AN INSTITIÚID UM THAIGHDE EACNAMAÍOCHTA AGUS SÓISIALTA
ESRI ECONOMIC & SOCIAL RESEARCH INSTITUTE

National Institute of Economic and Social Research

ESRI Working Paper No. 796

January 2025

A macro-model of the Northern Ireland Economy

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Abstract

This paper describes the structure and estimation of a structural macro-econometric model of the Northern Ireland economy. We show how it can be used to assess the potential impact of economic shocks and policy changes. Specifically, we have done so by examining the effects of shocks to UK monetary policy, Northern Ireland government spending, and the spillover impacts of an increase in Irish exports on the Northern Ireland and all-island economy. We find a weaker response of Northern Ireland output and inflation to a UK monetary policy shock vis-a-vis the rest of the United Kingdom. We also find that a 1 per cent increase in Northern Ireland government spending leads to a 0.3 per cent increase in Northern Ireland output with little effect on Northern Ireland inflation. Finally, we demonstrate that a 1 per cent temporary increase in demand for Irish exports results in a 0.15 per cent rise in Northern Ireland's output and a 0.3 per cent increase in the output of the all-island economy, before coming back to the baseline. However, in the case of a permanent shock, it leads to a permanent increase of 0.12 per cent in Northern Ireland's output. The modelling of these shocks by this new structural macro-economic model provides a useful illustration of the kinds of exercises that it can undertake.

Keywords: Macroeconomic Model; Northern Ireland economy; NiGEM

***JEL* classification:** C51, C53, E17.

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1. Introduction

This paper describes the structure and estimation of a structural macro econometric model of the Northern Ireland economy[1]. We show how the model can be used to assess the potential impact of shocks and policy changes. The UK withdrawal from the European Union at the start of 2021 is likely to have profound effects on Northern Ireland as it leaves Northern Ireland in the unique position of being part of the UK fiscal, welfare and monetary unions – where the main policy levers of demand are mostly exercised at a UK national level – while remaining within the EU Single Market and with dual EU/UK regulatory regimes for the movement of goods along with other provisions of the EU/UK Windsor Framework and in Safeguarding the Union. The economic effects of this are likely to evolve over time.

Despite the relative peace and stability in Northern Ireland and the development of an all-island economy with Ireland since the Good Friday Agreement in 1998, the Northern Ireland (NI) economy has underperformed for many years – particularly relative to Ireland. Historically, its export trade intensity has been much lower than that of Ireland as has the scale and nature of multinational investment. At the same time, Ireland has been growing much faster than the United Kingdom, meaning that it has become increasingly important for the NI economy. This suggests a need for a joined-up framework within which we can think about this in the context of the all-island economy. In particular, such a framework would need to include trade linkages between the two economies as well as their linkages with Great Britain. By linking our model of Northern Ireland to Ireland, Great Britain and the rest of the world within the National Institute of Economic and Social Research's Global Econometric Model, NiGEM, we can ensure that such linkages will be present in model-based projections and in simulations of the effects of government policies and economic shocks.

To examine the effects of shocks and policy changes – at the UK, Irish and Northern Ireland levels – a macroeconomic model is needed that ensures the effects of policy changes coming through a complete range of channels can be captured, while being flexible enough that it can be used to consider a wide range of policy questions and types of shocks. Importantly, in developing this structural macroeconomic model we did not restrict ourselves to the current set of devolved powers possessed by the Northern Ireland Assembly but gave the model enough flexibility so that it can be used, for example, to consider what might happen should the Assembly be given and use wider tax-raising powers.

The model can also be used to examine a broad range of shocks including shocks to NI competitiveness, UK interest rates, the sterling-euro exchange rate and demand for NI exports from Great Britain, Ireland, or the rest of the world. A range of fiscal simulations within the

[1] AMNIE: **A** **M**acro-model of the **N**orthern **I**reland **E**conomy

context of the powers devolved to the NI Executive can also be considered. What the model does not allow is to examine the effects of more microeconomic shocks such as changes in demand for particular goods and services (e.g., food) or productivity improvements in particular industries (e.g., banking). Nor does the model currently allow consideration of the effects of cross-border investment, i.e., Irish companies building factories in Northern Ireland or vice-versa.

The structure of the paper is as follows. The next section briefly reviews the relevant academic literature. Section 3 discuss the construction of the time series database needed to estimate and run the model, which is a significant contribution to the literature itself. Section 4 discusses the structure of the model; its main equations and estimation. Section 5 presents simulation results. Specifically, we examine the effects of shocks to UK monetary policy, NI government spending, and the and the spillover impacts of an increase in Irish exports on the Northern Ireland and all-island economy. These shocks provide a useful illustration of the kinds of exercises that can be carried with the model. Section 6 concludes.

2. Related literature

This paper is linked to a comprehensive literature on structural and semi structural macroeconometric models, which primarily use empirical data to understand the linkages within an economy and to analyse policy implications (Taylor, 1993; Mitchell et al., 1998). These models also offer a cohesive framework for generating forecasts for the short and medium run in addition to understanding how economies respond to shocks and policy changes over time. In this context, Welfe (2013) and Garratt et al., (2012) provide detailed summaries of various types of macroeconometric model used for European and non-European economies. Some of these models include the METRIC model for France, the LIMA model for Austria, the NiGEM model for the UK and global economies, the LINK and HERMES models for Ireland, the AWM model for the Euro Area, the Quarterly WEFA model for the United States and the Candide model for Canada.

Structural macroeconomic models typically consist of equations representing aggregate demand, supply, and policy components (Bårdsen, 2005). These models often include consumption, investment and trade equations for aggregate demand, production functions and labour market equations for aggregate supply, and monetary policy reaction functions. Fiscal policy is represented through government expenditure, taxation, and public debt variables. The models may incorporate New Keynesian elements, such as microeconomic foundations and inflation dynamics. They can be used for forecasting, policy analysis, and understanding economic functioning (Fagan et al., 2005). We incorporate these features into our NI macroeconomic model.

These models are primarily developed at national level but occasionally at sub-national or regional level (Bhattacharjee et al., 2023; Cherubini & Paniccià, 2013; Rickman, 2010; Siebern, 2003). However, given the significant regional disparities within the UK—ranging from productivity gaps to variations in economic growth rates—it becomes increasingly essential to understand the economic dynamics of its sub-national economies (Nguyen, 2019). Northern Ireland is a special case. Although Northern Ireland is a region within the United Kingdom, its economy shares key similarities with other European countries that are closely integrated with neighbouring EU economies. This is especially evident in its cross-border trade and labour mobility with Ireland (Kren & Lawless, 2023; McGuinness & Bergin, 2020). Thus, modelling efforts need to consider the regional context and the distinct economic interactions between Northern Ireland and Ireland. Regional models such as those used for Italy's north-south divide or Spain's regional disparities offer examples of how structural models can address issues of sub-national economies within larger political and economic unions (Mauro, 2004; Villaverde & Maza, 2009).

Post-Brexit, Northern Ireland's unique position within the United Kingdom and connectivity to the European Union necessitates a specialized macroeconomic model and its absence leaves a gap in the literature which we aim to fill with this model. Such a model needs to capture Northern Ireland's distinct regional and devolved position within the United Kingdom, its close trade integration with Ireland, and the broader economic implications of both UK and EU policies. Our development of a structural macroeconomic model for Northern Ireland, utilizing the approach of existing country models, closely follows the modelling approaches of two country models - NiGEM for the United Kingdom (Hantzche et al., 2018) and COSMO for Ireland (Bergin et al., 2017). Both models have proven effective in analysing macroeconomic issues for the United Kingdom and Ireland and serve as a foundational framework for modelling the NI economy.

3. Database

To build a comprehensive macroeconomic model for the Northern Ireland economy, it is essential to have an extensive dataset covering various dimensions of the economy, including the components of output, labour market, demographics, prices, interest rates etc. Given the absence of a centralised time series database specifically for Northern Ireland, it was necessary to construct one. With the exception of a few variables, the dataset spans the period from 1997 to 2021.

The main data sources include:

- Office for National Statistics (ONS) Regional Account (for NI data on public finances, deflators, output, trade, labour market, capital stock, consumption and income)

- UK HM treasury statistics (for data on NI block grant, UK income tax rate and UK deflators).
- Northern Ireland Statistics and Research Agency (NISRA) (for NI labour market and demographic data)
- Economic Statistics Centre of Excellence (ESCOE) (for UK regional estimates of gross fixed capital formation, output and output growth)

The final model database includes time series for around 60 macroeconomic variables and construction of the database required collecting around double that number of series. These include core components of the national accounts (such as consumption, investment, government expenditure, exports, and imports), labour market data (employment, wage, hours worked, unemployment rates), and demographic data (working-age population, total population, retired population).

