

# The Economic Impact on Cambodia of International Energy-Market Disruption



James Giesecke, Robert Waschik  
Milan Thomas, and Chhorn Dina

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## List of acronyms and abbreviations

|          |                                                                                    |
|----------|------------------------------------------------------------------------------------|
| ADB      | Asian Development Bank                                                             |
| CDC      | Council for the Development of Cambodia                                            |
| CDRI     | Cambodia Development Resource Institute                                            |
| E&E      | Electronics and electrical                                                         |
| EAC      | Electricity Authority of Cambodia                                                  |
| EU       | European Union                                                                     |
| EV       | Electric vehicle                                                                   |
| FDI      | Foreign direct investment                                                          |
| GDP      | Gross domestic product                                                             |
| GEMPACK  | General Equilibrium Modelling PACKage (simulation software used to solve GTAP-FIN) |
| GTAP     | Global Trade Analysis Project                                                      |
| GTAP-FIN | GTAP model incorporating a financial sector                                        |
| IDPoor   | Cambodia's Identification of Poor Households Programme                             |
| IMF      | International Monetary Fund                                                        |
| MAFF     | Ministry of Agriculture, Forestry and Fisheries                                    |
| MEF      | Ministry of Economy and Finance                                                    |
| MISTI    | Ministry of Industry, Science, Technology and Innovation                           |
| MLVT     | Ministry of Labour and Vocational Training                                         |
| MME      | Ministry of Mines and Energy                                                       |
| MoC      | Ministry of Commerce                                                               |
| MOSVY    | Ministry of Social Affairs, Veterans and Youth Rehabilitation                      |
| OPEC     | Organization of the Petroleum Exporting Countries                                  |
| PRC      | People's Republic of China                                                         |
| SAR      | Special Administrative Region                                                      |
| TVET     | Technical and Vocational Education and Training                                    |
| UK       | United Kingdom                                                                     |
| UN       | United Nations                                                                     |
| US/USA   | United States (of America)                                                         |

## Executive summary

Conflict in the Persian Gulf since February 2026 has driven up world prices for oil, gas, refined fuel and fertiliser, and has led some of the region's suppliers to restrict exports of these goods. Cambodia produces no oil of its own and depends on a small number of regional suppliers for its fuel and fertiliser, so it is exposed to both pressures at once. This report uses an economy-wide simulation model, GTAP-FIN, to estimate the size of that exposure and to set out a practical set of policy priorities for Cambodian decision-makers.

Under a moderate scenario, the model finds that Cambodian GDP would be around 1.16 percent lower in 2026 than it would otherwise be, household consumption around 3.93 percent lower, investment down by roughly 5.57 percent, and employment down about 2.42 percent. Construction and other investment-linked industries absorb most of the slowdown. A smaller group of export-oriented industries, including rubber, plastics and other trade-exposed manufacturing, actually benefits, because the weaker exchange rate that accompanies the shock makes their exports more competitive. The higher fuel and fertiliser prices affect Cambodia mainly by worsening its terms of trade: the country must give up more of its own output to pay for the same volume of imports.

The two sources of disruption behave differently over time. The effects of higher world energy prices fade as global markets adjust, with most of the damage concentrated in 2026 and substantial recovery by 2031. Export restraints imposed by neighbouring suppliers prove more persistent: because other suppliers do not readily step in to fill the gap, their smaller but steady drag on the economy continues through to the end of the simulation period. This distinction matters for policy, since the appropriate response to a temporary price spike differs from the response needed for a sustained supply constraint.

These results point to policy recommendations organised around five priorities:

- **Energy security:** Reduce exposure to imported energy by accelerating renewable energy deployment and building strategic fuel and fertiliser reserves;
- **Fiscal resilience:** Protect households through targeted, time-bound cash transfers rather than broad fuel subsidies, while preserving Cambodia's limited fiscal space for priority spending;
- **Agricultural resilience:** Secure fertiliser supply chains ahead of the planting season through emergency coordination and strategic stocks;
- **Industrial diversification:** Turn the currency depreciation that accompanies these shocks into an opportunity by promoting investment in electronics and electrical component manufacturing;
- **Social protection:** Strengthen support and skills training for affected workers and households, including scaling up the IDPoor social protection system and building a workforce for the renewable energy sector.

Delivering on these priorities will require sustained coordination across ministries; an energy security council, co-chaired by the Ministry of Economy and Finance and the Ministry of Mines and Energy, is recommended as the mechanism for doing so. The central message for policymakers is that Cambodia's vulnerability to energy-market disruption is structural, arising from its dependence on a small number of import sources, and that reducing this dependence, while cushioning households and firms in the interim, offers the greatest long-run protection against future shocks of this kind.



## 1. Introduction and motivation

We use GTAP-FIN, a dynamic global computable general equilibrium model, to examine the impact on the Cambodian economy of energy-market disruption in 2026. Beginning in February 2026, conflict in the Persian Gulf disrupted oil and gas production and impaired shipping through the Strait of Hormuz, raising world prices for crude oil, natural gas, refined petroleum products and chemicals. Higher natural gas prices and tighter supply raised the price of nitrogen fertiliser in particular. Several producing economies responded by restraining exports of refined fuels and fertiliser in favour of domestic supply, further tightening conditions for import-dependent economies.

Cambodia is exposed to this disruption on two fronts. It has no domestic oil production or refining capacity, and meets its demand for liquid fuels through imports of refined petroleum products from a small number of regional suppliers. It is likewise dependent on imported chemical fertiliser. Higher world energy prices therefore affect Cambodia directly, through the cost of imported fuels and fertiliser, and indirectly, as these costs pass through the input-output structure of the economy to the costs of transport, agriculture and other production. Export restraints by regional suppliers compound both effects.

The model identifies the Gulf and Arabian Peninsula as a distinct region, reflecting the concentration of the disruption in that region and allowing other oil- and gas-producing regions to respond as competing suppliers. It retains separate detail for the four commodities through which the shocks operate - oil, gas, refined petroleum products, and chemicals, the last embedding fertiliser - and identifies Cambodia's principal trading partners individually. The regional and sectoral aggregations are reported in the Appendix.

We examine two sets of shocks. The first is the rise in world energy prices, modelled as a fall in the productivity of oil and gas production in the Gulf and Arabian Peninsula, together with a deterioration in the productivity of the region's refined petroleum and chemical industries. The second is a set of restraints on exports of refined petroleum and fertiliser by China, Thailand and Vietnam, the principal regional suppliers of these products to Cambodia. We consider each set of shocks under three scenarios - light, moderate and severe - to trace how the consequences for Cambodia scale with the severity of the disruption.

The report proceeds as follows. Section 2 describes the GTAP-FIN model. Section 3 specifies the shocks and reports their estimated consequences for Cambodia's macroeconomic aggregates and for sectoral output and employment. Section 4 discusses results for other regions. Section 5 concludes.

## 2. Model and simulation design

### 2.1. The GTAP-FIN model

The GTAP-FIN model builds on the GTAP framework (Hertel 1997; Corong et al. 2017). It is a recursive dynamic model of the global economy, solved year-on-year. GTAP-FIN extends GTAP in three respects: (i) wage rigidity; (ii) sector-specific capital; and (iii) financial flows. We describe each in turn.

**Wage rigidity:** GTAP-FIN adopts the labour market specification of Dixon and Rimmer (2002), in which real wages are sticky in the short run but flexible in the long run. A shock to the labour market is therefore manifested in the short run as a change in both employment and wages, with a gradual transition to a long-run outcome in which the effect falls on wages and employment returns to its baseline level.

**Sector-specific capital:** In the standard GTAP model, capital is mobile across industries within a region. In GTAP-FIN, capital is specific to each regional industry (Dixon, Rimmer, and Tran 2019). New capital is created with a common technology but allocated across industries according to relative rates of return. This captures the adjustment costs facing capital, so that an industry experiencing a fall in its rate of return contracts through reduced investment over time, rather than through an immediate reallocation of its capital to other industries.

**Financial module:** The financial theory of GTAP-FIN is described in Dixon et al. (2021) and builds on the Global Trust concept of Ianchovichina and McDougall (2012). GTAP-FIN makes three changes. First, it introduces bilateral financial relationships, allowing analysis of policies in which regions discriminate between financial flows from particular partners. Second, it recognises that finance flowing from region *r* to region *s* may either establish a claim on the physical capital of *s* or be redirected by *s* to a third region, consistent with financial data that record claims of the residents of one region on those of another rather than on physical capital directly. Third, it replaces the cross-entropy allocation method with a financial optimiser in each region, which allocates the region's financial budget across domestic capital and foreign financial assets according to expected rates of return.

We solve GTAP-FIN using the GEMPACK software (Horridge et al. 2018) via the Runge-Kutta method.

## 2.2. Database and aggregation

GTAP-FIN is calibrated to the GTAP 12 Data Base, which has a 2023 reference year (Aguiar et al. 2025). This is a more recent vintage than that underlying our related earlier work with GTAP-FIN (Giesecke, Waschik, and Thomas 2025), which drew on the GTAP v.11c Data Base for 2017 (Aguiar et al. 2022). The asset and liability database that underpins the model's financial module is correspondingly updated to a 2023 data year.

For this study, we aggregate the GTAP 12 regions to 35 and condense its industries to 55. The regional aggregation identifies the Gulf and Arabian Peninsula as a distinct region, separate from the rest of the Middle East and from North Africa, and identifies Cambodia and its principal trading partners, including China, Thailand and Vietnam, individually. The sectoral aggregation retains separate detail for the four commodities through which the energy-market disruption operates: oil, gas, refined petroleum products, and chemicals. The full regional and sectoral aggregations are reported in the Appendix.

## 2.3. Baseline simulation

A GTAP-FIN application comprises two simulations: a baseline and a policy simulation. The baseline is a business-as-usual projection of the global economy in the absence of the disturbance under study. The policy simulation imposes the shocks of interest on this baseline, and results are reported as percentage deviations of variables from their baseline values. This isolates the effects of the shocks from the underlying evolution of the economy.

The baseline spans 2026 to 2031. It reflects observed data to the most recent year for which they are available and forecasts thereafter, drawn from external sources where available and

otherwise developed by the authors. Real GDP, for example, is constrained to follow IMF estimates and forecasts over the forecast horizon, with regional labour productivity growth accommodating these paths. Beyond the forecast horizon, real GDP is shaped by assumed rates of labour productivity growth and employment growth.

## 2.4. Energy price shocks

The first set of shocks represents the rise in world energy prices caused by the conflict in the Gulf and Arabian Peninsula region. We model this as a deterioration in productivity in the region's energy-producing industries, which raises the cost, and hence the price, of their output.

Table 1: Energy-price shocks, Gulf and Arabian Peninsula

| Shocked variable                                | Light | Moderate | Severe |
|-------------------------------------------------|-------|----------|--------|
| Price of oil output <sup>1</sup>                | +25%  | +50%     | +75%   |
| Price of gas output <sup>1</sup>                | +25%  | +50%     | +75%   |
| All-input-using productivity, refined petroleum | −5%   | −10%     | −15%   |
| All-input-using productivity, chemicals         | −5%   | −10%     | −15%   |

<sup>1</sup> Implemented via endogenous determination of the productivity of the regional oil and gas industries.

