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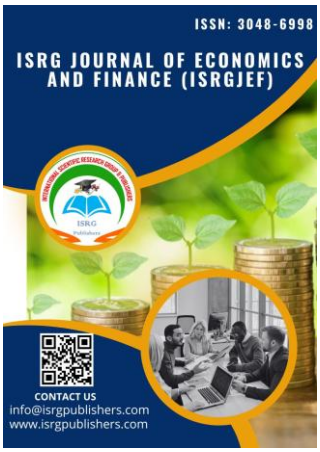

THE DETERMINING FACTORS OF FUEL SUBSIDIES IN BOLIVIA

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Abstract

The fuel subsidy has formed the central pillar of Bolivian economic policy, it is a constant instrument of its fiscal policy, created to guarantee access to supply to the vehicle fleet and its productive apparatus, stabilize domestic prices and mitigate inequalities in a context of high poverty and labor informality. Thus, with its State policy of importing fuels and the respective subsidy of diesel oil and gasoline, it preserved and controlled inflation for more than 30 years with its respective macroeconomic variables. In this understanding, the objective of this research is to identify, analyze and determine which are the determining variables of the total import of fuels and their respective subsidy, the latter variable, the fuel subsidy dependent on the variables of study such as GDP, inflation, public debt, fiscal balance, public spending, trade balance, the exchange rate and net international reserves that will be studied, based on a time series sample from 2006 to 2025. To analyse these data, we will first make the polynomial projections of each of the variables in relation to the fuel subsidy. Subsequently, we developed a multiple regression of the independent variables in correlation to fuel subsidies, the results obtained showed that inflation is the most correlated followed by public debt and international reserves with a multiple correlation coefficient of 93%.

Keywords: subsidy, fuels, inflation, public debt, international reserves

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Introduction

The fuel subsidy policy is one of the most profound problems in the global and Latin American political economy (Schaffitzel *et. al*., 2020, Carpio and Reategui, 2025 and Cazares, 2025). For more than three decades, fuel subsidies have been the central pillar of Bolivian economic policy and a constant instrument of its fiscal policy, created to guarantee universal access to affordable energy, stabilize domestic prices, and mitigate inequalities in a context of high poverty and labor informality (ECLAC, 2020 and 2023). According to the International Monetary Fund (2023 and 2025), fuel subsidy spending was estimated at 2,000 billion dollars per year, around 4% of GDP, and is conditioning many macroeconomic variables, mainly inflation and the exchange rate, as well as GDP, RIN, domestic and external debt, and fiscal and trade balances (Vargas *et. al.* (2024b).

Due to the increase in international oil prices and informality in the liquid fuels market and its implications for energy security, converging in rising prices in countries and even more so in developing economies with inflationary periods that mismatch foreign exchange reserves and their macroeconomic variables, to acquire more fuel at a higher price and with a more devalued exchange rate and a more depreciated currency and the depend to a large extent on the import of fuels and their respective subsidy Vargas *et. al.* (2022a); (2023a and b) and (2025b) and, you are aware that fuels are the blood that circulates in the veins of economic activity and are the organism of the productive apparatus.

In addition to the above, Bolivia in terms of hydrocarbons, especially fuels such as gasoline and diesel, encounters problems in self-sufficiency in its domestic market, either with production, with the subsidy of fuel imports or with the free market supply with the international price of oil Carpio and Reategui (2025), Cazares (2025) and Vargas *et. al.* (2025b), you are aware that this last external variable leads to an eminent inflationary spiral by referring to studies such as the authors Medinaceli and Velázquez (2024). However, according to the authors Vargas *et. al.* (2024b) deduce that the current economic crisis in Bolivia caused by the illiquidity of dollars and macroeconomic instability due to the vicious circularity of the economic, social, community, and productive model proposed by Arce (2020). In this understanding, it put at risk the elimination of the fuel subsidy, in this scenario the authors Aliaga and Terrazas (2025) analyze the macroeconomic impact of the elimination of the hydrocarbon subsidy with abrupt and gradual reforms.

Thus, the objective of this research is to identify, analyze and determine which are the conclusive variables of the total import of fuels and their respective subsidy, this last variable, the fuel subsidy dependent on the study variables such as GDP, inflation, public debt, fiscal balance, public spending, trade balance, exchange rate and net international reserves will be studied, From a time series sample from 2006 to 2025, we will develop a literature review and a regression analysis by individual variables and a linear regression to identify which variable correlates with the fuel subsidy.

Literature review

According to studies in experiences from other countries, we can mention Gelan (2018) and Ofori (2023) where they deduce that orthodox economic literature has historically conceptualized fuel subsidies as market distortions and an imbalance of their macroeconomic variables and that they generate allocative inefficiencies, on the consumption of non-renewable resources and unsustainable tax burdens.

More recent and applied research shows us the opposite, that eliminating fuel subsidies in developing countries caused more macroeconomic imbalances. We can indicate the research of Ezeoha & Uche (2017) that the elimination of the fuel subsidy in Nigeria emphasizes redistributive and social cohesion functions, in contexts of high structural inequality, mainly an increase in the fiscal deficit and public spending and other macroeconomic variables, in addition the implementation of the policy has caused immediate difficulties due to the sharp increase in fuel prices, transport and food and a macroeconomic imbalance, disproportionately affecting low-income households and critics argue that this is due to insufficient planning, overpricing and a lack of transparency in the management of the funds saved to pay fuel obligations, which is further deteriorating the confidence and credibility of those in power.

Similarly, the research of the author Ayoola, (2024) mentions that the elimination of the fuel subsidy in Nigeria has triggered inflationary pressure due to cost dynamics, increasing transport and production expenses and, consequently, raising consumer prices, especially food. The structural impact includes a strong positive correlation between fuel and food prices, a depreciation of the currency and a devaluation of the exchange rate and a structural mismatch of all macroeconomic variables, in addition to a decrease in real incomes, which leads to higher levels of poverty. In view of the above, we can conclude Ezeoha & Uche (2017) and Ayoola (2024), both of whom agree that the elimination of the fuel subsidy was intended to free up public funds for development, has caused widespread difficulties in GDP, indebtedness, labor informality, greater poverty and emphasize that although there are some studies that argue that at the beginning of this measure, there is a slowdown in inflation after an initial period, but it generates an inflationary spiral and a macroeconomic imbalance.

Similarly, authors Okorie *et. al*., (2024) conclude in their research that eliminating the fuel subsidy poses risks of increased poverty, inflation, exchange rate devaluation, and social unrest and macroeconomic instability, and recommend that successful reforms of the elimination of the fuel subsidy require complementary measures, such as direct cash transfers, to support vulnerable populations and manage the negative impacts of a deep recession.

For the author Ginn (2024), in the case of Malaysia, the fuel subsidy generates price stability, but unbalances macroeconomic variables, including the tax burden, although removing the subsidy generates aggregate welfare and increases with fiscal stabilization, he recommends that the highest level of welfare is achieved with targeted subsidies, a contradiction that calls into question the relevance of Malaysia's current energy policy.

Likewise, we can also mention the research of author Plante (2014) who deduces that the macroeconomic factors influenced by the elimination of fuel subsidies include the tax burden derived from the financing of the subsidy, the distortion in the allocation of resources that leads to lower economic growth of GDP and the increase in inflation and the potential for budget deficits and higher indebtedness. It further recommends that subsidies can lead to inefficient production and consumption patterns, a negative impact on the balance of trade and investment, and an obstacle to the transition to renewable energy.

