, thereby eliminating subsidies.

Prior to the reform, PEMEX had a monopoly in production and refining. Fuel subsidies were granted mainly for gasoline and diesel and financed through the state budget. The government set target retail prices based on futures market prices for gasoline and diesel and updated the Impuesto Especial sobre Producción y Servicios to smooth out adjustments in retail fuel prices.

Following the reform, private companies are now allowed to participate in the exploration and extraction of hydrocarbons, refining, and the commercialization of fossil fuels. Starting in 2016, third-party permits could be granted for the sale of fuels to the public and private service stations (other than PEMEX franchises) could participate. And, beginning in 2017, free importation of gasolines and diesel was permitted.

The reform also put in place a gradual process for eliminating fuel subsidies and fully liberalizing fuel prices by 2018. Since 2016, fuel prices have been allowed to fluctuate within a price band, which is established annually by the Secretaría de Hacienda y Crédito Público (SHCP), taking into account expected inflation. The SHCP determines the monthly maximum retail price for fuels. If fuel prices exceed the established upper band, consumers will only pay the upper limit (or ceiling) and the differential is covered by the state with a new "supplementary quota" of up to 1 percent of GDP. If prices fall below the lower limit (or floor), consumers pay this price; the differential represents an additional income for the government. In 2017, the band system was determined for different regions of the country. And, by 2018, it is expected that prices will be fully liberalized. To prevent discretionary price adjustments, the energy reform turned the IEPS into a fixed component of the fuel price formation value chain. Since 2014, the country has not subsidized fuels.

# CHAPTER 3: **Electricity Subsidies in Latin America and the Caribbean**

## Price-Gap Method for Measuring Electricity Subsidies

Governments have strong incentives to intervene in the electricity sector. Not only is electricity a key input in many economic and household activities, the sector also requires significant capital investments and long-term planning to keep up with changing and growing demand. Furthermore, while electricity generation can often lend itself to competition, electricity transmission and distribution companies typically function as natural monopolies, as economies of scale make it more efficient for fewer, larger firms to operate in a given area. Consequently, appropriate government regulation is critical to ensuring consumer welfare and the sustainability of the sector.

As is the case in the fuels market, setting the appropriate price for electricity is a fundamental component of regulation. Unlike fuels, however, electricity is not always traded and thus no international parity price exists to serve as an optimal reference for determining domestic electricity prices. At the same time, the electricity sector is complex, and costs and government objectives can vary widely from country to country. Electricity costs are affected by many factors, including the costs and risks associated with the mix of technologies used in generation, and the transmission and distribution systems' overall dispersion, efficiency, and reliability.

The price-gap approach is also used in this study to estimate electricity subsidies. The method calculates the gap between the average final consumer tariff and an estimated reference price for electricity across five consumer categories: residential, commercial, industrial, government/public lighting, and other. If the final consumer tariff is below the estimated reference price, then the resulting deviation, or gap, reveals a price subsidy.[1]

Ideally, for developing countries where electricity demand is increasing, reference prices for electricity should be based on "long-term, system-wide optimization and integrated resource planning," considering the trade-offs amongst alternative sources of electricity supply and alternative end uses of electricity (Kojima and Koplow, 2015). Yet such comprehensive estimates are not available for most LAC countries. Thus, in this study, reference prices estimate the average cost of electricity generation, transmission, and distribution, without accounting for costs related to system expansion. Generation costs are weighted according to the share of each generation technology's electricity output per year, considering the international price of fuels in the case of thermal generation.[2] Moreover, as was the case with fuels, this study includes only the general consumption tax—usually the VAT or GST—in reference price calculations given data constraints.

Additionally, subsidy calculations include costs related to technical and non-technical losses, following the "hidden-cost" approach.[3] Technical

1 See Appendix I for technical details.

2 Some reference generation costs for the nine countries in Beylis and Cunha (2017)—Bolivia, Brazil, Colombia, the Dominican Republic, El Salvador, Honduras, Haiti, Mexico, and Peru—are calculated using different methods. See paper for technical details.

3 See Kojima and Koplow (2015) for a discussion.

losses are an inherent part of all power systems and occur as electricity moves from generation to final distribution. A certain level of technical losses is considered unavoidable and thus efficient. Yet non-technical losses—which include electricity theft and non-payment of bills, for example—result in lost revenue for utilities. Combined, an elevated level of losses can negatively impact the financial and operational health of a company if revenues are not high enough to cover operating costs or new investments. The hidden-cost approach for subsidy calculation considers that elevated losses are a form of cross-subsidy that requires supplying additional energy to satisfy demand, resulting in a higher unit cost of electricity for paying customers. Thus, this approach calculates the cost of electricity subsidies due to electricity tariffs being below cost-recovery levels as well as due to losses.[4]

It is important to clarify, however, that elevated losses are not a direct result of government intervention in pricing but instead reflect a utility's inefficient operations. For this reason, subsidy reform efforts should not aim to raise end-user prices for electricity high enough to cover costs resulting from a high loss rate, but rather address these inefficiencies through comprehensive sector reform. Still, as will be shown in the following sections, underpricing electricity through government action, can, over time, impair the profitability of firms and lead to a deterioration in services and in the electricity sector more broadly.

## Electricity Prices during the Oil Price Boom

Electricity generation makes up the lion's share of the total cost structure for electricity across countries in Latin America and the Caribbean. Each generation technology has associated fixed and variable costs. The Levelized Cost of Energy (LCOE) measures the average, net present value cost of generating each unit of electricity over the lifetime of a power plant. It is a good proxy for comparing the costs associated with various generation technologies. On average, hydropower and electricity produced from coal and natural gas have lower LCOEs than electricity produced from oil products and unconventional renewables. Hydro and natural gas are the dominant sources of electricity generation in LAC. In 2014, for example, 48 percent of LAC's electricity was generated from hydraulic sources, 27 percent from natural gas, 10 percent from oil products, 7 percent from coal, and 8 percent from biofuels, waste, and unconventional renewables (Figure 3.1).

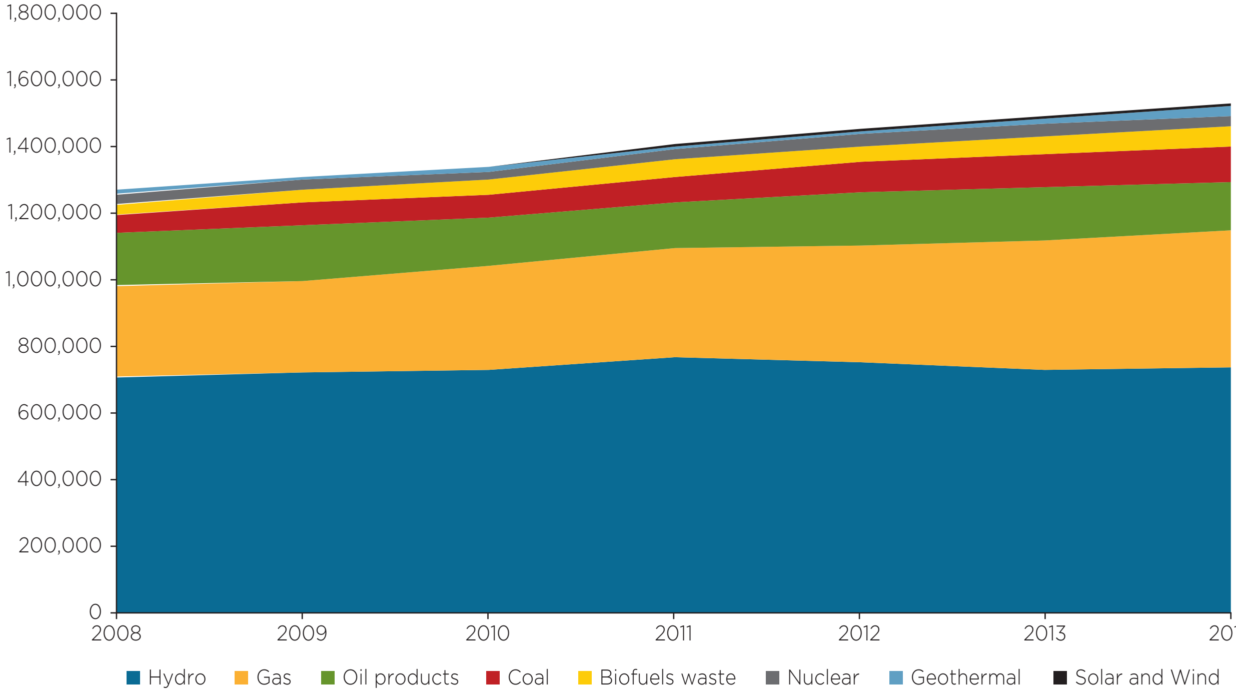
Yet the region's overall reliance on less costly sources of electricity masks the fact that many countries—particularly those in Central America and the Caribbean—are greatly dependent on oil products for electricity generation and thus often face very high electricity generation costs. In Central America and the Caribbean, for example, 60 percent of the electricity generated in 2014 came from oil products. Conversely, South American countries rely more on hydropower. An average of 56 percent of electricity was generated with hydraulic sources in these countries in 2014 (International Energy Agency, 2016b).

Still, even in Latin American and Caribbean countries with a significant share of hydropower in their generation matrix, electricity costs can depend on favorable hydrological conditions. Over the last decade and a half, the share of hydropower in LAC's generation mix declined as electricity demand continued to increase. Between 1980 and 2000, the share of hydropower in the region remained consistently above 60 percent, yet from 2000 until 2014, the share of hydropower fell from 61 percent to 48 percent, with the difference being largely made up by thermal energy generated from natural gas or oil products (International Energy Agency, 2016b). For many LAC countries, this has increased the sensitivity of electricity costs to changes in oil prices (Yépez-García and Dana, 2012).

Figure 3.2 shows the average, maximum, and minimum average final consumers tariffs for electricity in LAC between 2008 and 2014, inclusive of

[4] Beylis and Cunha (2017) do not use the hidden cost approach. See paper for more details.

**Figure 3.1 Electricity Generation by Source in LAC (GWh/year), 2008–14**




*Source:* International Energy Agency (2016b).

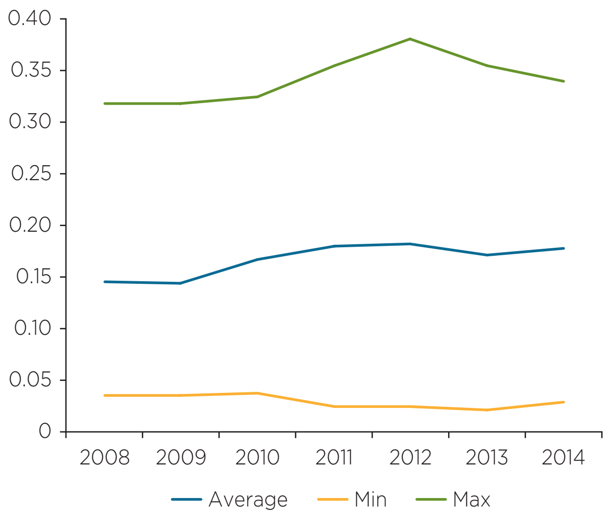
taxes. As was the case with fuels, there are significant differences in the prices paid for electricity among LAC countries. While consumers in some countries paid as high as 34 cents per kWh on average between 2008 and 2014, consumers in other countries paid as little as 3 cents per kWh on average. The variation in prices can be explained by two factors: the differences in the cost of supplying electricity across the region and the degree to which countries applied price controls during this time period. Setting electricity prices in a discretionary manner often led many LAC countries to subsidize electricity.

## Trends in Electricity Pricing Mechanisms

### How Are Electricity Prices Determined?

To understand how electricity subsidies arise, it is important to highlight how prices are typically determined in the market and through regulation. The electricity sector is broadly composed of three segments: generation, transmission, and distribution. Typically, electricity is generated by vertically integrated utilities, which generate, transmit, and distribute electricity to final consumers; indepen-

**Figures 3.2 Average Final Consumer Tariffs in LAC (US$/kWh), 2008–14**




*Source:* IADB calculations.

dent power producers (IPPs), which sell electricity to distributors, utilities, or large consumers through power purchase agreements (PPAs); or independent producers for self-consumption.

In many countries, wholesale electricity markets are managed through an "economic dispatch" system, wherein each generation plant's costs determine the order in which electricity produced is dispatched into the interconnected system, with the least expensive plants being dispatched first and so on until demand is fully satisfied. An economic dispatch system is meant to minimize the cost of electricity generated and reflect the system's marginal cost—or spot price—of electricity supply. In some countries, electricity distributors enter into long-term contracts with generators for a share of the electricity purchased and fulfill remaining demand through purchases in the spot market.

To ensure that both long-term and spot prices for generation reflect cost-recovery principles, generators' inputs, such as fuels, must also reflect their market value. When wholesale power prices are regulated, regulation should also reflect generators' market conditions. During the sample period, many countries that followed discretionary pricing schemes subsidized fuel inputs for electricity generation or capped wholesale power prices in an ad hoc manner, creating imbalances in the sector that sometimes led to large subsidy bills.

Prices for transmission and distribution services are formed differently than wholesale electricity prices. While generation prices can often be set in a competitive market, transmission and distribution firms function as natural monopolies within a geographical area or in the whole country if it is small. The electricity sector's regulator is generally responsible for setting tariffs and overseeing their proper implementation. Among other things, regulation for transmission and distribution tariffs should consider fixed and variable operating and maintenance costs, an appropriate rate of return for future investments, and schemes to incentivize efficiency.

Consumers in most Latin American and Caribbean countries are divided into two categories: regulated and unregulated. Regulated consumers broadly include residential, commercial, public lighting/government, and some categories of industrial consumers who purchase electricity from distributors and are thus subject to government-regulated tariffs. Unregulated consumers are typically large, industrial consumers who can negotiate the purchase of electricity directly with generators or distributors. Distributors are responsible for delivering electricity to final regulated consumers and charging customers according to the regulator's tariff schedule.

Electricity tariff schedules for regulated consumers vary by country and can be complex. Tariff schedules typically set out different price structures for various consumer categories and sub-categories. Consumers can be classified under various groups, such as sector (e.g., residential, commercial, industrial, etc.), geographical location, voltage level, level of electricity consumption, and time of use (peak versus non-peak) (Beylis and Cunha, 2017). Often, consumer categories—particularly in the residential sector—are further sub-divided and organized into an increasing block tariff (IBT) structure where the charge per unit of electricity consumed increases with consumption.

An IBT or similar pricing structures allow governments to provide subsidized "lifeline," or subsistence, tariffs to the first block of consumers—those with the lowest levels of consumption, which are generally also assumed to be low-income households. Subsidized or lower rates are typically extended to the first few consumption blocks, while consumers with higher levels of consumption pay higher or above cost-recovery prices in order to cross-subsidize consumption at lower levels. Among other charges, final tariffs are generally composed of a transmission toll, a charge for value-added distribution (VAD), and a charge to cover electricity generation costs.

## Pricing Mechanisms for Electricity in LAC

Price-setting mechanisms for electricity in Latin America and the Caribbean can also be classified as either discretionary or non-discretionary. Discretionary schemes are those where electricity tariffs are fixed or adjusted in an ad hoc manner,

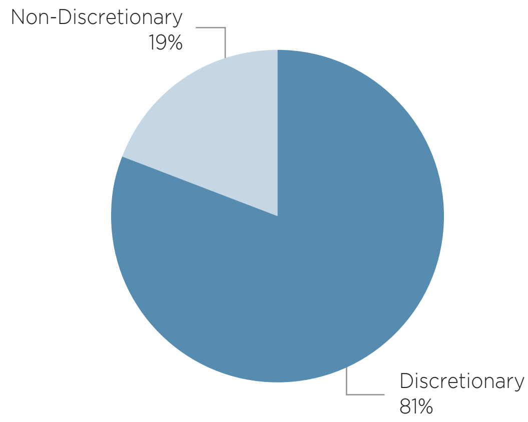
**Table 3.1 Typology for Electricity Pricing Schemes**

| Pricing Mechanism | Definition |
|---|---|
| Discretionary | Tariffs fixed or adjusted in an ad hoc manner. Or there is ad hoc government intervention in generation, transmission, and/or distribution markets to influence prices. |
| Non-Discretionary | Tariffs set and adjusted following sector regulation. Regulation of generation, transmission, and distribution segments follows rules-based, respected criteria. |

or those where governments intervene in a discretionary fashion in the generation, transmission, or distribution segments to influence prices. For example, governments sometimes cap wholesale electricity prices ad hoc, without considering sector regulation or following cost-recovery principles. Some governments also provide subsidized fuel inputs for electricity generation or leverage state-owned firms to purchase electricity at higher prices and sell at lower prices, without contemplating resulting subsidies in sector regulation. On the other hand, non-discretionary pricing mechanisms are those where electricity tariffs are determined and adjusted following established regulations, and regulation of the generation, transmission, and distribution segments is also adhered to in practice. Countries that follow either discretionary or non-discretionary pricing mechanisms may offer explicit subsidies for electricity (Table 3.1).

During the time period under study, the majority of Latin American and Caribbean governments followed discretionary price-setting mechanisms for electricity. Specifically, 21—or roughly 80 percent—of the 26 countries studied adopted discretionary pricing policies, either by freezing or adjusting tariffs ad hoc, or by intervening in the generation market in order to control electricity prices. Conversely, five—or roughly 20 percent—of the LAC countries in our sample followed non-discretionary pricing mechanisms, adhering to established regulations for setting and adjusting electricity prices. Figure 3.3 and Table 3.2 show the distribution and a summary of the pricing mechanisms followed by each of the 26 Latin American and Caribbean countries in our sample between 2008 and 2014.

**Figure 3.3 Distribution of Electricity Pricing Mechanisms in LAC, 2008–14**




Out of the countries that followed discretionary pricing mechanisms, roughly half intervened in the electricity generation segment to influence prices—specifically Argentina, Bolivia, the Dominican Republic, Ecuador, Guyana, Haiti, Honduras, Peru, Suriname, Trinidad and Tobago, and Venezuela. Some countries within this sub-group intervened in generation markets by subsidizing fuel inputs for thermal generation, including many oil and gas producers like Argentina, Bolivia, Ecuador, Peru, Suriname, Trinidad and Tobago, and Venezuela. Others capped wholesale generation prices in a discretionary fashion. In Argentina, for example, sector regulation was suspended in 2002 and the spot price at which distributors purchased wholesale electricity was capped at nominal levels for several years despite increasing inflation

## Table 3.2 Electricity Pricing Mechanisms by Country, 2008–14

| Country | Typology | Pricing Mechanism | Intervention in Supply Chain |
|---|---|---|---|
| Argentina | Discretionary | Tariffs varied geographically. Distribution costs were regulated regionally, while generation and transmission costs were regulated at the federal level. Numerous consumer categories and ancillary costs were considered. Sector regulation was suspended since 2002, following an emergency decree. Taxes varied according to province and consumer. The federal VAT was also charged. | Subsidized fuel inputs for private generators through ENARSA. Wholesale generation prices capped at nominal levels. CAMMESA purchased from generators at market prices and sold to distributors at capped prices, with government transferring the difference. Ad hoc tariff adjustments. |
| Bahamas | Discretionary | Electricity tariffs included a fuel and generation charge, a minimum charge to represent the cost of meter rental, and other adjustments meant to align tariffs with costs. | Fiscal transfers from government to cover operating deficit |
| Barbados | Discretionary | Five consumer categories considered: domestic (residential); general service (non-residential, mainly commercial); secondary voltage power (demand <5 kVA); large power (demand <50 kVA); street lighting. Tariffs included fuel surcharge adjusted monthly. Residential and general service tariff schedules had rising rates based on volume of electricity consumed for fixed charge and energy charge. VAT levied on electricity consumption. | Ad hoc tariff adjustments |
| Belize | Discretionary | Six consumer categories considered: social, residential, commercial, 2 industrial, and street lighting. Residential and commercial tariffs included 3 block rates depending on total consumption. Social and residential categories included a minimum charge, while the commercial and industrial categories had fixed charge. Both industrial categories also included a demand charge. Some segments were charged the VAT. | Ad hoc tariff adjustments |
| Bolivia | Discretionary | Several consumer categories considered. Maximum tariffs were set, indexed for inflation. Base rates consisted of a fixed charge, non-peak power charges, and charges for energy and peak power. Subsidized rates for residential consumers with up to 70 kWh/month and elderly consumers with consumption below 100 kWh/month. The VAT was applied to consumers. | "Subsidized fuel inputs. Wholesale electricity prices capped. Subsidies partially paid for by stabilization funds. |
| Brazil | Discretionary | Several consumer categories considered, varying by voltage and sector. Tariffs and taxes varied by region. Seasonal charges varied and were charged to some categories of consumers. | Ad hoc tariff adjustments |
| Colombia | Discretionary | Several consumer categories considered, including 6 residential classes. Class 1 received a 50% subsidy on the kWh unit cost of electricity, class 2 received a 40% discount, and class 3 received a 15% discount. Residential and non-residential consumers in other classes were charged higher rates to cover subsidies to lower classes. Consumption exempt from the VAT. | Ad hoc tariff adjustments to categories meant to cover cross-subsidies |
| Dominican Republic | Discretionary | Seven consumer categories considered according to sector and voltage. A formula-based tariff contemplated a base tariff rate, indexed by the price of Fuel Oil No.2, the CPI of the Dominican Republic and the USA, and the exchange rate of pesos per USD. BONOLUZ covered the first 100 kWh of consumption for low-income households. Exempt from VAT. | Subsidized wholesale electricity sold through CDEEE. Hydro power generated by EGEHID sold at subsidized prices. Ad hoc tariff adjustments. |
| Ecuador | Discretionary | Several consumer categories considered. Tariffs covered reference generation costs, transmission costs, and average distribution costs. Residential consumers with consumption <110 kWh/month in the highland region or <130 kWh/month in the coastal region subject to the "dignity tariff." Other subsidies and cross-subsidies existed. Consumption was exempt for the VAT. | Subsidized fuel inputs for CELEC through Petroecuador. By law, distribution tariffs prohibited from covering costs related to the expansion of the system. Explicit subsidies recorded. |
| El Salvador | Discretionary | Three categories of consumers were considered: small, medium, and large. Categories were further subdivided by energy consumption or voltage. Tariffs included fixed charges for commercialization and marketing, distribution, and energy costs. | Temporary universal subsidies implemented |
| Guyana | Discretionary | Four consumer categories considered: residential, commercial, industrial, public lighting. Each categories had two sub-categories and tariff structures: standard and "government." Government rates across consumer classes tended to be higher than standard rates. In some categories, higher rates were applied to customers with higher electricity consumption. | Subsidized fuel inputs for GPL |

*(continued on next page)*

**Table 3.2 Electricity Pricing Mechanisms by Country, 2008–14** *(continued)*

| Country | Typology | Pricing Mechanism | Intervention in Supply Chain |
|---|---|---|---|
| Honduras | Discretionary | Six consumer categories considered: residential, low voltage, high voltage, public service, water pumping, industrial. Residential tariff rates increased by block. Other tariffs included various extra charges. Tariffs included a correction factor to capture changes in fuel prices and exchange rate fluctuations. Most consumer categories exempt from the VAT. | PPAs uncompetitive. Generation purchases made by ENEE through decree throughout time period. Ad hoc tariff adjustments. |
| Haiti | Discretionary | Several consumer categories considered: residential, commercial, governmental organizations, and industrial. Tariffs had a fixed charge for all users. Residential clients with consumption levels up to 200 kWh/month paid a tariff that was almost half of the tariff paid by customers with consumption above 200 kWh per month. | Subsidized fuel inputs (Petrocaribe). Tariffs were frozen in 2009. |
| Mexico | Discretionary | Several consumer categories considered. Tariffs varied by consumer, voltage, geographical location, and season. Some categories faced increasing rates depending on consumption. | Below-cost tariffs set ad hoc by CFE. Government partially absorbed subsidies by canceling CFE's tax obligations. |
| Nicaragua | Discretionary | Several consumer categories considered. Different rates applied to consumers based on tension level and sector. Residential and general tariffs included fixed charges and rising rates for increased consumption. Industrial and large consumer tariffs included charge for energy consumption and capacity. Irrigation and medium tension tariffs subject to a charge for peak and off-peak rates, differentiated between summer and winter. Preferential VAT for some consumers; other exempt. | Ad hoc tariff adjustments. Tariffs frozen for social category for part of the sample period. |
| Panama | Discretionary | Three categories of consumers considered: low, medium, and high tension, with sub-categories for basic service, service with a peak demand charge, and service with on- and off-peak rates. Subsidies offered to some consumer categories were covered by cross-subsidies and stabilization funds. Electricity was exempt from the VAT. | Ad hoc tariff adjustments. Tariffs frozen in 2014. |
| Paraguay | Discretionary | Single tariff schedule applied to the whole country, with separate tariff rates levied on different categories of consumers. A lower "social tariff" applied to roughly 300,000 residential clients, and increasing demand was priced at higher levels. Average tariffs for industrial and commercial consumers were lower than average tariffs for residential and public lighting/government consumers across sample period. VAT levied on consumption. | Tariffs frozen |
| Peru | Discretionary | Several consumer categories considered. Tariffs varied geographically. Cross-subsidies among different categories of users. Special charges added to some consumers to support specific policies. VAT levied on consumption. | Subsidized fuel inputs. Wholesale prices capped below costs through emergency decree. |
| Suriname | Discretionary | Two consumer categories considered: residential and non-residential. Residential tariffs had a block-tariff structure with seven blocks and increasing fixed charges and rates per kWh for higher levels of electricity consumption. Non-residential tariffs included fixed charge, energy charge, and a demand charge per kVA, depending on consumer. | Subsidized fuel inputs for EBS through Staatolie. Ad hoc tariff adjustments. |
| Trinidad and Tobago | Discretionary | Five consumer categories considered: residential, commercial, industrial, heavy industrial, and street lighting. Residential block-tariff had a fixed charge and three blocks with increasing rates per kWh for higher levels of consumption. Commercial tariffs included a fixed charge and a single rate per kWh of energy consumed. Industrial and heavy industrial rates were differentiated based on maximum demand. | Subsidized fuel inputs for T&TEC through NGC. Ad hoc tariff adjustments. |
| Venezuela | Discretionary | Two consumer categories considered: residential and non-residential. Residential tariffs further distinguished between "social" and "general." The social category was heavily subsidized, with the first 200 kWh of consumption per month priced at US$0.001/kWh and excess consumption priced at US$0.01/kWh. Electricity was exempt from the VAT. | Subsidized fuel inputs for CONOLEC through PDVSA. Ad hoc tariff adjustments. |
| Chile | Non-Discretionary | Tariffs included node price charges for electricity consumption, charges for VAD, and a transmission toll. Subsidized rates applied to residential consumers facing an increase of 5 percent or more in electricity tariffs over six months. VAT levied on electricity consumption. | |

*(continued on next page)*

**Table 3.2 Electricity Pricing Mechanisms by Country, 2008–14** *(continued)*

| Country | Typology | Pricing Mechanism | Intervention in Supply Chain |
| --- | --- | --- | --- |
| Costa Rica | Non-Discretionary | Five consumer categories considered: residential, general, preferential, medium tension, and public lighting. Residential, general, and preferential categories were volume differentiated, with consumers with larger demands paying higher rates. Medium tension category paid tariffs based on time of use (peak, off-peak, and night). Initial 200 kWh of consumption subsidized for residential consumers; preferential tariff category also subsidized. Reduced GST for residential consumers; some categories exempt. | |
| Guatemala | Non-Discretionary | Two consumer categories considered: social and non-social. Tariffs based on average cost of supply and charges for transmission and distribution. Sub-categories included separate rates based on level of consumption, and some included distinct schedules for on- and off-peak consumption and electricity delivered at either low tension or medium tension. Tariffs adjusted each quarter to reflect changes in the wholesale cost of electricity and inflation. VAT levied on electricity consumption. | |
| Jamaica | Non-Discretionary | Five consumer categories considered: residential, general service, low voltage, medium voltage, and street lighting. Residential consumer rates based on an increasing block-tariff structure, with the first 100 kWh/month priced at less than half the rate of consumption <100 kWh. Other categories paid a flat rate per kWh and a fixed fee per month. Larger consumers paid demand charges per kW, or option to pay a flat rate or rate differentiated by time of use. Rates adjusted annually. | |
| Uruguay | Non-Discretionary | Several consumer categories are considered. Tariffs for residential consumers were based on time of use, with higher rates for peak hours. Tariffs were designed under a cost-plus scheme. The VAT levied on electricity consumption. | |

*Source:* IADB calculations.

and the devaluation of the Argentine peso, forcing government to compensate privately owned generators for the difference. Lastly, another group of countries leveraged state-owned firms to purchase or generate electricity at higher prices and sell at subsidized prices. In the Dominican Republic, for example, state-owned firms purchased and generated energy at higher prices and sold it at lower prices, often accumulating debt with generators.

Most Latin American and Caribbean countries that adopted discretionary pricing schemes—including many that also intervened in generation markets—prevented the full pass-through of higher electricity costs to consumers by making ad hoc adjustments to end-user tariffs or freezing them altogether for some or all categories of consumers. In Venezuela, for instance, electricity tariffs remained among the lowest in the world for several years despite rising costs in electricity generation. In Belize, prolonged discretionary tariff adjustments led to relatively elevated electricity subsidies and eventually to the nationalization of Belize Electricity Limited, following a multi-year legal dispute stemming from the government preventing tariff increases. In some countries, a combination of discretionary interventions was applied to regulate electricity prices.

On the other hand, only a small group of LAC countries followed non-discretionary pricing mechanisms during the sample period, specifically Chile, Costa Rica, Guatemala, Jamaica, and Uruguay. These countries set and adjusted electricity tariffs according to sector regulation. Moreover, there was no evidence of discretionary intervention in the electricity sector's supply chain in these countries. Instead, tariff-setting followed cost-recovery principles at every segment. Each country's context and pricing scheme is described in detail in the country summaries in the sections to follow.

## Electricity Subsidies and Pricing Mechanisms

A country's chosen mechanism to regulate electricity prices influenced the level and scope of resulting subsidies during the sample period. Countries that followed discretionary pricing mechanisms tended to prevent the cost of supplying electricity from being fully passed-through to final consumers, resulting in elevated subsidies for many countries. Table 3.3 shows the average yearly cost of electricity subsidies for each country in our sample as a share of GDP.[5]

Electricity subsidies were particularly burdensome for countries that intervened in electricity generation markets in an ad hoc manner to influence prices. Ecuador, Guyana, Haiti, Suriname, Trinidad and Tobago, and Venezuela subsidized fuel inputs for generators, underpricing the cost of wholesale electricity. Argentina, Bolivia, and Peru subsidized fuel inputs for generators and also capped wholesale power prices ad hoc. The Dominican Republic sold electricity below cost through state-owned enterprises and Honduras executed power purchase agreements between the state-owned utility and IPPs through emergency decrees.

Still, as was previously discussed, almost all of the LAC countries that adopted discretionary pricing mechanisms during the sample period, including many of those that also intervened in generation markets, did so by adjusting or freezing end-user tariffs in a discretionary manner. State-owned companies bore the lion's share of resulting subsidies in most countries.

Conversely, Latin American and Caribbean countries that followed non-discretionary pricing policies tended to subsidize electricity at much lower rates or not at all. If present, electricity subsidies in these countries arose infrequently during the sample period. In fact, most subsidies were concentrated in 2008—a year that saw a large spike in the price of oil, leading to an increase in electricity generation costs for most countries in the region. Jamaica and Costa Rica were the only two countries that did not subsidize the electricity sector between 2008 and 2014 according to the price-gap method.

Most Latin American and Caribbean countries extended electricity subsidies primarily to residential consumers. Close to half of all electricity subsidies provided in the region during the sample period were destined for this sector (Figure 3.4). Tariff schedules in most countries set forth a cross-subsidization structure whereby explicit subsidies were extended to certain residential consumers, while other sectors or consumers paid higher prices. LAC countries typically extended explicit subsidies to poorer households, for whom

[5] For countries covered by Beylis and Cunha (2017)—Bolivia, Brazil, Colombia, the Dominican Republic, El Salvador, Honduras, Haiti, Mexico, and Peru—data is only for 2008–13.

**Table 3.3 Electricity Subsidies by LAC Country (% of GDP), average 2008–14**

| Pricing Mechanism | Subsidies (% of GDP) | Country |
|---|---|---|
| Discretionary | 3.8 | Suriname |
| Discretionary | 3.4 | Venezuela |
| Discretionary | 2.2 | Nicaragua |
| Discretionary | 1.9 | Trinidad &Tobago |
| Discretionary | 1.7 | Belize |
| Discretionary | 1.6 | Argentina |
| Discretionary | 1.6 | Honduras |
| Discretionary | 1.2 | Bolivia |
| Discretionary | 1.0 | Ecuador |
| Discretionary | 0.8 | Guyana |
| Discretionary | 0.8 | Panama |
| Discretionary | 0.8 | Dominican Republic |
| Discretionary | 0.8 | Mexico |
| Discretionary | 0.7 | Peru |
| Discretionary | 0.6 | Barbados |
| Discretionary | 0.5 | Colombia |
| Discretionary | 0.2 | El Salvador |
| Discretionary | 0.2 | Brazil |
| Discretionary | 0.1 | Haiti |
| Discretionary | 0.1 | Bahamas |
| Discretionary | 0.1 | Paraguay |
| Non-Discretionary | 0.1 | Chile |
| Non-Discretionary | 0.1 | Guatemala |
| Non-Discretionary | 0.1 | Uruguay |
| Non-Discretionary | 0.0 | Costa Rica |
| Non-Discretionary | 0.0 | Jamaica |

*Source:* IADB calculations.

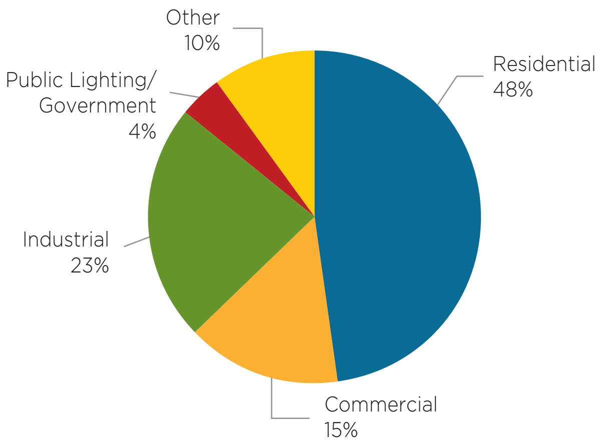
energy expenditures generally make up a larger share of overall income. Yet, in practice, discretionary interventions in the generation segment or ad hoc tariff adjustments translated into broader or universal subsidies. When faced with price shocks, most LAC countries responded by applying discretionary price controls. Large tariff increases for households in particular can be politically unpopular. Nineteen—or more than 70 percent—of the countries in our sample provided subsidies to the residential sector during the sample period.