Source: Authors' calculations

For oil and gas, we shock the 2026 price of regional output directly, allowing the productivity of the Gulf and Arabian Peninsula oil and gas industries to adjust endogenously to deliver the targeted price rise. Across the three scenarios, the 2026 price of regional oil output rises by 25, 50 and 75 percent, and the price of regional gas output by the same magnitudes. For refined petroleum products (p\_c) and chemicals (chm), we impose a deterioration in all-input-using productivity in the Gulf and Arabian Peninsula industries of 5, 10 and 15 percent across the three scenarios. These productivity deteriorations remain in place for the duration of the simulation. The shocks are summarised in Table 1. The implications for GTAP-FIN's world energy markets of these shocks are summarised in Table 2, which reports impacts in 2026 and 2031 on output and price of oil, gas, refined petroleum products and chemicals in the direct shock region (Gulf & Arabian Peninsula), the rest of the world, and the world as a whole, under the light, moderate and severe scenarios.

Because the energy-price shocks are directed at the Gulf and Arabian Peninsula specifically, the price rises for the four affected commodities are highest in this region - directly so for oil and gas, whose 2026 output prices are shocked, and indirectly for refined petroleum and chemicals, whose prices rise as a consequence of higher input costs and the productivity shocks they bear. Nevertheless, because inter-regional substitution elasticities for oil and gas in particular are high, these regional price rises transmit to higher prices globally. For example, in 2026 under the severe scenario, the Gulf oil price rises by 75.0 percent. Via substitution towards alternative sources, this pushes up oil prices from sources in the rest of the world by 63.7 percent. The corresponding figures for gas are 75.0 and 46.3 percent, for refined petroleum 73.2 and 45.0 percent, and for chemicals 22.2 and 6.5 percent. A wedge therefore opens between the price of energy originating in the shocked region and the price elsewhere. The wedge reflects the regional incidence of the shock: the contraction in supply is located in the Gulf, so Gulf-origin output carries the larger price increase, while producers elsewhere expand output in response to higher world prices and so face a smaller rise. While this pattern emerges endogenously within

the model, it is nevertheless consistent with the divergence observed during the disruption between Gulf-exposed crude benchmarks, such as Brent and the OPEC Reference Basket, and more insulated benchmarks such as West Texas Intermediate.

The contractions in Gulf oil and gas output reflect the direct impact of the shock. As discussed in the context of Table 1, the supply disruptions in these regions are modelled as efficiency losses in the oil and gas production sectors, which manifest in Table 2 as significant reductions in oil and gas output in the Gulf region. The rise in world oil and gas prices stimulates oil and gas output in the rest of the world, and substitution away from energy-intensive products. By 2031, the oil and gas output expansion in the rest of the world is elevated relative to the 2026 response, reflecting expansion in capacity over the period in response to the adverse Gulf shocks. Nevertheless, at the global level, the contractions in Gulf output dominate, which explains why oil and gas output globally contracts in all three scenarios over all time horizons, despite the increase in output in the rest of the world.

Refined petroleum and chemical production in the Gulf face two adverse shocks: large increases in the price of their oil and gas inputs, and the adverse productivity shocks themselves (Table 1). This results in output contractions for these two sectors that are, in each scenario, of a similar magnitude to the output contractions of the Gulf oil and gas sectors. The contractions in Gulf production of refined petroleum and chemicals pushes up the price of the output of these commodities produced in this region. Globally, this induces substitution towards alternative suppliers. In GTAP-FIN, the import substitution elasticities for these commodities are lower than those for oil. Hence, a wider gap opens between the rest-of-world and Gulf prices for these commodities than for oil. Note that the chemical price effects are smaller than for the other commodities. This reflects that, while chemicals receives a productivity shock of the same magnitude as refined petroleum, energy inputs are a smaller share of chemical production costs than for refined petroleum.

Table 2: World energy-market outcomes by region (percentage deviation from baseline)

| Variable                                 | Light scenario |        | Moderate scenario |        | Severe scenario |        |
|------------------------------------------|----------------|--------|-------------------|--------|-----------------|--------|
|                                          | 2026           | 2031   | 2026              | 2031   | 2026            | 2031   |
| <b>Oil output</b>                        |                |        |                   |        |                 |        |
| Gulf & Arabian Peninsula                 | -11.90         | -11.40 | -20.97            | -20.23 | -28.41          | -27.46 |
| Rest of world                            | 1.44           | 4.52   | 2.39              | 8.23   | 3.07            | 11.39  |
| World                                    | -2.99          | -0.53  | -5.43             | -0.87  | -7.53           | -1.12  |
| <b>Oil price</b>                         |                |        |                   |        |                 |        |
| Gulf & Arabian Peninsula                 | 25.00          | 7.80   | 50.00             | 14.64  | 75.00           | 20.96  |
| Rest of world                            | 21.62          | 4.55   | 42.83             | 8.39   | 63.68           | 11.85  |
| World                                    | 22.68          | 5.51   | 44.99             | 10.14  | 66.98           | 14.30  |
| <b>Gas output</b>                        |                |        |                   |        |                 |        |
| Gulf & Arabian Peninsula                 | -14.22         | -14.31 | -24.96            | -25.15 | -33.88          | -34.15 |
| Rest of world                            | 0.75           | 2.73   | 1.24              | 4.87   | 1.58            | 6.68   |
| World                                    | -2.54          | -0.94  | -4.64             | -1.75  | -6.54           | -2.53  |
| <b>Gas price</b>                         |                |        |                   |        |                 |        |
| Gulf & Arabian Peninsula                 | 25.00          | 9.97   | 50.00             | 19.60  | 75.00           | 29.76  |
| Rest of world                            | 17.08          | 3.06   | 32.46             | 5.39   | 46.33           | 7.32   |
| World                                    | 18.67          | 4.42   | 35.79             | 8.02   | 51.50           | 11.23  |
| <b>Refined petroleum products output</b> |                |        |                   |        |                 |        |
| Gulf & Arabian Peninsula                 | -9.24          | -9.60  | -18.38            | -18.33 | -27.53          | -26.39 |
| Rest of world                            | -2.24          | 0.14   | -3.96             | 0.40   | -5.32           | 0.72   |
| World                                    | -2.95          | -0.84  | -5.46             | -1.54  | -7.69           | -2.18  |
| <b>Refined petroleum products price</b>  |                |        |                   |        |                 |        |
| Gulf & Arabian Peninsula                 | 21.69          | 10.48  | 45.91             | 21.60  | 73.21           | 33.85  |
| Rest of world                            | 15.21          | 3.84   | 30.22             | 7.05   | 45.04           | 9.90   |
| World                                    | 15.83          | 4.47   | 31.67             | 8.35   | 47.51           | 11.95  |
| <b>Chemical products output</b>          |                |        |                   |        |                 |        |
| Gulf & Arabian Peninsula                 | -13.75         | -14.23 | -28.34            | -26.36 | -44.87          | -37.36 |
| Rest of world                            | -0.32          | 0.22   | -0.58             | 0.42   | -0.74           | 0.62   |
| World                                    | -0.64          | -0.10  | -1.25             | -0.18  | -1.84           | -0.25  |
| <b>Chemical products price</b>           |                |        |                   |        |                 |        |
| Gulf & Arabian Peninsula                 | 5.73           | 4.34   | 12.63             | 8.68   | 22.15           | 13.38  |
| Rest of world                            | 2.22           | 0.86   | 4.36              | 1.56   | 6.46            | 2.17   |
| World                                    | 2.30           | 0.93   | 4.53              | 1.70   | 6.74            | 2.37   |

Note: Output and price of oil, gas, refined petroleum products and chemicals, Gulf & Arabian Peninsula, rest of world, and world, under the light, moderate and severe scenarios, 2026 and 2031.

Source: Authors' calculations

## 2.5. Export restraints

The second set of shocks represents the restraint of exports of refined petroleum and fertiliser by China, Thailand, and Vietnam, the principal regional suppliers of these products to Cambodia. We confine the set of restraining regions to these three, which are observed to have restrained exports over the period.

For refined petroleum, we reduce the exports of each of the three regions by 5, 10 and 15 percent across the three scenarios, allowing the export tax on the commodity to adjust endogenously to deliver the targeted reduction.

The treatment of fertiliser requires an intermediate step because the model does not identify fertiliser as a separate commodity but instead aggregates it within chemicals (chm). We therefore translate an assumed restraint on fertiliser exports into equivalent restraints on chemical exports, scaling by the share of fertiliser in the relevant chemical trade. The underlying assumption is a restraint on the fertiliser exports of each of the three regions of 10, 40 and 70 percent across the three scenarios.

This translation proceeds in two layers, reflecting that fertiliser accounts for a much larger share of these regions' chemical exports to Cambodia than of their chemical exports in general. UN Comtrade data indicate that fertiliser accounts for 6.2, 1.1 and 6.8 percent of the chemical exports of China, Thailand and Vietnam, respectively, but for 19.8, 25.6 and 52.3 percent of their chemical exports to Cambodia specifically. Accordingly:

- A *general* restraint reduces each region's chemical exports by the fertiliser-export restraint scaled by the share of fertiliser in its total chemical exports. This yields reductions in chemical exports of 0.6, 2.5 and 4.3 percent for China; 0.1, 0.4 and 0.8 percent for Thailand; and 0.7, 2.7 and 4.8 percent for Vietnam, across the three scenarios.
- A *Cambodia-specific* restraint reduces each region's chemical exports to Cambodia by the fertiliser-export restraint scaled by the higher share of fertiliser in its chemical exports to Cambodia. This yields reductions of 1.4, 5.4 and 9.5 percent for China; 2.5, 9.8 and 17.2 percent for Thailand; and 4.6, 18.2 and 31.9 percent for Vietnam, across the three scenarios.

The shocks are summarised in Table 3. The two layers reflect the same underlying fertiliser restraint, applied first to each region's chemical exports as a whole and then, more intensively, to its chemical exports to Cambodia, where the fertiliser content is greatest. The effect is concentrated on Cambodia, and is largest in the case of Vietnam, more than half of whose chemical exports to Cambodia consist of fertiliser.

Table 3: Export-restraint shocks, China, Thailand, and Vietnam

| Shocked variable                                           | Light | Moderate | Severe |
|------------------------------------------------------------|-------|----------|--------|
| Refined petroleum exports <sup>1</sup>                     | –5%   | –10%     | –15%   |
| <i>Fertiliser export restraint (underlying assumption)</i> | –10%  | –40%     | –70%   |
| Chemical exports – in general <sup>2</sup>                 |       |          |        |
| China                                                      | –0.6% | –2.5%    | –4.3%  |
| Thailand                                                   | –0.1% | –0.4%    | –0.8%  |
| Vietnam                                                    | –0.7% | –2.7%    | –4.8%  |
| Chemical exports – to Cambodia <sup>3</sup>                |       |          |        |
| China                                                      | –1.4% | –5.4%    | –9.5%  |
| Thailand                                                   | –2.5% | –9.8%    | –17.2% |
| Vietnam                                                    | –4.6% | –18.2%   | –31.9% |

<sup>1</sup> Applied to each of China, Thailand and Vietnam; implemented via endogenous determination of the export tax.

<sup>2</sup> Fertiliser-export restraint scaled by the share of fertiliser in each region's total chemical exports (6.2, 1.1 and 6.8 percent for China, Thailand and Vietnam). <sup>3</sup> Fertiliser-export restraint scaled by the share of fertiliser in each region's chemical exports to Cambodia (19.8, 25.6 and 52.3 percent).

