

# LPG subsidies in Brazil: an estimate

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## 1. Introduction

Liquefied petroleum gas (LPG) is accessible to more than 98 % of households in Brazil according to the last household survey by the Institute of Geography and Statistics of Brazil in 2002. It has a slightly higher penetration than electricity which had reached 97 % of the 46.5 million households. Penetration of LPG in the rural areas is also remarkable; 93 % of rural households use LPG. In 2002 LPG consumption in the household sector reached 10 million (M) m<sup>3</sup>.

This short note intends to estimate the amount of LPG subsidies given in Brazil in the past decades. These subsidies, in our view, are one of the main reasons explaining the high penetration of this fuel in the household sector.

Removal of the price subsidy from LPG in January 2002 resulted in an immediate increase of 17 % in the average retail price and a decrease of 5.3 % in the household LPG consumption in 2002 equivalent to 9.3 PJ [MME, 2003]. In the same period the household consumption of natural gas increased from 140,000 m<sup>3</sup> to 179,000 m<sup>3</sup>, equivalent to 1.4 PJ.

The percentage share of the household sector in the total LPG consumption, which had increased at the rates of 3 % and 4 % for two consecutive years, 2000 and 2001, decreased from 82 % in 2001 to 70 % in 2003 [ANP, 2004]. The sudden fall in household consumption is evidence of the impacts of price increases, although there could be other factors such as an increase in the use of natural gas, changes in food preparation and eating habits, or improvements in the efficiency of gas stoves. From the paragraph above, however, it can be observed that the use of natural gas replaced only 16 % of the LPG during the period under consideration.

Moreover, unlike the other factors, price changes normally have an immediate impact on fuel consumption pattern; other factors may have influenced fuel consumption more gradually over time. Information on the other factors is hardly available and quantifying impacts of these factors would require further field surveys. It is also worth noting that in Brazil the use of LPG in 13-kg bottles destined for household use is prohibited for use in automotive and other sectors such as industrial and commercial, although it cannot be ignored that a portion of this fuel might have had non-household uses during the period under consideration.

## 2. LPG pricing

Brazil practiced a cross-subsidy scheme for several decades in order to make LPG affordable to households in all parts of the country. Funds were collected from sales of various petroleum derivatives whose final consumer prices were administered by the central government and were uniform across the country. The price structure was composed of four main categories: production costs paid to the refining company, a fuel fund (called PPE until 2001 and now known as CIDE), fiscal and sales taxes and lastly the distribution margin costs. In May 2001 end-user prices for LPG were liberalized as a part of a gradual process of deregulating the petroleum sub-sector.

As LPG prices were deregulated and collective subsidies to all customers were eliminated, the federal government started implementing a policy to assist low-income families to purchase the gas through a voucher valued at R\$<sup>[2]</sup> 7.5 (US\$ 2.38) per month per family. Unlike under the previous subsidy system, which subsidized every LPG user, the new program benefits are available only to families with a monthly income per capita that is no more than half the minimum-wage income<sup>[3]</sup>.

## 3. Estimations of the amount of subsidy to LPG

By subsidy we mean here any measure intended to keep the energy producers' costs below market levels or to keep end-users' retail prices below market levels. There is no consolidated information on the exact amount of subsidy that was used to promote the massive distribution of LPG in the country<sup>[4]</sup>. Because of the importance of subsidies in creating markets for LPG in Brazil, this section presents an estimate of the amount of subsidies paid over the 30-year period 1973-2003, using available information in the literature.

The amount of subsidy to LPG has been varying with time, as seen in Figure 1, which shows the production costs, ex-factory prices and percentages of subsidies<sup>[5]</sup> on the ex-factory prices from July 1998 to December 2001.

In December 2001, the retail price of a 13-kg bottle of LPG in Rio de Janeiro was R\$ 22.30 and the value of subsidy was R\$ 3.47 or 27 % of the ex-factory price, which includes production costs and taxes. The price structure was changed after the price liberalization as shown in Table 1. Unit retail price would have increased further if there had not been a reduction of 25 % in the production costs because of a fall in international petroleum prices and a gain in value of the local currency.