3.1 Addressing Gaps and Data Inconsistencies

However, compiling data from different sources presented several challenges. These included issues of consistency across datasets, missing values, limited time series, and in some cases, the absence of data for Northern Ireland. To address these challenges, we employed a variety of techniques. For example, we applied statistical methods to fill in missing values and used UK-wide data to splice together limited time series. In cases where historical data for Northern Ireland were incomplete, we extended the datasets by, for example, applying the NI population share to UK level data. Throughout this process, we conducted multiple checks to ensure the overall consistency and reliability of the dataset.

One of the major challenges encountered was missing data for Northern Ireland either from gaps in available time series and/or limited availability of consistent time-series data. There were notable gaps in the time-series data, for some key economic variables. For example, there is no consistent time series for price data and deflators for Northern Ireland. In this case, we use UK prices and deflators. Table 1 describes the main simplifying assumptions that used for missing data.

Table 1: Data gaps and assumptions

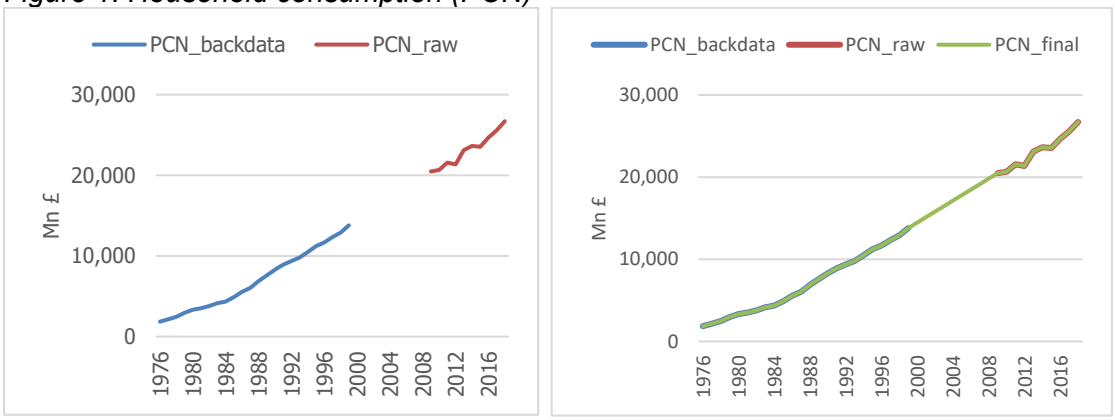
Data Gaps	Assumptions
Absence of NI deflators and prices (e.g., consumption, exports, imports etc.)	Used relevant UK deflators to convert NI series into constant prices
Missing variables – financial wealth etc. Limited time series such as tax receipts	Applied NI population share to the United Kingdom to construct NI variables such as financial wealth etc. Constructed measure of housing wealth Used UK values to splice limited time series such as tax receipts
Interest rates	Variable values set equal to UK values such as long-term lending rate etc.

There are also some inconsistencies and discontinuities in the available time-series data for Northern Ireland. For example, NI investment and consumption data were not consistently available. These gaps meant that we had to piece together a coherent dataset from multiple sources, using a range of statistical techniques. For instance, the absence of a full, continuous time series for NI national accounts required us to construct these accounts from several sources, including different vintages of ONS regional accounts[2]. Where time series were incomplete or inconsistent, we employed robust imputation methods and, where necessary, interpolated missing data. This approach allowed us to maintain consistency across different time periods and data sources. In many cases, we obtain several NI time-series variables in two parts – older series (1990-1996) and new series (1997-2021) from the ONS. Depending on the data, we apply different methods to construct consistent time series

For example, for variables that appear to be at a similar level (e.g. household income, consumption), we adopt linear Interpolation to fill the missing data (see Figure 1).

[2] We refer to the '*ONS regional trends (1976-98)*' and '*ONS regional accounts (1998 -)*' as the old ONS and new ONS database respectively.

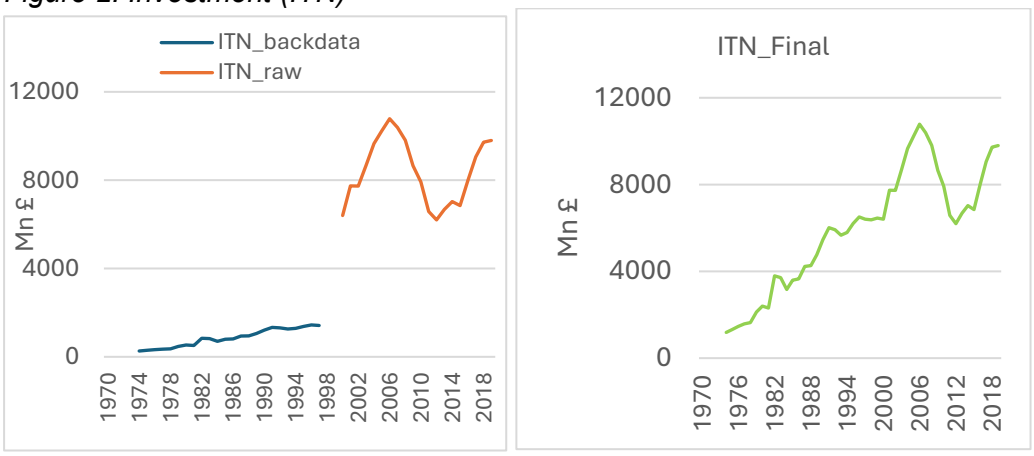
Figure 1: Household consumption (PCN)



Sources: _backdata: ONS Regional Trends; _raw: ONS Domestic Household Final Consumption Expenditure by COICOP commodities, NUTS1 countries and regions of the UK, 2009 to 2018 (Experimental statistics)

For variables that are at different levels (e.g. investment), we adopt linear Interpolation to fill the missing data and then backcast the series using linear splicing between old and new series (common factor) (See Figure 2).

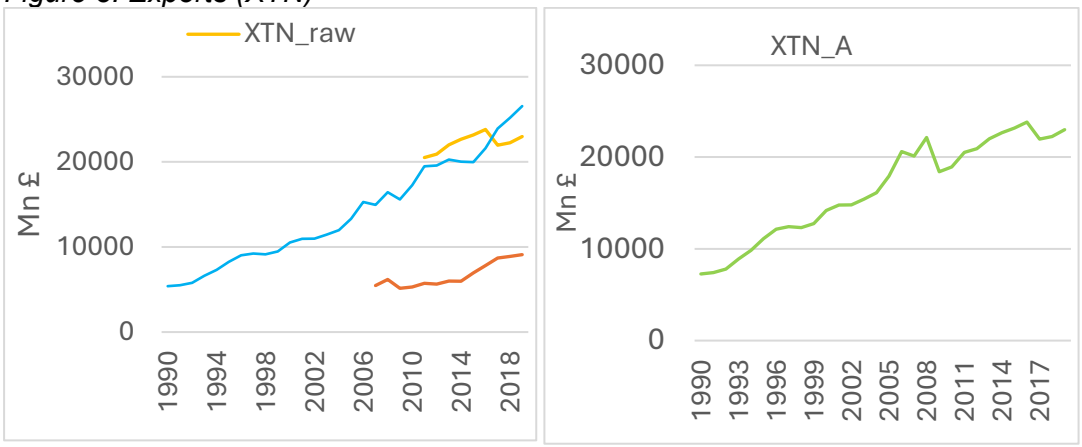
Figure 2: Investment (ITN)



Sources: _backdata: ONS Regional Trends; _raw: ONS Gross Fixed Capital Formation, regions of the UK, 2000 to 2018

For variables that available from different sources such as exports and imports, we first combine NISRA data (2011-2019) and ONS data (2007-2010), then backcast the NISRA data with growth rate of ONS data and finally backcast the time series to 1990 using the growth rate of the NI share in UK GDP. (See Figure 3).

Figure 3: Exports (XTN)



Sources: _backdata1: ONS Regional Trends 2007-2018; _backdata2: NI Share of UK exports, ONS, 1990-2018; _raw: exports and GB sales, NISRA, 2011-2018

After addressing the data gaps and finalising consistency checks for our time series, we compiled annual data for Northern Ireland for the period of 1990-2021. Then we transformed annual data into a quarterly frequency using the 'Denton' algorithm to meet the requirements of the NiGEM environment, which requires quarterly data.[3]

3.2 Descriptive statistics

Table 2 presents comparative data for Ireland, Northern Ireland, and the United Kingdom over the 1997 to 2021 period. The table reveals that Ireland tends to have higher but more volatile growth in key variables including consumption, investment, imports and overall output than Northern Ireland or the UK. The UK has the next highest growth rates and the data also show less volatility in these rates than for Northern Ireland. Overall, Northern Ireland has experienced more moderate growth rates relative to both Ireland and the United Kingdom, and more stability in these variables compared in Ireland but more volatility relative to the UK.