Source: Authors' calculations

### 3. Consequences for Cambodia

#### 3.1. Energy price shocks

##### 3.1.1. Macroeconomic aggregates

Table 4 reports percentage deviations of Cambodian macroeconomic variables from baseline under the energy price shocks centred on the Gulf and Arabian Peninsula region (see Section 2.4). Results are reported for two periods: the shock year, 2026, and five years later, 2031.

As noted in the discussion of Table 2, under each scenario, world energy and chemical prices spike in 2026 and, while they moderate thereafter, remain elevated relative to baseline in 2031. For Cambodia, as an energy and chemical importer, these price rises translate into a deterioration in its terms of trade (see Table 4 ). Under each scenario, the terms of trade deterioration is most pronounced in the shock year. Consistent with the results in Table 2, which point to attenuation of the price increases over time arising from global supply and demand responses to the shocks, the Cambodian terms of trade losses are also less deep in 2031 than in 2026. A secondary factor easing Cambodia's terms of trade decline in 2031 relative to 2026 is the smaller investment deviation. We return to this factor below.

Table 4: Cambodian macroeconomic outcomes: Energy price shock (% deviation from baseline)

| Variable                     | Light scenario |       | Moderate scenario |       | Severe scenario |       |
|------------------------------|----------------|-------|-------------------|-------|-----------------|-------|
|                              | 2026           | 2031  | 2026              | 2031  | 2026            | 2031  |
| Real GDP                     | -0.58          | -0.16 | -1.16             | -0.28 | -1.74           | -0.39 |
| Employment                   | -1.22          | -0.01 | -2.42             | 0.00  | -3.60           | 0.00  |
| Capital                      | 0.00           | -0.32 | 0.00              | -0.59 | 0.00            | -0.84 |
| Real consumer wage           | -0.79          | -0.60 | -1.58             | -1.09 | -2.34           | -1.53 |
| Real private consumption     | -1.99          | -0.47 | -3.93             | -0.84 | -5.80           | -1.17 |
| Real investment              | -2.74          | -0.35 | -5.57             | -0.64 | -8.26           | -0.90 |
| Real public consumption      | -1.99          | -0.47 | -3.93             | -0.84 | -5.80           | -1.17 |
| Export volumes               | 0.67           | 0.00  | 1.33              | 0.00  | 1.91            | -0.01 |
| Import volumes               | -1.34          | -0.29 | -2.67             | -0.53 | -3.95           | -0.75 |
| GDP deflator                 | -2.20          | -0.18 | -4.36             | -0.35 | -6.43           | -0.51 |
| Private consumption deflator | -0.73          | 0.22  | -1.47             | 0.38  | -2.18           | 0.52  |
| Terms of trade               | -1.72          | -0.40 | -3.34             | -0.74 | -4.86           | -1.03 |
| Investment price deflator    | -0.95          | 0.13  | -1.97             | 0.22  | -2.94           | 0.30  |

Source: Authors' calculations

We begin by discussing the 2026 results. We focus on the moderate scenario, since the light and severe scenario results are largely proportionate to the moderate outcomes, in line with the relative sizes of the underlying shocks. As noted above, the terms of trade decline (3.34 percent) is the point of first impact for the Cambodian macroeconomy. It generates several adverse macroeconomic outcomes in 2026. First, we model real wages as sticky in the short-run. In this setting, a fall in the terms of trade raises the real producer wage. This accounts for the fall in Cambodian employment in 2026. The lower employment generates a negative deviation in Cambodian real GDP in 2026 of -1.16 percent. The negative deviations in real GDP and in the terms of trade together cause real national income to fall, which generates negative deviations in private and public consumption spending. At the same time, the terms of trade decline reduces the return on capital relative to its cost, pushing down the rate of return on capital. This effect is augmented by the short-run fall in employment, which raises the capital / labour ratio and so lowers the marginal product of capital, further dampening short-run capital returns. This accounts for the substantial negative deviation in real investment in 2026. Together, the negative deviations in real consumption and real investment exceed in magnitude the negative deviation in real GDP. This moves Cambodia's real balance of trade towards surplus, which augments the negative terms of trade deviation generated by the rise in energy and chemical prices.

The severity of the Cambodian macroeconomic outcomes moderates by 2031. This reflects both the moderation of world energy and chemical price increases and economic adjustments within Cambodia. As noted earlier, adjustments in world energy markets reduce the 2031 energy price responses relative to 2026. Hence, Cambodia's terms of trade loss in 2031 is substantially smaller than in 2026. Within Cambodia, real wage adjustment has largely returned employment to baseline. This moderates the real GDP loss in 2031 relative to 2026. Nevertheless, the short-run negative deviations in investment, together with the persistent negative deviation in Cambodia's terms of trade, mean that the capital / labour ratio must fall in the long run. This explains the negative deviation in Cambodia's capital stock in 2031. This lower capital stock

generates a negative deviation in real GDP in 2031. Together with the negative deviation in the terms of trade, it generates a negative deviation in real consumption spending in 2031. The negative terms of trade deviation in 2031 thus continues to move Cambodia's real balance of trade towards surplus, which explains why the export deviation lies above the import deviation in 2031 under each scenario.

### 3.1.2. Sectoral outcomes

Tables 5 and 6 report sectoral output and employment outcomes. We focus on the output responses, since the employment outcomes largely reflect them.

Table 5: Energy price shocks - Impact on Cambodian industry output (% deviation from baseline)

| Sector                                 | Light scenario |       | Moderate scenario |       | Severe scenario |       |
|----------------------------------------|----------------|-------|-------------------|-------|-----------------|-------|
|                                        | 2026           | 2031  | 2026              | 2031  | 2026            | 2031  |
| Agriculture, forestry and fishing      | -0.18          | -0.01 | -0.36             | -0.02 | -0.55           | -0.03 |
| Mining                                 | -0.45          | -0.01 | -0.99             | -0.07 | -1.61           | -0.16 |
| Agro-processing                        | -0.25          | -0.12 | -0.50             | -0.21 | -0.76           | -0.30 |
| Garments, footwear & travel goods      | -0.21          | -0.22 | -0.45             | -0.39 | -0.74           | -0.56 |
| Wood, paper products, publishing       | 0.63           | 0.11  | 1.27              | 0.21  | 1.86            | 0.30  |
| Petrol., coal, chem. & assoc. products | 4.21           | 1.67  | 8.49              | 3.09  | 12.80           | 4.38  |
| Non-metallic mineral products          | -2.02          | -0.34 | -4.12             | -0.61 | -6.15           | -0.86 |
| Metal product manufacturing            | 0.75           | -0.23 | 1.34              | -0.46 | 1.72            | -0.73 |
| Machinery & equipment manufacture      | -0.53          | -0.30 | -1.09             | -0.54 | -1.70           | -0.77 |
| Utilities                              | -0.64          | -0.11 | -1.27             | -0.21 | -1.91           | -0.31 |
| Construction                           | -2.59          | -0.35 | -5.27             | -0.65 | -7.83           | -0.91 |
| Wholesale & retail trade               | -0.85          | -0.24 | -1.71             | -0.43 | -2.58           | -0.61 |
| Accommodation & food services          | 0.78           | -0.02 | 1.55              | -0.05 | 2.27            | -0.09 |
| Other services                         | -1.12          | -0.54 | -2.23             | -0.96 | -3.34           | -1.34 |
| Public admin, education & health       | -1.90          | -0.54 | -3.76             | -0.98 | -5.57           | -1.38 |

Source: Authors' calculations

Table 6: Energy price shocks - Impact on Cambodian industry employment (% deviation from baseline)

| Sector                                 | Light scenario |       | Moderate scenario |       | Severe scenario |       |
|----------------------------------------|----------------|-------|-------------------|-------|-----------------|-------|
|                                        | 2026           | 2031  | 2026              | 2031  | 2026            | 2031  |
| Agriculture, forestry and fishing      | -0.36          | 0.09  | -0.69             | 0.17  | -1.04           | 0.24  |
| Mining                                 | -1.43          | -0.23 | -3.09             | -0.44 | -4.94           | -0.66 |
| Agro-processing                        | -0.79          | -0.11 | -1.58             | -0.17 | -2.40           | -0.23 |
| Garments, footwear & travel goods      | 0.01           | -0.03 | -0.02             | -0.03 | -0.15           | -0.05 |
| Wood, paper products, publishing       | 4.85           | 0.02  | 10.01             | 0.13  | 15.13           | 0.21  |
| Petrol., coal, chem. & assoc. products | 5.64           | 1.86  | 11.44             | 3.45  | 17.34           | 4.88  |
| Non-metallic mineral products          | -2.44          | -0.32 | -4.98             | -0.57 | -7.42           | -0.79 |
| Metal product manufacturing            | 1.38           | -0.27 | 2.47              | -0.49 | 3.18            | -0.75 |
| Machinery & equipment manufacture      | -0.97          | -0.16 | -2.02             | -0.25 | -3.19           | -0.35 |
| Utilities                              | -1.99          | 0.15  | -3.95             | 0.27  | -5.90           | 0.38  |
| Construction                           | -5.67          | -0.13 | -11.38            | -0.25 | -16.71          | -0.32 |
| Wholesale & retail trade               | -1.67          | -0.19 | -3.38             | -0.32 | -5.08           | -0.44 |
| Accommodation & food services          | 1.23           | -0.02 | 2.47              | -0.04 | 3.62            | -0.08 |
| Other services                         | -3.91          | -0.21 | -7.63             | -0.38 | -11.15          | -0.50 |
| Public admin, education & health       | -2.20          | -0.55 | -4.34             | -1.01 | -6.44           | -1.42 |

Source: Authors' calculations

Most sectors contract, consistent with the general contraction in macroeconomic activity. In 2026, the largest contraction is in construction, reflecting the sharp decline in aggregate investment in that year. The same factor explains the large 2026 contraction in non-metallic mineral products, which includes cement, bricks and glass, which are key inputs to investment and construction activity.

Four sectors expand, however, reflecting the effects of real depreciation on import competition and export competitiveness:

*Wood, paper products and publishing.* This sector expands by 1.27 percent in 2026. It comprises the GTAP industries lum (wood products) and ppp (paper products and publishing), the former dominating the sector's activity in Cambodia. The expansion largely reflects the trade exposure of wood products, both to import competition (approximately 20 percent of domestic wood products use in Cambodia is imported) and to export markets (approximately 20 percent of Cambodian wood products output is exported). Real exchange rate depreciation benefits the sector on both fronts, raising the relative price of imported wood products and improving the competitiveness of Cambodian output in export markets.

*Petroleum, coal, chemical and associated products.* This sector expands by 8.49 percent relative to baseline in 2026 and remains 3.09 percent above baseline in 2031. As noted in the appendix, it comprises the GTAP industries p\_c (petroleum and coal products), chm (chemical products), bph (pharmaceutical products) and rpp (rubber and plastic products). In Cambodia, the last of these dominates, accounting for about 82 percent of the sector's activity. The Cambodian rubber and plastic products industry is heavily export-oriented and so benefits from the real depreciation generated by the terms of trade deterioration.

