

# Research Bulletin 22/3 Interpreting Productivity Challenges for Northern Ireland Using CGE Modelling

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## Summary

Productivity in Northern Ireland (NI) has been consistently below that in the rest of the UK for decades. There are many factors that influence productivity, which include, availability of fixed assets such as capital equipment and IT systems. Other issues that can influence how productive a particular worker is will include skills, ability, and motivation, as well methods of organisation and general management skills. This article considers the particular drivers for the productivity challenges in NI, in terms of identifiable industries and considers what potential reason this could be.

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## Introduction

Productivity is a measure of how efficiently an economy uses productive assets such as labour and capital to produce a given level of output. Productivity is important, as a nation's standard of living over the long-term will depend on its ability to increase economic competitiveness and output per worker.

To address future economic challenges, there is a need for policy makers to be proactive and try to shape the future needs and skills of the economy. Indeed, the Department for the Economy's economic vision for a '10X Economy', is focused on embracing innovation to increase levels of output and help deliver a ten times better economy over the long term. This will position the economy to benefit from future trends in emerging industries and ensure it can be at the forefront of promoting new technologies and ways of doing business.

To assist with this aim, it is essential to understand the long-standing weaknesses within the economy. Indeed, one of the key structural areas identified within 10X is the longstanding low levels of productivity in NI compared to the rest of the United Kingdom (UK).

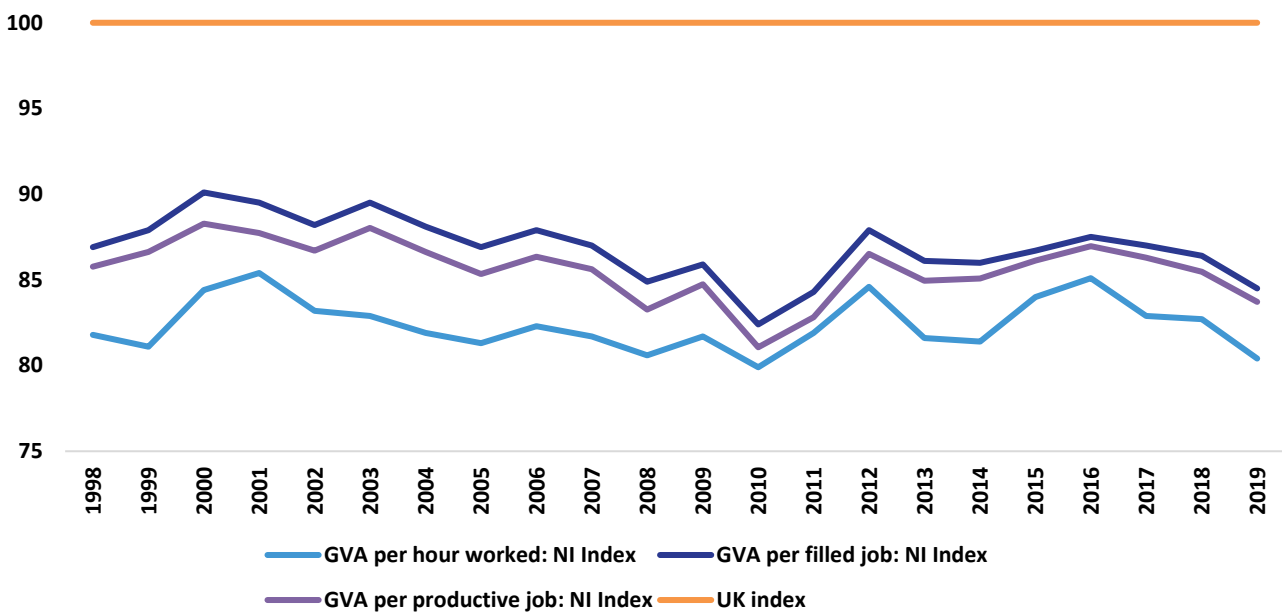
With this '10X Economy' vision in mind, this paper seeks to examine productivity at a detailed industry level and will use results from a Computable General Equilibrium (CGE) model to better understand the economic implications of improving the level of labour efficiency at an individual industry level within the economy.

## Background on Productivity Challenges for Northern Ireland

### NI Productivity Relative to the UK and ROI

The productivity gap between NI and the rest of the UK has occupied the minds of policy makers for some time and represents a long-standing feature of the NI economy. Indeed, figure 1 below clearly demonstrates that over the past two decades productivity in NI has consistently been below the UK average.

