POLICY NOTE



VIET NAM ENERGY-FOCUSED SOCIAL ACCOUNTING MATRIX (ESAM)

Estimating the Impacts of Oil Price Shocks: Insights from ESAM database and modelling

July, 2026

SUMMARY OF KEY MESSAGES

Illustrative modelling results

- A 49.3 per cent increase in oil import prices (from $67 to $100) produces a broad-based but uneven contraction: GDP falls by 0.25 per cent from the baseline and private consumption is reduced by 0.71 per cent.
- Sectoral impacts vary sharply: refined petroleum products and transport sectors face the steepest contractions, while oil extraction and durable manufacturing sectors expand, including electrical equipment, textile, machinery industries. Wind and solar electricity generation also grow slightly.
- Distributional impacts do not follow a simple pattern: nominal income losses are largest for urban non-farm households; real welfare losses are deepest for urban households overall, as they face a double squeeze of falling incomes and rising prices.
- Aggregate indicators alone are insufficient to capture who bears the burden; disaggregated, household-level analysis is essential for designing effective policy responses.

Economy-wide perspective from Social Accounting Matrices and Computable General Equilibirum modelling

- Given the dense interconnectedness of the industries in Viet Nam, an exogenous shock such as that of the oil price impacts many aspects of the economy. Computable General Equilibrium (CGE) models based on Social Accounting Matrices (SAM) capture direct, indirect and induced effects simultaneously, tracing how a price shock ripples through production costs, household incomes, wages and government revenues across the whole economy at once. This makes them well suited to a broad range of policy and shock analysis, including commodity price shocks, carbon taxation, fiscal interventions, energy policies among others.
- Results should be treated as indicative of direction and magnitude, and interpreted alongside other analytical tools including macro-, micro-simulation-, and sector-specific models as well as qualitative assessments.
- The Viet Nam ESAM-CGE experience offers a replicable methodology for other country contexts, spanning capacity development for data construction, model development and policy simulation, enabling a shift from reactive to anticipatory, evidence-based policymaking.

Policy recommendations

- Heterogeneous impacts across household groups and sectors suggests new forms of vulnerability emerging within Viet Nam's export-oriented, capital-intensive growth model. Social protection, labour market and fiscal policies should evolve to keep pace with these shifting risk profiles, ensuring that growth translates into equity and shared prosperity for all.
- Beyond external shocks, Viet Nam's own energy transition choices, could generate similar price and distributional effects to the oil shock modelled here. As these policies are designed, government should build in compensatory and equity-enhancing measures from the outset, to ensure the benefits and costs of the transition are equitably shared.
- Governments should invest in institutionalising economy-wide modelling capacity, embedding these tools to assess potential impact in anticipation of shocks, and to inform the design of policies that address them.

CONTEXT: OIL PRICES AND THE VIET NAM ECONOMY

The ongoing conflict in the Persian Gulf, and the consequent partial closure of the Strait of Hormuz, has introduced significant volatility to global oil markets. Disruptions to the Strait – through which approximately 35 per cent of the world's daily crude oil trade passes – transmit rapidly through global commodity markets, with consequences far beyond the immediate region.

Rising oil prices elevate costs across a range of supply chains. Energy, transport, fertiliser and industrial input costs are all directly impacted. These increases feed through consumer prices through higher production, labour and transport costs. Food prices are affected directly through the cost of fertilizers, and higher food prices feed through to the rest of the economy through their impact on nominal wages. The impact on household groups varies depending on employment and consumption patterns. People working in energy-intensive sectors are more likely to experience employment impacts, and households that spend a large share of income on fuel and food are exposed to changes in their expenditure.

Growth in developing countries is also constrained by access to foreign exchange, which is needed for essential imports—both for production and consumption—and to meet international financial obligations. Rising energy prices can affect the current account of the balan-ce of payments directly through higher oil, gas and coal prices, and indirectly through higher shipping costs, reduced exports including tourism earnings and the rising cost of servicing debt.

