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Modelling productivity levels in Ireland and Northern Ireland

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MODELLING PRODUCTIVITY LEVELS IN IRELAND AND NORTHERN IRELAND

ADELE BERGIN AND SEAMUS MCGUINNESS



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Seamus McGuinness

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EXECUTIVE SUMMARY

- This study examines sectoral productivity differences in Ireland and Northern Ireland and attempts to understand these by identifying the key determinants of productivity in both economies within a causal framework. While some existing studies have compared Northern Ireland's productivity to that of GB regions, we believe that this is the first comprehensive study to compare productivity in Ireland and Northern Ireland.
- Our approach is to exploit annual sectoral level data on labour productivity measured by gross value added per worker, with a view to modelling the determinants of productivity in each respective region.
- Of the 17 sectors for which we have comparable data, productivity levels in Ireland noticeably exceed those of Northern Ireland in 14 sectors, with particularly large gaps in Administrative and support services activities; Financial and insurance activities; Legal and accounting activities etc; and Scientific research and development. Northern Ireland has an advantage in the two sectors of Electricity and gas supply and Construction.
- Productivity levels in the two regions were broadly equivalent in 2000. Over the period 2001 to 2020, productivity levels in Ireland have trended slightly upwards, while in Northern Ireland productivity levels have been trending downwards. By 2020, productivity per worker was approximately 40 per cent higher in Ireland compared to Northern Ireland.
- Our econometric model for Ireland performs well, with sectoral productivity increasing with levels of investment and also the employment share of educated workers. Productivity is also higher the greater the proportion of part-time workers employed. We also find that export intensity is also an important factor in driving Irish productivity.
- Despite using comparable data sources and applying the same estimation methods used for the Ireland model, we find no evidence of a causal relationship between the range of factors captured (education, investment, exports) in the models and Northern Ireland productivity. Such an outcome raises questions regarding the underlying competitiveness of the Northern Ireland economy and its responsiveness to changes in what are generally considered key policy levers.
- The models for Northern Ireland do not show significant results for the usual drivers of productivity levels. It may be the case that there are other economic, social and political factors that need to be considered in devising a policy response. It is possible that the impacts of The Troubles, a relatively closed economy in terms of international trade, peripherality, limited results from regional policy and a historical reliance on public sector employment have all combined to subdue the impact of market forces among Northern Ireland firms

leading to a productivity trend that appears largely exogenous with respect to key policy variables.

- A separate modelling approach (a decomposition) is used to measure the extent to which differences in productivity levels in the two jurisdictions are explained by differences in their endowments of key factors that should ultimately determine productivity and other factors. In around 2011, productivity levels in Ireland were just below 30 per cent higher than those of Northern Ireland and approximately all of this gap can be explained by differences in investment and labour market related endowments between the two regions.
- The decomposition results show that lower proportions of workers educated to post-secondary level in Northern Ireland account for a 15.0 per cent gap in productivity; however the largest impact related to lower levels of investment in Northern Ireland which resulted in a 22.7 per cent gap in output per worker. These two variables alone account for more than 100 per cent of the explained productivity gap between Ireland and Northern Ireland, while some other variables reduce the size of the productivity gap somewhat.
- We undertake a simulation exercise to measure the impact on Irish productivity if we assume that it has the same levels of investment and human capital in 2020 that firms in Northern Ireland currently employ. The level of productivity in Ireland would be around 50 per cent lower if Ireland had the same levels of investment and education as Northern Ireland.
- Our analysis points to the need to rapidly expand investment and improve skills in Northern Ireland, particularly at the post-secondary level. However, our models also suggest that without a comprehensive strategy aimed at improving competitiveness among Northern Ireland firms, the reform of education and skills provision and increasing investment in isolation are not guaranteed to enhance Northern Ireland productivity.

CHAPTER 1

Introduction

There has been a growing interest in comparative analysis of the economies of Northern Ireland and Ireland over recent times, particularly following the 2016 Brexit referendum. Somewhat surprisingly, very little research was undertaken on the relative performance of both economies prior to the Brexit vote. Within the previous literature, the performance of the Northern Ireland economy has traditionally been benchmarked against regions in Great Britain, while the performance of the Irish economy has tended to be compared with the UK as a whole and with other EU countries. The last number of years has seen a rapid expansion of North-South comparative research, including as a result of the Shared Island research programme commissioned by the Department of the Taoiseach and the work of academic initiatives including the Analysing and Researching Ireland North and South (ARINS) project by the Royal Irish Academy and the University of Notre Dame.

It is probably fair to say that, up until relatively recently when the evidence base began to further develop, there existed a general belief that income levels in Northern Ireland were somewhat higher than those in Ireland, due mainly to high levels of transfers from the UK Government. This view persisted, despite the fact that the Northern Ireland economy has historically been a poor performer when compared against GB regions (McGuinness and Sheehan, 1998), and the exceptional performance of the Irish economy over the Celtic Tiger era (1995-2007) and recovery from the financial crisis. The lack of North-South comparative research may also have contributed to this perception. However, recent evidence and data have begun to challenge such perceptions, with a number of papers pointing to the existence of a very substantial productivity gap between Northern Ireland and Ireland (FitzGerald and Morgenroth, 2019; McGuinness and Bergin, 2020; Bergin and McGuinness, 2021). Productivity is regarded as a key source of growth and competitiveness in an economy and as a driver of incomes more generally.¹ For example, Krugman (1994) states:

*Productivity isn't everything, but in the long run it is almost everything.
A country's ability to improve its standard of living over time depends
almost entirely on its ability to raise its output per worker.*

Building on the existing body of work, this research examines sectoral productivity differences in Ireland and Northern Ireland, initially at a descriptive level, to

¹ There are different measures of productivity, but all generally examine the volume of output (using measures of output such as GDP, Gross Value Added etc.) produced from inputs such as labour (where labour input can be measured in terms of the number of workers, hours worked etc).

highlight similarities and differences between the two jurisdictions. The report adopts panel estimation methods to identify the key determinants of productivity growth in both economies within a causal framework. The research also uses a decomposition approach to measure the extent to which differences in North-South productivity levels are explained by differences in endowments of key productivity related factors such as human capital etc. Finally, simulation analysis is used to illustrate how productivity levels might vary for changes in the level of endowments. The goal of the research is to gain a deeper understanding of the similarities and differences between both economies and to identify potential policy levers that could accelerate productivity growth in both jurisdictions. While some existing studies have been produced comparing Northern Ireland's productivity to that of GB regions (Jordan 2022; Johnston and Stewart, 2019; McGuinness and Sheehan, 1998), we believe that this is the first comprehensive study to compare productivity in Ireland and Northern Ireland.

