A Short Term Forecasting Framework with Multinational Distortions: The Case of Ireland.

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ESRI ECONOMIC & SOCIAL RESEARCH INSTITUTE

o Evolution of Irish GDP - Euro Mn

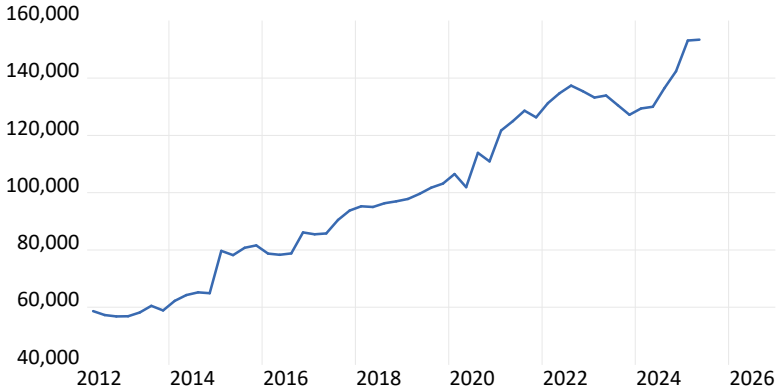


Figure: Quarterly GDP trends in Ireland

o Cross Country GDP growth

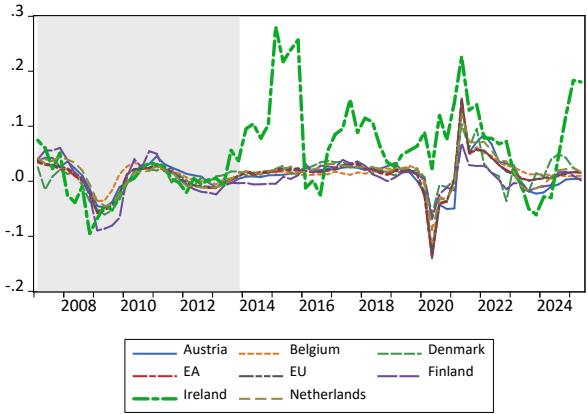


Figure: Cross Country GDP Growth Comparison

o Domestic Economic Trends Cross Country

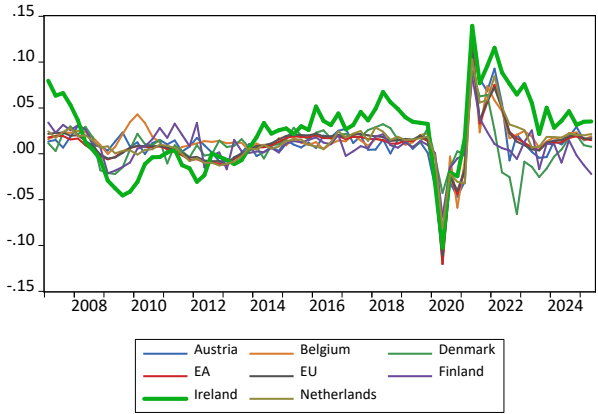


Figure: Cross Country Consumption Comparison

Investment Extremely Volatile

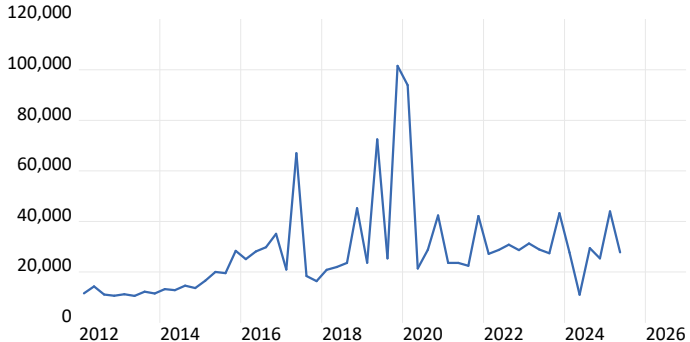


Figure: Quarterly investment trends in Ireland

o Always an exporter, now more than ever

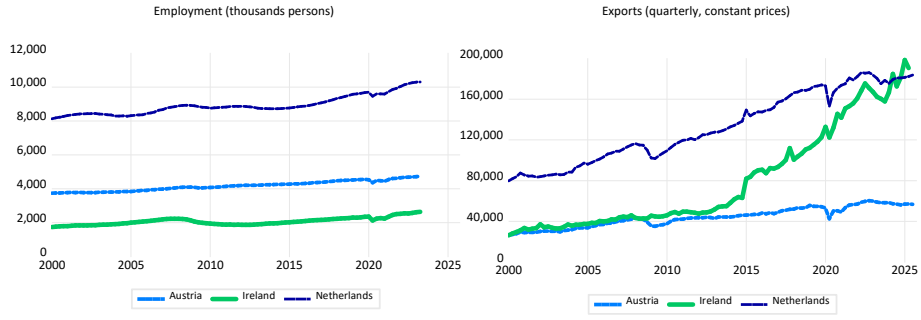


Figure: Employment and exports in Ireland, Austria and Netherlands

Classifying Ireland's challenges

- The headline figures above are affected by two distinct phenomena
- First, distortions that are purely statistical in nature
  - Firm-specific investment dynamics, particularly for IP
  - Export behaviour of large firms; contract manufacturing, goods for processing, royalties, and aircraft leasing
  - Not closely connected to economic activity occurring in Ireland
- Second, two booming export sectors
  - Pharmaceutical goods exports
  - Computer services exports
  - Genuine economic activity occurring in Ireland
  - Overwhelmingly focused on export markets

o Building on other modified measures

- Well-recognised need for adjusted measures for Irish economy
- **GNI* (modified GNI)**
  - > Excludes depreciation on IP and aircraft leasing as well as profits of redomiciled PLCs