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It is necessary to refer to computable general equilibrium models, such as those developed by Gelan (2018) and Li & Solaymani (2021), have been widely used to simulate the macroeconomic effects of these gradual policy reforms or fuel subsidy shocks, with respect to all their macroeconomic variables such as GDP, consumption, investment, public spending, indebtedness, and exports, incorporating sectoral productive efficiency analysis following methodologies by Kumbhakar et al. (2020).

In addition to the above, Bolivia in terms of hydrocarbons, especially fuels such as gasoline and diesel, encounters problems with self-sufficiency in its domestic market, either with production, with the subsidy of fuel imports or with the free market supply with the international price of oil Vargas et. al. (2025b), aware that this last external variable entails an eminent inflationary spiral by resorting to studies such as the authors Medinaceli and Velázquez (2024). However, according to the authors Vargas *et. al.* (2024b) the current economic crisis in Bolivia caused by the illiquidity of dollars and macroeconomic instability due to the vicious circularity of the economic, social, community and productive model, put at risk the elimination of the fuel subsidy with the incorporation of an intermediary company that quadrupled the cost of importing fuels and its respective subsidy of diesel and gasoline fuels in foreign currency, in this scenario, the authors Aliaga and Terrazas (2025) analyze the macroeconomic impact of the elimination of the hydrocarbon subsidy with abrupt and gradual reforms.

According to the authors Vargas *et. al.* (2025b) the historical statistical data of the Bolivian State policy, is successful because the fuel subsidy stabilized prices or inflation for more than 30 years with the help of their respective macroeconomic variables. It should be noted that in 2022 the authors Vargas, *et. al.* (2022a and b) point out that the economic, social, community and productive model was to depend excessively on economic surplus sectors, mainly the export of natural gas without added value and productive for export, a non-renewable resource, and to take the surpluses to savings and public investment mainly to the new strategic public enterprises that became a significant public expenditure in foreign currency and with little foreign exchange generation.

Similarly, the research of Vargas *et. al*. (2003a), (2024b) and (2025a) where they agree that it was not possible to specialize in exploration or renewable energies, nor were they able to maintain and sustain the import and subsidization of gasoline and diesel oil with the generation of sources of foreign exchange income or dollars with "renewable resources" with a productive apparatus and formal employment, rather with extractivist public policies or "non-renewable resources" such as the export sale of raw materials such as natural gas and others (Vargas *et. al.* 2002a), generating a derisory future of labor informality, indebtedness and disposal of its savings reserves such as gold and added corruption by placing Bolivia at the highest levels in the rankings.

Study variables and regression models

To analyze these data, we will first make the polynomial projections of the entire sample and individually for each of the study variables, the polynomial variables are mainly used in regression analysis to model nonlinear relationships between variables by creating a trend line or calculating a polynomial equation from a set of data. To identify cyclical patterns or complex curves with increasing and decreasing trends and to be able to compare which of the economic models is more accurate, the following equations by study variables were used, polynomial regression by degrees according to study variables:

Equation of the dependent variable of degree 6:

$$FSt = x\beta^6 + x\beta^5 + \beta^{x\,4} + x\beta^3 + x\beta^3 + x\beta^2 + x + u\beta_t$$

Equations of the independent variables of degree 3:

(1) $GDP_t = x\beta^3 + x\beta^2 + x + u\beta_t$

(2) $IN_t = x\beta^3 + x\beta^2 + x + u\beta_t$

(3) $PD_t = x\beta^3 + x\beta^2 + x + u\beta_t$

(4) $FB_t = x\beta^3 + x\beta^2 + x + u\ t\beta$

(5) $PS_t = x\beta^3 + x\beta^2 + x + u\beta_t$

(6) $BT_t = x\beta^3 + x\beta^2 + x + u\beta_t$

(7) $ER_t = x\beta^3 + x\beta^2 + x + u\beta_t$

(8) $NI_t = x\beta^3 + x\beta^2 + x + u\beta_t$

Where:

FS: Fuel Subsidy

βn: Regression coefficients

Xn: Degrees of Regression

GDP: Gross Domestic Product (GDP)

IN: Inflation (IN)

PD: Public Debt (PD)

FB: Fiscal Balance (FB)

PS: Public Expenditure (PS)

BT: Trade Balance (BT)

ER: Exchange Rate (ER)

NIR: Net INTERNATIONAL RESERVE (NIR)

u: Error term

t: Time

In addition, to estimate that the multivariate linear regression model, following the proposed methodology and the variables mentioned in the previous sections. In this way, we will apply this equation to the joint analysis of macroeconomic variables following the methodology (Vargas *et. al.* 2024a), the following equation, regression for economic models, was used

$$FSt = + \propto \beta_{1GDP} + \beta_{2IN} + \beta_{3PD} + \beta_{4FB} + \beta_{5PS+6}\beta BT + \beta_{7ER+8}\beta IR + u_t$$

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Where:

FS: Fuel Subsidy

α: Constant

βn: Regression coefficients

GDP: Gross Domestic Product (GDP)

IN: Inflation (IN)

PD: Public Debt (PD)

FB: Fiscal Balance (FB)

PS: Public Expenditure (PS)

BT: Trade Balance (BT)

ER: Exchange Rate (ER)

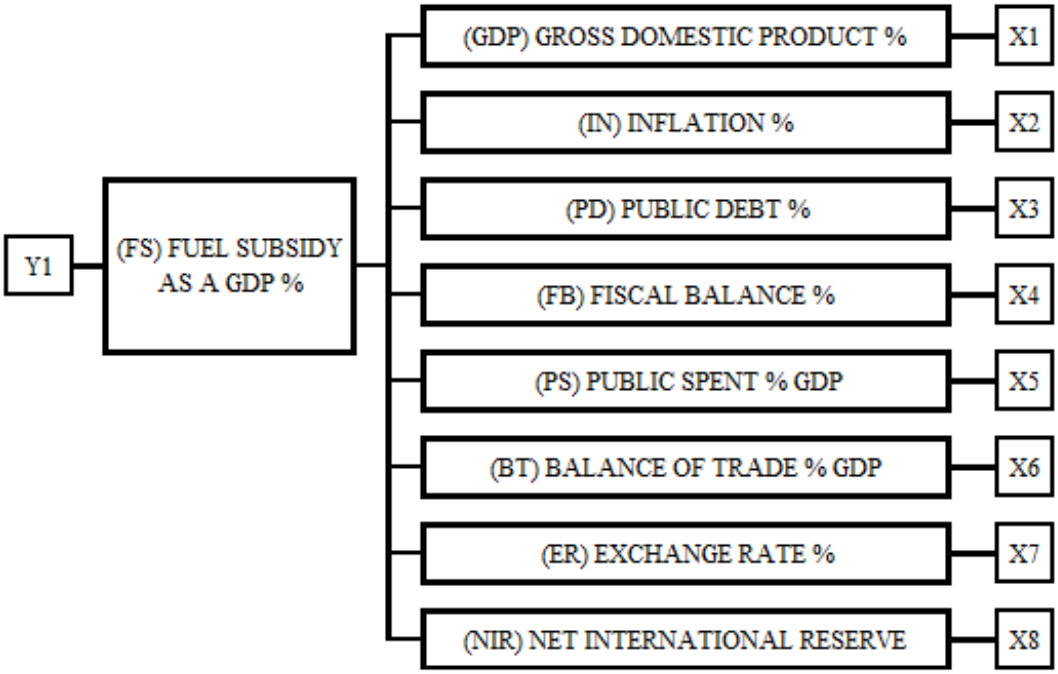
NIR: Net INTERNATIONAL RESERVE (NIR)

u: Error term

t: Time

To all of the above mentioned in the reference framework, we identify and focus on eight explanatory variables of the aforementioned research, with a survey of the information of the General Budget of the State of Bolivia, the study variables are: GDP, inflation, public debt, fiscal balance, public spending, trade balance, exchange rate and net international reserves, all of which explain the fuel subsidy, see Table 1.