CHAPTER 2

Existing literature

There is an emerging body of research pointing to the existence of a productivity gap between Northern Ireland and Ireland. McGuinness and Bergin (2020) show that GDP per capita in 2014 in the Southern and Eastern Region of Ireland² stood at \$55,991, compared to \$28,159 in Northern Ireland. Ireland's GDP is heavily distorted by globalisation effects; however, the productivity gap between Ireland and Northern Ireland remains substantial when other measures of output, such as GNI* which adjusts for certain globalisation effects, are used for Ireland in such comparisons. Comparing GNI* per capita in Ireland to GDP per capita in Northern Ireland, shows that GNI* per capita was around 51 per cent higher in Ireland than in Northern Ireland in 2018. Bergin and McGuinness (2021), using OECD data, demonstrate a gap in household disposable income of 12 per cent in 2017, in favour of Ireland, which is also consistent with relatively lower levels of productivity in Northern Ireland. While there is some ongoing debate on the magnitude of productivity and income gaps between Ireland and Northern Ireland, there is a growing consensus that productivity in Northern Ireland significantly lags that of Ireland.

Despite the emerging evidence, little remains known about the underlying causes of Northern Ireland's low relative productivity. FitzGerald and Morgenroth (2019) argue that low productivity growth in Northern Ireland is due to low levels of investment in physical and human capital. McGuinness and Bergin (2020) argue that at least some of the causes relate to gaps in educational attainment, FDI and export intensity. In terms of human capital, McGuinness and Bergin (2020) point out that Northern Ireland performs consistently poorly in terms of educational attainment compared to GB regions; however the differences relative to Ireland are somewhat more pronounced. Based on 2015 data, they report that 35 per cent of young people in Northern Ireland (aged from 24 to 30 years old) attained only the two lowest levels of schooling (primary and lower secondary), compared to under 11 per cent in Ireland. Conversely, just under 40 per cent of Northern Ireland young people attained the two highest levels of attainment (post-secondary or third-level), compared to approximately 60 per cent in Ireland. Bergin and McGuinness (2021) further report that the rate of early school leaving in Northern Ireland is approximately twice that of Ireland.³

² The region contains approximately 70 per cent of the country's population.

³ Bergin and McGuinness (2021) used the OECD definition of early school leaving which is measured as the proportion of individuals aged 18 to 24 who have finished no more than a lower secondary education and are not involved in further education or training. Smyth et al. (2022) examine a range of definitions of early school leaving and report similar findings.

Other key productivity factors examined by McGuinness and Bergin (2020) include levels of FDI and export intensity and, again, they find that Ireland has distinct advantages in both areas. Based on 2015 data, foreign enterprises accounted for 22.2 per cent of employment in Ireland and 14.0 per cent in Northern Ireland. Value added in the Irish FDI sector was substantially higher than in Northern Ireland, with turnover per worker almost five times that of Northern Ireland-based foreign enterprises (McGuinness and Bergin, 2020). The gap in FDI productivity is largely explained by Northern Ireland's FDI concentration in sectors such as construction and distribution, which contrasts with the dominance of high value-added service sector firms in the Irish FDI sector. With regard to export intensity, exports account for approximately 15 per cent of total business turnover in Northern Ireland compared to 54 per cent in Ireland. Mac Flynn (2016) demonstrates that worker productivity in Northern Ireland falls behind the average in Great Britain across the majority of economic sectors and argues that this is largely due to a lack of sufficient investment in both human and capital investment. Johnston and Stewart (2019), like Mac Flynn (2016), also point out that Northern Ireland's relatively lower productivity cannot be explained by its sectoral employment mix alone. Nevertheless, a key weakness of existing studies is that they speculate on the key determinants of productivity growth in both areas without providing any evidence of causal relationships. This report aims to address this gap.

CHAPTER 3

Data and methods

This research seeks to provide evidence of the key drivers of productivity levels in Northern Ireland and Ireland, to develop a greater understanding of the underlying factors that drive productivity and ultimately income differences, including at a sectoral level, between both jurisdictions. Our approach is to exploit annual sectoral level data on gross value added per worker, with a view to modelling the determinants of productivity in each respective region. The modelling framework formally measures the role of variables such as educational attainment, investment, export orientation, migrant employment, and worker under-utilisation in both areas. By comparing and contrasting the model outputs, the study aims to identify the key factors determining productivity in each region. We also undertake scenario analysis that captures the change in productivity that is likely to arise by varying levels of endowments.

The key advantage of using sectoral level time series data is that these data will give us workable samples to produce reliable productivity panel models for each jurisdiction. Furthermore, aggregate Irish output data are often distorted due to globalisation effects, whereby recorded activity in some multinational sectors is disconnected from actual trends so certain sectors may be excluded from the analysis, or the models for those sectors may be estimated over a shorter time period, to remove such distortions. Our measure of productivity is output per worker. For Northern Ireland, data from the Office of National Statistics on regional gross value added by broad economic sector (NACE Rev. 2 definitions generate 20 broad economic sectors)⁴ are available for around 20 years, and similar data are available for Ireland from the National Accounts produced by the Central Statistics Office.⁵ Sectoral employment data come from the respective Labour Force Surveys.⁶

Having constructed our panel of productivity observations for each jurisdiction we also construct a series of variables that will help explain productivity levels in each respective area. In keeping with the structure of the productivity dataset, these are constructed for each sector in each region in each year. We use the annual microdata from the respective Labour Force Surveys to extract potential explanatory variables including the employment shares of educated workers, migrants, females, part-time workers, temporary workers, under-utilised workers⁷

⁴ The data for both Northern Ireland and Ireland include more granular data on the manufacturing sector.

⁵ Some manufacturing sectors at the more granular level are suppressed in the Irish data for confidentiality reasons.

⁶ It should be noted that the data relate to total sectoral activity and are not based on firm level observations.

⁷ This is defined as the share of workers who wish to work usually more than their current number of hours.

and mismatched⁸ workers. This is achieved by extracting averages for each explanatory variable for each country for each year that we have productivity data. We use other regional datasets from national and international sources for sectoral level measures of other productivity drivers such as exports.⁹ The data on sectoral investment (gross fixed capital formation) comes from Eurostat for Ireland and the ONS for Northern Ireland.¹⁰ While the rationale for including variables related to the stock and quality of human capital are self-evident, the inclusion of controls for overeducation, under-employment and contractual status etc. are based on the observation that these variables are frequently observed to be correlated with wages; as productivity and wages are highly interdependent it is plausible that such factors also influence productivity.

More formally, we examine the determinants of productivity using a panel estimation framework and the general relationship is described in Equation 1 for each region:

$$y_{it} = \beta_0 + \beta_j X_{ijt} + \alpha_i + \varepsilon_{it} \quad (1)$$

where y_{it} is the dependent variable (gross value added per worker) observed for each sector i in time t , β_0 is a constant term, X_{ijt} represents a number of j independent variables with β_j the associated coefficients, α_i is the unobserved time-invariant sector effect and ε_{it} the error term. In terms of the specific panel modeling approach adopted, we opt for a fixed effect estimator, following the results of a Hausman test, that allows us to model the determinants of productivity while controlling for time invariant country-level fixed effects and identify causal relationships. The adoption of a fixed effects specification allows us to factor out biases related to time-invariant unobserved factors that simultaneously influence both the explanatory variables and our outcome measure. Unobserved factors that remain relatively constant over time and may impact productivity include infrastructural assets such as airports and ports. As such, the approach enables us to generate much more robust estimates, compared to models using cross-sectional or pooled data, and moves the analysis much closer to measuring causal relationships.