**Figure 1: Productivity Measures for Northern Ireland 1998 - 2019 (UK=100)**



Source: ONS Regional Productivity

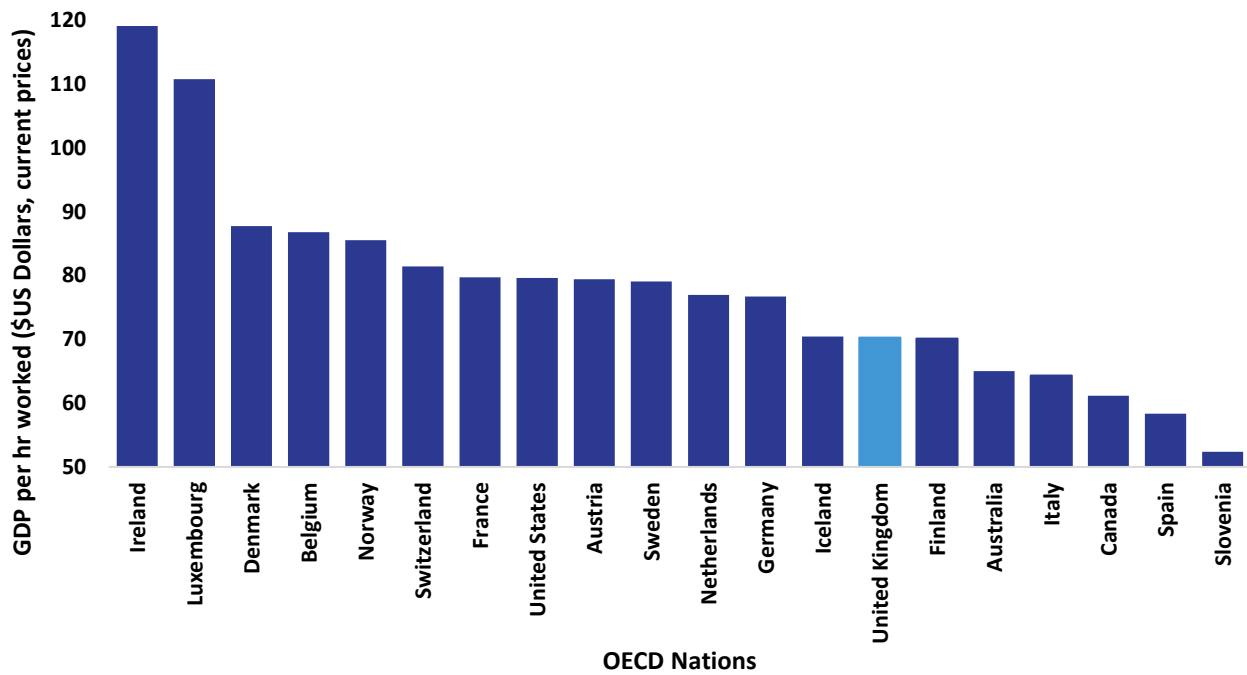
Figure 1 highlights that productivity levels in NI have remained stagnant over the past two decades and the productivity gap between NI and the rest of the UK has remained a persistent feature of the economy. Indeed, the Gross Value Added (GVA) per filled job index in NI was at a series high in the year 2000. However, since then, this trend has reversed and productivity in NI has been declining. Furthermore, the statistics for 2019 demonstrate that GVA per job filled was 15.5% below the UK average<sup>i</sup> and that NI was 9<sup>th</sup> out of the 12 regions of the UK when comparing GVA per filled job. The only regions that performed worse were the North East, Yorkshire & Humberside and Wales.

The GVA per hour worked index in NI has been relatively unchanged over the past two decades. In 1998, NI was 18.2% below the UK average, whereas the data for 2019 shows that this gap has widened marginally with NI now 19.6% below the UK average. Of the 12 sub regions of the UK, NI ranked in last position for this productivity measure. The GVA per productive job index for NI follows a similar stagnating pattern over the past two decades, with latest data in 2019 showing NI 16.3% below the UK average.

## UK Productivity Relative to International Nations

Figure 2 below shows an international comparison of labour productivity using data compiled by the Organisation for Economic Co-operation and Development (OECD)<sup>ii</sup>. The OECD brings together 38 member nations across Europe, North & South America and the Asia Pacific. Members tend to be the wealthiest nations making up around 80% of global trade and investment.