Table 1. Explanatory economic variables



Source: Authors' elaboration based on Vargas *et. al. (2025)*

For better understanding and analysis, we will develop the study for the entire period of the twenty-year sample from 2006 to 2025 of each economic variable of study and separately. It should be noted that in order to have a sample comparability of twenty years, we considered all the data recorded and accounted for, except for the year 2025, when we had to consider the estimated data from the government of the day and from international sources, as it is a year in execution, this year being the bicentennial of Bolivia since its foundation.

Table 2 shows the study variables, description, unit of measurement and data source for the respective regressions mentioned above.

Table 2. Summary of data of the study variables

Variable	Description	Unit	Data Source
FUEL SUBSIDY	Measure for the import of fuels with and without subsidies with respect to the Gross Domestic Product (GDP) of Bolivia	Percent	Indicators of the General Budget of the State of Bolivia, published by the National Institute of Statistics (2025) and the Ministry of Economy and Finance (2025) and Bolivian Fiscal Oil Fields (2025)
ECONOMIC GROWTH	Measured by the Gross Domestic Product (GDP) of Bolivia	Percent	Indicators of the General Budget of the State of Bolivia, published by the National Institute of Statistics (2025) and the Ministry of Economy and Finance (2025)

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INFLATION	Measured by Consumer Price Index prices	Percent	Indicators of the General Budget of the State of Bolivia, published by the National Institute of Statistics (2025)
TOTAL PUBLIC DEBT	Measured by external and internal credits to GDP	Percent	Indicators of the General Budget of the State of Bolivia, published by the Ministry of Economy and Finance (2025) and the Central Bank of Bolivia (2025)
BALANCE FISCAL	Measured by the income and expenditure of the State generating a surplus or deficit with respect to GDP	Percent	Indicators of the General Budget of the State of Bolivia, published by the Ministry of Economy and Finance (2025)
TOTAL PUBLIC EXPENDITURE	Measured by expenditure with respect to GDP	Percent	Indicators of the General Budget of the State of Bolivia, published by the Ministry of Economy and Finance (2025)
BALANCE OF TRADE	Measured by the results of exports and imports generating a surplus or deficit with respect to GDP	Percent	Indicators of the General Budget of the State of Bolivia, published by the National Institute of Statistics (2025), the Ministry of Economy and Finance (2025) and the Chamber of Exporters of Bolivia (2025)
EXCHANGE RATE	Measured by the rate or exchange rate between two currencies, the ratio of proportion that exists between the value of one currency and the other	By hundred	Indicators of the General Budget of the State of Bolivia, published by the National Institute of Statistics (2025), the Ministry of Economy and Finance (2025) and Bolivia dollar today (2025)
RESERVES INTERNATIONAL NETS	Measured by the gold reserves, foreign exchange and special drawing rights with respect to GDP	Percent	Data published by the Central Bank of Bolivia (2025)

Source: Own elaboration

Analysis for each study variable

In addition to all that has been studied in the previous sections described, we will collect, interpret, compare and analyse the economic variables under study, first from the polynomial regression and later from the multiple regression.

Total fuel imports and subsidies

The total import of diesel and gasoline fuels and their respective fuel subsidy with respect to GDP. With respect to total fuel imports, it has had a considerable growth since 2006 from 0.8% to 2024 with 6.4% and by 2025 it was estimated at the budget level to reach almost 7%. It should be noted that in the period 2006 to 2019 in fourteen years the average was 2.2%, the year 2020 was not considered due to COVID and between the period 2021 to 2025 in five years the average was 6.2%, this is mainly due to the creation of a Bolivian company Botrading based in the country of Paraguay, an intermediary company for the purchase of fuels which quadrupled the purchase of said import from from 2021 to 2025, see Graph 1.

Graph 1. Subsidization and total importation of fuels

Period: 2006 to 2025 (In percentages)

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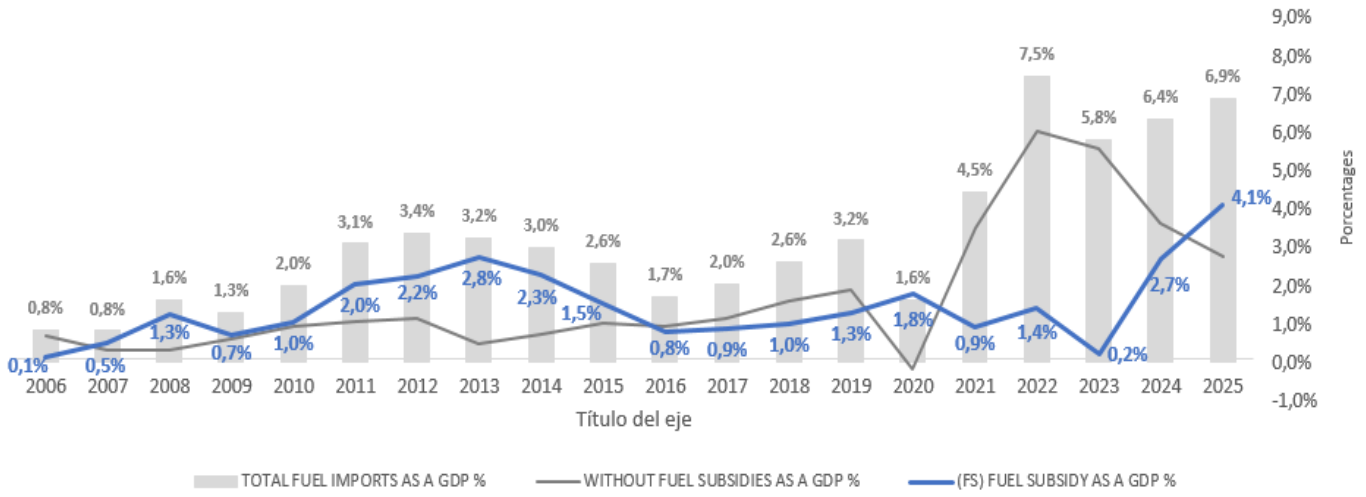


Source: From the INE (2023 and 2025) and the Ministry of Economy and Finance (2025)