We also estimate a decomposition aimed at identifying the extent to which any gaps in productivity between both jurisdictions are due to (a) differences in the levels of factors such as educated workers, migrants and export intensity between

⁸ For mismatched workers, we use a proxy measure of overeducation, namely the share of workers with degree (and above) education employed in non-graduate occupations.

⁹ Data on FDI and other potential productivity drivers such as R&D expenditure are not available at a granular sectoral level over time. Export intensity, which is captured in our models, tends to be positively correlated with these factors.

¹⁰ Gross fixed capital formation consists of investment, less disposals, in new fixed assets, where fixed assets can be tangible or intangible assets. Some examples include machinery and equipment and research and development.

both jurisdictions (endowment effects); (b) differences in the way that the explanatory variables interact with productivity between both jurisdictions (coefficient effects); and (c) unexplained factors not included in the model. The decomposition approach applies the standard Oaxaca-Blinder decomposition approach which takes the form of Equation 2:

$$\Delta Y = (\bar{X}_A - \bar{X}_B)\beta_B + (\beta_A - \beta_B)\bar{X}_B + (\bar{X}_A - \bar{X}_B)(\beta_A - \beta_B) \quad (2)$$

The left hand variable (ΔY) measures the difference in productivity between the two regions (A and B); the first term right hand side (RHS) measures the part of the observed gap that is explained by differences in productivity related endowments (\bar{X} education etc.) between the two regions, and is our key measure of interest. The second RHS term measures the proportion of the difference that is related to differences in the coefficient effects (β) for a given level of endowments. Finally, the third element of the equation is an interaction term that measures the proportion of the observed productivity gap that is not explained by the model. The sum of the second and third elements measure the total proportion of the gap that cannot be explained by the model.

Finally, we undertake a simulation exercise examining the estimated impact on productivity in a region as a consequence of changes in the drivers of productivity that are likely to be responsive to policy (education, labour market variables, export orientation). This takes the form of Equation 3 and, specifically, we examine the impact on productivity in a region if it had the endowments of the other region.

$$\Delta Y_B = (\bar{X}_A - \bar{X}_B)\beta_B \quad (3)$$

CHAPTER 4

Descriptive statistics

This section profiles both aggregate trends in productivity and examines sectoral differences in productivity between Ireland and Northern Ireland. The distortionary impact of the multinational sector on the Irish National Accounts has been well documented (see, for example, FitzGerald, 2015 and 2018 for more details) and, as a consequence, the use of aggregate measures such as GDP per capita to benchmark Ireland's productivity performance against other countries has been heavily criticised in the past. To account for this, we exclude the sectors with a heavy multinational presence in Ireland from the data for both series.

Table 4.1 shows the annual growth in aggregate productivity over time for both regions. The table reveals that excluding the sectors that distort Ireland's output data dampens productivity growth in Ireland. While these exclusions have a major impact on the Irish data they have a much more limited impact on productivity growth in Northern Ireland. The excluded sectors account for 45 per cent (9 per cent) of recorded GVA and 10 per cent (7 per cent) of employment in Ireland (Northern Ireland) in 2019. Overall, real productivity growth in Ireland over the 1998-2020 period averaged 0.2 per cent per annum, while real productivity fell in Northern Ireland (average fall of 1.2 per cent per annum) over the same period.

TABLE 4.1 AGGREGATE PRODUCTIVITY GROWTH IN IRELAND AND NORTHERN IRELAND

	Sectors	2019, € thousands, output per worker	Nominal Growth (%) 1998-2020	Real Growth (%) 1998-2020
IR	All	145.8	5.6	2.9
NI	All	55.1	1.4	-1.0
IR	Excluding CC, CD-CE, CF, CI, CJ, CK, CM & J	88.2	3.4	0.2
NI	Excluding CC, CD-CE, CF, CI, CJ, CK, CM & J	53.6	1.4	-1.2

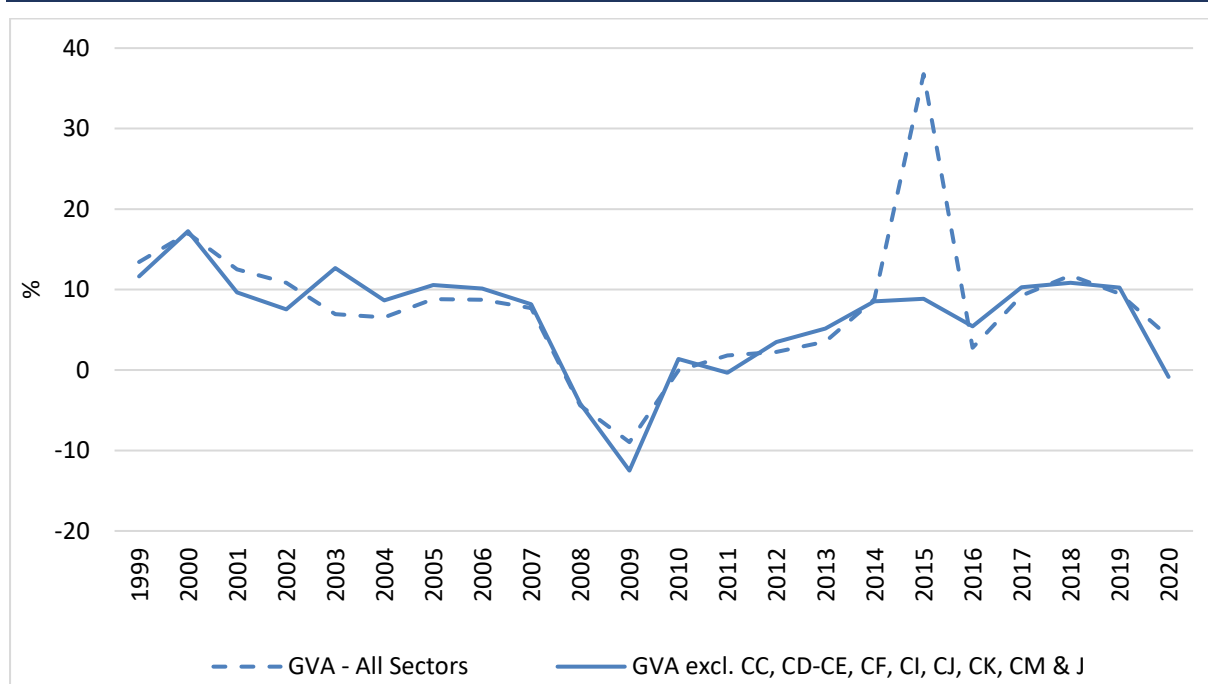
Source: CSO National Accounts, ONS Regional Gross Value Added Dataset, Labour Force Survey.

