

Towards economy-wide modelling to support green and just energy transition in Viet Nam

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1. Opening remarks

Overview

1. Opening remarks

- Acknowledge UNDP, CIEM/IPSS, GSO/NSO and other Vietnamese partners
- Policy context
- UNDP support

2. International experience

- Carbon pricing, what does the green transition cost, and equity concerns

3. Illustrative static CGE model applications and results

- (i) A 15$/ton CO2e **carbon tax** (without and with transfers), (ii) a 10% **energy efficiency** improvement, and (iii) **renewable energy development**

4. Policy implications

- (i) **Carbon tax**, (ii) **energy efficiency**, and (iii) **renewable energy development**

5. Conclusions, recommendations and the way forward

- Make data and model available for widespread use and learning, continue to build analytical capacity, and move from static to dynamic modelling

2. International experience

2a. Carbon pricing

Why economists often recommend carbon pricing

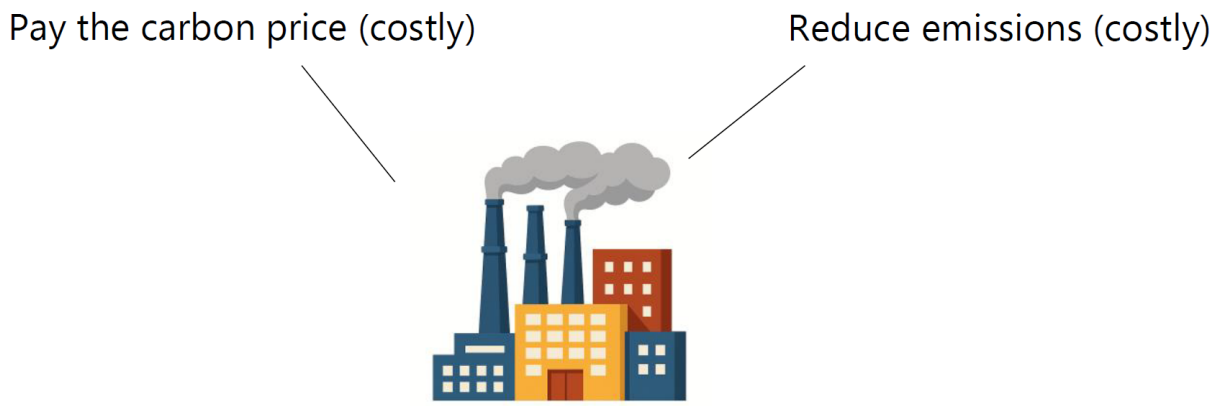
- The core problem: the **social cost** of carbon emissions is not considered by consumers and firms (there is a difference between private and social costs)
- Put a **direct fee** on per ton of emissions: will incentivize consumers and firms indirectly to take social costs into account
- The **idea**: address the externality problem at its source, in contrast to other policies such as subsidies to renewable energy



Carbon pricing and efficiency

Efficiency

- Emissions reductions occur where they are cheapest.
- Firms face the trade-off:



- Firms will reduce emissions until the cost of reducing one additional tonne is the same as paying the emissions tax.
- Ensures that a given emissions reduction target is achieved at lowest possible costs (Baumol and Oates, 1971).

Combining instruments to protect domestic industries

- To **protect** domestic industries government can combine carbon pricing with other instruments such as output subsidies and renewable energy subsidies
- Often discussed in combination with **carbon leakage** concerns - occurs when strict climate policies in one country leads to increased emissions elsewhere with looser regulations, as carbon-intensive industries relocate or lose market share
- Other instruments like output subsidies can **counter loss** of competitiveness due to carbon prices
- **But** these instruments increase the costs of achieving a given domestic emissions target

Exemptions and differentiated carbon pricing

- A **second-best** way to shield selected sectors from loss of competitiveness is to
  - Exempt them from carbon pricing mechanism
  - Impose a lower carbon price on those sectors
- In Danish case, mineralogical processes, mainly cement **(Portland)** production, face a substantially lower carbon price motivated by leakage concerns
- This has a **cost** as society foregoes relatively cheap emission reductions in those sectors
  - Other sectors must do more to achieve given target



2b. Broader dimensions

What does the green transition cost?