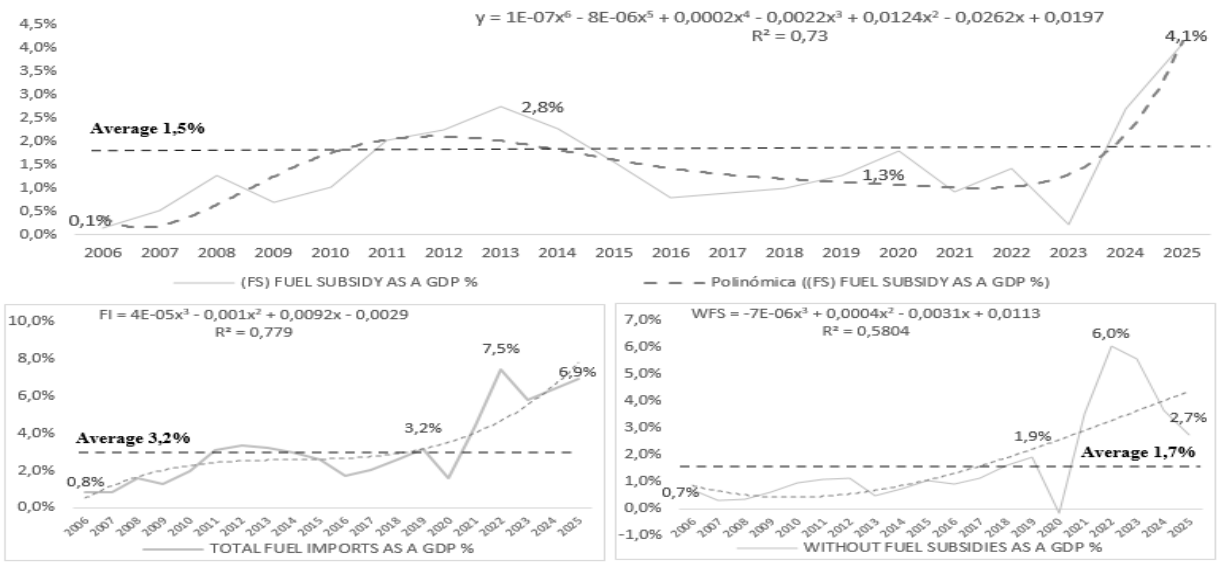
With respect to the analysis individually, the variable fuel subsidy with respect to GDP, in twenty years between 2006 and 2025 there is a growth of 0.1% from 2006 to 2025 of 4.1%, while the variable without fuel subsidy with respect to GDP had a growth of 0.7% from 2006 to 2025 of 2.7%.

Making the same analysis, in the period 2006 to 2019 in fourteen years the average was 1.3% the fuel subsidy, while without fuel subsidy it was less than 0.9%, this is mainly due to the reserves of the national production of gasoline and diesel. In the period 2021 to 2025 in five years the average was 1.9% the fuel subsidy, while without fuel subsidy it was less than 4.3%, this is due to the low fuel reserves and the increase in the vehicle fleet, but mainly to the intermediary company Botrading based in Paraguay, see equation and Graph 1.

The sixth-degree polynomial projection of the fuel subsidy variable shows us a moderate cyclical trend except for the last five years that has an increasing trend, the average was 1.5% in twenty years between 2006 and 2025 and had a significant R^2 coefficient of determination 0.73, see the equation in Graph 2.

Graph 2. Polynomial regression by degrees: fuel imports and subsidies

Period: 2006 to 2025 (In percentages)



Source: From the INE (2023 and 2025) and the Ministry of Economy and Finance (2025)

With respect to the third-degree polynomial projection for the total fuel import variable, it was with an increasing trend and with an average growth of 3.2% in the last twenty years and with a significant square coefficient of determination R^2 of 0.77, while the variable without fuel subsidy with an upward trend and the average in the same period was greater than 1.7% and, with a moderate square coefficient of determination R^2 of 0.58, see the equation in Graph 2.

The fuel subsidy and the Gross Domestic Product

The Gross Domestic Product (GDP) has grown considerably since 2006 from 4.8% to 1.4% in 2025 estimated by the World Bank (2025), having an average of 3.7% in the twenty years of economic GDP growth between 2006 and 2025. If we compare separately the GDP variable and the fuel subsidy, with their respective third-degree polynomial projections, it shows us a moderate cyclical trend over the twenty years where the GDP had a significant R^2 coefficient of determination 0.21 and the fuel subsidy was higher with a significant R^2 0.60, although there is a direct relationship

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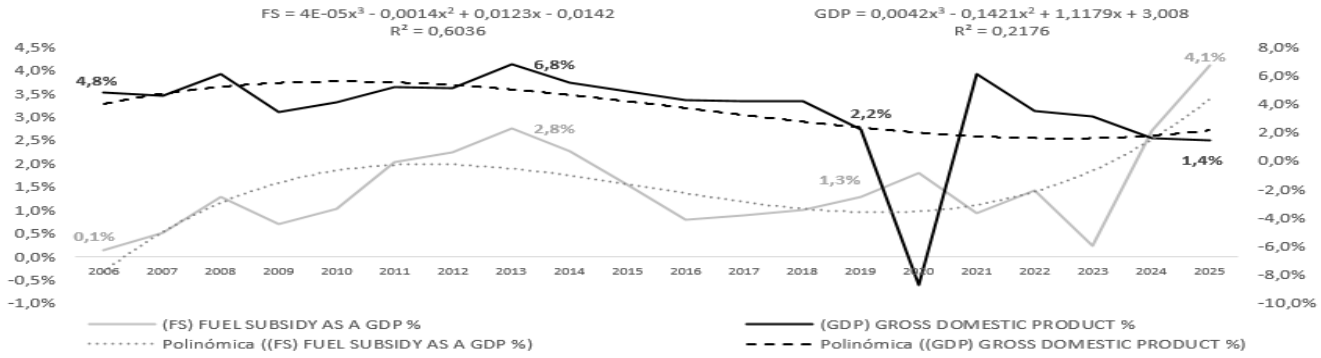
in the years 2006 to 2018, the situation changes and returns vice versa from 2021 to 2025 the more the fuel subsidy goes up, the GDP goes down, see the equations in Graph 3.

Graph 3. Polynomial Regression: Fuel Subsidy and GDP

Period: 2006 to 2025 (In percentages)



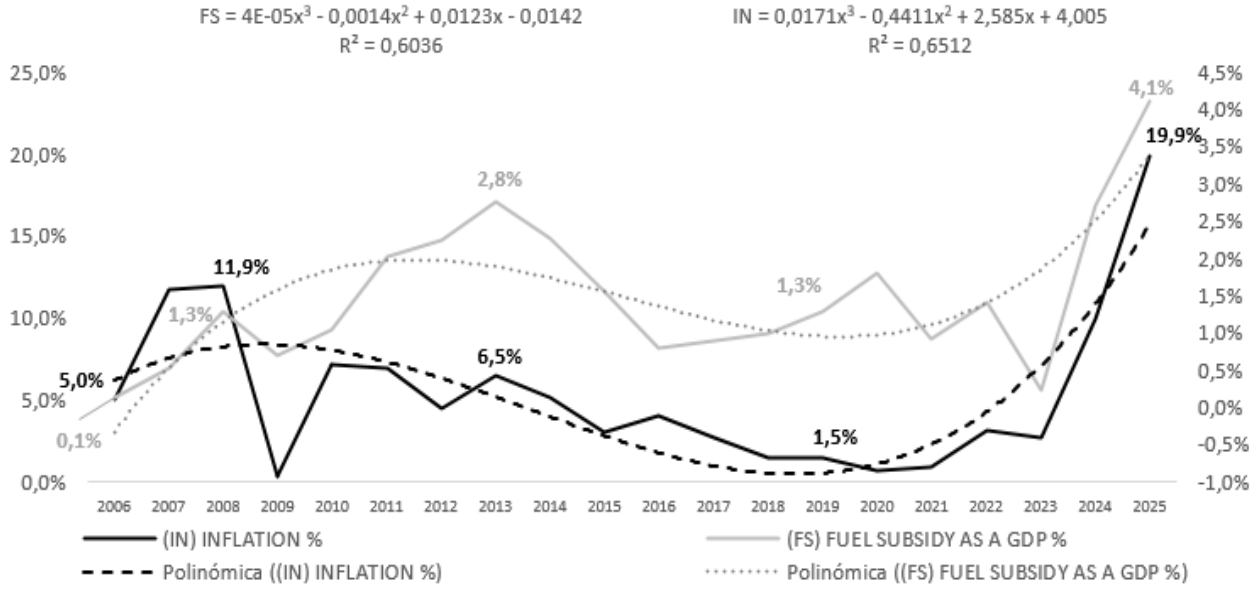
Source: From the INE (2025) and the Ministry of Economy and Finance (2025)

The fuel subsidy and inflation

Inflation, in 2006 reached 5%, had its highest peaks in 2008 with 11.9%, and from that year it fell to 6.5% in 2013 and 2019 it reached only 1.5% from that year it began to grow until it reached 9.97% in 2024 and by mid-October 2025 it reached 19.22% due to the shortage of dollars due to the decrease in sales of natural gas exports, in 2025 the government estimated reaching 7.5% according to the National Institute of Statistics (2025), having an average inflation of 4.8% in the twenty years of inflation between 2006 and 2025, as can be seen in Graph 4.

