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Lessons Learned from Brazil's Experience with Fossil-Fuel Subsidies and their Reform

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June 2010

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Global Subsidies Initiative (GSI) of the International
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Table of Contents

1. Introduction

Brazil has a long history of subsidizing energy. Assistance has been provided by successive governments for most energy sources and for a variety of reasons. Electricity generation (hydroelectric and thermal power plants), ethanol and various petroleum products have all benefited from government support to producers, consumers, or both. The primary objective behind these policies has been the promotion of industrialization but governments have also implemented subsidies to achieve social and environmental goals.

This paper outlines Brazil's history of providing fossil-fuel subsidies and analyzes its attempts to reform its policies. Through to the 1970s, Brazil experienced a gradual build-up of fossil-fuel subsidies. These policies primarily benefit industry, consumers in regional areas or users of liquified petroleum gas (LPG). The two oil crises of the 1970s saw an escalation of support, which reached unsustainable levels in the 1980s. An ambitious reform agenda was launched during the 1990s that aimed to liberalize Brazil's energy sector by removing subsidies, allowing private investment and encouraging competition. The reforms were opposed by politically strong stakeholders, including unions, consumers, industry and nationalists. The reforms were partially completed before electricity shortages in 2001 gave final impetus to anti-reform lobbyists to quell further liberalization of the energy sector.

The reform process stalled but was not immediately reversed. The partially liberalized regime for the oil sector remained in place for most of the 2000s. The discovery of large offshore oil resources announced in 2006 prompted calls for the reintroduction of petroleum subsidies. Petrobras effectively provided petroleum price subsidies in 2007 and 2008, during the period of record-high oil prices (Agência Nacional do Petróleo, Gás Natural e Biocombustíveis [ANP], 2008). The Brazilian government has yet to make a decision about long-term price subsidies based on the country's new oil production and revenue.

Brazil's experience with fossil-fuel subsidies leading up to the untenable financial situation of the 1980s should argue for caution against the introduction of new subsidies. The lessons learned from this period are salient not only to other countries wishing to reform their fossil-fuel subsidies but to Brazil itself as the government encounters renewed pressure to provide subsidized petroleum.

2. Use of Fossil-Fuel Subsidies in Brazil

2.1 The 1930s through the 1950s: Early fossil-fuel subsidies

Brazil was an agrarian society until the 1930 revolution when a political coalition replaced the *terratenientes* (landlord) order (Sodré, 1979). Import substitution policies were adopted by the Getulio Vargas Government (1930–45) to promote industrialization of the country (Lattimore and Kowalski, 2008). Energy was expected to be cheap and plentiful to induce industrial growth and the development of a national energy system was a central part of early policies to encourage development. Subsides were provided in the form of soft financing for the establishment of energy generation and supply infrastructure. Power utilities received loans to develop a hydropower system, taking advantage of favourable sites in the industrializing southeast.[1]

Brazilian energy consumption accelerated in the 1950s, driven by industrialization and urbanization. Short of domestic crude oil reserves, oil was largely imported. In 1953 the Brazilian Government established Petrobras, a state-owned monopolistic company, to develop the domestic supply of petroleum products (Petrobas, n.d.).[2] Petrobras was regulated to sell its domestic production of crude oil and petroleum

Brazil's fossil-fuel subsidies: A timeline	
1930s	Government loans used to fund energy infrastructure
1950s	Prices for petroleum products based on import parity
	Subsidies applied to transportation of petroleum fuels along Brazil's coastline
1953	Creation of Petrobas (monopolistic state-owned oil company)
1960s	Levies and cross-subsidies introduced to equalize prices for end-user prices of petroleum products across the nation
	Subsidies for liquid petroleum gas (LPG) introduced
1970s	Cross-subsidies applied to diesel, fuel oil and LPG
	"Oil fund" created by Petrobas to maintain consistent ex-refinery prices for domestically produced petroleum products
mid-1980s	Diesel subsidies briefly removed (reintroduced at end of 1980s)
1988	New Constitution dictates that energy resources must be subject to competitive licensing processes
1991	Commencement of phased liberalization of petroleum prices
1995	Petrobas monopoly removed
1997	Act 9.478 provides new regulations for the oil sector based on principles of liberalization and privatization
2001	Contribuição de Intervenção no Domínio Econômico (CIDE) levy introduced on imported petroleum products
	Energy crisis and rationing of electricity
2002	Reform of the energy sector put on hold
2004	National Biodiesel Production Program (PNPB) created to establish a mandate for use of biodiesel; tax incentives introduced for biodiesel production
2008	New petroleum subsidies introduced in response to high oil prices
2009	Introduction of energy bills into parliament to increase government control over oil resources and revenue

1 Short of fossil-fuel resources, Brazil adopted policies that promoted the use of the renewable energy. Currently, approximately 95 per cent of electricity is generated by hydropower plants, ethanol supplies almost 20 per cent of liquid fuels used in transportation and firewood provides one third of the energy used by householders (Balanço Energético Nacional, 2008).

