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The Impact of Energy Subsidy Polices on Gross Domestic Product Growth: Evidence from Emerging and Developing Economies

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ABSTRACT

This study examines the impact of energy subsidy policies on economic growth in ten emerging and developing economies: China, India, Russia, Egypt, Mexico, Indonesia, Algeria, Malaysia, Saudi Arabia, and Iran, during the period 2010-2024, using a Panel ARDL model estimated through the pooled mean group (PMG) approach. The results show that energy subsidies have a positive, albeit limited, effect on GDP growth, with a 1% increase in subsidies raising GDP only by 0.011% in the long run and 0.009% in the short run. In contrast, gross fixed capital formation and population growth show much stronger positive effects, with elasticity coefficients of 0.99% and 1.19%, respectively. The findings suggest that while energy subsidies may stimulate economic activity in the short term, they are relatively ineffective in supporting long-term growth. Accordingly, the study recommends a gradual reform of energy subsidy policies, and the redirection of financial savings towards productive investment and renewable energy sectors, to enhance financial sustainability and support sustainable economic development.

Keywords: Energy Subsidies, Economic Growth, Panel Data
JEL Classifications: Q4, O4, C33

1. INTRODUCTION

Energy subsidy policies have long been a central component of economic and social policy in many emerging and developing countries. Governments often use subsidies to shield consumers from volatile energy prices, support industrial competitiveness, and promote social stability. While these measures can offer short-term economic relief, they frequently impose heavy fiscal burdens and distort market incentives, potentially reducing investment efficiency and hindering sustainable economic growth. The debate over the economic implications of energy subsidies has therefore become increasingly significant, particularly in light of global efforts toward fiscal consolidation and sustainable energy transitions.

International Monetary Fund reports indicated that fossil fuel subsidies reached $7 trillion in 2022, equivalent to approximately 7.1% of global GDP. This exceeds what governments spend annually on education (4.3% of global income) and nearly two-thirds of what they spend on healthcare 10.9% (Black et al., 2023). Fossil fuel subsidies are classified into two main categories: explicit and implicit subsides. The following Figure 1 shows the estimated and Projected Explicit and Implicit Global Fossil Fuel Subsidies.

Explicit subsidies refer to the direct undercharging for supply costs such as labor, capital, and raw materials, and are reflected as actual government expenditures in public budgets, where implicit subsidies arise because market prices fail to incorporate

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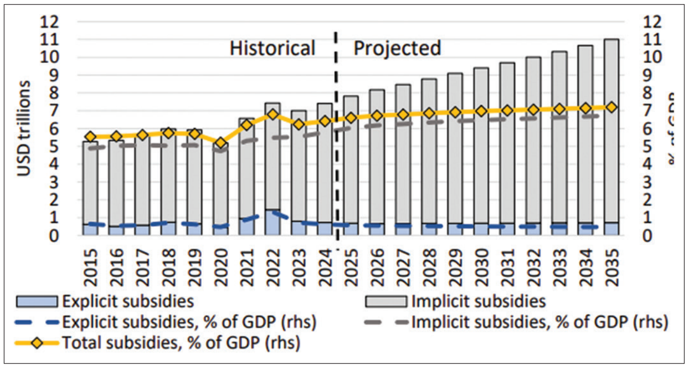
Figure 1: Estimated and projected explicit and implicit global fossil fuel subsidies



Source: Black et al., 2025

environmental externalities, including the social costs of air pollution and greenhouse gas emissions. Figure 1 clearly shows that implicit subsidies account for the largest share of total subsidies, far exceeding explicit fiscal support. While explicit subsidies remain relatively modest and stable over time, implicit subsidies drive the overall upward trend, increasing total subsidies from around \$6-7 trillion in recent years to a projected \$10-11 trillion by 2035.

Despite this rise in absolute terms, the subsidy burden remains broadly stable at about 6-7% of global GDP, indicating that the issue is structural rather than temporary. The temporary decline around 2020 reflects reduced energy demand during the COVID-19 pandemic, followed by a sustained upward trajectory in the projection period. Overall, the figure highlights that fossil fuel subsidies are not merely a matter of direct fiscal spending, but rather a systemic problem of energy mispricing. The dominance of implicit subsidies suggests that policies focusing only on reducing explicit subsidies will be insufficient. Effective reform requires aligning energy prices with their full social costs through mechanisms such as carbon pricing and environmental taxation. Such reforms are essential for improving economic efficiency, strengthening public finances, and supporting long-term sustainable growth (Black et al., 2025).

In general energy subsidies are a crucial tool in the economic policies specially in developing countries, given their role in reducing inequality and achieving social justice. However, the literature differs on the impact of energy subsidy reform on economic growth, with some seeing a positive effect and others a negative one (Mostafa, 2021).