The Vietnamese economy is resilient and partially insulated from these effects because of the availability of domestic substitutes for some imports and increasing demand for exports of electronic components. Although the country has a relatively high level of energy self-sufficiency, with domestic energy production accounting for approximately 66 per cent of total supply in 2019, the country still depends on imports for around one-third of its energy needs. Crude oil import dependency in 2019 stood at nearly 41 per cent of total crude oil supply, and Viet Nam is a significant net importer of petroleum products. As a result, global oil price movements feed into domestic production costs and household expenditure patterns, with knock-on effects across sectors.

Understanding how oil price shocks transmit through the economy, and which groups bear the greatest burdens, is essential for timely and well-targeted policy responses. This policy note presents how economy-wide modelling can be applied to assess the potential impact of such economic shocks.

THE ESAM-BASED CGE MODELLING FRAMEWORK

In 2025, UNDP Viet Nam, in partnership with the Institute for Policy and Strategy Studies (IPSS), the University of Copenhagen, and Viet Nam's National Statistics Office completed the construction of the 2019 Energy-focused Social Accounting Matrix (ESAM) for Viet Nam, a comprehensive economy-wide database that captures product flows, monetary circulations, and the processes of income generation and distribution among industries and institutions.

This is built on longstanding collaboration between international partners, including the University of Copenhagen, the Danish International Development Agency (DANIDA), UN World Institute of Development Economics Research (UNU-WIDER), other international partners, and the Institute of Policy and Strategy Studies (Previously named the Central Institute for Economic Management as part of the Ministry of Planning and Investment of Viet Nam), the National Statistics Office (NSO) to construct Social Accounting Matrices starting from the mid-1990s until now.

The ESAM extends a conventional Social Accounting Matrix by incorporating detailed electricity production data in monetary terms across 46 economic activities and 41 commodity groups, with 10 distinct energy sub-sectors and products including coal, crude oil, natural gas, petroleum products, and six disaggregated types of electricity generation. This granularity allows for a much richer analysis of the structural relationships between electricity use, economic output, and household welfare than standard tools permit.

What distinguishes the ESAM from a standard database is its capacity to serve as the foundation for economy-wide policy simulation models. By linking detailed energy accounts to the full circular flow of income in the economy, it enables analysts to trace how a price shock in one part of the economy ripples through production costs, household incomes, wages and government revenues simultaneously. Oil import price increases provide a clear example of this transmission.

Building on this database, the team developed a Computable General Equilibrium (CGE) model, which represents how producers, consumers and the government interact across all sectors of the economy simultaneously. Unlike simpler analytical tools, a CGE model captures both the direct and indirect effects of policy shocks: when oil prices rise, it accounts not only for the direct cost increase faced by transport or manufacturing, but also the cascading effects on wages, consumer prices, and household spending patterns. This approach makes the ESAM-CGE framework particularly well suited to examine the economy-wide and distributional impacts of commodity price shocks, carbon pricing, energy transition policies or fiscal interventions.

SCENARIO: AN ILLUSTRATIVE OIL PRICE SHOCK

Oil prices have fluctuated significantly since the onset of the Iran conflict. At their peak, Brent crude prices reached nearly USD 130 per barrel, roughly 80 per cent higher than pre-crisis levels. Prices have since eased into the USD 94 – 104 per barrel range, or approximately 40 percent higher than pre-crisis. To assess the potential scale and distribution of impacts on Viet Nam's economy, the CGE model was run under an illustrative scenario of a sustained oil import price increase of 49.3 per cent from baseline (an increase from a price of $67 to $100 per barrel).

This scenario is deliberately illustrative. Its purpose is not to predict a specific outcome, but to demonstrate the magnitude and nature of macroeconomic and distributional impacts that could arise from an oil price shock of this scale, and to showcase how the ESAM-CGE framework can be applied by national and international partners to generate actionable, distributional insights for policymakers. The model results should be interpreted as indicative of the direction and relative magnitude of impacts, not as precise forecasts.