### 3.1. The 1973-2001 period: LPG ex-factory price subsidy

Combining the observations from Figure 1 and Table 1, in the period from 1973 to 2001 we can estimate the average percentage of subsidy to be 30 % on the ex-factory price and 18 % on the retail price. Moreover, using the information on LPG annual consumption and retail prices (Figure 2) at current values, the cumulative value of subsidies (at 18 % annually) reaches US\$ 8.235 billion (current US\$). Using the internal price index<sup>[6]</sup> to correct for inflation and converting the LPG domestic prices into 2001 US\$, the total amount of subsidy over the period is

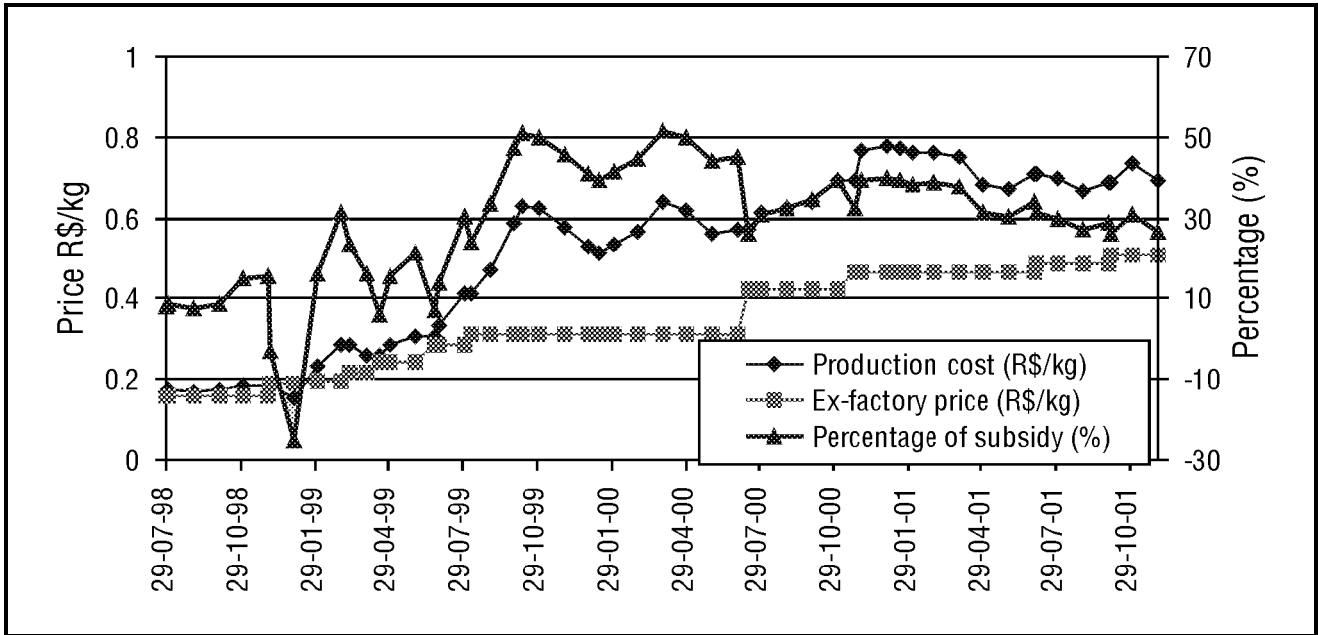


Figure 1. Available information on LPG subsidies (1998-2001) (current R\$)

