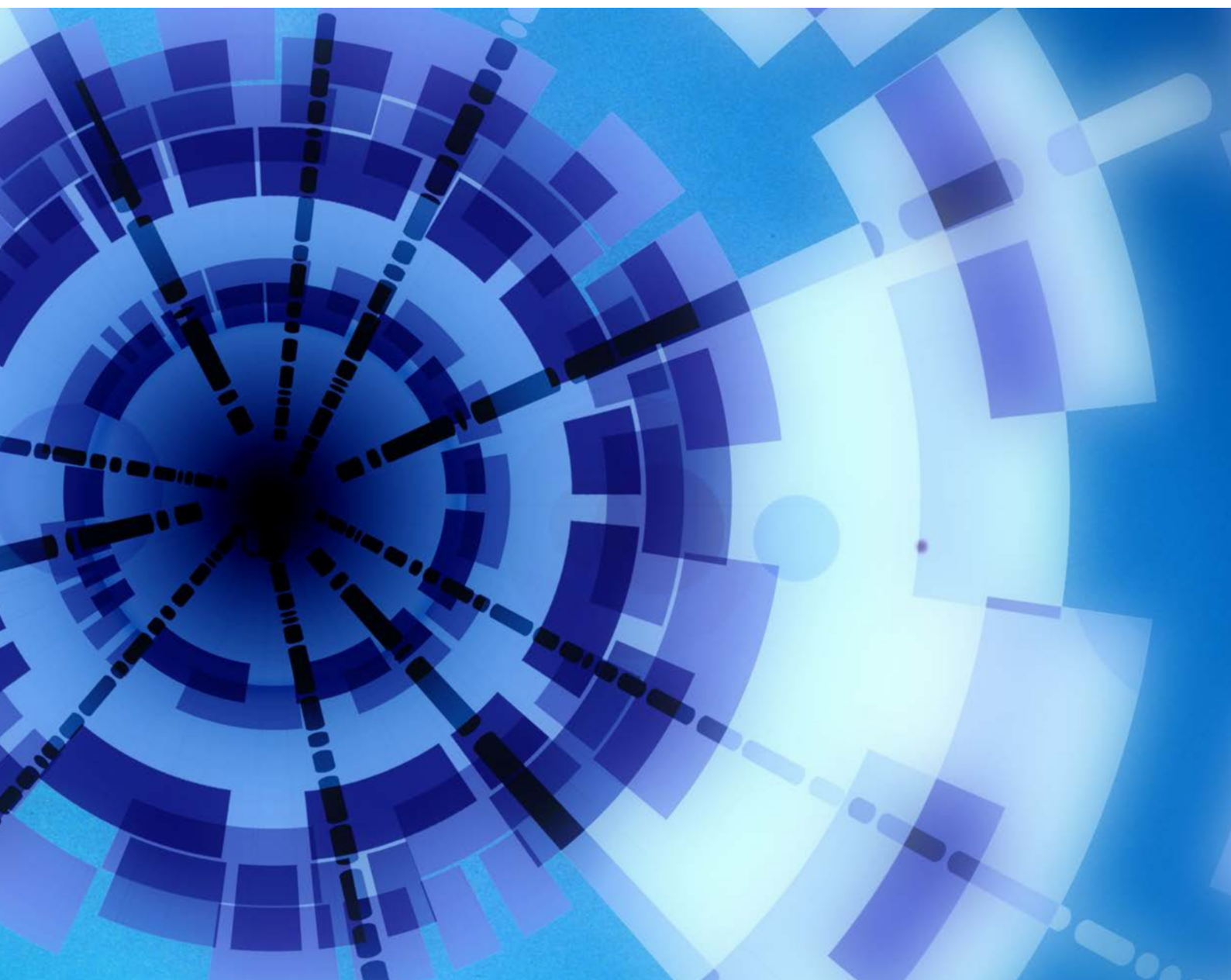


FDI Qualities Assessment of Ireland



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Foreword

This report examines the impact of foreign direct investment (FDI) attracted to Ireland over the period 2006-16 and provides an overview of the direct contribution and spillover effects of this investment on the local economy. The analysis pre-dates the COVID-19 pandemic and does not take account of the impact of this phenomenon on foreign investment in Ireland. The report has provided important background research and analysis as input to the development of IDA Ireland's new strategy.

The report finds that Ireland is one of the most open economies in the world and that the FDI base deeply integrates Ireland's economy into global value chains (GVCs). The sectors in which IDA supported foreign firms are concentrated have exhibited rapid growth in recent years and are associated with higher productivity, research and development (R&D) expenditures and wages than sectors with less foreign firm activity. The report also identifies a lack of diversification among Ireland's FDI base, which is concentrated in manufacturing, information and communications and the finance and insurance sectors. This could expose the Irish economy to risks related to macroeconomic trends in trade and investment and to policy changes in partner countries. In response, the report recommends a continued focus by IDA on diversifying the sectors and foreign sources of investment in Ireland.

Despite the fact that the report was prepared before the COVID-19 crisis, preliminary observations in 2020 showed that sectors in which IDA supported foreign firms are concentrated exhibited a remarkable level of resilience during the crisis. The OECD Economic Outlook in December 2020 highlights that Ireland's important position in trade of COVID-19-related medical goods provided a bulwark against the precipitous drop in international trade experienced elsewhere. Foreign firms in Ireland were not unaffected by the pandemic, the full impact of which continues to unfold. However, the overall resilience of these firms in the face of an unprecedented global economic shock in 2020 suggests that the sectoral mix of FDI in Ireland, while concentrated, is aligned with sectors that drive economic growth in the 21st century.

Ireland's consistent success in attracting investment from firms in these sectors is the result of a strategic approach to the targeting of inward investment by IDA. In turn, the success of this approach by IDA is only possible due to the policy choices and support of successive Irish Governments and the actions of other key stakeholders, including reinvestment by existing investors. These have fostered an environment conducive to attracting further investment that is strongly aligned with Ireland's key strengths in areas such as an educated workforce, the availability of skills, Return on Investment (ROI), ease of doing business and the consistency of relevant public policies such as support for R&D and training.

The report has been jointly developed by the OECD and IDA Ireland and builds on OECD work under the FDI Qualities initiative. A first steering group meeting was held in December 2018 to agree on the scope and outline of the report. An interim report was submitted in February 2019 and a second meeting to discuss preliminary results was held at IDA Ireland. The final report includes four chapters of analysis. Chapter 1 examines the role of FDI in Ireland's trade and GVC integration. Chapter 2 examines the role of FDI for productivity and labour market outcomes. Chapter 3 analyses foreign MNEs' productivity dynamics from 2006 to 2016. Chapter 4 focuses on the factors driving spillovers from FDI in Ireland.

The report was prepared by Maria Borga, Cecilia Caliandro, Letizia Montinari, and Martin Wermelinger, under the general guidance of Ana Novik, Head of the OECD Investment Division. Alexandre de Crombrughe provided substantive inputs and enabled this work, responding to IDA Ireland's request to study investment impacts, as a follow up to recent work on mapping the activities of OECD Investment Promotion Agencies. Niamh Roddy, Chief Economist at IDA Ireland, and Tim Costello were instrumental in providing guidance and feedback to the OECD team. Francesco di Lorenzo from Copenhagen Business School provided substantive inputs. The report benefited from discussions with and comments from Stephen Thomsen, Mike Pfister and Fares Al Hussami, OECD Investment Division, and members of the steering group of this project; namely, Kieran Donoghue, Chair of the Steering Committee and Head of International Financial Services, Strategy, and Public Policy at IDA Ireland; Breda O'Sullivan and Niamh Roddy, IDA Ireland; John Newham and Aine Maher, Department of Business, Enterprise, and Innovation; and Peter Clinch, Professor University College Dublin, Chair of Science Foundation Ireland, and Adviser to IDA Ireland.