**Figure 2: International Comparison of Labour Productivity in 2020<sup>iii</sup>**



Source: OECD

Data in Figure 2 reveals that in 2020, UK workers generated \$70 per hour worked. This ranks the UK in 14<sup>th</sup> position amongst OECD nations, which places the UK below many of their European neighbours such as Germany, France and ROI. The labour productivity statistics also show that UK workers generate around \$10 less per hour worked than their counterparts in the United States.

It may seem surprising that labour productivity levels in the UK compare so modestly to other major economies, given that the UK is the world's sixth largest economy. However, this trend has been apparent for the last decade, with growth in output per hour falling more sharply in the UK than other major economies. This again reinforces the scale of the productivity issue in NI, which performs poorly within the UK as a whole and by extension other international competitors.

## Productivity Data under the Microscope

### Issues with Data

To help understand which areas of the economy may be contributing to the productivity gap between NI and Great Britain (GB), it is important to assess the level of labour productivity at a detailed sectoral level. There are however currently limitations on the availability of this data as the ONS only publish labour productivity estimates for NUTS1 regions at a section level and do not provide estimates at a more detailed group level.

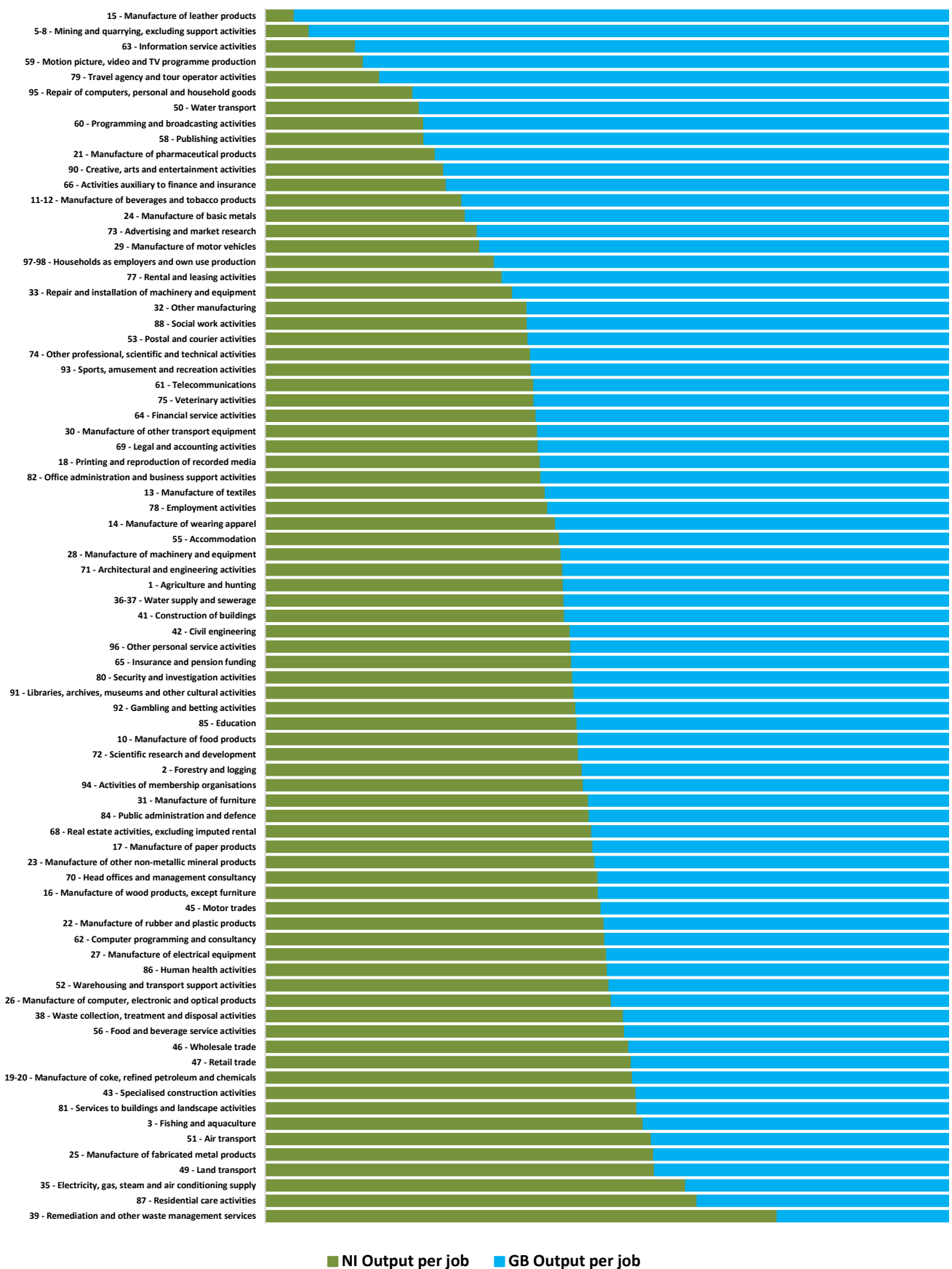
For the purposes of this paper, and in an attempt to understand productivity at a more detailed level, data relating to labour productivity has been analysed at a SIC07 Division level, which breaks the economy down into 89 separate sectors.