2 Eletrobras, another state-owned company, was created by several power utilities to coordinate the development of a national power system (Dias Leite, 2007).

products (such as gasoline, diesel and LPG) at import-parity prices (Navegantes de Oliveira, 1987).[3] Petrobas was permitted to use its revenue to finance the development of downstream supply capacity.

Concentrated in the metropolitan areas of the southeast, the industrialization process created large regional and social economic disparities (Pastore, Zylbertajn, H. & Pagotto, H., 1983). Subsidies for the transportation of petroleum fuels along the Brazilian coastline were used to reduce regional price disparities for these fuels (Navegantes de Oliveira, 1987).

2.2 The 1960s: Subsidies to equalize national access to energy

By the 1960s, regional disparities in economic development had become a major political issue. A complex system of levies and cross-subsidies was introduced in the energy sector to equalize prices for end-users across the nation. The aim was to avoid regional concentration of economic activities induced by price differentials in energy and petroleum products, as well as to lower energy prices for low-income households in the regions. A single pricing policy was adopted for petroleum products nationwide, despite regional differences in transportation and refining costs (ANP, 2001). Petrobras refineries were regulated to share their production and logistics costs so as to provide flat ex-refinery pricing.

Subsidies for LPG were first introduced in the 1960s. LPG was widely used for cooking purposes, especially in urban areas where firewood was scarcely available, and represented a substantial share of energy expenditure by low-income families (de Oliveira, 2006). The government opted to price LPG below its opportunity costs (import-parity price) for social reasons but this policy had the additional benefit of reducing firewood and charcoal consumption, hence limiting deforestation around the urban areas.

In the power sector, the *1973 Conta de Consumo de Combustíveis* policy introduced cross-subsidies to equalize national electricity prices. Profitable power utilities were regulated to share their profits with the unprofitable ones (de Oliveira, 2007a). In practice, electricity consumers connected to the national grid (mostly generated by hydroelectric dams) cross-subsidized consumers in regions (particularly in the Amazon) that were using electricity from inefficient, expensive thermal generation.

2.3 The 1970s and 1980s: Rising oil prices and rising subsidies

The escalation of international oil prices that occurred in the 1970s, commencing with the 1973–74 oil crisis, induced a shift in Brazil's energy subsidy policies. Brazil was importing around 80 per cent of its domestic oil consumption. Oil deposits were found offshore on Brazil's continental shelf but decades would pass before they began to be exploited.

New subsidies were introduced to help maintain economic growth and industrialization. Gasoline was considered a luxury good, while diesel and fuel oil were considered essential for industrialization and

3 "Import parity" refers to a price charged for a domestically-produced good that is set equal to the domestic price of an equivalent imported good—thus the world price plus transport cost plus tariff (Encyclo, n.d.).

cheap LPG was considered essential for the poor. Diesel passenger cars were banned in the 1970s to reduce diesel use outside the industrial sector (McClellan, 2001). Gasoline was priced at the refinery gates substantially over its import-parity price and the revenue generated was used to cross-subsidize other petroleum products. Cross-subsidies were provided for industrial energy consumers, diesel used in the transport of industrial goods and LPG consumers.

Commencing in the mid-1970s, large subsidies were also introduced to encourage the production and consumption of ethanol, a substitute for gasoline that was economically un-competitive with gasoline in Brazil at that time (de Oliveira, 1991). The ethanol subsidies had social, regional and macroeconomic objectives. Ethanol is produced in Brazil from sugar cane, the production of which employed a large number of unskilled labourers in rural areas, especially in the poor northeast of Brazil, and thus support for ethanol had an agricultural and social development goal. Domestically produced ethanol also promised to reduce Brazil's expenditure of hard currency for petroleum imports.