The report draws on analysis based on OECD data (TiVA indicators, FDI database, National Accounts Database, and Analytical AMNE database), IDA's Annual Business Survey and Annual Employment Survey, and other data sources (Eurostat, Financial Times' fDi Markets database, PatStat and ILO). The study builds on expertise developed through OECD frameworks, notably the OECD Policy Framework for Investment (PFI), lessons from Investment Policy Reviews (IPR), new work on FDI qualities, and the OECD Benchmark Definition of Foreign Direct Investment, 4th edition.

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Acronyms and abbreviations

ABSEI	Annual Business Survey of Economic Impact
AMNE	Activities of Multinational Enterprises
BEA	Bureau of Economic Analysis
BMW	Border, Midland, and Western Region
CSO	Central Statistical Office
EU	European Union
FATS	Foreign Affiliate Statistics
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GNP	Gross National Product
GVC	Global Value Chain
ICT	Information and Communication Technology
IDA	IDA Ireland (investment promotion agency)
ILO	International Labour Organization
IP	Intellectual Property
IT	Information Technology
MNE	Multinational Enterprises
OECD	Organisation for Economic Cooperation and Development
R&D	Research and Development
SME	Small and Medium-Sized Enterprise
SPE	Special Purpose Entities
TiVA	Trade in Value-Added
UIC	Ultimate Investing Country
UK	United Kingdom
UNCTAD	United Nations Conference on Trade and Development
UNIDO	United Nations Industrial Development Organization
US	United States
WTO	World Trade Organization

Executive summary

Ireland is an open and internationally engaged economy, the second most open economy to trade in the OECD and a significant destination for FDI. Ireland has enjoyed positive impacts of this outward orientation over many years, with the FDI sector providing crucial support to the economy during the COVID-19 pandemic in 2020. FDI was also central to Ireland's recovery from the financial crisis, which is the time period studied in this report. The report is the product of a collaboration between the OECD and IDA Ireland, which was completed in advance of the pandemic. The findings have been an important input into the development of IDA's new 2021-2024 organisational strategy. In this new strategy, IDA will partner with foreign firms to drive recovery and sustainable growth in the context of a challenging, changed and uncertain global economic environment.

The study examines the following questions: the role of FDI in trade and integration in global value chains (GVCs); how foreign investment contributes to productivity and labour market outcomes; labour productivity dynamics of foreign affiliates in two important sectors in the Irish economy (manufacturing and information and communications); and the indirect impacts of foreign affiliates – by examining potential factors driving spillovers to domestic firms, with a special focus on labour mobility as a key channel for spillovers.

Overall, the study shows that foreign affiliates made a considerable contribution to the Irish economy in terms of trade, productivity, innovation, and employment between 2006 and 2016, both directly and indirectly. As IDA Ireland implements the key pillars of its strategy for 2021 to 2024, which include objectives aimed at maximising the impact of FDI in Ireland, the findings of this study suggest it should continue to diversify the investor base, to focus on attracting technology-intensive and R&D intensive investments in different sectors, and to encourage expansions and reinvestments by existing investors. It could enhance the opportunities for domestic firms to benefit from FDI by working with other government agencies to develop domestic firms' capabilities and linkages with foreign affiliates. The OECD will continue to engage and collaborate with IDA, through the IPA Network and the OECD FDI Qualities Initiative, on best practices related to maximising the impact of FDI, including those related to strengthening the linkages between foreign and domestic firms.

Foreign affiliates' contribution to trade and integration in GVCs

FDI has deeply embedded Ireland in the modern global economy, and positioned Ireland at latter stages of global value chains, i.e. post-production services. Foreign affiliates accounted for the growing trade surplus following the financial crisis and enabled Ireland to increase its integration in GVCs: foreign affiliates' exports of value added were 23% of GDP in 2008, which increased to 39% by 2015. This greater integration ran counter to the trend in the OECD overall, which saw a retrenchment in GVCs during this time. Integration in GVCs is important for smaller economies because it enables them to produce and export more by specialising in selected stages of production. Ireland is generally located at the customer end of GVCs, as are most OECD economies. Ireland has a comparative advantage in marketing,

distribution, and after-sales services and in publishing. The share of value added at the customer end of GVCs grew between 2005 and 2015, supporting high-paying jobs in Ireland.

Given the competitive corporate tax regime in Ireland, profits make a significant contribution to foreign affiliates' value added due in part to MNEs shifting intangible assets to Ireland. These high profits accrue to the foreign investor and, thus, may not remain in the domestic economy. As such, Ireland may not benefit as much from the value added exports of foreign affiliates as the data initially indicate. Efforts to identify reinvestment and expansion projects, including through IDA Ireland's aftercare services, increase the share of these profits reinvested and thereby also increase the benefits to Ireland from these foreign affiliates.

Ireland's close business ties to the US and proximity to the EU facilitated its greater integration in GVCs. FDI in Ireland is dominated by the US, which accounts for 70% of the inward FDI stock. Because smaller economies are vulnerable to macroeconomic developments and changes in policy in their major partner countries, this reliance on the one dominant source country could pose risks. IDA Ireland has made progress in diversifying the investor base. There were strong increases in employment at Chinese- and Indian-owned firms between 2006 and 2016, albeit from very low levels, as well as expansions and new investments from countries that already had a presence in Ireland, including Japan, France, and Italy. These efforts to diversify the investor base should continue.

Direct contributions to production, employment and innovation

FDI is concentrated in sectors with higher productivity, R&D expenditure and better employment outcomes. Foreign affiliates in Ireland accounted for 59% of value added (the highest share among EU countries) but only 18% of persons employed (Ireland ranks 14th in the EU) in 2015. While the Irish economy contracted sharply during the global financial crisis, foreign affiliates provided support to the economy during this time, especially in the Information and Communications sector as production and employment in this sector grew throughout the great recession. FDI also helped shift the economy to higher value added, and higher paying, services. This occurred not just in the Information and Communication sector, but also in Manufacturing and in Finance and Insurance. In Manufacturing, there was a shift away from physical production in Ireland to manufacturing abroad that was arranged and contracted for by foreign affiliates in Ireland. Together, these three FDI-intensive sectors accounted for 52% of Irish GDP in 2016, up from 39% in 2006. This shift to services helped the economy grow and increased labour productivity and wages.

Foreign affiliates also contributed to the growth and increasing sophistication of the Irish economy through their contributions to productivity growth, R&D expenditures, and employment. FDI is concentrated in sectors that are more productive and in industries with higher expenditures on R&D, and higher employment growth. Finally, foreign affiliates received 80% of all patents granted in Ireland between 2006 and 2016. These findings underscore that IDA Ireland's strategy to attract foreign investments in R&D-intensive sectors has been successful. Foreign affiliates are however less likely to engage in R&D activities in Ireland compared to domestic firms, which also explains that more than half of all researchers associated with patents granted to firms based in Ireland, are themselves located outside Ireland. Continuing to seek new investments in technology-intensive activities, and enhancing R&D activities in Ireland, is likely to be successful in the future and to contribute to economic and productivity growth in Ireland.