The results presented in this policy note are generated using the Viet Nam ESAM-CGE model and are intended solely for illustrative purposes. The scenario described here — a 49.3 per cent increase in oil import prices (from $67 to $100 per barrel) — has been designed to demonstrate the type of insights and analytical outputs that this modelling framework can produce, rather than to prescribe or predict a specific policy outcome. As with any modelling exercise, the results capture one part of a broader analytical picture. A comprehensive impact assessment would require the integration of additional tools and models, including sector-specific analysis, micro-simulation approaches, and qualitative assessments of institutional and behavioural responses. Users are encouraged to treat these outputs as a starting point for evidence-informed dialogue rather than a definitive policy prescription.

MACROECONOMIC IMPACT

Key scenario shock: A 49.3 per cent increase in oil import prices. All results below represent likely deviations from a baseline (business-as-usual) scenario. The timeline over which policy interventions or external shocks play themselves out for static CGE modelling is often considered to be 2-3 years.

GDP and Aggregate Demand

Under the illustrative scenario, the oil price shock generates a contraction across key macroeconomic aggregates. The increase in production costs operates through two principal channels.

First, the higher imported oil prices raise production costs in all industries and as a result erode the real purchasing power of households as consumer prices rise. Second, higher domestic production costs create upward pressure on the prices of Viet Nam's exported goods, which dampens export competitiveness. Taken together, this has a contractionary impact on GDP growth.

Indicator	Baseline (Tril. VND)	Change from Baseline (%)
Absorption (Total Demand)	7,452.6	-0.75%
GDP at market prices	7,746.1	-0.25%
Private Consumption	4,264.0	-0.71%
Investment	2,332.7	-1.04%
Government Expenditure	738.1	-0.20%
Exports	6,566.4	+0.65%
Imports	6,272.9	+0.10%
Real Exchange Rate	94 (Indexed)	+0.37%

Table 1. Key macroeconomic results under the oil price scenario of imported oil price increase by 49.3 percent. Source: Viet Nam ESAM-CGE model, 2025.

The illustrative scenario here points to a modest but broad-based macroeconomic contraction. Real GDP at market prices is estimated to fall by 0.25 per cent from the baseline, driven primarily by a squeeze on domestic demand as higher energy costs push up consumer prices and erode household purchasing power. Private consumption contracts by 0.71 per cent, reflecting the income effect on households. Government expenditure sees a smaller decline of 0.20 per cent. The one partial offset comes from the external sector: a modest real exchange rate depreciation of 0.37 per cent improves the price competitiveness of Viet Nam's exports, which register a marginal increase of 0.65 per cent from baseline, offsetting the dampening effect of rising cost of exports. However, this export uptick is insufficient to compensate for the demand compression across the rest of the economy, and total absorption falls by 0.75 per cent. Taken together, the results are consistent with the transmission mechanism expected from an external energy price shock: cost-push inflation contracting real incomes, dampening consumption and investment, with only limited relief from trade adjustment, assuming the exchange rate devaluates as suggested.

Sectoral Impact

An oil price increase does not affect all sectors uniformly. The heterogeneity of impacts reflects several interacting channels. The most immediate is oil use intensity: sectors that rely heavily on petroleum products as production inputs, such as the Transportation and Storage sector or the Oil Thermal power generation sector, face a direct and relatively inelastic rise in operating costs. A second channel works through intersectoral linkages, where even sectors with modest direct oil use are affected as cost increases from oil-intensive upstream suppliers pass through intermediate input prices.

Two channels shape the compositional picture. Sectors for which petroleum dependence is relatively high, are faced with relatively higher production costs than those that have relatively lower dependence on petroleum. Trade exposure also matters: export-oriented sectors, particularly in manufacturing, face a competitiveness squeeze which is offset by exchange rate depreciation. Together, these channels explain why a CGE simulation of an oil price shock produces highly heterogeneous outcomes across sectors, even when the initial price shock is uniform.

In practice, these channels operate simultaneously and interact with one another within the CGE framework. The model solves for a new economy-wide equilibrium in which prices, output, trade flows, and household incomes have all adjusted together, meaning the sectoral results presented below reflect the combined net effect of all channels rather than any single transmission mechanism in isolation. Sectors that are heavily exposed across multiple channels, through high direct oil intensity, deep upstream linkages, tend to bear a disproportionate burden. Figure 1 and 2 illustrate the simulated change in output by sector following the oil price shock.