Note: The excluded sectors are CC (Wood, paper and printing), CD-CE (Manufacture of coke and refined petroleum products, Manufacture of chemicals and chemical products), CF (Manufacture of basic pharmaceutical products and pharmaceutical preparations), CI (Manufacture of computer, electronic and optical products), CJ (Manufacture of electrical equipment), CK (Manufacture of machinery and equipment n.e.c.), CM (Manufacture of furniture; jewellery, musical instruments, toys; repair and installation of machinery and equipment) and J (Information and communications). These exclusions match the CSO's release on Gross Value Added for Foreign-owned Multinational Enterprises and Other Sectors, whereby foreign-owned Multinational Enterprise (MNE) dominated sectors occur where MNE turnover on average exceeds 85 per cent of the sector total.

It is important to note that while the multinational dominated sectors have been excluded, some multinational presence remains in the data; however, any potentially large distortionary impacts of multinationals on Irish productivity data have been accounted for by excluding the highlighted sectors. This is demonstrated

in Figure 4.1, which shows that the exclusions have eradicated the major distortions that were most evident in the 2015 Irish National Accounts.¹¹ The series also indicates that growth in nominal GVA per worker has been positive at most points throughout the 1998 to 2020 period, with the exception of the 2008-2010 financial crisis.

FIGURE 4.1 GROWTH IN NOMINAL GVA PER WORKER IN IRELAND



Source: CSO National Accounts and Labour Force Survey.

Part of the explanation for productivity differences will relate to variations in the composition of sectoral employment, with Northern Ireland expected to have a higher employment share in areas with traditionally lower levels of value added. The sectoral distribution of 2019 employment is detailed in Table 4.2 and shows Northern Ireland has higher employment shares in typically lower value added sectors such as Administration and support services and Distribution, and a lower share of employment in traditionally high value added sectors such as Financial and insurance industries.

¹¹ The econometric analysis in Section 5 discusses a robustness check whereby certain other sectors are excluded on the basis that recorded productivity may be artificially high; however the model results are robust to these exclusions.

TABLE 4.2 **SECTORAL EMPLOYMENT SHARES IN IRELAND AND NORTHERN IRELAND**

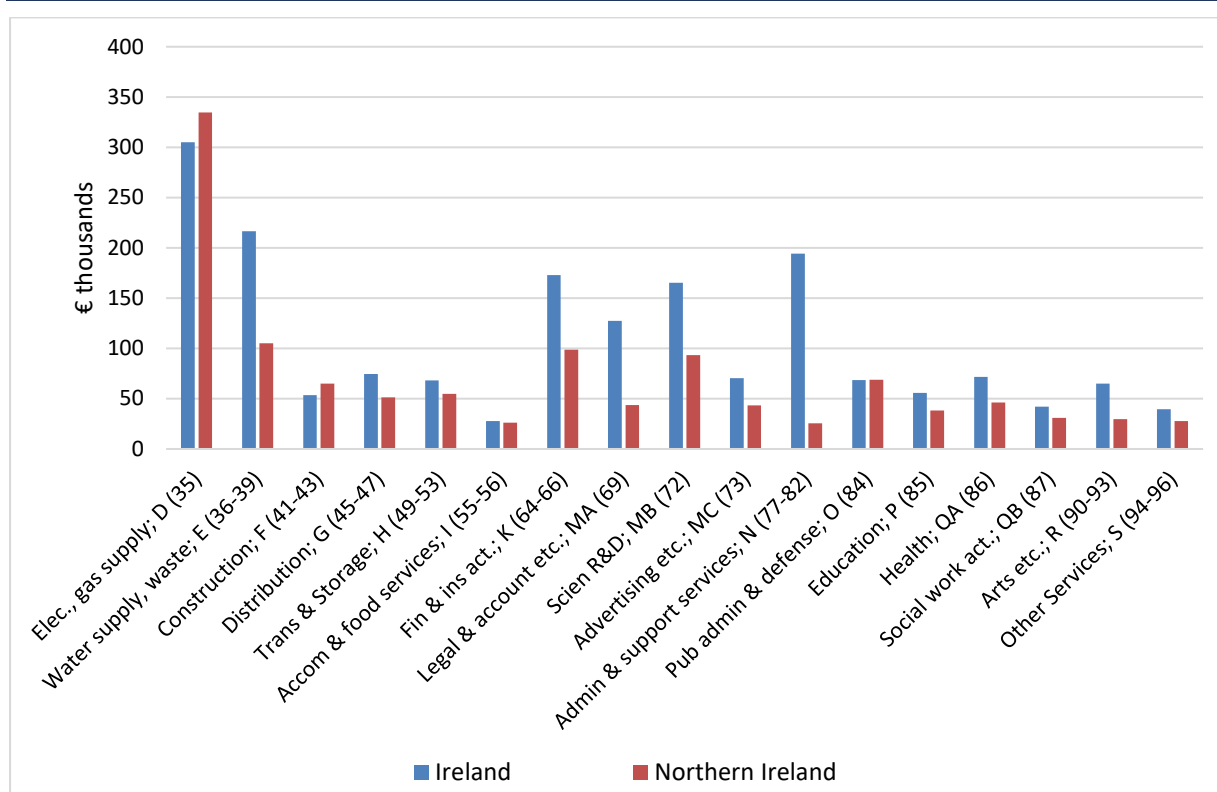
			Ireland	Northern Ireland
Sector	NACE Rev. 2 section	NACE Rev. 2 division	Share in Employment 2019	Share in Employment 2019
Agriculture, forestry and fishing	A	01-03	4.5%	3.3%
Mining and quarrying	B	05-09	0.3%	0.2%
Manufacturing				
Food products, beverages and tobacco products	CA	10-12	2.4%	2.6%
Textiles, wearing apparel and leather products	CB	13-15	0.1%	0.4%
Rubber and plastic products, and other non-metallic mineral products	CG	22-23	0.8%	1.2%
Basic metals and fabricated metal products, except machinery and equipment	CH	24-25	0.9%	1.2%
Transport equipment	CL	29-30	0.2%	1.3%
Electricity, gas, steam and air-conditioning supply	D	35	0.4%	0.2%
Water Supply; sewerage, waste management and remediation activities	E	36-39	0.4%	0.8%
Construction	F	41-43	6.9%	6.5%
Wholesale and retail trade, repair of motor vehicles and motorcycles	G	45-47	14.8%	15.9%
Transportation and storage	H	49-53	4.5%	4.0%
Accommodation and food services activities	I	55-56	8.7%	5.9%
Financial and insurance activities	K	64-66	4.1%	2.2%
Real estate activities	L	68	0.6%	1.2%
Legal and accounting activities; activities of head offices; management consultancy activities; architecture and engineering activities; technical testing and analysis	MA	69-71	4.0%	3.8%
Scientific research and development	MB	72	0.3%	0.2%
Advertising and market research; other professional, scientific and technical activities; veterinary activities	MC	73-75	1.3%	0.8%
Administrative and support service activities	N	77-82	5.4%	6.7%
Public administration and defence; compulsory social security	O	84	6.1%	5.8%
Education	P	85	7.8%	8.4%
Human health activities	QA	86	6.8%	8.2%
Social work activities	QB	87-88	4.8%	6.6%
Arts, entertainment and recreation	R	90-93	1.8%	2.2%
Other service activities	S	94-96	1.9%	3.1%
Other Sectors			10.2%	7.0%

Source: Eurostat National Accounts data by industry, ONS Workforce jobs by region and industry Dataset.