Figure 3 below shows the GVA per worker within each industrial sector in NI relative to GB. Industrial sectors are presented at a 2-Digit SIC level. This detailed sectoral analysis demonstrates the key sectors where productivity levels differ between NI and GB.

This has included sub regional GVA data provided by ONS, Employee data from the Business Register Employment Survey (BRES) and Self-Employed data from the Annual Population Survey. Labour productivity estimates were then calculated relating to GVA per filled job for each separate industry.

It is important to note that investigating the data at this level of detail does challenge the robustness and reliability of the results, given the quality of some of the survey results at a more detailed level. Therefore, the analysis should be viewed in that context and only be used as a means to identify areas for closer inspection and further investigation.

**Figure 3: Output per Job in NI Relative to GB**



Sources: ONS Sub Regional GVA, Business Register Employment Survey and the Annual Population Survey.

Of the industrial sectors identified on Figure 3 that make up the Northern Ireland economy, only 18 display a higher level of GVA per worker compared to the rest of the UK. Of these sectors, areas where NI appears to have a significantly higher<sup>iv</sup> level of GVA per worker include:

- Fishing and aquaculture
- Manufacturing of coke, refined petroleum and chemicals
- Manufacture of fabricate metal products
- Manufacture of computer, electronic and optical products
- Manufacture of electrical equipment
- Electricity, gas, steam and air conditioning supply
- Waste collection, treatment and disposal activities
- Remediation and other waste management services
- Specialised construction activities
- Wholesale trade
- Retail Trade
- Land Transport
- Air Transport
- Warehousing and transport support activities
- Food and beverage service activities
- Services to buildings and landscape activities
- Human Health
- Residential care activities

When considering those sectors where the rest of the UK has a higher level of GVA per worker it is perhaps unsurprising that this includes sectors such as Financial & Insurance services, given the prominence and significance of the City of London as a Global leader in these industries. However, the other top 10 sectors where the rest of the UK appears to have significantly higher levels of GVA per worker include:

- Manufacturing of Leather Products.
- Mining and quarrying, excluding support activities
- Information service activities
- Motion picture & TV production
- Travel agency and tour operator activities
- Repair of computers, personal and household goods
- Water Transport
- Programming and broadcasting activities
- Publishing activities

- Pharmaceutical Products

It is notable that the Pharmaceutical Products sector is significantly more productive in GB compared to NI. Indeed, based on this data, GVA per worker in GB is over three times higher than the equivalent figure for NI. This may be somewhat surprising given the success of the pharmaceutical sector in NI and its significance for the local economy in terms of generating external sales and exports.

It is also interesting to observe that industries that rely on culture and creativity appear to be significantly more productive than the equivalent in NI. This includes industries such as Motion picture, broadcasting as well as arts and entertainment activities.

## Mind the Gap

As noted earlier, productivity in NI has been consistently below that in the rest of the UK for decades. However, it is interesting to consider the particular drivers for this gap, in terms of identifiable industries and consider what potential reasons this could be.

Indeed, based on 2018 levels of GVA and jobs data, output per job is approximately 15% lower in NI compared to GB. To put this another way, workers in NI would need to produce a total of £7.2bn more in terms of GVA, to be as productive as workers in GB.