Graph 4. Polynomial Regression: Fuel Subsidy and Inflation

Period: 2006 to 2025 (In percentages)



Source: From the National Institute of Statistics (2025)

If we compare separately the inflation variable and the fuel subsidy, with their respective third-degree polynomial projections, it shows us a similar moderate cyclical trend even in the peaks over the twenty years where inflation had a higher and significant coefficient of determination R^2 of 0.65 and the fuel subsidy was lower with a significant R^2 0.60, both in the range of 0.60, see the equations in Graph 4.

Fuel subsidies and public debt

As can be seen in Graph 5, Bolivia's public debt tends to increase year after year, since 2006 it was 54.5% and by 2025 it increased to 95% according to official data from the International Monetary Fund report (2025).

Graph 5. Polynomial Regression: Fuel Subsidy and Public Debt

Period: 2006 to 2025 (In percentages)

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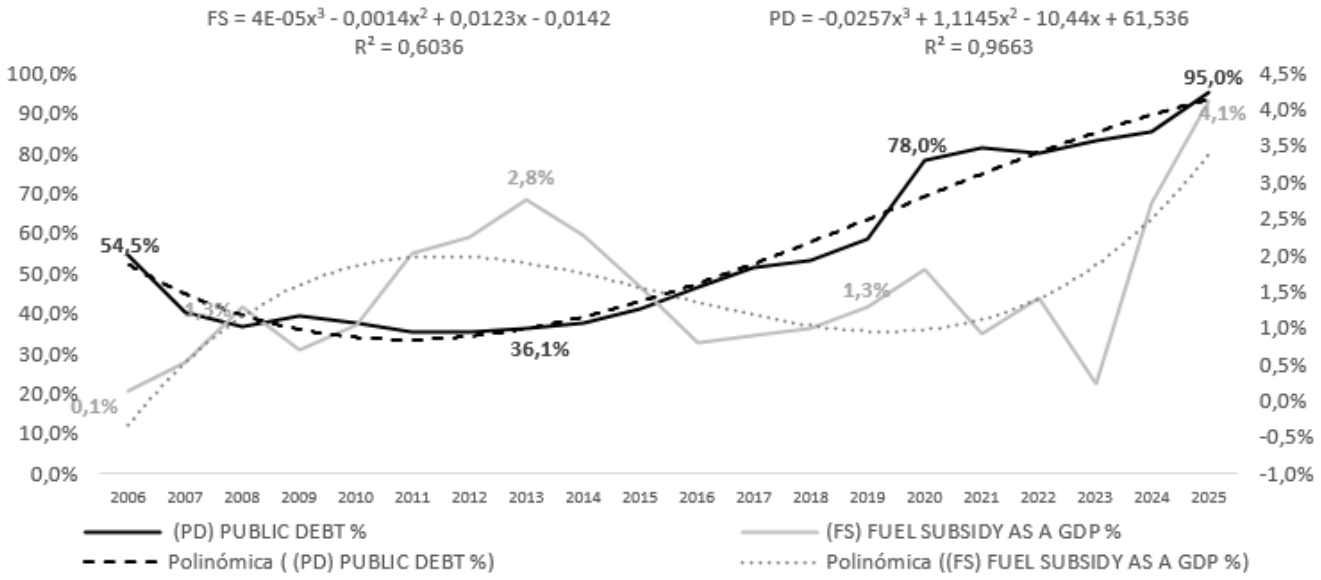


Source: Central Bank of Bolivia (2025) and the Ministry of Economy and Finance (2025)

If we compare separately the variable public debt and the fuel subsidy, with their respective third-degree polynomial projections, it shows us an increasing trend in public debt in the twenty years where this debt had a very significant coefficient of determination R^2 of 0.95 and the fuel subsidy was lower with a significant R^2 0.60, this is because in order to import fuels and the subsidy, it was necessary to resort to the public debt, see the equations in Graph 5.

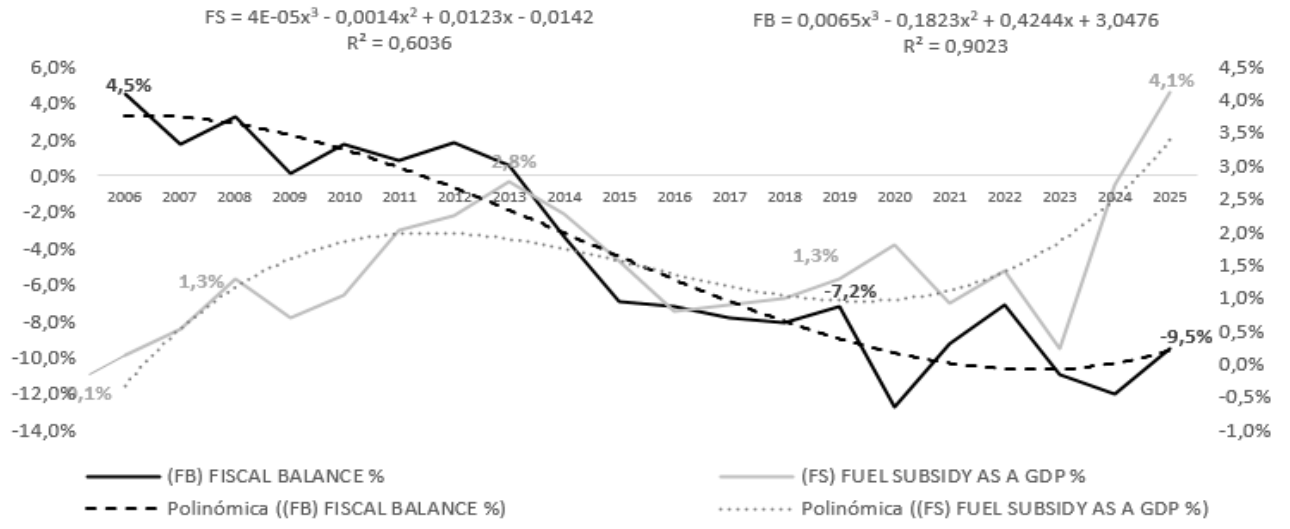
The fuel subsidy and the fiscal balance

As can be seen in Graph 3, the fiscal balance shows deficits and surpluses between 2006 and 2025, from 2006 there is a surplus of the fiscal balance with the highest peak of 4.5% and the fiscal deficit returns from 2014 to 2024 with (-12%) and by 2025 the government estimates to reach (-9.5%,) having an average fiscal deficit of (-4.4%) over the twenty years, see equation and Graph 6.

If we compare separately the fiscal balance and the fuel subsidy, with their respective third-degree polynomial projections, it shows a decreasing trend in the fiscal balance in the twenty years where this fiscal balance had a very significant coefficient of determination R^2 of 0.90 and the fuel subsidy was lower with a significant R^2 0.60, this is because to cover the import of fuels and the subsidy, the fiscal deficit had to be resorted to, see the equations in Graph 6.