*Metal product manufacturing.* This sector comprises the GTAP industries *i\_s* (ferrous metals), *nfm* (metals n.e.c.) and *fmp* (metal products). Its expansion reflects real depreciation, which assists the domestic ferrous metals industry (approximately 45 percent of Cambodia's use of ferrous metals is imported in the GTAP database) and the metals n.e.c. industry (which the GTAP database records as exporting approximately 70 percent of its output)

*Accommodation and food services.* In the GTAP database, nearly two-thirds of the output of Cambodia's accommodation and food services industry is exported, reflecting sales of services to tourists. Like the other trade-exposed sectors, it benefits from the real depreciation generated by Cambodia's adverse terms of trade shock.

## **3.2. Export restraints**

### ***3.2.1. Macroeconomic aggregates***

Table 7 reports percentage deviations of Cambodian macroeconomic variables from baseline under the export restraints on refined petroleum and chemical products imposed by key suppliers to Cambodia (see Section 2.5). Results are reported for two periods: the shock year, 2026, and five years later, 2031.

The channel of macroeconomic causation under the export restraints is the same as that under the energy price shock: a deterioration in Cambodia's terms of trade. The restriction of refined petroleum and chemical exports to Cambodia by China, Thailand and Vietnam forces Cambodia to substitute towards higher-cost sources for these imports, relative to baseline. This deteriorates Cambodia's terms of trade, and the resulting macroeconomic consequences follow the same causal chain as those generated by the energy price shock, although the magnitudes are smaller, consistent with the smaller terms of trade loss that the export restraints impose.

The two sets of shocks differ, however, in their time profile. The energy price shock attenuates: world prices spike in 2026 and then attenuate somewhat as global supply and demand respond, so Cambodia's terms of trade loss recovers substantially by 2031. The export restraints, by contrast, are sustained, and hence Cambodia's terms of trade loss persists undiminished across the horizon (-0.68 percent in both 2026 and 2031 under the moderate scenario). This persistence carries through to the macroeconomic aggregates. Real private consumption shows little recovery between 2026 and 2031 (-0.77 and -0.74 percent under the moderate scenario), in contrast to its substantial recovery under the energy price shock.

Table 7: Cambodian macroeconomic outcomes: Export restraints (% deviation from baseline)

| Variable                     | Light scenario |       | Moderate scenario |       | Severe scenario |       |
|------------------------------|----------------|-------|-------------------|-------|-----------------|-------|
|                              | 2026           | 2031  | 2026              | 2031  | 2026            | 2031  |
| Real GDP                     | -0.08          | -0.06 | -0.22             | -0.16 | -0.35           | -0.26 |
| Employment                   | -0.17          | -0.01 | -0.47             | -0.02 | -0.76           | -0.03 |
| Capital                      | 0.00           | -0.11 | 0.00              | -0.29 | 0.00            | -0.47 |
| Real consumer wage           | -0.11          | -0.31 | -0.31             | -0.82 | -0.49           | -1.33 |
| Real private consumption     | -0.29          | -0.28 | -0.77             | -0.74 | -1.24           | -1.19 |
| Real investment              | -0.39          | -0.26 | -1.04             | -0.70 | -1.67           | -1.13 |
| Real public consumption      | -0.29          | -0.28 | -0.77             | -0.74 | -1.24           | -1.19 |
| Export volumes               | 0.08           | 0.07  | 0.18              | 0.15  | 0.28            | 0.22  |
| Import volumes               | -0.21          | -0.16 | -0.60             | -0.49 | -0.97           | -0.80 |
| GDP deflator                 | -0.31          | -0.26 | -0.88             | -0.74 | -1.42           | -1.21 |
| Private consumption deflator | -0.10          | -0.02 | -0.30             | -0.10 | -0.49           | -0.17 |
| Terms of trade               | -0.25          | -0.25 | -0.68             | -0.68 | -1.09           | -1.09 |
| Investment price deflator    | -0.14          | -0.08 | -0.40             | -0.25 | -0.64           | -0.40 |

Source: Authors' calculations

### 3.2.2. Sectoral outcomes

Tables 8 and 9 report sectoral output and employment outcomes. We focus on the output responses, since the employment outcomes largely reflect them.

As under the energy price shock, most sectors contract, consistent with the general contraction in macroeconomic activity, and the largest contractions are again experienced by the investment-linked sectors. Construction contracts most (-0.97 percent in 2026), with non-metallic mineral products close behind (-0.70 percent), reflecting the decline in aggregate investment and the role of cement, bricks and glass as inputs to investment and construction activity. The contraction pattern across the remaining sectors tracks the macroeconomic aggregates, as it did under the energy price shock.

A smaller group of trade-exposed sectors again expands, reflecting the effects of real depreciation on import competition and export competitiveness. Wood, paper products and publishing expands modestly (0.12 percent in 2026), as does metal product manufacturing (0.04 percent), while accommodation and food services expands more strongly (0.51 percent), reflecting the export orientation of these sectors and, in the case of accommodation and food services, the dominance of tourist sales in its output. These are the same trade-exposed sectors that expanded under the energy price shock, benefiting through the same real depreciation channel.

The petroleum, coal, chemical and associated products sector records the largest expansion (1.18 percent in 2026). Its expansion differs in origin from that observed under the energy price shock. There, the sector expanded on the export competitiveness of its dominant rubber and plastics component under real depreciation. Here, by contrast, the restraints fall directly on Cambodia's imports of refined petroleum and chemical products. The resulting restriction in supply raises the domestic price of these import-competing goods, and the domestic sector expands as production substitutes towards domestic sources. The expansion is therefore led by both import substitution and export competitiveness.

The sectoral outcomes differ from those under the energy price shock principally in their dynamics, mirroring the contrast drawn at the macroeconomic level. Under the energy price shock, the sectoral contractions recovered substantially by 2031 as the terms of trade recovered. Under the sustained export restraints, the contractions persist, and several deepen over the simulation horizon: mining moves from -0.23 percent in 2026 to -0.46 percent in 2031, other services from -0.40 to -0.58 percent, and metal product manufacturing from a marginal expansion of 0.04 percent to a contraction of -0.41 percent. This deepening reflects the negative deviation in the Cambodian capital stock by 2031, which falls most heavily on the capital-intensive sectors. The expanding sectors display the same persistence in the opposite direction: the expansion in petroleum, coal, chemical and associated products grows to 1.56 percent by 2031, and that in accommodation and food services to 0.84 percent, as the real depreciation that drives them is itself sustained and capital inflow to these sectors gradually lifts their output relative to baseline.

Table 8: Export restraints - Impact on Cambodian industry output (% deviation from baseline)

| Sector                                 | Light scenario |       | Moderate scenario |       | Severe scenario |       |
|----------------------------------------|----------------|-------|-------------------|-------|-----------------|-------|
|                                        | 2026           | 2031  | 2026              | 2031  | 2026            | 2031  |
| Agriculture, forestry and fishing      | -0.03          | -0.01 | -0.08             | -0.02 | -0.13           | -0.04 |
| Mining                                 | -0.10          | -0.21 | -0.23             | -0.46 | -0.38           | -0.74 |
| Agro-processing                        | -0.03          | -0.02 | -0.09             | -0.08 | -0.15           | -0.14 |
| Garments, footwear & travel goods      | -0.05          | -0.05 | -0.28             | -0.35 | -0.49           | -0.62 |
| Wood, paper products, publishing       | 0.05           | 0.01  | 0.12              | 0.00  | 0.18            | -0.02 |
| Petrol., coal, chem. & assoc. products | 0.37           | 0.50  | 1.18              | 1.56  | 1.98            | 2.62  |
| Non-metallic mineral products          | -0.26          | -0.23 | -0.70             | -0.58 | -1.12           | -0.93 |
| Metal product manufacturing            | -0.01          | -0.21 | 0.04              | -0.41 | 0.08            | -0.64 |
| Machinery & equipment manufacture      | 0.00           | 0.02  | -0.01             | 0.06  | -0.02           | 0.08  |
| Utilities                              | -0.09          | -0.08 | -0.21             | -0.18 | -0.34           | -0.27 |
| Construction                           | -0.36          | -0.25 | -0.97             | -0.66 | -1.57           | -1.07 |
| Wholesale & retail trade               | -0.12          | -0.09 | -0.33             | -0.27 | -0.55           | -0.44 |
| Accommodation & food services          | 0.17           | 0.28  | 0.51              | 0.84  | 0.84            | 1.37  |
| Other services                         | -0.17          | -0.24 | -0.40             | -0.58 | -0.64           | -0.92 |
| Public admin, education & health       | -0.26          | -0.24 | -0.70             | -0.62 | -1.12           | -1.00 |

Source: Authors' calculations

Table 9: Export restraints - Impact on Cambodian industry employment (% deviation from baseline)

| Sector                                 | Light scenario |       | Moderate scenario |       | Severe scenario |       |
|----------------------------------------|----------------|-------|-------------------|-------|-----------------|-------|
|                                        | 2026           | 2031  | 2026              | 2031  | 2026            | 2031  |
| Agriculture, forestry and fishing      | -0.06          | 0.03  | -0.16             | 0.08  | -0.26           | 0.13  |
| Mining                                 | -0.31          | -0.29 | -0.73             | -0.62 | -1.17           | -0.98 |
| Agro-processing                        | -0.10          | -0.03 | -0.30             | -0.11 | -0.50           | -0.18 |
| Garments, footwear & travel goods      | 0.05           | 0.15  | -0.06             | 0.23  | -0.14           | 0.33  |
| Wood, paper products, publishing       | 0.40           | 0.06  | 1.06              | 0.19  | 1.70            | 0.29  |
| Petrol., coal, chem. & assoc. products | 0.41           | 0.49  | 1.21              | 1.41  | 2.02            | 2.32  |
| Non-metallic mineral products          | -0.32          | -0.24 | -0.84             | -0.62 | -1.36           | -1.00 |
| Metal product manufacturing            | -0.04          | -0.26 | -0.04             | -0.50 | -0.06           | -0.79 |
| Machinery & equipment manufacture      | 0.05           | 0.14  | 0.10              | 0.37  | 0.14            | 0.58  |
| Utilities                              | -0.28          | -0.05 | -0.67             | -0.03 | -1.06           | -0.02 |
| Construction                           | -0.80          | -0.32 | -2.14             | -0.85 | -3.44           | -1.38 |
| Wholesale & retail trade               | -0.23          | -0.10 | -0.66             | -0.29 | -1.08           | -0.48 |
| Accommodation & food services          | 0.27           | 0.40  | 0.81              | 1.19  | 1.33            | 1.95  |
| Other services                         | -0.58          | -0.21 | -1.41             | -0.47 | -2.24           | -0.74 |
| Public admin, education & health       | -0.30          | -0.25 | -0.80             | -0.65 | -1.29           | -1.04 |

Source: Authors' calculations

### 3.3. Joint effect of energy price shocks and export restraints

Tables 10, 11 and 12 report the macroeconomic and sectoral outcomes when the model is shocked simultaneously with the energy price scenario and the export restraints. Results are again reported for 2026 and 2031.

The model is non-linear, so the joint effect of the two sets of shocks is not in general the exact sum of their separate effects. In the present case, however, the interaction is small. Across the macroeconomic aggregates and sectoral results, the joint deviations lie close to the sum of the energy-price and export-restraint deviations reported in Sections 3.1 and 3.2, with the residual interaction nowhere material to the outcomes.