However, it is important to consider what industries are driving this gap, and whether it is realistic to expect a small regional economy such as NI to produce output at this level. Table 1 below outlines those industries that would contribute most to closing the productivity gap if NI workers output were at the same level to those in GB:

**Table 1: Top 10 Industries Where GB are More Productive than NI**

Industries		% More Productive than NI
1	Mining and quarrying, excluding support activities	22%
2	Water transport	9%
3	Manufacture of pharmaceutical products	9%
4	Financial service activities	8%
5	Education	6%
6	Legal and accounting activities	6%
7	Social work activities	5%
8	Public administration and defence	5%
9	Activities auxiliary to finance and insurance	4%
10	Civil engineering	3%
	<b>Total</b>	<b>76%</b>

Table 1 highlights the main industries that are contributing to the Productivity Gap and suggests that if NI output per worker was able to match that in GB, then 76% of the productivity gap with GB would be eliminated. However, is this realistic? When considering the industries in question, it is apparent that it includes output from the oil and gas sector, an industry in which NI has no natural resources. In addition, the water transport sector includes passenger and sea freight transport and takes account of national ports and international shipping lanes. Furthermore, the prominence and significance of the City of London as a global centre for international finance and services is apparent in this analysis with industries such as Financial Service Activities, Legal & Accounting Activities as well as Activities auxiliary to finance and insurance contributing to the gap. Consequently, it is debatable to what extent it is realistic to expect NI workers to be producing similar levels of output to workers in these industries that are highly specialised and benefit from scale at a national and global level.

Despite these issues, the analysis does raise questions in relation to why Northern Ireland workers produce less per job in industries such as pharmaceutical products, given its significance to the NI economy and potential to grow given the strong foothold and skill base that already exists.

## **Improvements in Labour Efficiency**

There are many factors that influence productivity e.g., availability of fixed assets such as capital equipment and IT systems. Other issues that can influence how productive a particular worker is will include skills, ability, and motivation, as well methods of organisation and general management skills.

Policy makers try to improve productivity by introducing new policies related to these issues to ensure that each unit of labour can produce more output. Ultimately this leads to either an overall increase or decrease in the efficiency of labour.

A key challenge for policy makers is assessing the potential long run macro-economic impact resulting from a particular intervention. To assist with this problem the Department for the Economy operates a Computable General Equilibrium (CGE) model that can analyse the potential impacts arising from a variety of policy shocks. As part of the research into the productivity challenges for Northern Ireland, potential improvements in the efficiency of labour will be analysed to assess the macroeconomic as well as sectoral impact of these changes.

## **Modelling Changes to Labour Efficiency**

The first simulation considers what the impact would be if the output per worker was at a similar level for the rest of the UK for those sectors where NI is currently lagging behind in terms of output per job. These increases in the efficiency of labour at a sectoral level are outlined in Table 2 below:



**Table 2: Increases in Efficiency of Labour Needed to Match the Rest of the UK at a Sectoral Level**

SAM Sectors	% Increase
Pub. Admin, Education and Health	2%
Mechanical and Other Manufacturing (incl Repair)	6%
Water, sewerage and Waste	15%
Other services	18%
Agriculture, forestry and fishing	26%
Textile, Leather, Wood, Paper, Printing	26%
Food and drink	33%
Financial services, insurance and services	39%
Chemicals and Pharmaceutical	48%
Real Estate, professional act., R&D	50%
Information and Communication	52%
Other primary	866%

Applying these increases to the efficiency of labour within NI, results in a significant long-term increase in GDP of 5.72%. Indeed, a full list of the main economic variables is included within Table 3 below:

**Table 3: CGE Analysis – Long-Term Macroeconomic Impact from Increases in the Efficiency of Labour**

Headline Impacts	Year 15
GDP	5.72%
Investment	5.20%
Regional Imports	-2.93%
Regional Exports	10.36%
ROW Exports <sup>1</sup>	10.81%
ROW Imports	-6.08%
Employment	-1.43%
Nominal Labour Cost	-10.57%
Unemployment rate	34.40%

Recognising that the increase of 866% for Other Primary could represent an outlier, GDP would still be 5.56% higher than would otherwise be the case if the Other Primary sector is removed from this simulation.

It is notable that increases in labour productivity of this magnitude lead to significant increases in both regional exports to GB as well as exports to the rest of the world. This also requires a significant increase in investment levels highlighting the attractiveness that increases in labour efficiency at this level would have on both domestic and foreign investment. These results confirm that improving the efficiency of labour to these levels would make Northern Ireland a much more competitive region of the UK.

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<sup>1</sup> ROW = Rest of World

However, this simulation also demonstrates the significant impact on the NI labour market with the nominal cost of labour reducing by approximately 11% and the unemployment rate increasing by 35%. The results highlight that the unintended consequence of making workers more productive within their existing roles will lead to greater levels of unemployment and lower wages (*ceteris paribus*), as fewer workers can produce output at an economically efficient level.