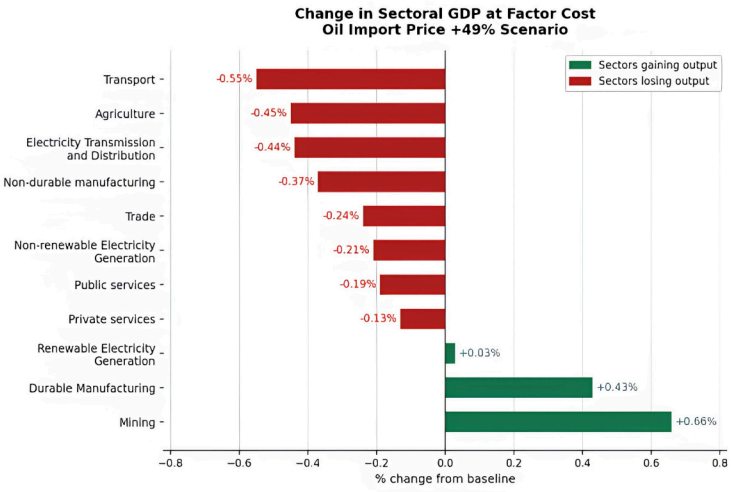


Figure 1. Change in Sectoral GDP (at Factor cost) in % from baseline for aggregated sectors

Percentage change in sectoral GDP from baseline under illustrative scenario. Positive values indicate sectors that expand under the shock. Source: Viet Nam ESAM-CGE model, 2025.

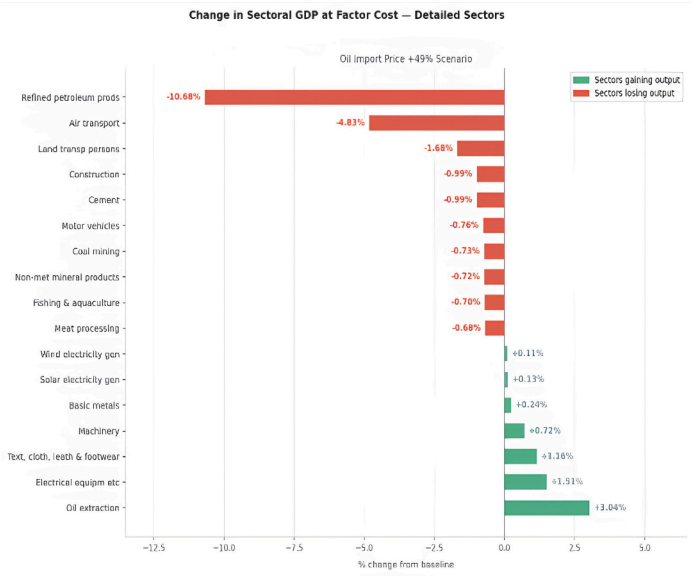


Figure 2. Change in Sectoral GDP (at Factor cost) in % from baseline for selected detailed sectors

Percentage change in sectoral GDP from baseline under illustrative scenario. Positive values indicate sectors that expand under the shock. Source: Viet Nam ESAM-CGE model, 2025.

The oil price shock produces a clear divide between losing and gaining sectors. The aggregated sectors chart in Figure 1 shows that Transport and Agriculture are the hardest hit, contracting by 0.55 and by 0.45 per cent respectively from baseline, reflecting their direct exposure to rising fuel and input costs. Electricity transmission and distribution falls by 0.44 per cent as demand contracts and logistics costs rise. On the other side, Mining expands by 0.66 per cent as higher world energy prices boost the value of domestic extraction, and Durable Manufacturing gains 0.43 per cent, likely supported by improved export competitiveness as the real exchange rate depreciates.