The table also reveals structural differences between Northern Ireland and Ireland and the UK. For example, government spending (as a share of GDP), is notably higher in Northern Ireland reflecting a larger role of the public sector in the economy. Northern Ireland is less open in terms of trade compared to Ireland but has broadly similar export and import shares (of GDP) to the UK.

[3] Please see table A1 in the appendix for further details on the variables.

Table 2: Summary statistics of national accounts variables for UK, IRE and NI for 1997- 2021

	Ireland				Northern Ireland				United Kingdom			
Variables	***Mean***	***Max***	***Min***	***Std. Dev.***	***Mean***	***Max***	***Min***	***Std. Dev.***	***Mean***	***Max***	***Min***	***Std. Dev.***
Consumption growth (per cent)	3.9	13.8	-4.9	3.6	2.2	7.2	-4.4	2.2	2.4	6.1	-5.5	2.1
Exports/GDP	0.8	1.2	0.4	0.1	0.3	0.3	0.2	0.1	0.3	0.3	0.2	0.1
Government spending/GDP	0.2	0.2	0.1	0.0	0.4	0.5	0.3	0.1	0.2	0.3	0.2	0.1
Import growth (per cent)	9.4	43.9	-30.5	12.9	4.2	12.5	-11.2	4.7	4.5	12.6	-11.3	4.3
Imports/GDP	0.7	1.3	0.4	0.1	0.3	0.3	0.1	0.1	0.2	0.3	0.2	0.1
Investment growth (per cent)	10.6	171.9	-68.3	31.0	2.5	31.3	-18.7	11.4	2.6	15.3	-22.6	6.7
Investment/GDP	0.2	0.7	0.1	0.1	0.3	0.4	0.2	0.1	0.1	0.2	0.1	0.1
GDP growth (per cent)	5.5	26.2	-9.6	6.0	1.0	10.9	-14.7	4.6	2.1	5.2	-6.1	1.9

Source: ONS, ESCOE and authors' calculations

4. Model Structure

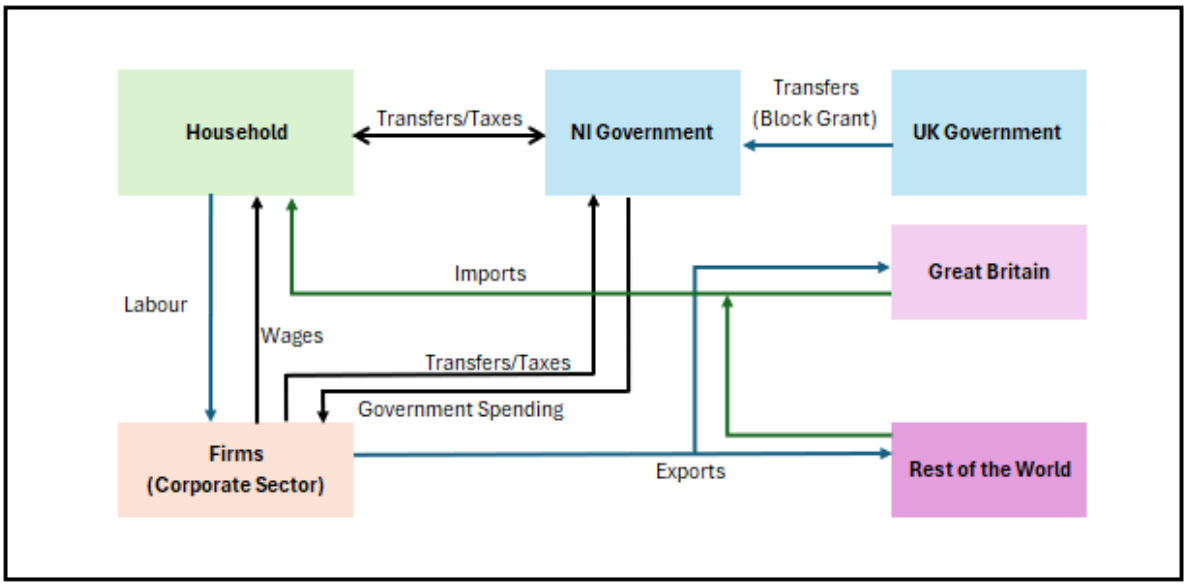
This section presents the main equations for the Northern Ireland structural model. The overall structure follows that of individual country models within NiGEM, as outlined in Hantzsche *et al*. (2018), but we make some specific adaptations to reflect the fact that Northern Ireland is part of the United Kingdom. The model has a theoretical structure with econometrically estimated parameters and dynamics. It provides a framework to understand economic relationships, generate forecasts and assess policy impacts. As with all macroeconomic models, the model is a simplification of the complex relationships and processes that ultimately determine economic activity.

The macroeconomic model for Northern Ireland consists of four sectors: Households, Firms, Government and Foreign. Households consume goods and services and supply labour to firms, while receiving wages from firms. They invest in housing and financial assets. Firms in the corporate sector are responsible for producing goods and services using labour, which is supplied by the household sector, and capital.

The Public Sector in Northern Ireland operates under power sharing agreements agreed in the Belfast/Good Friday Agreement and legislated for by the UK Government. Central to this devolved administration is a Northern Ireland Assembly and the Northern Ireland Executive – which has authority over several areas like health, education, infrastructure and justice. NI Executive spending is primarily funded by the Westminster Government's block grant, supplemented by local taxes and other revenues, though key tax rates, including those for income tax and VAT, are controlled by the UK government. The block grant is calculated using the Barnett Formula that adjusts the grant based on spending changes in the United Kingdom as a whole and the NI population.

Finally, the Foreign Sector encompasses the economic interactions Northern Ireland has within the United Kingdom, Ireland, the EU and the rest of the world. Exports depend on global demand and competitiveness, while import demand is driven by aggregate demand and relative prices. As a part of the Brexit agreement, the Windsor Framework enables Northern Ireland to remain within the EU single market for goods while Great Britain remains its most significant trading partner and economic influencer, impacting the NI economy through trade, policy, and financial transfers. This interconnectedness ensures a dynamic feedback loop between Northern Ireland and Great Britain, affecting overall economic stability and growth. We describe the model structure in the figure 4 below.

Figure 4: Model structure



Source: Author's description of the model

4.1 Estimation

The core behavioural equations are specified within an error correction model (ECM) framework. This framework allows the long run equilibrium, represented by the cointegrating

relationship, to be modelled in a theoretically consistent manner while the short run dynamics are adjusted to best fit the data. We follow the standard error correction model structure as below, where the long-run equilibrium relationship between the series Y_t and a set of other variables, X_t, is embedded in an equation that also contains short-run dynamics, as follows:

$$\Delta Y_t = \alpha + \delta\underbrace{(Y_{t-1} - \beta_1 X_{t-1})}_{\text{Long-Run Effect}} + \underbrace{\beta_2 \Delta X_t}_{\text{Short-Run Effect}}$$

where α is a constant, β_1 are the long-run coefficients, β_2 are the short-run elasticities and δ is the speed of adjustment.

As outlined in Engle and Granger (1987), the ECM approach is helpful in modelling the relationship between non-stationary time-series variables that are cointegrated as it allows to understand both short-term dynamics and long-term equilibrium relationships. The variable δ denotes the speed of adjustment which is how quickly deviations from the long-run equilibrium are corrected. A higher speed of adjustment indicates a faster return to equilibrium.

In the Northern Ireland model, while most equations are freely estimated, we impose calibrated parameters in some of the equations (generally based on UK estimates).

4.2 Household sector

Households in the model are assumed to consume, supply labour, earn income through labour supplied and invest their savings in housing and financial assets. Household consumption depends on real personal disposable income, demographics and wealth. Total Wealth, *tw*, consists of both financial wealth and tangible wealth (housing), which is further described in detail below. The estimated consumption function is:

$$\begin{aligned}\Delta\, ln(c) = {} & \underset{(0.007)}{0.0191} \\ & - \underset{(0.023)}{0.0548}\Big[ln(c_{-1}) - \underset{(0.048)}{0.705}\, ln(\mathrm{rpdi}_{-1}) - \underset{(0.029)}{0.091} ln\Big(\frac{\mathrm{popr}_{-1}}{\mathrm{popr}_{-1} + \mathrm{popwa}_{-1}}\Big) \\ & - \underset{(0.021)}{0.144}\, ln\Big(\frac{\mathrm{nw}_{-1} \times 100}{\mathrm{ced}_{-1}}\Big) - (1.0 - 0.705 - 0.091 - 0.144)\, ln\Big(\frac{\mathrm{hw}_{-1} \times 100}{\mathrm{ced}_{-1}}\Big)\Big] \\ & + \underset{(0.095)}{0.677}\Delta ln(rpdi)\end{aligned}$$

where *c* denotes consumption, *popr* denotes the population of retirees, *popwa* denotes the population of working age, *rpdi* denotes real personal disposable income, which includes

wages, transfers less taxes, and other personal income, *ced* denotes the consumer expenditure deflator, *nw* denotes net financial wealth and *hw* denotes housing wealth.