2. ENERGY SUBSIDY REFORM AND GDP GROWTH

Energy subsidy reform affects GDP growth through several interconnected channels (Figure 2). In the short run, removing subsidies raises energy prices, increasing the costs of fuel, electricity, transportation, fertilizers, raw materials, and food, which reduces household purchasing power and weakens consumption and economic activity. These direct effects are accompanied by indirect effects through wage and price mechanisms, as higher living costs lead to wage demands that further increase production costs and generate broader inflationary pressures across the economy.

However, despite these short-term contractionary effects, subsidy reform may support long-term economic growth by improving fiscal sustainability, enhancing energy efficiency, reducing wasteful consumption, and enabling governments to redirect public resources toward more productive sectors such as infrastructure, healthcare, and education.

According to Kimura (2016) the impact of Energy subsidy reform on GDP may be transmitted through three main channels: the price effect, the energy-saving effect, and the budget effect (Figure 3). The overall impact on economic growth depends on the relative strength of each channel.

1- Price effect: Eliminating energy subsidies leads to price increases, which in turn reduces household consumption due to decreased purchasing power. Exports weaken as domestic products lose their competitiveness, while imports increase proportionally. Overall, the price impact is expected to negatively affect GDP, as the decline in consumption and economic activity outweighs any potential gains.

Subsidy removal → Higher energy prices → Higher CPI/WPI → Lower consumption and weaker economic activity → Lower GDP.

2- Energy-saving effect: Once energy prices rise after subsidy removal, consumers and firms reduce energy consumption. Lower demand for electricity and fuel reduces domestic energy use, particularly imports of petroleum products and natural gas. This generates two possible positive outcomes: Lower fuel imports, which improves the trade balance. And higher net energy exports, especially if domestic production remains unchanged.

As a result: Higher energy prices → Lower energy demand → Lower fuel imports/higher exports → Improved trade balance → Higher GDP.

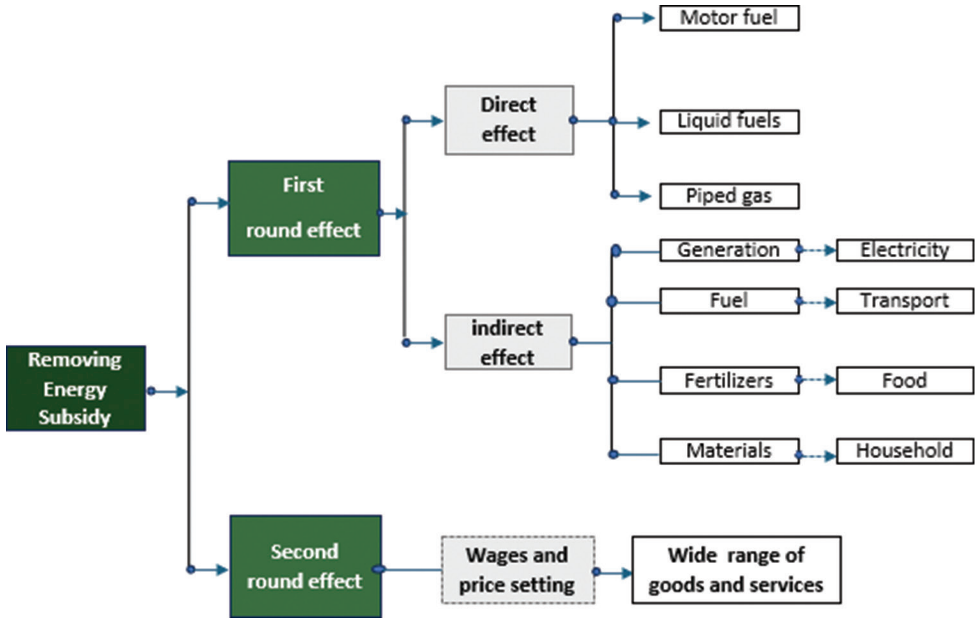
3- Budget effect: The fiscal consequences of subsidy reform depend critically on how governments allocate the budget savings obtained from reducing subsidies.

A. Negative budget effect: Initially, removing subsidies lowers households' disposable income because consumers now pay higher energy prices. This reduces private consumption and may lower GDP. If the government uses the saved funds only to: Reduce the fiscal deficit, or decrease public debt, government spending declines, which can further weaken aggregate demand and economic activity.

Hence: Lower subsidies → Lower disposable income + lower government spending → Lower GDP.