Note: The data in the table exclude sectors CC (Wood, paper and printing), CD-CE (Manufacture of coke and refined petroleum products, Manufacture of chemicals and chemical products), CF (Manufacture of basic pharmaceutical products and pharmaceutical preparations), CI (Manufacture of computer, electronic and optical products), CJ (Manufacture of electrical equipment), CK (Manufacture of machinery and equipment n.e.c.), CM (Manufacture of furniture; jewellery, musical instruments, toys; repair and installation of machinery and equipment) and J (Information and communications).

However, as pointed out by Johnston and Stewart (2019) and Mac Flynn (2016) with regard to Great Britain, it is likely that productivity in Northern Ireland will also vary within sectors when compared to Ireland. Figure 4.2 shows that, of the 17 sectors for which we have comparable data, productivity levels in Ireland noticeably exceed those of Northern Ireland in 14 sectors, with particularly large gaps in Administrative and support services activities; Financial and insurance activities; Legal and accounting activities etc; and Scientific research and development.¹² Northern Ireland has higher levels of productivity in Electricity and gas supply and Construction. Productivity levels in the two regions are broadly similar in Public administration. Figure 4.3 presents the same information in terms of the magnitude of sectoral productivity gaps.

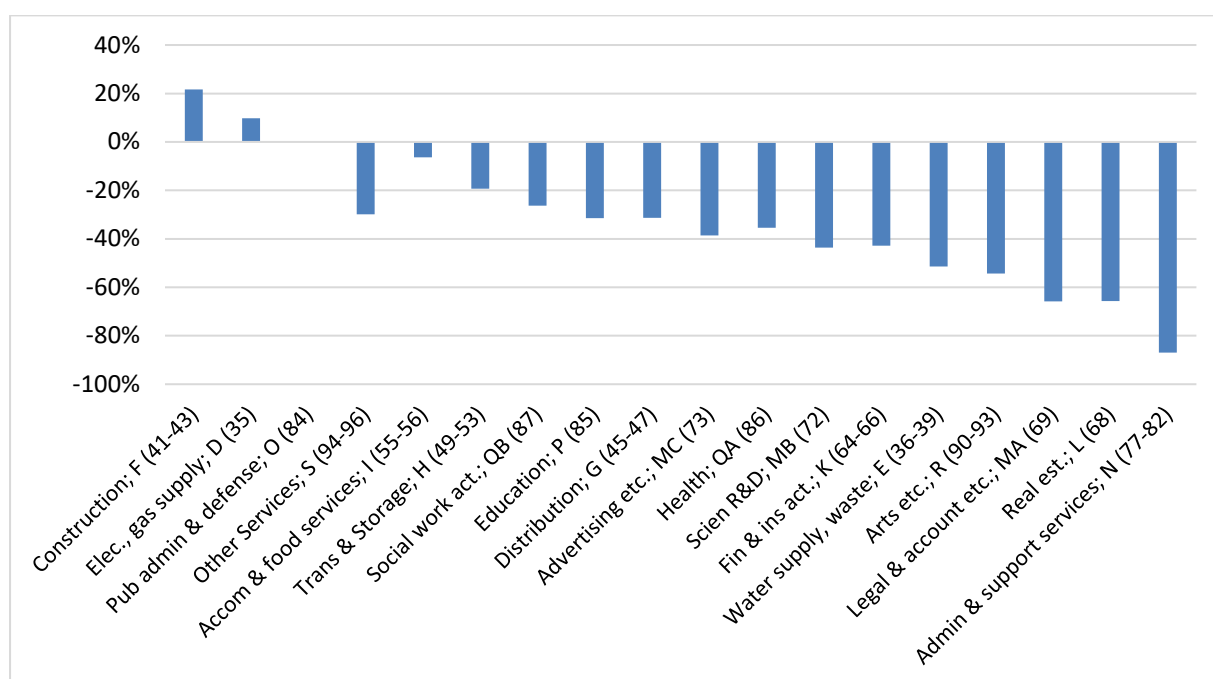
FIGURE 4.2 OUTPUT PER WORKER, 2019 CONSTANT PRICES



Source: CSO National Accounts, ONS Regional Gross Value Added Dataset, Labour Force Surveys.

¹² Real Estate Activities (sector L) is excluded from the graph as measured productivity in the sector is very high in both jurisdictions relative to other sectors. This is likely due to the inclusion of imputed rents in the calculation of GVA in National Accounts. The productivity model results (in Section 5) are robust to the exclusion of certain sectors where measured productivity may be artificially high.

FIGURE 4.3 NORTHERN IRELAND SECTORAL PRODUCTIVITY GAP RELATIVE TO IRELAND IN 2019 (%)

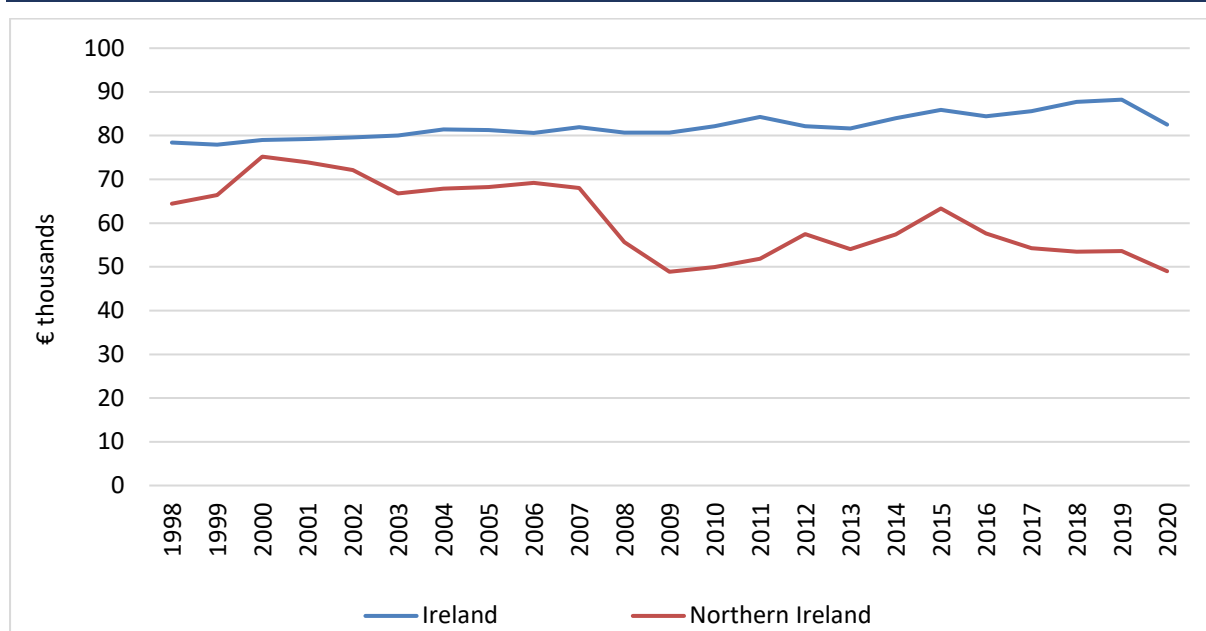


Source: CSO National Accounts, ONS Regional Gross Value Added Dataset, Labour Force Surveys.