Graph 6. Polynomial Regression: Fuel Subsidy and the Fiscal Balance

Period: 2006 to 2025 (In percentages)



Source: From the Ministry of Economy and Finance (2025)

Fuel subsidies and public spending

As can be seen in Graph 7, according to sources from the Ministry of Economy and Finance (2025), the consolidated budget has grown considerably since 2006, from 3,377 to 45,565 billion dollars by 2023, 92.5%. As can be seen in Graph 7, based on sources from the Central Bank of Bolivia (2025), the National Institute of Statistics (2025) and the Ministry of Economy and Finance (2025), public spending with respect to GDP has grown considerably since 2006 from 29.8% to 2015 to 44.6% and by 2024 36.8% and by 2025 the government estimates to reach 41.3%. having an average of 32.2% in the twenty years from 2006 to 2025.

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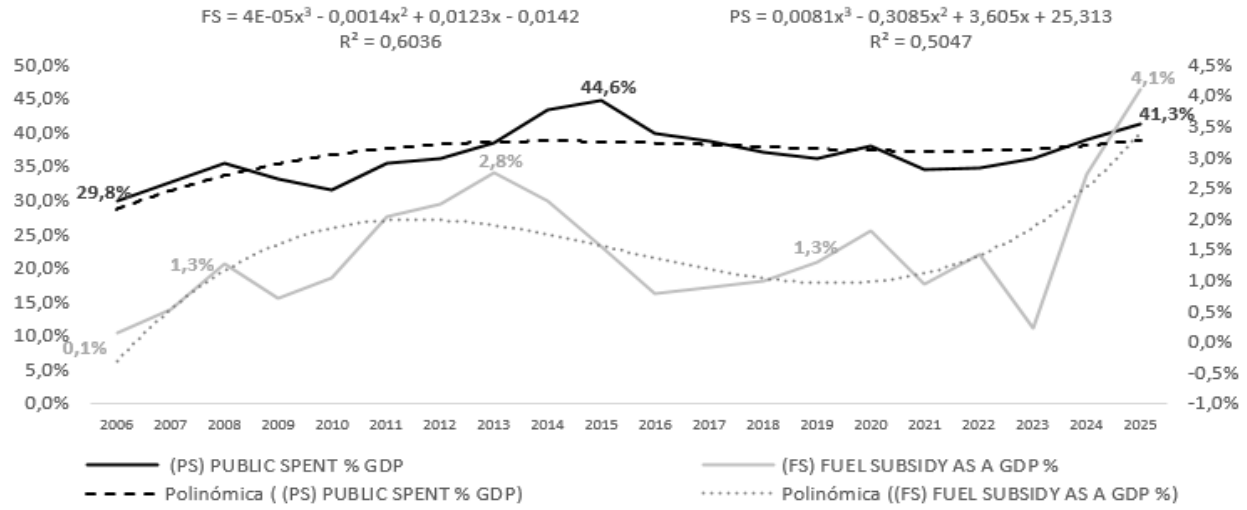
Graph 7. Polynomial Regression: Fuel Subsidization and Public Spending

Period: 2006 to 2025 (In percentages)



Source: Ministry of Economy and Finance (2025)

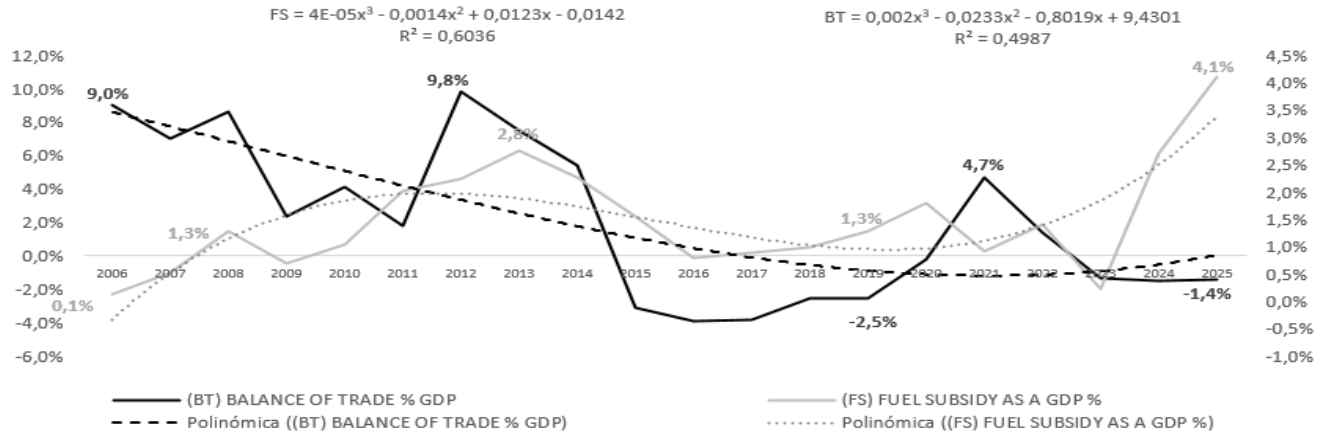
If we compare separately the variable public expenditure and the fuel subsidy, with their respective third-degree polynomial projections, it shows us a moderate upward trend in public expenditure in the twenty years where this expenditure had a moderate R^2 coefficient of determination of 0.50 and the fuel subsidy was higher with a significant R^2 0.60, we can see that public spending in national currency was not used as much in the last five years for the import of fuels and the respective subsidy since these two depend on the foreign currency dollars, see the equations in Graph 7.

The fuel subsidy and the trade balance

The trade balance is the difference between the exports and imports of a country, Bolivia has maintained a positive trade balance of surplus since 2006 with 9% reaching its highest peak in 2012 of 3,401 million dollars and with a surplus until 2015, but since then it has entered a trade deficit by 2023 of -697 million dollars, This is due to the increase in imports and the fall in natural gas exports, due to the lack of public policies to promote the export production apparatus and political instability and this trend has been accentuated in recent years, reaching the year 2025 to be negative and deficit the trade balance of (-1.4). see Graph 8.

Graph 8. Polynomial Regression: Fuel Subsidy and the Trade Balance

Period: 2006 to 2025 (In percentages)



Source: From the National Institute of Statistics (2025), Ministry of Economy and Finance (2025) and Chamber of Exporters of Bolivia (2025)

If we compare separately the trade balance and the fuel subsidy, with their respective third-degree polynomial projections, it shows a decreasing trend in the trade balance in the twenty years where the trade balance had a moderate R^2 coefficient of determination of 0.49 and the fuel subsidy was higher with a significant R^2 0.60, we can deduce that the export productive apparatus was not able to cover the import of fuels and the respective subsidy since these two depend on the foreign currency dollars, see the equations in Graph 8.