Evidence from CGE models

- Meta-study of climate policy assessments in CGE models by Carbone and Rivers (2017):

  1. Unilateral climate policy reduces output from energy-intensive and trade-exposed sectors.
     - Main estimate: 20% emissions reduction leads to 5% loss in output of these sectors.

  2. But the welfare effects are generally small even for large mitigation targets.
     - Main estimate: 20% emissions reduction leads to 0.5% welfare loss.

- Danish Economic Councils (2021) find that using carbon pricing, the Danish emissions target of 70% reduction by 2030 compared to 1990 would cost 0.3% of welfare.

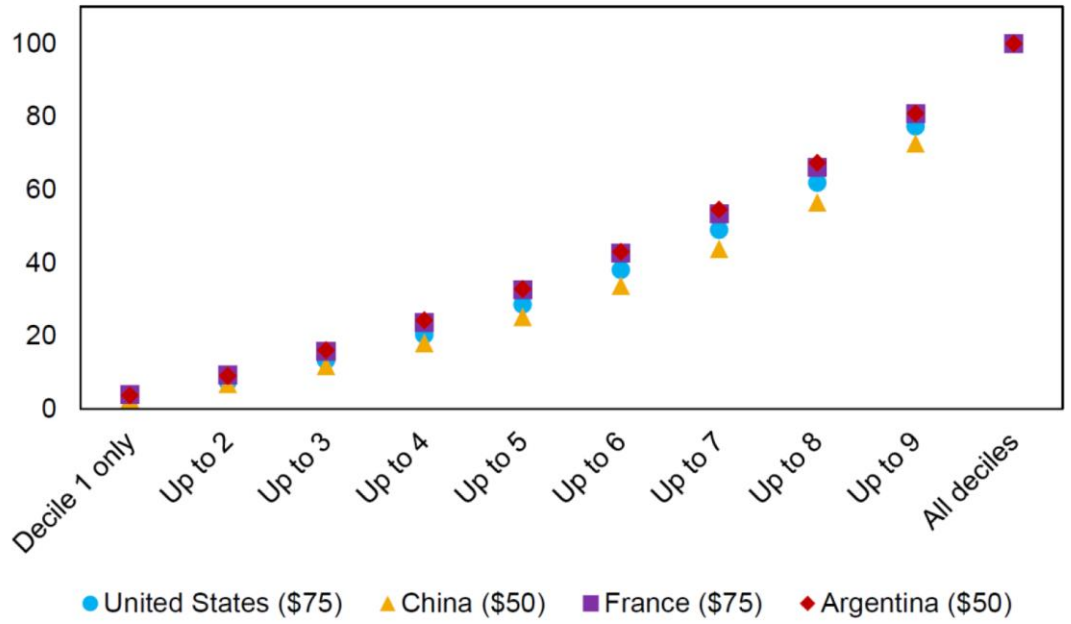
- Many other examples.

Equity concerns

It is in principle easy to compensate low-income households

- Black et al. (2024) find that compensating the 50% lowest income households will cost around 30% of the revenue generated by a carbon tax.

Figure 5. Costs to Fully Compensate Household Deciles for the Impact of a Carbon Price
(% of revenue raised)



Source: Black et al. (2024).

Key take aways from international experience

- Carbon pricing ensures the right incentives and a cost-effective green transition.
- Carbon pricing can take many forms and be combined with other instruments, depending on other policy goals besides climate.
- The economic literature finds that significant reductions in carbon emissions can be achieved at very low social costs.
  - But costs are not distributed evenly and depend on policy implementation.
- Increases in government revenue from carbon pricing is more than enough to compensate low-income households.