Following the second oil crisis of the 1970s, triggered by the 1979 Iranian revolution, the government introduced a further measure to reduce the effects of crude-oil price volatility. Petrobas was required to establish an oil price stabilization fund in its accounting practices (Lodi, 1993).[4] Domestic oil was priced below or above the imported oil price to keep the oil costs for Petrobras refineries at a set price determined by the government. Any deficit in the oil fund would be made good by the government (taxpayers) in the future.

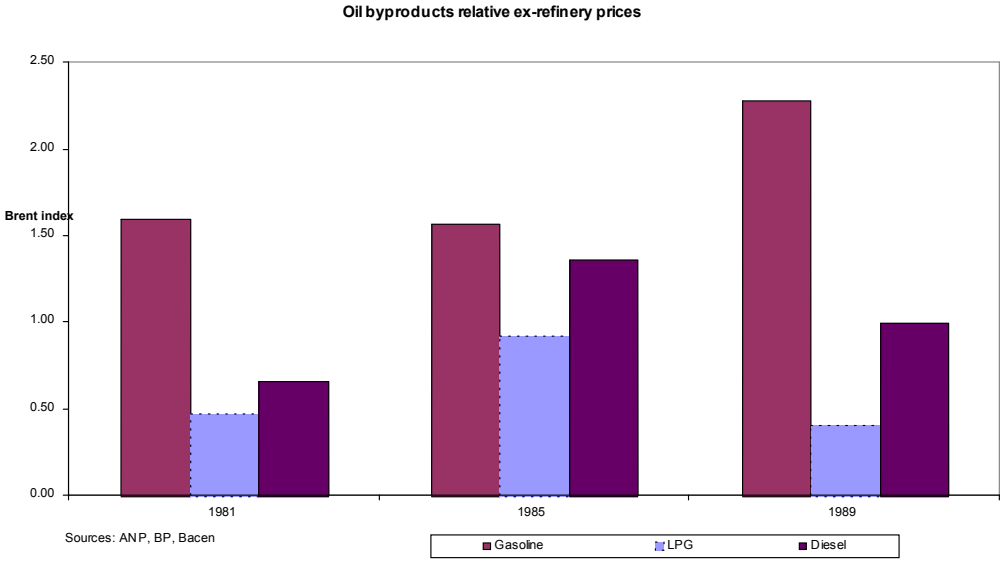
When international crude oil prices fell in the mid-1980s, diesel subsidies were temporarily removed and levies introduced to supplement the cross-subsidies to other fuels, such as ethanol and LPG. Diesel subsidies were reintroduced briefly towards the end of the decade.

Unfortunately, reliable figures do not exist for the subsidy levels provided to producers and consumers during these years. Inflation was rampant and energy prices were adjusted monthly with no actual link to their opportunity costs. Figure 1 shows that large subsides were provided at Petrobras refinery gates for diesel and LPG consumers, partially funded by the cross-subsidy from gasoline. Diesel and LPG were priced at the refinery gate below the international price of crude oil at the time, while gasoline was priced significantly higher.[5] Figure 2 indicates that levies on gasoline (and later on diesel as well) were used to subsidize ethanol producers and industrial consumers of petroleum fuels.

4 Fundo Especial de reajuste de Estrutura de Preços dos Combustíveis e Lubrificantes (Decreto-lei no 1785/80).

5 Assuming that the crude price (Brent) is a reasonable proxy of the petroleum opportunity costs, Figure 1 indicates that gasoline was not subsidized at the refineries gates during the 1980s.