Productivity dynamics of foreign affiliates

There is a wide variety in productivity performance among IDA clients. Growth in relative productivity among these firms is linked to higher salaries and R&D intensity. Between 2006 and 2016, foreign firms had much higher productivity growth than domestic firms, but this aggregate growth resulted from complex dynamics at the firm level. Some large, resilient foreign affiliates can maintain high levels of productivity

and support employment for extended periods of time, playing an important role in improving living standards. At the same time, entries and exits of firms provide a channel to reallocate resources among firms, also crucially affecting aggregate productivity trends. Using IDA Ireland's data to examine the productivity dynamics of foreign firms in the manufacturing and Information and Communications sectors reveals that the range of productivity levels among foreign affiliates operating between 2006 and 2016 is very wide, with some stellar performers. These 'frontier firms' are almost ten times as productive as the median foreign affiliates.

In manufacturing, the best performers tended to remain at the top of the productivity distribution. These 'resilient' top performers supported the largest share of jobs overall. Exits more than new entrants supported dynamism within manufacturing, with exits concentrated in the lower productivity levels. In the Information and Communications sector, there was also a group of large resilient foreign affiliates at the top of the productivity distribution that support high productivity jobs, but there was more dynamism than in manufacturing, with 55% of lower productivity foreign affiliates moving up the productivity distribution between 2006 and 2016. New entrants also played an important role in the dynamics in the Information and Communications sector and accounted for a significant share of jobs, indicating that Ireland has been successful in attracting firms at the productivity frontier in this industry.

Overall, the most productive and resilient foreign affiliates were the ones exporting more and paying, on average, higher salaries. Higher wages were also found in foreign affiliates that were the most upwardly mobile (i.e. firms that 'climbed' the productivity distribution). In manufacturing, foreign affiliates that made the biggest improvements in productivity had also invested intensively in R&D, but this correlation was not found in the Information and Communications sector. Finally, the origin country of foreign investors matters; affiliates with owners from the United States, Denmark, Japan, and France had the highest relative productivity over the period 2006-16.

Factors driving spillovers from foreign affiliates to domestic firms

So far the focus has been on the direct impacts of foreign firms on the Irish economy, but they can also have indirect impacts on the outcomes of domestic firms through buy/sell linkages as well as through competition/imitation effects. Research has shown that the extent of spillovers is affected by several factors, including: the capabilities gap between domestic and foreign firms; the 'proximity' to foreign firms, such as through business linkages; and the movement of labour from foreign to domestic firms.

The capabilities gap reflects the ability of domestic firms to adopt foreign technology and to benefit from positive FDI spillovers. There are significant productivity gaps between domestic and foreign firms, but the size of the gaps varies across sectors. Foreign firms in chemicals were almost ten times as productive as the few domestic firms in this industry, but only 50% more productive than domestic firms in transport equipment manufacturing. Foreign firms are also more productive than domestic firms in all regions, with the largest gap in the South and East where foreign firms were five times more productive.

While capacity gaps as measured in this report are not precise enough to provide concrete guidance, the assessment shows in which sectors and regions gaps are higher and catching up efforts may be more warranted. Gaps are particularly high in some sectors and regions where domestic firms might be less present (e.g. chemicals) or where global frontier firms are responsible for disproportionate performance gaps and for productivity disparities even within the group of foreign affiliates (e.g. in manufacturing in the rest of South and East, or in information and communications in Dublin). As such, it might prove useful to target policy efforts to 'secondary' foreign affiliates with which domestic firms have lower capacity gaps, are more likely to engage in business linkages, and from which they are more likely to learn. Recent research shows that innovation spillovers on domestic firms from 'secondary' foreign firms are more likely to materialise than those from the global frontier innovators. Finally, and importantly, one needs to recall that higher performance of foreign firms across sectors and regions directly and positively contributes to

the Irish economy. This finding underpins a conclusion made earlier that foreign firms are not only concentrated in higher productivity sectors but they are also outperforming domestic peers within those sectors.

Business linkages can increase domestic firms' productivity by enabling domestic firms to reduce costs and innovate. Linkages with locally established foreign firms can further strengthen domestic firms' participation in GVCs. In Ireland, foreign firms are important gateways for domestic firms' integration in GVCs by enabling them to export indirectly by having their output embodied in the exports of foreign affiliates. While foreign affiliates in Ireland source less domestically compared to the OECD overall (domestic sourcing accounts for 24% of foreign affiliates' output in Ireland, much lower than the OECD average of 41%), the share is similar to other small, advanced economies. In addition to a declining share of domestic sourcing by foreign affiliates, the absolute value of sourcing from domestic firms dropped by 40% over 2008-16. The absolute value of domestic sourcing also decreased in other small OECD countries, such as the Netherlands and Switzerland, although to a lesser degree. IDA data show that in 2008 43% of its clients were engaged in manufacturing, and by 2016 this had fallen to 34%, partly explaining a shift in the types of inputs used by foreign affiliates.

Strengthening the capabilities of domestic firms is essential to enhancing spillovers from FDI. A collaborative approach between IDA and other government agencies in charge of enterprise development, trade, innovation, and skills development is important to design and implement policies that support the development of domestic firms' capabilities and linkages. Capabilities in services are particularly and increasingly important in Ireland. Services accounted for the highest share of inputs sourced domestically in the OECD. Domestic firms can also benefit by purchasing higher quality or lower cost intermediate inputs from foreign firms; in 2016, 30% of foreign affiliates' output was used as an input by domestic companies.

Another important channel for spillovers between foreign and domestic firms is the movement of workers. When workers move from foreign firms to domestic firms, they can bring knowledge and skills that can enhance the domestic firms' performance. Between 2009 and 2015, more than one out of every four employees at foreign firms either moved to a domestic firm or became self-employed. In addition, more than one in three start up founders previously worked at a foreign firm. Labour mobility within Ireland is also very likely among highly skilled researchers that have been associated with patents in Ireland. One out of two inventors changed employer at least once over 2006-16. As most inventors are based in foreign MNEs, the FDI spillovers related to inventor mobility also play an important role in Ireland.

1. The role of FDI in trade and integration in GVCs in Ireland

This chapter explores the degree of globalisation in the Irish economy. It examines the role of MNEs in trade and in the integration of Ireland in GVCs. It then looks at trade and investment relationships by industry. The chapter also derives improved measures of the impact of trade on the Irish economy by taking account of the profits earned by foreign MNEs on exports from Ireland. Finally, it examines Ireland's bilateral trade and investment relationships with a special focus on the United States, Ireland's most important trade and investment partner.

1.1. Summary

Ireland has one of the most globalised economies in the OECD. It ranks among the highest in openness to both trade and investment. Strategic planning to attract foreign direct investment (FDI) is central to Ireland's success in this regard. Since much of the FDI it attracts is export-oriented, multinational enterprises (MNEs) account for a sizable share of Ireland's trade and integration in global value chains (GVCs), which has increased since 2006, unlike in many other OECD countries. Following the global financial crisis, MNEs played a key role in Ireland's growing trade surplus through increased exports. They also supported the recovery in value added, employment growth and R&D spending.