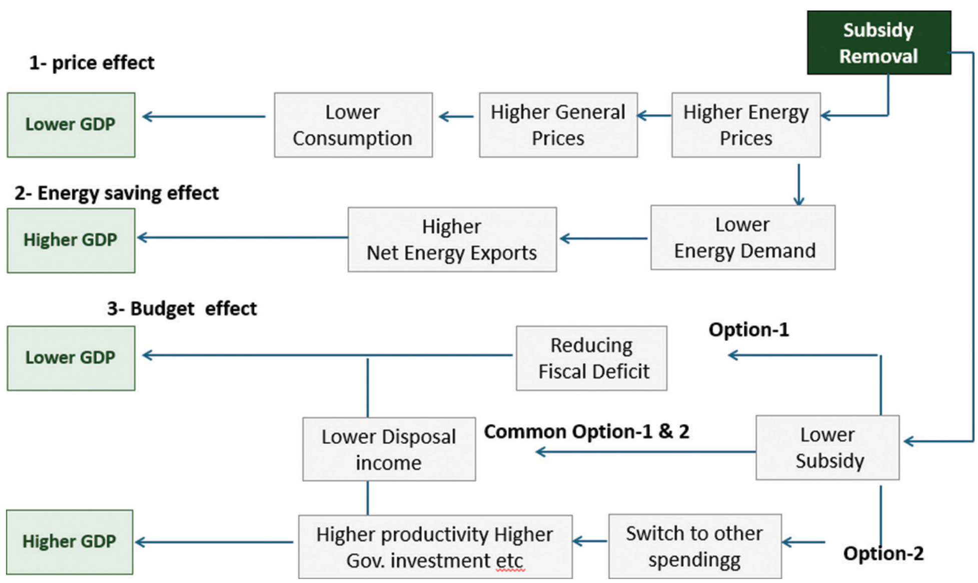
B. Positive budget effect: The budget effect can become positive if governments reallocate subsidy savings toward productive expenditures such as: Infrastructure, healthcare, education,

Figure 2: Effects of energy subsidy reform on gross domestic product growth



Source: By authors

Figure 3: Channels that energy subsidies affects economic growth



Source: (Kimura, 2016)

social protection programs. These expenditures increase economic productivity and stimulate aggregate demand in both the short and long run.

Subsidy savings → Productive public investment → Higher productivity and economic activity → Higher GDP.

Overall interpretation: The total impact of subsidy reform on GDP is ambiguous and depends on the balance among the three effects:

- Price effect → Negative
- Energy-saving effect → Positive
- Budget effect → Can be positive or negative depending on fiscal policy choices.

Therefore, the final macroeconomic outcome of subsidy reform depends largely on: The magnitude of inflationary pressures, improvements in energy efficiency and trade balance, and especially how governments utilize the fiscal savings generated by subsidy removal.

3. LITERATURE REVIEW

A substantial literature addressing the macroeconomic effects of energy subsidies. Some studies suggest that subsidies stimulate short-term economic activity by lowering production costs and enhancing household welfare, while others argue that they crowd out productive public investment and contribute to long-term inefficiencies.

Vagliasindi (2013) analyzed energy subsidy reform in several developing countries, focusing on understanding the economic, social, and political factors that determine the success or failure of these reforms, and proposing more efficient and equitable policies for restructuring fuel and electricity subsidies. The study relied on energy prices, government subsidy levels, and some of macroeconomic indicators such as budget deficits, inflation, and per capita subsidies. The study concluded that energy subsidy reform is most successful when implemented gradually and accompanied by social protection programs such as targeted cash transfers. It also emphasized that blanket subsidies lead to economic distortions and increased fiscal deficits without achieving genuine equity in the distribution of benefits.

Coady et al. (2015) used panel data to estimate explicit and implicit energy subsidies and examine their macroeconomic effects, the study covers over 150 countries globally. The results showed that fossil fuel subsidies are large and economically inefficient, distorting resource allocation and weakening productivity. The study concluded that reforming these subsidies could support economic growth by strengthening fiscal balances and redirecting resources toward more productive uses.

Mundaca (2017) aimed to analyze the impact of fossil fuel subsidy reform on economic growth, focusing on countries in the Middle East and North Africa. It tests the hypothesis that countries that reduce or eliminate energy subsidies achieve higher rates of per capita GDP growth, along with improved employment levels and labor market participation, particularly among youth. The price gap approach is used to measure the size of subsidies by comparing domestic prices to global prices. The study concluded that reducing fuel subsidies leads to a tangible increase in economic growth rates (as raising fuel prices by 20% per liter could raise per capita growth by 0.30-0.48%). to enhancing allocation efficiency and reducing excessive energy consumption, in addition to redirecting subsidy savings towards vital sectors such as health, education and infrastructure, which supports long-term economic growth.

Groot and Oostveen (2019) study aimed to assess the potential for improving social welfare by replacing energy subsidies with direct cash transfers in 11 developing countries. This was achieved through a simulation of income distributions assuming a normal logarithmic distribution, Based on the concept of compensatory change, the study concluded that the value of the cash compensation required to protect households is less than the total financial savings resulting from eliminating subsidies. This allows for a neutral fiscal reform that enhances overall welfare. The findings also concluded that the energy subsidy system is inefficient due to the leakage of benefits to the wealthy and the encouragement of excessive consumption.