This analysis also reinforces the need for inclusive innovation, as set out within the 10X Vision. This will help to ensure that whilst particular sectors of the economy become more productive, other sectors will need to expand, taking up some of the slack arising from the economy having spare capacity within its labour market as workers become more productive, with fewer workers being required within certain industries.

### Sectoral Analysis

Potential changes to the efficiency of labour can also be analysed at a detailed sectoral level within the CGE framework. Table 4 below provides the results of achieving GB levels of labour efficiency for those sectors of the NI economy that currently underperform GB in terms of output per job.

**Table 4: CGE Analysis – Labour Efficiency Changes Modelled by each Individual Sector, to Close Gap with GB**

Headline Impacts	GDP	Investment	Regional Imports	Regional Export	ROW Export	ROW Imports	Employment
Public admin, education & health	0.23%	0.13%	-0.25%	0.84%	0.81%	-0.84%	-0.25%
Mechanical and other manufacturing	0.29%	0.33%	-0.03%	0.53%	0.61%	-0.16%	-0.03%
Water, sewage & waste	0.08%	0.06%	0.02%	0.20%	0.26%	-0.09%	-0.02%
Other services	0.54%	0.36%	-0.09%	1.08%	1.04%	-1.08%	-0.08%
Agriculture, forestry and fishing	0.12%	0.13%	0.06%	0.23%	0.35%	-0.17%	-0.02%
Textile, Leather, Wood, Paper, Printing	0.13%	0.10%	-0.14%	0.30%	0.26%	-0.13%	-0.06%
Food & Drink	0.52%	0.45%	-0.33%	1.33%	1.06%	-0.47%	-0.22%
Financial Services, insurance and services	0.83%	1.07%	-0.11%	1.12%	1.64%	-0.66%	-0.08%
Chemicals & Pharmaceuticals	0.18%	0.16%	-0.27%	0.27%	0.32%	-0.19%	-0.09%
Real Estate, professional act., R&D	1.34%	1.16%	-1.16%	1.91%	1.74%	-1.40%	-0.23%
Information & Communication	1.04%	0.78%	-0.64%	1.28%	1.58%	-0.88%	-0.09%
Other primary	0.15%	0.14%	-0.13%	0.55%	0.36%	-0.32%	-0.12%

These results demonstrate that the largest increases in GDP are associated with the modelled increases in Real Estate & Professional activities (1.34%), Information & Communication (1.04%), Financial Services (0.83%) as well as Other Services 0.54%. It is also notable that after these services sectors, the next largest increase is driven by improvements to labour efficiency within the Food and Drink Sector (0.52%).

It is also evident that exports increase significantly, especially within the service sectors. Again, this reflects the potential for economic growth arising from being more competitive in the international services sector if NI labour in these sectors was as efficient as that achieved in GB.

## **Conclusion**

This paper has sought to examine issues around Northern Ireland's productivity at a detailed industry level to understand the reason for its relatively poor performance in this area, something that has challenged policy makers for many years.

Undertaking this exercise has highlighted the challenge of generating reliable productivity data at a more detailed industry level. However, it is important to consider productivity at this level to understand the precise reasons for Northern Ireland's lower performance and to better understand what particular industries account for this.

The modelling exercise demonstrates that a significant proportion of the productivity gap could be closed if the output per worker in Northern Ireland for several key service sectors was at a similar level to that in GB. It will therefore be important to understand whether skills are a contributory factor in explaining this difference and to what extent Northern Ireland workers can be expected to produce output at these levels given the different markets in which they operate.

## **Economic Modelling Branch, Department for the Economy**

For further information or queries please e-mail [analyticalservices@economy-ni.gov.uk](mailto:analyticalservices@economy-ni.gov.uk)

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<sup>i</sup> [Regional productivity time series - ONS](#)

<sup>ii</sup> [Labour Productivity statistics - OECD](#)

<sup>iii</sup> Ireland tends to report output as Gross National Income (GNI) rather than GDP, GNI is designed to exclude the globalisation effects that make Ireland's GDP figure disproportionately high. Luxembourg offers a favourable tax regime, which hundreds of international companies avail of by setting up operations there. The large profits registered by these companies will be reflected in high GDP per hour worked in Figure 2.

<sup>iv</sup> For the purposes of this study defined as being at least 10% higher than GB.