MNEs in Ireland account for almost 60% of value added, a higher share than in other countries, and almost 20% of jobs. Yet the gap between the share of value added and employment accounted for by MNEs is bigger in Ireland than in other countries, partly due to the very high profits that MNEs earn in Ireland. These profits result from highly profitable MNEs choosing to locate in Ireland in part due to its low statutory tax rate. However, these high profits accrue to the foreign investor and may not remain in the domestic economy, indicating that, despite the high returns, Ireland may not benefit as much from FDI as the data might initially suggest.

The relationship of Ireland with its key investment partners reveals that they benefit from their investment not only through the income they receive from their Irish operations but also as a channel through which their products reach other export destinations, making Ireland an important GVC hub. However, FDI in Ireland lacks diversification: FDI is concentrated in a few sectors (manufacturing, information and communications, finance and insurance) and is dominated by FDI from the United States. In addition, a small number of very large MNEs in Ireland account for most FDI.

Ireland has successfully attracted FDI into targeted sectors and in support of its GVC integration, but this lack of diversification could pose risks for the economy. While small economies are expected to have some specialisation, they are also highly sensitive to macroeconomic trends in trade and investment and to policy changes in partner countries. By diversifying sectors and origins of investment, Ireland would be better placed to respond to these challenges as well as to changes in technology and in the nature of work. Indeed, there is evidence that IDA Ireland is attracting investments from some countries that have not invested as much in the past, including China and India, as well as expanding investments from some long-time investors, including Japan, France, and Italy.¹

Furthermore, sell and buy linkages between affiliates of foreign MNEs established locally and domestic firms have the potential to strengthen domestic firms' participation in GVCs. Domestic buy linkages exist if foreign MNEs source intermediate inputs and services from domestic firms. Foreign MNEs operate not only as customers in host economies but also supply intermediates that are further processed by domestic firms, as well as final products. New OECD evidence shows the increasing importance of foreign affiliates in domestic value chains not only as buyers of locally produced intermediate goods but also as suppliers of inputs to domestic companies. The OECD findings confirm that foreign affiliates are important gateways to international markets and connect the domestic and international parts of GVCs. Accordingly, the chapter also examines the extent of linkages between foreign affiliates established in Ireland and domestic firms, distinguishing between Irish non-MNEs (which include many SMEs), Irish MNEs and other foreign affiliates located in Ireland.²

Foreign affiliates established in Ireland source relatively more internationally than from the domestic market, but their domestic sourcing also benefits Irish firms. These affiliates source less domestically and their domestic sourcing benefits less domestic companies compared to foreign affiliates in the OECD overall. Similar results hold for other small open economies such as Luxembourg, Belgium and the Netherlands. This is unsurprising given the small size of their respective domestic markets. Services account for the largest share of inputs sourced domestically in Ireland. Production of foreign affiliates in Ireland is mainly exported reflecting Ireland's small domestic market, its attractiveness as a location from

which to serve the EU Single Market, and IDA's focus on attracting export-oriented FDI. Similarly, the production of foreign affiliates in other small open economies such as Luxembourg, Belgium and the Netherlands is also mostly exported.

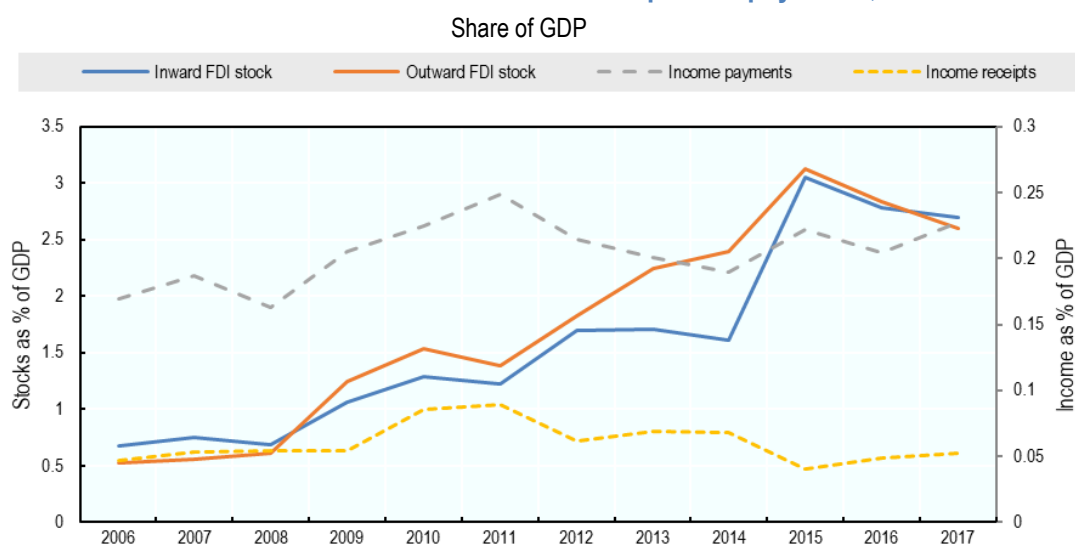
1.2. Ireland is one of the most highly globalised economies in the OECD

This chapter examines the role of foreign MNEs in Ireland's trade and integration in GVCs. It will take a sectoral approach when possible given not only that FDI is concentrated in a few specific industries and sectors in Ireland but also trends in these sectors differ. In addition, it will focus on net impacts when warranted given that not all of the value added of foreign-owned firms remains in the host economy, in particular the profits earned from their operations in Ireland accrue to the foreign investors.

Ireland is among the most open economies to FDI in the OECD

Inward and outward FDI stocks both grew rapidly between 2008 and 2015. In 2017, Ireland was a net recipient of inward investment, with the 2017 inward FDI stock equivalent to 256% of GDP (Figure 1.1); this was the second highest value in the OECD after Luxembourg,³ and higher than in the other small advanced economies in the OECD: the Netherlands 4th, Switzerland 5th, New Zealand 24th, Israel 25th, Denmark 26th, and Finland 29th out of the 35 OECD countries in 2017. Outward stocks were just below inward, at 247% of GDP. However, companies that moved their headquarters to Ireland, called redomiciled companies, account for most outward investment; in 2016; these companies accounted for 56% of the outward FDI stock (CSO, 2017). After falling in 2008, FDI income payments increased in 2009 to over 20% of GDP and remained relatively high. FDI income receipts have settled around 5% of GDP in recent years.⁴

Figure 1.1. Inward and outward FDI stocks and income receipts and payments, 2012 to 2017



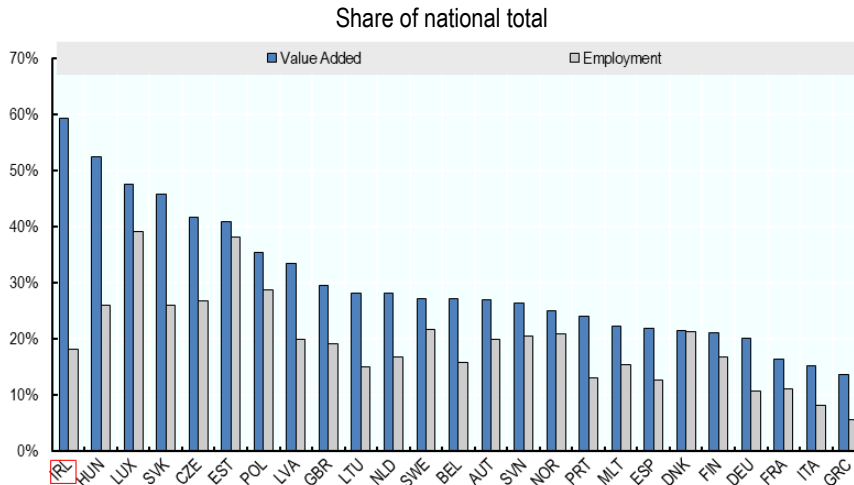
Source: OECD FDI Statistics (BMD4); Break in series: after 2014, FDI series exclude resident SPEs.