### *State Participation in the Sector and Subsidies*

There is an important connection between the pricing mechanism chosen by a country, the degree to which it subsidized electricity, and the extent to which the state participated in the sector during the sample period. As was the case in the fuels sector, the market structure of the electricity sector in LAC influenced the way electricity pricing policies were implemented. In many countries, state-owned enterprises controlled a large share of the market or enjoyed a monopoly over electricity generation, transmission, or distribution. This often enabled the application of discretionary pricing policies that prevented the full pass-through of electricity costs, as resulting losses could be financed off-budget and were ultimately borne largely by government.

As Table 3.4 reveals, state-owned enterprises dominated the electricity generation segment in 19 of the 26 countries in our sample during the sample period, specifically in the Bahamas, Belize, Bolivia, Brazil, Costa Rica, Ecuador, El Salvador, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Paraguay, Peru, Suriname, Trinidad and Tobago, Uruguay, and Venezuela. SOEs played a significant role in the transmission segment in all but three countries in our sample: Barbados, Chile, and Peru, which had privatized transmission markets. Finally, only Argentina, Barbados, Chile, El Salvador, Guatemala, Nicaragua, and Panama had largely privatized distribution segments. In the remaining 19 countries, state-owned distributors were key players.

**Figure 3.4 Distribution of Electricity Subsidies by Sector, Average 2008–14**




*Source:* IADB calculations.

With the exception of Argentina and the Dominican Republic, the state played a dominant role in the generation segment in Bolivia, Ecuador, Guyana, Haiti, Honduras, Peru, Suriname, Trinidad and Tobago, and Venezuela—the subset of countries that intervened in generation markets in a discretionary fashion during the sample period. This often facilitated the implementation of such pricing schemes. In some cases, state-owned utilities bore the cost of generating or purchasing electricity from IPPs at higher prices and selling power at lower prices. In other cases, such as in Bolivia, Ecuador, Suriname, Trinidad and Tobago, and Venezuela, state-owned utilities further benefited from access to subsidized fuels through state-owned oil and gas companies.

Even in Argentina and the Dominican Republic, however, where the generation segment is largely privatized, state-owned firms enabled government intervention in the segment. In Argentina, for example, ENARSA, a state-owned company, imported natural gas and petroleum products at international prices and sold fuels below cost. Moreover, CAMMESA, the wholesale market administrator, purchased power from generators at higher prices and then sold it to distributors at capped prices. The government transferred the difference to CAMMESA. In the Dominican Republic, where wholesale power

**Table 3.4 Market Structure of the Electricity Sector in LAC, 2008–14**

| Country | Price Setting | Generation | Transmission | Distribution |
|---|---|---|---|---|
| Argentina | Discretionary | State (Salto Grande, Yacyreta, Atucha I, Embalse, others) and private participation | State (EPEC, EPESF, Energía de Misiones) and private participation | Private participation and provincial state-ownership |
| Bahamas | Discretionary | State (BEC) and private participation | State (BEC) and private participation | State (BEC) and private participation |
| Barbados | Discretionary | Private monopoly (BL&P) | Private monopoly (BL&P) | Private monopoly (BL&P) |
| Belize | Discretionary | State (BEL) and private participation | State monopoly (BEL) since 2011 | State monopoly (BEL) since 2011 |
| Bolivia | Discretionary | State (ENDE) and private participation | State (ENDE) and private participation | State and private participation |
| Brazil | Discretionary | State (Eletrobrás) and private participation | State (Petrobras) and private participation | State (Petrobras) and private participation |
| Colombia | Discretionary | State (EPM, ISAGEN, others) and private participation | State (EPM, ISAGEN) and private participation | State and private participation |
| Dominican Republic | Discretionary | State (EGEHID) and private participation | State monopoly (ETED) | State monopoly (EDEESTE, EDENORTE, and EDESUR) |
| Ecuador | Discretionary | State (CELEC) and private participation for projects of 50 MW or less; required joint venture with regional or central government for larger projects | State monopoly (CELEC) | State (CELEC) and private participation through joint ventures |
| El Salvador | Discretionary | State (CEL and LaGeo) and private participation | State monopoly (ETESAL) | Private participation |
| Guyana | Discretionary | State (GPL) and private participation | State monopoly (GPL) | State monopoly (GPL) |
| Haiti | Discretionary | State (EDH) and private participation | State monopoly (EDH) | State monopoly (EDH) |
| Honduras | Discretionary | State (ENEE) and private participation | State monopoly (ENEE) | State monopoly (ENEE) |
| Mexico | Discretionary | State (CFE) and private participation | State monopoly (CFE) | State monopoly (CFE) |
| Nicaragua | Discretionary | State (ENEL) and private participation | State monopoly (ENATREL) | Private participation |
| Panama | Discretionary | State (EGSA and ACP) and private participation | State monopoly (ETESA) | Private participation |
| Paraguay | Discretionary | State monopoly (ANDE) | State monopoly (ANDE) | State monopoly (ANDE) |
| Peru | Discretionary | State (Electroperu) and private participation | Private participation | State (Electronorte and others) and private participation |
| Suriname | Discretionary | State (ESB) and private participation | State monopoly (ESB) | State monopoly (ESB) |
| Trinidad and Tobago | Discretionary | State (T&TEC) and private participation | State monopoly (T&TEC) | State monopoly (T&TEC) |
| Venezuela | Discretionary | State monopoly (CORPOELEC) | State monopoly (CORPOELEC) | State monopoly (CORPOELEC) |
| Chile | Non-Discretionary | Private participation | Private participation | Private participation |
| Costa Rica | Non-Discretionary | State (ICE) and limited private participation | State monopoly (ICE) | State (ICE and others) |
| Guatemala | Non-Discretionary | State (EGEE) and private participation | State (ETCEE) and private participation | Private participation |
| Jamaica | Non-Discretionary | Joint state and privately owned (JPS) and private participation | Joint state and privately owned monopoly (JPS) | Joint state and privately owned monopoly (JPS) |
| Uruguay | Non-Discretionary | State (UTE) and private participation | State monopoly (UTE) | State monopoly (UTE) |

*Source:* IADB calculations.

prices were capped, Corporación Dominicana de Empresas Eléctricas Estatales, the group of state-owned transmission and distribution companies, purchased power from IPPs at higher prices and sold it at subsidized rates. Moreover, hydropower sold by state-owned generator Empresa de Generación Hidroeléctrica Dominicana was priced below cost.

State-owned companies also played a key role in the majority of countries that intervened in electricity distribution markets in an ad hoc manner. Private participation in the distribution segment for this set of countries was only significant in Argentina, Barbados, Nicaragua, El Salvador, Nicaragua, and Panama. Regardless of whether the burden fell on private or state-owned firms, price-control schemes and the discretionary application of sector policies during the sample period often weakened the financial and operation health of energy companies and exacerbated an already existing investment gap in the sector. The following sections will examine in detail the application and effect of chosen electricity pricing mechanisms for each of the 26 countries in our sample.

## Discretionary Pricing Mechanisms

### *Suriname*

Suriname has one large hydropower plant—the Afobaka Hydropower Plant owned by Suralco, a bauxite and aluminum producer—which provided nearly half of the country's electricity during the time period under study. The rest was generated with petroleum products, mainly heavy fuel oil. Energie Bedrijven Suriname (EBS), a state-owned company, operated thermal power plants and had a monopoly over transmission and distribution. Through Suriname's state-owned oil company, Staatsolie, EBS purchased fuels for generation at subsidized prices. Consumers not connected to a grid ran their own generators and paid the market rate for fuels. In the sparsely inhabited interior of the country, the Ministry of Natural Resources informally provided electricity free of charge during a few hours per day, though shortages were common.

Between 2008 and 2014,[6] electricity tariffs were set by Suriname's Ministry of Natural Resources for consumers linked to the major transmission grid. Two consumer categories were considered: residential and non-residential. Within the residential group, there was a block-tariff structure with seven blocks and increasing fixed charges and rates per kWh for higher levels of electricity consumption. The government provided an explicit subsidy to customers with low levels of consumption. The non-residential group was differentiated between small and large consumers. Small consumer tariffs included a fixed charge and an energy charge at rates that were, on average, higher than the average cost for similar consumption for a residential consumer. Large consumers were charged a fixed charge, an energy charge per kWh, and a demand charge per kVA.

While there was some level of cross-subsidization between consumers, average tariffs were below the level required to adequately cover the cost of supplying electricity during the time period under study. Tariff adjustments were irregular and subsidies were borne increasingly by government. EBS suffered from revenue shortfalls and was unable to invest in new generation capacity or upgrades and expansions to the system over time. Nevertheless, authorities began the process of phasing out electricity subsidies in October 2015 with tariff increases.

### *Venezuela*

Beginning in 2007, Venezuela's electricity sector underwent a series of reforms that resulted in the creation of state-owned Corporación Nacional Eléctrica S.A. (CORPOLEC), which operated as a vertically integrated monopoly in electricity generation, transmission, and distribution throughout the sample period. Between 2008 and 2014, the majority of the electricity generated in Venezuela came from hydraulic sources, though their share in the country's electricity matrix declined from previous years. The fall was compensated with elec-

[6] Tariff rates have since changed. For new rate schedule, please see http://www.nvebs.com/thuis/elektriciteit/betalen/.

tricity generated from natural gas and oil products, which increased costs. In 2014, for example, 68 percent of the country's electricity came from hydro, compared to 73 percent in 2008. On the other hand, 18 and 14 percent of electricity generated in 2014 came from natural gas and oil products respectively, compared to 15 and 13 percent in 2008 (International Energy Agency, 2016b). CORPOLEC purchased fuels from PDVSA, the state-owned oil and gas firm, at subsidized prices.

The Ministry of Electric Energy regulated the sector, with the Minister also serving as the president of CORPOLEC. The tariff schedule considered two classes of consumers: residential and non-residential. Within the residential category, tariffs were further distinguished between "social" and "general." The social category was heavily subsidized, with the first 200 kWh of consumption per month priced at US$0.001/kWh and excess consumption priced at US$0.01/kWh. Average tariffs for non-residential consumers were also below cost-recovery prices.

The Venezuelan government suspended regular tariff increases in 2003 and has since made only ad hoc adjustments. Paralleling the case of fuels, between 2008 and 2014, Venezuela's average electricity prices were among the lowest in the world. Over time, this has been compounded by an increase in the cost of supplying electricity and has resulted in decreased revenues, which have augmented the financial burden on the company and resulted in a decline in the quality of service provided. Moreover, the share of uncollected bills increased dramatically during the sample period. According to the Ministry of Electric Energy, non-collection of bills as a share of total electricity billed rose from 4 percent in 2008 to 34 percent in 2014. The majority of uncollected income was attributed to the residential sector. The sector was exempt from the VAT.

### *Nicaragua*

Traditionally, electricity generation in Nicaragua has relied primarily on oil products, though this changed in recent years. From 2008 to 2014, the share of electricity generated from oil products fell from 64 percent to 46 percent, and the fall was largely made up by renewable energy sources. In 2014, 19 percent of the country's electricity came from solar and wind, 15 percent from geothermal, 11 percent from biofuels and waste, and 9 percent from hydro (International Energy Agency, 2016b). Nevertheless, electricity costs in Nicaragua remained high relative to other countries in the region. Although the sector is open to private participation, state-owned companies remained major participants in electricity generation and transmission throughout the sample period through the Empresa Nicaragüense de Electricidad (ENEL) and the Empresa Nacional de Transmisión Eléctrica (ENATREL). The country's two distribution companies, Dissur and Disnorte, were privately owned and managed by the same owner as a single company.

The Instituto Nicaragüense de Energía (INE) regulated the energy sector. INE calculated electricity tariffs considering different rates for consumers based on the tension level of service (low and medium) and sector (residential, commercial, industrial, etc.). Residential and general consumers with low consumption were subject to monthly fixed charges and rising rates for increased consumption. Larger general and industrial tariffs included separate charges for energy consumption and capacity (per kW of peak demand). Irrigation and medium tension consumers were also subject to peak and off-peak rates that were further differentiated between summer and winter. Large consumers that purchased electricity directly from the wholesale market were charged only for transmission.

Per sector regulation, electricity tariffs were meant to be adjusted periodically to reflect changes in the wholesale cost of electricity, yet they were adjusted in an ad hoc manner throughout the sample period. In general, commercial, industrial, government, and other tariffs were high enough to cover the cost of electricity and served to partially cross-subsidize the residential sector. The subsidized social tariff applied to more than 80 percent of residential customers and had been frozen since 2005. After 2011, government introduced an explicit transfer to Dissur and Disnorte to finance subsidies to the residential sector. Nicaragua's very high non-technical losses also imposed high implicit subsidies on the system. Close to one-quarter of electricity generated was lost.

Residential electricity consumption between 300 kWh and 1,000 kWh per month was taxed at a preferential VAT rate. Residential electricity consumption below 300 kWh was exempt from the VAT, although consumers had to pay the VAT on their full consumption if they exceeded 300 kWh. In addition, electricity used for agricultural irrigation was exempt from the VAT.

### *Trinidad and Tobago*

Trinidad and Tobago is a producer and exporter of natural gas, crude oil, and refined petroleum products. During the sample period, the country relied on natural gas for nearly all of its power generation (International Energy Agency, 2016b). The state-owned Trinidad & Tobago Electricity Commission (T&TEC) dominated electricity generation and had a monopoly over transmission and distribution. In addition to its own power plants, T&TEC had majority control of PowerGen, the country's largest power generator, and de facto control over government-owned Trinidad Generation Unlimited (TGU). Trinidad Power was the only entirely privately held independent power producer in the country. Between 2008 and 2014, T&TEC purchased natural gas from NGC, a state-owned company, at subsidized rates. Moreover, T&TEC periodically held back payments to NGC, resulting in shortfalls for NGC that were covered by the government.

The Regulated Industries Commission (RIC) regulated the sector and was responsible for setting electricity tariffs. Since 2006, the RIC was meant to publish new tariff schedules every five years; existing tariffs were meant be adjusted annually based on T&TEC's proposals. RIC made the first tariff determination in 2006, but new tariffs for some consumer categories were not implemented until 2008. Tariff adjustments were made ad hoc or denied altogether throughout the sample period.

T&TEC considered five consumer categories: residential, commercial, industrial, heavy industrial, and street lighting. Residential tariffs had a block-tariff structure of three blocks with increasing rates per kWh for higher levels of consumption as well as fixed charges. Commercial tariffs included a fixed charge and a flat rate per kWh of energy consumed. Industrial and heavy industrial rates were differentiated based on maximum demand. While there was some cross-subsidizing, it was not enough to cover subsidies for the time period under study.

### *Belize*

Most of the electricity consumed in Belize during the sample period came from domestic hydropower and imports from Mexico. Electricity imports rose or fell in response to hydroelectric output. The cost of electricity imported from Mexico was higher than domestically produced hydropower, resulting in higher overall electricity costs for the years that saw an increase in imports. In 2011, Belize Electricity Limited (BEL) was nationalized following a multi-year legal dispute stemming from the government preventing prior tariff increases. During the sample period, BEL operated a small share of electricity generation capacity and purchased imports and electricity generated by independent power producers. BEL had a monopoly over the country's transmission and distribution systems.

Electricity tariffs in Belize were set by the Public Utility Commission (PUC) during the sample period. Sector regulations called for a full tariff review every four years and for annual tariff adjustments to align tariffs with costs. Yet, tariff adjustments and reviews were delayed, leading to the aforementioned disputes between BEL and the PUC.

PUC considered six different customer categories: social, residential, commercial, two industrial categories, and street lighting. The residential and commercial categories included three separate tariff rates depending on the customer's monthly total consumption. The social and residential categories included a minimum charge, while the commercial and industrial categories had a fixed service charge levied in addition to charges per kWh of energy consumed. Both industrial categories also included a demand charge, in addition to energy and service charges. While there was some cross-subsidization between consumer categories during this time period, average tariffs were not enough to cover the cost of supplying electricity across every year in our study. Some customer segments were charged the VAT.

### *Argentina*

Until recently, most of Argentina's electricity was generated from domestically produced natural gas. Yet, declining natural gas production combined with growing electricity demand forced the country to import increasing quantities of natural gas at higher prices as well as increase the share of oil products used in power generation. In 2014, natural gas represented 48 percent of the country's electricity generation, hydro 29 percent, oil products 14 percent, nuclear 4 percent, and other sources made up the rest (International Energy Agency, 2016b). During the sample period, several private electricity generators operated in the country alongside state-owned nuclear, thermal, and hydroelectric power plants. Power transmission and distribution services were mainly carried out through concessions to private firms, though some provinces maintained provincial state-ownership over electricity distribution.

The Ente Nacional de Regulación Eléctrica (ENRE) regulated the sector. The country had a complex system of tariff schedules that varied geographically and by consumer. By law, tariffs in Argentina were meant to be designed under a price-cap scheme, which was supposed to provide for earnings and cost recovery while incentivizing efficiency. However, the country experienced an economic crisis in 2002 that resulted in the passage of the Economic Emergency Law, bringing forth important changes to the electricity sector that were still in effect during the sample period. Importantly, the law suspended sector regulation, leaving the sector to be managed in an ad hoc manner.

The Argentine government subsidized electricity generation by importing fuels (mainly natural gas) at international prices and selling these to generators at lower prices. Moreover, the wholesale spot price for electricity was capped at 120 AR$/MWh, and remained at this nominal level despite increasing inflation and the devaluation of the Argentine peso. In order to sustain the wholesale price, CAMMESA, the country's wholesale market administrator, purchased electricity from generators at market prices and then sold to distributors at the capped prices. Transfers from the government to CAMMESA compensated for the difference. Distribution companies and large consumers entering into long-term agreements with generators to purchase electricity generally did so at higher prices.

The Economic Emergency Law of 2002 also froze transmission and distribution tariffs, overturning provisions relating to price adjustments and inflation indexation mechanisms, and granting power to the executive branch to renegotiate contracts with utilities, including the rates applicable to such services. For the time period under study, the gap between the cost of supplying electricity and final consumer tariffs represented an increasingly large financial burden for service providers as well as for the Argentine government. The tax system on electricity varies according to each province and type of consumer. The federal VAT is also charged to consumers.

### *Honduras*[7]

During the sample period, oil products made up an average of roughly 56 percent of Honduras's electricity generation mix while hydropower made up an average of 38 percent (International Energy Agency, 2016b). Honduras imported all the fuels it used in electricity generation and thus faced high electricity costs as a result of increasing oil prices. Other factors also added to high electricity costs during this time, including high technical and

[7] Information derived from Beylis and Cunha (2017).

non-technical losses; an uncompetitive generation segment in which many power purchase agreements between state-owned Empresa Nacional de Energía Eléctrica (ENEE) and IPPs were made through emergency decrees; and laws that promoted electricity generation from renewable resources with higher costs. ENEE is a vertically integrated company with a monopoly on electricity transmission and distribution.

The Comisión Nacional de Energía (CNE Honduras) set tariff rates for final consumers. Tariffs were meant to reflect busbar prices—the short-run marginal cost of electricity generation plus transmission costs—and the value added for distribution services. Yet the calculation of short-run costs was based on the theoretically optimal operation of available plants and estimated demand, which were not well aligned with actual costs. Different tariffs were applied to different sectors and varied by maximum demand and voltage level. Tariffs also included a correction factor—calculated on a monthly basis—meant to capture changes in fuel prices and exchange rate fluctuations. Yet these corrections were not always applied in order to prevent full pass-through of fuel price increases.

On average, electricity prices were kept below costs for several years under study, resulting in large losses to ENEE that were compounded by a high share of non-payment of bills. The residential segment enjoyed the lowest average tariffs and represented around 40 percent of electricity consumption. Until 2010, various direct subsidies were extended to residential consumers with consumption of up to 500 kWh per month. Over time, these subsidies became narrower. Full exemption from payment was later only granted to customers consuming less than 75 kWh per month of electricity. Nevertheless, given the gap between overall costs and tariffs, persistent financial imbalances remained. Only residential customers with consumption of more than 750 kWh per month paid the VAT.

### *Bolivia*[8]

Over recent years, the use of natural gas for electricity generation has grown in Bolivia. In 2008, more than 45 percent of electricity generation came from natural gas, while hydro made up 37 percent of supply. By 2014, the share of electricity generation from natural gas increased to 70 percent and hydro declined to 26 percent (International Energy Agency, 2016b). Natural gas prices for electricity generation were fixed by decree in 2001. Throughout the sample period, the state dominated electricity generation, transmission, and distribution through state-owed Empresa Nacional de Electricidad (ENDE).

The Autoridad de Fiscalización y Control Social de Electricidad regulated the sector and set tariffs. Customers were divided into regulated and non-regulated consumers. Non-regulated customers were defined as large consumers who may negotiate electricity supply contracts directly with generators or buy from the spot market. Distributors purchased electricity in the wholesale market through contracts or via the spot market and supplied electricity to regulated consumers. Purchases by distributors made through contracts were subject to a regulated node price. Distributors purchasing from the spot market, on the other hand, were subject to the "applied node price," which was a regulated price that changed in response to rules set forth by a stabilization fund. Obligations incurred by the stabilization fund grew during the time period under study.

Maximum distribution prices were also set by the regulator for a period of four years, indexed for inflation, and calculated for different tension levels. The base rates consisted of a fixed charge, nonpeak power charges, and charges for energy and peak power. In practice, the tariff structure applied to final consumers favored low-income households through the use of increased energy charges for increased consumption. A subsidized "dignity tariff" for consumers with consumption of less than 70 kWh per month applied to close to half of all residential consumers. Lower tariffs also applied to the elderly population with consumption below 100

[8] Information derived from Beylis and Cunha (2017).

kWh per month. A stabilization fund was also created for the distribution segment to take into the account the difference between the costs incurred by distributors and the revenue received from consumers. The fund's obligations also grew during the sample period. The VAT was levied on electricity consumption.

### *Ecuador*

Since the mid-1980s, Ecuador's electricity has been generated primarily from hydraulic sources. However, the share of hydropower in the country's electricity matrix decreased in recent years, while the share of more expensive energy generated from fossil fuels increased. In 2014, 47 percent of the country's electricity came from hydro, 37 percent from oil products, 13 percent from natural gas, and the rest from other sources (International Energy Agency, 2016a). During the sample period, the market for electricity generation in Ecuador consisted of a mixture of state- and privately owned companies, of which state-owned Corporación Eléctrica del Ecuador (CELEC) was the largest. Transelectric, owned by CELEC, had a monopoly over electricity transmission. The state also played a dominant role in the distribution segment through CELEC.

In 2005, the Ecuadorean government issued an executive order mandating that the electricity sector pay subsidized prices for fuels used in thermal generation, which continued into the time period under study. Relatively elevated losses imposed an additional cost on the system. In particular, most distribution companies in Ecuador suffered from difficulties with bill collection. Nevertheless, through various efforts, the share of technical and non-technical losses declined from 22 percent in 2008 to 15 percent in 2014.

The Agencia de Regulación y Control de Electricidad (ARCONEL)[9] regulated the sector and determined electricity tariffs using the following guidelines: final consumer tariffs had to cover an established reference price for electricity generation, transmission costs, and distribution costs. Distribution costs were calculated as the average cost of all distribution companies in the country. Large consumers could negotiate their tariffs directly with distribution companies. The calculation of average distribution costs for regulated consumers forced some distribution companies to operate at a loss; the government compensated them for the deficit. According to the Ecuadorean constitution, the Ministry of Finance must cover the deficit between the cost of supplying electricity and the final consumer tariff with resources from the state budget. Moreover, by law, tariffs did not cover costs related to the expansion of the system.

ARCONEL also considered explicit subsidies for specific groups, including a "dignity tariff," which charged a preferential tariff rate of 4 cents per kWh to households that consumed less than 110 kWh per month in the highland region and less than 130 kWh per month in the coastal region of the country. The current tariff schedule also established cross-subsidization across consumer categories. Nevertheless, final average tariffs were not enough to cover electricity costs. In the face of a growing subsidy bill, the government was compelled to upgrade the country's thermal power plants to use cheaper, domestically produced fuel oil instead of more expensive imported diesel.

### *Guyana*

Between 2008 and 2014, Guyana's electricity generation came primarily from imported oil products. Guyana Power & Light (GPL), a state-owned company, generated roughly half of Guyana's electricity and had a monopoly on transmission and distribution. The Guyana Sugar Corporation—the nation's second-largest electricity producer—also sold its excess power to GPL. Numerous small private companies produced electricity for rural markets. Aside from the high cost of fuel imports, GPL's older, less efficient generation plants and high technical and non-technical losses imposed additional costs on the system. During the sample period, Guyana had some of the region's highest electricity costs. GPL was thus dependent on government to meet its op-

9 Formerly known as Consejo Nacional de Electricidad.

erational costs; government transfers often took the form of subsidies to purchase fuels for generation.

The Public Utilities Commission (PUC) regulated the sector and set electricity tariffs. Consumers were categorized as residential, commercial, industrial, and public lighting, with each class containing two sub-categories and tariff structures—one standard and a separate "government" rate. Government rates across consumer classes tended to be slightly higher than standard rates. A system of cross-subsidies existed across and within consumer classes. Within some consumer classes, higher tariffs were applied to customers with higher electricity consumption. Guyana's base tariff for each class and consumption block has not changed since 2008, although recently a fuel discount has been applied to the base rate. Across consumer classes, average tariffs remained relatively flat throughout the sample period. The residential category made up roughly 92 percent of GPL's customers, yet they were responsible for only 45 percent of total electricity sales. While average final consumer tariffs in Guyana were among the highest in the region, they were not high enough to cover the full cost of electricity for several years under study.

### *Dominican Republic*[10]

Electricity generation in the Dominican Republic has historically been reliant on oil products, though their share in the electricity matrix has declined in recent years and been replaced primarily by natural gas. In 2014, oil products made up 52 percent of the electricity generated in the country, natural gas made up 21 percent, coal 13 percent, hydro 9 percent, and unconventional renewables 5 percent (International Energy Agency, 2016b). Nevertheless, with the rise in oil prices, the cost of generating electricity rose dramatically during the time period under study. At the same time, energy losses surpassed 35 percent, adding to the high cost of power. A lack of investment in the sector contributed to the high loss rate and led to frequent blackouts.

During the sample period, private participation was allowed in the generation segment, except for hydroelectric production, which was reserved for the state. Transmission and distribution were state monopolies. Distributors were required to purchase a minimum of 20 percent of the energy supplied through the national interconnected system on the spot market and the rest could be purchased through long-term contracts. Electricity purchased in the spot market was sold at market prices, while energy purchased through the Corporación Dominicana de Empresas Eléctricas Estatales (CDEEE), the state-owned company that includes the transmission and distribution companies, was purchased from IPPs at higher prices and sold at subsidized prices. Moreover, hydropower sold by state-owned generator Empresa de Generación Hidroeléctrica Dominicana (EGEHID) was also priced below cost.

The Superintendencia de Electricidad (SE) set tariffs for regulated consumers. Unregulated consumers were free to negotiate directly with electricity generators. Since the enactment of the General Electricity Law in 2001, tariff rates were meant to reflect the cost of generating, transmitting, and distributing. Tariffs were meant to be set monthly, with rates based on changes in fuel prices, inflation, and the exchange rate. BONOLUZ was an explicit targeted subsidy that covered the first 100 kWh of electricity consumption for low-income households that qualified for the program. However, during the time period under study, tariffs for all consumers were consistently set below cost and adjustments were consistently made in an ad hoc manner.

Combined, subsidies to electricity generation and large technical and non-technical losses led to large fiscal deficits for many companies in the sector, particularly generators and distribution companies. Deficits for the state-owned distributors were regularly financed through budgetary transfers, but nevertheless resulted in frequent blackouts and rationing of electricity supply to certain neighborhoods. Large debt arrears to generators also resulted in production rationing.

[10] Information derived from Beylis and Cunha (2017).

### *Mexico*[11]

During the sample period, more than half of the electricity generated in Mexico came from natural gas. Oil products also represented a large share of production, making up around 11 percent of the country's electricity matrix in 2014 (International Energy Agency, 2016b). Historically, the electricity market in Mexico developed under public policies implemented through two state-owned enterprises, Comisión Federal de Electricidad (CFE) and Luz y Fuerza del Centro (LyFC). In 2009, however, the electricity market came under the control of just one state-owned company, CFE. Limited generation activities have been open to private participation since 1992 but, during the time period under study, CFE remained responsible for more than 80 percent of generation. Transmission and distribution were state monopolies.

Between 2008 and 2014, Mexico had a complex system of tariffs that varied by consumer, voltage level, geographical location, and season. Some tariffs were divided into blocks depending on consumption, with each block facing a different price. Costs, on the other hand, were calculated using CFE's average costs for generating and supplying electricity to final consumers. The difference between final tariffs and costs was called "tariff insufficiency" and was absorbed by CFE. The federal government reimbursed CFE for part of the subsidies by cancelling the company's tax obligations. Tariffs were sometimes used as a public policy tool during the sample period, both for income redistribution purposes and to increase industrial competitiveness. Low tariffs for residential and other consumers posed a significant financial burden on CFE and the Mexican government. Subsidies were concentrated mainly in the residential sector, accounting for about 70 percent of total subsidies.

The Mexican government embarked on an ambitious reform of the energy sector in 2013–14, in part with the goal of reducing electricity subsidies and increasing private participation in electricity generation. The transition from a discretionary pricing mechanism to one where electricity prices would reflect cost-recovery principles is detailed in the final section of this chapter.

### *Panama*

Between 2008 and 2014, more than half of Panama's electricity generation came from hydraulic sources, roughly 30 percent came from oil products, and the rest was made up by other sources including coal, biofuels, and unconventional renewables (International Energy Agency, 2016b). Panama's generation sector was structured around a competitive wholesale market that included both private and state-owned companies. Empresa de Transmisión Eléctrica Panameña (ETESA), a state-owned firm, had a monopoly over the transmission of electricity and acted as a market maker, purchasing power from generators and operating the wholesale electricity market through a subsidiary. There were three privately owned electricity distributors, each with a monopoly within their concession area.

The Autoridad Nacional de los Servicios Públicos (ASEP) was responsible for regulating the electricity sector and setting consumer tariffs. Tariffs were meant to be calculated based on the wholesale cost of electricity and the cost of transmission and distribution, including technical losses. A separate commercialization charge was added to cover distribution companies' cost for billing and management. Tariff schedules were based on delivered tension level (low, medium, and high), with sub-categories for basic service, service with a peak demand charge, and service with on- and off-peak rates. Panama offered lower tariff rates for specific consumer classes, partially covered by higher tariffs on other consumers and explicit government transfers through stabilization and compensation funds: the Fondo de Estabilización Tarifaria (FET), Fondo de Compensación Energética (FACE), and Fondo Tarifario de Occidente (FTO).

The FET was created in 2004 with the purpose of mitigating the effect of volatile oil prices on final

[11] Information derived from Beylis and Cunha (2017).

consumer tariffs. Tariff schedules were established considering the oil price at US$40 per barrel. If the oil price was higher and tariffs were not enough to cover costs, the fund would cover the gap; if the oil price was lower, tariffs would remain higher than costs and the fund would be replenished. However, oil prices remained high for the following decade and tariffs remained below cost-recovery levels. FACE and FTO were thus subsequently created to compensate electricity distribution companies for losses incurred. Over 40 percent of Panamanian consumers benefited from subsidies during the time period under study. The government adjusted tariffs on an ad hoc basis and froze tariffs in 2014. In 2015, however, ASEP began to increase electricity rates for some consumers, thus gradually targeting and reducing subsidies. Electricity was exempt from the VAT.

### *Peru*[12]

In 2008, 59 percent of the electricity generated in Peru came from hydraulic sources, 31 percent from natural gas, and the rest from other sources including oil products. By 2014, the share of hydro in the country's electricity generation mix had declined to 49 percent, while the share of natural gas had increased to 46 percent, nearly eliminating generation from oil products (International Energy Agency, 2016b). During the time period under study, private participation was allowed in the generation, transmission, and distribution segments, yet the state still played an important role in generation (through Electroperú) and distribution.

Poor hydrological conditions and congested natural gas pipelines caused the marginal cost of electricity to rise in the years leading up to 2008. In December 2008, the Peruvian government enacted an emergency decree capping wholesale electricity costs at "idealized marginal cost" levels, which were calculated under the assumption that no restrictions existed on the transportation capacity of natural gas pipelines. Additional costs incurred by generation companies with variable costs higher than the "idealized marginal costs" were included in the transmission charges assumed by all users. The decree was extended until December 2016. Peru also subsidized electricity generation by providing natural gas to electricity generators at below international prices through the Natural Gas Industry Development Promotion Act.

The Organismo Supervisor de la Inversión en Energía y Minería (OSINERGMIN) was the regulatory body in charge of setting electricity tariffs. Consumers were divided into two categories: regulated and free users. Regulated users had a demand of less than 200kW and were supplied electricity at the regulated, or "idealized" prices, while free users had a demand of more than 2,500 kW and were free to negotiate prices directly with generators. Consumers with demand between 200 kW and 2,500 kW could choose to be free or regulated. Tariffs for regulated consumers were made up of the "idealized" generation costs, a transmission toll, and a value-added cost for distribution, which was set as the weighted-average cost for the country.

Cross-subsidies existed among different categories of users, and special charges were added to certain consumers in order to support specific public policies. Tariffs for users with a demand of less than 100 kWh per month were subsidized and financed through a charge on regulated users with higher consumption levels. The "Rural Electrification Charge" was charged to consumers in order to promote electrification in rural areas, and free consumers were charged a surcharge aimed at incentivizing the use of residential and vehicular natural gas, the development of new power supplies for vulnerable populations, and the promotion of access to LPG. Overall, residential users absorbed 46 percent of all of the subsidies provided, followed by commercial users, which accounted for 36 percent, and industrial users, which accounted for 17 percent. The VAT was levied on electricity consumption.

### *Barbados*

As in most Caribbean countries, most electricity in Barbados was generated from imported oil prod-

[12] Information derived from Beylis and Cunha (2017).

ucts during the sample period. Barbados Light & Power Company Limited (BL&P)—a privately owned, vertically integrated utility—had a monopoly over electricity generation, transmission, and distribution. Roughly 8 percent of the country's total electricity consumption was self-generated, mainly by hotels and other commercial establishments.

BL&P's electricity tariffs were set by the Utility Regulation Department within the Fair Trading Commission (FTC). BL&P tariffs were revised in 2010—the country's first increase in electricity tariffs since 1983.The tariff schedule considered five consumer categories: domestic (residential), general service (non-residential, which included mainly commercial consumers), secondary voltage power (consumers with demand in excess of 5 kVA), large power (consumers with demand in excess of 50 kVA), and street lighting. Fuel costs, which accounted for roughly two-thirds of the cost of producing electricity in Barbados, were passed on to customers through a monthly adjusted fuel surcharge. Moreover, the FTC set BL&P's allowable return on investment at 10 percent. Residential and general service tariff schedules had rising rates based on volume of electricity consumed for both their base fixed charge as well as the energy charge per kWh. Residential tariffs were set lower than those for general service, and BL&P employees enjoyed a subsidized tariff that was slightly below the standard domestic tariff rate. The VAT was levied on electricity.