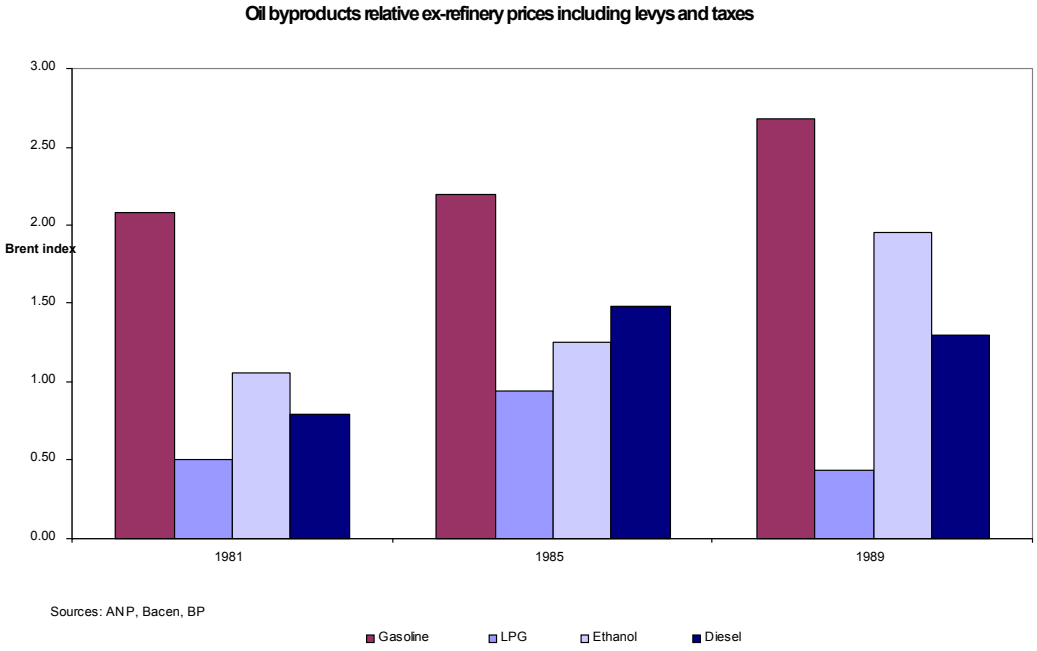
Figure 1 Subsidy index: Average domestic petroleum prices (pre-tax) divided by a benchmark international price for crude oil



Notes: Average prices at the refinery gates without tax and levies divided by the average spot price of Brent crude oil. Assuming that the Brent is a proxy for international ex-refinery prices, an index above one indicates that there were no subsides, while those below one indicates that subsides were offered.

Source: Calculations by the author.

Figure 2 Subsidy index: Average domestic petroleum prices (taxes and levies included) divided by a benchmark international price for crude oil



Notes: Average prices at the refinery gates including tax and levies divided by the average Brent prices

Source: Calculations by the author based on prices from Petrobas and Brent prices

However, the largest shares of the diesel and LPG subsides were provided by the policy of selling domestically produced crude oil to the refineries below its import-parity cost. The government had committed to reimburse any losses by Petrobas arising from under-pricing through the oil-price fund. At the end of the 1980s, the fund had run up an enormous deficit. Petrobras was facing growing difficulties in financing its projects, jeopardizing the domestic supply of oil. The Treasury partially compensated Petrobras for the subsidies offered during the 1980s, transferring R$5.8 billion (US$3.1 billion at 2010 exchange rates) to Petrobras in the middle of the 1990s to pay for subsidies accumulated in the oil fund.[6] However, at the end of 2008 the company was still owed R$900 million (US$480 million at 2010 exchange rates) by the Treasury for these losses.

In a period of escalating inflation, the subsidy policies proved to be a disaster. At the end of the 1980s, energy companies were unable to raise the financial resources needed to keep their energy production in tandem with demand. The subsidy regime had distorted the energy price signals to consumers, promoting sales of subsidized fuels while reducing incentives for energy conservation and efficiency. Although the LPG subsidy was intended to minimize expenditure by poor households on energy for cooking, it stimulated the use of LPG in industry and transport sectors as well as for luxury uses such as heating swimming pools and saunas. Although the practice was prohibited, many vehicles utilized LPG in clandestine and potentially dangerous adaptations (Lucon, Coelho & Goldemberg, 2004). Gasoline engines were replaced by diesel and ethanol engines that could take advantage of subsidized fuel. By artificially reducing prices for many products, petroleum subsidies increased oil imports. At one point, Brazil became a net exporter of gasoline and a large importer of diesel and LPG.

2.4 The 1990s: Era of liberalization and privatization in the energy sector

The 1990s marked the end of Brazil's import-substitution policies (Giambiagi & Moreira, 1999). Enacted in 1988, the new Constitution dictated that energy resources must be subject to competitive licensing. Subsequently, the import-substitution industrialization policies were abandoned and the liberalization of the Brazilian economy was initiated (Giambiagi & Moreira, 1999).

2.4.1 Objectives

The main objective of the 1990s energy-market liberalization was to introduce competition and improve economic efficiency. Competition was expected to reduce costs and provide the correct price signals to consumers, promoting energy conservation and efficiency. De-subsidization also promised to increase government revenue.

2.4.2 Implementation

The government pursued a gradual approach to the removal of subsidies in order to minimize opposition from the interest groups that had benefitted from the policies. To build public support for the reforms, the government promised consumers that privatization and liberalization would lower energy prices and improve energy services. Competition was expected to improve efficiency and drive down costs and end-user prices, compensating consumers for the removal of their subsidies.