Households supply labour and earn income for consumption. The labour force, *lf*, is determined by the labour force participation rate, *prt*, and the NI working age population.

$$lf = prt * popwa$$

Northern Ireland households hold tangible wealth in the form of housing assets. Housing investment adds to housing wealth. Housing wealth moves with house prices. House prices are backward-looking by default and depend on consumer prices and borrowing costs as proxied by the long-run interest rate and the borrowing-to-lending spread. The estimated equation is:

$$\Delta\, ln(\mathrm{ph}) = \underset{(0.009)}{-0.002} - \underset{(0.013)}{0.020}\left[ln(\mathrm{ph}_{-1}) - ln(\mathrm{ced}_{-1}) - \underset{(0.085)}{0.193}\, ln\left(\frac{\mathrm{lrr}_{-1}}{100} + \frac{\mathrm{lendw}_{-1}}{100}\right)\right]$$

where *ph* denotes house prices, *ced* denotes the consumer expenditure deflator, *lrr* denotes the long-term real interest rate and *lendw* denotes the household lending spread.

The desired housing stock, *kh*, depends on the user cost of capital, output and population growth. The estimated equation is given as -

$$\begin{aligned}\Delta\, ln(\mathrm{kh}) = {} & \underset{(0.021)}{0.154} \\ & - \underset{(0.006)}{0.046}\left[ln(\mathrm{kh}_{-1}) - \underset{(0.040)}{0.180}\, ln(\mathrm{ycap}_{-1}) - \underset{(0.013)}{0.059}\, ln(\mathrm{user}_{-1}) - \underset{(0.054)}{0.812}\, ln(\mathrm{popwa}_{-1})\right] \\ & + \underset{(0.013)}{0.025}\Delta\, ln(\mathrm{ycap})\end{aligned}$$

Where *kh* denotes the housing stock, *ycap* denotes trend output and *user* denotes the user cost of capital.

Housing investment is then given by the change in desired housing stock after depreciation:

$$ih = kh - kh_{-1}(1 - 0.25khdep)$$

Where *ih* denotes housing investment, *kh* denotes the housing stock and *khdep* denotes housing depreciation.

4.3 Firms

Firms in the model are assumed to invest in capital, hire labour and use energy in order to supply the economy with goods and services. As such, the potential output of the economy depends on labour, capital and energy:

$$\Delta\, ln(ycap) = (1 - \alpha - d\theta)\, ln(kstar) + (1 - \alpha)\Delta\, ln(etrnd) + \alpha(ln(oivol\ \frac{y}{(oivol_{-1})(y_{-1})})) + d\theta(techl - techl_{-1})$$

The role of $d\theta$ quantifies the effect of technological change on potential output and can be further broken down into:

$$\frac{(comp_{-1}+comp_{-2}+comp_{-3}+comp_{-4}+comp_{-5}+comp_{-6})\,(e_{-1}+e_{-2}+e_{-3}+e_{-4}+e_{-5}+e_{-6})}{(ee_{-1}+ee_{-2}+ee_{-3}+ee_{-4}+ee_{-5}+ee_{-6})\,(nom_{-1}+nom_{-2}+nom_{-3}+nom_{-4}+nom_{-5}+nom_{-6})}$$

Where *y* denotes output, *kstar* denotes the desired or trend capital stock, α denotes energy use as a share of GDP in 2017, *etrnd* denotes trend employment, *oivol* denotes the volume of energy input and *techl* denotes labour augmenting technical process, *ee* denotes employees in employment, *e* denotes total employment, *nom* denotes nominal gross domestic product and *comp* denotes total compensation.

Firms' desired capital (estimated) is determined from the production function:

$$\Delta\, ln(\text{kb}) = \underset{(0.051)}{0.047} - \underset{(0.041)}{0.035}\left[ln(\text{kb}_{-1}) - ln(\text{ycap}_{-1}) + \underset{(0.030)}{0.069}\, ln(\text{user}_{-1})\right]$$

Where *kb* denotes the business capital stock.

The flow of gross fixed capital formation by the business sector, *ib*, is then given by the change in desired gross business capital allowing for depreciation:

$$ib = kb - kb_{-1}(1 - 0.25\ kbdep)$$

Where *ib* denotes business investment and *kbdep* denotes business capital depreciation.

In the short run, output is demand determined:

$$y = c + ih + ib + ds + gc + gi + xvol + mvol$$

where *ds* denote stockbuilding, *gc* denotes government consumption, *gi* denotes government investment, *xvol* denotes exports and *mvol* denotes imports.

Labour demand will then depend on the demand for output. The profit maximising condition for labour demand sets the real wage equal to the Marginal Product of Labour and this determines labour demand in the long run. In the short run, wage growth will also depend on

labour market tightness given by the unemployment rate, *u*, less its equilibrium (or 'natural') rate, *ustar*. We further assume that firm costs will also depend on the extent to which they are utilising their capacity, *cu*. As demand increases and firms use more of their capacity, so costs rise. These conditions thus form the foundation for the long-run solutions to the equations for employment, *ee*, nominal wages, *wage*, and unit total costs, *utc*.

$$\Delta\, ln(\text{ee}) = \Delta\, ln(\text{lf}) + \underset{(0.053)}{0.263}\text{lfe}_{-1}(\Delta\, ln(\text{y}_{-1}) - \Delta\, ln(\text{ycap}_{-1})) - \underset{(0.009)}{0.015}\, ln\big((\text{ee}_{-1})(\text{hours}_{-1})\big) - ln\big((\text{etrnd}_{-1})(\text{ee}_{-1}/\text{e}_{-1})\big)$$

where *hours* denote hours worked per employee. We use calibrated UK parameters for inflation and capacity utilisation in the unit total cost equation below -

$$\Delta\, ln(utc) = 0.125\, ln\left({}^{utc_{-1}}/_{utc_{-5}}\right) + 0.125\,\frac{inft}{100} + 0.3(cu - cu_{-1})$$

where *inft* denotes the inflation target.

$$ln(\text{wage}) = ln(\text{wage}_{-1}) + \underset{(0.172)}{0.230} - \underset{(0.017)}{0.022}\, ln(\text{rpwage}_{-1}) + \left(\frac{1-s\sigma}{\sigma}\right)\text{techl}_{-1} - \left(\frac{1}{\sigma}\right) ln\left(\frac{\text{ycap}_{-1}}{(\text{e}_{-1})(\text{hours}_{-1})}\right) + \underset{(0.150)}{0.517}\Delta\, ln(\text{ced}) + \underset{(0.009)}{0.482}\, ln(\text{ced}_{+1}/\text{ced}) - \underset{(0.001)}{0.002}(\text{u}_{-1}/\text{ustar}_{-1})$$

Where *rpwage* denotes the real product wage and σ denotes the elasticity of substitution between capital and labour (a parameter in the production function).

We assume that average hours are related to the participation rate, real wage growth and output growth in the long run. We estimate the hours equation below while imposing UK parameter for the participation rate:

$$ln(\text{hours}) = ln(\text{hours}_{-1}) - \underset{(0.001)}{0.002}\, ln(\text{hours}_{-1}) - \underset{(0.003)}{5.783} + 0.5\big(\text{prt}_{-1}\big) - \underset{(0.069)}{0.302}\, ln\left(\frac{\text{rpwage}}{\text{rpwage}_{-1}}\right) + \underset{(0.043)}{0.164}\, ln\left(\frac{\text{y}}{\text{y}_{-1}}\right)$$

We assume in this model that the Northern Ireland consumer price index (CPI) follows the wider UK measure. And since Northern Ireland is part of the United Kingdom, we note that nominal interest rates and exchange rates will be exogenously determined at the wider-UK level.