3. Illustrative Viet Nam static CGE model applications and results

The model

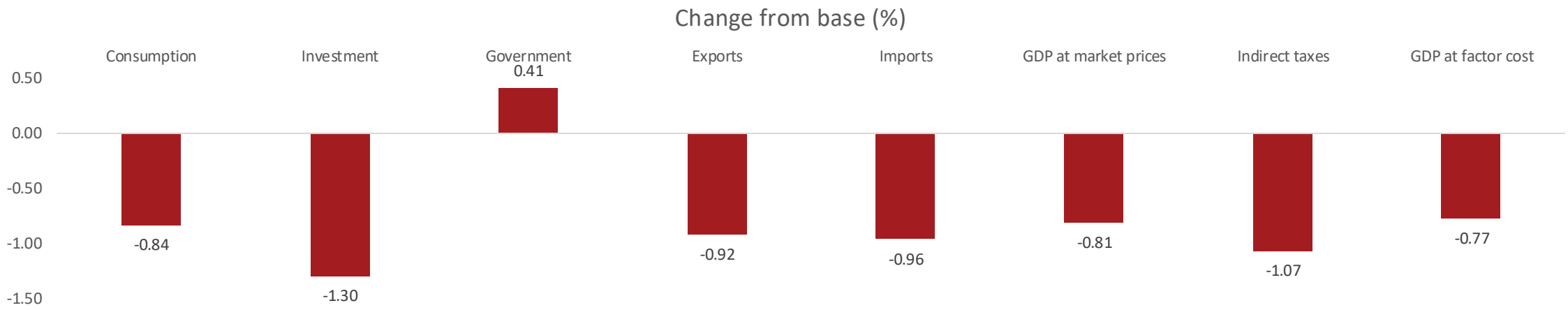
- A **static CGE** model capturing price adjustments, substitution, and economy-wide feedback from policy interventions
- CGE model based on the GSO/IPSS 2019 Viet Nam **ESAM** with 46 activities, 41 commodity markets, 11 production factors, 20 households
- **Energy use and emissions** generated by 14 types of energy bolted on to the CGE in the same way as one would do with employment

- Fully described in **IPSS Policy Report**
- Also identifies themes of some illustrative experiments, including:
  - **Carbon Tax**
  - **Energy Efficiency**
  - **Towards renewable energy**
- Each will be dealt with briefly

A 15$/ton CO2e carbon tax as policy lever

- **Motivation**: Weighing emissions reduction vs economy-wide costs
- **How modelled?** US$15/ton per CO2e emissions using industry level emissions accounts
  - In line with World Bank modelling
- **Note:** Emission per unit of production vary across industries
  - Big industry emitters higher taxed
- Will **increase production costs**
  - Prices up more for some industries than others (CGE model: relative prices)
  - Will raise government revenue but real expenditure is assumed fixed
- Modelled as a **"one time"** shock
  - No adjustment path (dynamic CGE domain)