6 Another R$26 billion was paid by the Treasury to the power utilities.

The movement to free-market prices was gradual, beginning in the early 1990s with petroleum products used by few consumers (asphalt, lubricants) and moving progressively to widely used products (gasoline, diesel, fuel oil and LPG) (Table 1). The phased removal of subsidies also followed a political agenda. The first products to lose subsidies were generally used by politically weak stakeholders, while the politically more difficult subsidies (for liquid fuels used for transport and by industry) were removed later. The removal of subsidies for ethanol producers and the suppliers of equipment and services to Petrobras were left to the end of the liberalization program. Subsidies for the supply of fuels to the inefficient thermal power plants of Amazonia, a regional politically sensitive issue, were maintained for a period of ten years.

Table 1 Brazil's Price-Liberalization Program for petroleum products

Year	Liberalization
1991	lubricants, residuals, kerosene for final consumers
1993	gasoline for airplanes for final consumers
1996	ethanol and gasoline for final consumers
1997	asphalt for final consumers
1998	LPG for final consumers
1999	gasoline and fuel oil at refinery gates
2000	naptha for petrochemicals at refinery gates
2001	gasoline, diesel and LPG prices adjusted to Brent prices every three months

Source: Adapted from ANP (2001).

In 1995, the monopoly of Petrobras was removed, despite strong opposition from the nationalists (de Oliveira, 2007b). Two years later, Act 9.478 established a new regulatory regime for the Brazilian oil industry (de Oliveira, forthcoming). The Act implemented the arrangements set out in Brazil's new 1988 constitution. The aim of the new regime was to expose Petrobras to fair competition and attract international oil companies to the Brazilian hydrocarbons market.

Any company, including Petrobras, engaged in the extraction and development of the country's hydrocarbon resources was made subject to a transparent regime requiring disclosure of financial compensation for their upstream activities (signature bonuses, royalties, special participation fees and leasing fees for retention of an area). Petrobras was forced to compete with other oil companies, paying royalties and taxes for its domestic crude production. The ability of the company to provide cross-subsidies using oil revenues from its domestic crude production, especially to its suppliers of goods and services, was drastically reduced.

Other features of the Act included (Baker Institute, 2004; Government of Brazil, 1997):

- creation of the National Council for Energy Policy (CNPE) to set energy industry policy;
- creation of the Agencia Nacional do Petroleo (ANP) to oversee deregulation and restructuring and to manage the auctioning of blocks for exploration;

- increased use of natural gas;
- increased competition in the energy industry; and
- domestic and foreign investment in power generation.

During the 1990s, several state-owned electricity companies were also privatized.

Price liberalization has been in effect since 2002, according to Law No. 9478/1997, amended by Law No. 9990/2000. There is no government setting of prices in the chain of production and marketing of fuels—production, distribution and retailing (ANP, n.d.) Under the scheme, the ANP follows fuel prices through the *Levantamento de Preços e de Margens de Comercialização de Combustíveis* (survey of fuel prices and margins), which includes gasoline, fuel ethanol, diesel, natural gas for vehicles and liquified natural gas LNG.[7]

2.4.3 Results

Liberalization induced several international oil companies to initiate activities in exploration and production in Brazil, in most cases in partnership with Petrobras. Both proven oil reserves and oil production increased steadily, and the new regulations increased the flow of oil revenues to the government. Despite these improvements, Brazil's oil import bill still represented 15 per cent of the current account deficit in 1999 (Baker Institute, 2004).

There was a great deal of resistance to the reforms. Decades of energy subsidies had created resistance to subsidy removal from politically strong stakeholders. Chief among them were the large industrial consumers, suppliers of Petrobras and ethanol producers. The reforms were also fiercely criticized by the political opposition, which perceived increasing energy prices as a constraint on industrial growth.

The poor were also affected, facing an increase in the average retail price of LPG of 17 per cent (Jannuzzi & Sangab, 2004). This contributed to a decrease in household usage of LPG of over 5 per cent, although factors other than price could have contributed to the lower usage.

While the privatization reforms appeared comprehensive on paper, Petrobras managed to preserve a de facto monopoly in the refining and transportation of petroleum for the domestic market (although new players have entered the retail distribution of fuel). The company was also allowed to keep a selected set of areas for oil exploration before the bidding process commenced for exploration rights for offshore oil basins.