In the detailed sectoral breakdown in Figure 2, Refined petroleum products see the sharpest contraction (-10.68 per cent). Air transport (-4.83 per cent) and land passenger transport (-1.68 per cent) are negatively affected given their direct dependence on fuel. Cement and construction (both at approximately -0.99 per cent) also contract, with particular relevance to their centrality to Viet Nam's infrastructure investment agenda.

Notably, oil extraction itself expands (+3.40 per cent) as higher world prices substantially increase the production value of domestic production. The electrical equipment and textiles and garments sectors (+1.51 and +1.16 per cent respective) also benefits, as the real exchange rate depreciation improves export competitiveness for labour-intensive manufacturing, with positive implications for employment in that sector. Wind and solar electricity generation see modest expansion under this scenario.

DISTRIBUTIONAL IMPACT

A key feature of ESAM-CGE modelling is its ability to shed light on distributional outcomes. Different household groups can experience differential impact from a macro-level shock. It could be argued that households are affected differently by an oil price shock for two main reasons. First, household groups differ in the share of their budget spent on fuel and fuel energy-intensive goods such as transport. Moreover, the working hypothesis is that lower-income households tend to spend a larger proportion of their income on these necessities, making the real income loss from rising prices regressive in nature. Second, households derive income from different factor endowments. Those dependent on wages from sectors heavily exposed to the oil shock face both a price effect on consumption and an income effect from reduced earnings, compounding their overall welfare loss, while households with income diversified across capital or less-exposed sectors may be relatively less impacted. The CGE model captures both dimensions simultaneously, tracing how the shock feeds through to household income and welfare via both the goods market and the factor markets. This allows the prior expectations to be confirmed or not.

Household Income Impact

The ESAM disaggregates households into 20 groups by urban/rural location, farm/non-farm income source, and income quintile, enabling a granular assessment of welfare impacts. Household income is the total money received by a family— wages from jobs, profits from a business or farm, rent from land or property, and any government transfers such as pensions or subsidies. When any of these sources a lower yield, families have less to spend on food, education, healthcare, and other needs.

The oil price shock depresses nominal household income across all groups, with the magnitude of impact varying by household type and income level.

Urban non-farm households see greatest contraction in income in percentage terms. City families whose livelihoods come from wages such as for example factory workers, transport drivers, service workers, office employees see their incomes fall between 0.80% and 1.14%. Urban non-farm households at the top of the income distribution (Q5) face the largest nominal income reduction (-1.14 per cent), reflecting their greater exposure to capital and wage income from sectors more sensitive to the oil price shock. This pattern could be attributable to greater exposure of urban non-farm households to sectors experiencing larger contraction because of oil price increase.

Rural farm households appear to be the least impacted by this price shock. Farming families in rural areas see relatively smaller income falls compared to other groups, around 0.5–0.6% from baseline. This may reflect the relatively lower exposure of rural farm households to the sectors most affected by the oil price shock, alongside potential gains from agricultural price movements. The underlying SAM data also shows that that rural farm households receive a relatively higher share of their income from transfers (government and rest of the world). Government transfers are assumed to be fixed in nominal terms and due to the exchange rate depreciation foreign transfers are up. This current transfer system, from government, and benefitting from exchange rate depreciation have helped rural households relatively more than other groups.