Mostafa (2021) studied the impact of energy subsidy reform on economic growth in Egypt, focusing on the direct and indirect effects and the main channels through which these effects are transmitted. The study adopted a mixed econometric approach, where indirect effects were estimated using structural equation modeling via AMOS and Warp PLS software, while direct effects were analyzed using an auto regressive distributed lag (ARDL) model to monitor short- and long-term relationships. The analysis is based on macroeconomic time series data covering the period 2012-2020, a period characterized by high global energy prices and increasing financial pressures. The study showed that indirect effects operate through multiple channels, including the industrial, transport, energy, and household sectors, as well as the degree of private sector participation in GDP, and key macroeconomic variables such as the budget deficit, balance of payments, inflation, foreign reserves, interest rates, and exchange rates. The findings indicate a positive relationship between energy subsidies and economic growth, meaning that subsidy reform or reduction could negatively impact growth through both direct and indirect channels, particularly by constraining fiscal and external balances and private sector activity. Accordingly, the study recommends a gradual and well-structured reform strategy supported by social protection policies to mitigate the negative economic effects.

(Amanda et al., 2023) study examined the impact of fuel subsidy policies on economic growth in Indonesia amidst rising fuel demand and volatile global energy prices. The analysis was based on recent data on fuel price adjustments in 2022, population growth trends, energy consumption patterns, and global oil market developments influenced by the Russia-Ukraine conflict. Using an analytical approach, the study assessed the effectiveness of government interventions, such as fuel subsidies and compensation programs. The findings indicate continued growth in fuel demand due to population expansion and the economy's heavy reliance on fossil fuels, which account for the majority of energy consumption, coupled with concerns about limited domestic oil reserves. Simultaneously, high global oil prices, reaching record highs per barrel, significantly increased the financial burden of subsidies. Nevertheless, fuel subsidies remain essential to support economic activity, particularly in the transportation sector, by mitigating cost pressures on households and businesses, thereby supporting economic growth. The study also emphasized the importance of complementary measures, including rationalizing fuel consumption and promoting more sustainable energy alternatives, given Indonesia's status as an oil-importing country.

(Samir and Kame, 2025) study aimed to measure the impact of fuel subsidies on economic growth during the period 2010-2020, using a sample of 11 energy-producing and exporting countries. The study employed an econometric methodology using a panel data model, analyzing fuel subsidy variables as a percentage of GDP, along with the annual growth rate of per capita GDP. The price gap approach was also used to estimate subsidy levels by comparing domestic prices to international benchmark prices or the cost of production recovery. The results showed that fuel subsidies have a significant negative impact on economic growth, with a 1% increase in subsidies leading to a 0.19% decrease in the growth rate in the countries studied. The findings also confirmed that fuel subsidy policies weaken the efficiency of resource allocation and exacerbate fiscal imbalances, despite their stated aim of protecting consumers. This underscores the need to reform the subsidy system and direct it more efficiently towards social safety nets, thereby enhancing long-term economic sustainability.

4. METHODOLOGY AND RESULTS

This study seeks to examine the impact of energy subsidy policies on GDP using panel data, evidence from ten emerging and developing countries: China, India, Russia, Egypt, Mexico, Indonesia, Algeria, Malaysia, Saudi Arabia, and Iran, over the period 2010-2024. The study employs the autoregressive distributed lag (ARDL) model within the Pooled Mean Group (PMG) framework, which allows for the estimation of both short-run and long-run relationships while accommodating country-specific heterogeneity.

By incorporating additional control variables, population and gross fixed capital formation, the study captures both the demographic and investment dimensions of economic growth. Through this approach, the analysis provides robust evidence on how energy subsidies influence long-term GDP growth and identifies whether such policies promote or hinder sustainable development in emerging and developing economies. Ultimately, the study aims to contribute to the policy debate on energy subsidy reform, offering insights into how fiscal resources can be reallocated to enhance growth, efficiency, and sustainability.

The model of the study incorporated GDP as the dependent variable, while total government energy subsidies (TOTSUB) served as the main independent variable of interest. Two additional control variables were included: Population (POP), capturing demographic and demand-side effects, and gross fixed capital formation (FCF), representing the level of physical investment within the economy. All variables were transformed into natural logarithms to estimate elasticities and ensure homoscedasticity. The study first determines the stationarity characteristics of the panel data variables. The unit root test represents the initial step in this process, as it aims to assess whether the variables are stationary at their level form or require differencing to achieve stationarity. By conducting unit root tests for the study data, the results were as presented in the Table 1.