### *Colombia*[13]

During the time period under study, more than 70 percent of Colombia's electricity came from hydraulic resources, while another 15 percent came from natural gas and 10 percent came from coal (International Energy Agency, 2016b). The generation market for electricity was competitive and open to private participation, though state-owned companies were responsible for roughly 30 percent of generation. The transmission and distribution segments were also open to private participation.

The Comisión de Regulación de Energía y Gas (CREG) regulated the sector and set tariff rates every five years. Consumers were divided into free and regulated consumers. Large free consumers were able to negotiate the purchase of electricity directly with generators while regulated consumers purchased electricity through distributors. Regulated consumers made up roughly 70 percent of total demand. By law, tariffs had to reflect the efficient cost of generating, transmitting, and delivering electricity, including losses considered efficient. The efficient cost had to be recorded on the consumer invoice along with any subsidy or tax imposed, depending on which the consumer was subject to.

Colombia had a system of cross-subsidies to benefit specific groups. Subsidies were awarded to some residential consumers based on their household's socioeconomic characteristics, including level of income. Residential consumers were divided into six classes. Class 1 received a 50 percent subsidy on the kWh unit cost of electricity, class 2 received a 40 percent discount, and class 3 received a 15 percent discount. Residential consumers in classes 1, 2, and 3 made up roughly 35 percent of all electricity demand in Colombia.

Subsidies were meant to be partially funded by a 20 percent tax on the service provided to the industrial sector and to residential customers belonging to higher consumption classes. Since 2012, however, the contribution from the industrial sector was eliminated, increasing the contribution necessary from the national budget to cover the deficit. Moreover, tariff increases on classes 1 and 2 were capped to inflation levels in 2003, although they should have increased enough over time to cover the contemplated level of cross-subsidies. This cap made the de facto subsidies closer to 60 percent of the efficient cost for class 1 and 50 percent of the cost for class 2. In 2012, approximately 55 percent of residential subsidies were funded by the federal government and 45 percent by consumer contributions. There were also subsidies for rural consumers

[13] Information derived from Beylis and Cunha (2017).

and for non-interconnected areas. Electricity consumption was exempt from the VAT.

### *El Salvador*[14]

During the time period under study, roughly 40 percent of electricity generated in El Salvador came from oil products, 35 percent from hydro, and 25 percent from geothermal resources (International Energy Agency, 2016b). El Salvador imported all fuels used in thermal generation and was particularly reliant on diesel, which resulted in a significant increase in electricity generation costs during the sample period. Private participation was allowed in the generation segment, though Comisión Ejecutiva Hidroeléctrica del Río Lempa (CEL) and La Geo, the state-owned hydroelectric and geothermal producers respectively, enjoyed a large market share. Transmission services were provided by state-owned Empresa Transmisora de El Salvador (ETESAL), and distribution services were open to private participation, with privately owned AES Gener controlling roughly 73 percent of the market.

The Superintendencia General de Electricidad y Telecomunicaciones (SIGET) set tariff rates for final consumers. Consumers were divided between regulated and unregulated consumers. Unregulated consumers had large demand and were free to purchase electricity from the wholesale market. Regulated users were divided into small, medium, and large categories based on energy demand. These categories were further subdivided by energy consumption or voltage. Tariffs were meant to be adjusted every three months, and included fixed charges for commercialization and marketing, as well as distribution and energy costs, which were meant to be passed on to consumers. Yet, during the sample period, government resorted to implementing universal subsidies in response to rising energy costs. Resulting subsidies were partially funded through the Fondo de Inversión Nacional en Electricidad y Telefonía (FINET) and CEL. In 2014, government began attempts to focalize subsidies. The VAT was levied on electricity consumption.

### *Brazil*[15]

Brazil is the largest electricity producer in Latin America and the Caribbean. Historically, the country has relied primarily on hydraulic sources for power generation. Yet, due to adverse drought conditions during the time period under study, the share of hydro in the country's electricity matrix declined from 80 percent in 2008 to 63 percent in 2014 (International Energy Agency, 2016b). The difference was largely made up by electricity generated from natural gas and oil products, which contributed to rising energy costs. Private participation was allowed across the generation, transmission, and distribution segments, though the state still played an important role in the sector. State-owned company Eletrobrás owned roughly one-third of generation capacity. Transmission and distribution services were also performed by SOEs including Eletrobrás and private companies.

Electricity tariffs were set by the Agência Nacional de Energia Elétrica (ANEEL). Consumers were split into regulated and free categories. Regulated consumers purchased electricity from distribution companies, which negotiated contracts with generators through auctions, while unregulated consumers were free to negotiate their contracts with generators directly. The generation segment was fully competitive until 2012. In 2013, however, the Brazilian government passed a law that, among other things, mandated that electricity generation costs for older power plants be regulated.

Final consumer tariffs were comprised of the cost of electricity generation, transmission, and "sectorial" tariff rates and taxes. Several consumer categories were considered, varying by voltage and sector. Sectorial rates included cross-subsidies charged to certain consumers to cover discounted electricity rates applied to other consumer groups or for development-related initiatives. Some discounts were removed from the pricing structure in 2013. Subsidies existed mainly for rural and

14 Information derived from Beylis and Cunha (2017).

15 Information derived from Beylis and Cunha (2017).

low-income residential consumers enrolled in the government's social programs registry. Rates and taxes varied regionally.

Until 2011, average consumer tariffs in Brazil were high enough to cover costs; after 2012, the situation was reversed, primarily as a result of price-control mechanisms imposed as a response to rising generation costs. In 2014, tariff adjustments were postponed to prevent the full pass-through of higher electricity generation costs to final consumers, resulting in budgetary transfers from the government to cover incurred losses.

### *Haiti*[16]

During the period under study, Haiti's reliance on oil products for electricity generation grew significantly. In 2008, 63 percent of the country's electricity was generated from oil products and 37 percent came from hydro resources. By 2014, the share of oil products in the electricity matrix grew to 91 percent, while hydro fell to 9 percent (International Energy Agency, 2016b). State-owned Electricité D´Haiti (EDH) had a monopoly on generation, transmission, and distribution in Haiti, although independent power producers were allowed to operate and sell to EDH. Since its creation, EDH lacked the full financial or institutional capacity to carry out operations. This limited its ability to invest in the maintenance or expansion of the system, or be able to dispatch electricity generated on a regular basis, such that electricity was typically available 12–14 hours a day on average.

Given the country's high dependence on imported fuels to generate electricity, the cost of supplying electricity climbed during the sample period. Moreover, very high technical and non-technical losses—estimated at 54 percent—placed an additional strain on the system (International Energy Agency, 2016b). Tariff rates varied by consumer categories, which included residential, commercial, industrial, and governmental organizations, and voltage level for industrial users. Tariffs had a fixed charge for all users. Residential clients with consumption levels between 1 and 200 kWh per month paid a tariff that was almost half of the tariff paid by customers with consumption above 200 kWh per month. In 2009, EDH doubled tariffs for residential consumers with consumption above 200 kWh per month to levels well above supply costs. Nevertheless, average tariffs were not high enough to cover costs and remained frozen since 2009.

Although the country had in place a formula to set tariff rates, it lacked an independent authority to do so free of political interference. The executive branch had regulatory authority over the power sector and several government ministers made up EDH's Board of Directors. Fund transfers from the government and subsidized fuels from Petrocaribe were necessary in order to maintain the sector's operations. Electricity subsidies represented a large financial burden on the Haitian government—this despite the fact that only close to 30 percent of the population has access to electricity.

### *Paraguay*

Paraguay is unique in the region in that it relies entirely on hydraulic resources for electricity. Two large hydroelectric plants—Itaipú and Yacyretá, which are jointly owned with Brazil and Argentina respectively—as well as smaller hydroelectric plants provide all of the country's electricity supply and allow for exports. During the sample period, the generation, transmission, and distribution segments were entirely state-owned and operated by the Administración Nacional de Electricidad (ANDE), with the only exception being two small distribution cooperatives located in isolated regions. The cost of electricity generation in Paraguay was the lowest in LAC. Nevertheless, ANDE suffered high losses at the distribution level due primarily to theft, imposing an additional cost on the system.

According to sector regulation, ANDE is meant to set electricity tariffs to reflect the actual cost of generation, transmission, and distribution. Yet ANDE did not authorize tariff increases throughout the same period, as the government decided to favor domestic consumers after an expansion of electrici-

[16] Information derived from Beylis and Cunha (2017).

ty exports to Brazil and Argentina over the past few years. ANDE considered a single tariff schedule for the whole country, with separate tariff rates levied on different categories of consumers. A lower "social tariff" applied to roughly 300,000 residential clients, and increasing demand was priced at higher levels. Average tariffs for industrial and commercial consumers were lower than average tariffs for residential and public lighting/government consumers across the time period under study.

At the same time, given ANDE's low operational costs, average tariffs across all consumer categories were consistently higher than the cost of supplying electricity, even when accounting for high levels of losses. The exceptions were between 2008 and 2010, when a small gap between ANDE's cost and average final tariff was revealed. Although tariffs have generally been high enough to cover costs, the discretionary application of sector regulation has meant that tariffs have remained below adjustments on other relevant products in the economy. The VAT was levied on consumption.

### *Bahamas*

The Bahamas generates all its electricity from imported diesel and heavy fuel oil. The country's small size and disparate geography, spanning across 30 inhabited islands, has led to monopolistic markets in the generation, transmission, and distribution of electricity. During the time period under study, the electricity sector was dominated by two vertically integrated monopolies. Bahamas Electricity Company (BEC), a state-owned firm, was responsible for more than 80 percent of the electricity distributed on the islands. The remaining share was produced by the Grand Bahama Power Company (GBPC), a privately owned firm exclusively supplying the island of Grand Bahama.

During the sample period, BEC was overseen by the Ministry of Public Works and Urban Development. GBPC was regulated by the Grand Bahama Port Authority and had a license to operate as a monopoly until 2054. Electricity tariffs included a fuel charge, a minimum charge, and other adjustments meant to align tariffs with costs. With the exception of 2008, average tariffs across residential, commercial, industrial, and other consumer classes were consistently high enough to recover costs. The gap between the average final consumer tariff and the cost of electricity in 2008 was likely the result of the spike in fuel costs that year. Nevertheless, BEC's latest available annual report from 2010 reports an operating deficit of US$26 million, or about 0.3 percent of the country's GDP, while the International Monetary Fund estimates electricity subsidies in the order of 0.5 percent of GDP for 2011–13, with fiscal transfers from the government to BEC making up the difference (Di Bella et al., 2015). In 2014, authorities adopted important regulatory changes for the sector out of concern over the impact of high oil prices on inflation, the country's balance of payments, and environmental concerns.

## Non-Discretionary Pricing Mechanisms

### *Chile*

During the time period under study, Chile's electricity generation relied primarily on hydro, coal, and hydrocarbons, though their weight in the country's generation matrix shifted over time. Between 2008 and 2014, the share of hydropower in Chile declined from 41 percent to 31 percent, while the share of electricity generated from coal increased from 24 percent to 35 percent. At the same time, the share of electricity produced from oil products fell from 27 percent to 6 percent, and the share of electricity produced from natural gas increased from 4 percent to 17 percent. The power sector in Chile was fully privatized, allowing participating firms in each segment to set prices and the terms of service within established regulations.

The generation and distribution segments were competitive, with many privately owned participants. The largest generation companies were Endesa, AES Gener, Clobún, and Suez Energy Andino. Given the country's geography, four interconnected systems served separate geographical areas: the Sistema Interconectado del Norte Grande (SING), which served the northern desert and mining region; the Sistema Interconectado Central

(SIC), which served the central region (and more than 90 percent of Chile's population); and the smaller Sistema Eléctrico de Aysén and Sistema Eléctrico de Magallanes, which served the southernmost areas of the country. Transelec had a monopoly over electricity transmission in SIC. The two largest distribution companies, Chilectrica and CGE Distribución, served more than 75 percent of regulated consumers. There were significant differences in average supply costs in different parts of Chile. Supply costs were particularly high in the northern parts of the country, which relied largely on more expensive thermal generation.

Consumers were categorized as either free or regulated. Free consumers, which have high consumption, purchased power directly from generators through bilateral negotiations. Distribution companies purchased electricity through public auctions for regulated consumers. The prices paid at auction were referred to as "long-term node prices." For each distribution company, an average node price—the price passed on to consumers—was calculated as the weighted average of the long-term node prices in each bidding process. If the average node price of energy of a single distribution company exceeded by more than 5 percent the weighted average price of energy calculated for all the distribution companies, the price for that distribution company was adjusted downwards. Any resulting difference was absorbed in the average prices of other companies in proportion to the energy they supplied to regulated customers.

The Comisión Nacional de Energía de Chile (CNE Chile) established electricity tariffs for regulated consumers. Final tariffs included node price charges for electricity consumption, charges for VAD, and a transmission toll. In 2005, a law was established to subsidize electricity rates for residential consumers who faced an increase of 5 percent or more in electricity tariffs over a period of six months. This measure was first applied between 2005 and 2006, reaching 40 percent of consumers; it was applied again in 2007 and 2008, triggered by rising electricity prices. The VAT was levied on electricity. Additionally, since 2014, electricity produced with fossil fuel inputs (coal, natural gas, and oil products) is subject to a low carbon fee levied at US$5 per ton of $CO_2$.

## *Guatemala*

During the sample period, Guatemala relied on a variety of sources for its electricity generation. Hydropower provided roughly half of the country's electricity supply, and biomass, coal, and oil products made up the rest. Guatemala's electricity sector was open to private participation, yet state-owned companies remained major participants in generation and transmission, and many local municipalities were involved in distribution. Guatemala's electricity generation sector was structured around a competitive cost-based wholesale market in which private and public companies competed to provide electricity to distributors and large consumers. Empresa de Generación de Energía Eléctrica (EGEE), a state-owned company, was the largest generator, managing more than 20 percent of installed capacity; state-owned Empresa de Transmisión y Control de Energía Eléctrica (ETCEE) was responsible for 85 percent of electricity transmission; and the distribution sector was dominated by three privately owned companies, the Empresa Eléctrica de Guatemala (EEGSA), Distribuidora de Occidente, S.A. (Deocsa), and Distribuidora de Oriente, S.A. (Deorsa), as well as companies owned by 13 municipalities.

The Consejo Nacional de Energía Eléctrica (CNEE) set retail tariffs based on the average cost of electricity supply, a charge for use of the national transmission system, and a charge that covered the value added for distribution. Tariffs were to be adjusted each quarter to reflect changes in the wholesale cost of electricity and inflation. The calculated VAD was based on the cost of an efficient company to provide distribution services and was to be reassessed every five years. Unregulated customers (with demand of at least 100 kW) purchased electricity directly from the wholesale electricity market via bilateral contracts with generators or through an intermediary electricity marketer.

Regulated residential customers with less than 300 kWh of demand per month were eligible for the subsidized “social” tariff structure, while larger consumers (including the commercial and services sector) paid the higher “non-social” tariff rate. For all regulated consumers, the electricity tariff consisted of a fixed monthly user fee plus a charge for the electricity consumed. The social tariff schedule included three separate rates for electricity consumption, divided between the first 50 kWh, 50–100 kWh, and 100–300 kWh. The non-social rate had a similar fixed charge and rate for electricity consumed. In addition, larger commercial and industrial consumers had distinct tariff schedules for on-peak and off-peak consumption and electricity delivered at either low tension or medium tension. The “social” rate, created in 2001, aimed to reduce electricity costs for the poorest segments of Guatemalan society. Its requirements, however, allowed the majority of residential customers to qualify. Nevertheless, during the time period under study, higher tariffs on other consumers generally allowed for cross-subsidization. The VAT was levied on electricity consumption.

### *Uruguay*

Historically, hydro has been a primary source of energy for Uruguay. Yet, hydroelectric output has varied significantly according to rainfall. In the past decade, the country experienced very dry years, especially from 2005 to 2008, and from 2011 to 2012, forcing a sharp increase in thermal generation from oil products and thus an increase in energy costs. In 2008, a drought year, 51 percent of the electricity generated in Uruguay came from hydraulic sources, 39 percent from oil products, 10 percent from biofuels waste, and the rest was generated from natural gas and unconventional renewables. On the other hand, in 2014, for example, rain patterns returned to average, increasing the share of hydroelectricity to 74 percent and decreasing the use of oil products for generation to 9 percent (International Energy Agency, 2016b). During the sample period, the power sector in Uruguay was state owned, with Administración Nacional de Usinas y Trasmisiones Eléctricas (UTE) holding a monopoly over transmission, distribution, and most of the generation segment. Fuels required for thermal generation were supplied by ANCAP—the country’s state-owned refinery—at market prices.

The Ministerio de Industria, Energía y Minería (MIEM) set consumer tariffs. Customers were divided into free and regulated consumers. Free consumers were allowed to negotiate electricity purchases directly with generators. UTE’s tariffs for regulated consumers were set considering expected future costs of generation, transmission, and distribution, as well as past imbalances resulting from wholesale prices being different than actual generation costs. Different tariffs were levied on various categories of consumption. Tariffs for residential consumers were based on time of use, with higher rates for peak hours. Tariffs were designed under a cost-plus scheme. UTE has followed a consistent and prudent policy to allow for tariffs to recognize costs, including the prices of fuels and capital recovery. The only exception during the sample period was 2008, when there was an unexpectedly large increase in international oil prices alongside lower hydroelectric output and there was a lag in tariff increases. The VAT is levied on electricity.

### *Costa Rica*

Historically, renewable energy has provided more than 90 percent of Costa Rica’s electricity supply. In 2014, for example, hydropower represented 66 percent of the country’s electricity supply, geothermal made up 15 percent, wind and solar made up 7 percent, and biomass represented 2 percent. Oil products made up the remaining 10 percent of electricity generation. During the sample period, state-owned Instituto Costarricense de Electricidad (ICE), a vertically integrated utility, played a dominant role in electricity generation and had a monopoly over transmission and distribution in the country. Private-sector participation in electricity generation was limited and the government restricted private thermal units to 20 MW and renewable energy projects to 50 MW in size.

The Autoridad Reguladora de los Servicios Públicos (ARESEP) was responsible for regulating the electricity sector and setting tariffs. ARESEP set tariffs based on the calculated cost of providing electricity services plus a reasonable rate of return. Tariffs were divided into five categories: residential, general, preferential, medium tension, and public lighting. The residential, general, and preferential categories were volume differentiated, where consumers with larger demands paid higher rates for their total consumption. Consumers in the medium-tension category paid tariffs based on time of use (peak, off-peak, and night). Within the residential sector, the initial 200 kWh of consumption each month were provided at a subsidized rate. The preferential tariff category was also subsidized and applied to specific customer classes in an effort to support social goals. It was extended to churches, hospitals, universities, and others, regardless of their need or ability to pay. Nevertheless, the actual average tariffs were above the estimated true cost of producing and delivering electricity. A reduced GST was applied to residential electricity consumption, and certain categories of consumers were fully exempt.

### *Jamaica*

During the time period under study, more than 90 percent of electricity supplied in Jamaica came from oil products. The country's electricity sector was organized around the Jamaica Public Service Company (JPS), a mixed private- and state-owned company. JPS had a monopoly over the transmission and distribution segments and was the country's largest electricity generator, although independent power producers also participated and sold power to JPS. The cost of generating electricity rose alongside increases in the international price of oil during the sample period, but final consumer tariffs remained at levels high enough to recover costs.

Jamaica's electricity sector was regulated by the Office of Utilities Regulation (OUR), which oversaw tariff-setting and electricity service standards. JPS's tariff-setting methodology was based on a price-cap scheme and considered factors such as rate of return, service quality, inflation, foreign exchange rates, and other externalities that may affect JPS's costs and performance. JPS's electricity tariffs included five distinct categories: residential, general service, low voltage, medium voltage, and street lighting. The schedule for residential consumers was based on an increasing block tariff structure, with the first 100 kWh of monthly consumption priced at less than half the rate of consumption above 100 kWh. All other consumer classes paid a flat rate per kWh and a fixed fee per month. Larger consumers were required to pay a demand charge per kW but had the option to pay a flat rate or a lower rate that was differentiated by time of use. Between formal rate reviews, rates were adjusted annually based on a number of factors including fuel prices, exchange rates, inflation, and other factors.

## Reforming Discretionary Electricity Pricing Mechanisms: The Case of Mexico

The energy reform carried out in 2013–14 aimed to restructure the power sector in Mexico in an effort to reduce the cost of generating electricity and subsidies. Prior to the reform, CFE set electricity prices at the wholesale and retail levels without adhering to cost-recovery principles. CFE did not have an obligation to be profitable; rather, it had a mandate of maintaining price stability. The government's dominance across the generation, transmission, and distribution sectors allowed it to set tariffs in a discretionary manner.

With the reform, CFE gained more legal and financial independence from the government. Private participation was introduced to the generation segment and a wholesale electricity market was established. The wholesale market itself consists of a short- and long-term market. In the short-term market, electricity prices are determined competitively by CFE and private generators, while the long-term market allows large users with high demand to enter into contracts to purchase electricity. The wholesale market determines a single, competitive price for electricity in the country based on the technology available to generate electricity throughout the national system. It aims to maximize the economic surplus of market participants.

CFE continues to have a monopoly over the transmission and distribution segments, yet the energy reform calls for CFE segments to be divided and independent from each other. CFE's generation arm will be independent from its transmission and distribution services. In this way, the generator will be able to sell energy to third parties competitively and the distributor will be able to purchase energy competitively.

The energy reform still allows the government to determine tariffs for specific groups, which in practice has led to maintaining electricity subsidies through CFE. Nevertheless, since the reform, electricity subsidies have decreased significantly, in part due to the fall in fuel prices post-2014, but also as a result of costs being more aligned with tariffs. In 2016, estimated electricity subsidies came in at 0.58 percent of GDP, compared to 0.83 percent of GDP in 2014, including losses. With a greater number of participants in the generation segment over time, it is expected that subsidies will gradually decline.

# CHAPTER 4: **Fiscal and Sectoral Implications of Energy Subsidies**

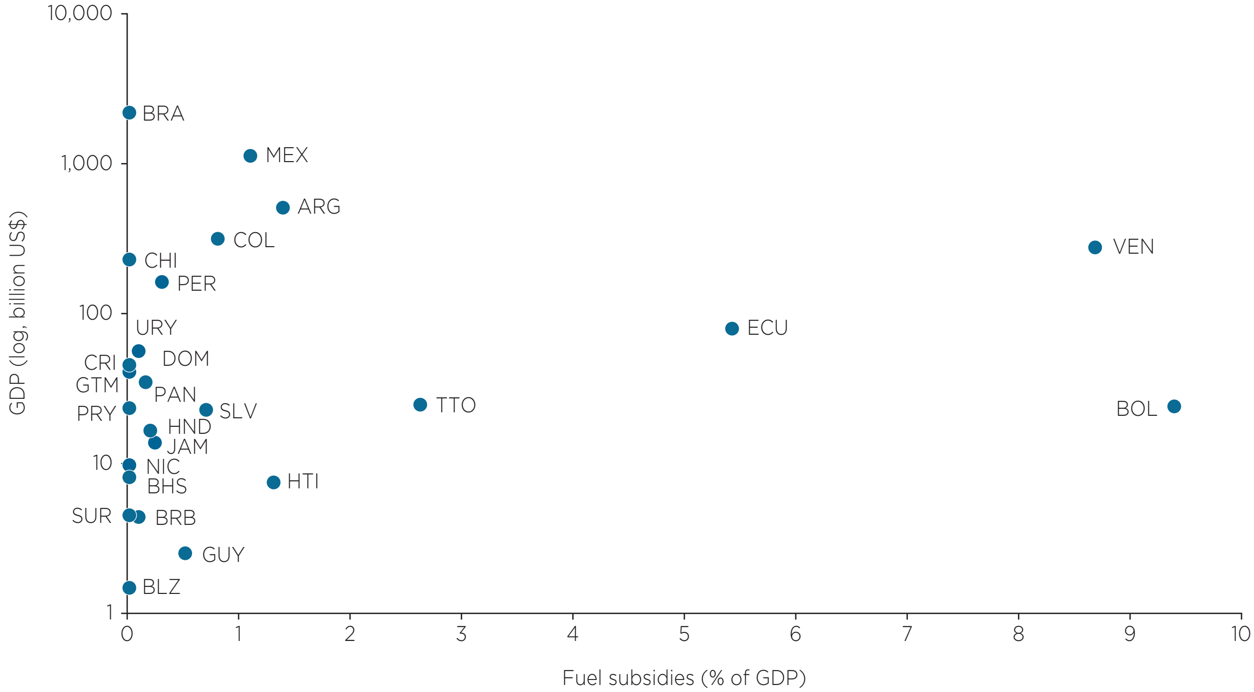
Energy subsidies often have unintended and detrimental consequences for a country's economy, household welfare, the energy sector, and the environment. In Latin America and the Caribbean, discretionary pricing policies applied to fuels and electricity between 2008 and 2014 often resulted in elevated subsidies, exacerbating fiscal deficits for some countries and putting added pressure on trade and balance of payment imbalances. In extreme cases, government spending on energy subsidies grew to be higher than public sector spending on education and health combined, despite the fact that higher-income groups, which typically consume more energy, tended to receive a majority of subsidies—an analysis that will be explored in detail in Chapter 5.

In countries where fuel or electricity prices did not account for opportunity costs or adhere to cost-recovery principles, energy companies—particularly state-owned firms—often absorbed a large share of resulting subsidies. Over time, losses hindered companies' operations and their ability to invest in the necessary infrastructure to maintain the quality of services and provide for future demand. In an environment with protracted levels of underinvestment in either the fuels or electricity sector, companies suffered from deteriorating operating conditions, which in turn made them less profitable, more indebted, and more dependent on government transfers. Deep-seated sectoral inefficiencies can have the unintended effect of raising the cost of electricity supply or increasing the need for fuel imports, creating a vicious cycle where higher subsidies are called for to cover increasing costs.

As shown in the previous chapters, most Latin American and Caribbean countries offered some type of price support for fuels, electricity, or both between 2008 and 2014. Energy subsidies were not correlated with a country's economic size, but rather implemented with varied intensity by many LAC countries in our sample at some point during the sample period (Figures 4.1–4.2). Overall, fuel subsidies were larger than electricity subsidies and were highly concentrated in a small set of oil- and gas-producing countries, primarily Bolivia, Ecuador, Trinidad and Tobago, and Venezuela. A much more diverse set of small and large economies, net fuel importers and exporters, and countries with varied input costs subsidized electricity. Costa Rica and Jamaica were the only two countries that did not subsidize electricity during the sample period according to the price-gap method.

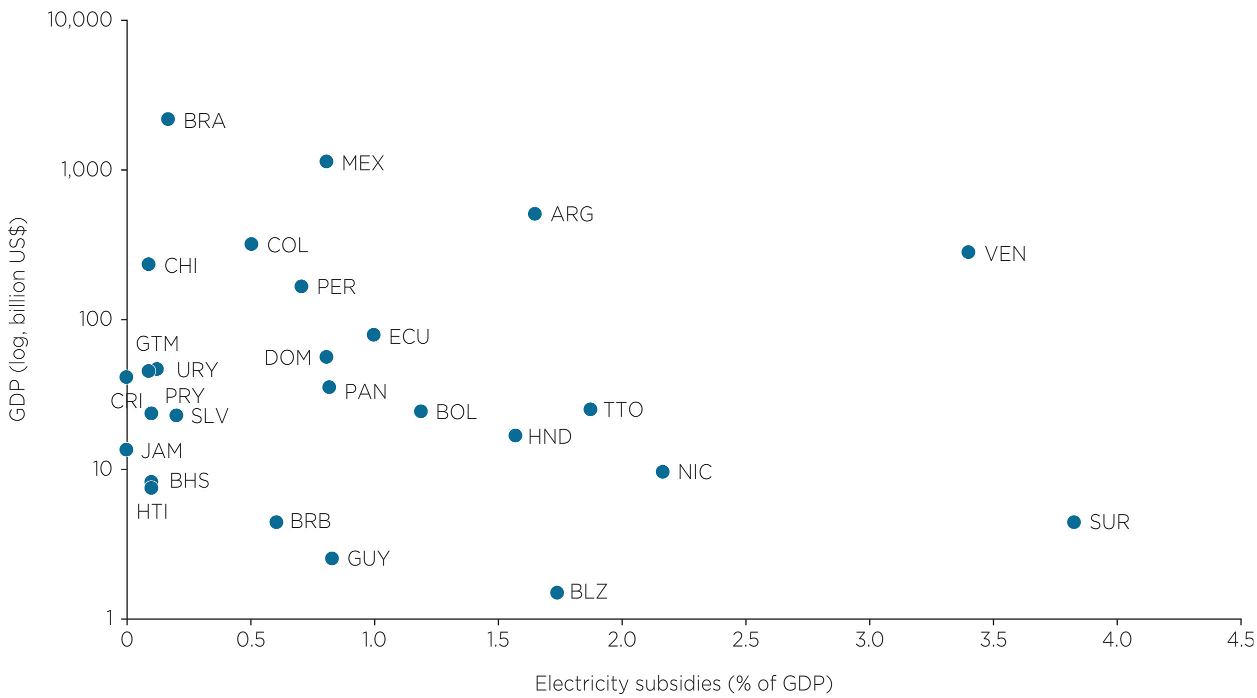
Combining fuel and electricity subsidies, Argentina, Bolivia, Ecuador, Suriname, Trinidad and Tobago, and Venezuela subsidized energy at rates that were above the regional average (Figure 4.3). Fuel subsidies were the primary drivers of high subsidization rates in Bolivia, Ecuador, Trinidad and Tobago, and Venezuela. Fuel subsidies also made up the largest share of total energy subsidies in Colombia, El Salvador, Mexico, Haiti, and Jamaica during the sample period—though subsidies as a share of GDP were much lower in this group than in the former set of countries. As previously mentioned, electricity subsidies were found in every LAC country studied except Costa Rica and Jamaica. In Nicaragua and Suriname in particular, electricity subsidies were the only drivers of these countries' relatively high overall subsidization rates during the sample period.

**Figure 4.1 Fuel Subsidies and Economic Size, Average 2008–14**



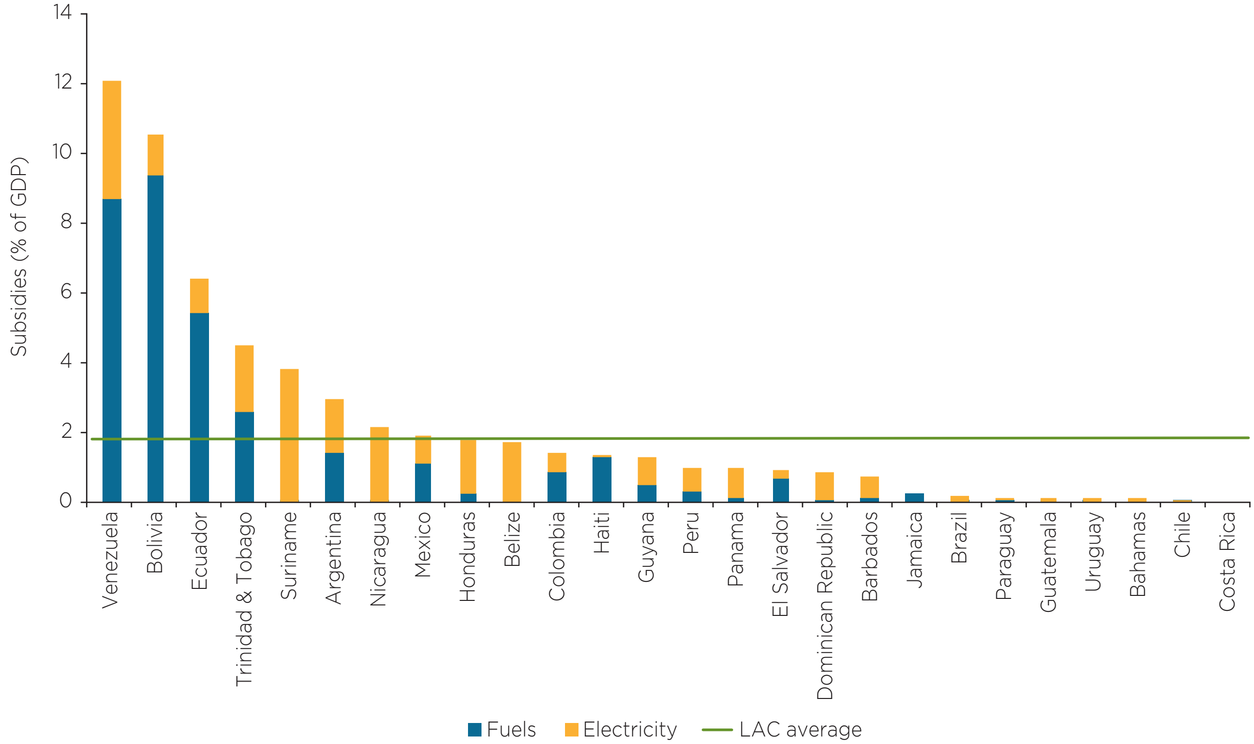

*Source:* International Monetary Fund (n.d.) and IADB calculations.

**Figure 4.2 Electricity Subsidies and Economic Size, Average 2008–14**




*Source:* International Monetary Fund (n.d.) and IADB calculations.

**Figure 4.3 Total Energy Subsidies by Country (% of GDP), Average 2008–14**




*Source:* IADB calculations.

As shown in Table 4.1, more than 70 percent—19 out of 26—of the countries in our sample adopted discretionary pricing mechanisms for both fuels and electricity during the sample period, while only two countries—Chile and Costa Rica—adopted non-discretionary schemes for both sectors. Although energy subsidies tended to be higher among countries that chose discretionary pricing schemes, the cost associated with fuels and electricity subsidies ultimately depended on the scope and intensity with which discretionary pricing schemes were implemented. Countries that fixed energy prices or intervened in the sectors' supply chain in the medium or long term incurred higher subsidies overall.

In the case of fuels, countries that adopted price-control mechanisms that effectively divorced domestic fuel prices from international prices on a continuous basis saw the largest subsidies. This included, for example, Bolivia, Ecuador, Trinidad and Tobago, and Venezuela, which froze fuel prices altogether during the sample period. In the case of electricity, countries that intervened in electricity generation markets and set tariffs ad hoc also created entrenched disassociations between the actual cost of electricity supply and consumer prices, leading to higher subsidies. This included, for example, Argentina, which regulated price-setting in a discretionary manner since suspending sector regulation in 2002, and countries such as Suriname and Venezuela, which subsidized electricity generation and resorted to ad hoc tariff adjustments throughout the sample period.