  - > Produced by the Central Statistics Office
    - However, only available annually and at a lag
    - Issues persist around deflating to constant prices
    - Doesn't present a bottom up solution from underlying components of GDP
- **Modified Domestic Demand**
  - > Adds a modified investment value to domestic consumption and government expenditure
  - > Produced by the Central Statistics Office
    - Consistent and available quarterly
    - But it excludes all of the traded sector from a highly globalised small open economy

o Modified Domestic Demand

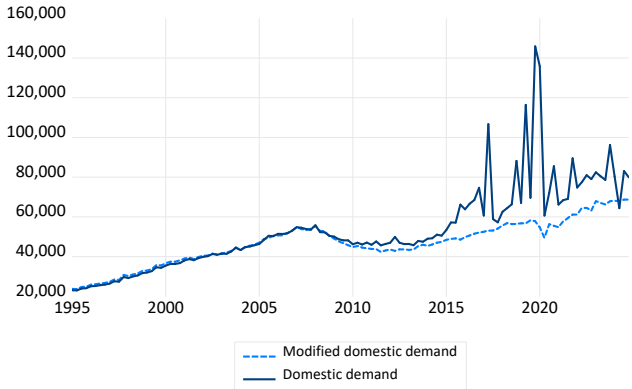


Figure: Quarterly Level of domestic demand

What Do We Do?

- Aim to build a small scale short term forecasting framework which can move beyond these distortions
- Set up a model that can be run and estimated quickly after the release of QNA data (within 2-5 days)
- Incorporate modified and adjusted measures into the model that allow the underlying economy to be analysed and forecast.
- Put forward an additional indicator (Adjusted Output or Adjusted-Y) which allows some traded activity to feed back through model

What will I do now?

1. Highlight where these distortions come from!
2. Highlight what we do with these data...

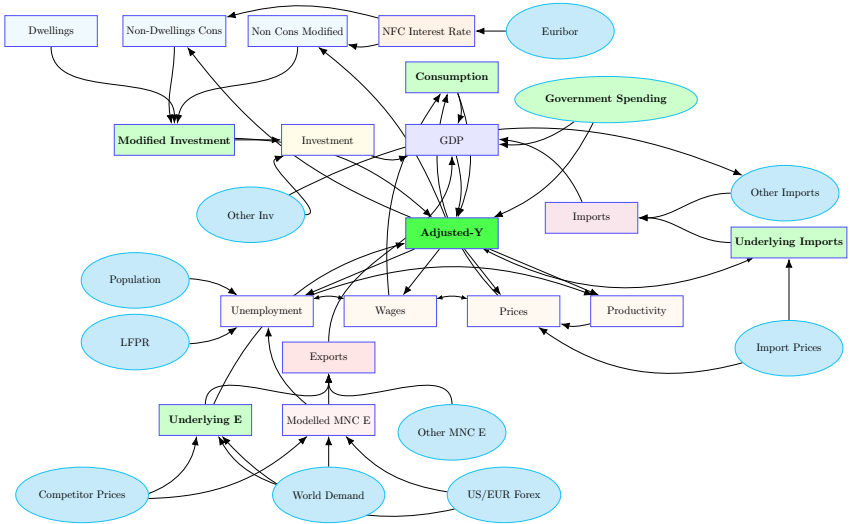
Adjusted output adds underlying traded sector to MDD

$$
\begin{aligned}
MDD &= C + G + I(MOD) \\
Y(ADJ) &= MDD + X(Underlying) - M(Underlying), \\
where &: \\
X(Underlying) &= X(Goods\_NonPharma) + X(ServUnderlying) \\
M(Underlying) &= M(Goods\_Underlying) + M(ServUnderlying) + M(GoodsMachEquip)
\end{aligned}
$$

More specifically,...