The fuel subsidy and the exchange rate

With the implementation of the neo-statist period and the economic, social, community and productive model (Arce, 2020 and Arévalo, 2016), Bolivia has maintained a fixed exchange rate from 2011 to 2023 and from that year the exchange rate was devalued and began to rise from 8 bolivianos per dollar to almost 18 bolivianos per dollar by 2025. in the face of the shortage of

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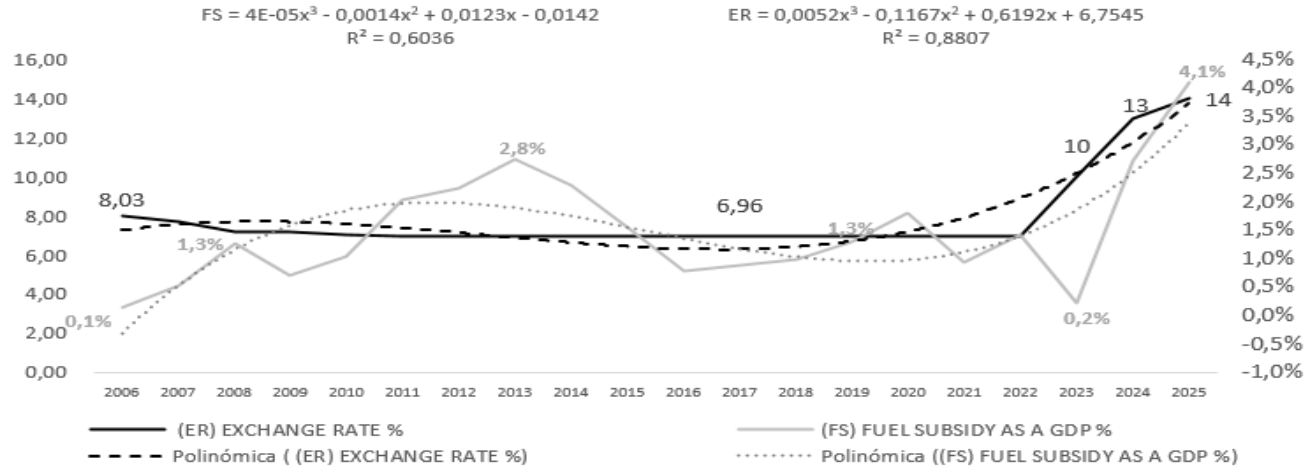
foreign currency to cover the costs of importing and subsidizing fuels and the fall in natural gas exports (Vargas *et. al.* 2002a), in view of the lack of public policies to promote the productive export apparatus and political instability, and this trend has been accentuated in recent years, see Graph 9.

Graph 9. Polynomial Regression: The Fuel Subsidy and the Exchange Rate

Period: 2006 to 2025 (In percentages)



Source: From the National Institute of Statistics (2025), Ministry of Economy and Finance (2025) and Chamber of Exporters of Bolivia (2025)

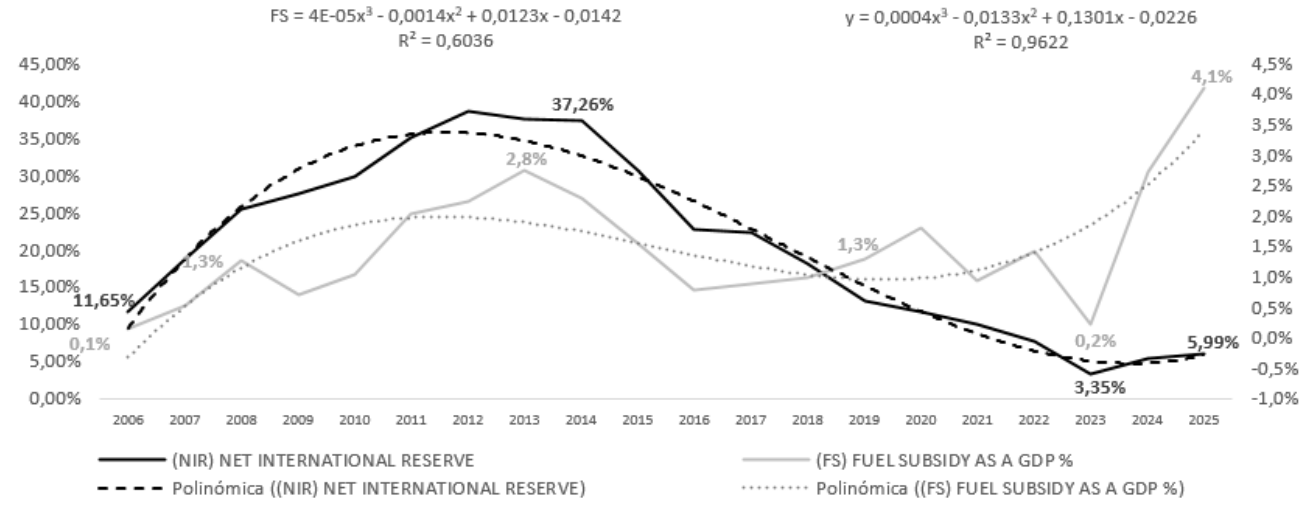
If we compare separately the variable exchange rate and the fuel subsidy, with their respective third-degree polynomial projections, it shows us a moderate and then increasing trend in the exchange rate over the twenty years, where this exchange rate had a significant R^2 coefficient of determination of 0.88 and the fuel subsidy was lower with a significant R^2 0.60, we can deduce that the import and subsidy of fuels have a direct relationship, the higher the exchange rate, the higher the cost of importing fuels and the respective subsidy, since these two variables depend on the relationship between the national currency and the foreign currency dollars, see the equations in Graph 9.

The fuel subsidy and the Net International Reserves

The Net International Reserves (NIR) with the implementation of the neo-statist period, Bolivia received with 11.65% of GDP and reached its highest peak in 2014 at 37.26%, from that year it had a decreasing trend, reaching only 3.35% in 2023, the lowest in the last thirty years, and by 2025 5.9%, see Graph 10.

Graph 10. Polynomial Regression: Fuel Subsidy and Net International Reserves

Period: 2006 to 2025 (In percentages)



Source: From the National Institute of Statistics (2025), Ministry of Economy and Finance (2025) and Chamber of Exporters of Bolivia (2025)

If we compare separately the RIN variable and the fuel subsidy, with their respective third-degree polynomial projections, it shows us an increasing and then decreasing trend of the RIN in the twenty years, where these reserves reached a very significant coefficient of determination R^2 of 0.96 and the fuel subsidy was lower with a significant R^2 0.60, we can deduce that the import and subsidy of fuels have a direct relationship, to supply the automotive market with the import of fuels and the respective subsidy, the RIN was used since these two variables depend on the foreign currency in dollars, see the equations in Graph 10.

In addition to all that has been described in previous paragraphs, developing the study and analysis individually of each of the independent variables with respect to the dependent variable that is the fuel subsidy, we were able to model the trends of each of the

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variables with their complex and non-linear data using a curve that adjusts to the fluctuating data through their respective third-degree polynomial projections. the results of the polynomial variables analyzed showed us the peaks and valleys and their adjusted R^2 shown in Table 3, the two most significant independent variables of the eight analyzed are IR and FB and the least significant is GDP.

Table 3. Results of the studied variables of polynomial regression

Dependent variable	*R^2*	*Independent variables*	*R^2*
(FS) FUEL SUBSIDY AS A GDP %	>0,60	(GD) GROSS DOMESTIC PRODUCT %	0,21
		(PS) PUBLIC SPENT % GDP	0,49
		(PS) PUBLIC DEBT %	0,50
		(IN) INFLATION %	0,65
		(ER) EXCHANGE RATE %	0,88
		(BT) BALANCE OF TRADE % GDP	0,90
		(FB) FISCAL BALANCE %	0,96
		(IR) NET INTERNATIONAL RESERVE	0,96

Analysis and discussion of the results of multiple regression

Once the individual analysis of each independent variable in relation to the fuel subsidy has been made, we apply the multiple regression estimates and their equation is as follows:

$$FSt = + \propto \beta_{1GDP+2}\beta IN + \beta_{3PD+4}\beta FB + \beta_{5PS+6}\beta BT + \beta_{7ER+8}\beta IR + u_t$$

In Table 4, it can be seen that the multiple correlation coefficient model is 93% and the linear correlation of Bolivia's fuel subsidy is significant with adjusted R^2 of 77% and the determination coefficient R^2 is 86% with five positive coefficients, these are IN, FB, PD, PS and IR and the most explanatory variable is IR with a coefficient of 0.1183 and with a higher correlation in probability are the IN, IR and PD, which means that the fuel subsidy has a very high correlation with Net International Reserves, inflation and public debt, this can be explained that to cover the import of fuels and the respective subsidy it was necessary to cover these obligations with savings of IR and later with the PD indebtedness, generating an inflationary spiral of rising prices IN the face of the illiquidity of foreign currency.