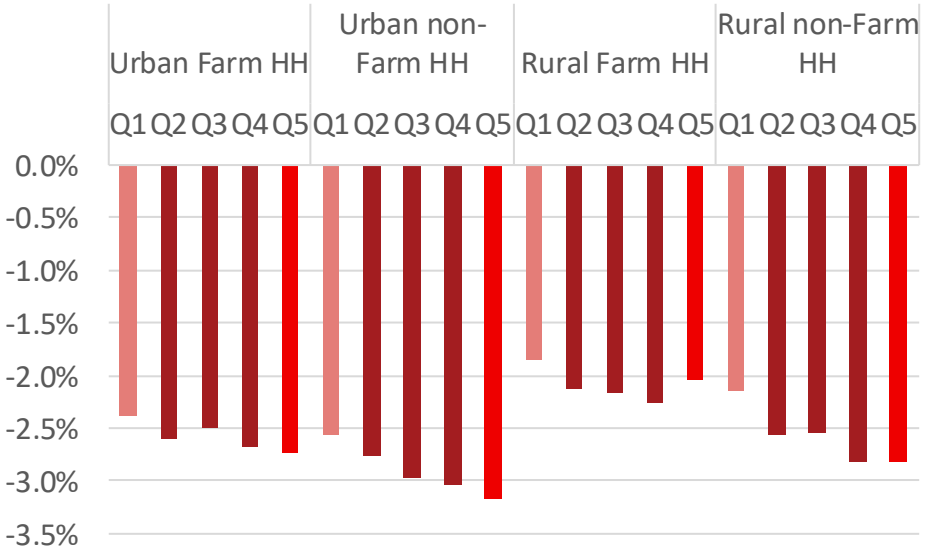
Macro-economic results of carbon tax



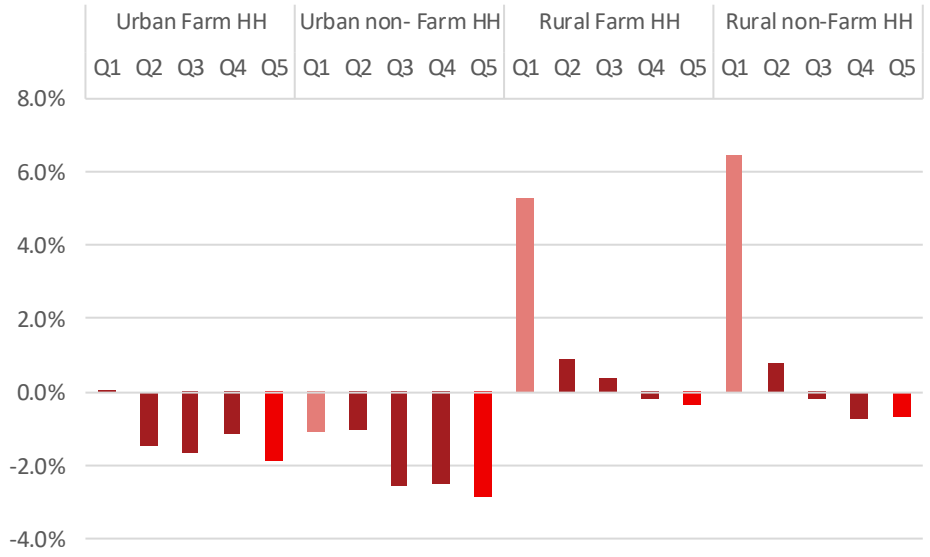
- Small negative changes off the base ESAM levels
  - GDP down by 0.8%
  - Trade is harmed relatively slightly more
  - Government expenditure in nominal terms up
    - Recall: assumed to be fixed in real terms
    - But prices of the goods and services basket it buys, is up on average
  - Industry output
    - Carbon pricing hits fossil fuels hardest
    - Relative price effects drive substitution away from carbon-intensive fuels

Detailed household results

- All households suffer
  - High income more than low income



- **Recycle** some of carbon tax revenue
  - Government transfer to households
  - According to **existing** patterns of ESAM



- High income households
  - Earnings more from high emitting industries
  - Relative to low income households