- Quarterly semi-structural macro-econometric model for short-term forecasting of Irish economy
- Aim is to produce consistent and interpretable short-term forecasts in the presence of multinational distortions
- Series of adjustments used to achieve this
  - 90+ equations or identities
  - 30+ estimated behavioural equations
  - 7 variables driven by technical assumptions to deal with multinational volatility
  - Aim for historical outcomes to match annually to sum of QNA outcomes.
  - Estimation process is automated:
    1. Quarterly data download and cleaning - national accounts and survey data
    2. Equation estimation and main workfile production
    3. Technical assumptions, model estimation and output
  - Provides a framework to adjust each behavioural variable by a judgement parameter

o Model Overview

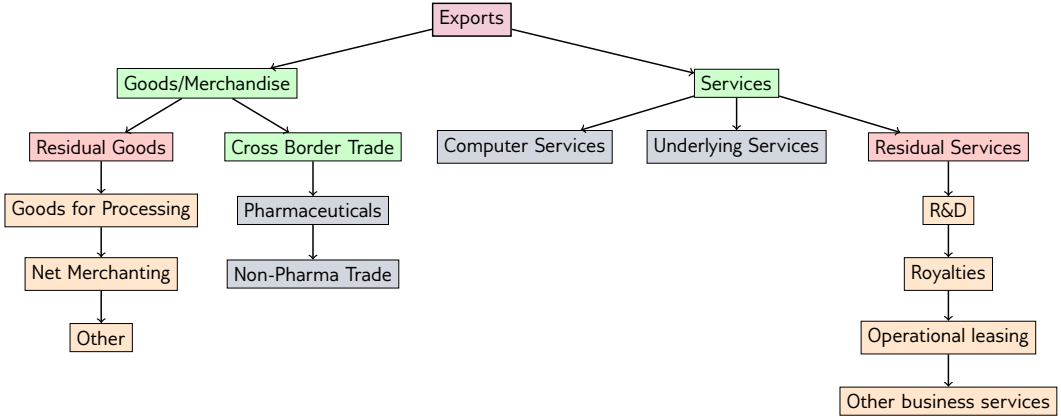


o Main Exogenous Variables - Draws on ESRI structural model COSMO, which takes exogenous path from NiGEM

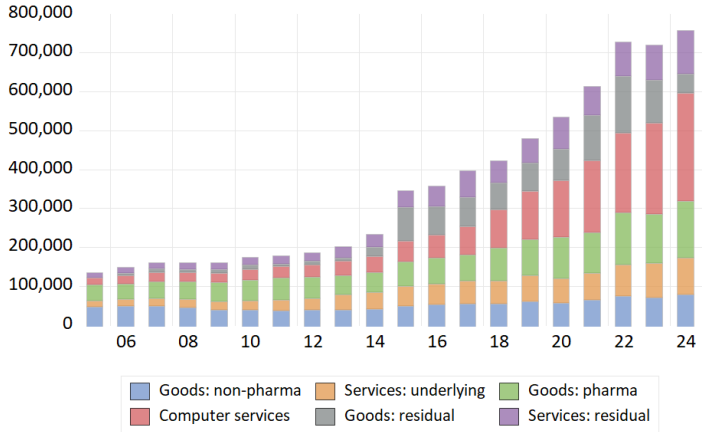
VARIABLE	STATUS
Euribor	Assumed path
World Demand	Wt Ave of Partners from ESRI COSMO
Oil Prices	ESRI COSMO
Gas Prices	ESRI COSMO
Coal Prices	ESRI COSMO
US/EU Exchange Rate	ESRI COSMO
Competitors prices	ESRI COSMO
Labour force participation rate	Assumption based on 4QMA
Population	Egan and Bergin (2024) rebased.