## Fiscal Implications of Energy Subsidies

Elevated energy subsidies can have significant implications for a country's fiscal stance and divert public spending away from other priority sectors. Energy subsidies represented an average of 5.6 percent of yearly fiscal revenues for the LAC region as a whole during the sample period. As could be

**Table 4.1 Energy Subsidies by Pricing Mechanism Type, Average 2008–14**

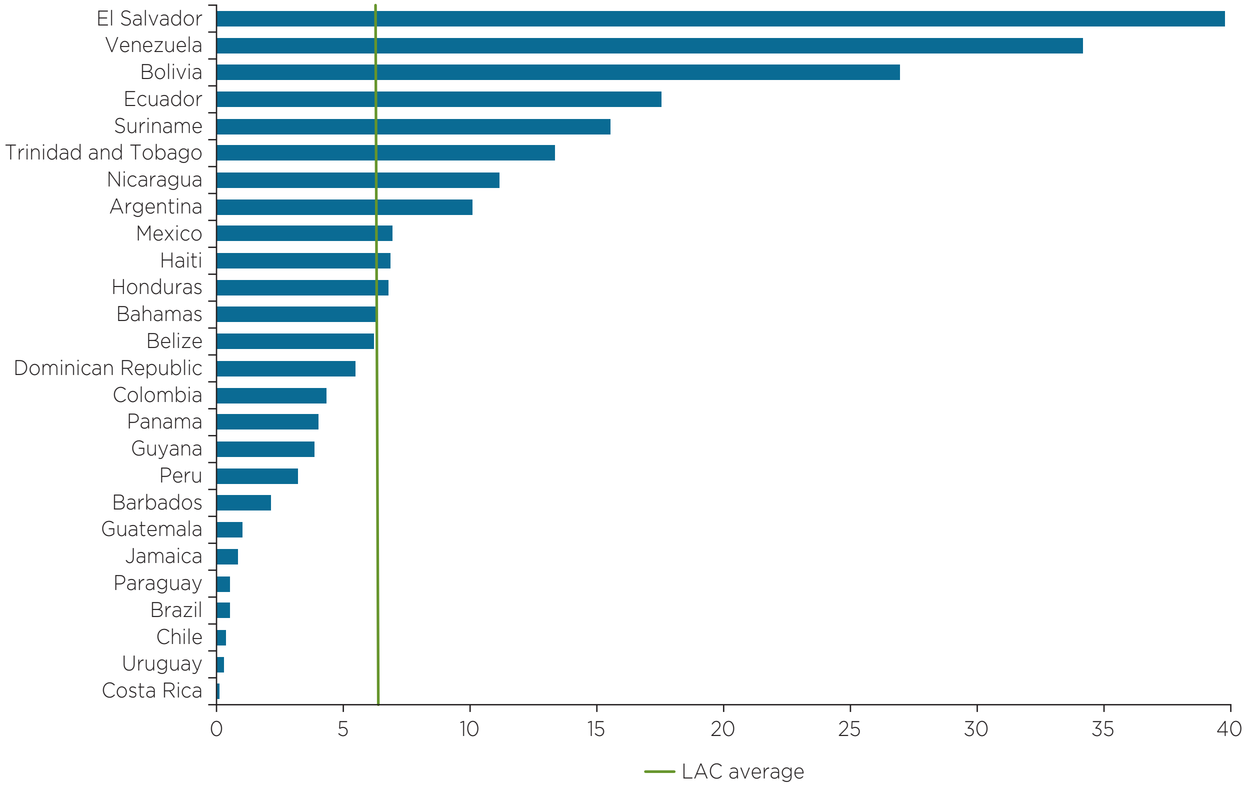
| | | Pricing Mechanism | |
|---|---|---|---|
| Country | Subsidy (% of GDP) | Fuels | Electricity |
| Venezuela | 12.1 | Discretionary | Discretionary |
| Bolivia | 10.6 | Discretionary | Discretionary |
| Ecuador | 6.4 | Discretionary | Discretionary |
| Trinidad & Tobago | 4.5 | Discretionary | Discretionary |
| Suriname | 3.8 | Discretionary | Discretionary |
| Argentina | 3.0 | Discretionary | Discretionary |
| Nicaragua | 2.2 | Non-discretionary | Discretionary |
| Mexico | 1.9 | Discretionary | Discretionary |
| Honduras | 1.8 | Discretionary | Discretionary |
| Belize | 1.7 | Discretionary | Discretionary |
| Colombia | 1.4 | Discretionary | Discretionary |
| Haiti | 1.4 | Discretionary | Discretionary |
| Guyana | 1.3 | Discretionary | Discretionary |
| Peru | 1.0 | Discretionary | Discretionary |
| Panama | 1.0 | Non-discretionary | Discretionary |
| El Salvador | 0.9 | Discretionary | Discretionary |
| Dominican Republic | 0.9 | Discretionary | Discretionary |
| Barbados | 0.7 | Discretionary | Discretionary |
| Jamaica | 0.2 | Discretionary | Non-discretionary |
| Brazil | 0.2 | Discretionary | Discretionary |
| Paraguay | 0.1 | Discretionary | Discretionary |
| Guatemala | 0.1 | Discretionary | Non-discretionary |
| Uruguay | 0.1 | Discretionary | Non-discretionary |
| Bahamas | 0.1 | Discretionary | Discretionary |
| Chile | 0.1 | Non-discretionary | Non-discretionary |
| Costa Rica | 0.0 | Non-discretionary | Non-discretionary |

*Source:* IADB calculations.

expected, energy subsidies represented an even higher proportion of fiscal revenues in countries that followed protracted discretionary pricing mechanisms for energy products during this time. In Venezuela, for example, energy subsidies were as large as 34 percent of fiscal revenues on average. In Bolivia and Ecuador, energy subsidies represented 27 and 18 percent of average yearly fiscal revenues respectively; in Argentina, Nicaragua, Suriname, and Trinidad and Tobago, they represented between 10 and 15 percent of fiscal revenues. In El Salvador, price support for LPG was the primary driver of energy subsidies, representing close to 40 percent of revenues on average (Figure 4.4).

In many Latin American and Caribbean countries, energy subsidies were found alongside challenging fiscal positions. Energy subsidies surpassed average fiscal deficits in Argentina, Ecuador, Mexico, Nicaragua, Suriname, and Venezuela (Figure 4.5). Among countries with the largest average deficits, such as Ecuador and Venezuela, energy subsidies were roughly 4.5 and 1.5 times larger than the deficit respectively. For many net energy importers, particularly those in Central America and the

**Figure 4.4 Energy Subsidies (% of Fiscal Revenue), Average 2008–14**




*Source:* International Monetary Fund (n.d.) and IADB calculations.

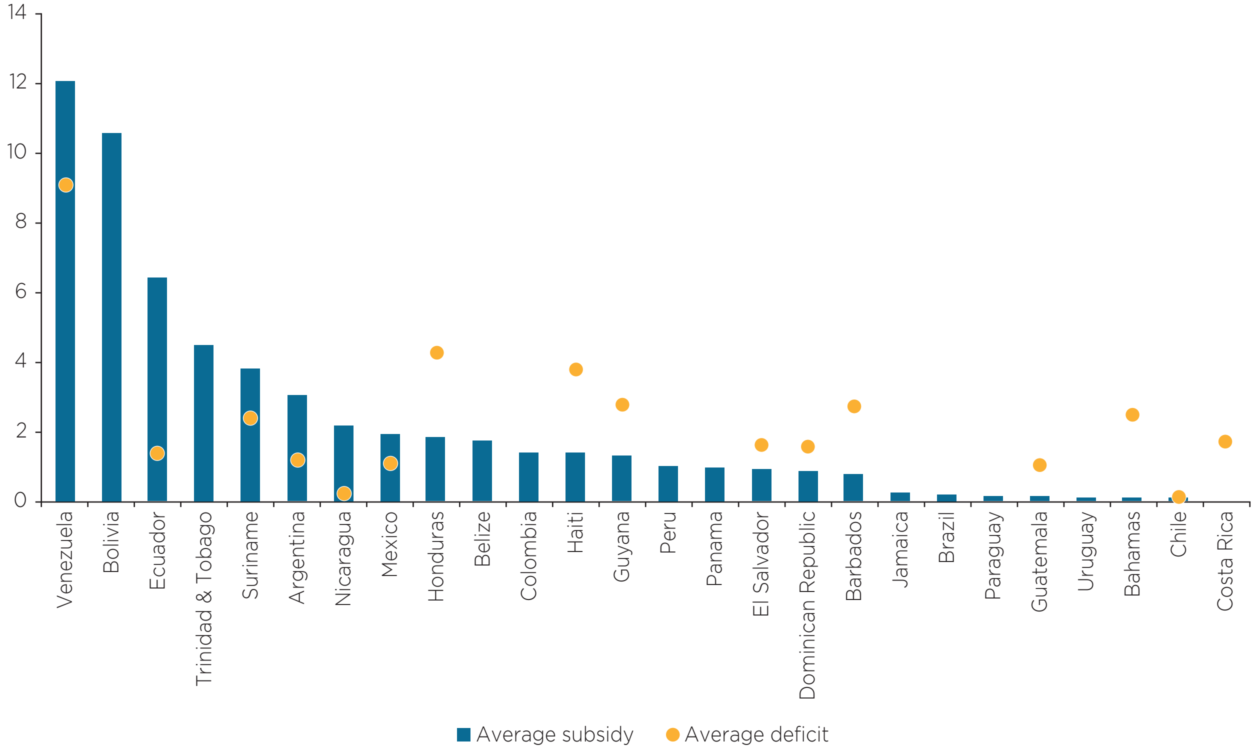
Caribbean who faced higher fuel and electricity costs, energy subsidies tended to be lower than fiscal deficits.

Even when energy subsidies did not threaten fiscal sustainability directly, they complicated planning efforts and increased fiscal uncertainty when applied in a discretionary manner. A large share of Latin American and Caribbean countries followed discretionary mechanisms, applying taxes in an ad hoc manner to smooth out fuel price increases during the sample period. Taxes can be an important source of fiscal revenue for many countries (see Box 1). Thus, when levied in a discretionary manner, reduced taxes can drive swings in revenue collections. Resulting foregone revenues in many LAC countries were generally not recorded in official budgets and were not necessarily captured by the price-gap method, which only accounted for the general VAT or GST.

In many LAC countries, energy subsidies also represented a larger-than-average share of yearly public expenditure. On average, energy subsidies in El Salvador represented roughly 32 percent of yearly public expenditures; they represented more than 27 and 23 percent of expenditures in Bolivia and Venezuela respectively, 16.5 percent of public spending in Ecuador, and between 9 and 13 percent of yearly expenditures in Argentina, Nicaragua, Suriname, and Trinidad and Tobago (Figure 4.6).

Finally, in some LAC countries, spending on energy subsidies diverted public spending away from other important sectors. As Figure 4.7 indicates, yearly spending on energy subsidies was larger than combined public spending on health and education in Venezuela. On the other hand, while energy subsidies remained below combined health and education spending in other countries, subsidies did crowd out public spending in these

**Figure 4.5 Energy Subsidies vs Fiscal Deficit (% of GDP), Average 2008–14**




*Source:* International Monetary Fund (n.d.) and IADB calculations. Net average surpluses not shown for Bolivia, Trinidad and Tobago, Belize, Brazil, Panama, Peru, Colombia, Jamaica, Paraguay, and Uruguay.

sectors. Combined spending on health and education in Ecuador, for example, was roughly 20 percent below the regional average between 2008 and 2014. Although energy subsidies represented 1 percent of GDP on average in Peru, public spending on health and education remained close to 6 percent of GDP, or roughly 33 percent below the regional average.

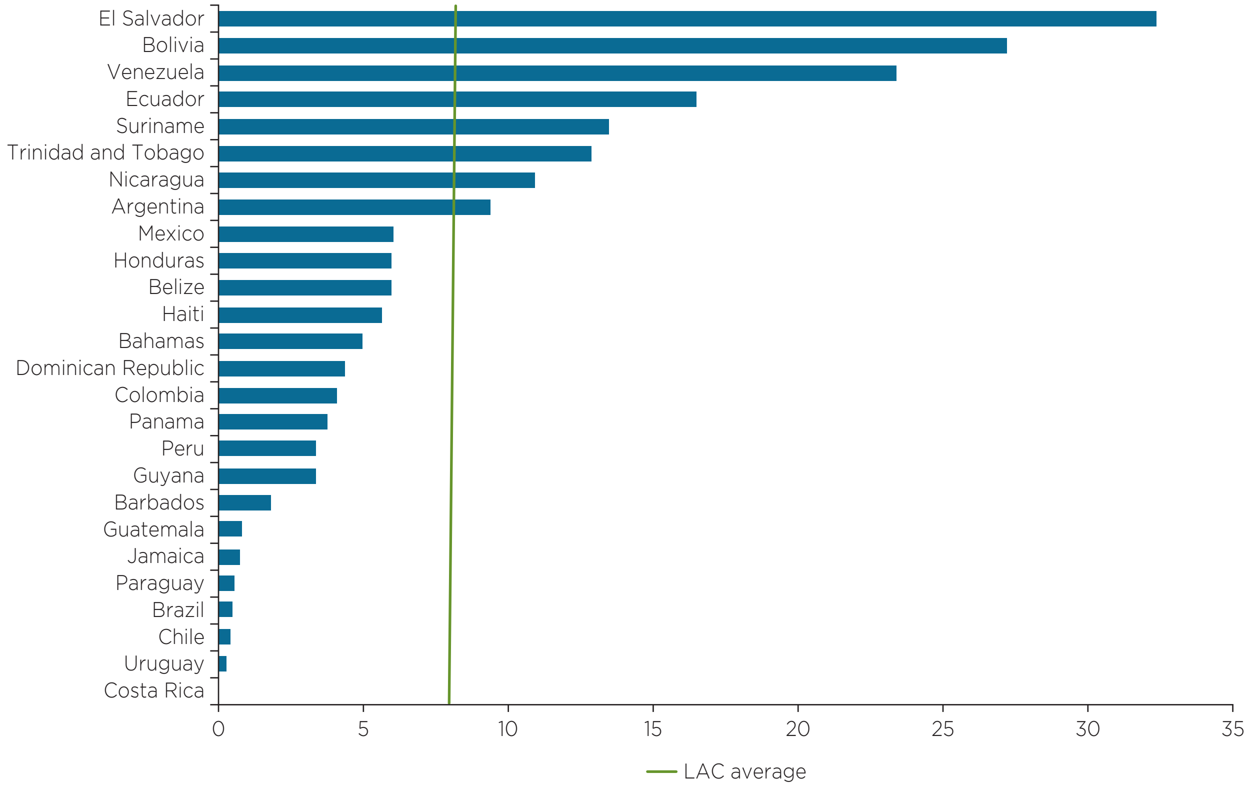
## Sectoral Implications of Energy Subsidies

Energy companies often absorb a large share of the losses resulting from the application of price control mechanisms for fuels and electricity. In the short run, price controls result in lower profit margins, reduced efficiency, and increased uncertainty for companies operating in the sector. Yet, as companies lose the ability to absorb variations in costs without the capacity to pass through increases to consumers, price controls can begin to threaten not only an individual company's operational and financial health but also the sector's overall sustainability. This was the case in several of the LAC countries that applied discretionary pricing mechanisms to fuels and electricity during the sample period.

Persistently slim profit margins or operating losses reduce a company's ability to invest in the necessary capacity and infrastructure to maintain the quality of current services and keep pace with projected demand. Lower profits and losses to energy companies can also spill over and result in the accumulation of payment arrears to suppliers along the energy value chain. As was seen in the country summaries in Chapters 2 and 3, payment arrears often accumulated to state-owned suppliers in some LAC countries that adopted discretionary pricing mechanisms for fuels or electricity during the sample period.

Moreover, protracted underinvestment in the hydrocarbons and electricity sectors often led to

**Figure 4.6 Energy Subsidies (% of Public Expenditure), Average 2008–14**



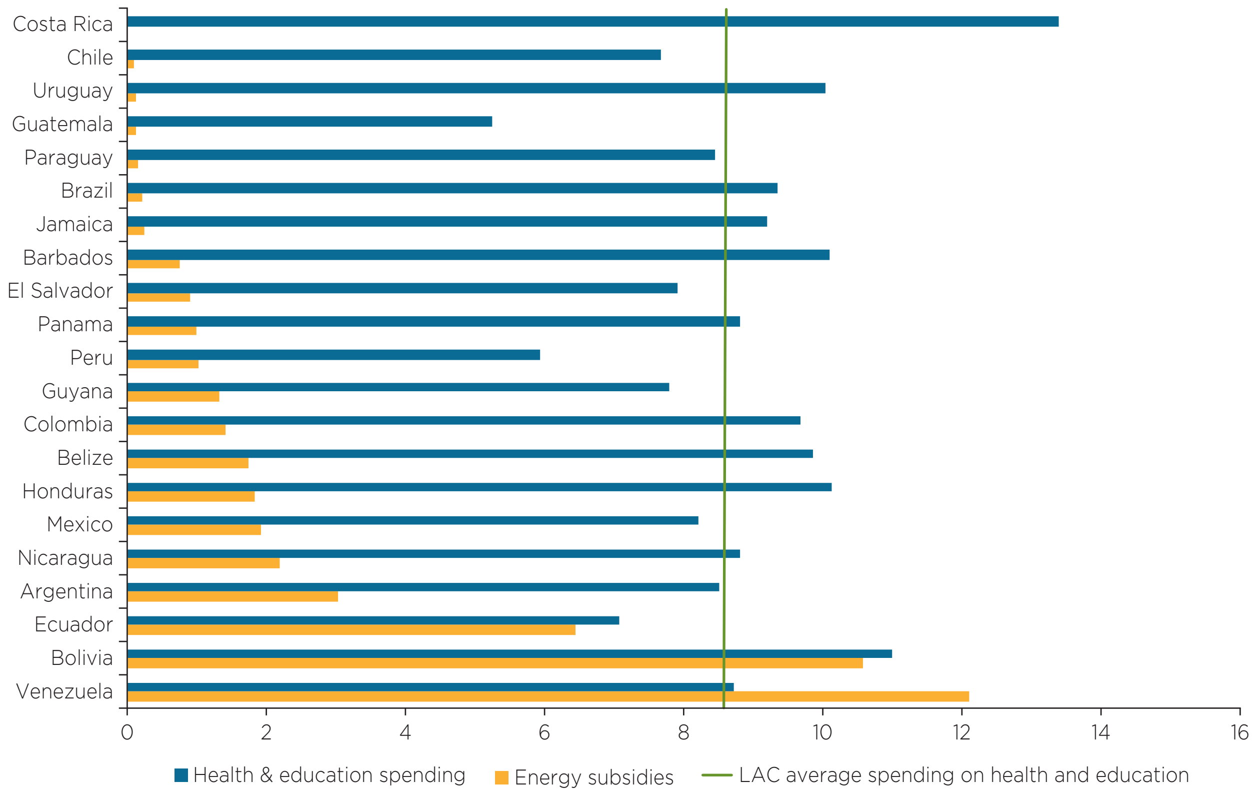

*Source:* International Monetary Fund (n.d.) and IADB calculations.

declining production of hydrocarbons for oil- and gas-producing countries; falling refining capacity; or, in the case of electricity, a deterioration in services and higher generation costs. Falling oil and gas production can reduce government revenue for oil- and gas-producing countries and constrain government's fiscal space. Declining refining capacity, on the other hand, can increase the need for higher fuel imports if refineries can no longer cover domestic demand. If oil and gas or fuel production declines significantly, this can alter the country's trade position, turning it from a net exporter to a net importer of hydrocarbons or fuels. Increased reliance on imports can thus put pressure on a country's current account and balance of payments as the country must finance higher imports. Subsidies contributed to declining sector productivity in many LAC countries during the sample period.

In Venezuela, for example, pump prices for most fuels were the lowest in the world, and the government also provided below-cost natural gas and fuels for electricity generation. Domestic consumption—which is equivalent to roughly 21 percent of PDVSA's total production—generated a negative cash flow for the company because fuels were highly subsidized (Hernández and Monaldi, 2016). A high subsidy bill compounded the effects of mandatory fiscal contributions plus a deteriorating macroeconomic context, leaving PDVSA indebted and in a precarious financial position. Oil production has declined steadily due to a lack of investment. Between 2010 and 2015, oil production in Venezuela declined by 253,000 barrels of oil per day, reaching 2.86 million barrels per day in 2015 (Hernández and Monaldi, 2016).

Although Venezuela is an extreme example, energy companies throughout the region experienced losses as a result of underpricing fuels during the time period under study. As with PDVSA, deteriorating operating conditions were not solely the

**Figure 4.7 Energy Subsidies vs Health and Education Spending in LAC (% of GDP), Average 2008–14**




*Source:* International Monetary Fund (n.d.) and IADB calculations.

result of price controls, but such discretionary pricing schemes contributed to a worsening situation in several LAC countries. In Trinidad and Tobago, for example, state-owned Petrotrin's financial standing was relatively weak, with annual reports from 2011 to 2013 showing after-tax losses or profit margins in the single digits despite the country's natural resource wealth (Petrotrin, 2011–13).

In Ecuador, while production of oil remained relatively flat, underinvestment in the country's state-owned refineries meant that Petroecuador had to import an increasing amount of fuels, priced at higher international prices. Between 2007 and 2014, the country's fuel imports grew by roughly 80 percent, from 32 million barrels to 48.6 million barrels (Banco Central del Ecuador, 2016). Similarly, in Argentina, price controls applied to natural gas contributed to a decline in production since 2004, resulting in an increased need for more expensive imports. In Bolivia, on the other hand, permanent price distortions for crude oil and oil derivatives lowered the incentives for oil exploration and production and shifted investment to natural gas projects instead, given that a significant share of natural gas is exported at higher prices.

In the case of electricity, a deteriorating sector has negative consequences that can reverberate through an economy. Costly and unreliable electricity can constrain economic growth and disproportionately affect poorer populations. Often, this goes against the intended reasoning for subsidizing electricity in the first place. Protracted underinvestment in the sector can lead to a vicious circle of high technical and non-technical losses, poor quality of services, and the need for even higher subsidies. Several LAC countries found themselves in this cycle as, over time, losses resulting from subsidies added to deteriorating operating conditions. Often, companies relied on government commitments to cover investment projects or losses. Such transfers were generally not well documented or transparent.

In Argentina, for example, below-cost electricity tariffs caused financial distress to companies and resulted in deteriorating services and even energy shortages in periods of peak demand. The government not only subsidized electricity generation through budgetary transfers, but also absorbed the burden of investing in the expansion of services. Similarly, in Suriname, state-owned EBS suffered from chronic revenue shortfalls and was unable to invest in new generation capacity or upgrades and expansions to the system. Below-cost tariffs in the Dominican Republic, on the other hand, have resulted in the accumulation of arrears to electricity generation companies by state-owned distributors. Deficits accumulated by distribution companies were also regularly financed through budgetary transfers. Still, transfers were not enough to prevent the sector from suffering from very high losses, frequent blackouts, and rationing in certain neighborhoods. Other LAC countries faced a similar vicious cycle of low investment, poor quality of service, and high levels of theft and non-payment, while at the same time facing high generation costs.

# CHAPTER 5: **Distributive Impact of Energy Subsidies and Reform**

*By Adrien Vogt-Schilb, Estefanía Marchán, Kuishuang Feng, and Klaus Hubacek*

The previous chapters show that energy subsidies across Latin America resulted in high fiscal costs and often had onerous sectoral and economic implications. The natural question is then, why, despite such implications, do governments provide energy subsidies? In the case of large oil and gas producers in LAC and globally, subsidies were often adopted as a mechanism for distributing natural-resource wealth to the population. More generally, however, from a political economy point of view, one reason subsidies exist is that they are a visible mechanism for governments to provide benefits to poor and middle-class voters and sometimes to industrial interests in exchange for political support (Victor, 2009; Vogt-Schilb and Hallagatte, 2017). During our sample period, the rise in energy subsidies in Latin America and the Caribbean followed an unprecedented spike in oil prices that had far-reaching effects on energy prices that proved politically difficult to fully pass through to final consumers. Governments used subsidies to mitigate the effect of higher energy prices on vulnerable populations.

Yet, while energy subsidies may be *effective* at shielding poor households from energy price hikes, they are a very *inefficient* way to do so. Indeed, we find that in 2014 only 23 percent of the average (median) energy subsidy in Latin America and the Caribbean ended up in the pockets of households in the bottom 40 percent of the population (ranked by per capita income).[1] On average across energy products and countries, it cost about US$10 to transfer US$1 to the bottom quintile using subsidies. This cost is much higher than better targeted social protection programs implemented in LAC such as cash transfers, which cost around US$2 for every US$1 that is transferred to poor households (Inter-American Development Bank, 2016). Given that energy subsidies are an inefficient vehicle for protecting vulnerable populations, their negative sectoral, economic, and environmental effects become more difficult to justify.

Acknowledging the inefficiency of fossil fuel subsidies, their high fiscal cost, and the perverse incentives they create to emit pollutants, governments around the world have committed to phasing out energy subsidies. In September 2009, for example, the leaders of the G20—a group of the 20 largest economies, including Argentina, Brazil, and Mexico—pledged to "phase out and rationalize over the medium term inefficient fossil fuel subsidies while providing targeted support for the poorest."

International experience shows that governments will likely be unsuccessful at reforming subsidies if they lack an understanding of the effects of subsidy removal on the welfare of households and other key stakeholders, and if they do not take specific steps to tackle these effects and appropriately communicate them. Phasing out subsidies may hurt poor and middle-class households and voters. This may be considered a problem on

[1] Across a subset of 11 countries and all energy types. Subsidies for some energy types were better at targeting poor people than others: 26 percent of the budget cost of natural gas and LPG subsidies went to households in the bottom two quintiles of the population (as gas and LPG are typically used in households for cooking), while only 18 percent of diesel and gasoline subsidies ended up in their pockets (as poorer households are less likely to own a car).

normative grounds, because many governments aim at improving, not worsening, the livelihood of poor and middle-class households. And it may translate into a de facto barrier to reform: these households may use their political power to bar reforms they perceive would not serve their best interest (Trebilcock, 2014; Olson, 1977).

International experience also suggests that governments that chose to recycle part of the budgetary savings gained from a reduction in subsidies into compensation measures for more vulnerable groups are more likely to succeed (Sdralevich, Sab, and Zouhar, 2014; Rentschler and Bazilian, 2016). Such compensation measures can take the form of targeted social spending, for instance using cash transfer programs, or, when this is not feasible, with subsidized services used by vulnerable households such as public transportation, education, health, or school meal programs.

In this chapter, we estimate what fraction of government proceeds from subsidy removal or energy taxation would need to be redirected to the bottom 40 percent of households to compensate them for energy price hikes. In addition, our analysis identifies the specific vehicles through which different households are impacted by price increases for various energy types in each country, providing insight into how, if necessary, poor households could be compensated for potential welfare losses with in-kind measures.

These insights are based on an assessment of the welfare impacts of raising energy prices in 11 countries in Latin America and the Caribbean (Table 5.1). We analyze the direct and indirect welfare impacts across income quintiles of raising fuels and electricity prices. The *direct* impact measures by how much households' direct spending on energy is affected by the price hikes. The *indirect* impact measures by how much the price of all other goods and services increase given the increases in energy prices and how this affects households.

The price hikes are modeled for all fuels and electricity in each country, regardless of whether the country actually subsidized energy, in order to provide a sense of the populations' vulnerability to energy price increases. For countries that subsidize fuels or electricity, the study provides an understanding of which households capture the most benefits from subsidies and how each would be impacted if these were reduced. For countries that do not currently subsidize energy, the study reveals how future price shocks or other price increases—due to carbon taxes, for example—would affect households across the income spectrum.

In the following sections, we first describe the method applied to estimate welfare impacts using household consumption surveys and input-output analysis. We then analyze the welfare impacts of price shocks on diesel and gasoline, natural gas and LPG, and electricity. We define regressive impacts as those where the percentage of welfare loss resulting from a price shock decreases as household income increases, and progressive impacts as those where the percentage of welfare loss resulting from a price shock increases alongside household income. In other words, the impact of raising the price of an energy product is regressive when poorer households lose relatively more income than wealthier ones, whereas the impact is progressive when wealthier households lose relatively more than poorer households.

We find that price hikes on natural gas and LPG tend to be most regressive, reflecting the fact that these fuels are used largely by households for basic needs such as heating and cooking and spending on these fuels represents a higher share of income for poor households than for wealthier ones. We also find that the direct impact of price increases

**Table 5.1 Countries in Sample**

| | | | | | |
|---|---|---|---|---|---|
| Argentina | Bahamas | Barbados | Chile | Costa Rica | Ecuador |
| Guatemala | Jamaica | Nicaragua | Paraguay | Uruguay | |

on gasoline and diesel tend to be progressive, as transport fuels are used more by wealthier households because they are more likely to own a car. However, the indirect impacts of gasoline and diesel price hikes affect poor households through higher public transportation, electricity, and food prices.

Finally, the direct welfare impacts on households of raising electricity prices tend to be regressive or neutral, reflecting the fact that electricity prices affect households directly and indirectly by increasing the cost of most other goods and services. Still, even when price hikes are progressive, they can affect poor households significantly. In the last section, we thus assess how much governments would need to spend in better-targeted social protection schemes to compensate poor households for the direct and indirect price of energy price hikes, and present those results by country and energy types.

## Method

The simulation involves raising the average consumer price of gasoline, diesel, LPG, natural gas, and electricity reported in each country. The magnitudes of the shocks chosen for each energy type were selected considering similar studies by the IMF and the World Bank. Table 5.2 below lists the modeled price increases by energy type.[2]

**Table 5.2 Modeled Price Shocks**

| Energy Type | Price Increase (USD) |
|---|---|
| **Electricity** | 5 cents/kWh |
| **Gasoline and Diesel** | 25 cents/Liter |
| **Natural Gas and LPG** | 250 cents/MMBTU |

Drawing from national household consumption surveys, the analysis identifies how much, on average, households across income quintiles spend on energy and other products. To facilitate comparisons across countries, the surveys are harmonized and household spending is binned into 12 aggregate categories, including, for example, electricity, natural gas, transportation, food, and clothing.[3] For each consumption item, consumption reported in surveys is scaled up so that total spending matches national spending per national accounts. We define welfare as the household's total annual expenditure reported in the household survey, converted to US dollars. This expenditure represents the household's budget constraint.

Following any increase in energy prices, it would be more expensive for households to consume the same amount of energy. *The direct impact* of energy price hikes is the additional share of its total budget that a household would now need to spend to continue to consume the same amount of energy as before the price hike. This practice, common in the literature (Arze del Granado, Coady, and Gillingham, 2014; Coady, Flamini, and Sears, 2015), provides a reasonable upper bound of the short-term impact of price hikes on households, before they have had time to adjust their consumption or adapt, by, for example, investing in more energy-efficient cars or appliances. The method also assumes that firms pass on the full increase in costs to consumers.

Energy is also used by firms across the economic value chain to produce goods and services that households consume, such as public transport, food, and clothing. We used harmonized input-output (IO) tables describing the economic structure of these 11 countries to estimate the energy content of goods and services produced in each country. With this data, we project by how much the price of goods and services consumed by households

[2] The fact that these shocks are somewhat arbitrary reduces our ability to report results aggregated across energy types. LPG and natural gas are different fuels with different uses and prices across Latin America and the Caribbean. The harmonized household surveys that we use, however, do not provide separate information on spending for each fuel, thus the modeled price shocks have to be combined. Nevertheless, only four countries in our sample consume natural gas and LPG (Argentina, Chile, Ecuador, and Uruguay). For these countries, the welfare impact of price shocks will include both fuels. For all other countries, only the impact of LPG price shocks is included. A US$2.50/MMBTU shock corresponds to US$0.06/liter for LPG.

[3] Standardized household survey data taken from Jimenez and Yépez-García (2016).

would increase if energy prices increased. For instance, if in a given country producing US$1 worth of processed meat requires US$0.20 of gasoline on average (e.g., to transport the meat), then doubling the price of gasoline would, on a first approximation, increase the price of meat by 20 percent. Combining IO tables and household surveys, we are thus able to analyze the *indirect impact* of energy price increases on household welfare (see Appendix II for technical description of the analysis). In doing so, we can also identify through which consumption categories households are most hurt when an energy price hike occurs.

Additionally, we extend our analysis of the direct impact of raising energy prices on household welfare into two scenarios: *unconditional* and *conditional*. Unlike the indirect impacts of energy price increases, which affect households by raising the prices of other goods and services they consume, the direct welfare effects only depend on how much and whether households consume a specific energy product. For example, the direct impact of raising electricity prices will be different for households who have electricity connections in their homes versus households who do not and therefore do not purchase electricity. In the *unconditional* scenario, the direct effects of raising energy prices are analyzed for all households in an economy, whereas in the *conditional* scenario, the impact of energy price shocks is only analyzed for those households that directly consume a particular energy type. Consequently, the direct effects on household welfare of raising energy prices may vary between the conditional and unconditional scenarios.

Considering both the direct and indirect impacts across quintiles, we are able to determine what share of the total welfare cost of energy price hikes would fall on different income categories. This number allows us to determine that energy subsidies are an inefficient way of transferring income to poor households. We present this as the total cost for the government to transfer US$1 of income to any income category using fuels or electricity subsidies. We then calculate how much of this budget governments could redirect to mitigation measures that would leave the two poorest quintiles (the bottom 40 percent of the population) at least as well off as they were before the price increases. For instance, if only 5 percent of the spending on gasoline subsidies ultimately reach households in the bottom quintile, then a government could in principle remove the subsidy and redirect as little as 5 percent of its savings to households in the bottom quintile. If the government could use ideal, perfectly targeted transfers, households in the bottom quintile would not be worse off after the reform.

One caveat should be kept in mind when interpreting these results: they provide lower-bound estimates of the spending required to compensate poor households. In reality, transferring income to poor households is not always easy. Existing cash transfers, for instance, do not achieve perfect targeting. Some poor households who should benefit from the program can be excluded by mistake. In the average Latin American country, only 40 percent of poor people benefit from these schemes (Robles, Rubio, and Stampini, 2015). And better-off households, who should not benefit, are included by mistake. Because of these inclusion errors, it costs an average of US$1.90 to transfer US$1 to poor households in LAC using existing cash transfer programs (Inter-American Development Bank, 2016). Thus, the numbers we provide do not reflect what spending increases would make *existing* cash transfer programs able to compensate households for direct and indirect impacts of energy price hikes. Rather, they reflect the amount governments should spend in an *improved* cash transfer program, or any other social protection scheme, that effectively targets and covers poor households.