The government assumed that, in time, newcomers to the sector would erode Petrobras's dominant position in the oil exploration, refining and transport business but Petrobras ultimately became the preferred partner by the new companies in the search for oil on the Brazilian continental shelf. There was no attempt by newcomers to construct new refining facilities.

7 The objective of the *Levantamento de Preços e de Margens de Comercialização de Combustíve* is to inform consumers of the prices and margins charged by fuel marketers, thus contributing to the transparency of business practices and facilitating choice by consumers regarding the best pricing option. The survey also provides a database for the ANP for surveillance and monitoring purposes (ANP, n.d.).

Liberalization did, however, break up historical business relations between the state-owned energy companies and their suppliers of equipment and services. Historically protected by Brazil's import-substitution policies, many of these suppliers were unable to compete with foreign suppliers to Brazilian energy companies in a more open market. Their dissatisfaction was voiced by their industrial associations. Privatization and liberalization led to early-retirement programs and layoffs, while reforms were resisted by the trade unions.

Privatization also moved resources from government control to private ownership, in some cases to foreign ownership. Nationalists added their outcries to those of the unions, concentrating their criticism on the opening of Brazil's energy sector to foreign investors. In response to these criticisms and despite its commitment to liberalization, in 2001 the government introduced a new levy (*Contribuição de Intervenção no Domínio Econômico* [CIDE]) on the importation and marketing of petroleum products. The levy raised revenues that were then used to fund: i) subsidies for ethanol producers; ii) the transportation costs of hydrocarbons and LPG used by low-income families; iii) projects oriented to environmental protection; and iv) the construction of roads.

The government paid little attention to the need to keep the supply and demand of energy in balance. Lack of investment in electricity generation infrastructure combined with a drought in 2001 caused Brazil's hydroelectricity reservoirs to become dangerously depleted (de Araujo, 2006). Rather than accelerate electricity price liberalization to raise producer revenues and moderate consumer consumption, the government introduced regulations that forced producers to ration the electricity they supplied to consumers. This disastrous political decision produced a sudden drop in GDP, eventually convincing a large share of society that the political opposition's view was correct: that liberalization and privatization were harmful to Brazilian economic development. Consumers joined the unions, nationalists and energy suppliers in expressing their dissatisfaction with the power-sector reform.

The rationing of power in 2001 offered political legitimacy to criticisms about the government's energy liberalization agenda more broadly. The energy crisis became a major issue for the 2002 election, with the opposition promising a review of energy policy if it were elected.

2.5 From 2002 onwards: The liberalization process stalls

When the opposition won the 2002 election, the new government put aside the energy reform agenda of the previous government (Baker Institute, 2004). Thanks to the effects of power rationing, heavy rains (which replenished the hydro-electric reservoirs) and the instalment of new thermal power plants fuelled by natural gas, electricity supply capacity recovered quickly from the earlier crisis and was soon in surplus. The government took advantage of this surplus to introduce new regulations that, effectively, created cross-subsidies from power generators to electricity-distribution companies (de Oliveira, 2007a). Plans to liberalize prices of natural gas were also put on hold, which hindered the development of further gas-fired power plants (Baker Institute, 2004).

Initially there was no change in the oil-sector regulations, as oil imports were still a major macroeconomic concern. Indeed, the new government was required to assure financial markets that the macroeconomic

policies of the previous government would be preserved, following a devaluation of the Brazilian currency from June 2002 when opinion polls indicated that the left-wing opposition would win the October election. Petrobras was informally instructed to protect the Brazilian economy from this drastic devaluation of the currency. The currency held its value and the partially liberalized regime for the oil sector was maintained for most of the 2000s.

The 2007–08 escalation of the international oil price and the identification of large domestic offshore oil reserves radically changed the perception of the Brazilian oil situation. Brazil is expected to become a large oil-exporting country and revenues from domestic oil production are expected to increase dramatically (de Oliveira, 2008; Petrobras, 2009). Oil abundance prompted the view that Brazil can take advantage of the lower cost of domestic crude to speed up industrialization and to mitigate social, regional and environmental problems as well. Price subsidies for petroleum products were reintroduced in 2008, when the domestic oil production matched domestic oil consumption, in order to minimize the effect the brutal escalation of the oil price during that year had on the economy.