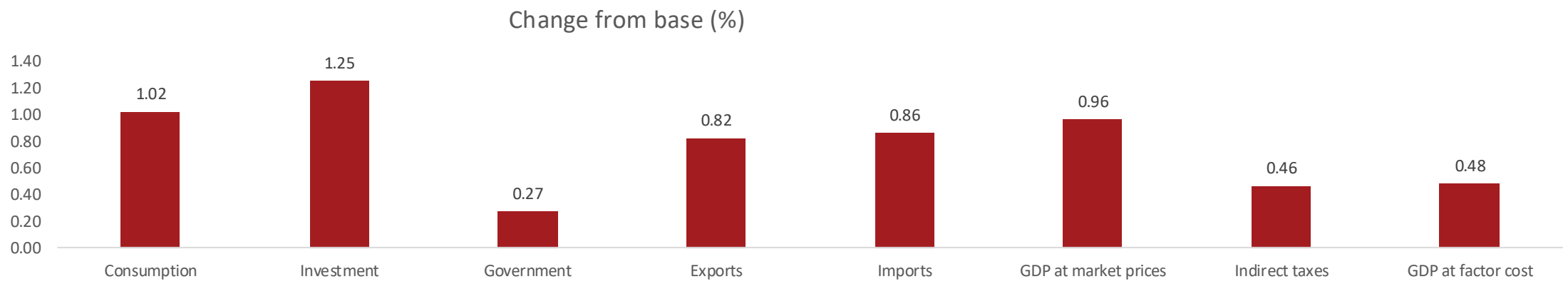
- Design Matters: A Well-Structured Carbon Tax
  - Can cut emissions
  - Without undermining growth or the low income

Beyond fiscal policy: carbon tax should be seen as part of a broader green growth strategy

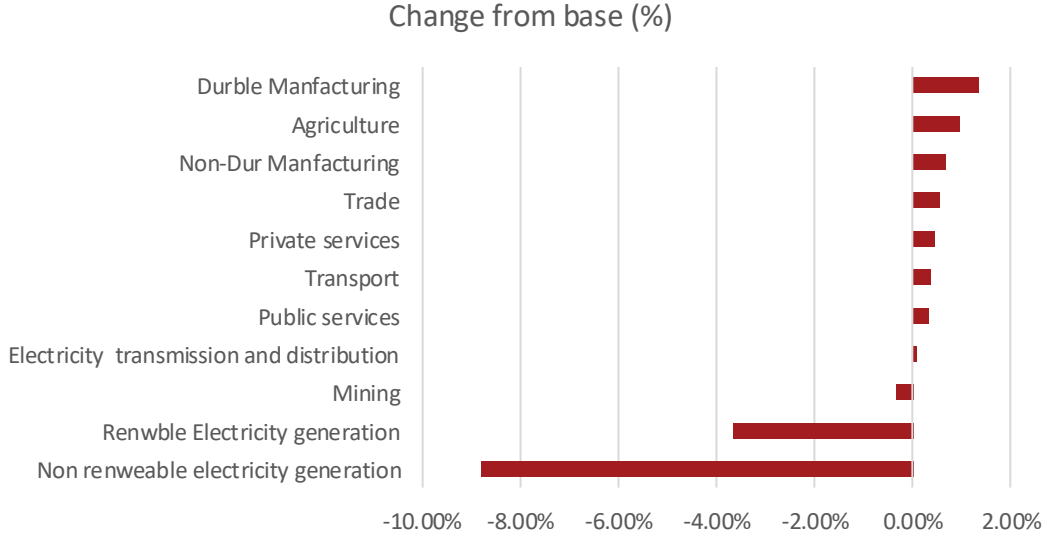
Energy efficiency

- **The growth dilemma:** decoupling Viet Nam's economic expansion from fossil-fuel dependence
- **Efficiency as strategy:** using energy saving as a macro-economic and competitiveness tool
- **How modelled**: 10% reduction in industry costs and households expenditure of electricity use
  - **Policy realism:** Aligned with Viet Nam's feasible 7–10% energy-saving targets
  - **Measurable impact:** Selecting a 10% shock to capture clear economy-wide effects
  - **A pragmatic medium-term target:** Achieving results through existing policy and tech upgrades
  - **Note**: requires investment, regulatory enforcement, firm-level capability in upgrading and supporting infrastructure
    - Note: the costs thereof are not modelled at this stage
- **Expected outcomes are complex**:
  - But final GDP gains can be used as benchmark for costing: investment, regulatory enforcement and supporting infrastructure