## Welfare Impacts of Energy Price Shocks

### Gasoline and Diesel

#### *Unconditional Welfare Impacts*

Latin American and Caribbean countries' exposure to gasoline and diesel price shocks varies. Figure 5.1 shows the total (direct and indirect) impact of price increases for gasoline and diesel on house-

**Figure 5.1** **Direct and Indirect Welfare Losses from a US$0.25/L Gasoline and Diesel Price Increase (% of Current Expenditure)**

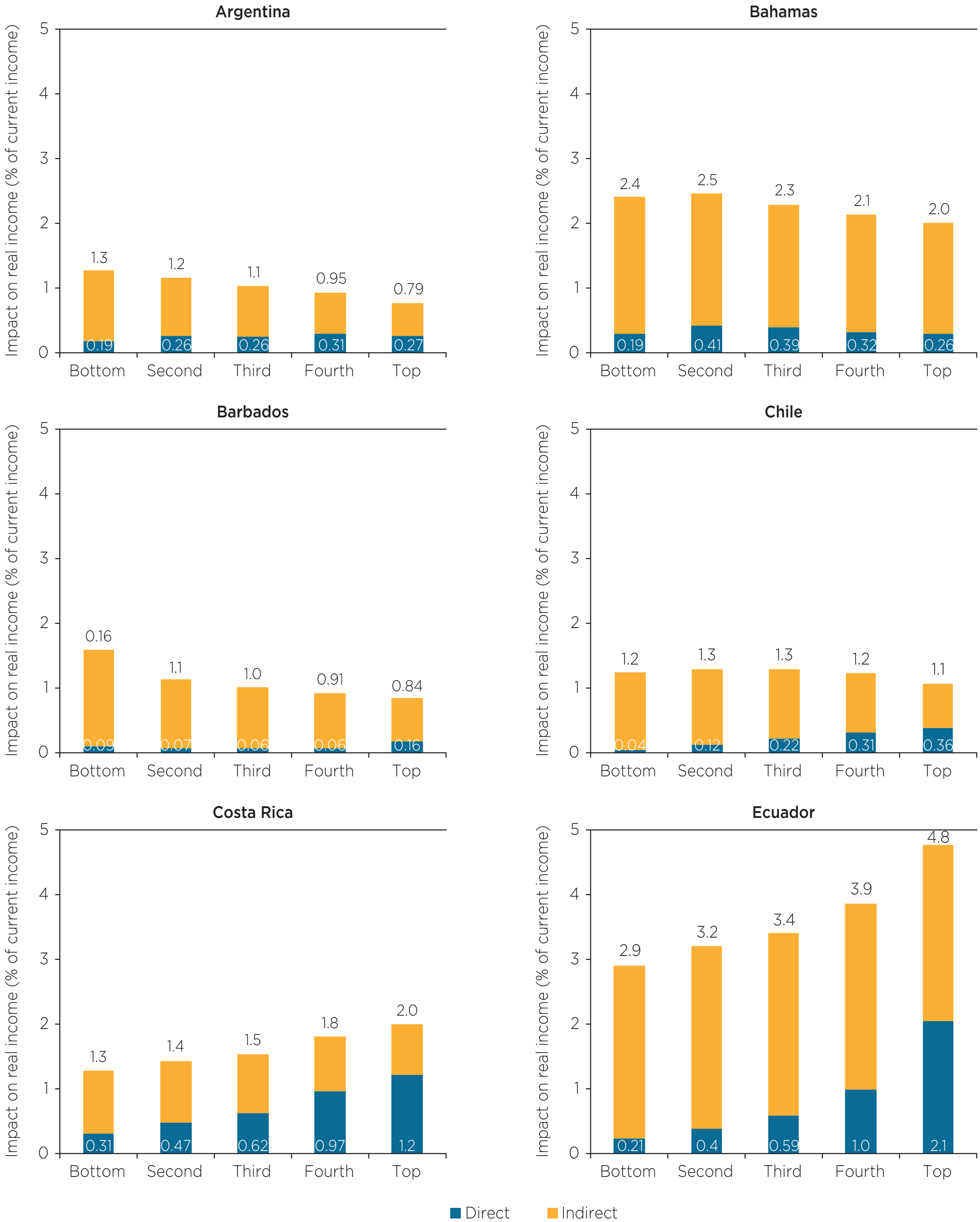



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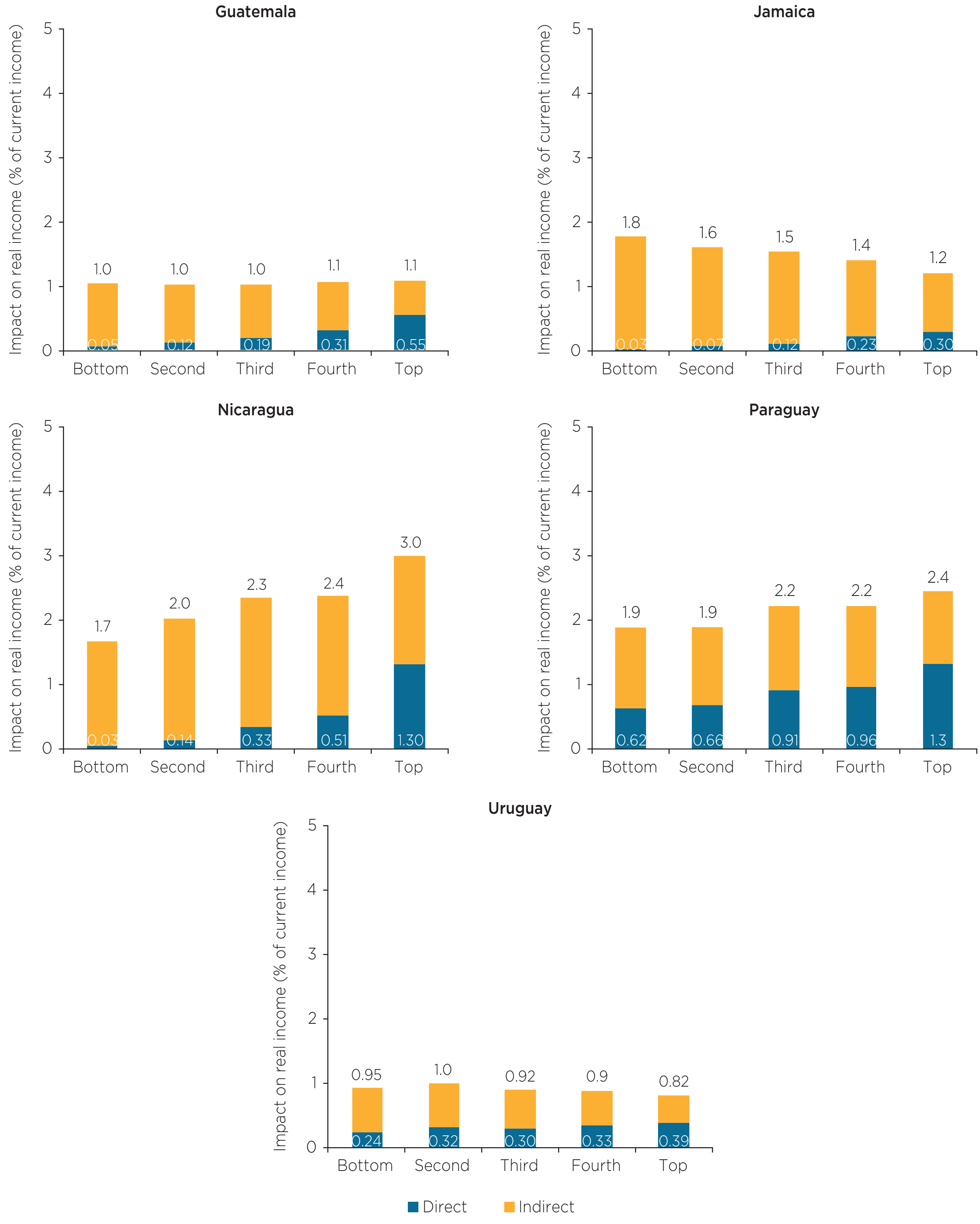
**Figure 5.1 Direct and Indirect Welfare Losses from a US$0.25/L Gasoline and Diesel Price Increase (% of Current Expenditure)** *(continued)*



hold welfare across income quintiles. Some countries including Argentina, Bahamas, Barbados, and Jamaica exhibit a regressive impact of price increases, meaning that lower-income groups would lose a higher share of their welfare than higher-income groups as a result of increased fuel prices. On the other hand, raising gasoline and diesel prices in other countries including Costa Rica, Ecuador, Nicaragua, and Paraguay produces a progressive impact, whereby higher-income groups would be affected relatively more than lower-income groups if prices rise. Still, another set of countries including Chile, Guatemala, and Uruguay shows a somewhat neutral distributional effect of fuel price increases.

The countries in each group above do not necessarily share any specific characteristics that determine the way the welfare impacts of increasing gasoline and diesel prices are distributed among income groups. In fact, the total relative progressivity or regressivity of a fuel price shock is country specific. In addition, it is also important to state that cross-country comparisons of the magnitude of the welfare impacts should be approached carefully because a US$0.25/L increase in gasoline and diesel prices represents a different price shock for each country (Table 5.3). With the exception of Ecuador and Uruguay, the countries in our sample did not subsidize gasoline or diesel in 2014. Nevertheless, there are still important regional trends that can be identified from the analysis.

First, the direct impact of gasoline and diesel price increases tends to be progressive. Except for the Bahamas, increasing the cost of gasoline and diesel would cost richer households relatively more than it would cost poorer households in every country in our sample. Ecuador and Nicaragua show the largest contrast between poor and rich households. The price hike would have a smaller effect on the bottom quintiles—costing 0.2 percent and 0.03 percent of their expenditure, respectively—while it would cost 1.3 and 2.1 percent of expenditure to the top quintiles. The progressivity of the impact is because households in richer quintiles are more likely to directly consume gasoline or diesel in the first place, for instance because they are more likely to own a car than households in the bottom quintile.

Second, the indirect impact of gasoline and diesel price hikes on household welfare tends to be regressive. Apart from Ecuador and Nicaragua, where the incidence of price hikes is almost neutral, increasing the cost of gasoline and diesel would impose a relatively higher welfare cost on poorer households than on wealthier ones in every country in our sample. The indirect effect of the price hike on the lowest quintile ranges from 0.7 percent of a household's budget in Uruguay to more than 2 percent in the Bahamas. Barbados and Jamaica show the largest contrast between the poorest and richest quintiles. Increasing fuel prices would amount to 1.5 and 1.8 percent of the poorest households' yearly budget respectively, while it would cost the top quintiles 0.7 and 0.9 percent respectively.

Finally, taken together, the total welfare effects of gasoline and diesel price increases are largely influenced by the indirect effects of price hikes. Across the 11 countries of our sample, the indirect impacts account for 70 percent of the total welfare cost of a price increase. How these indirect price increases affect households depends on the gasoline and diesel content in the goods and services they consume. Table 5.4 shows the simulated impact of a US$0.25/L hike on diesel and

**Table 5.3 Increase in Gasoline and Diesel Prices (% of Current Price)**

| | Argentina | Bahamas | Barbados | Chile | Costa Rica | Ecuador | Guatemala | Jamaica | Nicaragua | Paraguay | Uruguay | Median |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Diesel and Gasoline | 19 | 59 | 26 | 19 | 21 | 86 | 24 | 20 | 24 | 22 | 14 | 22 |

**Table 5.4 How a Price Increase on Gasoline and Diesel May Increase the Relative Price of Goods and Services (% of Current Price)**

| | Argentina | Bahamas | Barbados | Chile | Costa Rica | Ecuador | Guatemala | Jamaica | Nicaragua | Paraguay | Uruguay | Median |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Public Transport | 6.0 | 7.9 | 3.1 | 6.3 | 7.9 | 13 | 51 | 7.5 | 16 | 12 | 5.7 | 7.9 |
| Electricity | 8.1 | 36 | 8.6 | 2.0 | 2.2 | 10 | 0.37 | 6.7 | 0.73 | 0.46 | 1.6 | 2.2 |
| Durables | 0.91 | 2.9 | 0.74 | 1.4 | 1.3 | 5.5 | 2.4 | 1.9 | 1.6 | 0.52 | 0.26 | 1.4 |
| Food | 1.4 | 1.7 | 0.43 | 0.6 | 0.99 | 1.1 | 1.0 | 0.88 | 0.51 | 0.85 | 0.6 | 0.88 |
| Household Services | 0.21 | 2.3 | 0.64 | 0.6 | 0.77 | 1.1 | 0.25 | 0.84 | 0.62 | 0.88 | 0.22 | 0.64 |
| Clothes | 0.48 | 1.7 | 0.46 | 0.31 | 0.98 | 0.89 | 0.74 | 0.81 | 0.32 | 0.43 | 0.31 | 0.48 |
| Water | 0.46 | 3.9 | 0.97 | 0.16 | 0.1 | 4.9 | 0.28 | 0.77 | 0.37 | 0.75 | 0.17 | 0.46 |
| Natural Gas | 0.09 | 1.5 | 0.4 | 1.1 | 0.37 | 0.71 | 0.0 | 0.08 | 0.09 | 1.9 | 0.05 | 0.37 |
| Communication | 0.23 | 1.3 | 0.35 | 0.22 | 0.16 | 0.84 | 0.99 | 0.34 | 0.93 | 0.42 | 0.21 | 0.35 |
| Entertainment | 0.2 | 2.2 | 0.54 | 0.27 | 0.26 | 0.29 | 0.09 | 0.43 | 0.49 | 0.21 | 0.14 | 0.27 |
| Personal Care | 0.24 | 0.88 | 0.23 | 0.2 | 0.22 | 0.83 | 0.21 | 0.22 | 0.53 | 0.38 | 0.1 | 0.23 |
| Education and Health | 0.22 | 1.7 | 0.44 | 0.19 | 0.16 | 0.56 | 0.13 | 0.46 | 0.59 | 0.23 | 0.12 | 0.23 |
| Other Fuels | 0.13 | 4.0 | 1.0 | 0.59 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

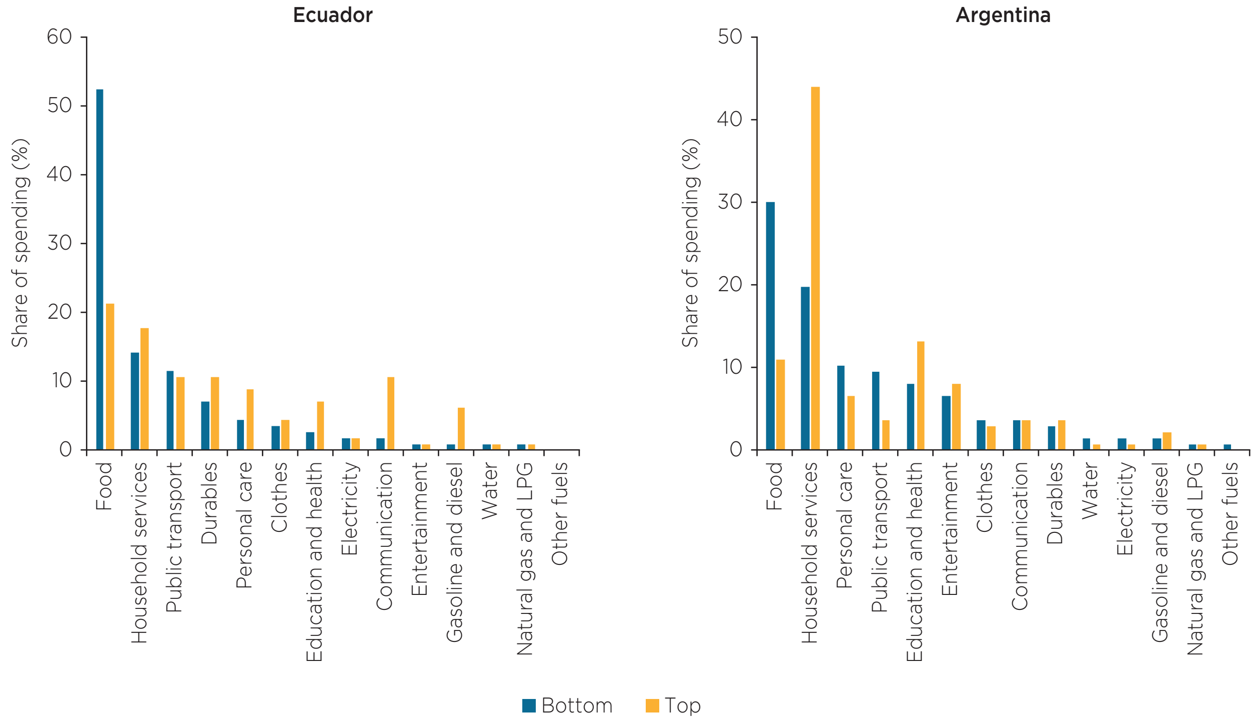
gasoline on the price of different consumption categories in the 11 countries in our sample. As could be expected, public transport is the most affected consumption category across countries, with a median price increase of around 8 percent and a large distribution, ranging from 3 percent in Barbados to as much as 51 percent in Guatemala. Electricity is also significantly affected by the price increases,[4] especially in Caribbean and other countries where power generation relies heavily on petroleum products. Electricity prices increase by 36 percent in the Bahamas and 8.6 percent in Barbados, for example.

These indirect price hikes affect different households differently, depending on how households spend their money. Figure 5.2 shows the budget of the top and bottom quintile households in Argentina, a country where the total welfare effects of a price hike would be relatively regressive, and Ecuador, a country where the total welfare effects of a price hike would be relatively progressive.

In Argentina, the regressive indirect effects of the price hike end up outweighing the more moderate progressive direct effects. Consumption categories such as food and public transport, both of which have a relatively higher gasoline and diesel content, are key spending categories for households in the bottom quintile and are less significant for the highest quintile. On the other hand, the share of direct spending on gasoline and diesel for both the top and bottom quintiles is relatively modest. Thus the higher regressive indirect effects of gasoline and diesel price shocks end up shifting the total relative welfare burden to the poorer quintiles. In Ecuador, on the other hand, a high share of direct spending on diesel and gasoline by the top quintile relative to the bottom quintile means that the large progressive direct effects of an increase in fuel prices outweighs the relatively neutral (though still large) indirect effects on the poorest quintiles. Similar illustrations of the budget shares for all the other countries in our sample are available in Appendix II.

4 In this analysis, fuel oil used in power generation is considered to fall in the "diesel and gasoline" category.

**Figure 5.2 Budget Distribution for the Bottom and Top Income Quintiles in Argentina and Ecuador (% of Current Expenditure)**




*Source:* Household survey data (Jimenez and Yépez-García, 2016).

Given that the total welfare effects of gasoline and diesel price shocks are determined by each country's specific context, it is important to understand the channel through which higher gasoline and diesel prices affect the most vulnerable households, particularly if protecting these groups against price volatility is governments' motivation for regulating fuel prices. Table 5.5 provides the top five consumption categories that contribute most to the loss of household welfare in the bottom quintile when there is a hike on diesel and gasoline prices. In Argentina, for example, 39 percent of the total impact of a price hike on the poorest quintile is a result of an increase in the cost of public transport, 28 percent is a result of food price increases, 14 percent is due to the direct impact of the increase in gasoline and diesel prices, 8 percent is due to an increase in electricity prices, and 3 percent is due to more expensive household services, which includes rent and dwelling construction.

In all countries but the Bahamas, Barbados, Costa Rica, and Guatemala, the main vehicle through which diesel and gasoline price hikes decrease the welfare of the bottom quintile is higher public transportation costs. In the Bahamas and Barbados, ensuing electricity price increases are the most difficult to tackle for the poorest households, while in Costa Rica and Guatemala it is food prices. Interestingly, the direct impact of diesel and gasoline never ranks first in Table 5.5. In some countries, like Paraguay or Nicaragua, the direct effect is not even in the top five channels through which the hike affects households in the bottom 20 percent. In fact, over all quintiles, the indirect impact of gasoline and diesel price hikes accounts for 70 percent of the cost of a price hike for households.

These results suggest ways of compensating poor households for subsidy removal or increased taxation on these fuels (for instance due to carbon taxes). Cash transfers targeted to poor people are in

**Table 5.5 Top Five Consumption Categories for Bottom Quintile by Country, Ranked by Their Contribution to Welfare Losses Resulting from a Price Increase in Gasoline and Diesel (% of Total Welfare Losses)**

| | | | | | |
|---|---|---|---|---|---|
| **Argentina** | Public transport 39 | Food 28 | Gasoline and diesel 14 | Electricity 8 | Household services 3 |
| **Bahamas** | Electricity 38 | Household services 16 | Gasoline and diesel 12 | Entertainment 9 | Public transport 6 |
| **Barbados** | Electricity 61 | Education and health 9 | Public transport 8 | Household services 7 | Gasoline and diesel 6 |
| **Chile** | Public transport 58 | Household services 18 | Food 12 | Electricity 5 | Gasoline and diesel 3 |
| **Costa Rica** | Food 30 | Gasoline and diesel 24 | Household services 14 | Public transport 12 | Durables 9 |
| **Ecuador** | Public transport 49 | Food 18 | Durables 12 | Gasoline and diesel 7 | Electricity 5 |
| **Guatemala** | Food 63 | Durables 12 | Public transport 10 | Clothes 6 | Gasoline and diesel 5 |
| **Jamaica** | Public transport 44 | Electricity 23 | Food 19 | Household services 6 | Education and health 2 |
| **Nicaragua** | Public transport 67 | Food 13 | Household services 6 | Personal care 4 | Durables 2 |

principle the most straightforward and efficient way to compensate poor households. But if cash transfers are not feasible or desirable in a specific country, public spending on public transportation, cross-subsidizing electricity prices, or support for nutritional programs are examples of compensating measures that governments can put in place to alleviate the impact of higher energy prices. To help policymakers design such compensation schemes, the next section examines what share of the revenues from subsidy removal or gasoline taxation the government could use to fund these types of programs.

## *Conditional Welfare Impacts*

The previous analysis established that the indirect impacts of a rise in gasoline and diesel prices tend to hurt poorer households most across our sample of Latin American and Caribbean countries, while the direct impacts of a price hike tend to have a relatively larger effect on wealthier households. The reason these dynamics hold is that wealthier households are more likely to consume a greater share of gasoline or diesel directly versus poorer households, because, for instance, they are more likely to own one or more cars. When looking at the bottom quintile across some of our sample countries, for example, only 8 percent of Chileans, 7 percent of Ecuadorians, 3 percent of Jamaicans, and 1 percent of Nicaraguans report directly consuming diesel or gasoline.

Yet, the welfare impacts of gasoline and diesel price increases on lower-income households that do consume gasoline and diesel directly may be important for governments to consider when planning subsidy removal (or increased fuel taxation) because they can affect the political economy of reform. Or governments might find that protecting these more vulnerable households from price shocks is important in and of itself.

To shed light on this question, we computed the direct impact of diesel and gasoline price hikes only on those households who do consume diesel and gasoline. As mentioned in the methods section, we call this the *conditional* analysis. This contrasts with the *unconditional* analysis, which applies to all households regardless of whether they consume fuels. Figure 5.3 compares the conditional and un-

**Figure 5.3** **Conditional and Unconditional Direct Welfare Losses from a US$0.25/L Diesel and Gasoline Price Increase (% of Current Expenditure)**

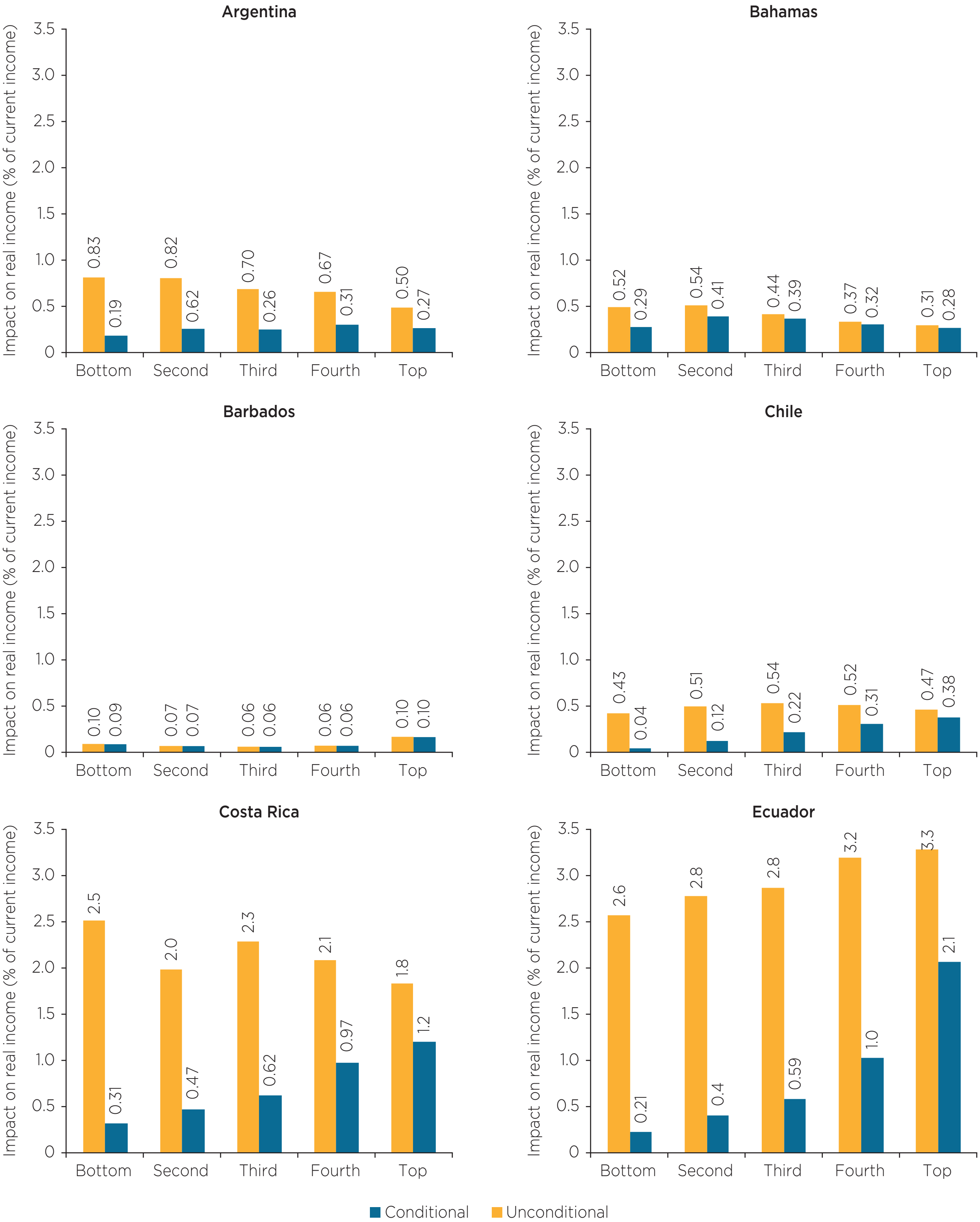



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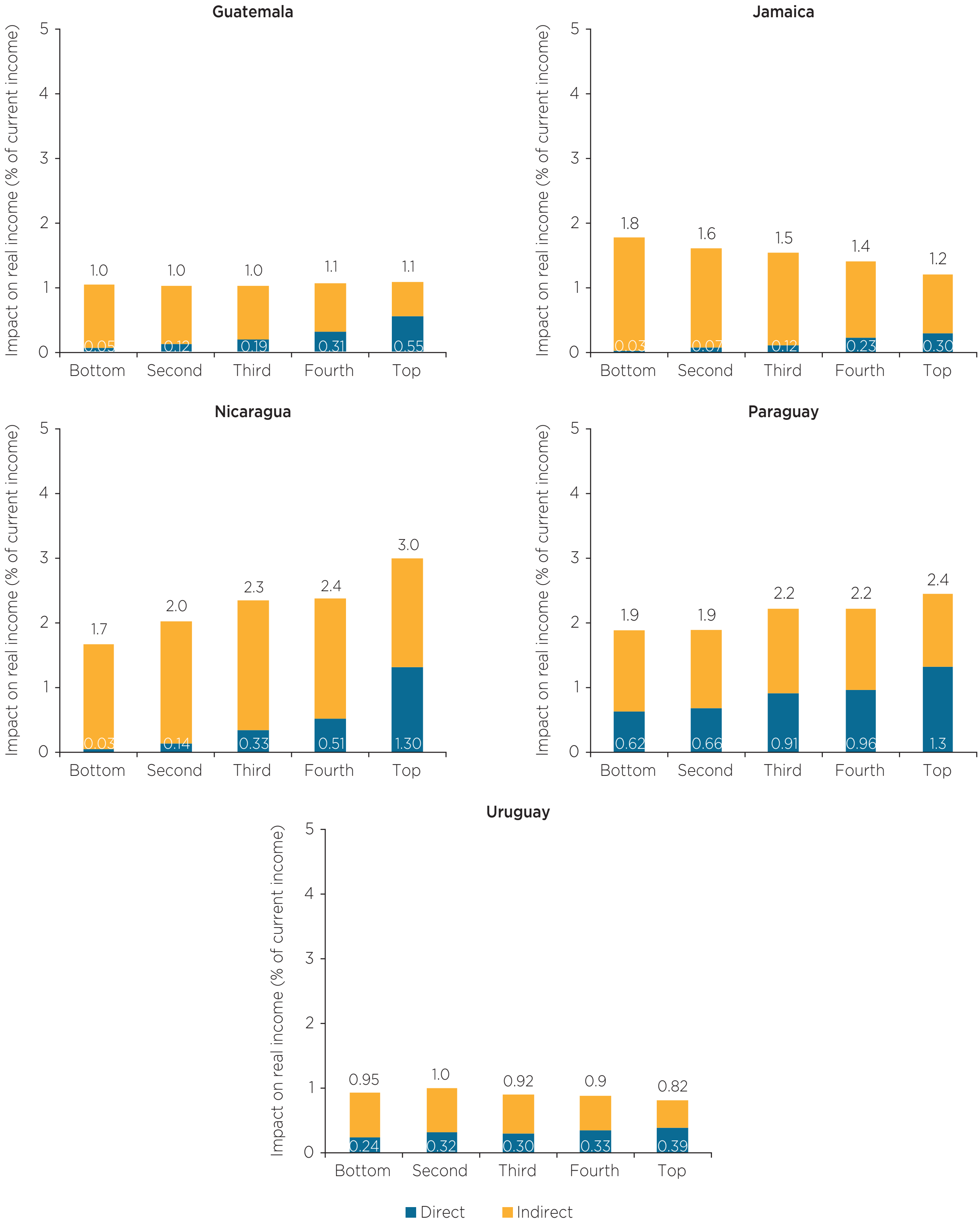
**Figure 5.3 Conditional and Unconditional Direct Welfare Losses from a US$0.25/L Diesel and Gasoline Price Increase (% of Current Expenditure)** *(continued)*



conditional incidence of a US$0.25/L price hike on gasoline and diesel.

Compared to the unconditional analysis, the conditional impact is less progressive in many countries in our sample. In fact, in Argentina, Costa Rica, Guatemala, and Uruguay, the progressive impact witnessed in the unconditional scenario turns regressive when focusing only on those households who do consume gasoline or diesel. In Chile and Jamaica, the progressive impact seen in the unconditional scenario turns neutral when modeling conditional impacts. And, in the Bahamas and Barbados, the effect is small and neither clearly progressive nor regressive.

On the other hand, in Ecuador, Nicaragua, and Paraguay, the progressive unconditional impacts seen under the unconditional scenario are mitigated, but the total impact is magnified. In Ecuador, while the unconditional price increase would cost only 0.2 percent of income on average to the bottom quintile, it would cost as much as 2.6 percent to those households who do consume diesel or gasoline in that same quintile. In addition, a hike conditional on consumption has less of a progressive impact on all households: it costs 2.6 percent to the bottom quintile and up to 3.3 percent to the top quintile. In Nicaragua, focusing on consumers who do consume gasoline or diesel yields the same result: a more moderate progressive effect, with costs ranging from 2 percent on the bottom quintile to 2.9 percent on the top quintile. The effect is similar in Paraguay.

Combined, the conditional and unconditional analyses show that—whether the impact of raising prices is progressive or regressive—the nominal impacts of gasoline and diesel hikes on the welfare of poor households can be significant. As the next subsections show, a similar finding arises from the assessment of price hikes on other fuels and electricity.

## Natural Gas and Liquefied Petroleum Gas

### *Unconditional Welfare Impacts*

Natural gas and LPG are different fuels with different uses and prices across Latin America and the Caribbean. In our sample, only four countries use natural gas in their production system—Argentina, Chile, and, to a lesser extent, Ecuador and Uruguay. In Argentina, natural gas is the primary fuel used by households, industries, and in electricity generation; it was responsible for the largest share of energy subsidies in the country during the period under study. In Chile, two-thirds of natural gas is used in electricity production, while the rest goes to households and industry. Ecuador uses natural gas only for power generation. And, in Uruguay, natural gas consumption is in fact almost negligible. LPG, on the other hand, is used in every country in our sample, primarily by lower-income households for cooking and heating.

As was described in the method section, the harmonized household surveys used to assess the impact of price shocks do not provide separate information on spending for natural gas and LPG, and thus the modeled price shocks are combined for both fuels in Argentina, Chile, Ecuador, and Uruguay. For all other countries, only LPG price shocks are included.

Figure 5.4 shows the total direct and indirect impact of natural gas and LPG price increases on household welfare across income quintiles. For most countries, the total welfare effects of price increases tended to be regressive, meaning that lower-income groups would bear a relatively larger burden than higher-income groups as a result of the price hikes. In Guatemala, Nicaragua, and Panama, the total welfare effects were relatively neutral or concentrated in the middle class.

The direct welfare effects of price increases drove the overall welfare impacts in most countries because natural gas and LPG tend to be used directly by households for heating and cooking in the countries in our sample. The effects were also likely to be regressive. The most prominent exception is Argentina, where there is a heavy reliance on natural gas in particular across all economic sectors.