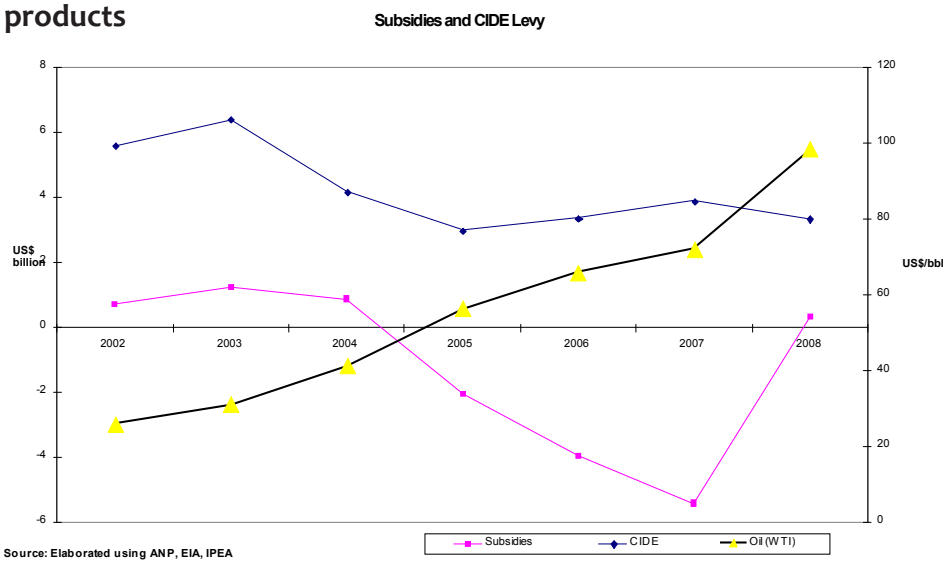
There are no official subsidy estimates for this period. Jannuzzi and Sanga (2004) estimate that the average LPG subsidy for the period from 1973 to 2001 was 30 per cent of the ex-refinery price and 18 per cent of the retail price. Based on average consumption and retail prices, they estimate that the cumulative value of the subsidy during this period reached over US$3 billion (in 2001, and corrected for inflation). The government introduced a new LPG subsidy in 2002 to assist low-income families' purchase of LPG through a voucher valued at US$2.38 per month per family. This was only fuel available to families with a monthly income of no more than half the minimum wage. The government spent US$349 million in 2002 and US$463 million in 2003 on the gas-voucher subsidy program (Jannuzzi & Sanga, 2004).

Figure 3 estimates the total level of petroleum subsidies (or revenue, in the case of negative subsidies) from 2002 to 2008. The estimates describe the opportunity cost of supplying petroleum products at non-market prices.[8] The results reveal that Petrobras was able to recover most of the subsidies offered to consumers in that period.

Figure 3 also estimates the revenues received from the CIDE levy on petroleum products. These estimates indicate that the government used the CIDE to adjust petroleum prices for final consumers, as it lowered the levy when international oil prices rose. New announcements indicating that Brazil's offshore petroleum reserves were larger than previously estimated also appear to have influenced the government's decisions about the level of the CIDE levy. The government reduced the CIDE levy on gasoline and diesel in 2004 and removed the CIDE levy on LPG and fuel oil. As a result of the lower levy rate and narrower coverage, the aggregate total amount of the CIDE did not increase in spite of the growing consumption of petroleum products.

8 The calculations are based on a comparison of Petrobras's ex-refinery prices with average petroleum prices in the United States as a proxy for an international market price (data from the Energy Information Administration – www.eia.gov), multiplied by the volume of petroleum consumed by Brazil in each year.

Figure 3 **Estimated petroleum subsidies or revenue in Brazil and revenue from the Contribuição de Intervenção no Domínio (CIDE) levy on imported petroleum products**



Notes: Positive subsidies indicate that consumers were being subsidized (Petrobas was selling products below market values). Negative subsidy values (between 2005 and 2007) show net taxes for consumers.

Source: Calculations by the author.

2.6 Future subsidy levels

A group of energy bills were sent by the government to the Congress in September 2009. The main objectives of these bills are to grant the government greater control of the oil sector, increase government oil revenues and enhance the government's ability to use this revenue for public-policy purposes.

The bills propose to replace the current concession regime by production-sharing agreements. Under these arrangements, the government would receive a share of the oil produced and will use or trade it based on government objectives. A new oil company, 100 per cent state owned, would be created to govern the large oil reserves recently identified offshore. Petrobras will become the single operator for all future oil fields discovered.

The government also intends to create a special fund with its oil revenues. This fund would be used to finance several types of programs (social, environmental, regional, educational and technological, including the support of renewable energy technologies), as well as to assist the development of domestic suppliers of equipment and services for the oil industry.