Table: KEY EXOGENOUS VARIABLES

o Exports – Proposed Strategy



o Exports - 6 categories capture statistical distortions and booming sectors



o Exports - specific definitions

First, the overall export identity is:

$$\begin{aligned} X_t &= X(Goods\_NonPharma)_t + X(Pharma)_t + X(Goods\_Residual)_t \\ &+ X(Computer\_Serv)_t + X(Underlying\_Serv)_t + X(Residual\_Serv)_t \end{aligned}$$

where:

$$\begin{aligned} X(Goods\_Residual_t &= X(Goods\_QNA)_t - X(Cross\_Border\_Trade)_t \\ X(Goods\_NonPharma)_t &= X(Cross\_Border\_Trade)_t - X(Pharma)_t \\ X(Computer\_Serv)_t &. \ takenfromQIA \\ X(Underlying\_Serv)_t &= Communications + insurance + finance + travel + repairs + other \\ X(Residual\_Serv)_t &= X(Total\_Serv\_QNA) - X(Computer\_Serv)_t - X(Underlying\_Serv)_t \end{aligned}$$

Data are then seasonally adjusted, grown backwards for time series (services) and applied as a share of total goods/services from QNAs.

o Exports - modelling strategy

Four separate export categories are modelled as a function of world demand in an error-correction structure. For export category i:

$$\Delta \ln X_{i,t} \quad = \quad \alpha + \beta_1[\ln X_{i,t-1} - \beta_2 \ln World\_Demand_{t-1}] + ... + \epsilon_t$$

Short-term difference variables for each export category added according to general to specific procedure.

We apply a technical assumption to the residuals. They are modelled as (for example):

$$X(Residual\_Serv)_t \quad = \quad X(Residual\_Serv)_{t-4} * FORE(X(Residual\_Serv))$$

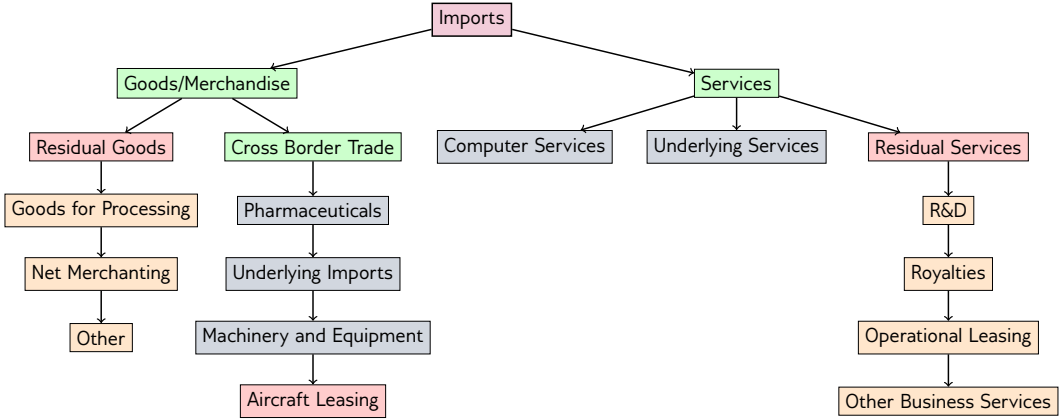
Where FORE is a parameterised path using judgement.

Modelling separately allows different sensitivities to world demand

Export category	Long-run coefficient on world demand
Pharmaceutical goods	3.7
Non-pharmaceutical goods	2.2
Computer services	4.6
Underlying services	1.3

Table: Export categories sensitivity to world demand

o Imports - proposed strategy



o Imports - specific definitions

First, the overall import identity is:

$$\begin{aligned} M_t &= M(Goods\_Residual)_t + M(Goods\_NonPharma)_t \\ &+ M(Goods\_Mach)_t + M(OTE)_t + M(Underlying\_Goods)_t \\ &+ M(Comp\_Serv)_t + M(Underlying\_Services)_t + M(Residual\_Services)_t \end{aligned}$$

where:

$$\begin{aligned} M(Goods\_Residual)_t &= M(Goods\_QNA)_t - M(Cross\_Border\_Trade)_t \\ M(Pharma)_t &= \text{Chemicals and related products (5)} \\ M(Goods\_Machinery)_t &= \text{Machinery and transport equipment (7) - (79)} \\ M(OTE)_t &= \text{Other transport equipment (79)} \\ M(Underlying\_Goods)_t &= M(Cross\_Border\_Trade)_t - M(Pharma)_t - M(Goods\_Machinery)_t - M(OTE)_t \\ M(Comp\_Serv)_t &\quad \text{taken from QIA} \\ M(Underlying\_Services)_t &= \text{Communications + insurance + finance + travel + repairs + other} \\ M(Residual\_Services)_t &= M(Total\_Serv\_QNA)_t - M(Comp\_Serv)_t - M(Underlying\_Services)_t \end{aligned}$$