The indirect impacts of price increases tended to be small or negligible in most countries except Argentina and Chile, where they account for 65 and 51 percent of the welfare cost respectively. Both countries use natural gas for power generation, thus

**Figure 5.4 Direct and Indirect Welfare Losses from a US$2.50/MMBTU Natural Gas and LPG Price Increase (% of Current Expenditure)**

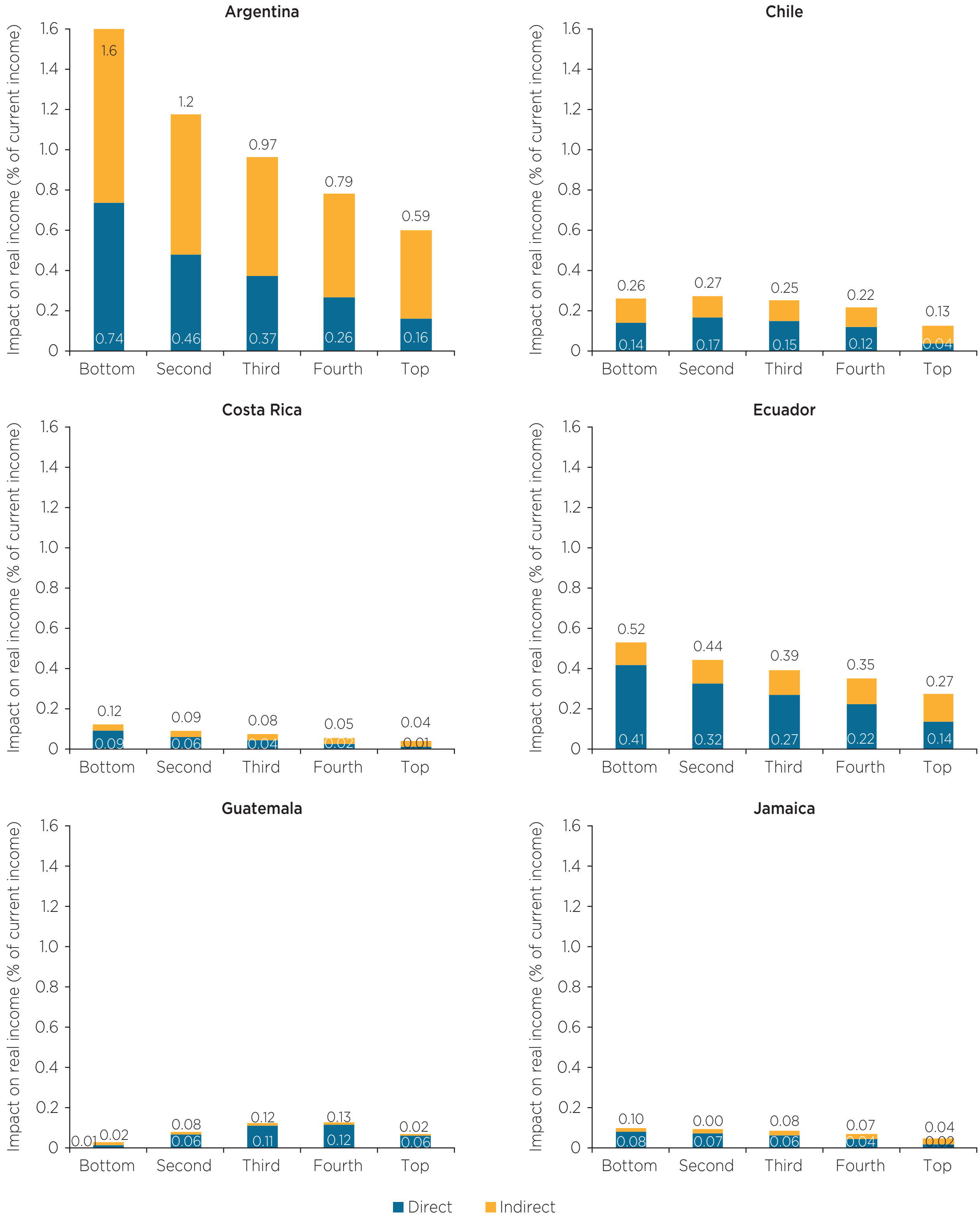



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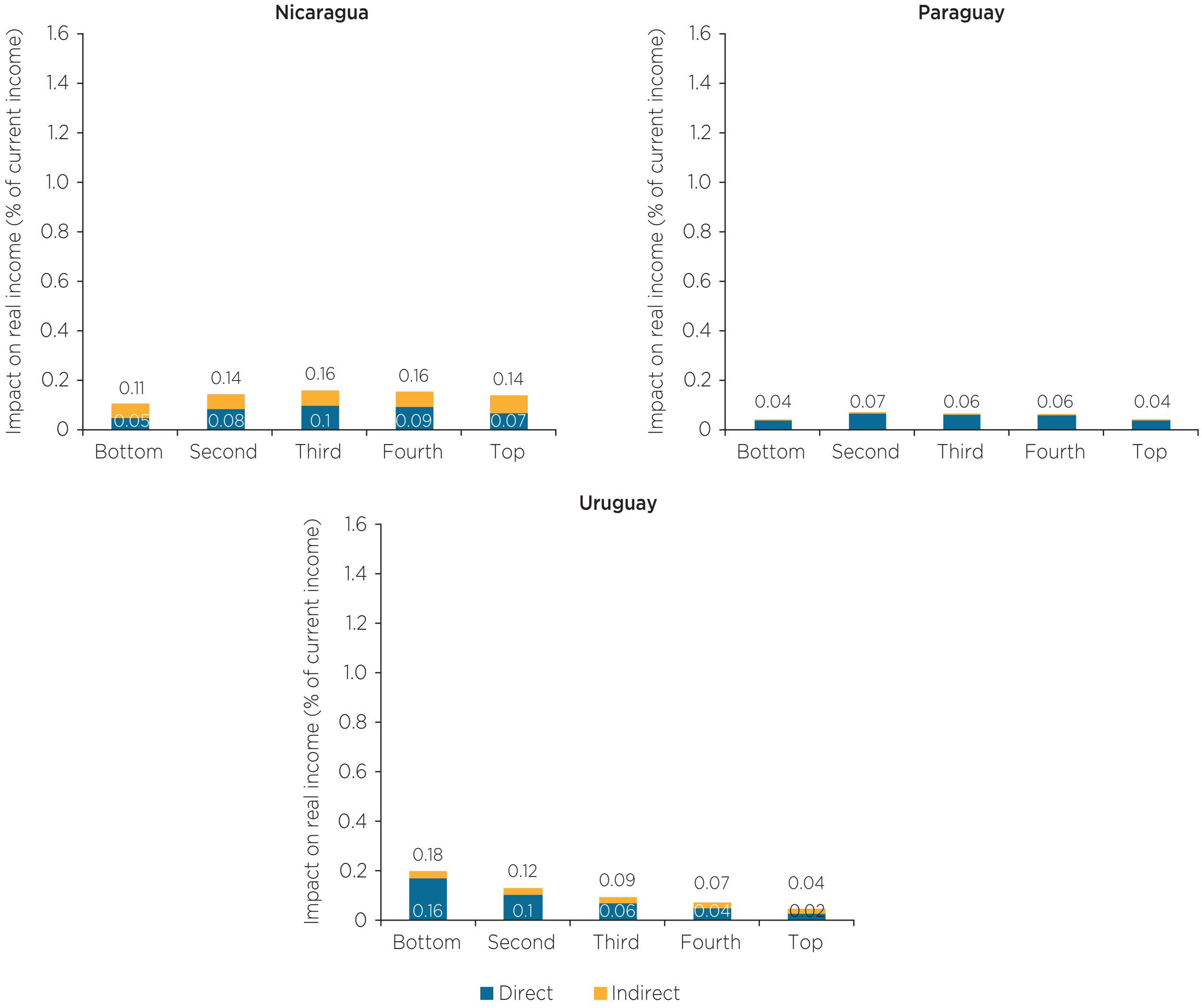
**Figure 5.4 Direct and Indirect Welfare Losses from a US$2.50/MMBTU Natural Gas and LPG Price Increase (% of Current Expenditure)** *(continued)*




driving price increases of goods and services across the economy when there is a price shock. Table 5.6 compares the contribution of the direct and indirect impacts on welfare losses for the bottom quintile to get an understanding of the main drivers behind the overall regressive welfare effects of natural gas and LPG price increases in each country.

In all countries, the direct welfare effects of natural gas and LPG price increases explain most of the impact on households in the bottom quintile. In Argentina, Chile, and Ecuador—where natural gas is used for power generation—the indirect welfare impacts through electricity price increases arrive in second position. Food and household services play a significant role in many countries.

## *Conditional Welfare Impacts*

In Chapter 1, it was established that between 2008 and 2014, Latin American and Caribbean countries prevented the full pass-through of price increases for LPG more than any other fuel. In fact, many governments offered explicit subsidies for LPG in an effort to aid poorer households, which tend to consume more of the fuel relative to higher-income

**Table 5.6 Top Five Consumption Categories for Bottom Quintile by Country, Ranked by Their Contribution to Welfare Losses Resulting from a Price Increase in Natural Gas and LPG (% of Total Welfare Losses)**

| | | | | | |
|---|---|---|---|---|---|
| **Argentina** | Natural gas and LPG<br>46 | Electricity<br>22 | Food<br>10 | Public transport<br>8 | Household services<br>3 |
| **Chile** | Natural gas and LPG<br>54 | Electricity<br>20 | Household services<br>9 | Public transport<br>6 | Food<br>4 |
| **Costa Rica** | Natural gas and LPG<br>75 | Food<br>14 | Durables<br>6 | Household services<br>3 | Entertainment<br>1 |
| **Ecuador** | Natural gas and LPG<br>79 | Electricity<br>9 | Food<br>4 | Durables<br>3 | Household services<br>2 |
| **Guatemala** | Natural gas and LPG<br>48 | Durables<br>38 | Food<br>9 | Clothes<br>2 | Household services<br>1 |
| **Jamaica** | Natural gas and LPG<br>82 | Household services<br>5 | Food<br>4 | Education and health<br>3 | Entertainment<br>2 |
| **Nicaragua** | Natural gas and LPG<br>45 | Household services<br>14 | Food<br>12 | Personal care<br>11 | Public transport<br>5 |
| **Paraguay** | Natural gas and LPG<br>88 | Public transport<br>4 | Food<br>4 | Household services<br>2 | Durables<br>0 |
| **Uruguay** | Natural gas and LPG<br>85 | Food<br>5 | Electricity<br>4 | Gasoline and diesel<br>3 | Household services<br>1 |

households. Natural gas was also subsidized by many LAC countries. In this context, differentiating the conditional versus the unconditional effects of a direct LPG or natural gas price increase could be particularly important.

Figure 5.5 shows the unconditional and conditional direct impact of a US$2.50/MMBTU price shock on LPG and natural gas on household expenditure. In all countries, the conditional impacts are regressive. This analysis reveals that in some countries, such as Chile and Guatemala, the relatively neutral unconditional welfare impacts hide the fact that LPG (and natural gas when applicable) use is concentrated in a small proportion of poor households. For those households, a price hike would have a significant impact, such that the conditional impact is much higher and regressive than the unconditional impact.

## Electricity

### *Unconditional Welfare Impacts*

In Chapter 2, it was established that governments routinely intervene in the electricity sector to regulate prices. Electricity is a key input in many economic and household activities, and thus electricity price hikes directly and indirectly affect the welfare of households. As discussed before, price increases of petroleum products and natural gas lead to higher electricity costs for many LAC countries that use thermal generation. Yet, electricity tariffs can also be raised independently of fuel prices, for instance if the government reforms tariffs or changes taxes on electricity. This section examines the welfare impacts across households of a US$0.05/kWh increase in electricity prices.

One difficulty when analyzing the impact of electricity price hikes on household welfare is that households across income quintiles often face different tariff rates. Electricity tariffs can vary drastically across regions and income groups within each country, though typically lower-income households or households with lower consumption pay lower tariff rates.[5] Most official household surveys, however, only report consumption of electricity as expenses in monetary value rather than

[5] See Chapter 3 for more details.

**Figure 5.5 Conditional and Unconditional Direct Welfare Losses from a US$2.50/MMBTU Natural Gas and LPG Price Increase (% of Current Expenditure)**

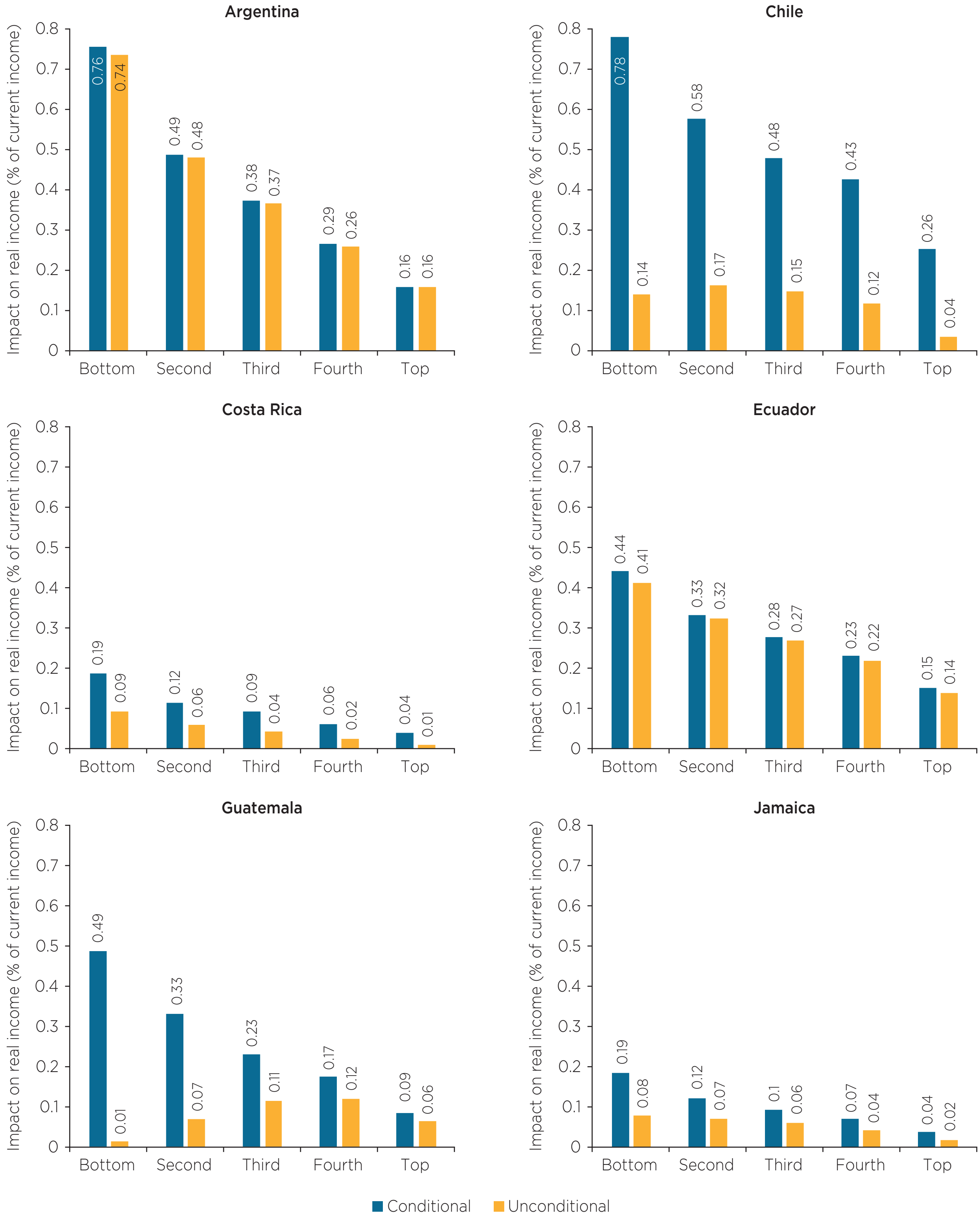



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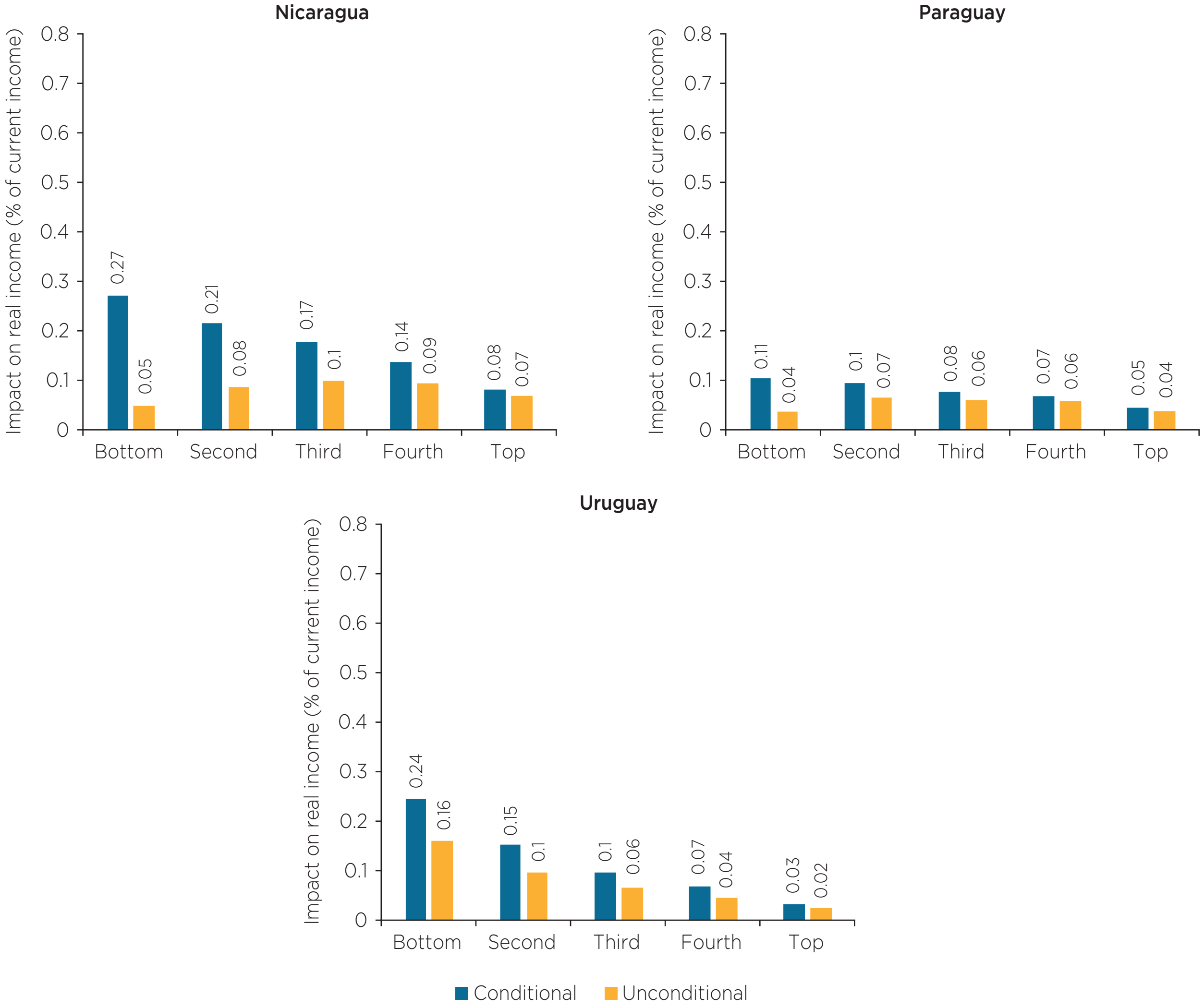
**Figure 5.5 Conditional and Unconditional Direct Welfare Losses from a US$2.50/MMBTU Natural Gas and LPG Price Increase (% of Current Expenditure)** *(continued)*




quantity consumed. There is thus no clear relationship between the spending on electricity reported in household surveys and actual consumption of electricity. To work around this issue, we proceed in two steps.

First, we model the welfare impacts of raising electricity prices assuming that all households face a flat price per kWh of electricity consumed, which we take to be the average electricity price in each country. In this analysis, the direct impacts of price increases on household welfare across income quintiles should be interpreted with caution as average tariffs do not represent the actual tariff structure typically faced by households. There can be more confidence in the indirect welfare effects.

Second, using more detailed original household survey data for the Buenos Aires region in Argentina, we test an alternative tariff schedule, fitted on actual data of household electricity consumption in physical units. In this scenario, the price of electricity increases with consumption. As it turns out, both assumptions lead to roughly the same result in terms of the welfare impacts of

**Figure 5.6 Direct and Indirect Welfare Losses from a US$0.05/kWh Electricity Price Increase (% of Current Welfare)**

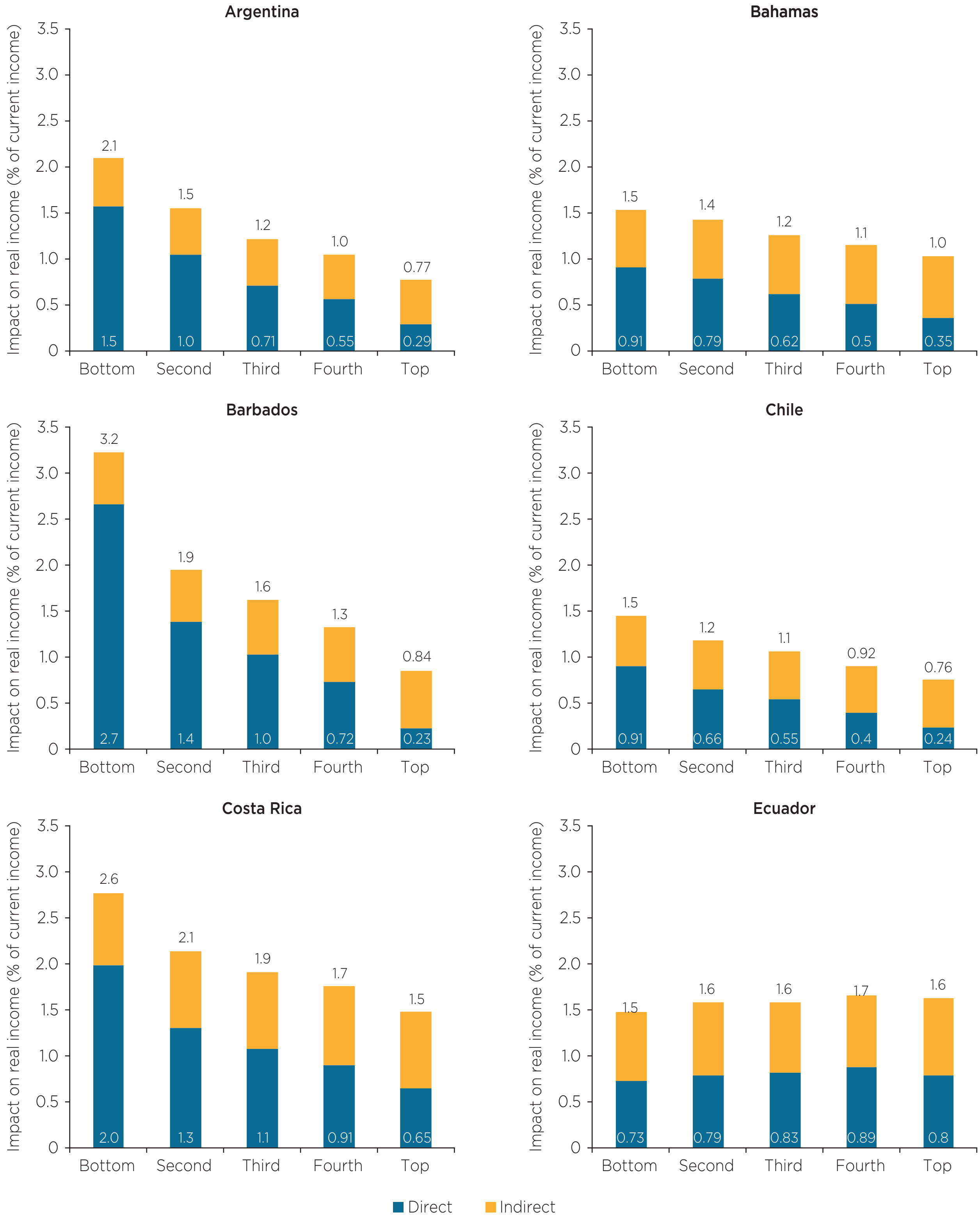



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**Figure 5.6 Direct and Indirect Welfare Losses from a US$0.05/kWh Electricity Price Increase (% of Current Welfare)** *(continued)*

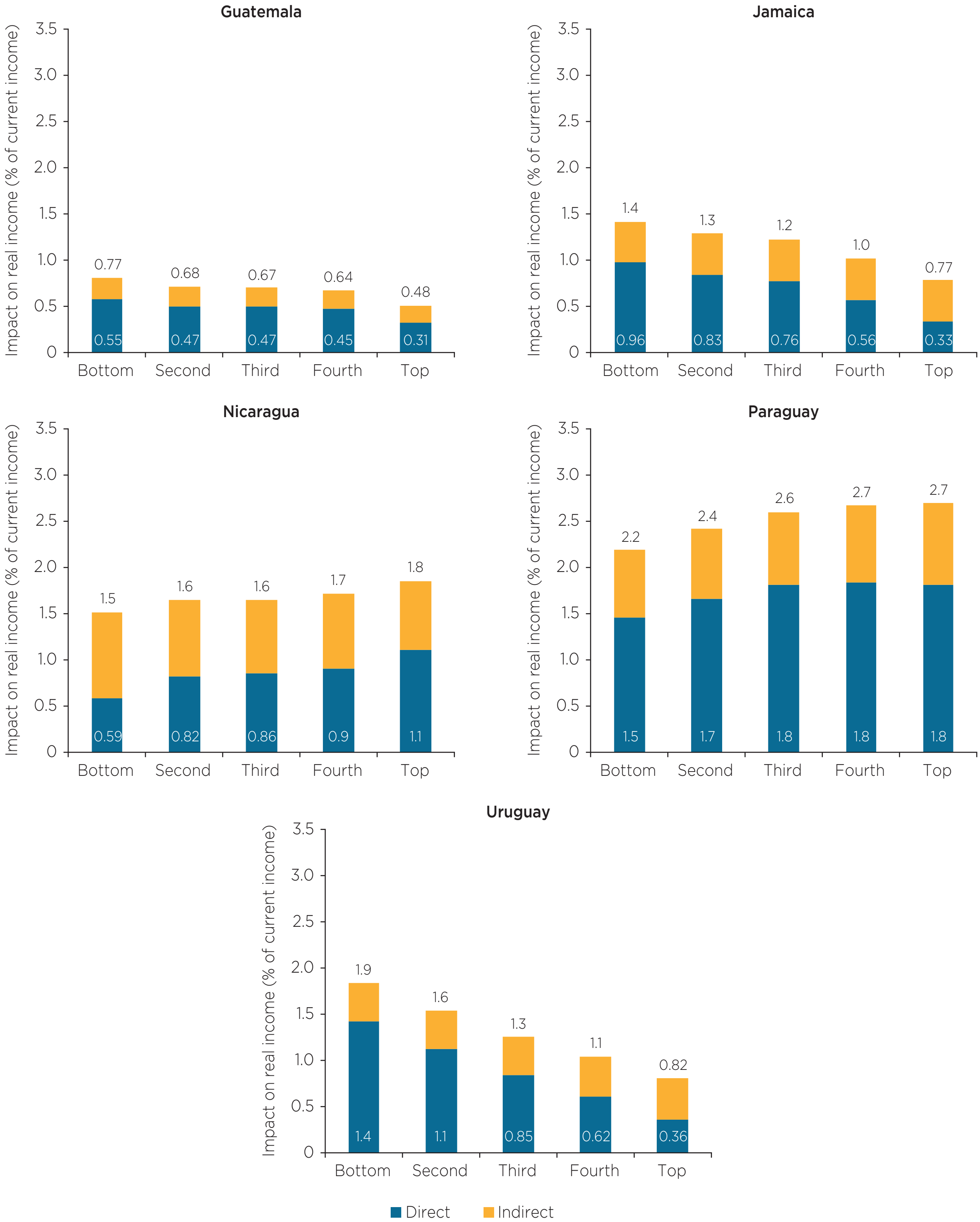


**Table 5.7 Increase in Electricity Prices (% of Current Average Tariff)**

| | Argentina | Bahamas | Barbados | Chile | Costa Rica | Ecuador | Guatemala | Jamaica | Nicaragua | Paraguay | Uruguay | Median |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Electricity | 120 | 47 | 24 | 33 | 59 | 62 | 43 | 18 | 27 | 130 | 36 | 43 |

an electricity price hike. We take that as an indication that the average-price model yields relevant results. Figure 5.6 shows the total direct and indirect impact of price increases for electricity on household welfare across income quintiles using the average-price method.

Latin American and Caribbean countries' exposure to electricity price shocks varies, though the welfare effects tend to be regressive in most of the countries analyzed. In Argentina, the Bahamas, Barbados, Chile, Costa Rica, Guatemala, Jamaica, and Uruguay, raising electricity prices would have a regressive impact across households, meaning that lower-income groups would lose a higher share of their welfare relative to higher-income groups. On the other hand, raising electricity prices would have a slightly progressive effect in Ecuador and Nicaragua and a more pronounced progressive impact in Paraguay.

A US$0.05/kWh increase in electricity prices represents a different price shock for each country not only because some countries subsidized electricity in 2014 while others didn't, but also because electricity costs vary by country, reflecting many factors including the mix of technologies used in generation and the efficiency and reliability of each country's transmission and distribution systems. In 2014, only Argentina, Ecuador, Barbados, and Nicaragua subsidized electricity (Table 5.7).

As was the case with gasoline and diesel price hikes, the country grouping above does not share specific characteristics that determine whether the total welfare impacts of increasing electricity prices will be regressive or progressive. Nevertheless, there are still important regional trends that can be established from the analysis.

First, the direct distributional effects of electricity price increases on household consumption tend to be regressive. With the exception of Nicaragua and Paraguay, increasing electricity prices would cost lower-income households relatively more than it would cost wealthier households in every country in our sample. Argentina, Barbados, and Costa Rica show a large contrast between poor and rich households. The price hike would have a relatively small effect on the top quintiles in each country—costing 0.3 percent, 0.2 percent, and 0.7 percent of their budgets respectively—while it would cost 1.6, 2.7, and 2 percent to the bottom quintiles.

Second, across the 11 countries of our sample, the direct and indirect effects have a relatively equal weight in the total welfare effects of raising electricity prices. On average, the direct impacts account for 54 percent of the total welfare cost of a price increase, while the indirect impacts account for 46 percent. Further, the indirect impact of electricity price hikes on household welfare tends to be neutral, except in Nicaragua, where it is slightly regressive, and Paraguay, where it is slightly progressive. This reflects the fact that electricity is widely used in all economic sectors to produce all types of goods.

Indeed, electricity price hikes indirectly increase the price of other goods and services in an economy. Table 5.8 shows the simulated impact of a US$0.05/kWh hike on electricity on the price of different consumption categories in the 11 countries in our sample. The table shows that water and durable goods tend to be most impacted.

**Table 5.8 How a Price Increase on Electricity May Increase the Relative Price of Goods and Services (% of Current Price)**

| | Argentina | Bahamas | Barbados | Chile | Costa Rica | Ecuador | Guatemala | Jamaica | Nicaragua | Paraguay | Uruguay | Median |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Water | 3.3 | 0.49 | 0.4 | 1.2 | 0.31 | 17 | 5.7 | 3.4 | 3.3 | 2.0 | 1.4 | 2.0 |
| Durables | 1.7 | 0.28 | 0.23 | 1.3 | 0.54 | 1.3 | 0.88 | 4.6 | 0.78 | 1.6 | 1.1 | 1.1 |
| Household Services | 0.48 | 1.2 | 0.58 | 0.65 | 0.65 | 0.71 | 0.14 | 0.5 | 1.4 | 1.1 | 0.49 | 0.65 |
| Entertainment | 0.43 | 3.2 | 1.2 | 0.6 | 2.5 | 0.2 | 0.1 | 0.42 | 0.45 | 0.76 | 0.78 | 0.6 |
| Clothes | 0.66 | 0.28 | 0.22 | 0.56 | 0.71 | 0.64 | 0.28 | 4.2 | 0.4 | 0.72 | 0.41 | 0.56 |
| Food | 0.57 | 0.4 | 0.6 | 0.55 | 0.77 | 0.81 | 0.16 | 0.42 | 0.88 | 0.44 | 0.37 | 0.55 |
| Communication | 0.42 | 0.54 | 0.27 | 0.65 | 0.25 | 1.6 | 0.19 | 0.32 | 1.3 | 1.4 | 0.56 | 0.54 |
| Personal Care | 0.48 | 0.7 | 0.29 | 0.45 | 0.71 | 1.0 | 0.11 | 0.21 | 0.27 | 0.78 | 0.4 | 0.45 |
| Public Transport | 0.4 | 0.8 | 0.5 | 0.47 | 0.34 | 0.25 | 0.07 | 0.21 | 0.47 | 0.49 | 0.29 | 0.4 |
| Education and Health | 0.46 | 0.28 | 0.58 | 0.21 | 0.12 | 0.57 | 0.07 | 0.27 | 0.29 | 0.65 | 0.37 | 0.29 |
| Other Fuels | 1.2 | 0.43 | 0.34 | 0.16 | 0.16 | 0.16 | 0.16 | 0.16 | 0.16 | 0.16 | 0.16 | 0.16 |
| Gasoline and Diesel | 0.2 | 0.05 | 0.03 | 0.4 | 0.04 | 0.68 | 0.14 | 0.03 | 0.18 | 0.67 | 0.04 | 0.14 |
| Natural Gas | 0.06 | 0.18 | 0.13 | 0.22 | 0.21 | 0.53 | 0.0 | 0.05 | 0.13 | 0.17 | 0.13 | 0.13 |

The indirect price hikes are only part of the story, however. Different households are differently exposed to electricity price shocks depending on how they currently spend their money. Table 5.9 provides the top five consumption items that contribute most to the loss of household welfare in the bottom quintile when there is a hike on electricity prices. The direct impact on electricity is found to be the most important channel through which electricity price hikes affect households in the bottom quintile in all countries.

In all countries, households in the bottom quintile are first and mostly affected by the direct effect of the electricity price itself. Food and household services (including rent and dwelling construction) tend to arrive in second and third position. This suggests that targeted interventions in these sectors could be a way to shield poor households from the impact of electricity price hikes. The next sections discuss how cash transfers are also a strong option to do so.

## *Conditional Welfare Impacts*

Compared to fuels, access to electricity is much more widespread and uniform across income quintiles in most Latin American and Caribbean countries, so that the conditional and unconditional analyses do not yield dramatically different results for electricity price hikes. Indeed, a lot of progress has been made in the region with respect to achieving universal access to electricity. In 2014, access to electricity in LAC was estimated at 97 percent, and the region is predicted to be the first to achieve universal energy access (World Bank, 2014). Furthermore, some of the gaps between the conditional and unconditional impacts come from limitations of the method used: we based our assessment of electricity consumption on electricity spending. In reality, many poorer households in the region may consume electricity but not pay for it. Figure 5.7 shows the conditional and unconditional welfare impacts of electricity price increases.