The consumer expenditure deflator depends on the indirect tax rate, *itr*, import prices, *pm*, and unit total costs, *utc*. The estimated equation is given as below -

$$\Delta\, ln(\text{ced}) = \underset{(0.103)}{-0.594} + ln\frac{(1+0.5\text{itr})}{(1+0.5\text{itr}_{-1})} - \underset{(0.022)}{0.061}\, ln\left(\frac{\text{ced}_{-1}}{1+0.5\text{itr}_{-1}}\right) - \underset{(0.068)}{0.383}\, ln(\text{pm}_{-1}) - (1$$
$$- 0.383)\, ln(\text{utc}_{-1}) + \underset{(0.005)}{0.087}\, \Delta\, ln(\text{pm}) + \underset{(0.007)}{0.269}\, \Delta\, ln(\text{utc}) + \underset{(0.002)}{0.020}\, \Delta\, ln(\text{pm}_{-1})$$
$$+ \underset{(0.004)}{0.034}\, \Delta\, ln\frac{\text{ced}_{-1}}{1+0.5\text{itr}_{-1}} + (1 - 0.087 - 0.269 - 0.020 - 0.034)(1 + \text{cedf}/4)$$

where *cedf* denotes the average forecast for the consumer expenditure deflator over the following 10 years.

Non-commodity export prices, *pxncom*, are assumed to be determined by the consumer expenditure deflator, the indirect tax rate, the sterling-dollar exchange rate, *rx*,competitors' domestic prices, *dpx*, and competitors' export prices, *cpx*:

$$\Delta\, ln(\text{pxncom}) = \underset{(0.161)}{0.361} - \underset{(0.024)}{0.054}\, ln(\text{pxncom}_{-1}) - \underset{(0.114)}{0.272}\; ln\left(\frac{\frac{\text{ced}_{-1}}{1+0.5\text{itr}_{-1}}}{\text{rx}_{-1}}\right) + ln(\text{dpx}_{-1})$$
$$+ (1.0 - 0.272 - 0)\, ln(\text{cpx}_{-1}) + \underset{(0.074)}{0.740}\Delta\, ln\left(\frac{\frac{\text{ced}_{-1}}{1+0.5\text{itr}_{-1}}}{\text{rx}_{-1}}\right)$$

4.4 Public Sector

Northern Ireland has a devolved government, the Northern Ireland Executive, and local councils, which spends on consumption and investment. Most of the funds for NI government spending comes from the United Kingdom's block grant, local taxes and other devolved revenue sources (rates and long-haul air passenger duties). The block grant is primarily governed by the Barnett Formula, which calculates changes in the block grant by considering changes in spending in England, adjusted by a population-based factor for Northern Ireland. Income tax, corporation tax and VAT raised in Northern Ireland are transferred to the government in Westminster and so are effectively included in the block grant, as are transfers to households. So, the avenue to run fiscal shocks in the model is through changes to the block grant. That said, our model also allows us to consider the hypothetical case of the NI Executive being given tax raising powers and changing NI tax rates.

This is a breakdown of the Barnett Formula:

$$Change\ in\ Funding =$$
$$Change\ in\ Departmental\ Spending\ x\ Comparability\ Percentage\ x\ \frac{Population\ of\ Devolved\ Administration}{Population\ of\ England}$$

The government budget balance equation is given as –

Budget balance = Barnet transfer + miscellaneous taxes – total government expenditure – transfers

On the spending side, government consumption and government investment are assumed to grow roughly in line with potential output in the long run:

$$\Delta\, ln(\text{gc}) = \underset{(0.273)}{0.135} - \underset{(0.018)}{0.0387}\left(ln(\text{gc}_{-1}) - \underset{(0.739)}{0.503}\, ln(\text{ycap}_{-1})\right) + \underset{(0.072)}{0.103}\Delta\, ln(\text{ycap})$$

$$\Delta\, ln(\text{gi}) = -\underset{(0.01)}{0.173} - \underset{(0.035)}{0.0817}\left(ln(\text{gi}_{-1}) - \underset{(0.010)}{0.896}\, ln(\text{ycap}_{-1})\right) + \underset{(0.003)}{0.286}\Delta\, ln(\text{ycap})$$

Government transfers, *tran*, depend on inflation, as well as the number of unemployed workers (lf – e) and the number of inactive or retired workers (popwa – lf + popr):

$$\Delta\, ln(\text{tran}) = \underset{(0.001)}{0.011} + \underset{(0.023)}{0.041}\,\Delta\, ln(\text{ced}) + \underset{(0.032)}{0.095}\,\Delta\, ln(\text{lf-e}) + \underset{(0.016)}{0.201}\Delta\, ln(\text{popwa - lf} + \text{popr})$$

4.5 Foreign Sector

Northern Ireland exports depend on world demand, the size of the NI export market and competitiveness (i.e., relative prices) whereas imports depend on aggregate demand and import prices.

$$\Delta\, ln(\text{xvol}) = \underset{(0.504)}{1.625} - \underset{(0.067)}{0.218}\left(ln(\text{xvol}_{-1}) - \underset{(0.052)}{0.709}\, ln(\text{s}_{-1}) + \underset{(0.097)}{0.268}\, ln\left(\frac{\text{pxncom}_{-1}}{\text{cpx}_{-1}}\right)\right) + \underset{(0.115)}{0.797}\Delta\, ln(\text{s})$$

where *s* denotes export market size, *pxncom* denotes non-commodity export prices and *cpx* denotes competitor's export prices.

The Import function is estimated as below:

$$\Delta\, ln(\text{mvol}) = -\underset{(0.194)}{0.295} - \underset{(0.015)}{0.023}\left(ln(\text{mvol}_{-1}) + \underset{(0.211)}{0.421}\, ln(\text{rpm}_{-1}) - \underset{(0.098)}{2.146}\, ln(\text{tfe}_{-1})\right) + \underset{(0.097)}{0.759}\Delta\, ln(\text{tfe})$$

where *rpm* denotes real import prices and *tfe* denotes real total final expenditure.

Since the model is developed within the NiGEM environment, in addition to enabling us to examine and understand macroeconomic dynamics for the NI economy, it also enables us to carry out macroeconomic analysis of the all-island economy (covering Northern Ireland and Ireland) and the east-west linkages between Great Britain and Northern Ireland. This feature allows the model to capture the economic interdependencies between these regions, including

trade flows, labour market dynamics, and fiscal relationships. This makes it a useful tool for forecasting and scenario analysis.

4.6 Potential Output

Potential output is determined by a production function incorporating factor inputs and labour-augmenting technical progress. Firms' desired factor demands stem from this function. Long-term labour demand is influenced by real wages, technological progress, and productivity. Wages, shaped by a bargaining model, reflect labour supply and demand factors such as productivity, unemployment, and prices. In the model, we rely on CES production with labour augmenting technical progress. Factor inputs (labour (L), capital (K) and oil (O)) are embedded in the production function within a Cobb-Douglas structure, which is given as –

$$YCAP = \gamma \left[s(K)^{(-\rho)} + (1-s)\left(Le^{\lambda}\right)^{(-\rho)} \right]^{(-1/\rho)^{(1-\alpha)}} O^{(\alpha)}$$

Where $\rho = \left(\frac{\sigma}{1+\sigma}\right)$ is the substitution parameter, σ is the elasticity of substitution between labour and capital and α is the share parameter for oil. In this production function, capital-labour composite is combined with oil and elasticity of substitution between the capital-labour composite is 1. At any point in time output may deviate from its long-run level. Such deviations prompt price and wage adjustments to bring the economy towards equilibrium again.

5. Simulations

This section presents the results of various simulations using the NI model[4]. These simulations illustrate the model's performance, such as its stability and convergence. They also demonstrate the capability of the NI model to generate simulations not only for the Northern Ireland economy but also for all-island economy. Additionally, it also facilitates comparisons between Northern Ireland, the United Kingdom and Ireland.

We discuss the responses of selected variables to temporary and permanent shocks. These figures depict the evolution of these time series over 20 quarters following the shocks, which begin in 2024. In each case the results are presented as changes compared to the baseline scenario.

We examine four distinct shocks:

- A 100-basis point increase in the Bank of England policy rate (temporary shock).
- A 1 per cent increase in NI government consumption shock (temporary shock).

[4] We provide a detailed discussion on the projections for Northern Ireland and all-island economy in a supplementary ESRI report “Modelling Northern Ireland economy within the context of the all-island economy”.

- A 1 per cent increase in Irish exports and its spillover to Northern Ireland economy and all-island economy (temporary shock)
- A 1 per cent permanent increase in Irish exports and its spillover to Northern Ireland economy (permanent shock)

5.1 Monetary policy shock

This shock examines an increase in the Bank of England Policy Rate by 100 basis points for 8 quarters. The simulation results are presented in Figure 5.1 for both Northern Ireland and the United Kingdom. While the transmission of the shock is the same for both Northen Ireland and the United Kingdom, the model dynamics capture differential macroeconomic responses due to the different macroeconomic structures of the two economies captured by differences in the estimated relationships for various macroeconomic variables. Changes in the short-term interest rate influence the term structure of interest rates, thereby affecting long-term interest rates. The change in long-term rates impacts the financing costs for households, firms, and governments, altering intertemporal incentives and subsequently affecting consumption, investment, price levels and output.