Figure 4.4 plots aggregate productivity per worker between the two regions in constant prices; as such the chart measures volume differences in output per worker that have occurred over the 1998 to 2020 period. Productivity levels in the two regions were broadly equivalent in 2000, however a gap in favour of Ireland has steadily evolved over the 2001 to 2020 periods.¹³ Over the period, productivity levels in Ireland have trended slightly upwards; however, in contrast, Northern Ireland productivity levels have been trending downwards.¹⁴ By 2020, productivity was approximately 40 per cent higher in Ireland compared to Northern Ireland, which is a quite remarkable gap to have emerged over what is a relatively short time period in economic terms.

¹³ In Ireland, there was no marked fall in productivity around the time of the Great Financial Crisis. This may be attributable to the Irish economy's export orientation and the sectoral composition of exports (see, for example, McQuinn and Varthalitis, 2018; Barry and Bergin, 2016).

¹⁴ There is a growing literature on the global slowdown in labour productivity (see, for example, Erber et al., 2017).

FIGURE 4.4 OUTPUT PER WORKER, CONSTANT PRICES (VOLUME/REAL TERMS)

Source: CSO National Accounts, ONS Regional Gross Value Added Dataset, Labour Force Surveys.

Note: The data in the graph exclude sectors CC (Wood, paper and printing), CD-CE (Manufacture of coke and refined petroleum products, Manufacture of chemicals and chemical products), CF (Manufacture of basic pharmaceutical products and pharmaceutical preparations), CI (Manufacture of computer, electronic and optical products), CJ (Manufacture of electrical equipment), CK (Manufacture of machinery and equipment n.e.c.), CM (Manufacture of furniture; jewellery, musical instruments, toys; repair and installation of machinery and equipment) and J (Information and communications).

A priori, we expect sectoral productivity to be positively related to educational attainment and negatively related to measures of work under-utilisation; however the likely direction of the remaining coefficients remains somewhat uncertain. Table 4.3 shows the sectoral distribution of various characteristics for Ireland and Northern Ireland in 2019. Across all sectors, Ireland has a lower (higher) employment share of workers with primary education (post-secondary education) than in Northern Ireland and generally has higher sectoral employment shares of graduates. Furthermore, for the majority of sectors Ireland has higher rates of under-employment (workers who wish to work more than their current number of hours). The table also shows the migrant sectoral employment shares, which are also generally higher in Ireland. Previous research on migration in Ireland has shown that migrants in Ireland tend to be on average better educated than natives and that migration has kept labour costs and wages below where they otherwise would have been, which is consistent with having a positive effect on productivity (McGuinness, et al., 2010).

TABLE 4.3 SECTORAL EMPLOYMENT SHARES OF VARIOUS ENDOWMENTS IN IRELAND AND NORTHERN IRELAND IN 2019

	IRELAND					NORTHERN IRELAND				
	Primary	Post-Secondary	Degree	Under-employment	Migrant Share	Primary	Post-Secondary	Degree	Under-employment	Migrant Share
Agriculture, forestry and fishing (A)	23%	25%	11%	7%	2%	26%	14%	12%	1%	3%
Mining and quarrying (B)	13%	17%	18%	10%	5%	30%	5%	28%	22%	0%
Manufacturing (C)	2%	23%	38%	12%	14%	12%	12%	23%	3%	21%
Electricity etc.; Water supply etc. (D+E)	3%	25%	37%	13%	10%	6%	14%	25%	6%	5%
Construction (F)	5%	33%	17%	13%	9%	14%	9%	18%	3%	5%
Wholesale and retail trade etc. (G)	3%	21%	21%	16%	12%	16%	9%	18%	9%	6%
Transportation etc.; Information and communications (H&J)	3%	16%	47%	13%	16%	11%	11%	28%	4%	8%
Accommodation and food service activities (I)	4%	19%	21%	21%	22%	18%	9%	13%	12%	18%
Financial and insurance activities (K)	0%	14%	70%	9%	8%	3%	14%	45%	4%	3%
Real estate activities; Professional, science and tech. activities, Admin. and support service activities (L+M+N)	4%	16%	53%	14%	14%	8%	11%	44%	7%	8%
Public administration etc. (O)	1%	20%	49%	10%	3%	3%	12%	44%	4%	3%
Education (P)	1%	14%	74%	14%	5%	5%	12%	60%	8%	7%
Human health and social work activities (Q)	2%	28%	52%	13%	9%	7%	19%	40%	6%	7%
Arts, entertainment and recreation; Other service activities (R+S)	4%	23%	32%	21%	9%	7%	13%	36%	10%	10%

Source: Derived from Labour Force Surveys.

Note: Full descriptive statistics for all variables are available from the authors on request.

CHAPTER 5

Econometric analysis

As export data were only available for some sectors in some years, we estimate two specifications for each region; the first specification excludes exports and is estimated on the full sample, while the second model is restricted to those sectors (and time periods) for which export data were available.¹⁵ In terms of key productivity driving explanatory variables, we include the sectoral level investment as well as the share of workers with lower secondary, upper secondary, post-secondary and third-level qualifications. The models also control for the share of workers in each sector who are female, migrants, have temporary contracts or work part-time. The models also contain two measures of labour under-utilisation; firstly a measure of under-employment which reflects the share of workers in each sector who would prefer to work more hours and, secondly, a control for the share of graduates in non-graduate occupations as a proxy measure of overeducation.

The results from the Irish model are reported in Table 5.1. The model is well specified and conforms to expectations, with sectoral productivity increasing with the level of investment and share of educated workers. Productivity is also higher the greater the proportion of workers who are employed part-time. We found no impacts with regard to gender, migrant employment, under-employment or contractual status. With respect to education, the model suggests that a 1 per cent increase in the share of graduates employed generates a 1 per cent increase in sectoral productivity; the productivity impacts of a 1 per cent increase in the shares of workers educated to upper secondary and post-secondary level standing at 1.39 per cent and 1.12 per cent respectively. A 1 per cent increase in investment generates a 0.2 per cent rise in productivity. Finally, there is weak evidence that a 1 per cent increase in the share of part-time employees boosts output per worker by 1.3 per cent.