Source: Petrobras, 2004

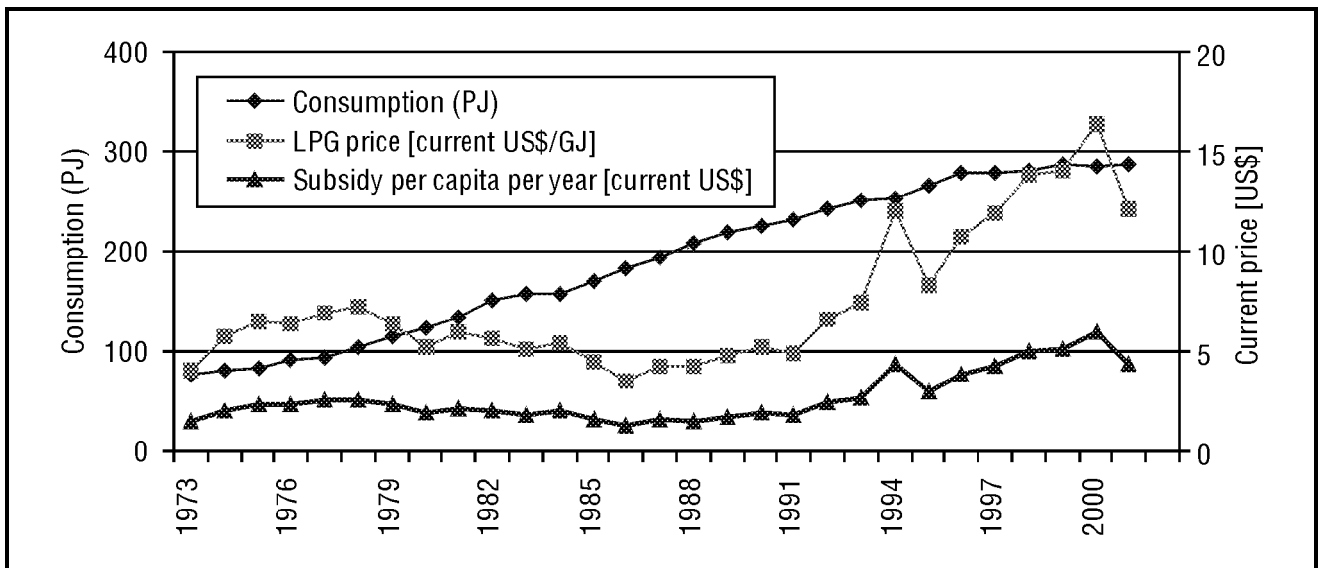


Figure 2. Evolution of the annual LPG consumption (TJ), consumer price and annual per capita subsidies from 1973 to 2001 (in current US\$)

Source: MME, 2003 and authors' estimates

US\$ 2.929 billion.

Geller and Dutt [1983] show that an average LPG consumption for cooking is approximately 2 GJ per capita per year. This has also been proved to be constant across countries in various studies [Ang, 1980]. Assuming the per capita consumption of 2 GJ per year for Brazil, equivalent annual consumption of LPG is 40.32 kg or slightly more than three 13-kg LPG bottles. Using this information, the annual average per capita subsidy (in current US\$) during 1973-2001 is also plotted on Figure 2. The average value of the LPG subsidy per capita is US\$ 2.69 and correcting for internal inflation the average value is US\$ 0.73 at constant 2001 US\$<sup>[7]</sup>. The value of LPG subsidy per capita at current prices reached its maximum of US\$ 5.93 in 2000 and in 2001 it dropped to US\$ 4.38.

### 3.2. The 2002-2003 period: LPG low-income end-user subsidy

The government spent R\$ 650 million for 6.7 million families in 2002 (US\$ 349 million, in 2001 US\$) for gas vouchers, representing 4.8 % of all government expenditures on social assistance programs according to the Ministry of Finance [MF, 2004]. In 2003, the number of beneficiaries increased to 7.9 million families (almost 20 % of the population) and the amount of money totaled US\$ 462 million (in 2001 US\$). The average subsidy spent by the government per family on gas vouchers in 2002 and 2003 was therefore equal to US\$ 52.10/yr and US\$ 58.48/yr (2001 US\$), respectively. The current gas voucher represents an annual subsidy of US\$ 16 per capita for the low-income families benefiting from the

program, since the average family size in this low-income range is 3-4 people [IBGE, 2004]. Thus, the current subsidy per capita is higher than the historical average subsidy as estimated in the previous section.