Based on the results of the unit root test of panel data (Baltagi, 2021) and (Blundell and Bond, 1998) shown in the table above, the Levin, Lin and Chu t-test and the PP-Fisher Chi-square test were used to determine the degree of integration of the variables under study, which include gross domestic product (LGDP), total energy subsidies (LTOTSUB), fixed capital component (LFCF), and population (LPOP). The results indicate that some variables were stationary at the I(0) level, as the probability values were less than the significance level of 0.05 in the case of a fixed term or trend, thus rejecting the null hypothesis in the presence of a unit root. In contrast, other variables showed unstationarity at the I(0) level, but became stationary after the first difference I(1).

Therefore, the variables under study are integrated at different orders, some being of first order I(1) and others of zero order I(0). Since this variation in degree of integration does not exceed I(1), the most appropriate model for estimating the dynamic relationship between the variables is the distributed lag autoregression model (ARDL), as it allows the integration of variables of different levels of integration I(0) and I(1) and is suitable for testing the existence

Table 1: Results of the unit root tests

Variables	Level											
	Common unit root levin, lin and chu t*						PP-Fisher Chi-square					
	Intercept		Intercept and trend		None		Intercept		Intercept and trend		None	
	Statistics	Probability	Statistics	Probability	Statistics	Probability	Statistics	Probability	Statistics	Probability	Statistics	Probability
LGDP	−4.5710	0.0000	−5.61128	0.0000	7.1176	1.0000	118.405	0.0000	129.4670	0.0000	0.00358	1.0000
LTOTSUB	−15.5253	0.0000	−14.1173	0.0000	−0.1595	0.4366	31.9464	0.0439	31.9464	0.0439	7.31742	0.9955
LFCF	−3.1193	0.0009	−4.98359	0.0000	5.56889	1.0000	58.7092	0.0000	115.903	0.0000	0.01433	1.0000
LPOP	−13.2241	0.0000	10.2545	1.0000	−8.4282	0.0000	67.4414	0.0000	0.00200	1.0000	0.01791	1.0000
First difference												
D (LTOTSUB)	−12.0814	0.0000	−10.1326	0.0000	−14.9132	0.0000	73.9071	0.0000	40.4085	0.0044	143.1800	0.0000
D (LFCF)	−6.9852	0.0000	−5.5667	0.0000	−6.2884	0.0000	87.6934	0.0000	90.9707	0.0000	84.8159	0.0000

of a long-term equilibrium relationship between GDP and each of energy subsidies, population, and the fixed capital component. Our econometrics model of the study as follow:

$$LGDP_{it} = \beta_{it} + \beta 1_{it}\, L\ totsub_{it} + \beta 2_{it}\ lpop_{it} + \beta 3_{it}\ Lfcf_{it} + u_{it} \quad (1)$$

Secondly: The general panel ARDL(p, q_1, q_2, q_3) model can be written as:

$$ln\,GDP_{it} = \alpha_i + \sum_{k=1}^{p} \varnothing_{ik} ln\,GDP_{i,t-k} + \sum_{k=0}^{q1} \gamma 1,_{ik}\ ln\,totsub_{i,t-k} + \sum_{k=0}^{q2} \gamma 2,_{ik}\ ln\ pop_{i,t-k} + \sum_{k=0}^{q3} \gamma 3,_{ik}\ ln\ fcf_{i,t-k} + u_{it} \quad (2)$$

Then the Bounds test based on Panel ARDL - PMG approach (Pesaran et al., 1999) will be as follow:

$$\Delta ln\,GDP_{it} = \alpha_i + \sum_{k=1}^{p-1} \varnothing_{ik} \Delta ln\,GDP_{i,t-k} + \sum_{k=0}^{q1-1} \beta_{1k}\ \Delta ln\,totsub_{i,t-k} + \sum_{k=0}^{q2-1} \beta_{2k}\, \Delta\, ln\ pop_{i,t-k} + \sum_{k=0}^{q3-1} \beta_{3k}\ \Delta\, ln\ fcf_{i,t-k} + \gamma_1\, ln\,GDP_{i,t-1} + \gamma_2\ lntotsub_{i,t-1} + \gamma_3\ ln\ pop_{i,t-1} + \gamma_4\ lnlfcf_{i,t-1} + \varepsilon_{it} \quad (3)$$

Where: Δ: First difference (short-run change), α_i: Individual fixed intercept, the parentheses is the deviation from the long-run equilibrium at t-1, γ1: Error-correction coefficient) should be negative and significant: It measures the speed of adjustment back to the long-run equilibrium.

The Bounds test for cointegration using: H_0: $\gamma 1 = \gamma_2 = \gamma_3 = \gamma_4 = 0$ (no long run relationship), H_1: At least one $\gamma_j = 0$ (cointegration exists), then compare the computed F-statistic with the Pesaran critical bounds:

- If F> I(1) upper bound, reject H_0, so long run cointegration exists
- If F< I(0) lower bound, fail to reject H_0, so no cointegration exists
- If I(0) < F< I(1), inconclusive.