The hike in the short-term interest rate raises the long-term real interest rate, which in turn lowers house prices, housing wealth, and household consumption below where they otherwise would have been. However, due to the lower interest rate elasticity of housing demand in Northern Ireland, the decline in housing wealth compared to the baseline is less pronounced compared to the United Kingdom as a whole. This could arise as more mortgages are on fixed-term rates in Northern Ireland relative to the wider United Kingdom. This translates to a relatively smaller reduction in consumption and real disposable income in Northern Ireland than in the United Kingdom. Furthermore, the increased long-term interest rate raises the cost of financing new investment in the business and housing sectors. Through the user cost of capital channel, this higher cost reduces capital stock accumulation in both sectors, thereby leading to a reduction in investment. Due to lower capital stock sensitivity to long-term interest rates, the NI economy experiences a smaller reduction in investment compared to the United Kingdom. As a result, relative to the baseline, NI aggregate output contracts less than the UK output.

The different size of the contractions in aggregate output and trend output between Northern Ireland and the United Kingdom also impacts the labour market responses, particularly in terms of wage dynamics. In response to a policy rate increase, businesses face higher financing costs and diminished consumer demand, prompting them to curtail investment and reduce labour demand. Consequently, unemployment rises, with the increase typically being less severe in Northern Ireland compared to the United Kingdom as a whole. This difference

could be attributed to a smaller reduction in aggregate demand in Northern Ireland relative to the United Kingdom. Moreover, the softer job market exerts downward pressure on wages, as employees have reduced bargaining power amid higher unemployment rates.

Figure 5.1: Response to 100 basis point increase in BoE policy rate

Source: Authors' analysis

As a result of the reduction in aggregate demand following the policy rate cut, inflationary pressures decrease in both Northern Ireland and the United Kingdom. However, Northern Ireland experiences a smaller reduction in inflation compared to the United Kingdom. Overall, our model captures the differential responses in Northern Ireland and the United Kingdom

following a contractionary monetary policy, highlighting varying sensitivities of macroeconomic variables and the strength of transmission channels.

5.2 Government consumption shock

Figure 5.2 present the simulation results for a 1 per cent increase in NI government consumption for two years. The most immediate impact of the positive shock is to increase aggregate domestic demand. It further leads to an increase in output through the multiplier effect, where increased incomes from government spending further amplify consumption and investment. Increased output raises consumption, and it also fuels private investment above the baseline.

Figure 5.2: Response to 1 per cent increase in government consumption

Source: Authors' analysis

The increase in government consumption can affect private investment in two opposite ways: first, it can raise the demand for loanable funds, leading to higher interest rates on loans, which may crowd out private investment as borrowing becomes more expensive. Second, government spending can also stimulate private investment, known as 'crowding in,' through improving business confidence and creating opportunities in complementary sectors. In the case of Northern Ireland, this shock leads to a net crowding-in effect, boosting private investment. This is because interest rates in Northern Ireland are set by the Bank of England at the level of the United Kingdom and so will not respond to a relatively small shock in Northern Ireland.

The trade balance worsens due to higher domestic demand leading to increased imports. This increased domestic demand pushes up inflation through a demand-pull channel, especially if the economy is near full capacity, and through a cost-push channel if the increased demand for inputs raises production costs.

The labour market experiences significant changes as well. Increased government spending raises the demand for labour, leading to higher employment and reduced unemployment rates. As demand for labour increases, employers may offer higher wages to attract and retain workers, especially in sectors directly benefiting from the spending. This upward pressure on wages may further increase consumption, reinforcing the initial boost in aggregate demand. However, if the labour market is already tight, wage increases can contribute to inflationary pressure, though this pressure is quite moderate in this case.

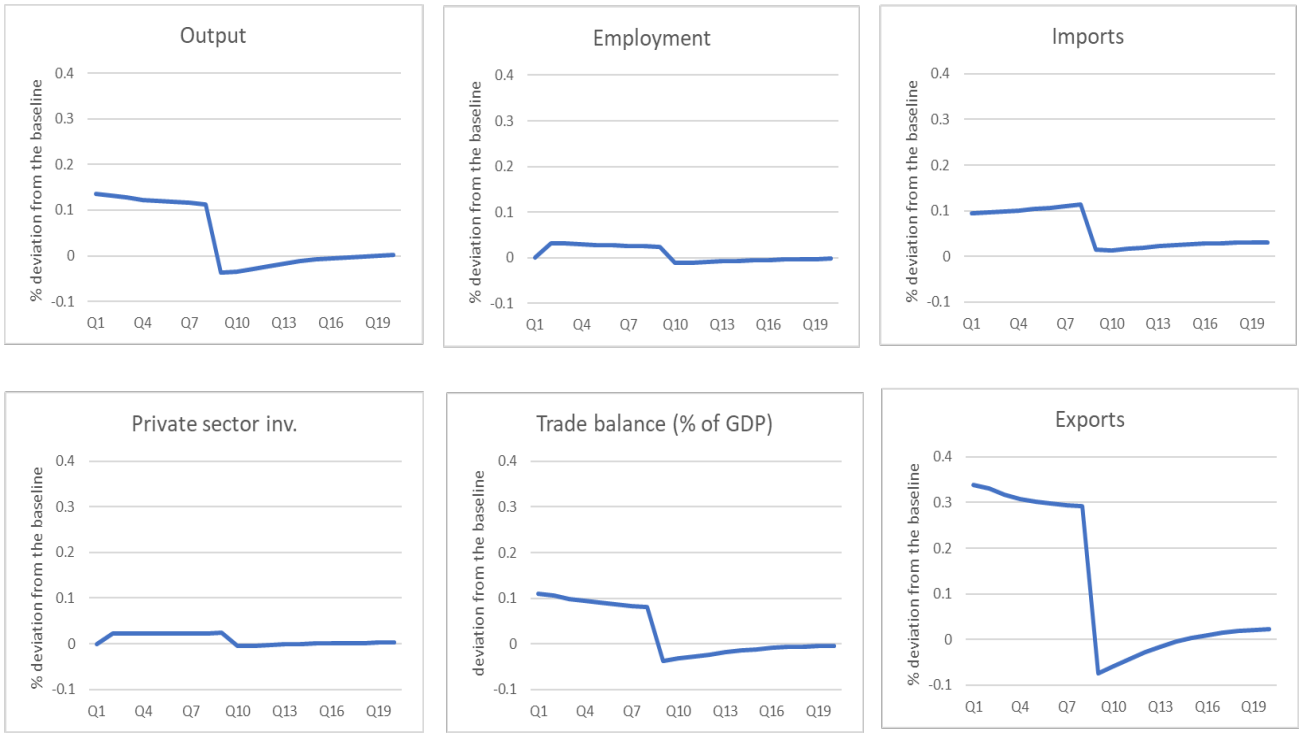
5.3 A temporary positive shock to Irish exports – Spillover effects to Northern Ireland and the all-island economy

The next set of scenarios examine the possible spillover effects from improved growth prospects in Ireland on Northern Ireland. Specifically, we examine a scenario where exports in Ireland are 1 per cent higher for 8 quarters.[5] This positive shock feeds through the trade channel and both exports and imports in Northern Ireland are boosted above their baseline levels.[6] The impact on Northern Ireland exports is higher than for imports and the trade balance improves as a result of the shock (see Figure 5.3). The overall level of output in Northern Ireland ends up around 0.1 per cent above baseline. This has knock-on positive impacts for consumption and investment leading to higher demand in Northern Ireland, which also positively impacts employment.

[5] This shock to Irish exports will impact other countries including Northern Ireland and can feed back to the Irish economy.

[6] A positive shock to Irish exports will be spread across countries that import from Ireland. The positive shock to Irish exports also leads to higher incomes in Ireland which positively impacts Irish import demand from all countries, including Northern Ireland.