Table 5.1 also reports the results for the model restricted to exporting sectors. The model is highly consistent with that estimated on the larger sample, with sectoral productivity again positively related to the shares of educated workers. However, the marginal effects are considerably higher compared to the earlier sample, with a 1 per cent increase in the proportion of employees to post-secondary and third-level raising productivity levels by 4.5 and 3.3 per cent respectively. The relationship between productivity and investment was broadly consistent with the general model. Unlike the general model, no impacts were detected with respect to part-time employment, however there was weak evidence that output per worker in exporting sectors increased the higher the share of female employees.

¹⁵ Specifically, accommodation and food services, public administration and defence, education and health are excluded.

A 1 per cent increase in the value of exports was found to increase productivity levels by 0.12 per cent. It is important to note that the exporting measure will also tend to encompass the impacts of productivity corollaries such as foreign direct investment (FDI) and research and development (R&D) spending that are not explicitly measured here within our data.

TABLE 5.1 PRODUCTIVITY MODELS IRELAND (FIXED EFFECTS)

	All Sectors	Exporting Sectors
Constant	2.004***	-1.044
Female share	-0.713	1.497*
Temporary contract share	0.242	1.203
Part-time share	1.303*	0.787
Migrant share	0.674	0.191
<i>Education (reference primary)</i>		
Lower secondary share	0.427	1.318
Upper Secondary education	1.39***	2.750*
Post-secondary share	1.122**	4.528***
Tertiary share	0.986**	3.317**
Under-employed share	-0.507	1.824**
Overeducated share	-0.087	-0.664
Export sales (logged)		0.119**
Investment (logged)	0.205***	0.176***
N	321	67
R2 Overall	0.3207	0.4159
R2 Within	0.3701	0.6270
R2 Between	0.3268	0.5111
F statistic	15.81***	6.30***

Source: Authors' analysis.

Notes: ***, ** and * denote significance at the 1 per cent, 5 per cent and 10 per cent levels.

Certain sectors in Ireland may still be impacted by distortionary data. For example, the Administrative and support services sector (sector N) includes the Aircraft leasing sector where some firms are Irish headquartered. The capital in this sector is not deployed against labour in this country, rather the aircrafts are used in markets around the world; however the use of the capital is counted in Irish GVA and only a small share of GVA will be attributed to the leasing activities carried out by staff in Ireland. This may lead to artificially high recorded productivity in that sector. For both jurisdictions imputed rents used in GVA calculation by statistical offices may inflate measures of productivity in the Real estate activities sector (sector L). In our econometric models, sectors L (Real estate activities), M (Professional, scientific and technical activities) and N (Administrative and support services) are amalgamated because of data availability. However, as a robustness

check, we re-ran the Irish productivity models excluding these sectors and the results are robust to this exclusion.¹⁶

The results for the Northern Ireland model are reported in Table 5.2 and are statistically much weaker compared to the Ireland model. Beginning with the estimation based on the entire sample, only the control variables measuring the shares of part-time workers, migrants and those educated to third level are statistically significant, with the output suggesting that productivity levels actually fall with the higher the share of graduates in employment. The model diagnostics also confirm that the control variables explain only a small amount of the differences in sectoral productivity observed over time. Moving to the model restricted to exporting sectors, none of the control models are statistically significant and, in fact, the model F statistic indicates that we cannot reject the hypothesis that the model coefficients are jointly zero.

The poor performance of the econometric model for Northern Ireland, which was compiled using comparable data sources and applying the same estimation methods used for the Ireland model, raises questions regarding the underlying competitiveness of the Northern Ireland economy. It is of real concern that we do not observe any standard relationship between, for example, educated worker shares and productivity or any relationship with respect to export intensity. The lack of any operational model for Northern Ireland suggests that productivity in the region is likely to be relatively unresponsive to key policy levers, such as changes in education and skills provision, which creates real challenges for achieving improved economic growth. There are no obvious explanations for these findings. It may be the case that there are other economic, social and political factors that need to be considered in devising a policy response. It is possible that the impacts of The Troubles, having a relatively closed economy in terms of international trade, peripherality, limited results from regional policy¹⁷ and a historical reliance on public sector employment have all combined to subdue the impact of market forces among Northern Ireland firms, leading to a productivity trend that appears largely exogenous with respect to key policy variables.

¹⁶ Results available from authors on request.

¹⁷ Taylor and Wren (1997) use administrative data to trace the evolution of regional policy in the UK from the 1970s onwards. They show that total spending on regional policy declined from 0.4 per cent of GDP in the early 1980s, to 0.1 per cent by the late 1990s.

TABLE 5.2 PRODUCTIVITY MODELS NORTHERN IRELAND (FIXED EFFECTS)

	All Sectors	Exporting Sectors
Constant	4.385***	3.568***
Female share	0.107	-0.561
Temporary contract share	0.731	0.010
Part-time share	-0.818**	0.502
Migrant share	-0.504*	0.339
<i>Education (reference primary)</i>		
Lower secondary share	-0.262	-0.057
Upper Secondary education share	0.137	0.692*
Post-secondary share	-0.073	0.231
Tertiary share	-0.565**	0.505
Under-employed share	-0.632	-0.259
Overeducated share	-0.122	0.134
Export sales (logged)		-0.001
Investment (logged)	0.014	0.037
N	314	94
R2 Overall	0.1084	0.0046
R2 Within	0.1188	0.1360
R2 Between	0.1067	0.0009
F statistic	3.54***	1.05

Source: Authors' analysis.

Notes: ***, ** and * denote significance at the 1 per cent, 5 per cent and 10 per cent levels.

Despite the lack of any statistical relationship between Northern Ireland productivity and variables capturing investment, human capital accumulation and export intensity, we can still proceed with the estimation of a decomposition model by relying on the coefficient estimates of the Irish model to measure the percentage of any productivity gap that is attributable to differences in endowments between the two regions; for instance, differences in the shares of educated employees, migrants, under-employed workers etc. The model is estimated by pooling all productivity observations across time and will effectively decompose the productivity gap at the mid-point of the period (approximately at 2011). As we are estimating a pooled model, we can also add controls for sector that are potentially important explanatory factors.

The results from the decomposition are reported in Table 5.3. At the mid-point of the series, productivity levels in Ireland were just below 30 per cent higher than those of Northern Ireland and effectively all of the gap is explainable by differences in investment and labour market related endowments between the two regions. The table also shows the contribution of differences in the particular attributes that contribute to the explained gap. Differences in some endowments widen the gap

in favour of Ireland (and are positive) while others lower it (and are negative); however all endowment impacts sum to a 36.1 per cent gap in productivity favouring Ireland. The results show that two factors alone account for almost all of the observed productivity gap. Lower levels of investment account for a 22.7 per cent gap in productivity, with lower proportions of workers educated to post-secondary level in Northern Ireland accounting for a further 15.0 per cent. Lower endowments in graduate employment resulted in a further 1.7 per cent gap in productivity. The decomposition also points to lower productivity levels in Northern Ireland as a result of lower shares of part-time workers. However, differences in lower/upper secondary attainment and under-employment favour Northern Ireland and serve to reduce the expected North-South productivity gap by 5.7 per cent.