Foreign MNEs account for a higher share of value added in Ireland than in any other economy in the EU

As of 2015, foreign-owned firms were only about 1% of total enterprises, but they accounted for 59% of value added and 18% of persons employed in Ireland, excluding the agriculture and finance sectors (Figure 1.2).⁵ While this is the highest share of value added accounted for by foreign firms among the EU countries, the share of employment is much lower, and Ireland ranks 14th. As discussed below, the high

profitability of foreign MNEs in Ireland explains this gap. Comparing to other small advanced economies in the OECD, the Netherlands ranks 11th in terms of value added, Denmark 20th, and Finland 21st. Of these countries, only Denmark ranks higher than Ireland in terms of the share of employment at foreign-owned firms.

Figure 1.2. Foreign-owned firms' share of value added and employment, 2015

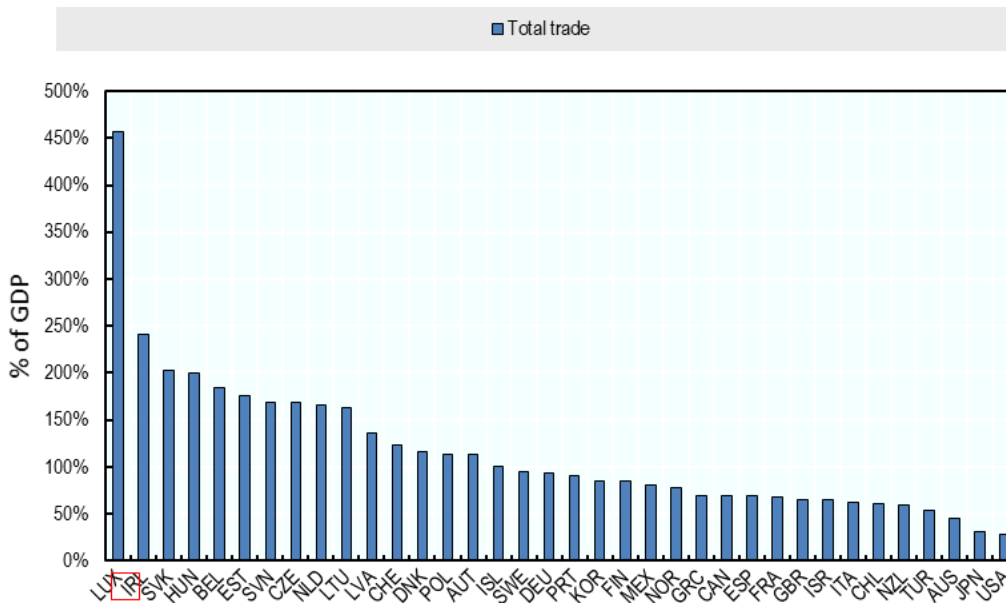


Source: Eurostat FATS Database. Ireland is among the most open economies to trade in the OECD

Ireland is among the most open economies to trade in the OECD

Ireland is the second most open economy to trade in the OECD as measured by gross exports plus imports over GDP (Figure 1.3). Ireland ranks behind Luxembourg, and is ahead of the other small advanced economies in the OECD (Netherlands 9th, Switzerland 11th, Denmark 13th, Finland 21st, Israel 29th, and New Zealand 32nd).

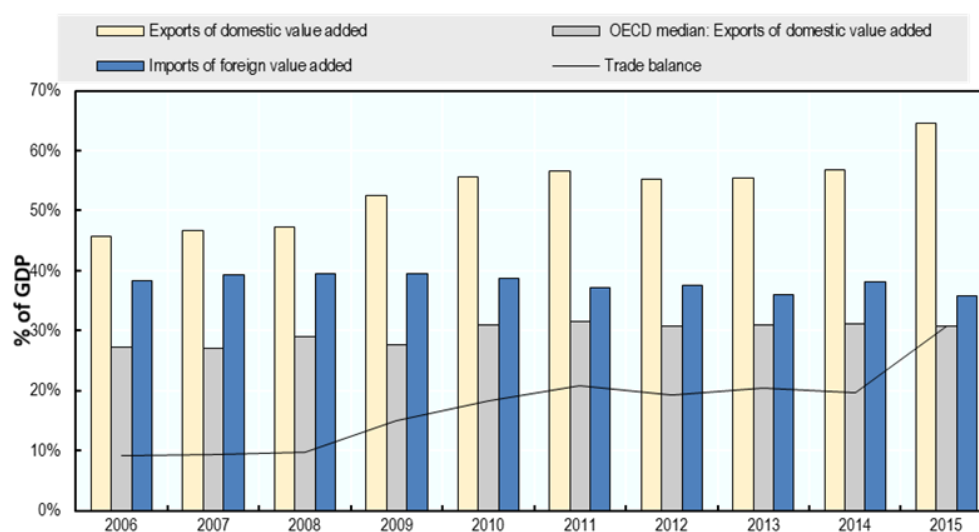
Figure 1.3. Trade openness, 2016



Source: OECD National Accounts database.

Gross exports were more than 127% of GDP in 2017, and gross imports were 95% of GDP. Ireland's trade surplus has generally been growing since the financial crisis. Yet, trade measured on a gross basis can overstate its impact on the economy. Trade measured in value added terms can provide a better indication of the impact of exporting on the economy because it estimates how much of the domestic value added is exported and the amount of foreign value added that is imported by an economy. Figure 1.4 shows Ireland's exports of value added (yellow bar) from 2006 to 2015; it is higher than the OECD median (grey bar) in every year. The figure also shows imports of value added (blue bar) and the resulting trade balance.⁶ Data measured in value added terms show that the growing trade surplus was driven largely by an increase in exports. Taken all together, these statistics indicate that Ireland is among the most globalised economies in the OECD.

Figure 1.4. Exports and imports of value added and the trade balance, 2006 to 2015



Source: OECD Trade in Value Added Database.