Figure 5.3: Response to 1 per cent increase in Irish exports on Northern Ireland economy



Source: Authors' analysis

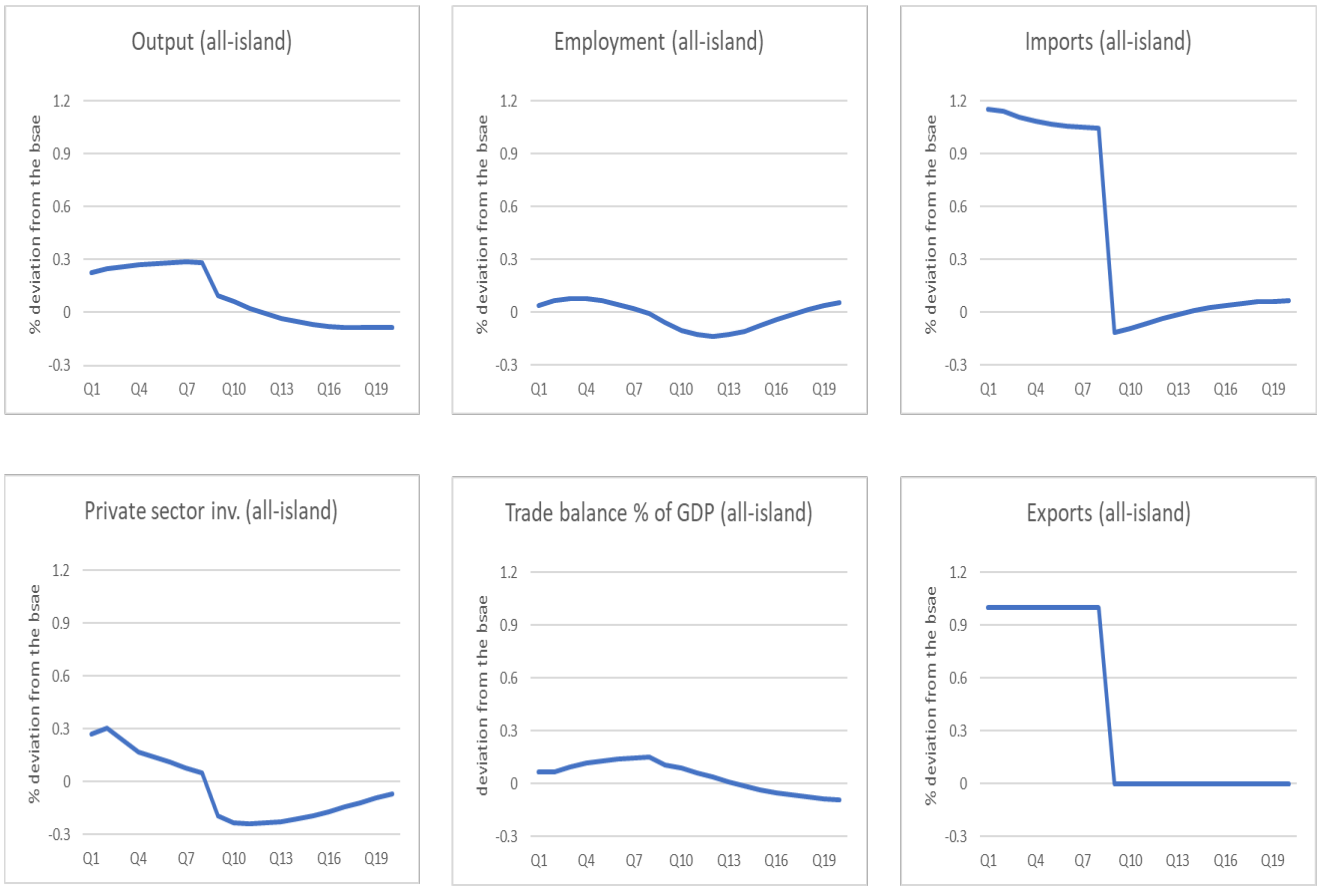
Figure 5.4 shows the impact on the 'all-island economy' of a 1 per cent increase in Irish exports lasting for two years[7]. The impact of the shock on the all-island economy is more pronounced than the impact on Northern Ireland. All-island output increases by nearly 0.3 per cent above baseline, reflecting the strong boost in external demand and increased production to meet export demand. However, when the shock dissipates after two years and external demand reverts to baseline, all-island output also returns to baseline levels. Employment follows a similar pattern, with an initial surge as firms hire to meet the increased production demand, but as export growth returns to baseline, the impact on employment also tapers off. Import demand also increases above baseline, driven by higher demand for inputs and consumer goods and services in response to the stronger economy, consistent with the rise in output and employment.

Private-sector investment increases above baseline initially, as firms respond to higher demand, but this effect is temporary. Finally, the trade balance improves in the short term and

[7] The results for the all-island economy are generated using a weighted average of the effects on both Northern Ireland and Ireland in response to the Irish export shock. This approach allows us to reflect the relative size of each region within the all-island context.

returns to baseline in the medium term as the effects of the temporary shock to Irish exports dissipate.

Figure 5.4: Response to 1 per cent increase in Irish exports on all-island economy



Source: Authors' analysis

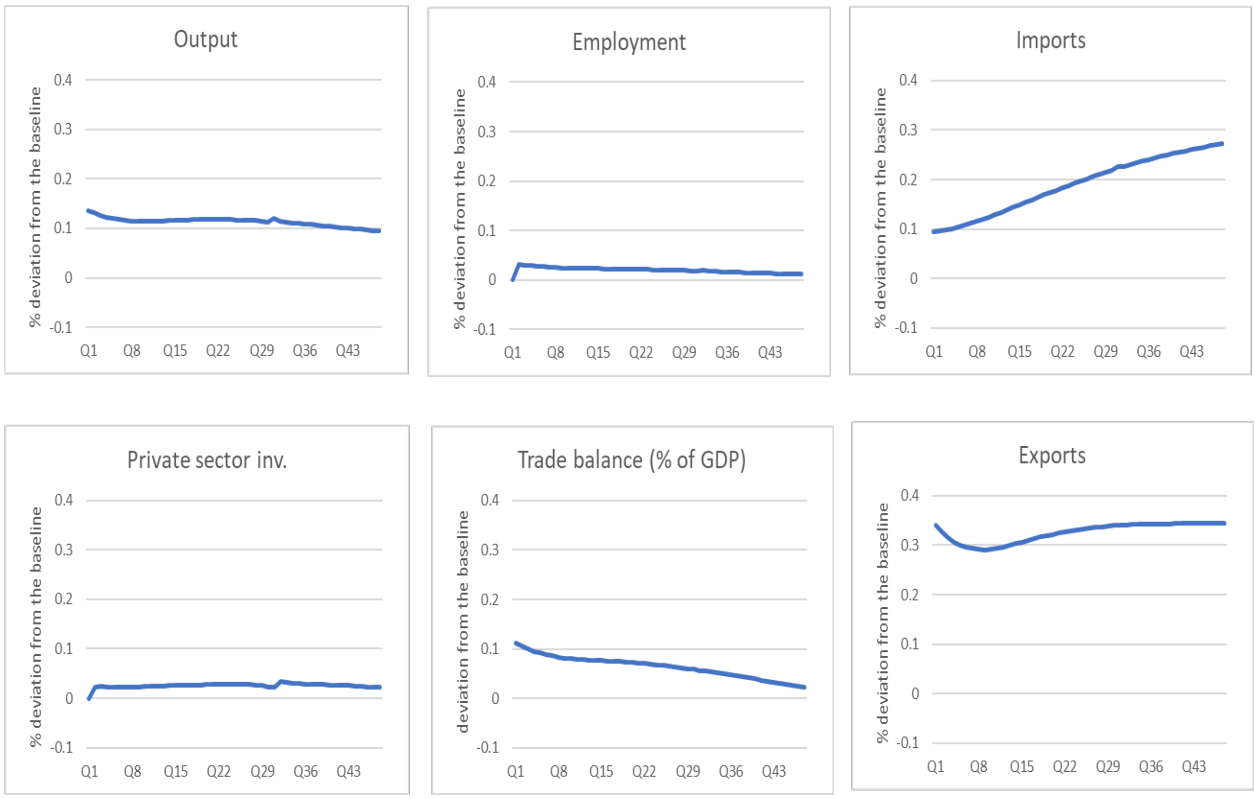
5.4 A permanent positive shock to Irish exports and spillover to Northern Ireland economy

We next consider a permanent shock to Irish exports to demonstrate the convergence properties of the NI model, specifically examining how a long-lasting shock spills over to the Northern Ireland (NI) economy over 12 years. The results are shown in figure 5.5.

The simulation responses show that the NI economy experiences a moderate but sustained positive impact on output and employment due to increased demand for its goods and services driven by stronger economic activity in Ireland. The initial export boost in Ireland leads to a slight but persistent increase in NI output, reflecting enhanced trade linkages and economic integration between the two regions. However, as imports gradually increase in NI to support higher production and consumption, the initial gains in the trade balance (as a percentage of

GDP) begin to diminish, ultimately converging back toward the baseline. This indicates that, while the positive shock initially boosts net exports, increased import demand eventually rebalances the trade flows over time. Employment also shows a mild but stable improvement, suggesting that the positive spillover effects support job creation.