Data are then seasonally adjusted, grown backwards for time series (services) and applied as a share of total goods/services from QNAs.

o Imports - modelling

Endogenous economic import variables are modelled differently - depending on the most relevant dependent variable:

$$
\begin{aligned}
lnM(Pharma)_t &= \alpha + \beta lnX(Pharma)_t + \epsilon_t \\
lnM(Underlying\_Goods)_t &= \alpha + \beta lnMDD_t + \epsilon_t \\
lnM(Goods\_Machinery)_t &= \alpha + \beta lnI(MOD)_t + \epsilon_t \\
lnM(ResidualServices)_t &= \alpha + \beta lnI(Other)_t + \epsilon_t \\
lnM(OTE)_t &= \alpha + \beta lnI(Other)_t + \epsilon_t \\
lnM(Underlying\_Serv)_t &= \alpha + \beta lnMDD_t + \epsilon_t
\end{aligned}
\tag{1}
$$

Short term lags are then included in an error-correction specification using a general to specific procedure
For the rest of the categories (computer services, residuals, aircraft leasing) we apply a technical assumption. They are modelled as:

$$
M(RESID)_t = M(RESID)_{t-4} * FORE(M(RESID))
$$

o Modified investment series

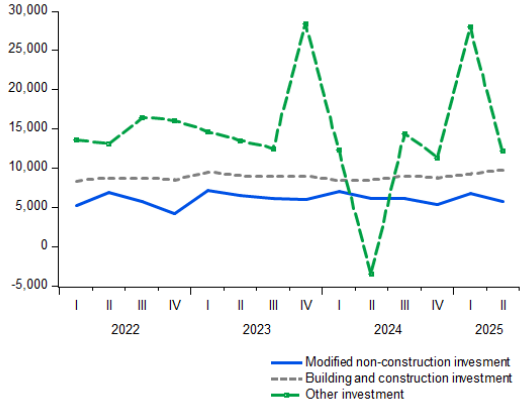


Figure: Investment and modified investment

o Investment Equations

Headline investment is separated into building and construction, modified non-construction investment and an "Other" category.

$$GFCF_t = BANDC_t + ModifiedNonConstruction_t + RestofInvestment_t$$

All three have a different treatment in the model.
The Rest of Investment is defined as:

$$RestofInvestment_t = GFCF_t - ModifiedGFCF_t$$

and it is modelled as:

$$RestofInvestment_t = RestofInvestment_{t-4} * FORE(ROI)$$

o Investment Equations - Accelerator model

The remaining components of investment, namely non-dwellings investment and modified non-construction investment are modelled as an accelerator model, where real adjusted output and the real cost of capital are the explanatory variables.

For category i of investment

$$\Delta \ln I_{i,t} = \alpha + \beta_{t-1}[\ln I_{i,t-1} - \beta_2 r_{t-1} - \beta_3 \ln Y(Adj)_{t-1}] + \epsilon_t$$

Short-term lagged difference variables added based on general to specific procedure.

- **Adjusted output can also be understood as a series of adjustments to quarterly GDP**

$$
\begin{aligned}
Y(ADJ) &= GDP \\
&- OtherGFCF \\
&- X(Pharma) + M(Pharma) \\
&- X(ComServ) + M(ComServ) \\
&- X(GoodsResidual) + M(GoodsResidual) \\
&- X(ServicesResidual) + M(ServicesResidual) \\
&+ M(OthTransportEquip)
\end{aligned}
$$