So far, there is no indication of how the oil fund or the government's share of the oil supply will be used. Lobbyists in Congress are actively pushing for the creation of new subsidies with the revenues from the oil fund, and the government offered clear signs that it intends to use oil as a major source of revenues for achieving its economic and social objectives.[9]

9 *Ministério de Minas e Energia* (Ministry of Mines and Energy): www.mme.gov.br

3. Lessons Learned

3.1 Energy subsidies can hinder economic growth

The primary objective of successive Brazilian governments in providing energy subsidies has been the promotion of industrialization. Yet Brazil's own experience in the 1980s demonstrates that subsidies can work against this goal.

While subsidies might provide short-term economic stimulus and help redistribute income, government intervention in the energy sector can be expensive in the longer term and become untenable at times of high international oil prices or low domestic supply, creating an impediment to sustained growth. They prevent a country from reaping the efficiency gains from the liberalization of energy markets and keeping it competitive internationally (Baker Institute, 2004). The huge deficit in Petrobas's oil fund required the transfer of billions of dollars of taxpayer money. Under-pricing and state control caused low investment in exploration and refining capacity by Petrobas, jeopardizing the country's domestic oil supplies.

3.2 Partial reforms lead to only partial benefits

By the end of the 1990s, the era of liberalization appeared to be yielding positive results in the fossil-fuels sector. Private investment in exploration and production commenced. Oil reserves, production and government revenue increased. However, the government stopped short of full liberalization. Petrobas was allowed to maintain a de facto monopoly for the domestic petroleum supply and cross-subsidies were maintained for some fuels. By maintaining these policies, the government limited the economic benefits of liberalization.

When the 2001 electricity crisis occurred, the liberalization of the petroleum market became associated in the public's mind with problems affecting electricity supplies. Electricity shortages were blamed on liberalization rather than on the previous decades of consumer subsidies that had caused under-investment in new supply infrastructure. Politically powerful stakeholders who had long opposed reform used the opportunity to call for a halt to energy sector reform and the reintroduction of subsidies.

3.3 Subsidies become entrenched

Once imposed, subsidies tend to become entrenched and politically difficult to reform. Fossil-fuel subsidies in Brazil created politically strong stakeholder groups that resisted reforms during a decade of liberalization in the energy sector, and eventually contributed to the halt of the reform agenda. New subsidies are likely to have the same effect. Indonesia, for example, provided consumer subsidies for petroleum while it was a net oil exporter but has been unable to remove these subsidies since transitioning to becoming a net importer (International Energy Agency, 2008). The consequence has been large fiscal deficits and political unrest when the government has been forced to raise fuel prices due to untenable costs of the subsidy program.

3.4 Reforms are fragile

A major lesson from Brazil's experience is the fragility of reforms, and the ease with which problems in one energy sub-sector (in this case, electricity) can attach themselves to another energy sub-sector (petroleum) and bring reforms in both to a halt.

4. Conclusions

The lessons from Brazil's experience with subsidies in the 1970s and the 1980s were not fully learned. While intended to promote industrialization, subsidies reduced investment and competition in the energy sector, discouraging energy efficiency and distorting signals to consumers. Several subsidy policies were intended to improve economic equality. These benefitted mainly select groups while disadvantaging the country as a whole.

The biggest winners of the petroleum subsidies were the ethanol producers and the large industrial energy consumers that were cross-subsidized during the 1970s and the 1980s. Poor families and the Amazonian electricity consumers experienced economic gains as well. The biggest losers were the taxpayers that had to provide fiscal resources to repay Petrobas's oil fund in the 1990s and consumers of gasoline that cross-subsidized other fuel consumers.

Brazil's situation is changing now that it is poised to become a major oil producer. However, the subsidies have not changed. New consumer subsidies would have the same effects as when Brazil was a major importer: encouraging wasteful consumption, distorting price signals to consumers, discouraging investment in energy infrastructure and—if not reformed—eventually leading to a high fiscal burden when the government can no longer afford to under-price petroleum but politically strong stakeholders demand the continuation of consumer subsidies. These problems may appear distant while domestic oil supplies are plentiful but Brazil's experience clearly shows that the distortions created by subsidies inevitably come back to affect future governments. Yet an abundance of oil resources should provide an opportunity to raise fiscal revenue to support social, regional and industrial policies, which could be achieved through import-parity pricing of domestic supplies and appropriate taxation.

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