The Bounds test results showed F-statistic exceeding the upper critical values at all significance levels. Consequently, a cointegrating relationship is evident between real GDP, government subsidies to the energy sector, population size, and fixed capital formation in the countries under study (Kao, 1999) and (Pedroni, 1999).

The econometric estimation using Panel ARDL (Nkoro and Uko, 2016) with the PMG method demonstrated that the elasticity of total energy subsidies has a statistically significant positive impact on economic growth in these countries, with a coefficient of 0.011%. This means that every 1% increase in energy subsidies leads to a 0.011% increase in GDP. In the short run, this effect is also low, at 0.009%. While the elasticity of the fixed capital component (LFCF) reached 0.99%, thus the fixed investment component is considered the main driver of economic growth, the elasticity of the population (LPOP) reached 1.19, which is strongly positively correlated with GDP, indicating that the size of the market and the supply of labor have a strong effect on the size of economic growth.

Where short-run dynamics effect, can be shown by General panel ECM (ARDL(p,q_1,q_2,q_3) as in the following equation:

$$\Delta\, ln\,GDP_{it} = \alpha_i + \sum_{k=1}^{p-1} \varnothing_{ik} \Delta\, ln\,GDP_{i,t-k} + \sum_{k=0}^{q1-1} \beta_{1k}\ \Delta ln\,totsub_{i,t-k} + \sum_{k=0}^{q2-1} \beta_{2k}\, \Delta\, ln\ pop_{i,t-k} + \sum_{k=0}^{q3-1} \beta_{3k}\ \Delta\, ln\ fcf_{i,t-k} + \varnothing_i (ln\,GDP_{i,t-1} - \theta_1\, lntotsub_{i,t-1} - \theta_2\, ln\ pop_{i,t-1} - \theta_3\, lnlfcf_{i,t-1}) + \varepsilon_{it} \quad (4)$$

Where, Δ: First difference (short-run change), α_i: Country fixed effect, $\varnothing_i$: Error correction coefficient, that measure the speed back to long run equilibrium, θ_j: Are the long run elasticity's. Error-Correction Representation, which indicates short-run dynamics: The results showed that the ECM ≈ −0.79, meaning that the short-term equilibrium is rapidly restored (i.e., 79% of the deviation is corrected within 1 year). This indicates that the economies of these countries are rapidly approaching long-term equilibrium.

The weak impact of subsidies can be explained by the nature of the studied economies. Some countries (such as Saudi Arabia, Russia, Algeria, and Iran) are rentier states that rely on energy revenues to finance their public budgets, making subsidies more of a tool for social and financial stability than a catalyst for productive growth. In emerging industrial countries (such as China, India, Malaysia, and Mexico), energy subsidies are often aimed at reducing production costs and improving competitiveness.

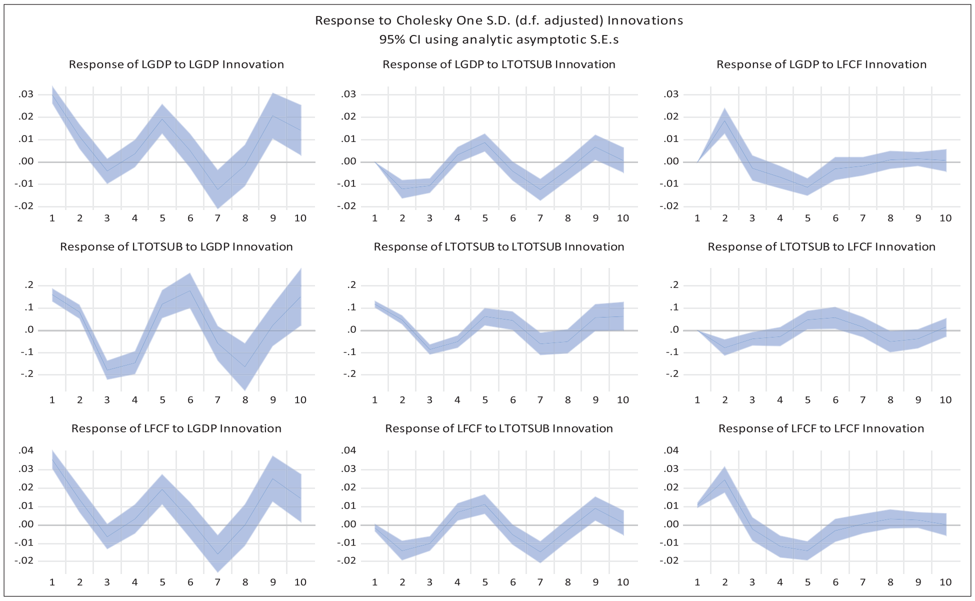
However, their economic effects remain limited due to the inefficiency of subsidy distribution and its diversion to consumption rather than investment. For energy-importing countries (such as Egypt and Indonesia), subsidies contribute to easing the cost of living and increasing domestic demand, but they impose a significant financial burden on the budget and limit the state's ability to finance higher-yielding development investments. Accordingly, the findings show that energy subsidy policies in emerging and developing countries remain short-term and of limited sustainability, and that their effectiveness in stimulating economic growth depends on the extent to which they are directed towards productive activities and infrastructure.