Macro & industry results energy efficiency



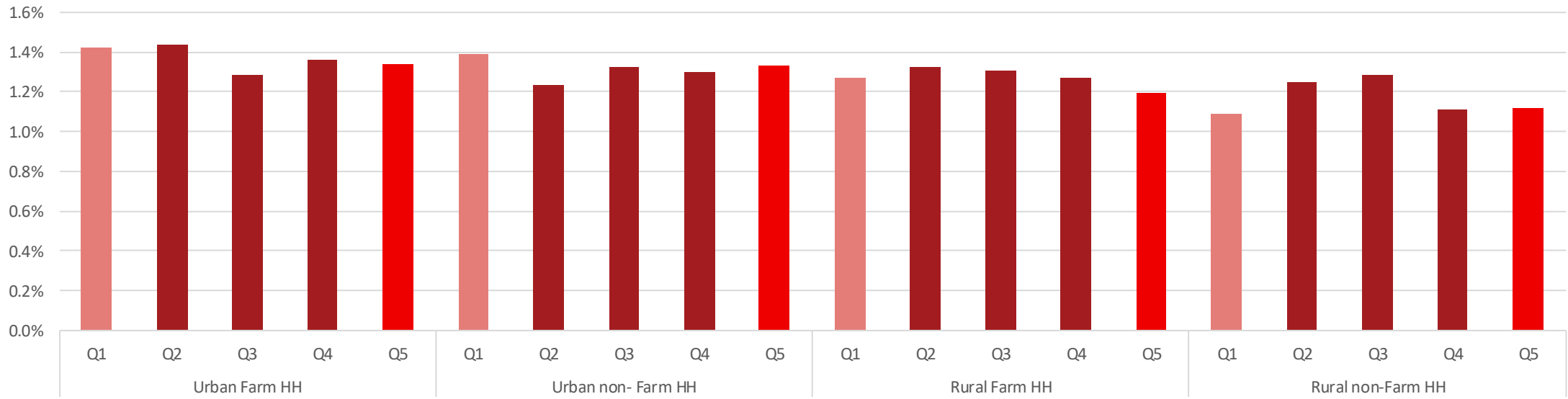
- Overall **positive** results
  - Government expenditure fixed in real terms but up in nominal terms due to price effect



- Electricity sectors' output down
  - Non-renewable most
  - Mining down
    - Indirect impacts due to being supplier to electricity sector
  - Durable manufacturing up most
  - Agriculture up
    - Not only directly as it is not a big electricity user
    - Indirectly due to higher economic activity (GDP)

Detailed household results of energy efficiency experiment

All households benefit with average around 1% higher incomes



- **Little variation**: low income slightly better off in urban areas but not in rural areas
- Variation in impacts depends on
  - Sources of incomes: which industries
  - Industry mix of low income household's sources
    - Urban workers more likely to benefit due to employment in industries where energy efficiency has greater impact such as manufacturing

Renewable energy in Viet Nam

Motivation

- Vietnam's energy transition: balancing growth, emissions, and energy security
- Beyond emissions: will renewable energy policy instruments matter for Viet Nam's economy?

Experiments

- Sim 1: Increasing investment in renewable electricity generation
  - **Motivation:** investment-led renewable energy expansion scenario, additional capital directed into hydro, wind and solar
  - **How:** A 25% boost in renewable electricity generation capital stock, as if **mana from heaven** (or FDI)
    - **But:** Associated investment is ignored: must be considered going forward (dynamic CGE)
  - **Expectation**: renewable electricity supply up ➔ price will come down ➔ shift towards renewable but indirect effects?
- Sim 2: Improving electricity transmission and distribution
  - Ignored in this presentation as it is more about network upgrading
- Sim 3: Increasing production tax on non-renewable electricity generation
  - **Motivation :** a targeted fossil-fuel electricity taxation scenario
  - **How:** A 25-percentage point increase in the production tax rate from about 1% to 26%
  - **Expectation**: production cost of non-renewable up ➔ their prices up ➔ shift away from non-renewable but indirect effects?