### 3.3. The 1973-2003 period: total subsidy

The total value of subsidy from 1973 to 2003 is therefore equal to the sum of subsidies before and after 2001, i.e., US\$ 3.740 billion.

## 4. Conclusion

The estimated average annual per-capita LPG subsidy was US\$ 0.73 for all users during the 1973-2001 period and it is currently US\$ 16 for the qualified low-income families only. These levels of subsidies are relatively small compared to the benefits of providing greater access to a better cooking fuel. Although there has been an increase in the annual per-capita subsidy the net government expenditures on subsidies decreased by almost a half from 2001 to 2002, since subsidies are now only directed to the lowest-income households. Subsidies may have played an important role in Brazil to create a market for household LPG use, but once the market is established, LPG subsidies now only make sense if directed to the lowest-income part of the population which is normally most affected by price rises.

### Notes

1. The author is concurrently Executive Director of the International Energy Initiative.
2. Brazilian real, the local currency, equivalent to US\$ 0.319 (June 2004).
3. Currently the minimum wage is equivalent to R\$ 240 (or US\$ 76.50) per month.
4. This statement refers to the period before 2001. From 2002 onwards there is information on the amount spent by the social programme Vale-gás (gas voucher) at the website of the Ministry of Finance.
5. Subsidies here are presented as percentage of the ex-factory prices which includes production costs and taxes.
6. The IGP-DI deflator, derived from the National Energy Balance 2003 of the Ministry of Mines and Energy (MME), was used to correct for inflation during the period of 1973-2001 [MME, 2003].

**Table 1. Price structures for a 13-kg bottle of LPG before and after liberalization in December 2001 and January 2002 (in R\$)**

| Price components                              | December 2001 | January 2002 |                     |
|---|---------------|--------------|---------------------|
|   |               | Average      | Low-income class    |
| Production costs                              | 9.00          | 6.67         | 6.67                |
| Levies (federal and state taxes)              | 3.76          | 3.36         | 3.36                |
| Distribution and profit margins               | 13.02         | 13.71        | 13.71               |
| Subsidy                                       | -3.47 (PPE)   | 0            | -7.50 (gas voucher) |
| Final retail price                            | 22.30         | 23.74        | 16.24               |
| Subsidy (as % of production costs and levies) | 27 %          | 0            | 75%                 |

Source: ANP/Petrobras, 2002.

7. Inflation rates have been very high in Brazil especially in the 1980s and 1990s. The average annual inflation between 1984 and 1994 was more than 1000 %.

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## Pilot-scale commercial DME production and utilization as a household fuel in China

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It has been widely known that dimethyl ether (DME) can be a potential substitute for LPG because it has similar physical properties to LPG. In early 1995, the Institute of Coal Chemistry of the Chinese Academy of Sciences built the first commercial plant for DME fuel production in Xi'an, Shaanxi Province. This plant had a capacity of 500 tonnes/year (t/y) of DME and used methanol as the feedstock. This plant had one fixed-bed reactor

using a modified solid-acid catalyst for methanol dehydration and two distillation columns for product purification. The downstream equipment used for product DME storage, transportation, and distribution were designed according to national standards for LPG.

The plant was successfully operated for two years, but was then shut down because the methanol price was too high. We had made some modifications and improvements to the plant based on problems found during the test run. After that, no additional experiments were performed. The plant was designed to produce DME of three different grades according to purity to meet different areas of market demand. During the two-year operation, all of the DME was directly used as household fuel in different ways. Therefore, the purity of the product DME was 99.5%. Low-purity DME, 98% or 93% produced at higher methanol feeding rate, could be used to blend with methanol to improve its vaporization or blend with LPG as an oxygenate to improve its combustion properties. This kind of blended fuel was not produced and tested.

We have obtained not only experience with the plant