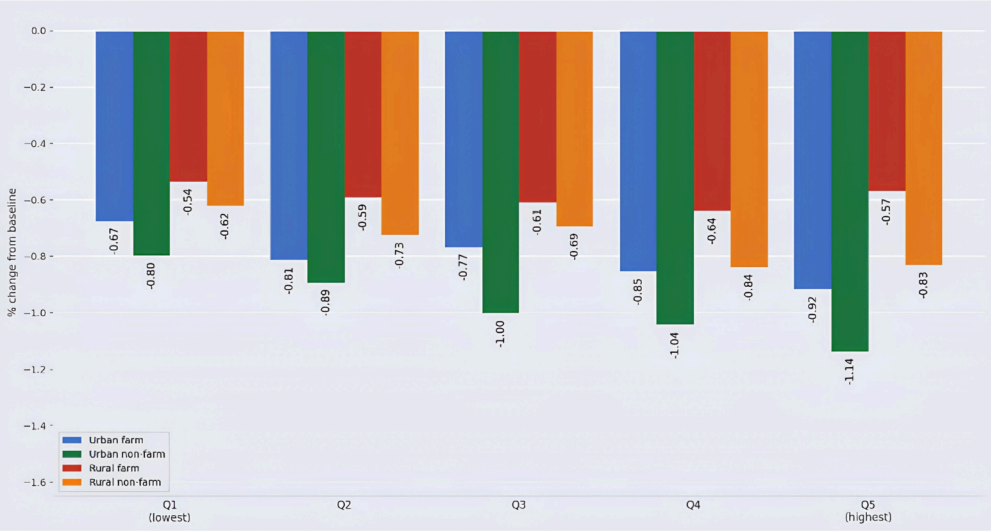


Figure 3: Change in household nominal income by type and income group (Oil +49.9% scenario)

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Real Welfare Loss

However, nominal income changes alone do not capture the full distributional picture. Lower-income households, particularly rural farm households, spend a proportionally higher share of their income on food and basic fuels. Rising prices for these necessities therefore erode real purchasing power more severely for poor households than the nominal income alone suggest. Economists use a measure called "equivalent variation" (EV) to capture some of these effects more accurately.

Equivalent variation (EV) is a welfare measure used in CGE modelling that captures the overall change in household well-being resulting from economy-wide changes in incomes, prices, and consumption patterns. The EV estimates presented here reflect the combined net effect of multiple transmission channels within the model and should not be interpreted as a pure price effect alone, although higher consumer prices and reduced real purchasing power are likely to be key drivers under an oil price shock scenario.

The chart below captures the welfare impact for different household groups:

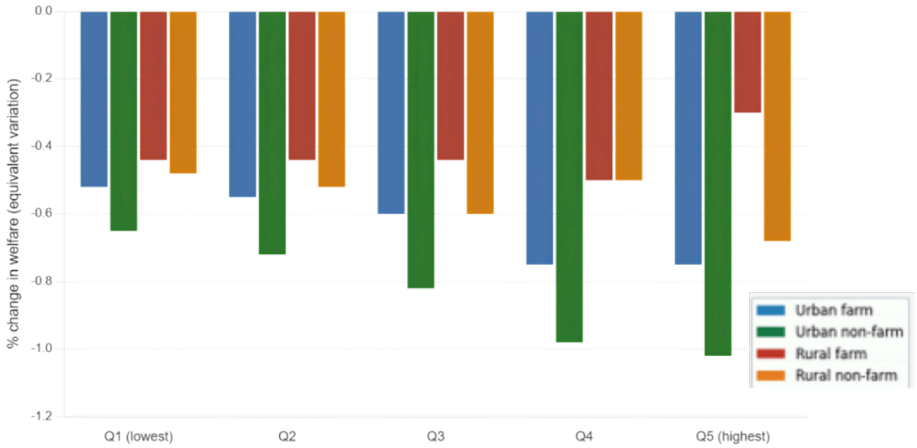


Figure 4: Real welfare loss (equivalent variation) by household type and income group

The EV chart shows a particularly striking result for rural farm households at the top of the income scale. Rural farm Q5 households — the wealthiest rural farmers — show a noticeably smaller welfare loss than their nominal income figures would suggest. This could be attributable to the fact that the expenditure basket of rural households are less exposed to the oil price shock, relative to the expenditure basket of other groups. SAM data also demonstrates that highest income rural farm households benefit the most out of all rural farm households from foreign transfers, and therefore currency depreciation has like contributed to insulating this group from negative impacts of oil price increase. Urban non-farm households, by contrast, show the deepest real welfare losses, likely due to lower income and consumption patterns more impacted by oil price increase.

Overall, the gap between nominal income loss and real welfare loss is widest for urban households. City dwellers face a "double squeeze": their income and therefore expenditure falls while their cost-of-living rises.