Renewable energy experiment results



Sim 1: increased **investment** in renewable energy

Sim3: Increasing **production tax** on non-renewable electricity

- **Sim1**: Investment in renewable energy broadly **positive** as expected
  - These results suggest that renewable energy investment can generate a growth effect while supporting cleaner structural trans formation
  - "Dual benefit": it supports GDP, consumption, investment and trade while contributing to the transition toward cleaner electr icity
  - Emissions are reduced by 1%
- **Sim3:** Taxing non-renewable energy broadly **negative** impact
  - Like most production taxes (carbon or otherwise) they usually have a negative impact on economic activity
  - Price-based disincentives for non-renewable electricity can be effective for shifting incentives
  - Should be implemented gradually and combined with compensating measures for affected sectors and households
  - Emission are about 2% lower

4. Policy implications

Implication 1

- A carbon tax (price mechanism) can deliver **meaningful** emission reductions
- Must be accompanied by **revenue redistribution** to vulnerable households to be “just”
- Should be **gradually** phased-in to avoid excessive growth and welfare costs



Implication 2

- Improving energy-efficiency a **broadly beneficial** policy instrument
- Has potential to simultaneously raise GDP, reduce costs, improve household welfare, and cut emissions, with positive distributional effects across all income groups
- But analyse costs: **who pays**!



Implication 3

- **Investment-led** renewable energy expansion (Sim 1) delivers the positive impact on green GDP growth
- Fossil fuel taxation (Sim 3) can shift incentives (price based) but should be phased **gradually** and paired with compensating measures



5. Conclusion, recommendations and way forward

Key conclusion

- Viet Nam's green transition not a narrow environmental agenda
- A core component of a **new development model** — one that links
  - high economic growth
  - energy security
  - emissions reduction
  - protection of vulnerable groups, and industrial competitiveness
- Evidence suggests these goals could be **complementary** rather than at odds, if transition policies are
  - well-designed
  - sequenced appropriately
  - anchored in the principle of leaving no-one behind

Key recommendations

- Viet Nam (IPSS) and others now have the **tools** and the infrastructure to fine tune existing experiments and develop new ones
  - Do experiments that represent detailed economic policy trade-offs in Viet Nam
  - Offer an opportunity to get familiar with CGE modelling
- **Start with** understanding comparative static CGE
  - Focus on one-off economy-wide adjustments to policy interventions and exogenous shocks
  - With limited energy & emissions representation
- **Gradual** approach name of the game here!
- **Benefit:** can be deployed at short notice for short turn around analysis of **many** different issues (oil price shocks, tariff changes etc)

Way forward - 1

- **Do more** concrete policy packages
- Future simulations can expand on current simulations by modelling specific instruments to **answer specific** policy questions
  - carbon tax roadmaps
  - emission trading systems (ETS) designs
  - electricity tariff reforms
  - renewable auction mechanisms
  - household compensation schemes

- The ESAM-based modelling system should be **institutionalised** as a standing policy analysis tool within Viet Nam's public sector to inform evidence-based policy making
- This system is advantageous in helping to **clarify trade-offs**, comparing alternative instruments, and identifying who wins and who loses from each policy option

Way forward - 2

- Regular **database updates** are critical
- The ESAM, energy, and emission accounts should be refreshed every **2–3** years to track Viet Nam's rapidly evolving energy mix, industrial structure, and household consumption patterns
- **NSO** has a key role to play together with MOF, IPSS, ISPAE and others such as MOIT

- Upgrade from static to **dynamic CGE** with more comprehensive energy and emissions representations.
- Needed to simulate **transition pathways** to 2045 (high-income vision) and 2050 (net-zero target)
- Because the **timing** of investment and the path of capital scrapping are central
- But more **complex** and analytically demanding