By conducting the Impulse Response Function analysis, the results were as follows in Figure 4.

The VAR model shows the responses of the three variables, with each graph illustrating how the study variables respond to a shock of one standard deviation in another variable or itself over a 10-year period.To analyze the economic relationship dynamically based on the Figure:

First: The response of LGDP: The LGDP-in-itself shock exhibits a normal oscillatory pattern indicating a persistent effect, reflecting

Figure 4: Impulse response function



the self-reactive nature of LGDP over time. The energy subsidy shock to LGDP (LTOTSUB-LGDP) has a negative impact in the initial periods (1:3), then gradually becomes positive after approximately period 4:6, before stabilizing. This can be explained by the fact that reducing energy subsidies (i.e., a negative subsidy shock) may initially lead to a slowdown in economic activity due to increased production costs, but over time, economic performance improves as resources are reallocated towards more efficient investments. The impact of a shock to the fixed capital component (LFCF-LGDP) is positive and rapid, then gradually declines. Interpretation: Increased fixed capital formation supports growth in the short and medium term, but the effect diminishes over time.

Second: Energy subsidy response (LTOTSUB) to output shock (LGDP-LTOTSUB): The figure shows a weak positive relationship initially, then a slight negative one after the midpoint. This can be explained by the fact that as output rises, the need for subsidies may decrease (due to improved government revenues or subsidy rationalization), which explains the subsequent shift towards a negative effect. Meanwhile, the energy subsidy shock itself (LTOTSUB-LTOTSUB) fluctuates or oscillates around zero, indicating that subsidies follow a corrective (mean reverting) behavior after any shock. The impact of the fixed capital component shock (LFCF-LTOTSUB) is gradually negative, perhaps suggesting that increased investment may reduce reliance on energy subsidies over time.

Third: The fixed capital component (LFCF) response to output shock (LGDP-LFCF) is initially strong and positive, then slowly declines, meaning that higher output stimulates investment. This is explained by the fact that economic growth encourages the formation of fixed capital components through increased demand and market optimism. In contrast, a shock to energy subsidies (LTOTSUB-LFCF) initially has a negative impact, which then shifts slightly positively later. This can be explained by the fact that reducing subsidies may temporarily raise production costs, thus reducing investment, but in the medium term, it may stimulate efficiency and investment in productive alternatives. The intrinsic response of a fixed capital component shock (LFCF-LFCF) is also positive initially, followed by gradual stabilization, a pattern expected in investment chains. The general relationship between the three variables (the economic function) is that reducing energy subsidies leads to a short-term decline in output but improves long-term growth, while increased investment is the main driver of sustainable economic growth.

Subsidies are not merely a financial burden, as is sometimes portrayed, but rather a sensitive policy tool that can be transformed from consumer spending into a productive lever if precisely targeted towards sectors capable of generating added value and raising national productivity. For example, subsidies directed towards clean energy, agriculture, or small businesses achieve a multiplier effect on output and reduce unemployment, which positively impacts overall growth.

The positive coefficient and high significance confirm that increased fixed capital formation contributes significantly to boosting GDP. When a government invests in infrastructure, machinery, equipment, and productive buildings, it raises total productive capacity and increases resource utilization efficiency. From a Keynesian perspective, investment is one of the most important components of aggregate demand, while from a neoclassical perspective, it promotes capital accumulation and thus raises the marginal productivity of labor. An increase in fixed capital represents a shift in the economy towards a higher productivity trajectory, as every riyal or dollar invested in fixed assets generates cumulative returns in the long term, especially when directed towards value-intensive productive sectors.

Population (POP): The positive relationship between population and GDP means that population growth contributes to boosting overall economic activity, provided it is accompanied by increased productivity and skills.

Economically speaking, the population constitutes both the workforce and the source of demand. An increase in population leads to higher aggregate consumption and stimulates domestic production. As long as the economy can employ the population efficiently, demographic growth transforms from a burden into a driver of growth. Human resources are not merely a factor of production, but the primary engine of innovation, entrepreneurship, and the capacity for productive expansion.

4.1. Country-Specific Interpretations and Policies

China: A massive industrial economy with high energy consumption, there is no doubt that energy subsidies and transmission policies are increasing to stimulate industry. The low elasticity of subsidies can be explained by the fact that subsidies often reduce energy costs in the short term but are not directly linked to a significant increase in overall productivity. This is because large companies may benefit without expanding their productive investments, or because some growth is based on efficiency and technology improvements, not just subsidies. Focusing on directing subsidies towards energy efficiency and innovation will stimulate the transition to low-carbon energy and redirect any savings towards productive investments (Zhang et al., 2018).