**Table 5.9 Top Five Consumption Categories for Bottom Quintile by Country, Ranked by Their Contribution to Welfare Losses Resulting from a Price Increase in Electricity (% of Total Welfare Losses)**

| | | | | | |
|---|---|---|---|---|---|
| **Argentina** | Electricity 75 | Food 8 | Household services 4 | Durables 2 | Personal care 2 |
| **Bahamas** | Electricity 59 | Entertainment 18 | Household services 12 | Personal care 5 | Education and health 1 |
| **Barbados** | Electricity 83 | Education and health 7 | Food 3 | Household services 3 | Entertainment 2 |
| **Chile** | Electricity 62 | Household services 17 | Food 9 | Public transport 4 | Personal care 2 |
| **Costa Rica** | Electricity 71 | Food 11 | Entertainment 8 | Household services 6 | Durables 2 |
| **Ecuador** | Electricity 49 | Food 28 | Household services 7 | Durables 6 | Personal care 3 |
| **Guatemala** | Electricity 72 | Food 15 | Durables 6 | Clothes 3 | Household services 2 |
| **Jamaica** | Electricity 69 | Food 12 | Household services 5 | Durables 4 | Water 3 |
| **Nicaragua** | Electricity 39 | Food 26 | Household services 16 | Water 11 | Personal care 2 |
| **Paraguay** | Electricity 67 | Household services 16 | Food 10 | Durables 2 | Communication 2 |

## Energy Subsidies Are Less Efficient Than Other Social Protection Schemes

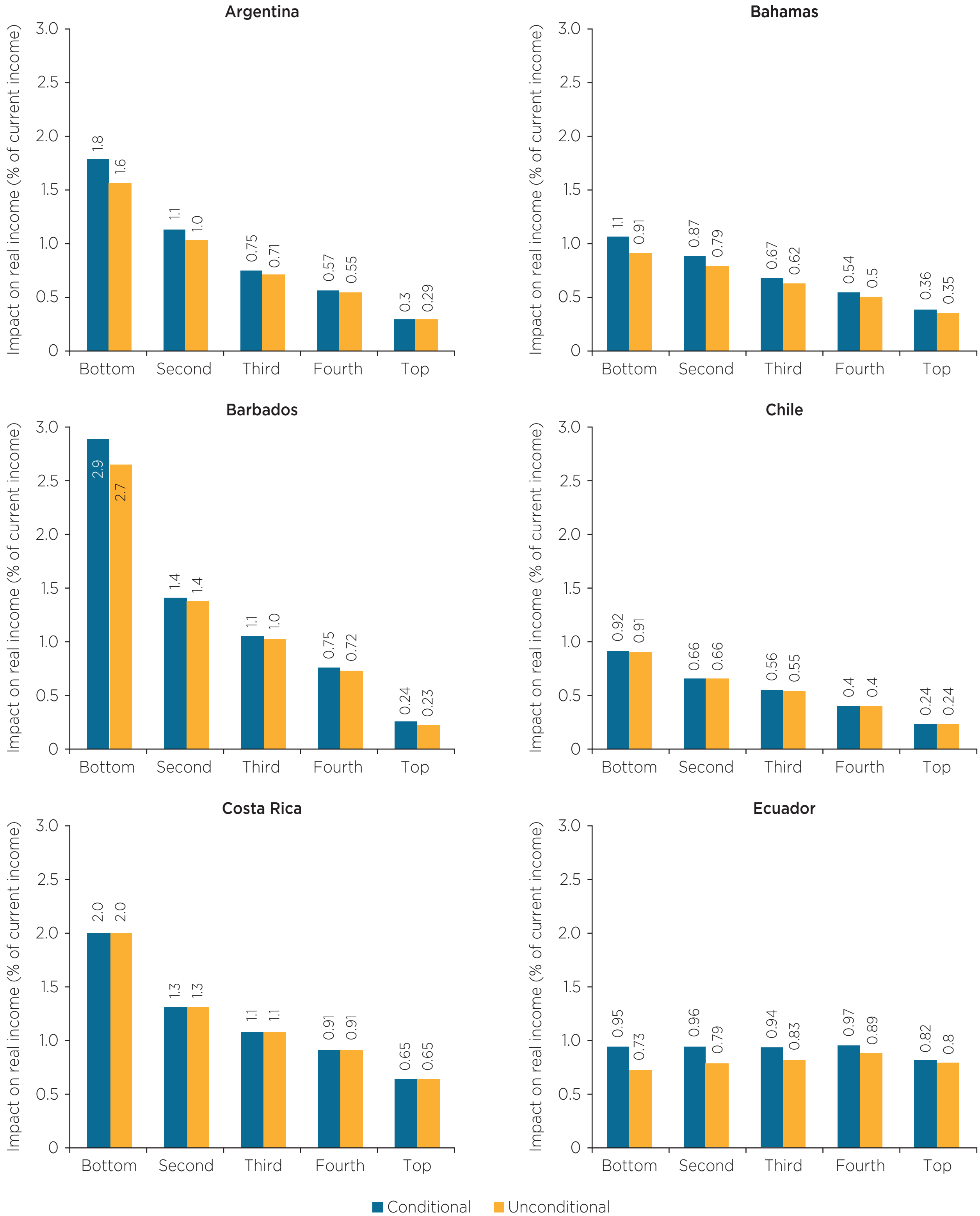
### Inefficient Vehicle for Transferring Income to the Poor

Energy subsidies are a very expensive way of redistributing income to poor households. On average across countries and energy types (regardless of whether fuels are currently subsidized), our analysis finds that it would cost governments US$11.80 to transfer US$1 of income to households in the poorest quintile if using energy subsidies.[6] Out of the energy products studied, gasoline and diesel are the most inefficient vehicles for providing income to the bottom quintile across every country in our sample, costing, on average, US$13.70 per every US$1 benefiting the bottom quintile. It costs about US$9.20 to provide US$1 using gas or LPG, the most pro-poor fuels in our sample. Finally, using electricity as a tool for income redistribution is also very expensive, costing, on average, US$11.80 per every US$1 disbursed to the bottom quintile. Table 5.11 shows the cost of providing US$1 to households across the five income categories using gasoline and diesel, electricity, and LPG and natural gas in each of the 11 countries in our sample.

These figures compare unfavorably to the cost of other ways of providing income to poor households. For instance, direct cash transfer programs are recognized as one the most efficient ways for delivering social assistance to poor households in developing countries (Bastagli et al., 2016; Robles, Rubio, and Stampini, 2015; Blattman and Niehaus, 2014; Cecchini and Madariaga, 2011). In Ecuador, for example, half the money spent on the Bono de Desarollo cash transfer program goes to the

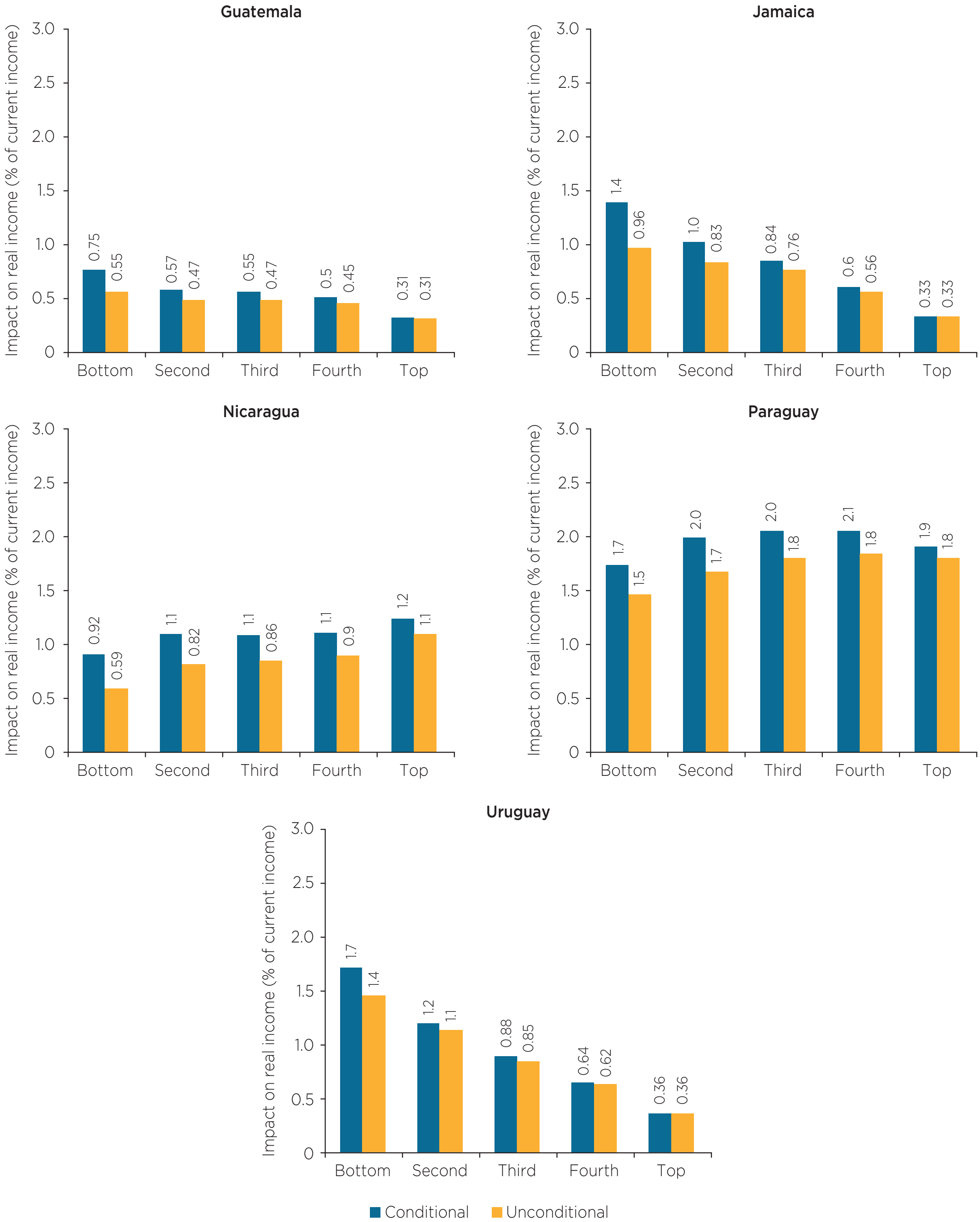
6 The analysis models the distributional effect of raising energy prices across countries. Thus, the "savings" gained from subsidy reduction or increased taxation reflect the cost of income redistribution.

**Figure 5.7 Conditional and Unconditional Direct Welfare Losses from a US$0.05/kWh Electricity Price Increase (% of Current Expenditure)**




*(continued on next page)*

**Figure 5.7 Conditional and Unconditional Direct Welfare Losses from a US$0.05/kWh Electricity Price Increase (% of Current Expenditure)** *(continued)*



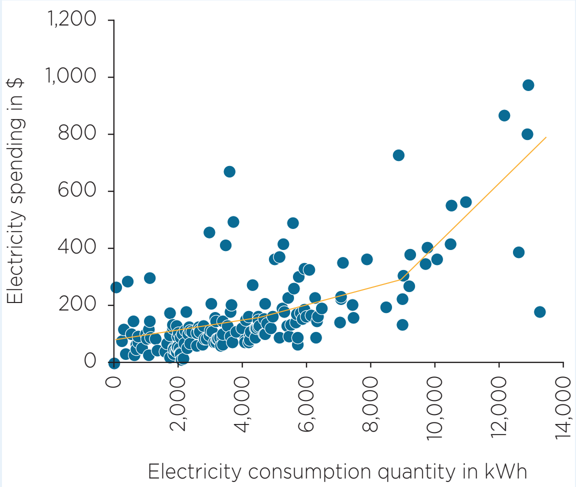
## Box 3: Assessing the Robustness of the Average Price Assumption

One of the main limitations of this study is that we base our estimates of the distribution of electricity consumption on the distribution of electricity spending, assuming that all households face a flat price per kWh of electricity consumed. With the exception of Argentina—which reports electricity consumption in physical units in the Buenos Aires region—other household surveys report spending only in monetary units. Electricity tariff schedules are complex, however, with tariffs often varying by consumer category, geographical location, voltage level, level of electricity consumption, and/or time of use. Therefore, electricity consumption is not strictly proportional to electricity spending as is the case when adopting a flat tariff schedule.

Here we assess the sensitivity of our results to the assumption used for converting electricity spending into electricity consumption (i.e., applying each country's average tariff per kWh to all households). We compare two scenarios for modeling electricity price shocks in Argentina. The first scenario is the one presented above, using the average price of electricity. In the second, we test an alternative tariff schedule for Argentina, fitted on physical consumption data from the country's household survey, where the price of electricity increases with consumption.

To calibrate the price schedule for the second scenario, we drop inconsistent observations where households report positive spending on electricity (in monetary terms) but no electricity consumption (in kilowatts). Dropping these outliers and focusing on households in the Greater Buenos Aires region, we are able to fit a piecewise linear price schedule on the microdata that links consumption in kWh and electricity spending in US$ (Figure 5.8). We then use that estimated price schedule to convert all reports of electricity spending into energy consumption.

**Figure 5.8 Electricity Consumption Based on Increasing Tariff Schedule**




We then model the electricity price shock based on the increasing tariff schedule and compare it to our original findings using the average-price assumption. Only the direct welfare impacts are subject to change. The results are encouraging: as shown in Table 5.10, the direct impacts of a US$0.05/kWh price hike on electricity are found to be very similar with either assumption.

The increasing tariff schedule results in a slightly more regressive direct welfare effect, with the price shock now being more material for poorer households and less so for wealthier households. However, the differences are not large: with the average-price assumption, households in the bottom quintile lose 1.6 percent of their income to an electricity price shock; with the increasing tariff schedule, they lose 1.7 percent.

**Table 5.10 Comparisons between Increasing Tariff and Average-Price Scenarios**

| | Bottom | Second | Third | Fourth | Top |
|---|---|---|---|---|---|
| Increasing Tariff Schedule | 1.68 | 1.09 | 0.72 | 0.53 | 0.28 |
| Average Price | 1.57 | 1.04 | 0.71 | 0.55 | 0.29 |

**Table 5.11 Energy Products Are Very Expensive Vehicles for Redistributing Income to Poor Households**

| | | Bottom | Second | Third | Fourth | Top |
|---|---|---|---|---|---|---|
| **Argentina** | Diesel and Gasoline | 11.5 | 7.5 | 5.6 | 4.2 | 2.8 |
| | Electricity | 8.2 | 6.6 | 5.6 | 4.3 | 3.2 |
| | Natural Gas and LPG | 8.2 | 6.6 | 5.4 | 4.4 | 3.2 |
| **Bahamas** | Diesel and Gasoline | 9.1 | 6.2 | 5.0 | 4.4 | 3.3 |
| | Electricity | 7.9 | 5.9 | 5.0 | 4.5 | 3.6 |
| **Barbados** | Diesel and Gasoline | 18.9 | 11.4 | 8.5 | 6.2 | 1.7 |
| | Electricity | 11.8 | 8.3 | 6.6 | 5.4 | 2.2 |
| **Chile** | Diesel and Gasoline | 11.8 | 7.7 | 6.1 | 4.5 | 2.5 |
| | Electricity | 8.0 | 6.7 | 5.9 | 4.9 | 2.8 |
| | Natural Gas and LPG | 9.2 | 6.0 | 5.1 | 4.2 | 3.4 |
| **Costa Rica** | Diesel and Gasoline | 17.9 | 9.8 | 7.0 | 4.4 | 2.1 |
| | Electricity | 8.4 | 6.7 | 5.7 | 4.6 | 2.9 |
| | Natural Gas and LPG | 6.5 | 5.4 | 5.0 | 5.1 | 3.8 |
| **Ecuador** | Diesel and Gasoline | 12.5 | 8.4 | 6.6 | 4.9 | 2.3 |
| | Electricity | 10.0 | 7.1 | 5.9 | 4.6 | 2.7 |
| | Natural Gas and LPG | 6.4 | 5.6 | 5.4 | 5.0 | 3.6 |
| **Guatemala** | Diesel and Gasoline | 18.7 | 10.7 | 7.4 | 4.8 | 2.0 |
| | Electricity | 13.8 | 8.7 | 6.1 | 4.3 | 2.4 |
| | Natural Gas and LPG | 55.8 | 11.4 | 5.1 | 3.3 | 2.5 |
| **Jamaica** | Diesel and Gasoline | 13.7 | 8.4 | 6.6 | 4.8 | 2.2 |
| | Electricity | 12.3 | 7.5 | 5.9 | 4.8 | 2.5 |
| | Natural Gas and LPG | 11.6 | 6.9 | 5.6 | 4.6 | 2.7 |
| **Nicaragua** | Diesel and Gasoline | 15.6 | 9.0 | 6.1 | 4.6 | 2.3 |
| | Electricity | 11.9 | 7.7 | 6.0 | 4.5 | 2.5 |
| | Natural Gas and LPG | 14.2 | 7.3 | 5.2 | 4.1 | 2.8 |
| **Paraguay** | Diesel and Gasoline | 11.9 | 8.2 | 5.6 | 4.7 | 2.5 |
| | Electricity | 11.8 | 7.7 | 5.6 | 4.5 | 2.6 |
| | Natural Gas and LPG | 13.2 | 5.6 | 4.7 | 4.0 | 3.5 |
| **Uruguay** | Diesel and Gasoline | 19.7 | 9.9 | 6.9 | 4.5 | 2.1 |
| | Electricity | 12.1 | 7.8 | 5.9 | 4.6 | 2.5 |
| | Natural Gas and LPG | 7.9 | 6.5 | 5.6 | 4.7 | 3.0 |

poorest 40 percent of households in the country. Although the targeting is imperfect, it costs the government only US$2 for each US$1 received by the bottom 40 percent of the population (Expresso, 2015).

In fact, among 56 social assistance programs in Latin America and the Caribbean, cash transfers are the best performers in terms of targeting poor people (Lindert, Skoufias, and Shapiro, 2006). An 18-country study from the Inter-American Development Bank found that, on average, it costs US$1.90 to transfer US$1 to poor households in LAC using existing cash transfer programs (Inter-American Development Bank, 2016).

Of course, cash transfers are not exempt from problems. Most importantly, the coverage of existing cash transfer programs among poor people is sometimes low. On average across the region, only 40 percent of poor people benefit from these schemes (Robles, Rubio, and Stampini, 2015). In some countries, the benefits of low energy prices could reach more poor people than current social protection schemes.

## Proceeds from Subsidy Reform or Energy Taxation Can Be Used to Compensate Poor Households

Whether the total welfare effects on households of raising energy prices are progressive, regressive, or neutral, phasing out subsidies or taxing energy more substantially may hurt poor and middle-class households and voters. The fact that wealthier households are more affected by a tax or subsidy removal is not necessarily a consolation for vulnerable households faced with increasing prices for basic goods and services. The good news is that governments can protect poor and lower middle-class households from the direct and indirect impacts of energy price increases by redirecting only a fraction of the budgetary savings from subsidy reduction or taxation into targeted, more efficient compensation schemes.

Specifically, our analysis shows that, in principle, only 19 percent of the potential savings from an increase in gasoline and diesel prices could be redirected to well-targeted compensation schemes to neutralize the welfare impacts of the price hikes on the bottom 40 percent of households. Roughly 27 percent of government savings resulting from subsidy removal or tax increases on natural gas and LPG would be necessary to compensate the two bottom quintiles. Finally, roughly 21 percent of the savings gained from a flat increase in electricity prices would be enough to compensate the bottom 40 percent of households for their welfare losses. Table 5.12 provides a country and fuel breakdown of the share of the savings needed to compensate households across income quintiles.

As mentioned before, Table 5.12 reflects the amount governments would need to spend in compensating measures that effectively target and cover poor households. The figures do not reflect what spending increase would be sufficient for *existing* cash transfer programs, or other existing social protection schemes, if those schemes poorly target low-income households. If governments use schemes with imperfect targeting to compensate households, they may need to spend more than what is reported in the table. This issue is ripe for further research.

## In-Kind and Cash Transfers Can Be Used to Compensate Poor Households

One possibility for governments to protect poor households from energy price hikes is to expand existing social protection schemes such as cash transfers. Instead of the perverse incentives that energy subsidies create, conditional and unconditional cash transfers have been found to successfully reduce poverty (especially in women and girls), improve school attendance (with some evidence of improved cognitive development), increase the uptake of health services, improve dietary diversity and mass and weight indicators, reduce stunting and malnourishment, encourage savings and investment in productive assets and livestock, foster business creation, increase labor force participation for adults and reduce child work, and increase employment rates (Bastagli et al., 2016; Cecchini and Madariaga, 2011; Ibarrarán et al., 2017). Moreover, as was previously mentioned, cash transfer programs in Latin America have also been found to be an efficient tool for redistributing income to poor households (Robles, Rubio, and Stampini, 2015).

Comparing the cost of energy subsidies to cash transfers, it appears that governments could remove energy subsidies while putting in place cash transfer programs or expanding existing ones at a lower cost and with better outcomes. Doing so could reduce the onerous economic, sectoral, and environmental costs associated with cheap energy, while promoting several aspects of human development instead.

International experience with energy subsidy reform suggests that when countries replace subsidies with cash transfers, their chances of suc-

**Table 5.12 Fraction of Government Proceeds from Subsidy Removal or Energy Taxation Needed to Compensate Households**

| | | Bottom | Second | Third | Fourth | Top |
|---|---|---|---|---|---|---|
| Argentina | Diesel and Gasoline | 8.7 | 21.9 | 39.7 | 63.7 | 100 |
| | Electricity | 12.2 | 27.4 | 45.3 | 68.5 | 100 |
| | Natural Gas and LPG | 12.1 | 27.2 | 45.8 | 68.6 | 100 |
| Bahamas | Diesel and Gasoline | 10.9 | 27.0 | 47.1 | 69.8 | 100 |
| | Electricity | 12.7 | 29.6 | 49.6 | 71.8 | 100 |
| Barbados | Diesel and Gasoline | 5.3 | 14.1 | 25.9 | 42.0 | 100 |
| | Electricity | 8.5 | 20.5 | 35.6 | 54.1 | 100 |
| Chile | Diesel and Gasoline | 8.5 | 21.4 | 37.8 | 59.9 | 100 |
| | Electricity | 12.5 | 27.3 | 44.3 | 64.7 | 100 |
| | Natural Gas and LPG | 10.9 | 27.6 | 47.4 | 71.0 | 100 |
| Costa Rica | Diesel and Gasoline | 5.6 | 15.7 | 30.1 | 52.9 | 100 |
| | Electricity | 11.9 | 26.7 | 44.2 | 65.7 | 100 |
| | Natural Gas and LPG | 15.4 | 33.9 | 53.7 | 73.4 | 100 |
| Ecuador | Diesel and Gasoline | 8.0 | 20.0 | 35.0 | 55.6 | 100 |
| | Electricity | 10.0 | 24.2 | 41.2 | 62.8 | 100 |
| | Natural Gas and LPG | 15.7 | 33.6 | 52.2 | 72.4 | 100 |
| Guatemala | Diesel and Gasoline | 5.4 | 14.7 | 28.2 | 48.9 | 100 |
| | Electricity | 7.3 | 18.7 | 35.1 | 58.2 | 100 |
| | Natural Gas and LPG | 1.8 | 10.6 | 30.2 | 60.3 | 100 |
| Jamaica | Diesel and Gasoline | 7.3 | 19.1 | 34.3 | 55.0 | 100 |
| | Electricity | 8.2 | 21.4 | 38.3 | 59.3 | 100 |
| | Natural Gas and LPG | 8.6 | 23.2 | 40.9 | 62.6 | 100 |
| Nicaragua | Diesel and Gasoline | 6.4 | 17.5 | 34.0 | 55.6 | 100 |
| | Electricity | 8.4 | 21.4 | 38.2 | 60.6 | 100 |
| | Natural Gas and LPG | 7.0 | 20.7 | 39.9 | 64.3 | 100 |
| Paraguay | Diesel and Gasoline | 8.4 | 20.6 | 38.5 | 60.0 | 100 |
| | Electricity | 8.5 | 21.4 | 39.4 | 61.8 | 100 |
| | Natural Gas and LPG | 7.6 | 25.4 | 46.7 | 71.6 | 100 |
| Uruguay | Diesel and Gasoline | 5.1 | 15.1 | 29.7 | 52.0 | 100 |
| | Electricity | 8.3 | 21.2 | 38.1 | 60.1 | 100 |
| | Natural Gas and LPG | 12.7 | 28.1 | 45.9 | 67.1 | 100 |

cess improve significantly. In fact, according to an International Monetary Fund study of subsidy reform efforts in the Middle East and North Africa, all cases where cash and in-kind transfers were introduced as compensation measures were associated with successful outcomes, while only 17 percent of the cases where transfers were not introduced resulted in a successful reform (Sdralevich, Sab, and Zouhar, 2014).

Making sure that all or most of the losers from subsidy reform are compensated with cash transfers may require expanding existing programs or creating new ones. Most countries in Latin America and the Caribbean have a conditional or unconditional cash transfer program in place (World Bank, 2015b), though an Inter-American Development Bank study suggests that in the average country, only 42.6 percent of poor people benefit from these schemes (Robles, Rubio, and Stampini, 2015).[7] Thus, compensation measures for welfare losses due to energy price increases would need to be designed carefully. In-kind measures—such as subsidized public transport, food stamps or school feeding programs, expansion of primary health care, electrification in poor and rural areas, and distribution of efficient light bulbs—could complement cash transfers (Fay et al., 2015; International Monetary Fund, 2013). The information we provide in the "Welfare Impacts of Price Shocks" section sheds light on the specific channels through which energy price increases could affect poor households directly and indirectly, thus helping governments design such compensation measures.

Whatever the compensation package, international experience of subsidy reform suggests that effective communication about the savings and benefits of reform is essential (Vagliasindi, 2012). In many cases, the general population does not know how much government spends on energy subsidies, or how reducing them could provide more fiscal space for spending on social protection programs, health, public transport, and education. At the same time, households across the income spectrum may perceive that energy subsidy reform would not serve their best interests and thus become an obstacle to reform (Trebilcock, 2014; Olson, 1977; Victor, 2009).

[7] To tackle the targeting issue, some countries around the world have moved toward universal transfers to ensure that everybody is covered. Iran, for example, implemented a quasi-universal cash transfer (about US$45 per month per capita) as part of its energy reforms, and the Indian government is considering taking this path (Safi, 2017). Universal transfers may help with the political economy of the reform, because nobody is excluded from the benefits (even though some will remain net losers). In addition, if opposition to subsidy reforms is stronger in the middle class than among the poorest, having the middle class covered by the compensation—even partly—may make the reform much more acceptable.

# CHAPTER 6: **Concluding Thoughts**

## Energy Subsidies Are Expensive, Harmful, and Inefficient

In this report, we studied the effect that the recent oil price super-cycle had on energy prices and subsidies across Latin America and the Caribbean. We found that the unprecedented and sustained oil price increases experienced between 2008 and 2014 led most countries in the region to introduce discretionary price controls for fuels and electricity, which often resulted in expensive and inefficient subsidies. On average, energy subsidies in LAC represented 1.6 percent of the region's GDP each year.

Fuel subsidies were highly concentrated in a small set of oil- and gas-producing countries—primarily Bolivia, Ecuador, Trinidad and Tobago, and Venezuela. Gasoline and diesel were responsible for 67 percent of the total cost of fuel subsidies in LAC, followed by natural gas, which made up 22 percent of subsidies, LPG, which made up 8 percent, and kerosene, which made up 3 percent. In contrast, every Latin American and Caribbean country except Costa Rica and Jamaica subsidized electricity at some point during the sample period. Electricity subsidies were highest among countries that intervened in generation markets to influence prices. Close to half of all electricity subsidies provided in the region during the sample period were destined for the residential sector.

While most LAC governments subsidized energy in an effort to protect vulnerable households and the economy from the sharp increases in oil prices experienced during this time, subsidies proved to be an inefficient vehicle for providing social protection. Our study found that in 2014, only 23 percent of the average (median) energy subsidy in Latin America and the Caribbean ended up in the pockets of households in the bottom 40 percent of the population (ranked by per capita income). On average across energy types and countries, it cost about US$10 to transfer US$1 to the bottom quintile using subsidies.

Gasoline and diesel subsidies proved to be the most inefficient vehicles for providing protection to the most vulnerable households, costing, on average, US$13.70 per every US$1 benefiting the bottom quintile. Using electricity subsidies as a tool for income redistribution also proved expensive, costing, on average, US$11.80 per every US$1 disbursed to the bottom quintile.

At the same time, energy subsidies exacerbated fiscal deficits in many countries, put added pressure on trade and balance of payments imbalances, and diverted public spending from other critical sectors. Even if they did not threaten fiscal sustainability directly, price controls for fuels increased fiscal uncertainty when applied in a discretionary manner. Tax revenues from fuel products are a significant, often equitable, source of revenue for many countries. A large share of Latin American and Caribbean countries manipulated fuel taxes in an ad hoc manner to smooth out price increases during the time period under study.

Subsidies also had negative repercussions across the energy sector, often feeding into a vicious cycle of entrenched sectoral inefficiencies, which led to an increased need for fuel imports or higher electricity costs and thus even higher subsidies. Energy companies—particularly state-owned firms—often absorbed a large share of the subsidies. Companies relied on government commitments to cover investment projects or losses. Such transfers were generally not well documented or transparent.

## Subsidies Arise Due to a Lack of Adequate Regulatory Stability in Price-Setting

There are important lessons for the region in studying government responses to the oil price super-cycle of the last decade. Overall, we learned that energy subsidies arose largely due to a lack of adequate regulatory stability in price-setting. The costs associated with energy subsidies in LAC depended on the types of mechanisms chosen to regulate fuel and electricity prices. Subsidies tended to be highest in countries that adopted discretionary pricing mechanisms, meaning that end-user prices were set by governments at their own discretion, either by decree or through ad hoc regulation. On the other hand, subsidies tended to be lower or nonexistent in countries where governments set energy prices through a set of depoliticized and respected formulas, regulations, norms, or market mechanisms.

Moreover, there is an important link between the type of pricing mechanism chosen by a country, the degree to which it subsidized energy, and the extent to which the state participated in the sector. The market structure of the hydrocarbons and electricity sectors in LAC countries influenced the manner in which pricing policies were implemented during the sample period. The dominance of state-owned enterprises in production, refining, and often in distribution facilitated selling or transferring oil, natural gas, or refined oil products at subsidized prices for those countries pursuing discretionary pricing schemes. Similarly, the dominance of state-owned enterprises in electricity generation, transmission, and distribution in many Latin American and Caribbean countries often enabled the application of discretionary pricing policies that prevented the full pass-through of electricity costs because any resulting losses could be financed off-budget and be absorbed largely by government.

## Towards Stability in Price-Setting in Latin America and the Caribbean

Latin America and the Caribbean's experience during the recent oil price super-cycle highlighted the risks inherent in discretionary energy pricing schemes. Given the onerous economic, sectoral, distributional, and environmental consequences associated with energy subsidies, they become difficult to justify even in the face of price shocks. Yet, the region can move in the direction of greater regulatory stability in price-setting for fuels and electricity while also meeting its social protection goals.

International experience shows that successful subsidy reform requires an understanding of the effects of subsidy removal on the welfare of households and other key stakeholders and taking steps to tackle these effects. Established best practices for subsidy reform include: designing a comprehensive plan, starting with clarifying what objectives the government is trying to achieve with the reform and working backwards from there; reducing subsidies gradually and predictably, giving households and firms time to adapt rather than imposing sudden price hikes; assessing and managing distributional impacts of subsidy reform; designing and executing a comprehensive communication campaign about subsidies, their cost, the reform, and compensation measures; and, importantly, depoliticizing energy pricing schemes (Coady, Flamini, and Sears, 2015; Vagliasindi, 2012).

More generally, where fuel or electricity prices are controlled, one of the most important tasks for governments is to establish and implement clear criteria for setting and adjusting prices. In the case of fuels in particular, many countries begin by adopting a formula-based automatic price adjustment mechanism before deregulating markets, though in markets where competition is inadequate, full deregulation may not be ideal and instead result in higher prices paid by consumers. In cases where fuel or electricity prices are highly subsidized, the adoption of formula or rules-based adjustment mechanisms may entail sharp price increases at first. Starting with smaller and gradual price increases may be a better option. Moreover, starting by eliminating subsidies for energy products that disproportionately benefit wealthier households or products that have narrow economic benefits may also ease implementation (Kojima, 2013).

International experience also suggests that governments that chose to recycle part of the budgetary savings gained from subsidy reduction into compensation measures for more vulnerable groups are more likely to succeed. As we have shown in this study, a small share of the budget currently allocated to energy subsidies in Latin America and the Caribbean can be redirected to better-targeted social protection schemes that protect vulnerable households. In principle, only 19 percent of the potential savings gained from an increase in gasoline and diesel prices could be redirected towards better-targeted schemes to compensate the bottom 40 percent of households for the welfare losses resulting from price increases. Roughly 27 and 21 percent of government savings would be needed to compensate the poorest households for welfare losses resulting from price increases on natural gas and LPG and electricity respectively.

Latin American and Caribbean countries are now adjusting once again to a world of lower energy prices. Although eliminating subsidies can be politically contentious, today's low-price environment and the continued fiscal pressures currently facing many LAC countries—particularly many oil producers—present an opportunity for reform. Effective reforms can introduce regulatory stability to price-setting and healthy competition to the energy sector, both of which can aid in the development of a more diverse energy portfolio based on sound economics that reduce the risk posed by future price shocks. At the same time, energy subsidy reform can reinforce social programs that protect the most vulnerable segments of the population.

# Appendix I

## Price-Gap Method

The price-gap method estimates the deviation between domestic consumer prices and reference prices for fuel products and electricity. The difference between consumer prices and the estimated reference price is considered a price subsidy. The analysis covers four main petroleum products, including gasoline, diesel, LPG, and kerosene; natural gas; and electricity. Data was collected for 2008–14 for the following 17 countries: Argentina, Bahamas, Barbados, Belize, Chile, Costa Rica, Ecuador, Guatemala, Guyana, Jamaica, Nicaragua, Panama, Paraguay, Suriname, Trinidad and Tobago, Uruguay, and Venezuela. For all other countries, reference Beylis and Cunha (2017).

Fuel subsidies are measured as follows:

$$S_t = [(BP_t + T_t) - P_t] * C_t$$

where the subsidy in year *t* equals the difference between the estimated reference price of a fuel (*BP*), inclusive of the general consumption tax rate (*T*), and the final consumer price (*P*) multiplied by consumption (*C*). Reference and final consumer prices are in US$/liters for petroleum products and in US$/MMBTU for natural gas. All prices are annual averages. The general consumption tax rate is taken to be the prevailing VAT or GST in all countries. Total consumption is in liters for petroleum products and MMBTU for natural gas.

Electricity subsidies are measured as follows:

$$S_t = [(BP_t + T_t) - P_t * (1 - \lambda_t)] * G_t$$

where the subsidy in year *t* equals the difference between the estimated reference price of electricity (*BP*), inclusive of the general consumption tax rate (*T*) and the final consumer price (*P*). $\lambda_t$ denotes a loss factor for technical and non-technical losses; a loss factor greater than zero implies that the volume of electricity that is paid for is a fraction $0 < 1 - \lambda_t < 1$ of the volume generated (Di Bella et al., 2015). *Gt* is the volume of electricity generated in a given year. Reference and final consumer prices are in US$/kWh. All prices are annual averages. The general consumption tax rate is taken to be the prevailing VAT or GST in all countries. Electricity generated in is MWh.

## Data Sources

Reference and retail prices, including data on taxes, are taken from original IADB calculations based on questionnaires sent to authorities and completed by in-country experts unless otherwise stated. Energy consumption and generation data is also based on official questionnaires or taken from the International Energy Agency (2016b).