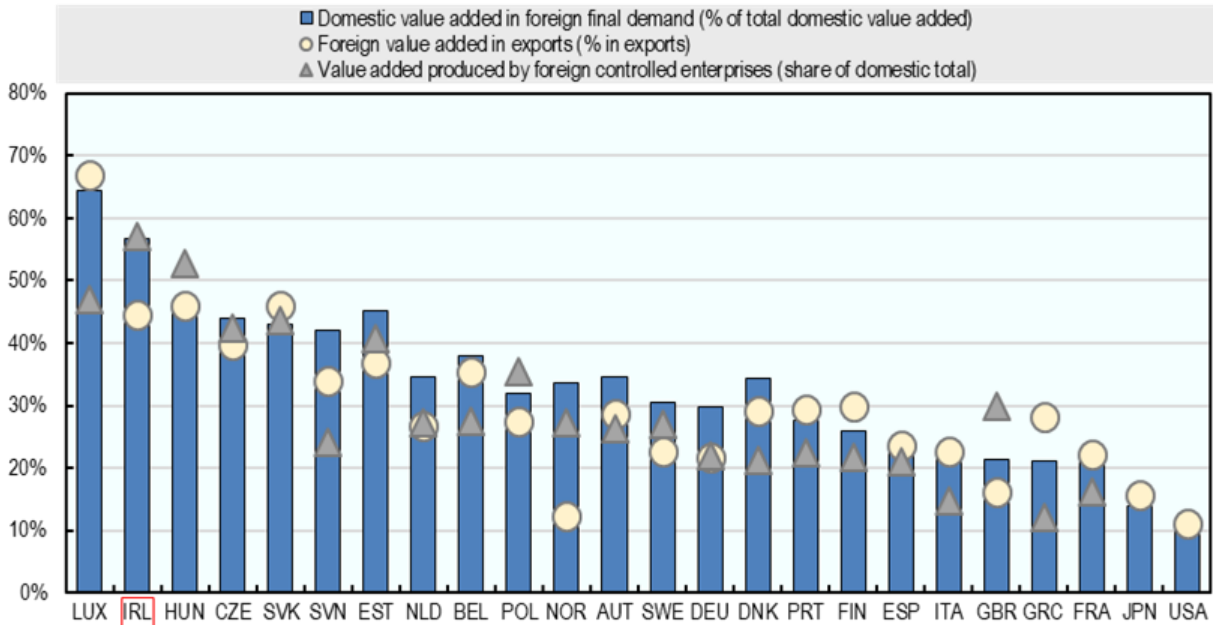
1.3. MNEs' contribution to GVC integration

Foreign MNEs play a key role in Ireland's GVC integration

Figure 1.5 provides a first indication of the role that foreign-owned firms play in integrating economies into GVCs. It shows the latest TiVA and AMNE data for a selection of OECD economies. First, it shows the export orientation of each economy (blue bar), which is measured as the share of domestic value added that is exported. The figure is sorted by export orientation; Ireland is second only to Luxembourg in the OECD with exports of just below 60% of domestic value added (or GDP). Second, the figure shows another important TiVA indicator: the value of foreign value added embodied in a country's exports (yellow circle). This is an indicator of GVC integration because it measures the extent to which a country relies on imports for its exporting, or, in other words, its backward linkages. Generally, the higher the share of foreign value added embodied in exports, the more integrated a country is in GVCs. Foreign value added in Irish exports is also relatively high at 50%.

Finally, Figure 1.5 shows the share of value added by foreign-owned firms in GDP (grey triangle). This share is higher in Ireland than in all of the other countries shown. Looking at all three series together, they tend to move in the same direction, meaning that a greater presence of foreign firms in the economy is associated with higher export orientation and greater integration in GVCs as measured by their backward linkages. This shows that MNEs can facilitate countries integration into GVCs.

Figure 1.5. Export orientation, foreign-owned firm value added, and the import content of exports, 2014

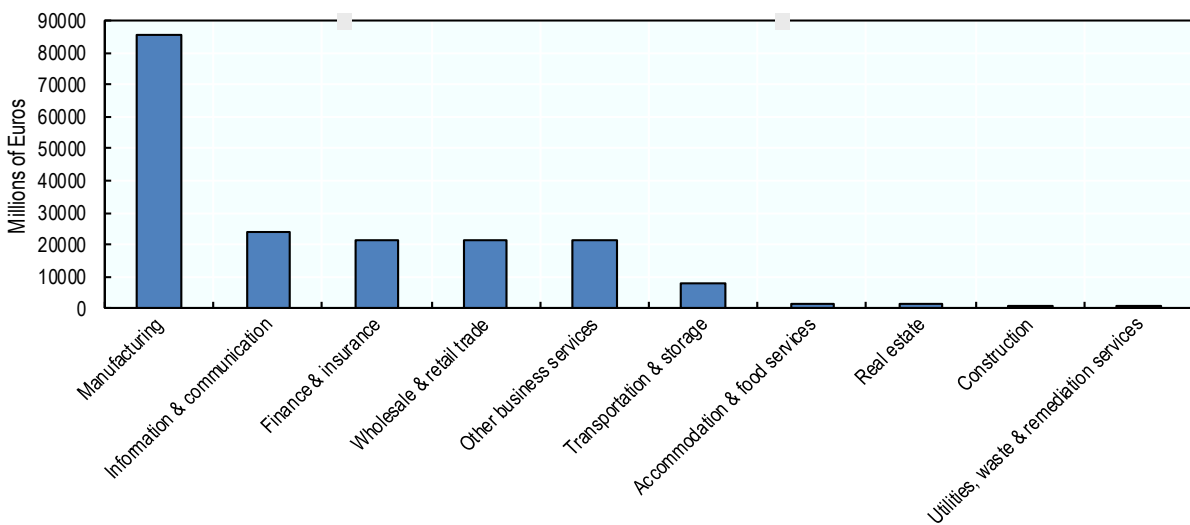


Source: OECD-WTO Trade in Value Added Data and OECD AMNE statistics – data for 2014

Exports are concentrated in FDI-intensive sectors

Exports of domestic value added is driven by the manufacturing sector. Manufacturing accounts for 58% of total exports, almost all of which is in pharmaceuticals, food, ‘other’ manufacturing (which includes medical devices) and computers. Information and communications (IC), finance and insurance, wholesale and retail trade, and other business services sectors follow (Figure 1.6).⁷

Figure 1.6. Exports of value added by sector, 2014



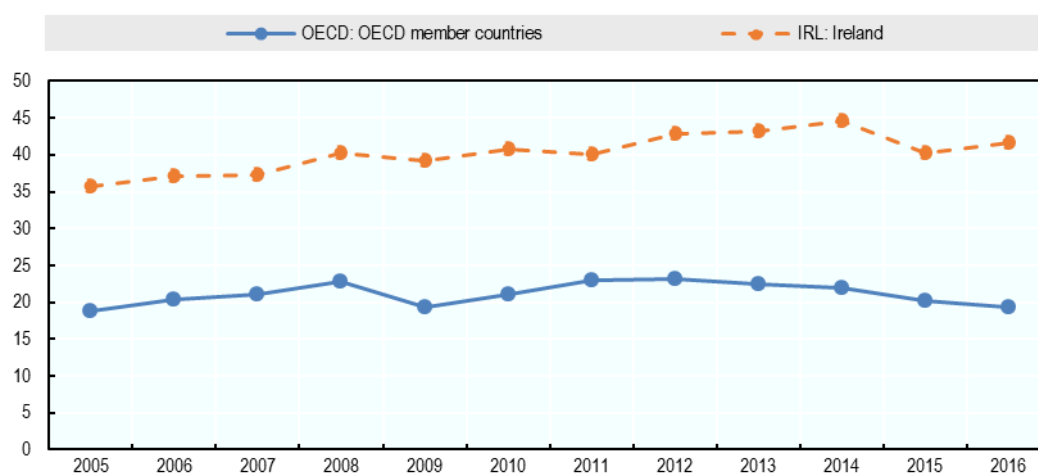
Source: OECD Trade in Value Added Database.

Ireland increased its GVC integration after the financial crisis

Integration in GVCs is especially important for small economies like Ireland because it enables them to export by developing comparative advantages in selected stages of the production processes rather than having to master the production of entire products (OECD, 2013). This integration relies not only on foreign demand but also on importing foreign value added to enable exports because they have specialised in one or more specific stages of production.