Changes in Household Spending

Beyond income effects, the oil price shock reshapes household consumption patterns as the relative prices of different goods change. Energy and transport costs rise most directly, but these increases cascade into food prices, manufactured goods, and services. When prices rise and real incomes fall, households do not reduce spending on everything equally. They cut back on things they can do without, delay big purchases, and shift to cheaper alternatives. This pattern of spending change reveals which products face falling demand — and, indirectly, which workers face the greatest risk of job losses.

The chart shows how real household spending (measured in base prices) on key commodity and service categories changes under the oil price

shock. Red bars indicate spending falls; a green bar indicates spending rises.

Spending on petroleum products face the biggest decrease of 8.1% — a significant demand destruction effect. This reduction represents direct, indirect, induced impacts (as captured in CGE modelling), i.e. spending on petroleum products and spending on other products that use petroleum as an input. The transport sector faces significant demand collapse. Air travel spending falls by 4.4%, water transport by 3.7%, and land freight by 2.5%. This has cascading effects on tourism, trade, and regional connectivity. There is also contraction in consumption of essential goods and services such as food, health and education. This requires close monitoring to ensure that human development does not risk sliding back if the current situation is not addressed swiftly.

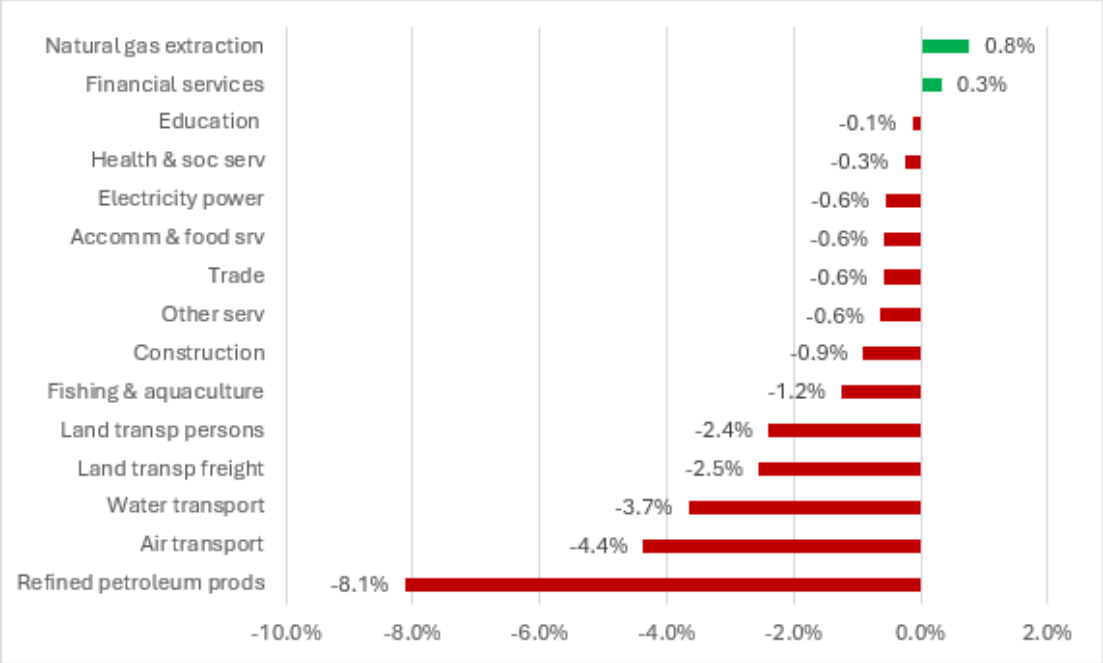


Figure 5: Change in household spending by commodity and service category (For selected number of sectors)

CONCLUSION AND IMPLICATIONS FOR UNDP COUNTRY OFFICES

Viet Nam entered this period of sharply higher energy prices in a strong position. Exports of electronics and electronic components are surging as global investment in data centers and related activities expands as part of the artificial intelligence boom. The country has also adjusted to rising import prices with the production of import substitutes, including fertilizers. However, some industries and groups of consumers have suffered a disproportionate impact. The modelling exercise carried out on the basis of the 2019 ESAM points to employment and price effects that disadvantage energy intensive sectors and urban households.