It should also be noted that there are three negative coefficients: GD, BT and ER, the most explanatory variable is ER with a negative coefficient of (-0.0031) and with a low correlation of probability are the other two variables, GDP and BT, as can be seen in Table 4. That is, the exchange rate has a very high correlation with the fuel subsidy, this is because to pay for the import of fuels and their respective subsidy it is necessary to resort to the exchange rate to convert the national currency into foreign currency, considering the inflation that was generated since 2023 and the fixed exchange rate of 6.96 bolivianos for each dollar and the devaluation of the exchange rate of exchange rate reached 18 bolivianos for every dollar for the 2025 administration, causing a depreciation of the national currency and a loss of purchasing value of more than 50%, unbalancing all macroeconomic variables and a national economic imbalance.

Table 4. Results of the variables studied in the multiple regression.

Regression statistics			*Coefficients*	*Probability*
Multiple correlation coefficient	0,9316	Interception	-0,0709	0,038
Coefficient of determination R^2	0,8678	(GD) GROSS DOMESTIC PRODUCT %	**-0,0005**	0,245
R^2 Adjusted	0,7717	(IN) INFLATION %	0,0009	0,001
Typical error	0,0047	(FB) FISCAL BALANCE %	0,0005	0,574
Remarks	20	(BT) BALANCE OF TRADE % GDP	**-0,0002**	0,659
		(PS) PUBLIC DEBT %	0,0007	0,004
		(PS) PUBLIC SPENT % GDP	0,0006	0,397
		(ER) EXCHANGE RATE %	**-0,0031**	0,974
		(IR) NET INTERNATIONAL RESERVE	0,1183	0,002

Source: Own elaboration

From all that has been studied, we can conclude that the determining factors of fuel subsidies according to the multiple regression in twenty years are the expected results, where the most explanatory and positive correlated variables are Net International Reserves (RI), inflation (NI) and indebtedness (PD) and the negative variables are the exchange rate (ER). the trade balance (LV) and the Gross Domestic Product (GDP) comparing their peak and valley trends with the analysis of polynomial variables, the study analysis is clearer, see Graph 11.

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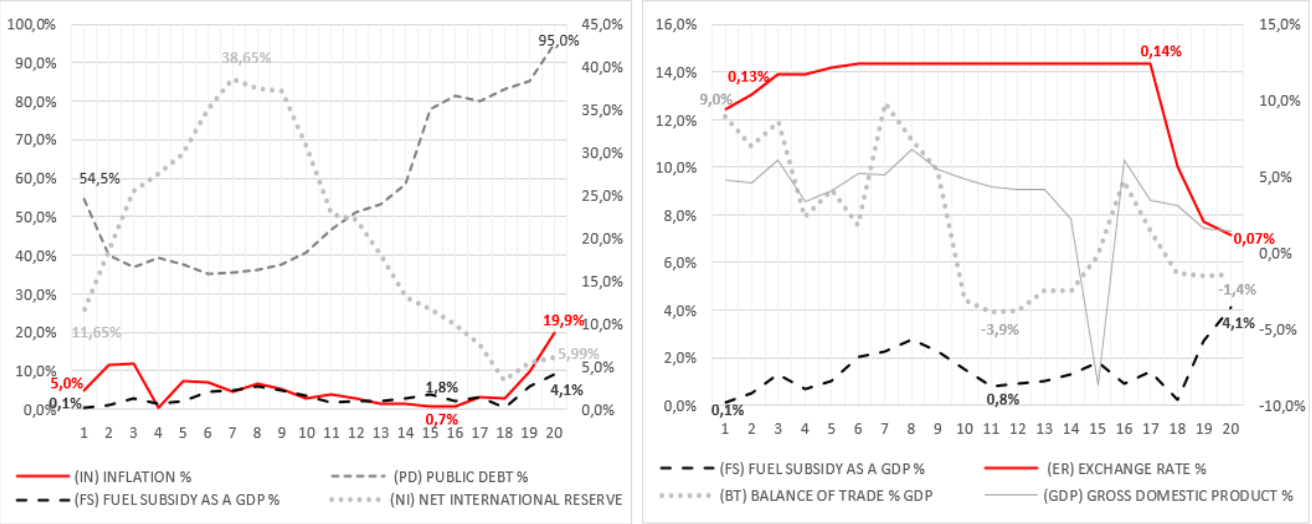
Graph 11. The fuel subsidy and the most correlated variables

Period: 2006 to 2025 (In percentages)



Source: From the National Institute of Statistics (2025), Central Bank of Bolivia (2025), Ministry of Economy and Finance (2025)

Conclusions

We can conclude that fuel subsidies have historically formed the central pillar of Bolivian economic policy, guaranteeing access to supply to the vehicle fleet and its productive apparatus, having internal price stability and controlled inflation for more than 30 years and, as mentioned by recent research, aware that corruption and fuel smuggling destabilized the authentic fuel subsidy policy. It is important to refer to and conclude that in Bolivia with the creation of an intermediary company Botrading a macroeconomic imbalance was generated, due to the increase in overprices and the high level of corruption and smuggling in the import of fuels and their respective redistribution that led to an increase in the fuel subsidy from 40% to 60% in the last five years. with an average of 1.3% of GDP in fourteen years from 2006 to 2019 to 4.1% of GDP by 2025. The level of corruption is gigantic and the diversion of resources to that black market is great, the subsidy has become a synonym for corruption, not help for the citizen.

We can conclude that the results of the third-degree polynomial variables analyzed, showed us the peaks and valleys and their adjusted R^2, the two most significant independent variables of the eight analyzed are the Net International Reserves (IR) and the Fiscal Balance (FB) with their respective fiscal deficit for more than 12 years and the least significant is the GDP with respect to the fuel subsidy.

We can also conclude that the determining factors of the fuel subsidy according to the multiple regression in twenty years are the expected results, where the most explanatory and positive correlated variables are the Net International Reserves (IR), inflation (NI) and indebtedness (PD) and the negative variables are the exchange rate (ER), the trade balance (BT) and the Gross Domestic Product (GDP). with a multiple correlation coefficient model is 93%, this can be explained by the fact that in order to cover the import of fuels and the respective subsidy in the face of the overpricing of these variables, it was necessary to resort to each of these variables mainly to cover these obligations with IR savings and later with PD indebtedness. generating an inflationary spiral of rising IN prices and a devaluation of the ER exchange rate due to the illiquidity of foreign currency dollars due to dependence on the export of natural gas and minerals and the lack of a foreign policy in the BT trade balance to move the productive apparatus with formal employment, leading to a fall in GDP in the last five years.

To recommend that the elimination of the fuel subsidy in Bolivia would cause poorly redistributive functions and deep social problems, in contexts of high corruption, smuggling, structural inequality and labor informality, in addition to causing immediate difficulties in a greater increase in the level of inflation prices with the 280% increase in fuel prices, affecting transport and food and an even more significant macroeconomic imbalance, affecting low-income households and increasing poverty, it is necessary to eliminate corruption and smuggling and not the fuel subsidy that was good for Bolivia's economic history.

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