The joint outcomes may therefore be understood in terms of the separate contributions of the two sets of shocks, as set out in Sections 3.1 and 3.2. The macroeconomic and sectoral patterns are those already described: a terms of trade deterioration that contracts activity most sharply in 2026, led by the investment-linked sectors, alongside the expansion of the trade-exposed sectors under real depreciation; and, by 2031, the combination of recovery from the transient energy price shock and persistence of the sustained export restraints. We do not repeat that discussion here.

Table 10: Cambodian macroeconomic outcomes - Joint effect of energy shocks and export restraints (% deviation from baseline)

| Variable                     | Light scenario |       | Moderate scenario |       | Severe scenario |       |
|------------------------------|----------------|-------|-------------------|-------|-----------------|-------|
|                              | 2026           | 2031  | 2026              | 2031  | 2026            | 2031  |
| Real GDP                     | -0.67          | -0.22 | -1.43             | -0.44 | -2.19           | -0.65 |
| Employment                   | -1.41          | -0.02 | -2.97             | -0.02 | -4.53           | -0.03 |
| Capital                      | 0.00           | -0.43 | 0.00              | -0.89 | 0.00            | -1.34 |
| Real consumer wage           | -0.91          | -0.91 | -1.93             | -1.95 | -2.95           | -2.92 |
| Real private consumption     | -2.30          | -0.75 | -4.81             | -1.61 | -7.31           | -2.43 |
| Real investment              | -3.15          | -0.61 | -6.71             | -1.37 | -10.17          | -2.08 |
| Real public consumption      | -2.30          | -0.75 | -4.81             | -1.61 | -7.31           | -2.43 |
| Export volumes               | 0.75           | 0.07  | 1.50              | 0.15  | 2.16            | 0.21  |
| Import volumes               | -1.56          | -0.46 | -3.33             | -1.04 | -5.08           | -1.60 |
| GDP deflator                 | -2.53          | -0.45 | -5.31             | -1.12 | -8.00           | -1.78 |
| Private consumption deflator | -0.83          | 0.20  | -1.77             | 0.28  | -2.67           | 0.35  |
| Terms of trade               | -1.98          | -0.66 | -4.07             | -1.43 | -6.08           | -2.16 |
| Investment price deflator    | -1.10          | 0.05  | -2.38             | -0.03 | -3.62           | -0.11 |

Source: Authors' calculations

Table 11: Impact on Cambodian industry output - Joint effect of energy shocks and export restraints (% deviation from baseline)

| Sector                                 | Light scenario |       | Moderate scenario |       | Severe scenario |       |
|----------------------------------------|----------------|-------|-------------------|-------|-----------------|-------|
|                                        | 2026           | 2031  | 2026              | 2031  | 2026            | 2031  |
| Agriculture, forestry and fishing      | -0.22          | -0.02 | -0.47             | -0.05 | -0.74           | -0.07 |
| Mining                                 | -0.57          | -0.23 | -1.33             | -0.59 | -2.25           | -1.02 |
| Agro-processing                        | -0.28          | -0.14 | -0.62             | -0.30 | -0.99           | -0.45 |
| Garments, footwear & travel goods      | -0.26          | -0.27 | -0.76             | -0.75 | -1.33           | -1.18 |
| Wood, paper products, publishing       | 0.68           | 0.12  | 1.39              | 0.20  | 2.06            | 0.27  |
| Petrol., coal, chem. & assoc. products | 4.60           | 2.18  | 9.75              | 4.72  | 14.98           | 7.15  |
| Non-metallic mineral products          | -2.30          | -0.57 | -4.93             | -1.23 | -7.54           | -1.87 |
| Metal product manufacturing            | 0.71           | -0.47 | 1.24              | -0.94 | 1.42            | -1.52 |
| Machinery & equipment manufacture      | -0.53          | -0.28 | -1.14             | -0.49 | -1.85           | -0.71 |
| Utilities                              | -0.74          | -0.20 | -1.55             | -0.40 | -2.42           | -0.62 |
| Construction                           | -2.98          | -0.60 | -6.35             | -1.34 | -9.63           | -2.03 |
| Wholesale & retail trade               | -0.98          | -0.33 | -2.11             | -0.71 | -3.28           | -1.09 |
| Accommodation & food services          | 0.95           | 0.26  | 2.10              | 0.82  | 3.20            | 1.34  |
| Other services                         | -1.31          | -0.79 | -2.74             | -1.57 | -4.23           | -2.31 |
| Public admin, education & health       | -2.18          | -0.78 | -4.56             | -1.63 | -6.95           | -2.44 |

Source: Authors' calculations

Table 12: Impact on Cambodian industry employment - Joint effect of energy shocks and export restraints (% deviation from baseline)

| Sector                                 | Light scenario |       | Moderate scenario |       | Severe scenario |       |
|----------------------------------------|----------------|-------|-------------------|-------|-----------------|-------|
|                                        | 2026           | 2031  | 2026              | 2031  | 2026            | 2031  |
| Agriculture, forestry and fishing      | -0.42          | 0.12  | -0.90             | 0.26  | -1.43           | 0.39  |
| Mining                                 | -1.79          | -0.53 | -4.10             | -1.12 | -6.79           | -1.77 |
| Agro-processing                        | -0.90          | -0.13 | -1.96             | -0.28 | -3.09           | -0.41 |
| Garments, footwear & travel goods      | 0.06           | 0.13  | -0.09             | 0.22  | -0.33           | 0.33  |
| Wood, paper products, publishing       | 5.30           | 0.09  | 11.33             | 0.32  | 17.46           | 0.52  |
| Petrol., coal, chem. & assoc. products | 6.08           | 2.36  | 12.80             | 4.93  | 19.71           | 7.37  |
| Non-metallic mineral products          | -2.79          | -0.57 | -5.95             | -1.23 | -9.09           | -1.88 |
| Metal product manufacturing            | 1.28           | -0.55 | 2.16              | -1.07 | 2.43            | -1.69 |
| Machinery & equipment manufacture      | -0.93          | -0.02 | -2.00             | 0.11  | -3.26           | 0.23  |
| Utilities                              | -2.31          | 0.10  | -4.81             | 0.23  | -7.44           | 0.35  |
| Construction                           | -6.50          | -0.46 | -13.65            | -1.14 | -20.39          | -1.79 |
| Wholesale & retail trade               | -1.93          | -0.29 | -4.16             | -0.62 | -6.45           | -0.94 |
| Accommodation & food services          | 1.51           | 0.39  | 3.35              | 1.20  | 5.11            | 1.96  |
| Other services                         | -4.53          | -0.42 | -9.22             | -0.86 | -13.79          | -1.27 |
| Public admin, education & health       | -2.52          | -0.81 | -5.26             | -1.68 | -8.01           | -2.52 |

Source: Authors' calculations

## 4. Results for other regions

The preceding sections have reported outcomes for Cambodia. We now consider the effects of the shocks on the other regions of the model. We report regional outcomes for the energy price shock only, for two reasons. First, the regional effects of the export restraints are small beyond their direct impact on Cambodia. Second, and more fundamentally, the export restraints were calibrated to the Cambodian case: the chemical restraint incorporates a Cambodia-specific layer that scales the restraint by the high fertiliser content of Cambodia's chemical imports from China, Thailand, and Vietnam (see Section 2.5), and no corresponding destination-specific adjustment was implemented for chemical exports to other regions, this being beyond the scope of the present study. The representation of the restraints is therefore accurate for the Cambodian impact but is not constructed to support regional reporting for other regions. We accordingly confine the regional discussion to the energy price shock.

Tables 13 and 14 report real GDP and real private consumption deviations by region under the energy price shock. We focus on the moderate scenario.

The largest real GDP losses fall on the Gulf and Arabian Peninsula region (GulfPen), which contracts by 9.76 percent in 2026, several times the loss recorded by any other region. This reflects the disruption to the region's oil, gas, refined petroleum and chemical production that defines the energy price shock (see Section 2.4): these sectors are central to the GulfPen economy, and the contraction in their output drives the region's real GDP well below baseline. The GDP loss is sustained, standing at 9.67 percent in 2031, since the underlying production disruption persists across the horizon.

The GulfPen consumption loss is far less severe than its GDP loss in the shock year, at 1.42 percent in 2026. As a major energy exporter, the region enjoys a terms of trade gain on its energy exports, and this gain supports real income, and hence real consumption, even as the volume disruption to its energy and chemical sectors lowers real GDP. This offset erodes over the horizon, however. As world energy prices moderate, the terms of trade gain that funds the consumption cushion diminishes, while the production disruption persists, so that by 2031 the consumption loss has deepened to 6.97 percent, converging towards the region's GDP loss. GulfPen is thus the one region whose consumption deviation worsens markedly between 2026 and 2031.

The wider regional pattern divides along energy-trade lines. Net energy importers record real consumption losses that exceed their real GDP losses, as the rise in world energy prices turns their terms of trade against them, in the manner already described for Cambodia. Net energy exporters display the opposite configuration: real consumption is held above real GDP, and in several cases, including Central Asia, the Russian Federation, North Africa and Canada, both rise above baseline, as the terms of trade gain on energy exports raises real income. The gap between the real consumption and real GDP deviations thus orders the regions by their position in world energy trade. We examine this relationship more formally below.

The regional pattern described above suggests that a region's consumption outcome is governed by its position in world energy and chemical trade. We examine this directly by regressing the regional real consumption deviations under the energy price shock on four measures of trade exposure drawn from the model's database: each region's energy and chemical exports, and its energy and chemical imports, each expressed as a share of GDP. Energy here comprises oil, gas and refined petroleum. We exclude the Gulf and Arabian Peninsula region, whose consumption outcome is dominated by the direct disruption to its own production rather than by the terms of trade channel that operates elsewhere. The regression is run on the moderate scenario for 2026, the year in which the terms of trade effects are largest. Results are reported in Table 15.

The four trade shares account for almost all of the cross-region variation in real consumption, with an  $R^2$  of 0.93. The two energy shares carry this result. A larger energy export share raises a region's consumption deviation, and a larger energy import share lowers it, both with the signs and significance that the terms of trade channel implies: regions that export energy gain as world energy prices rise, while regions that import energy lose. The two coefficients are of similar magnitude and opposite sign, so that a region's consumption outcome is well summarised by its net energy trade position. The chemical shares, by contrast, add little. The chemical export share is at most weakly significant and the chemical import share is indistinguishable from zero. This is consistent with the shock being predominantly an energy price event, in which chemical price movements are a secondary factor.