# Appendix II

## Input-Output Analysis

Input-output analysis is applied to model the impacts on household expenditure of a price increase in gasoline and diesel, natural gas and LPG, and electricity. Households are grouped into quintiles based on income per capita. The objective of this method is to capture both the direct and indirect effects of energy price hikes on household expenditure.

For this, we proceed in steps. First, we build the column vector $y_i$ of income group *i*'s consumption of 57 consumption categories.

Second, we build row vectors of energy price increases ($f_k$) for each type of energy *k*. This contains 0 for each of the 57 sectors, except on the line corresponding to the energy type *k*, where it has the corresponding price increase.

Third, we compute the Leontief inverse matrix $(I-A)^{-1}$ where *I* is the identity matrix with ones on the diagonal and zeros on the off-diagonal and *A* is the input coefficients matrix of a nation's economy, which is derived by intermediate input from each sector divided by the total input of the receiving sector.

To estimate the direct and indirect effects of a price increase for energy *k* on income group *I*, we $c_{k,i}^{indir}$, we build a row vector of cost increase per unit of sectoral output, $e_k$. Here, $e_k$ is derived from the production cost increase in each economic sector due to the price increase for energy *k* divided by the total sectoral output. The cost increase in each economic sector is estimated using the total consumption of energy *k* multiplied by the price increase rate (e.g., 25 cents per kWh for electricity).

$$c_{k,i}^{indir} = e_k * (I - A)^{-1} y_i \qquad (3)$$

The direct effects, $c_{k,i}^{indir}$ a price increase on income group *i* is calculated using the household direct consumption of energy *k* of income group *i* multiplied by the price increase rate of the energy *k*.

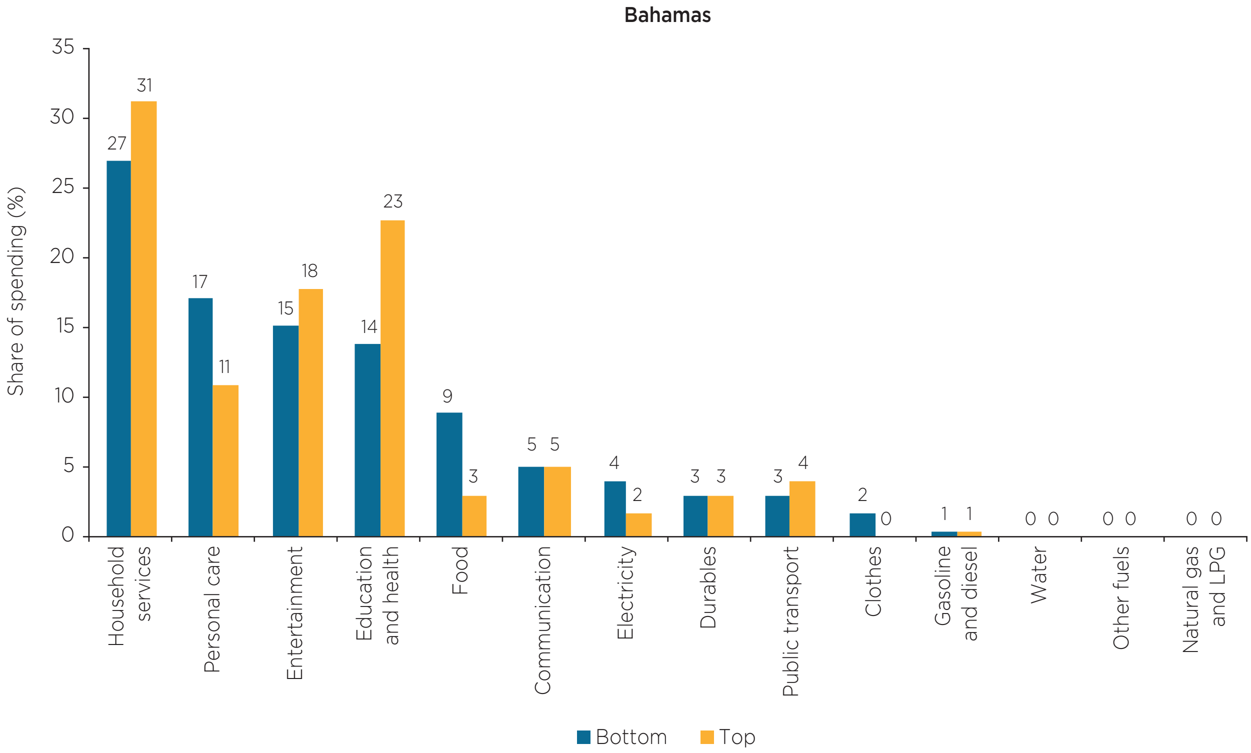
$$c_{k,i}^{dir} = p_k * y_{k,i} \qquad (4)$$

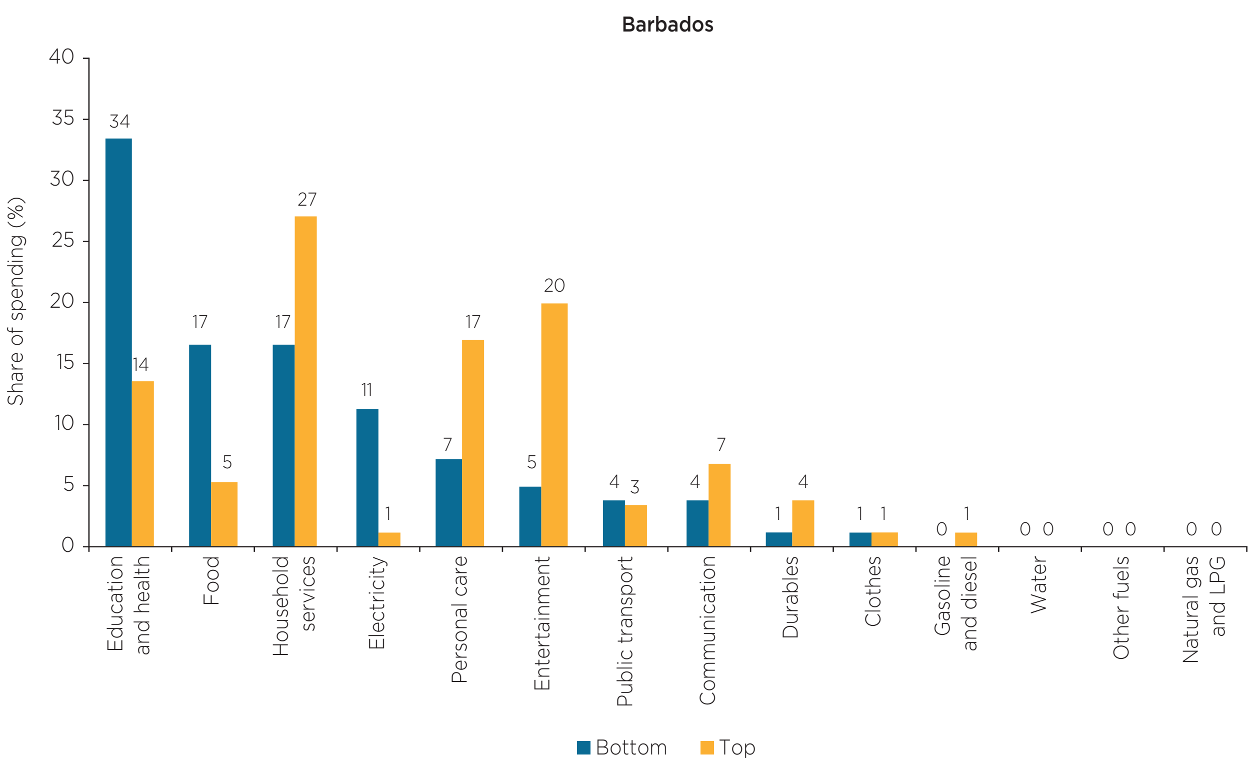
To calibrate this model, we used three data sources.

First, IO tables were extracted from the Global Trade Analysis Project (GTAP) database version 9. For each country, the IO table includes intermediate and final consumption matrices, value added and total output in 2011, reported for 57 economic sectors in monetary terms. To complete the data and improve the accuracy in terms of energy flows, we used energy flow data from the International Energy Agency (2016b).

Finally, for consumption data, we use harmonized consumption surveys for 14 aggregate consumption categories that are identical across countries. These 14 categories were matched to the 57 sectors in the IO tables. All harmonized data comes from Jimenez and Yépez-García (2016).

## Household Budgets

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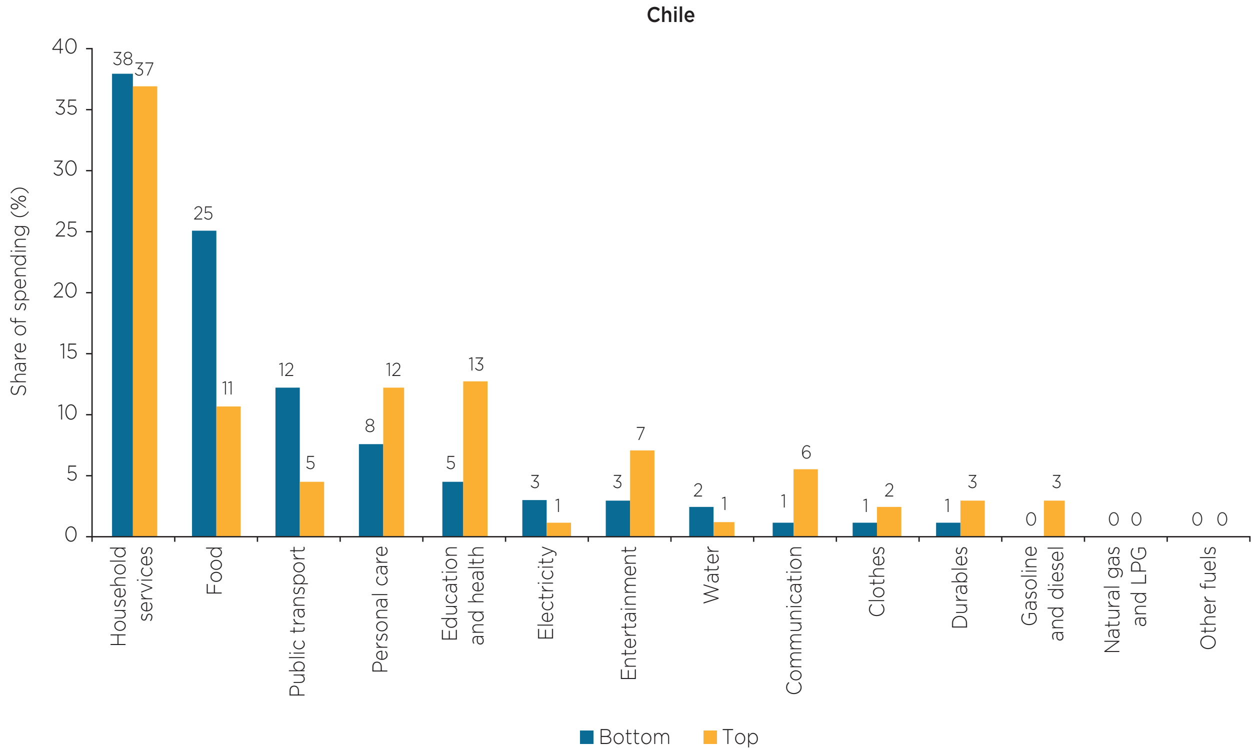
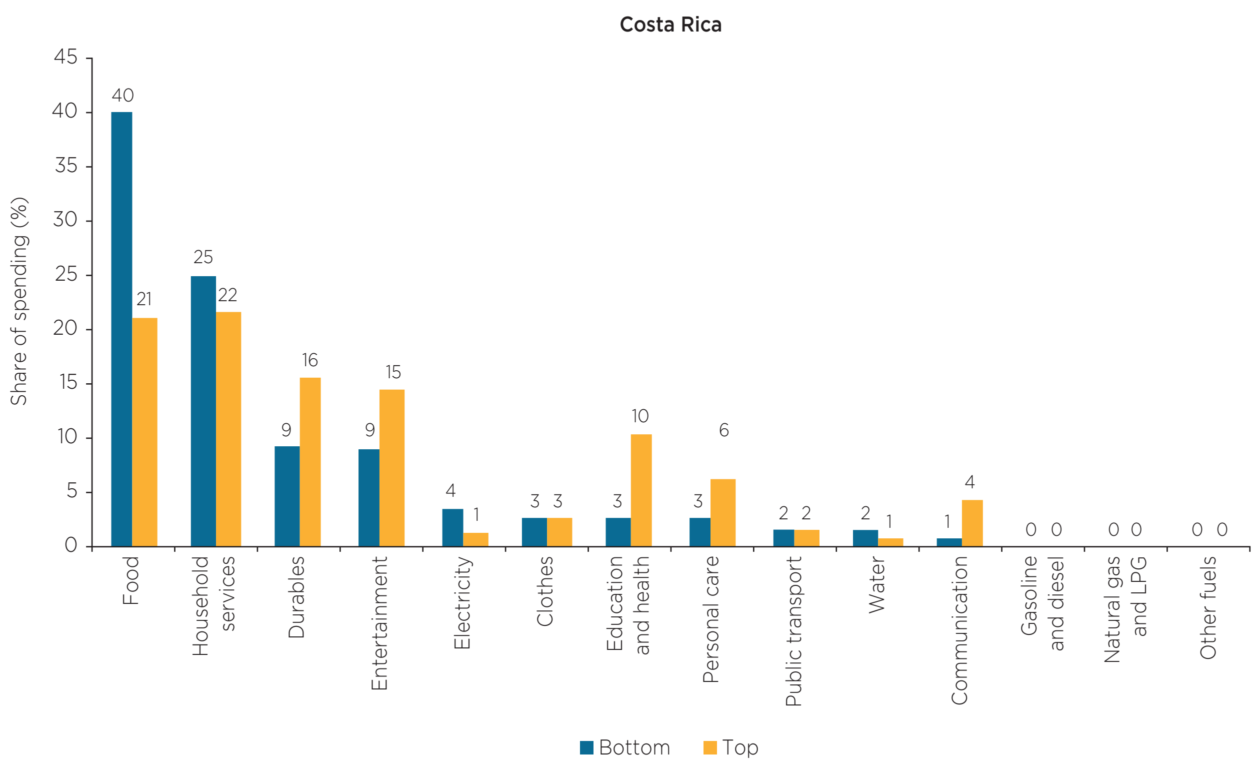
## Household Budgets *(continued)*

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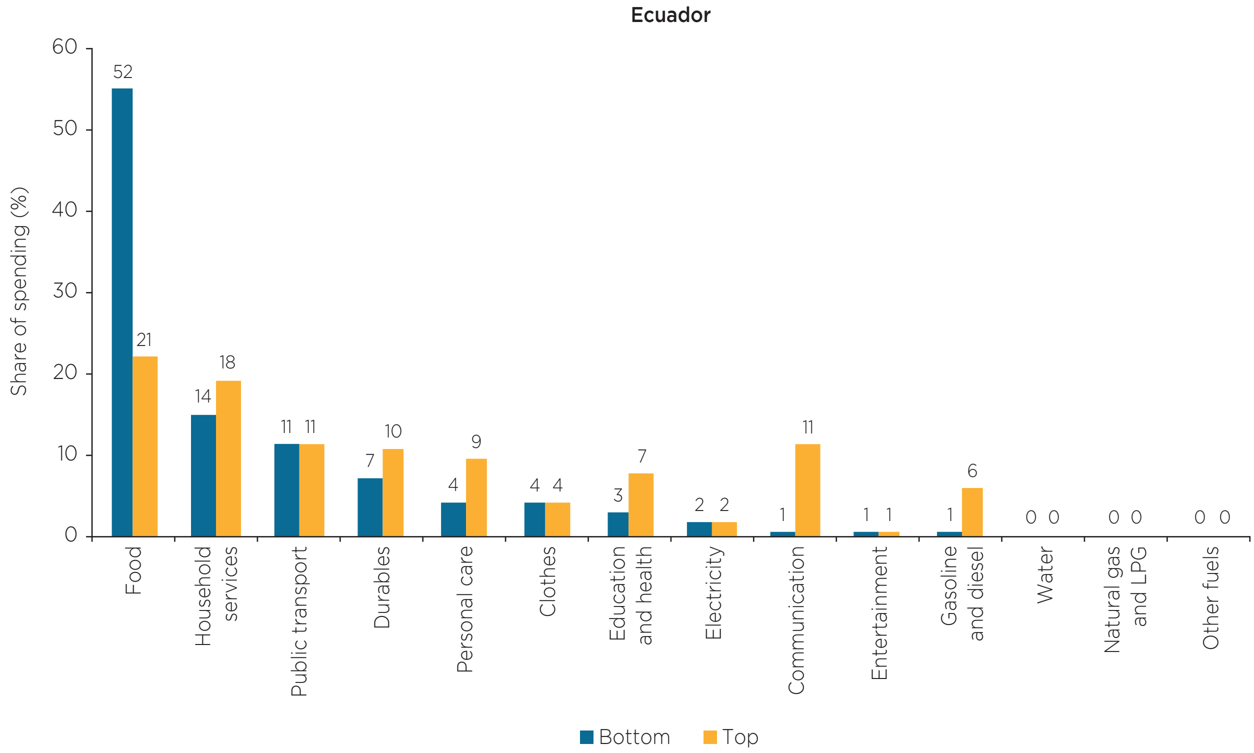


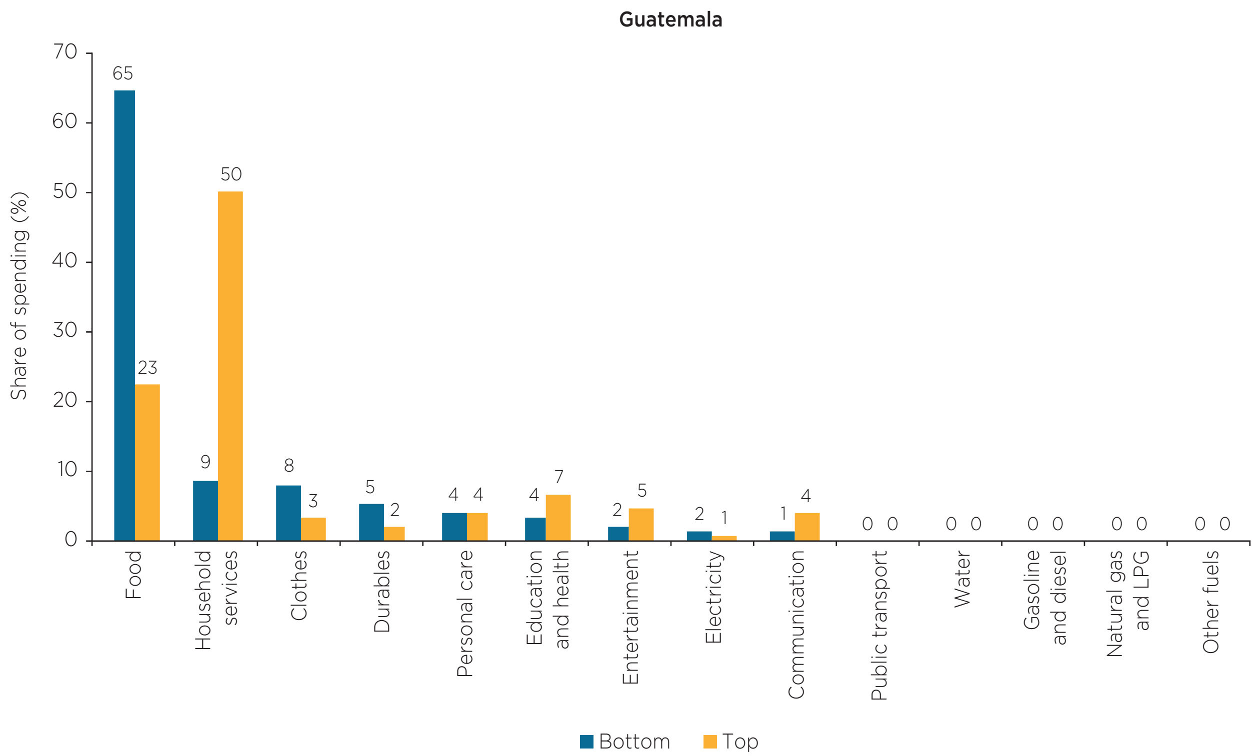


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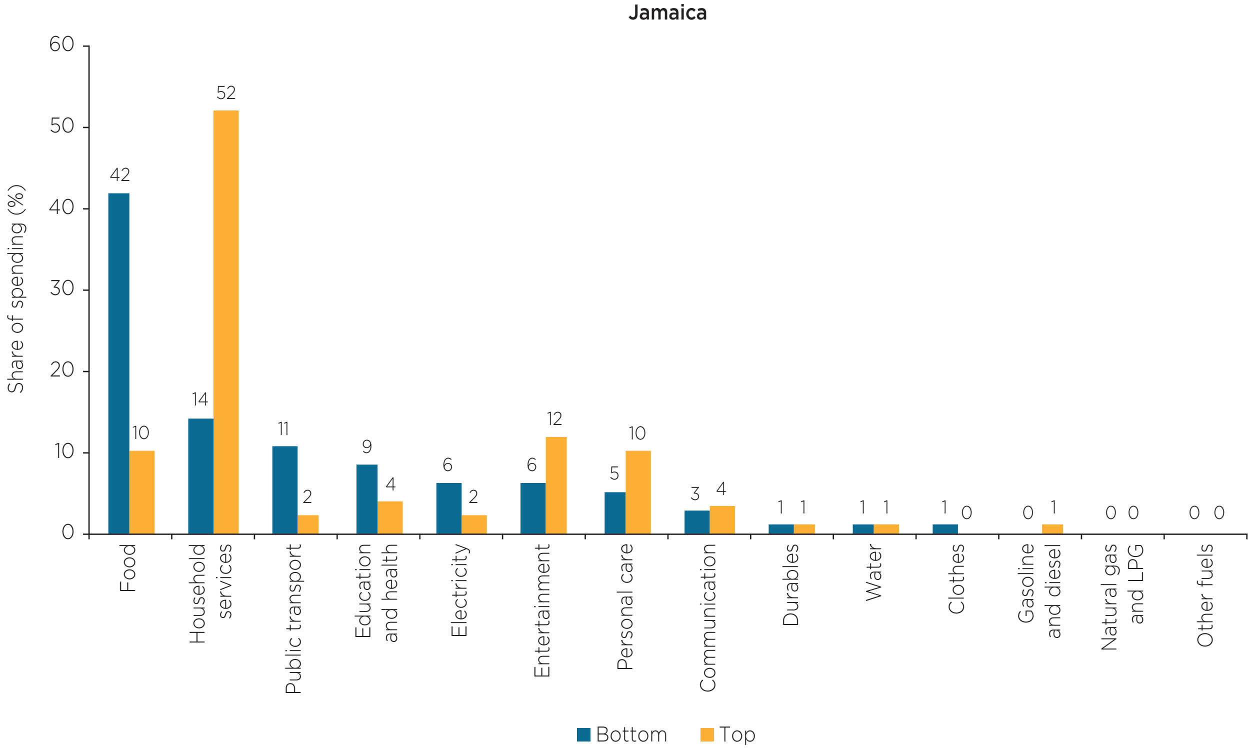


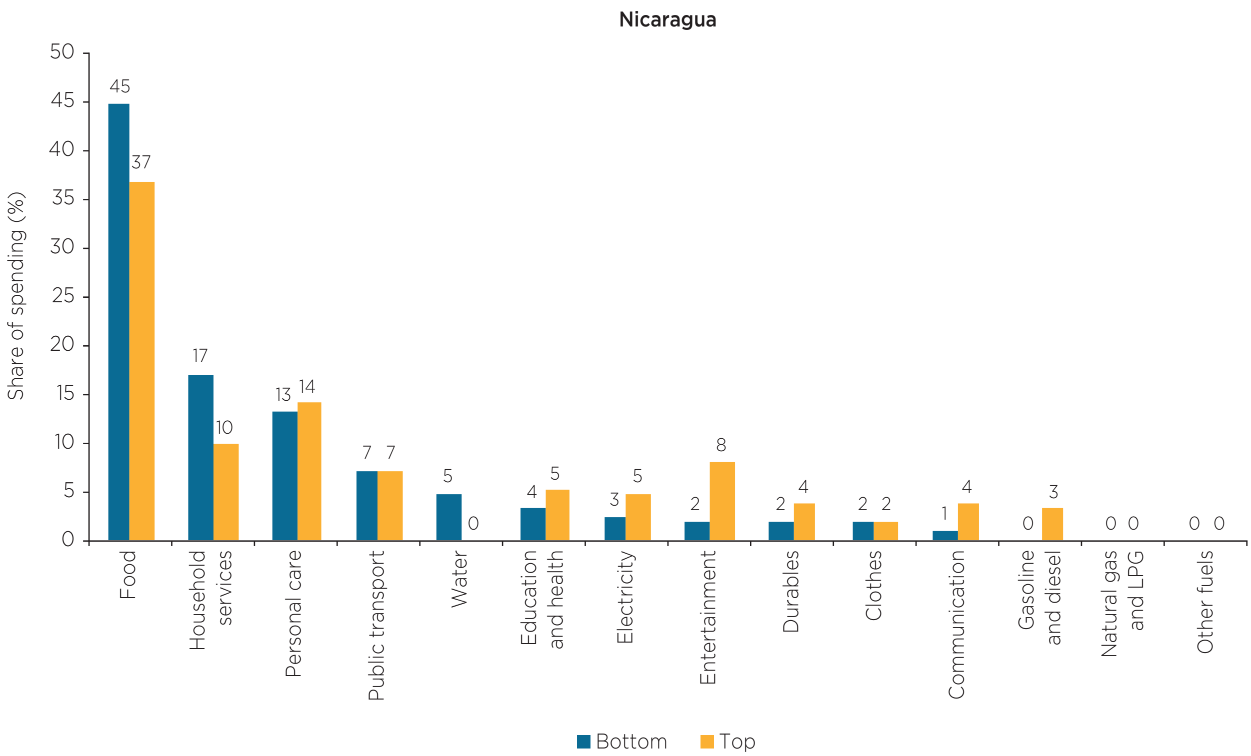


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# Bibliography


Arze del Granado, J., D. Coady, and R. Gillingham. 2014. *The Unequal Benefits of Fuel Subsidies: A Review of Evidence for Developing Countries.* Washington, DC: International Monetary Fund.

Banco Central del Ecuador. 2016. *Data Bank.* Retrieved from https://www.bce.fin.ec/index.php/component/k2/item/788.

Bastagli, F., J. Hagen-Zanker, L. Harman, V. Barca, G. Sturge, T. Schmidt, and L. Pellerano. 2016. *Cash Transfers: What Does the Evidence Say? A Rigorous Review of Programme Impact and of the Role of Design and Implementation Features.* London: Overseas Development Institute.

Beylis, G., and B. Cunha. 2017. *Energy Pricing Policies for Inclusive Growth in Latin America and the Caribbean.* Washington, DC: World Bank.

Blattman, C., and P. Niehaus. 2014. *Show Them the Money.* New York: Foreign Affairs.

Cecchini, S., and A. Madariaga. 2011. *Conditional Cash Transfer Programmes: The Recent Experience in Latin America and the Caribbean.* Santiago de Chile: Economic Commission for Latin America and the Caribbean.

Clements, B. 2013. *Energy Subsidy Reform: Lessons and Implications.* Washington, DC: International Monetary Fund.

Coady, D., J. Arze del Granado, L. Eyraud, H. Jin, V. Thakoor, A. Tuladhar, and L. Nemeth. 2012. *Automatic Fuel Pricing Mechanisms with Price Smoothing: Design, Implementation, and Fiscal Implications.* Washington, DC: International Monetary Fund.

Coady, D., V. Flamini, and L. Sears. 2015. *The Unequal Benefits of Fuel Subsidies Revisited: Evidence for Developing Countries.* Washington, DC: International Monetary Fund.

Coady, D., R. Gillingham, R. Ossowski, J. Piotrowski, S. Tareq, and J. Tyson. 2010. *Petroleum Product Subsidies: Costly, Inequitable, and Rising.* Washington, DC: International Monetary Fund.

Coady, D., I. Parry, L. Sears, and B. Shang. 2015. *How Large Are Global Energy Subsidies?* Washington, DC: International Monetary Fund.

Diamond, P., and J. Mirrlees. 1971. "Optimal Taxation and Public Production." *American Economic Review*, 8–27.

Di Bella, G., L. Norton, J. Ntamatungiro, S. Ogawa, I. Samake, and M. Santoro. 2015. *Energy Subsidies in Latin America and the Caribbean: Stocktaking and Policy Challenges.* Washington, DC: International Monetary Fund.

*The Economist.* 2014. "Petrocaribe and the Caribbean: Single Point of Failure." October 4.

Erten, B., and J. Ocampo. 2012. Super-Cycles of Commodity Prices since the Mid-Nineteenth Century. *UN DESA Working Paper No. 110*.

Espinasa, R. 2016. *Brand New Model, Same Old Price.* Washington, DC: Inter-American Development Bank.

Espinasa, R., and R. Gillingham. 2013. *Energy Pricing Principles and Practice*. Retrieved from http://www.iadb.org/res/centralBanks/publications/cbm81_1254.pdf.

Espinasa, R., & Sucre, C. 2014. *Long Term Dynamics of Crude Oil Markets.* Washington, DC: Inter-American Development Bank.

____ . 2015. *Cheap Oil? Making Sense of a Competitive Oil Market.* Washington, DC: Inter-American Development Bank.

*Expresso*. "Así Están Los Beneficiarios Del Bono de Desarrollo Humano." August 30, 2015.

Fay, M., S. Hallegatte, A. Vogt-Schilb, J. Rozenberg, U. Narloch, and T. Kerr. 2015. *Decarbonizing Development: Three Steps to a Zero-Carbon Future.* Washington, DC: World Bank.

Franks, M., O. Edenhofer, and K. Lessmann. 2015. *Why Finance Ministers Favor Carbon Taxes, Even If They Do Not Take Climate Change into Account.* Cambridge: Harvard Project on Climate Agreements.

Goldwyn, D. L., and C. R. Gill. 2014. *Uncertain Energy: The Caribbean's Gamble with Venezuela.* Washington, DC: Atlantic Council.

____ . 2016. *The Waning of Petrocaribe? Central America and Caribbean Energy in Transition.* Washington, DC: Atlantic Council.

Government of Jamaica. 2009. *National Energy Policy 2009-2030.*

Heine, D., J. Norregaard, and I. Parry. 2012. *Environmental Tax Reform: Principles from Theory and Practice to Date.* Washington, DC: International Monetary Fund.

Hernández, I., and F. Monaldi. 2016. *Weathering Collapse: An Assessment of the Financial and Operational Situation of the Venezuelan Oil Industry.* Cambridge: Center for International Development at Harvard University.

Ibarrarán, P., N. Medellín, F. Regalia, and M. Stampini. 2017. *How Conditional Cash Transfers Work: Good Practices after Twenty Years of Implementation.* Washington, DC: Inter-American Development Bank.

International Energy Agency. 2016a. *World Energy Outlook.* Paris: OECD.

———. 2016b. *World Energy Statistics and Balances.* Paris: OECD. Retrieved from http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en.

International Monetary Fund. n.d. *World Economic Outlook Database.* Washington, DC: International Monetary Fund. Retrieved from https://www.imf.org/external/pubs/ft/weo/2017/01/weodata/index.aspx.

____ . 2013. *Energy Subsidy Reform: Lessons and Implications.* Washington, DC: International Monetary Fund.

Jimenez, R., and A. Yépez-García. 2016. *Composition and Sensitivity of Residential Energy Consumption.* Washington, DC: Inter-American Development Bank.

Kojima, M. 2013. *Petroleum Product Pricing and Complementary Policies.* Washington, DC: World Bank.

Kojima, M., and D. Koplow. 2015. *Fossil Fuel Subsidies: Appoaches and Valuation.* Washington, DC: World Bank.

Koplow, D. 2009. *Measuring Energy Subsidies Using the Price-Gap Approach: What Does It Leave Out?* Winnipeg: International Institute for Sustainable Development.

Lindert, K., E. Skoufias, and J. Shapiro. 2006. *Redistributing Income to the Poor and the Rich: Public Transfers in Latin America and the Caribbean.* Washington, DC: World Bank.

Olson, M. 1977. *The Logic of Collective Action: Public Goods and the Theory of Groups.* Cambridge: Harvard University Press.

Parry, I., D. Heine, E. Lis, and S. Li. 2014. *Getting Energy Prices Right: From Principle to Practice.* Washington, DC: International Monetary Fund.

Parry, I., and J. Strand. 2011. *International Fuel Tax Assessment: An Application to Chile.* Washington, DC: International Monetary Fund.

Petrotrin. 2011–13. *Annual Report.*

Rentschler, J., and M. Bazilian. 2016. *Reforming Fossil Fuel Subsidies: Drivers, Barriers and the State of Progress.* Climate Policy.

Robles, M., M. G. Rubio, and M. Stampini. 2015. *Have Cash Transfers Succeeded in Reaching the Poor in Latin America and the Caribbean?* Washington, DC: Inter-American Development Bank.

Safi, M. 2017. "India Weighs Up the Return on Cash Handouts for the Poorest." *The Guardian*. February 6.

Sdralevich, C. A., R. Sab, and Y. Zouhar. 2014. *Subsidy Reform in the Middle East and North*

*Africa: Recent Progress and Challenges Ahead.* Washington, DC: International Monetary Fund.

Trebilcock, M. J. 2014. *Dealing with Losers: The Political Economy of Policy Transitions.* New York: Oxford University Press.

UN Comtrade. n.d. *Statistics Database.* Retrieved from https://comtrade.un.org/db/default.aspx.

U.S. Energy Information Administration. n.d. *Petroleum & Other Liquids: Data.* Retrieved from https://www.eia.gov/petroleum/data.php.

Vagliasindi, M. 2012. *Implementing Energy Subsidy Reforms: An Overview of the Key Issues.* Washington, DC: World Bank.

Victor, D. 2009. *The Politics of Fossil Fuel Subsidies.* Geneva: International Institute for Sustainable Development.

Vogt-Schilb, A., and S. Hallagatte. 2017. *Climate Policies and Nationally Determined Contributions: Reconciling the Needed Ambition with the Political Economy.* Washington, DC: Inter-American Development Bank.

Walter, M. 2016. *Extractives in Latin America and the Caribbean: The Basics.* Washington, DC: Inter-American Development Bank.

World Bank. 2014. *World Development Indicators.* Retrieved from http://data.worldbank.org/.

____ . 2015a. "Special Focus: Putting the Recent Plunge in Oil Prices in Perspective." *Commodity Markets Outlook*.

____ . 2015b. *The State of Social Safety Nets.* Washington, DC: World Bank.

Yépez-García, R. A., and J. Dana. 2012. *Mitigating Vulnerability to High and Volatile Oil Prices: Power Sector Experience in Latin America and the Caribbean.* Washington, DC: World Bank.