ESRI ECONOMIC & SOCIAL RESEARCH INSTITUTE

A Broader Economic Assessment of the Carbon Budgets

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Introduction

- We aim to create a better understanding of the potential secondary, macro economic and distributional impacts of the carbon budgets
- Our work is still under way
- We hope to present more detailed results next week
- This presentation introduces the background and describes our approach and some initial high level results

Economics of Carbon Budgets

- How can we transition to a low carbon economy at the **least overall economic cost**?
- How can we ensure a smooth and **societally accepted** transition?
- How can we **finance** a transition?

UCC TIM model

- The **UCC TIM** model is a highly detailed bottom up engineering model
- Gives insights to what is **technologically** possible
- Reduces emissions at the **least cost** (from a technological point of view)
- Answers how we can transition at the least cost based on **system costs**.
- This is the first **essential** assessment needed

“Economic ” optimal transition

To understand a least cost transition in terms of our economy and society we need to also understand:

- **Secondary impacts**
  - Sectoral shifts
    - Secondary impacts on non-core sectors, labour market
  - Behavioural responses
    - Consumption changes in reaction to prices
  - Interaction with other climate policies such as carbon tax
- **Financing**
  - **How do we pay** for this? Borrowing? Increased taxation? Decreased spending on other goods and services? What will the impacts of that be?
- **Overall economic impacts**
  - Including secondary impacts and financing impacts
- **Social/economic feasibility**
  - Can society adapt within the timeframes of TIM
    - Can consumers shift to EVs at the pace needed?
    - Can additional expenditures be absorbed?
    - Can the construction sector meet demand?
  - How are the costs distributed across society (sectors, households)

“Economic ” optimal transition

- A complete analysis of carbon budgets in this sense is extremely complex and time consuming
- We approach this by:
  - An investigation into **secondary** (sector level and HH level, carbon tax) impacts with the **I3E model** of:
    - **Funding investments**
    - **Expansion of Electricity sector**
    - **EVs and Retrofits**

  - **A33E61**: 33% reduction agriculture, 66% energy
  - **A51E51**: 51% reduction agriculture, 51% energy

Core Elements of the TIM Carbon Budgets

- **Power**
  - Large increase in renewable power (wind, solar), increase in natural gas in the short run
- **Transport**
  - Electricity, Hydrogen and CNG replace diesel and petrol
  - By 2030 42% of the cars on the road are electric, by 2035 80% in A33E61
- **Residential**
  - 213 000 retrofits in 2025, 329 000 in 2030 in A33E61
  - Energy efficiency improvements and shift to electricity
- **Production**
  - Increased use of electricity, ambient heat, biomass and biogas
  - Decreased use of natural gas
- **Agriculture**
  - Shifts from natural gas to biogas (for a decade)

Core Elements of the TIM Carbon Budgets

Mln € annual	2018	2025		2030	
		A51E51	A33E61	A51E51	A33E61
Total Investments	4	3,693	4,120	7,829	10,250
Power	-	1,223	1,352	2,678	2,712
Residential	1	1,207	1,389	2,079	2,484
Transport	2,443	3,933	4,010	6,177	9,202
Total	8,786	13,071	13,651	18,203	21,437

- Additional annual investments of up to **€10 billion** will be needed by 2030
- High costs to power, transport and residential

Retrofits and EVs

Retrofits and EVs

- Investments in retrofits and EVs will have various **secondary** economic impacts:
  - Increase in HH **spending** stimulating economic activity in Ireland (and abroad)
  - Decreases in **consumption** of other goods and services (decrease in VA and employment)
  - Decrease in HH **savings** leading to decreases in investments elsewhere (corporate level)