Figure 5.5: Response to 1 per cent permanent increase in Irish exports on NI economy



Source: Authors' analysis

The simulation response in this case exhibits strong convergence properties, which is important in the context of a permanent shock compared to a temporary one. Unlike a temporary shock where indicators would quickly revert to the baseline, the permanent export boost in this scenario leads to a gradual stabilization of key variables. The simulation shows that after the initial adjustment phase, output, employment, and trade balance in Northern Ireland converge steadily, reflecting the model's ability to capture the smooth adjustment of the economy to sustained external changes. This robustness ensures that the NI economy does not experience prolonged volatility, allowing it to reach a new equilibrium even in the face of permanent shifts.

6. Concluding remarks

This paper describes the development and estimation of a macro-econometric model of the Northern Ireland economy. This work involved constructing a macroeconomic database for Northern Ireland, which required us to deal with multiple data sources, missing data, and inconsistencies in available data. With a robust database in place, we were able to estimate the equations of our macroeconomic model individually using an error correction mechanism approach.

The model follows the structure of individual country models within NiGEM, while making some specific adaptations to reflect the fact that Northern Ireland is part of the United Kingdom. It consists of four sectors: Households, Firms, Government and Rest of the World. The household and corporate sectors are relatively standard relative to other models. We carefully model the Public Sector to reflect the situation in Northern Ireland. The Westminster Government's block grant heavily influences fiscal policy in Northern Ireland as it is the primary funding source for government spending. However, the modelling framework also allows for considering what might happen should the Northern Ireland Assembly and Executive be given and use wider tax-raising powers. Thus, the model can be used to help move the economic policy discussion in Northern Ireland away from focussing on technical aspects of changes to the Barnett Formula onto a broader set of economic policy tools. Finally, we were also careful to model the Foreign Sector so that it encompassed the economic interactions Northern Ireland has within the United Kingdom, along with Ireland, the EU and the rest of the world.

The model can be used to produce counterfactual simulations of alternative macroeconomic policies and to examine the effects of typical macroeconomic shocks. In particular, we looked at the effects of a UK monetary policy shock on the NI and UK economies, a government consumption shock in Northern Ireland and the spillover effects of a shock to Irish exports. We found a weaker response of NI output and inflation to a UK-wide monetary policy shock vis-a-vis the rest of the United Kingdom. We also found that a 1 per cent increase in NI government spending led to a 0.3 per cent increase in NI output with little effect on NI inflation. We also analysed the spillover effects of a positive shock to Irish exports on the Northern Ireland economy and the broader all-island economy. Additionally, we examined the impact of a permanent positive shock to Irish exports to assess the model's convergence properties.

While these results are interesting in themselves, they also illustrate the potential of the model to examine the effects of many different economic policies and economic shocks – both emanating from within Northern Ireland and from the outside world – on Northern Ireland, as well as the wider all-island economy, the United Kingdom and the global economy. In the future, the model has significant potential for broader applications beyond the scenarios

considered in this paper. It can be adapted to assess the impact of various economic shocks or policy changes, such as changes in global trade or tariffs and other fiscal policy adjustments.

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Appendix

Table A1 Overview of the final database

Mnemonic	Full description	Unit	Prices	Frequency	Source
BARNA	NI block grant	GBP Million	Current prices	A	HM Treasury (HMT) public expenditure Statistics
BUD	Net Fiscal Balance, public sector	GBP Million	Current Prices	A	ONS regional public sector finance
C	Household and NPISH Final Consumption Expenditure	GBP Million	Current Prices	A	ONS Regional statistics
CED	Consumption expenditure deflator	Index			Used UK level, UK HM treasury
CTA	Council tax	GBP Million	Current Prices	A	ONS regional public sector finance
CTN	Corporation tax	GBP Million	Current Prices	A	ONS regional public sector finance
DTAXQ	Total direct tax	GBP Million	Current prices	A	ONS regional public sector finance
E	Total in Employment, 16-64	Thousand		A	ONS regional labour market statistics
GC	Total Managed Expenditure	GBP Million	Current Prices	A	ONS regional public sector finance
GI	Government investment	GBP Million	Current Prices	A	ONS regional public sector finances
GI0	Government managed expenditure	GBP Million	Current Prices	A	ONS regional public sector finances
GIP	Total current expenditure, public sector debt interest	GBP Million	Current Prices	A	ONS regional public sector finance
GIPA	Public sector debt interest	GBP Million		A	ONS regional public sector finance
GVA	GVA deflator	Percent		A	ONS regional statistics
HOURS	Average weekly hours of work	units		A	ONS regional labour market statistics
HGI0	Total capital expenditure	GBP Million	Current Prices	A	ONS regional public sector finances
IB	GFCF: of which Business Investment	GBP Million	Current Prices	A	ONS regional accounts/ESCOE
IH	GFCF: of which Dwellings Investment	GBP Million	Current Prices	A	ONS regional accounts/ESCOE
IPA	Index of industrial production	Index		A	NISRA IOP statistical bulletin
INSHA	NI share of UK final energy consumption	percentage		A	UK regional statistics on final energy consumption
KG	Capital stock, public sector,	GBP Million	Current Prices	A	ONS regional public sector finance
KH	Capital stock, dwellings	GBP Million	Current Prices	A	ONS regional statistics
KB	Capital stock, business	GBP Million	Current Prices	A	ONS regional statistics
LANDFA	Landfill tax	GBP Million	Current Prices	A	ONS regional public sector finances
MVALRW	Imports from the rest of the world (total)	GBP Million	Current Prices	A	ONS regional trade statistics/NI Economic trade statistics
MVALUW1	Imports from individual countries	GBP Million	Current Prices	A	ONS regional trade statistics/NI Economic trade statistics
MVALUX	Imports from the rest of the UK	GBP Million	Current Prices	A	ONS regional trade statistics/NI Economic trade statistics
NOMA	GDP at current market prices	GBP Million	Current Prices	A	ONS regional statistics/ESCOE
PDI	Gross Disposable Income	GBP Million	Current Prices	A	ONS regional statistics
PDK	Investment deflator	Index		A	Used UK level, ONS regional statistics
PGC	Government expenditure deflator	Index		A	Used UK level, ONS regional statistics
PHA	House Price Index	Index		A	UK house price statistics, land registry
PM	Imports deflator	Index		A	Used UK level, ONS regional statistics
POPSA	Population of NI (0-15)	Thousand		A	NISRA population estimates
POPRA	Population of NI (65+)	Thousand		A	NISRA population estimates

POPTA	Population of NI, Total	Thousand		A	NISRA population estimates
POPWAA	Population of NI (15-64)	Thousand		A	NISRA population estimates
PX	Exports deflator	Thousand		A	Used UK level, ONS regional statistics
PY	GDP deflator	Index		A	Used UK level, ONS regional statistics
RATES	Non-domestic rates	GBP Million	Current Prices	A	ONS regional public finance
SRATA	Households' Saving ratio	percentage		A	ONS regional statistics
SRIT	Income tax rate	percentage		A	ONS regional public sector finance
SSC	Social Contributions	GBP Million	Current Prices	A	ONS regional public sector finance
STAMPA	Stamp duty land tax revenue	GBP Million	Current Prices	A	ONS regional public sector finance
TAX	Total direct tax	GBP Million	Current Prices	A	ONS regional public sector finance
TAX0	Fuel duties	GBP Million	Current Prices	A	ONS regional public sector finance
TAX1	VAT	GBP Million	Current Prices	A	ONS regional public sector finance
TAX2	VAT refunds	GBP Million	Current Prices	A	ONS regional public sector finance
TAXQ	Taxes on production and imports	GBP Million	Current Prices	A	ONS regional public sector finance
TAXR	Income tax rate	GBP Million	Current Prices	A	UK HM treasury statistics
TRAN	Social protection	GBP Million	Current Prices	A	ONS regional public sector finance
U	Unemployment rate	Per cent		A	ONS regional labour market statistics
UKE	UK employment	Thousand		A	NISRA IOP Statistical bulletin
UKH	UK hours	Thousand		A	ONS labour and employment statistics
UTCA	GVA deflator at basic prices	Percent		A	ONS regional statistics
Wages	Compensation of employees	GBP Million	Current Prices	A	ONS regional labour market statistics
XVALUX	Exports to the rest of the UK	GBP Million	Current Prices	A	ONS regional trade statistics/NI Economic trade statistics
XVLRW	Exports to the rest of the world (total)	GBP Million	Current Prices	A	ONS regional trade statistics/NI Economic trade statistics
XVLRW1	Exports to individual countries	GBP Million	Current Prices	A	ONS regional trade statistics/NI Economic trade statistics
YFC	GDP at factor cost	GBP Million	Current Prices	A	ONS regional statistics