Table 13: Impact on regional real GDP - Energy shocks (% deviation from baseline)

| Region                   | Light scenario |       | Moderate scenario |       | Severe scenario |        |
|--------------------------|----------------|-------|-------------------|-------|-----------------|--------|
|                          | 2026           | 2031  | 2026              | 2031  | 2026            | 2031   |
| Australia                | -0.18          | 0.05  | -0.33             | 0.11  | -0.46           | 0.18   |
| Cambodia                 | -0.58          | -0.16 | -1.16             | -0.28 | -1.74           | -0.39  |
| China (PRC)              | -0.50          | -0.06 | -1.00             | -0.11 | -1.48           | -0.14  |
| Hong Kong SAR            | -0.21          | -0.01 | -0.42             | -0.02 | -0.61           | -0.04  |
| Indonesia                | -0.10          | 0.03  | -0.20             | 0.07  | -0.30           | 0.12   |
| Japan                    | -0.67          | -0.12 | -1.32             | -0.21 | -1.94           | -0.29  |
| Laos                     | -0.24          | 0.00  | -0.46             | 0.01  | -0.65           | 0.02   |
| Malaysia                 | -0.45          | 0.06  | -0.85             | 0.17  | -1.22           | 0.33   |
| New Zealand              | -0.41          | -0.03 | -0.80             | -0.05 | -1.18           | -0.07  |
| Philippines              | -0.45          | -0.07 | -0.89             | -0.12 | -1.31           | -0.16  |
| Singapore                | -0.42          | -0.07 | -0.85             | -0.14 | -1.24           | -0.20  |
| South Korea              | -1.10          | -0.16 | -2.15             | -0.29 | -3.16           | -0.40  |
| Taiwan                   | -0.78          | -0.16 | -1.54             | -0.27 | -2.27           | -0.37  |
| Thailand                 | -1.08          | -0.23 | -2.11             | -0.38 | -3.09           | -0.50  |
| Vietnam                  | -0.65          | -0.08 | -1.29             | -0.12 | -1.92           | -0.16  |
| Rest of Asia Pacific     | -0.44          | 0.06  | -0.86             | 0.14  | -1.27           | 0.23   |
| Central Asia             | 0.81           | 0.72  | 1.64              | 1.36  | 2.46            | 1.95   |
| Bangladesh               | -0.18          | 0.00  | -0.36             | 0.01  | -0.53           | 0.02   |
| India                    | -0.75          | -0.10 | -1.51             | -0.16 | -2.29           | -0.21  |
| Pakistan                 | -0.65          | 0.02  | -1.28             | 0.08  | -1.91           | 0.15   |
| Sri Lanka                | -0.48          | -0.11 | -0.97             | -0.19 | -1.46           | -0.26  |
| USA                      | -0.22          | 0.05  | -0.42             | 0.11  | -0.60           | 0.17   |
| Canada                   | 0.19           | 0.12  | 0.47              | 0.26  | 0.79            | 0.43   |
| Mexico                   | -0.33          | -0.02 | -0.62             | -0.02 | -0.88           | 0.01   |
| Brazil                   | -0.29          | 0.09  | -0.52             | 0.20  | -0.80           | 0.31   |
| Rest of C. & Sth America | -0.29          | 0.04  | -0.54             | 0.10  | -0.76           | 0.18   |
| European Union           | -0.53          | -0.07 | -1.04             | -0.12 | -1.52           | -0.17  |
| UK                       | -0.31          | 0.01  | -0.62             | 0.02  | -0.92           | 0.04   |
| Switzerland              | -0.24          | -0.01 | -0.47             | -0.02 | -0.68           | -0.03  |
| Russian Federation       | 0.32           | 0.23  | 0.71              | 0.45  | 1.15            | 0.67   |
| Gulf & Arabian Peninsula | -5.08          | -5.08 | -9.76             | -9.67 | -14.23          | -13.98 |
| Other Middle East        | -0.86          | -0.08 | -1.69             | -0.14 | -2.47           | -0.19  |
| North Africa             | 0.06           | 0.21  | 0.20              | 0.44  | 0.41            | 0.68   |
| Sub-Saharan Africa       | -0.04          | 0.18  | -0.08             | 0.38  | -0.14           | 0.60   |
| Rest of World            | -0.14          | 0.16  | -0.17             | 0.35  | -0.11           | 0.57   |

Source: Authors' calculations

Table 14: Impact on regional real consumption - Energy shocks (% deviation from baseline)

| Region                   | Light scenario |       | Moderate scenario |       | Severe scenario |        |
|--------------------------|----------------|-------|-------------------|-------|-----------------|--------|
|                          | 2026           | 2031  | 2026              | 2031  | 2026            | 2031   |
| Australia                | 0.18           | 0.12  | 0.35              | 0.21  | 0.49            | 0.28   |
| Cambodia                 | -1.99          | -0.47 | -3.93             | -0.84 | -5.80           | -1.17  |
| China (PRC)              | -1.06          | -0.21 | -2.08             | -0.37 | -3.05           | -0.52  |
| Hong Kong SAR            | -0.61          | -0.18 | -1.16             | -0.32 | -1.65           | -0.44  |
| Indonesia                | -0.33          | -0.08 | -0.66             | -0.13 | -0.99           | -0.18  |
| Japan                    | -1.36          | -0.28 | -2.66             | -0.50 | -3.88           | -0.70  |
| Laos                     | -0.81          | -0.14 | -1.56             | -0.25 | -2.27           | -0.36  |
| Malaysia                 | -0.67          | -0.03 | -1.21             | -0.04 | -1.67           | -0.03  |
| New Zealand              | -0.85          | -0.15 | -1.67             | -0.27 | -2.45           | -0.37  |
| Philippines              | -1.59          | -0.27 | -3.13             | -0.49 | -4.62           | -0.68  |
| Singapore                | -1.14          | -0.33 | -2.21             | -0.58 | -3.18           | -0.80  |
| South Korea              | -2.47          | -0.47 | -4.79             | -0.84 | -6.95           | -1.16  |
| Taiwan                   | -1.79          | -0.46 | -3.47             | -0.82 | -5.05           | -1.13  |
| Thailand                 | -3.03          | -0.57 | -5.85             | -1.02 | -8.49           | -1.41  |
| Vietnam                  | -1.58          | -0.38 | -3.11             | -0.67 | -4.60           | -0.94  |
| Rest of Asia Pacific     | -0.31          | 0.02  | -0.63             | 0.03  | -1.01           | 0.02   |
| Central Asia             | 4.12           | 1.32  | 8.04              | 2.35  | 11.72           | 3.22   |
| Bangladesh               | -1.01          | -0.22 | -2.02             | -0.41 | -3.02           | -0.57  |
| India                    | -2.18          | -0.49 | -4.33             | -0.88 | -6.45           | -1.24  |
| Pakistan                 | -2.77          | -0.34 | -5.49             | -0.69 | -8.18           | -1.05  |
| Sri Lanka                | -2.02          | -0.38 | -4.06             | -0.73 | -6.07           | -1.05  |
| USA                      | -0.20          | 0.07  | -0.36             | 0.13  | -0.50           | 0.20   |
| Canada                   | 1.16           | 0.26  | 2.41              | 0.48  | 3.67            | 0.68   |
| Mexico                   | -0.68          | -0.04 | -1.26             | -0.05 | -1.74           | -0.06  |
| Brazil                   | 0.00           | 0.16  | 0.11              | 0.31  | 0.15            | 0.44   |
| Rest of C. & Sth America | -0.28          | 0.04  | -0.50             | 0.10  | -0.66           | 0.15   |
| European Union           | -0.97          | -0.15 | -1.87             | -0.27 | -2.70           | -0.36  |
| UK                       | -0.54          | -0.08 | -1.06             | -0.14 | -1.54           | -0.20  |
| Switzerland              | -0.39          | -0.06 | -0.74             | -0.09 | -1.04           | -0.12  |
| Russian Federation       | 2.49           | 0.78  | 4.89              | 1.42  | 7.17            | 1.98   |
| Gulf & Arabian Peninsula | -0.43          | -3.58 | -1.42             | -6.97 | -2.96           | -10.27 |
| Other Middle East        | -2.07          | -0.26 | -4.01             | -0.46 | -5.81           | -0.63  |
| North Africa             | 1.86           | 0.43  | 3.74              | 0.78  | 5.62            | 1.08   |
| Sub-Saharan Africa       | 0.75           | 0.31  | 1.49              | 0.58  | 2.14            | 0.84   |
| Rest of World            | 1.36           | 0.42  | 2.78              | 0.77  | 4.24            | 1.09   |

Source: Authors' calculations

The regional consumption results are therefore explicable in terms of what the database records about each region's energy trade exposure. Regions are arrayed along a single dimension, from energy importers, whose consumption falls furthest, to energy exporters, whose consumption is cushioned or, where their energy export share is large enough, rises above baseline. The relationship is not driven by the largest energy exporters, since it is unchanged when Central Asia and the Russian Federation are excluded. Re-estimating the regression for 2031 leaves the pattern intact but reduces the coefficients substantially, consistent with the moderation of world energy prices over the horizon and the consequent attenuation of the terms of trade effects.

Table 15: Regression of regional real consumption deviation on trade shares (energy price shock, moderate scenario, 2026)

| Explanatory variable  | Coefficient | t-statistic |
|-----------------------|-------------|-------------|
| Energy export share   | 0.60        | 14.84       |
| Chemical export share | 0.21        | 2.04        |
| Energy import share   | -0.73       | -8.49       |
| Chemical import share | -0.03       | -0.23       |
| Constant              | -0.46       | -1.32       |

Note:  $R^2 = 0.93$ ;  $n = 34$  (Gulf and Arabian Peninsula excluded). Trade shares are expressed as percentages of GDP.

Source: Authors' calculations

## 5. Concluding remarks

We have used GTAP-FIN to estimate the consequences for Cambodia of energy-market disruption originating in the Persian Gulf, under two sets of shocks and three scenarios. The disruption reaches Cambodia principally through one channel: a deterioration in its terms of trade. As an economy that imports energy and chemicals and produces no oil of its own, Cambodia faces higher prices for imported fuels, fertiliser, and the goods that embody them, and it is this terms of trade loss, rather than any direct disruption to domestic production, that drives the Cambodian results.

The macroeconomic consequences follow from this. Under the moderate energy-price scenario, real GDP falls 1.16 percent below baseline in the shock year, and real private consumption falls further, as the terms of trade loss augments the fall in real income. The contraction is concentrated in 2026 and is led by investment, and hence by the construction and non-metallic mineral sectors. A small group of trade-exposed industries expands, as the real depreciation that accompanies the terms of trade loss improves their competitiveness. By 2031, the energy-price effects have attenuated, as world prices moderate and employment returns to baseline, leaving a smaller residual loss carried by a reduced capital stock.

The export restraints work through the same terms of trade channel but differ in two respects. Their direct impact is smaller, and it is more durable. This is because the restraints are sustained and do not attenuate materially via production expansion in other regions as happens in the energy shock, and hence the terms of trade loss they impose persists across the simulation horizon, and the associated contractions do not unwind but in several sectors deepen as sectoral capital stocks adjust. When the two sets of shocks are imposed together, their interaction is small, and the joint outcome is well approximated by the sum of its parts.

The global results reinforce the centrality of the terms of trade channel. Across the model's regions, the consumption outcome is governed by energy-trade position. Energy importers bear consumption losses that exceed their output losses, while energy exporters are cushioned, and the largest energy exporters gain. Cambodia's experience is thus a particular case of a general pattern, its position determined by its reliance on imported energy and chemicals.

Two qualifications bear on the interpretation of these results. First, the analysis is conditional on the scenarios, which are illustrative rather than forecasts, and are designed to bracket a range of plausible severities rather than to predict the course of any particular disruption. Second, the export restraints are calibrated to the Cambodian case through a destination-specific treatment of the fertiliser content of chemical imports, and the regional results for the restraints are accordingly not reported. Within these bounds, the results give a consistent account of how an energy-market disruption of this kind is transmitted to a small, energy-importing economy, and of the channels through which its effects are felt and eventually moderated.