Even a moderate oil price shock of the kind associated with regional conflict disrupting shipping routes generates significant macroeconomic and distributional headwinds. For Viet Nam, a 49.3 per cent increase in oil import prices translates into a GDP growth drag of approximately 0.25 per cent, with meaningful sectoral contractions in energy-intensive and transport-dependent industries.

These aggregate effects alone however, mask important sectoral heterogeneity. Transport-dependent sectors (air, land passenger and freight), refined oil petroleum face the steepest output contractions, with implications for employment and supply chains that merit early attention in crisis response planning.

Governments need analytical tools that can quantify these magnitudes rapidly and credibly, and the CGE framework used here is one of them. The CGE model estimated from the 2019 ESAM has important policy implications. Nominal income losses are largest for urban non-farm households, particularly at the top of the income distribution, possibly reflecting greater exposure to wages and capital income from sectors most sensitive to the oil price shock. Rural farm households are comparatively less affected, which may be attributable to lower sectoral exposure and potential gains from agricultural price movements. Real welfare losses tell a more complex story: urban households face a double squeeze as both incomes and purchasing power

fall simultaneously, while rural farm households show a notably smaller welfare loss than their nominal income figures suggest, possibly due to consumption baskets that are less exposed to oil-intensive goods.

However, while upper income groups suffer the largest income falls, it is worth noting that urban poor households who have limited savings and disposable income may bear a greater burden of adjustment. The employment impact will be greatest in energy intensive sectors like petroleum products, tourism, transport and construction. Meanwhile, fuel subsidies mainly benefit higher income households which own personal vehicles and use more electricity. Due to complex intersecting channels of impact at play, policy interventions need to be assessed carefully, taking into account employment trends and spending patterns. Attention should be paid to low-income and other vulnerable groups to avoid an increase in the incidence and depth of poverty. Viet Nam must also carefully monitor the impact of higher energy prices on the balance of payments to avoid an unexpected external demand shock.

The CGE modelling exercise described in this policy brief illustrates the value to UNDP and government counterparts in compiling an up-to-date and comprehensive Energy Social Accounting Matrix to estimate the effects of external shocks on sectors, industries and groups of households. Geopolitical tensions, global financial instability, increasing evidence of the social and economic impact of climate change and rapid technological change—in the energy sector and beyond—demand timely and appropriate policy responses. This is difficult to achieve with evidence from partial equilibrium models and sectoral studies. UNDP can play an important role in ensuring that governments have the capacity to respond to shocks—both foreseen and unforeseen—with effective, well-targeted policy interventions.

Recommendation for UNDP Country Offices: The ESAM-CGE framework developed for Viet Nam demonstrates the value of investing in economy-wide modelling capacity grounded in disaggregated national data. Country offices working on economic resilience, social protection, or climate transition are encouraged to explore whether similar ESAM-based tools can be developed or adapted for their own country contexts. The Viet Nam experience, spanning from data construction to policy simulation, offers a replicable methodology with clear applications for the kinds of compound crises that UNDP is increasingly called upon to analyse and respond to, including commodity shocks, climate events and trade disruptions.

About the Viet Nam ESAM 2019

The 2019 Energy-focused Social Accounting Matrix (ESAM) for Viet Nam was constructed by UNDP Viet Nam in collaboration with the University of Copenhagen in Denmark, The Institute for Policy and Strategy Studies (IPSS), and The National Statistics Office of Viet Nam. It covers 46 activities, 41 commodities, 10 electricity sub-sectors, 11 factors of production, and 20 household groups disaggregated by location, farm status, and income quintile. The ESAM contains electricity use data in monetary terms which are combined with Energy Accounts in physical units to provide the foundation for both multiplier models and CGE simulations that can focus on aspects of just energy transition.

This policy note was prepared by UNDP Viet Nam. All model simulations are illustrative and should not be interpreted as forecasts. Data: Viet Nam ESAM 2019, CGE Model under project with University of Copenhagen, Institute of Policy and Strategic Studies and Viet Nam's National Statistics Office. | For further information, contact UNDP Viet Nam.