One of the key findings from the most recent TiVA release is a hint of a slowdown in the global fragmentation of production as evidenced by a fall in backward linkages (OECD, 2018). Figure 1.7 shows the share of foreign value added content in exports for the OECD as a whole and for Ireland from 2005 to 2016. For the OECD as a whole, there was a drop during the financial crisis followed by a recovery, but, since 2011, there has been a downward trend. By 2016, the share of foreign value added is virtually unchanged from 2005, which is interpreted as a retrenchment in GVC integration. However, Ireland has not followed this trend. There was a general upward trend in the foreign content of exports until 2014; even with a drop in 2015, the backward linkages in 2016 were higher than in 2005.⁸ In 2015, Ireland ranked fourth highest in foreign content of exports among OECD countries after Luxembourg, the Slovak Republic, and Hungary.

Figure 1.7. Share of foreign value added in exports, 2005 to 2016



Source: OECD Trade in Value Added Database.

The ABSEI data from IDA Ireland suggest that foreign-owned firms have played a role in increasing Ireland's integration in GVCs. According to these data, the total purchases of materials and services increased by 85% between 2006 and 2016, but the amount sourced in Ireland only increased by 6%. This indicates that these firms, which are very export intensive, increased their use of imported content during this period. It is important to note that while the more intensive use of imported content in exports means that the share of domestic content in exports falls, the absolute level of exports can still increase; this is important because it is the absolute level, rather than the share, that affects economic growth and employment. In fact, the domestic content of Irish exports fell from 64% in 2005 to 60% in 2015, but the value of exports of domestic value added increased by almost 75% from EUR 114.8 billion to EUR 200.3 billion. While it may have been a smaller share, it was a smaller share of a bigger pie.

The sectoral distribution also played a role in Ireland's growing backward linkages. While GVC integration in computer manufacturing fell, it actually increased in chemicals and pharmaceuticals manufacturing and in the information and communications and finance and insurance sectors. Finally, Ireland's close business

relationship with the United States appears to have helped. While GVCs centred on the United States as a supply hub retrenched (World Bank, 2019), Ireland actually increased the US value added content of its exports, especially those going to the rest of the EU.

1.4. Identifying buy and sell linkages between foreign affiliates and domestic firms

Domestic Irish firms may benefit from the presence of affiliates of foreign MNEs through buy and sell linkages. Such linkages help domestic companies extend their market for selling and raise the quality and competitiveness of their outputs. They can also generate spillovers, as discussed further in Chapter 4. Finally, having strong buy and sell linkages with domestic firms can embed foreign affiliates more deeply into the economy, making it less likely that foreign MNEs will move operations (OECD, 2013).

Domestic backward linkages are formed when foreign affiliates source inputs from domestic companies. Foreign affiliates can also sell intermediates to local companies. These linkages are referred to as domestic forward linkages. This section examines the extent of domestic backward and forward linkages between foreign affiliates and domestic companies in Ireland. The analysis identifies the main beneficiaries of domestic sourcing and buying of foreign affiliates (Irish non-MNEs, Irish MNEs and other foreign affiliates established locally) and shows the evolution of such linkages from 2008 to 2016.

Foreign affiliates source more internationally, but their domestic sourcing also benefits Irish firms

Foreign affiliates in host countries can import their intermediates or source them from the local market. In the latter case, they establish backward linkages with domestic companies or with other foreign affiliates established locally. New indicators based on the OECD Analytical AMNE database enables the comparison of the sourcing structure of foreign affiliates established in Ireland with that of domestic firms. It should be noted that unlike the ABSEI data used elsewhere in this report, this OECD data captures the activities of all foreign affiliates in Ireland, including those not supported by IDA Ireland such as companies in the wholesale and retail sector that serve the domestic market.

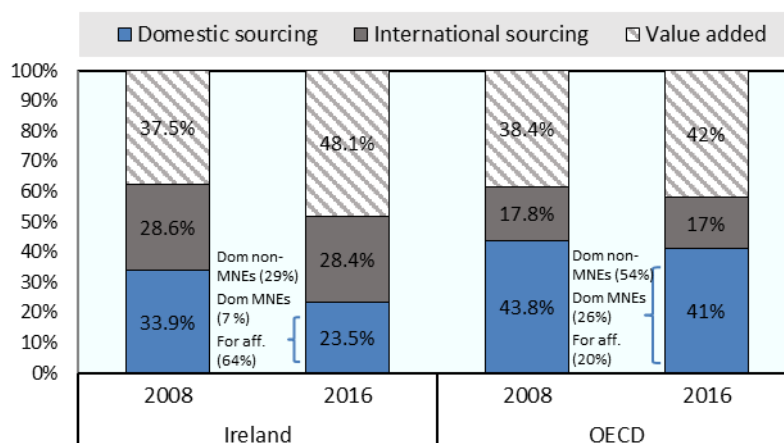
Purchased intermediates accounted for about 50% of foreign affiliates' output in 2016 (where value added accounted for the other 50% of total output) and about 55% of domestic firms' output (Figure 1.8).⁹ Foreign affiliates, just like domestic firms, in Ireland source intermediate goods both from suppliers abroad (via imports) and firms located in Ireland. The share of inputs purchased internationally represented 28% of foreign firms' output and 30% of domestic firms' output. Foreign and domestic firms also have similar levels of domestic sourcing at 23.5% and 26% respectively; reflecting perhaps the small size of the domestic Irish economy.

Interesting differences emerge when comparing the sourcing structure of foreign affiliates in Ireland with that of foreign affiliates in the OECD (Figure 1.10). In Ireland, foreign affiliates buy just slightly less intermediates (relative to their total outputs including value added) than in the OECD. In 2016, purchased intermediates accounted for about 50% of foreign affiliates' output in Ireland and for 58% in the OECD. However, foreign affiliates in Ireland source less domestically and their domestic sourcing benefits domestic companies less relative to foreign affiliates in the OECD. In 2016, inputs sourced domestically accounted for about 24% of total output in Ireland but for a much higher 41% in the OECD. In addition, domestic firms (non-MNEs and MNEs) accounted for only 36% of total local sourcing in Ireland but 80% in the OECD.

The sourcing structure of foreign affiliates has changed over time (Figure 1.10). The value added to output ratio of foreign affiliates in Ireland increased from about 38% to 48% between 2008 and 2016. This came at the expense of a smaller share of domestic sourcing, which decreased from around 34% to 24% over the same period. The share of international sourcing at around 30% of total output remained broadly constant during the same period further supporting the finding that foreign affiliates contributed to the increased integration of Ireland in GVCs following the financial crisis. A similar trend is observed in the OECD, but looking at more recent years points to rather shrinking international sourcing and thus GVCs. In addition to a declining share of domestic sourcing by foreign affiliates in Ireland, the absolute value of sourcing from domestic firms also dropped by 40% between 2008 and 2016. The absolute value of domestic sourcing also decreased in other small OECD countries, such as the Netherlands and Switzerland but to a smaller degree. IDA data show that in 2008 43% of its clients were engaged in manufacturing, and by 2016 this had fallen to 34%, partly explaining a shift in the types of inputs used by foreign affiliates.