## 6. Policy recommendations

GTAP-FIN simulations reveal a clear and consistent transmission mechanism underlying Cambodia's vulnerability to external energy shocks. With no domestic oil production and heavy reliance on imported refined petroleum, chemicals, and fertiliser, Cambodia's exposure operates almost entirely through a deterioration in its terms of trade. Under the moderate combined shock scenario, real GDP falls 1.16 percent below baseline in 2026, private consumption declines 3.93 percent, investment contracts 5.57 percent, and employment drops 2.42 percent, before partial recovery as energy prices ease. Export-restraint losses, though smaller in magnitude, are structurally persistent, continuing without meaningful attenuation through 2031 and deepening capital-stock erosion across several sectors.

### Energy security and reducing import dependency

Cambodia's terms-of-trade loss of 3.34 percent under the moderate energy-price shock reflects a structural vulnerability: nearly all refined petroleum is imported from a concentrated group of regional suppliers. Model results confirm that export restraints by these suppliers compound Gulf price shocks into sustained economic losses. Reducing physical exposure to imported petroleum is therefore the highest-leverage long-run intervention available.

- **Accelerate renewable energy deployment.** The Ministry of Mines and Energy (MME) and the Electricity Authority of Cambodia (EAC) should advance procurement timelines for solar and wind capacity under the Cambodia Power Development Master Plan 2022–2040, with binding coal-retirement schedules. Renewable energy has already been identified as a priority FDI sector, and the region's strong track record in attracting foreign investment into solar projects offers a proven pathway.
- **Establish strategic petroleum reserves and diversify fuel sourcing.** Model results identify China, Thailand, and Vietnam as the three suppliers whose restraints generate a distinct and sustained shock pathway. MME should formalise a minimum national fuel-stock requirement, with a longer-term target of building up strategic reserves over a defined multi-year horizon, and introduce import-licence conditions that prevent any single supplier from holding a dominant share of licensed petroleum volumes.

## Fiscal resilience and demand management

Investment contracts 5.57 percent under the moderate combined shock, generating a multi-year drag on capital accumulation. Cambodia's low public debt and a fiscal deficit that narrowed considerably in 2025, driven by stronger revenue collection and contained spending, provide a narrow but real window for countercyclical action. This space must be preserved by avoiding open-ended subsidies.

- **Use targeted, time-bound transfers rather than broad fuel-tax relief.** Targeted cash transfers through IDPoor and returnee channels cost substantially less per month than broad fuel-duty relief of equivalent scale. The Ministry of Economy and Finance (MEF) should formalise sunset clauses on existing fuel-duty measures and activate On-Demand IDPoor registration for newly affected households.
- **Protect priority expenditure during fiscal adjustment.** If consolidation falls on capital budgets, it will amplify the model's predicted medium-run capital-stock losses. MEF's medium-term fiscal framework should designate protected expenditure lines for education, health, and productive infrastructure, correcting a historical pattern where weak linkages between the National Strategic Development Plan and budget execution have diluted policy intent.

## Agricultural supply-chain resilience

The export-restraint simulations model a Cambodia-specific fertiliser shock, with Vietnam alone supplying over half of Cambodia's fertiliser-embedded chemical imports. Energy and agrochemical costs represent a large share of total crop production expenses, meaning an oil price spike can trigger a sharp surge in input costs, an acute threat during Cambodia's narrow May–June planting window.

- **Establish an emergency fertiliser coordination mechanism and strategic stock.** The Ministry of Agriculture, Forestry and Fisheries (MAFF) and the Ministry of Commerce (MOC) should coordinate with importers and distributors to fast-track customs clearance and licensing, issue extension advisories on efficient fertiliser application, and publish weekly provincial price data to deter hoarding. Over the medium term, a government-backed reserve sufficient to cover two planting seasons, with sourcing diversified to include India and Middle Eastern producers, should be developed.

## Industrial diversification and trade-exposed sector opportunities

The model identifies sectors that expand under both shock scenarios through the real depreciation channel. The petroleum, coal, chemicals, and associated products sector, dominated in Cambodia by rubber and plastics, expands 8.49 percent under the moderate combined shock in 2026, illustrating how currency depreciation can generate competitive gains in specific industries.

- **Develop a targeted investment promotion package for electronics and electrical components.** Wiring harnesses, sensors, and basic electrical components represent feasible near-term diversification products. The Council for the Development of Cambodia (CDC) and the Ministry of Industry, Science, Technology and Innovation (MISTI) should develop a dedicated electronics and electrical (E&E) investment promotion package that leverages depreciation-driven cost competitiveness, while actively targeting FDI from India, the EU, and the United States to reduce geographical concentration risk.

## Social protection, labour-market adjustment, and human capital

Employment falls 2.42 percent under the moderate combined scenario in 2026, with the construction sector alone contracting 5.27 percent. Real consumer wages remain 1.58 percent below baseline in 2031, reflecting the persistent terms-of-trade loss associated with export restraints.

- **Scale up IDPoor and returnee social protection with shock-responsive triggers.** IDPoor is the foundation of Cambodia's social protection architecture, covering a substantial share of the population. The Ministry of Social Affairs, Veterans and Youth Rehabilitation (MOSVY) and MEF should activate the shock-responsive trigger within the Family Package and extend coverage to near-poor households.
- **Invest in clean energy skills development.** A significant skills deficit exists across solar installation, energy efficiency, and electric vehicle sectors. The Ministry of Labour and Vocational Training (MLVT) and MME should develop TVET curricula for solar system design, energy auditing, and EV maintenance, building the domestic workforce that renewable energy deployment, the model's highest-leverage long-run intervention, requires.

### Cross-cutting implementation notes

The priority policies above share a common prerequisite: inter-ministerial policy coherence. This remains Cambodia's binding governance constraint. An energy security council, co-chaired by MEF and MME, with permanent membership from MAFF, MISTI, MOSVY, and MLVT, should serve as the central coordination vehicle, using GTAP-FIN scenario outputs as a shared analytical framework.

Sequencing should mirror the model's own time structure. **Near-term measures:** targeted transfers and fertiliser coordination should be time-bound and trigger-linked. **Structural investments:** renewable energy deployment, E&E value-chain integration, and clean energy skills development justify multi-year commitments that extend beyond any individual disruption episode.

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## Appendix: Regional and sectoral aggregations

This appendix documents the aggregations used in the simulations. Table A1 reports the regional aggregation, in which the GTAP 12 Data Base (2023 reference year) is aggregated to 35 regions. Table A2 reports the sectoral aggregation from the 65 GTAP 12 commodities to the 55 sectors at which the model is solved. Table A3 reports the further aggregation from these 55 sectors to the 15 sectors used to report results in the body of the paper.

Table A1: Regional aggregation (35 regions)

| Code              | Region                     | Composition (GTAP 12 source regions)                                                                                                                                                                                                                                               |
|-------------------|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>aus</b>        | Australia                  | Australia                                                                                                                                                                                                                                                                          |
| <b>nzl</b>        | New Zealand                | New Zealand                                                                                                                                                                                                                                                                        |
| <b>jpn</b>        | Japan                      | Japan                                                                                                                                                                                                                                                                              |
| <b>kor</b>        | Republic of Korea          | Republic of Korea                                                                                                                                                                                                                                                                  |
| <b>tw</b>         | Taiwan                     | Taiwan                                                                                                                                                                                                                                                                             |
| <b>chn</b>        | China                      | China                                                                                                                                                                                                                                                                              |
| <b>hkg</b>        | Hong Kong SAR              | Hong Kong SAR                                                                                                                                                                                                                                                                      |
| <b>vnm</b>        | Vietnam                    | Vietnam                                                                                                                                                                                                                                                                            |
| <b>lao</b>        | Laos                       | Lao PDR                                                                                                                                                                                                                                                                            |
| <b>khm</b>        | Cambodia                   | Cambodia                                                                                                                                                                                                                                                                           |
| <b>sgp</b>        | Singapore                  | Singapore                                                                                                                                                                                                                                                                          |
| <b>tha</b>        | Thailand                   | Thailand                                                                                                                                                                                                                                                                           |
| <b>mys</b>        | Malaysia                   | Malaysia                                                                                                                                                                                                                                                                           |
| <b>idn</b>        | Indonesia                  | Indonesia                                                                                                                                                                                                                                                                          |
| <b>phl</b>        | Philippines                | Philippines                                                                                                                                                                                                                                                                        |
| <b>bgd</b>        | Bangladesh                 | Bangladesh                                                                                                                                                                                                                                                                         |
| <b>ind</b>        | India                      | India                                                                                                                                                                                                                                                                              |
| <b>pak</b>        | Pakistan                   | Pakistan                                                                                                                                                                                                                                                                           |
| <b>lka</b>        | Sri Lanka                  | Sri Lanka                                                                                                                                                                                                                                                                          |
| <b>CentAsia</b>   | Central Asia               | Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan, Rest of Former Soviet Union                                                                                                                                                                                                        |
| <b>pac</b>        | Rest of Asia Pacific       | Rest of Oceania, Mongolia, Rest of East Asia, Brunei Darussalam, Rest of Southeast Asia, Afghanistan, Nepal, Rest of South Asia                                                                                                                                                    |
| <b>usa</b>        | United States of America   | United States of America                                                                                                                                                                                                                                                           |
| <b>can</b>        | Canada                     | Canada                                                                                                                                                                                                                                                                             |
| <b>mex</b>        | Mexico                     | Mexico                                                                                                                                                                                                                                                                             |
| <b>bra</b>        | Brazil                     | Brazil                                                                                                                                                                                                                                                                             |
| <b>LatinAmer</b>  | Latin America              | Argentina, Bolivia, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, Venezuela, Rest of South America, Costa Rica, Guatemala, Honduras, Nicaragua, Panama, El Salvador, Rest of Central America, Dominican Republic, Haiti, Jamaica, Puerto Rico, Trinidad and Tobago, Caribbean |
| <b>gbr</b>        | United Kingdom             | United Kingdom                                                                                                                                                                                                                                                                     |
| <b>che</b>        | Switzerland                | Switzerland                                                                                                                                                                                                                                                                        |
| <b>EU27</b>       | European Union             | Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden                                 |
| <b>GulfPen</b>    | Gulf and Arabian Peninsula | Bahrain, Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates, Rest of Western Asia                                                                                                                                                                                 |
| <b>OthMidEast</b> | Other Middle East          | Israel, Jordan, Lebanon, Palestine, Syria, Turkey                                                                                                                                                                                                                                  |
| <b>NthAfr</b>     | North Africa               | Algeria, Egypt, Morocco, Tunisia, Rest of North Africa                                                                                                                                                                                                                             |
| <b>SSA</b>        | Sub-Saharan Africa         | West, Central, Eastern and Southern African economies and Rest of Sub-Saharan Africa (incl. South Africa, Nigeria, Kenya, Ethiopia, Tanzania and the Southern African Customs Union)                                                                                               |
| <b>rus</b>        | Russian Federation         | Russian Federation                                                                                                                                                                                                                                                                 |

| Code               | Region        | Composition (GTAP 12 source regions)                                                                                                                                    |
|--------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>RestofWorld</b> | Rest of World | Rest of North America, Norway, Rest of EFTA, Albania, Serbia, Belarus, Ukraine, Rest of Eastern Europe, Rest of Europe, Armenia, Azerbaijan, Georgia, Rest of the World |

Notes: Authors' aggregation of the GTAP 12 Data Base. Single-economy regions take the corresponding GTAP 12 region. Composite regions list their constituent GTAP 12 source regions.