Retrofits and EVS

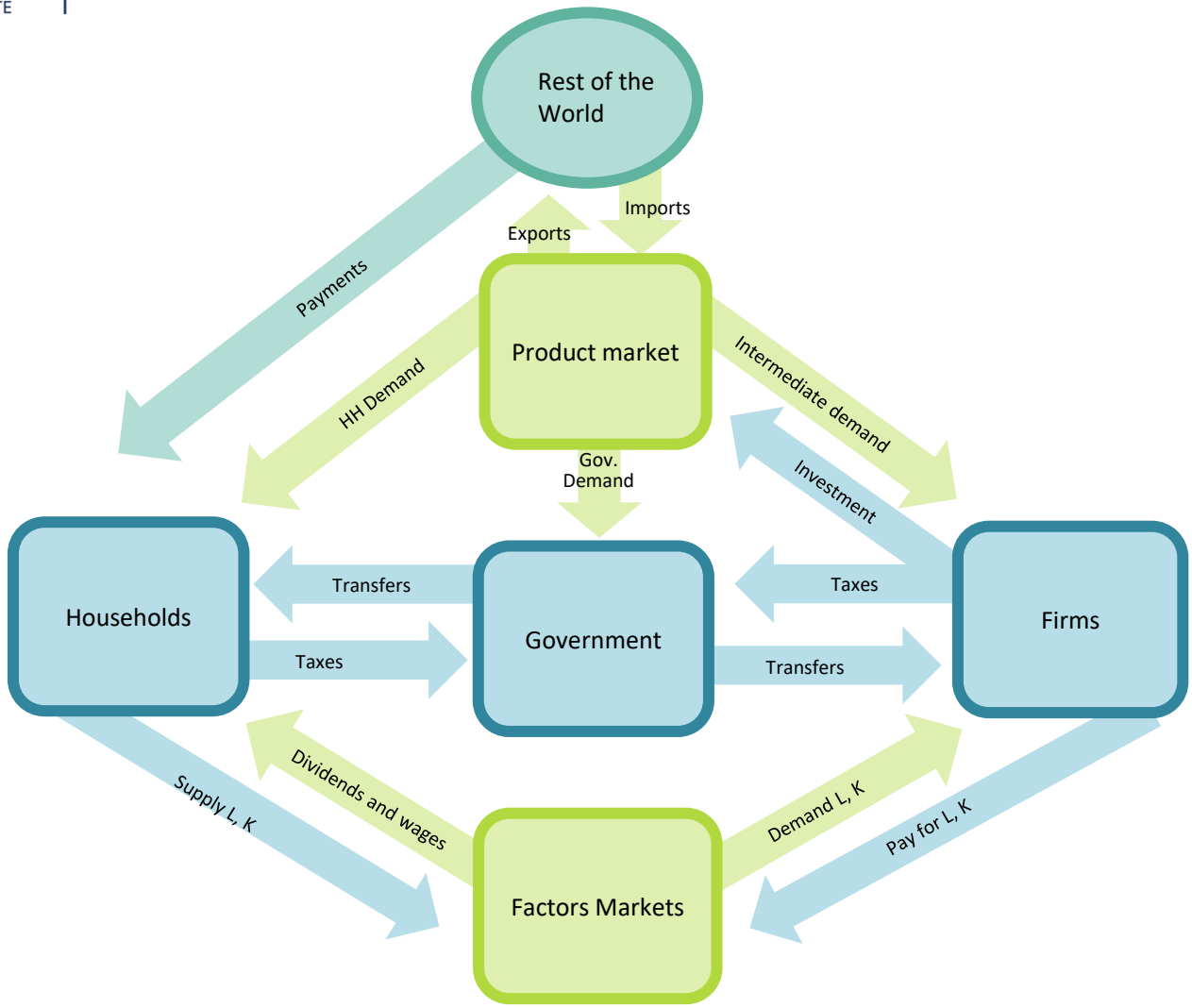
- EVs are **not** produced in Ireland
- Heat Pumps are to a large extent **imported**
- Construction sector is **overheating**

We examine the impacts with the I3E (preliminary results)

The I3E model

- Ireland Environment, Energy and Economy model
- https://www.esri.ie/current-research/the-i3e-model
- Dynamic Computable General Equilibrium model
- **Features**
  - Detailed representation of **production sectors** (34 sectors)
  - Detailed representation of **consumption goods** and services (39 commodities)
  - Inclusion of explicit **carbon commodities**
  - **Emissions** from combustion (ETS and non-ETS)
  - Detailed modelling of **government** sector
  - **Households** specification with 10 representative household groups (5 urban, 5 rural)
  - 3 **labour** types: low, medium and high skilled

I3E overview



Retrofits and EVs in I3E

- Assume a **Carbon tax** reaching **100€** in 2030
- **A33E61** TIM scenario
- Include **COVID-19** impacts
- We assume government **co-funds** retrofits of HH by 25%
- We do not fully capture the investments needed in power generation and hence underestimate the costs of electricity
- Results should be interpreted **with caution**

Sector impacts

- Our result show that the **carbon tax** has a dampening effect on the economy (without revenue recycling)
- Introducing carbon reduction measures such as EVs and RF will significantly **reduce** this taxation impacts
- However, there are relative **winners** and **losers**

Sector Impacts

- Relatively **negatively** impacted sectors due to **carbon tax**:
  - Electricity
  - Transport
  - Construction
  - Mining
  - Petroleum
  - Certain Manufacturing (metals, rubber and plastic)
- Additional Impacts of EVs and Retrofits
  - **Negative**
    - Petroleum
  - **Positive**
    - Electricity
    - Construction
    - Transportation (only slightly)
    - Manufacturing (especially: High tech products and Transportation equipment)
- Across services and manufacturing impacts differ considerably across subsectors depending on the connection to these main impacted sectors

Households

- **Wage impacts** are highest for rural and poorer households
- Relative **disposable income** impacts are highest for richer households (and urban)
- Richer urban adopt more retrofits and EVs

Conclusions on initial results

- Broader economic and distributional impacts are **complex**
- **Secondary impacts** are significant
- How a transition is **funded** has impacts
- Significant **sectoral shifts** outside the core sectors are expected
- **Households** are impacted through various channels: wage income decreases most for poorer rural households, expenditures increase most for richer urban households
- Carbon taxation and carbon reduction measures complement each other
- **Feasibility** and **distributional** impacts need to be considered

Accommodation & hotel services (NACE 55--56,79)
Agriculture (NACE 1-3)
Air transportation (NACE 51)
Basic metal manufacturing (NACE 24-25)
Basic pharmaceutical products (NACE 21)
Chemicals and chemical products (NACE 20)
Construction (NACE 41-43)
Education sector (NACE 85)
Food, beverage and tobacco (NACE 10-12)
Financial services (NACE 64--66,77)
Health sector (NACE 86--88)
High-technology products (NACE 26—28)
Land transportation (NACE 49)
Natural gas supply (NACE 35)
Other industrial products (NACE 17,18,33)
Other non-metallic products (NACE 23)
Renewables
Other manufacturing (NACE 31—32)
Other mining products (NACE 7 & 8)
Other services
Peat (NACE 8)
Petroleum (NACE 19)
Public sector (NACE 84)
Real estate services (NACE 68)
Rubber and plastic products (NACE 22)
Telecommunication services (NACE 61)
Textile (NACE 13-15)
Trade (NACE 45-47)
Transportation equipment (NACE 29—30)
Water and sewerage (NACE 36,37-39)
Water transportation (NACE 50)
Wood and wood products (NACE 16)
Electricity Production (NACE 35)