India: with its large domestic market and reliance on energy subsidies to boost purchasing power and reduce energy poverty, the weak positive impact of energy subsidies can be explained by the fact that subsidies increase consumer demand and are insufficient on their own to stimulate large investments. While they alleviate social pressure, they do not compensate for the lack of infrastructure. Recommendation: Target subsidies to vulnerable groups and redirect a portion of subsidies to finance energy infrastructure projects and improve distribution networks to increase their productive impact (Sharma et al., 2016).

Russia: A country with a strong energy sector (a major global energy exporter); therefore, energy pricing and subsidy policies may take a different form by affecting public revenues and expenditures. This can be explained as follows: Because the energy sector is a core part of the economy, domestic subsidies may distort incentives (e.g., encouraging domestic consumption rather than exports). Low elasticity means that an increase in subsidies does not automatically translate into broad-based economic growth. Recommendation: Exercise caution and improve the targeting of subsidies to preserve export revenues and use the proceeds to finance productive investments (Connolly, 2018).

Egypt: An energy-importing country, but there is an importance to achieving social stability through subsidies and reducing the cost of living. The limited impact of energy subsidies on economic growth can be explained as contributing to social stability but being limited in its effect on output because a large portion is consumed directly and not converted into investment. Recommendation: Replace general energy subsidies with targeted subsidies (beneficiary segments) (Mostafa, 2021).

Mexico: A mixed economy with an energy sector that has a historically oil-based role. Subsidies may reduce state revenues or be directed towards consumption without improving productivity. Low elasticity indicates that subsidies alone are less effective for growth. Recommendation: Redirect subsidies towards encouraging domestic investment in productive sectors and energy infrastructure, and expand the role of the private sector with investment incentives (Gutierrez et al., 2021).

Indonesia: A transforming energy market, sensitive to fuel prices, and previously extensive subsidy policies. Subsidies reduce energy costs for consumers and industry but may discourage the transition to cleaner sources and strain public finances; therefore, their impact on growth is limited. Recommendation: Redirect subsidies to energy efficiency programs and support for domestic renewable energy production, and provide financing for investments (Black et al., 2023).

Algeria: An economy dependent on energy revenues for public finances. Explanation: Domestic subsidies can be a burden on the treasury and reduce the incentive for private investment; the limited impact suggests that subsidies do not create broad economic expansion. Recommendation: Gradually reform subsidies and use the gains to finance economic diversification and infrastructure (Black et al., 2023).

Malaysia: A mix of export industries and a relatively advanced energy economy. Energy subsidies may support domestic competitiveness but do not stimulate significant growth on their own; investment is key. Recommendation: Focus on increasing investment in value-added sectors and supporting clean technologies (Raihan et al., 2022).

Saudi Arabia: A rentier economy heavily reliant on oil revenues and historically based energy subsidies. Domestic subsidies can lead to wasteful consumption; limited flexibility means that prolonged subsidies do not result in significant sustainable growth unless revenues are used for productive investments. Therefore, Vision 2030 emerged to diversify the economy. Recommendation: Utilize oil resources to finance economic diversification (Ubaid and Gulrez, 2025).

Iran: A partially insulated economy and historically extensive energy subsidy policies. Iran's experience with energy subsidies shows that while widespread fuel subsidies have helped reduce consumption costs and improve living standards, they have also increased energy intensity and weakened incentives for efficiency and productive investment. The limited impact of subsidies on economic growth reflects financial, technological, and regulatory barriers that have constrained the adoption of energy-efficient technologies (Barkhordar et al., 2018).

5. CONCLUSION

This study examines the impact of energy subsidy policies on economic growth in ten emerging and developing economies: China, India, Russia, Egypt, Mexico, Indonesia, Algeria, Malaysia, Saudi Arabia, and Iran, using Panel data, during the period 2010-2024. The results show that energy subsidies have a weak positive impact on GDP growth, with a 1% increase in subsidies raising

GDP by only 0.011% in the long run and 0.009% in the short run. In contrast, gross fixed capital formation and population growth have much stronger positive effects, with elasticities of 0.99% and 1.19%, respectively.

The findings suggest that while subsidies may provide short-term economic support, they distort resource allocation, encourage inefficient and energy-intensive activities, weaken incentives for private investment, and impose increasing fiscal burdens, with high-income groups benefiting disproportionately. The study also highlights that concerns about inflation and social unrest remain major challenges to subsidy reform. Accordingly, it recommends a phased approach to energy subsidy reform, strengthening social safety nets and targeted cash transfers, and redirecting financial savings toward productive investment, infrastructure, renewable energy, and energy efficiency sectors to enhance fiscal sustainability and support long-term sustainable economic growth.

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