Table A2: Sectoral aggregation: GTAP 12 commodities to the 55 model sectors

| No. | Code       | Model sector                              | GTAP 12 commodities                                  |
|-----|------------|-------------------------------------------|------------------------------------------------------|
| 1   | <b>pdr</b> | Paddy rice                                | <b>pdr</b> Paddy rice                                |
| 2   | <b>wht</b> | Wheat                                     | <b>wht</b> Wheat                                     |
| 3   | <b>gro</b> | Cereal grains n.e.c.                      | <b>gro</b> Cereal grains n.e.c.                      |
| 4   | <b>v_f</b> | Vegetables, fruit, nuts                   | <b>v_f</b> Vegetables, fruit, nuts                   |
| 5   | <b>osd</b> | Oil seeds                                 | <b>osd</b> Oil seeds                                 |
| 6   | <b>c_b</b> | Sugar cane, sugar beet                    | <b>c_b</b> Sugar cane, sugar beet                    |
| 7   | <b>pfb</b> | Plant-based fibres                        | <b>pfb</b> Plant-based fibres                        |
| 8   | <b>ocr</b> | Crops n.e.c.                              | <b>ocr</b> Crops n.e.c.                              |
| 9   | <b>ctl</b> | Bovine cattle, sheep, goats, horses       | <b>ctl</b> Bovine cattle, sheep, goats, horses       |
| 10  | <b>oap</b> | Animal products n.e.c.                    | <b>oap</b> Animal products n.e.c.                    |
| 11  | <b>rmk</b> | Raw milk                                  | <b>rmk</b> Raw milk                                  |
| 12  | <b>wol</b> | Wool, silkworm cocoons                    | <b>wol</b> Wool, silkworm cocoons                    |
| 13  | <b>frs</b> | Forestry                                  | <b>frs</b> Forestry                                  |
| 14  | <b>fsh</b> | Fishing                                   | <b>fsh</b> Fishing                                   |
| 15  | <b>coa</b> | Coal                                      | <b>coa</b> Coal                                      |
| 16  | <b>oil</b> | Oil                                       | <b>oil</b> Oil                                       |
| 17  | <b>gas</b> | Gas                                       | <b>gas</b> Gas                                       |
| 18  | <b>oxt</b> | Other mining and extraction               | <b>oxt</b> Other mining and extraction               |
| 19  | <b>cmt</b> | Bovine meat products                      | <b>cmt</b> Bovine meat products                      |
| 20  | <b>omt</b> | Meat products n.e.c.                      | <b>omt</b> Meat products n.e.c.                      |
| 21  | <b>vol</b> | Vegetable oils and fats                   | <b>vol</b> Vegetable oils and fats                   |
| 22  | <b>mil</b> | Dairy products                            | <b>mil</b> Dairy products                            |
| 23  | <b>pcr</b> | Processed rice                            | <b>pcr</b> Processed rice                            |
| 24  | <b>sgr</b> | Sugar                                     | <b>sgr</b> Sugar                                     |
| 25  | <b>ofd</b> | Food products n.e.c.                      | <b>ofd</b> Food products n.e.c.                      |
| 26  | <b>b_t</b> | Beverages and tobacco products            | <b>b_t</b> Beverages and tobacco products            |
| 27  | <b>tex</b> | Textiles                                  | <b>tex</b> Textiles                                  |
| 28  | <b>wap</b> | Wearing apparel                           | <b>wap</b> Wearing apparel                           |
| 29  | <b>lea</b> | Leather products                          | <b>lea</b> Leather products                          |
| 30  | <b>lum</b> | Wood products                             | <b>lum</b> Wood products                             |
| 31  | <b>ppp</b> | Paper products, publishing                | <b>ppp</b> Paper products, publishing                |
| 32  | <b>p_c</b> | Petroleum, coal products                  | <b>p_c</b> Petroleum, coal products                  |
| 33  | <b>chm</b> | Chemical products                         | <b>chm</b> Chemical products                         |
| 34  | <b>bph</b> | Pharmaceutical products                   | <b>bph</b> Pharmaceutical products                   |
| 35  | <b>rpp</b> | Rubber and plastic products               | <b>rpp</b> Rubber and plastic products               |
| 36  | <b>nmm</b> | Mineral products n.e.c.                   | <b>nmm</b> Mineral products n.e.c.                   |
| 37  | <b>i_s</b> | Ferrous metals                            | <b>i_s</b> Ferrous metals                            |
| 38  | <b>nfm</b> | Metals n.e.c.                             | <b>nfm</b> Metals n.e.c.                             |
| 39  | <b>fmp</b> | Metal products                            | <b>fmp</b> Metal products                            |
| 40  | <b>ele</b> | Computer, electronic and optical products | <b>ele</b> Computer, electronic and optical products |
| 41  | <b>eeq</b> | Electrical equipment                      | <b>eeq</b> Electrical equipment                      |
| 42  | <b>ome</b> | Machinery and equipment n.e.c.            | <b>ome</b> Machinery and equipment n.e.c.            |
| 43  | <b>mvh</b> | Motor vehicles and parts                  | <b>mvh</b> Motor vehicles and parts                  |
| 44  | <b>otn</b> | Transport equipment n.e.c.                | <b>otn</b> Transport equipment n.e.c.                |
| 45  | <b>omf</b> | Manufactures n.e.c.                       | <b>omf</b> Manufactures n.e.c.                       |

| No. | Code               | Model sector                       | GTAP 12 commodities                                                                                                                                                                                                    |
|-----|--------------------|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 46  | <b>utilities</b>   | Utilities                          | <b>ely</b> Electricity; <b>gdt</b> Gas manufacture, distribution; <b>wtr</b> Water                                                                                                                                     |
| 47  | <b>cns</b>         | Construction                       | <b>cns</b> Construction                                                                                                                                                                                                |
| 48  | <b>trd</b>         | Trade                              | <b>trd</b> Trade                                                                                                                                                                                                       |
| 49  | <b>afs</b>         | Accommodation and food services    | <b>afs</b> Accommodation, food and service activities                                                                                                                                                                  |
| 50  | <b>TranStoreWh</b> | Transport, storage and warehousing | <b>otp</b> Transport n.e.c.; <b>wtp</b> Water transport; <b>atp</b> Air transport; <b>whs</b> Warehousing and support activities                                                                                       |
| 51  | <b>OthServ</b>     | Other services                     | <b>cmn</b> Information and communication; <b>ofi</b> Financial services n.e.c.; <b>ins</b> Insurance; <b>rsa</b> Real estate activities; <b>obs</b> Business services n.e.c.; <b>ros</b> Recreation and other services |
| 52  | <b>osg</b>         | Public administration and defence  | <b>osg</b> Public administration, defence                                                                                                                                                                              |
| 53  | <b>edu</b>         | Education                          | <b>edu</b> Education                                                                                                                                                                                                   |
| 54  | <b>hht</b>         | Human health and social work       | <b>hht</b> Human health and social work                                                                                                                                                                                |
| 55  | <b>dwe</b>         | Dwellings                          | <b>dwe</b> Dwellings                                                                                                                                                                                                   |

Notes: Authors' aggregation of the GTAP 12 Data Base. Of the 65 GTAP commodities, 52 are retained one-for-one. The remaining sectors are formed by aggregation. Utilities combines electricity, gas manufacture and distribution, and water. Transport, storage and warehousing combines land, water and air transport with warehousing and support activities. Other services combines information and communication, financial services, insurance, real estate, business services, and recreation and other services.

Table A3: Reporting aggregation: 55 model sectors to the 15 reporting sectors

| Reporting sector (SEC15) | Description                                 | Constituent model sectors (55-sector classification)                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>AgForFish</b>         | Agriculture, forestry and fishing           | <b>pdr</b> Paddy rice; <b>wht</b> Wheat; <b>gro</b> Cereal grains n.e.c.; <b>v_f</b> Vegetables, fruit, nuts; <b>osd</b> Oil seeds; <b>c_b</b> Sugar cane, sugar beet; <b>pfb</b> Plant-based fibres; <b>ocr</b> Crops n.e.c.; <b>ctl</b> Bovine cattle, sheep, goats, horses; <b>oap</b> Animal products n.e.c.; <b>rmk</b> Raw milk; <b>wol</b> Wool, silkworm cocoons; <b>frs</b> Forestry; <b>fsh</b> Fishing |
| <b>Mining</b>            | Mining                                      | <b>coa</b> Coal; <b>oil</b> Oil; <b>gas</b> Gas; <b>oxt</b> Other mining and extraction                                                                                                                                                                                                                                                                                                                           |
| <b>FoodBevTob</b>        | Food, beverages and tobacco                 | <b>cmt</b> Bovine meat products; <b>omt</b> Meat products n.e.c.; <b>vol</b> Vegetable oils and fats; <b>mil</b> Dairy products; <b>pcr</b> Processed rice; <b>sgf</b> Sugar; <b>ofd</b> Food products n.e.c.; <b>b_t</b> Beverages and tobacco products                                                                                                                                                          |
| <b>TexClothFoot</b>      | Textiles, clothing and footwear             | <b>tex</b> Textiles; <b>wap</b> Wearing apparel; <b>lea</b> Leather products                                                                                                                                                                                                                                                                                                                                      |
| <b>WoodPapPub</b>        | Wood, paper and publishing                  | <b>lum</b> Wood products; <b>ppp</b> Paper products, publishing                                                                                                                                                                                                                                                                                                                                                   |
| <b>PetChmPha</b>         | Petroleum, chemicals and pharmaceuticals    | <b>p_c</b> Petroleum, coal products; <b>chm</b> Chemical products; <b>bph</b> Pharmaceutical products; <b>rpp</b> Rubber and plastic products                                                                                                                                                                                                                                                                     |
| <b>NonMetMin</b>         | Non-metallic mineral products               | <b>nmm</b> Mineral products n.e.c.                                                                                                                                                                                                                                                                                                                                                                                |
| <b>MetProds</b>          | Metals and metal products                   | <b>i_s</b> Ferrous metals; <b>nfm</b> Metals n.e.c.; <b>fmp</b> Metal products                                                                                                                                                                                                                                                                                                                                    |
| <b>MachEquip</b>         | Machinery and equipment                     | <b>ele</b> Computer, electronic and optical products; <b>eeq</b> Electrical equipment; <b>ome</b> Machinery and equipment n.e.c.; <b>mvh</b> Motor vehicles and parts; <b>otn</b> Transport equipment n.e.c.; <b>omf</b> Manufactures n.e.c.                                                                                                                                                                      |
| <b>Utility</b>           | Utilities                                   | <b>utilities</b> Utilities                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Const</b>             | Construction                                | <b>cns</b> Construction                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Trade</b>             | Trade                                       | <b>trd</b> Trade                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>AccomFood</b>         | Accommodation and food services             | <b>afs</b> Accommodation and food services                                                                                                                                                                                                                                                                                                                                                                        |
| <b>OthServ</b>           | Other services                              | <b>TranStoreWh</b> Transport, storage and warehousing; <b>OthServ</b> Other services; <b>dwe</b> Dwellings                                                                                                                                                                                                                                                                                                        |
| <b>PubEduHealth</b>      | Public administration, education and health | <b>osg</b> Public administration and defence; <b>edu</b> Education; <b>hht</b> Human health and social work                                                                                                                                                                                                                                                                                                       |

Notes: Authors' aggregation. The 15-sector classification is used to present sectoral results in the body of the paper.

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