TABLE 5.3 OAXACA-BLINDER DECOMPOSITION OF IRELAND AND NORTHERN IRELAND PRODUCTIVITY GAP

Productivity Ireland (logged)	4.42
Productivity Northern Ireland (logged)	4.13
% Difference	29.1
% Explained	36.1
% Unexplained	-7.0
Explained Component	
Female share	0.013
Temporary contract share	0.004
Part-time share	-0.032
Migrant share	0.016
Education (reference primary)	
Lower secondary share	-0.027
Upper secondary education share	-0.011
Post-secondary share	0.150
Tertiary share	0.017
Under-employed share	-0.019
Overeducated share	0.002
Sector	0.002
Investment	0.227
Total Explained	0.361

Source: Authors' analysis.

It is clear that gaps in educational attainment play a large part in differences in productivity performance between the two regions. However, the decomposition assesses these at the mid-point of the time series, and does not give us an idea of

the likely magnitude of the productivity gaps more recently as a result in differences in the levels of endowments between the two regions. To account for this, Table 5.4 predicts Irish productivity levels in 2020 based on Northern Ireland endowment levels and compares this with the 2020 level of actual output for Ireland. The results show that the level of productivity in Ireland would be around 50 per cent lower if Ireland had the same attributes as Northern Ireland. There are substantial variations in productivity with many sectors, including those of importance to Ireland's overall performance such as Financial services, predicted to experience productivity declines in excess of 60 per cent when the simulation exercise is conducted at sectoral level. Productivity levels would increase in only one sector, Construction, were Northern Ireland endowment levels incorporated into the Irish economy. The simulation is conducted using a model that controls for human capital and labour impacts only, and it is likely that the Irish productivity would fall further if we were to also account for differences in export intensity between the two regions.

TABLE 5.4 SIMULATION RESULTS: IMPACT (%) ON IRISH PRODUCTIVITY OF HAVING THE SAME ENDOWMENTS AS NORTHERN IRELAND

	All Sectors
Overall	-50.2
Agriculture, forestry and fishing (A)	-57.2
Mining and quarrying (B)	-15.3
Manufacturing (C)	-134.3
Electricity etc.; Water supply etc. (D+E)	-11.8
Construction (F)	16.0
Wholesale and retail trade etc. (G)	-61.5
Transportation etc.; Information and communications (H&J)	-138.5
Accommodation and food service activities (I)	-54.6
Financial and insurance activities (K)	-62.3
Real estate activities; Professional, science and tech. activities, Admin. and support service activities (L+M+N)	-60.7
Public administration etc. (O)	-67.4
Education (P)	4.0
Human health and social work activities (Q)	-46.0
Arts, entertainment and recreation; Other service activities (R+S)	-13.4

Source: Authors' analysis.

CHAPTER 6

Summary and conclusions

There has been a growing literature speculating on the factors explaining the widening gap in the performance of the economies of Ireland and Northern Ireland, yet substantive empirical evidence on the issue is scarce. To address this information gap, this study examines sectoral productivity differences in Ireland and Northern Ireland and attempts to understand these differences by identifying the key determinants of productivity in both economies within a causal framework. Our approach is to exploit annual sectoral level data on gross value added per worker, with a view to modelling the determinants of productivity in each respective region. Of the 17 sectors for which we have comparable data, we found that productivity levels in Ireland noticeably exceeded those of Northern Ireland in 14 sectors, with particularly large gaps in Administrative and support services activities; Financial and insurance activities; Legal and accounting activities etc; and Scientific research and development. Northern Ireland has an advantage in the two sectors of Electricity and gas supply and Construction.

Examining trends at the level of the economy, we show that productivity in the two regions was broadly equivalent in 2000. However, over the period 2001 to 2020, productivity levels in Ireland have trended slightly upwards, while in Northern Ireland productivity levels have been trending downwards. By 2020, productivity per worker was approximately 40 per cent higher in Ireland compared to Northern Ireland.

Our econometric analysis produced a model for Ireland that is well specified and conforms to expectations, with sectoral productivity increasing with the share of educated workers. Productivity was also found to increase with higher levels of investment. In another specification, we find that export intensity is also an important factor in driving Irish productivity. With respect to education, the model suggests that a 1 per cent increase in the share of graduates employed generates a 1 per cent increase in sectoral productivity. Furthermore, the results indicate the productivity impacts of a 1 per cent increase in the shares of workers educated to upper secondary and post-secondary level stand at 1.39 per cent and 1.12 per cent respectively. A 1 per cent increase in investment was found to increase worker productivity by 0.2 per cent. We then estimate a model for Ireland, restricted to exporting sectors, which is highly consistent with that estimated on the larger sample, with sectoral productivity again positively related to the shares of educated workers employed and investment. However, the marginal effects are considerably higher and, in addition, we found that a 1 per cent increase in the value of exports was found to increase productivity levels by 0.12 per cent. The drivers of productivity, including education and labour market variables, together with export

orientation and investment are all variables that are likely to be responsive to policy.

However, despite using the comparable data sources and applying the same estimation methods used for the Ireland model, we found no evidence of a causal relationship between the range of factors captured in our model and Northern Ireland productivity. Such an outcome raises questions regarding the underlying competitiveness of the Northern Ireland economy and its responsiveness to changes in what are generally considered key policy levers. There are no obvious explanations for the absence of productivity drivers in Northern Ireland. It may be the case that there are other economic, social and political factors that need to be considered in devising a policy response. It is possible that the impacts of The Troubles, a relatively closed economy in terms of international trade, peripherality, limited impacts from regional policy and a historical reliance on public sector employment have all combined to subdue the impact of market forces among Northern Ireland firms leading to a productivity trend that appears largely exogenous with respect to key policy variables.

Our decomposition analysis estimated that the productivity gap in 2011 was approximately 30 per cent in favour of Ireland and approximately all of this gap could be explained by differences in labour market related and investment endowments between the two regions. Lower proportions of workers educated to post-secondary level in Northern Ireland account for a 15.0 per cent gap in productivity, however the largest impact related to lower levels of investment in Northern Ireland which resulted in a 22.7 per cent gap in output per worker between the regions. These two variables alone account for more than 100 per cent of the explained productivity gap between Ireland and Northern Ireland. The decomposition also points to lower productivity levels in Northern Ireland as a result of lower shares of part-time workers. However, differences in lower/upper secondary attainment and under-employment favour Northern Ireland and serve to reduce the expected North-South productivity gap by 5.7 per cent.

Finally, we employ a sensitivity analysis to show that productivity levels in Ireland would fall by 30 per cent in 2020 if firms in Ireland were faced with the labour market provision currently employed by Northern Ireland firms. In some key sectors of the economy, the productivity loss in Ireland would be in excess of 60 per cent. The results demonstrate the relative benefits accruing to Irish firms from having more ready access to skilled labour and investment. Our analysis points to the need to rapidly improve skills in Northern Ireland, particularly at the post-secondary level. However, our models also suggest that without a comprehensive strategy aimed at improving competitiveness among Northern Ireland firms, the reform of education/skills provision and more intensive investment in isolation are not guaranteed to enhance Northern Ireland productivity.

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