o Importance of adjusted measures has grown over time

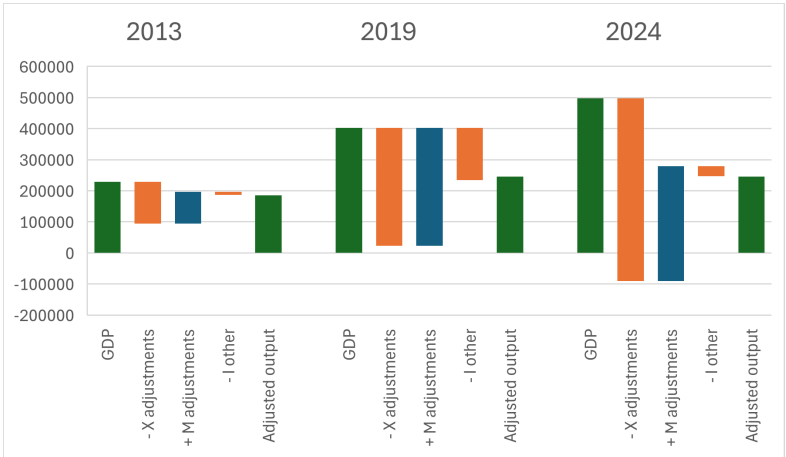
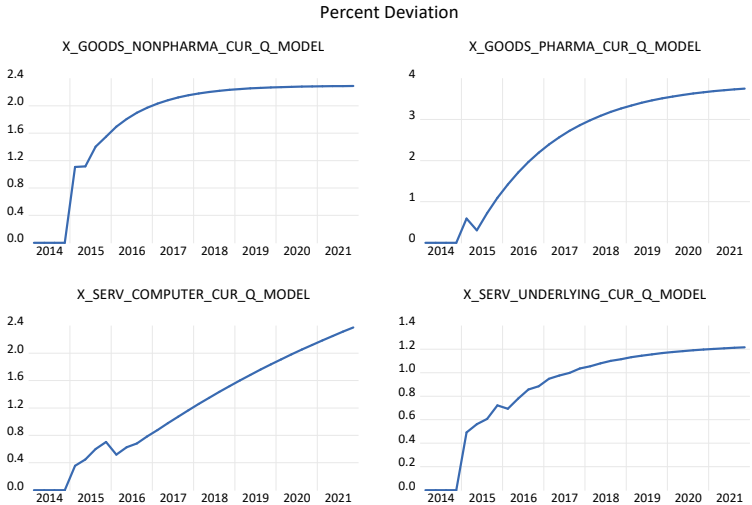


Figure: Walk from GDP to adjusted output in selected years

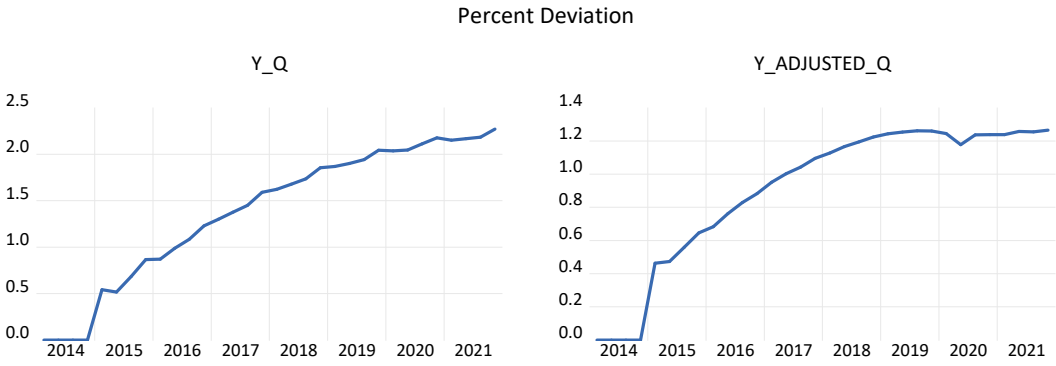
o Example Scenarios Showing Model Functionality

- Consider impact of 1 per cent shock to world demand. Test impacts on:
  - Export components
  - Imports
  - GDP, Adjusted-Y

o Impact on Output Measures of 1 per cent WD Shock



o Impact on Output Measures of 1 per cent WD Shock



Conclusions and Next Steps

- Ireland's economy is highly globalised and subject to huge distortions from multinationals
- Impossible to use these economic relationships for forecasting or analysis
- This framework allows us to produce consistent, timely and useful baseline forecasts in the short run
- Lots of work to do:
  1. Adding housing market and credit markets
  2. Better link between housing supply, house commencements and planning permissions
  3. Link to vulnerability in public finances.
  4. Corporation taxation from multinationals is extremely large and becoming hugely problematic due to multiple risks.
- Really appreciate comments and questions...

So What Do We Call It?

ESRI always likes to use Greek Mythology.... So we went with HESTIA - Greek Goddess of Home and Domesticity
Hybrid Econometric Structure with Trade and Internationalisation Adjustments (HESTIA)

Thank you

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