Figure 1.10. Foreign affiliates in Ireland source less domestically and their domestic sourcing benefits less domestic companies relative to foreign affiliates in the OECD

Sourcing structure of foreign affiliates, Ireland versus OECD, 2008 and 2016

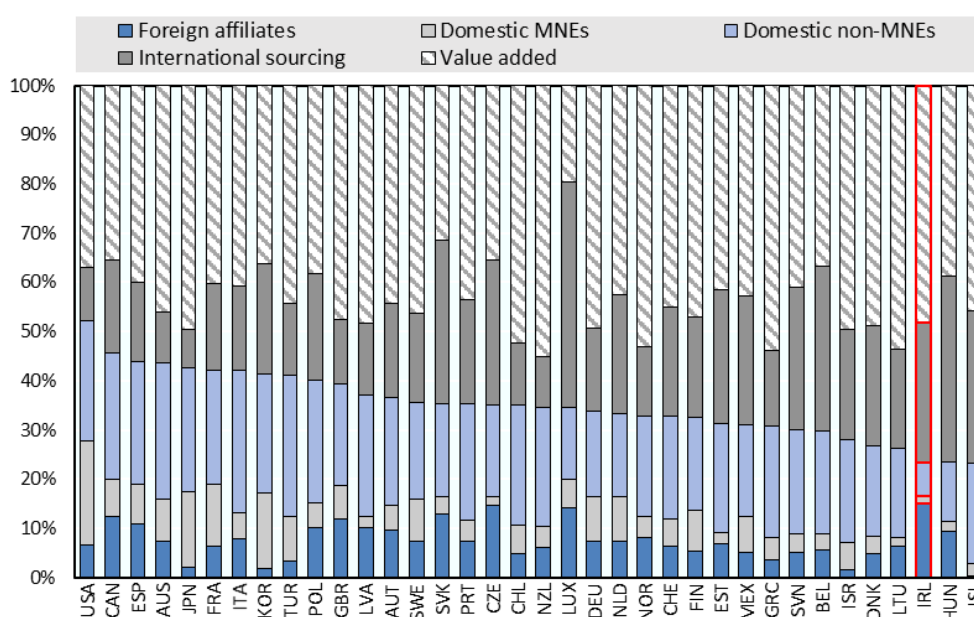


Source: OECD elaborations based on the OECD Analytical AMNE database

The data further indicate that foreign affiliates in Ireland and in other small open economies, such as Luxembourg, Belgium, and the Netherlands, source relatively more internationally than countries that can rely on larger domestic markets for intermediate goods, such as France, Italy, United States, and Japan (Figure 1.11). The share of linkages developed among foreign affiliates established locally is higher in Ireland compared to other small open economies, illustrating that foreign affiliates in Ireland often source locally from other foreign affiliates.

Figure 1.11. Ireland has one of the highest shares of linkages developed among foreign affiliates established locally

Sourcing structure of foreign affiliates in the OECD countries, 2016



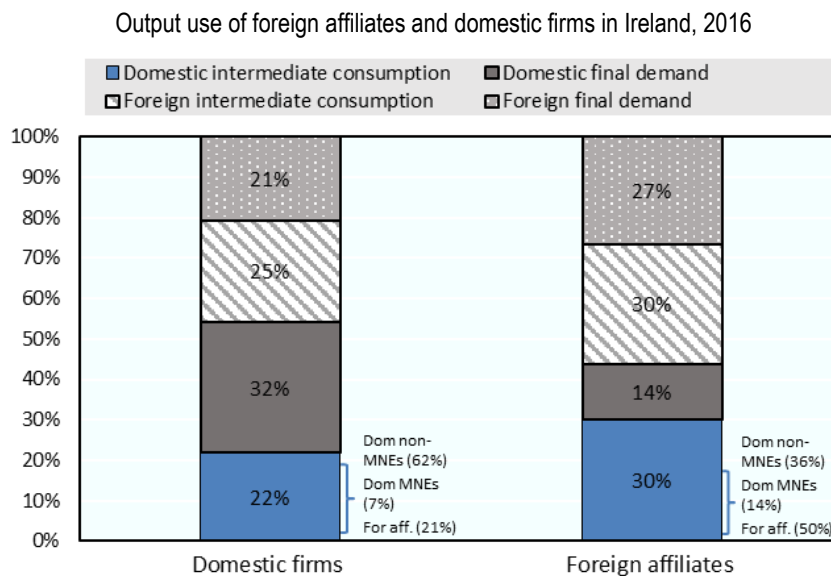
Note: Data are not available for New Zealand and Israel.

Source: OECD elaborations based on the OECD Analytical AMNE database

One-third of the production of foreign affiliates feeds back into domestic value chain

Affiliates of foreign MNEs operate in host countries not only as buyers of intermediate goods, but also as suppliers to domestic companies (forward linkages). Forward linkages between MNEs and local buyers has a positive impact on local enterprise productivity mostly through the acquisition of better quality inputs which were not locally available before (Criscuolo and Timmis, 2017). In addition, many MNEs, especially in industrial sectors such as machinery, often offer training to their customers on the use of their products as well as information on international quality standards (Jindra, 2006). Analysis based on the OECD Analytical AMNE database shows that in Ireland almost half of the production of foreign affiliates feeds back into domestic value chains: in 2016, 30% of foreign affiliates' output was used as an input by domestic companies and 14% was sold in the final domestic market (Figure 1.12). The domestic forward linkages of Irish companies were even larger: about 54% of domestic companies' output remained in the domestic economy, where 32% was destined to the final domestic market and 22% was sold as inputs to other domestic companies. Additionally, foreign affiliates produce relatively more intermediates than final goods for the domestic market relative to domestic companies.

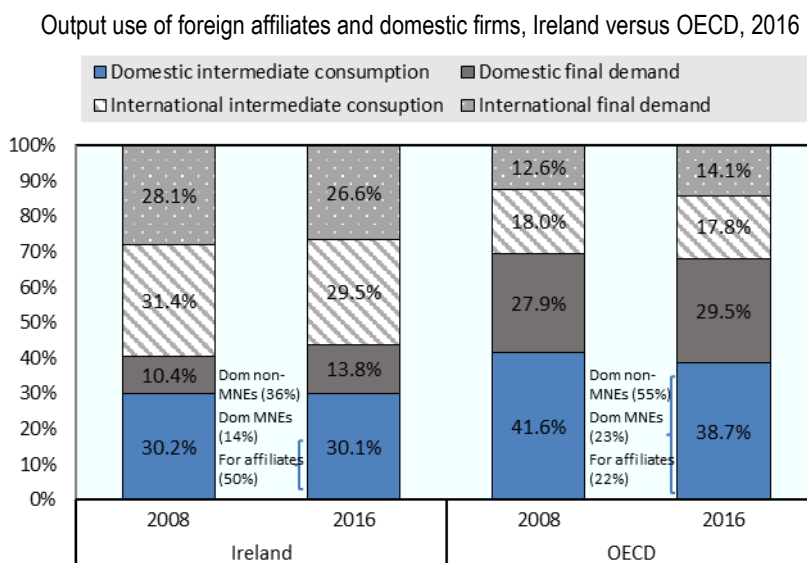
Figure 1.12. The domestic forward effects of foreign affiliates benefit largely Irish firms



Source: OECD elaborations based on the OECD Analytical AMNE database

The domestic forward linkages of foreign affiliates benefit Irish firms: 36% of intermediates sold by foreign affiliates in the domestic market were bought by Irish non-MNEs and 14% by Irish MNEs while the remaining 50% were purchased by other foreign affiliates located in Ireland. Not surprisingly given the relatively smaller size of the Irish economy and the focus of IDA on attracting export-intensive FDI, the data show that the production of foreign affiliates in Ireland is more destined to international markets than for the OECD overall: 56% in Ireland versus 32% in the OECD (Figure 1.13). The share of production sold abroad remained broadly constant both in Ireland and in the OECD over 2008-16.

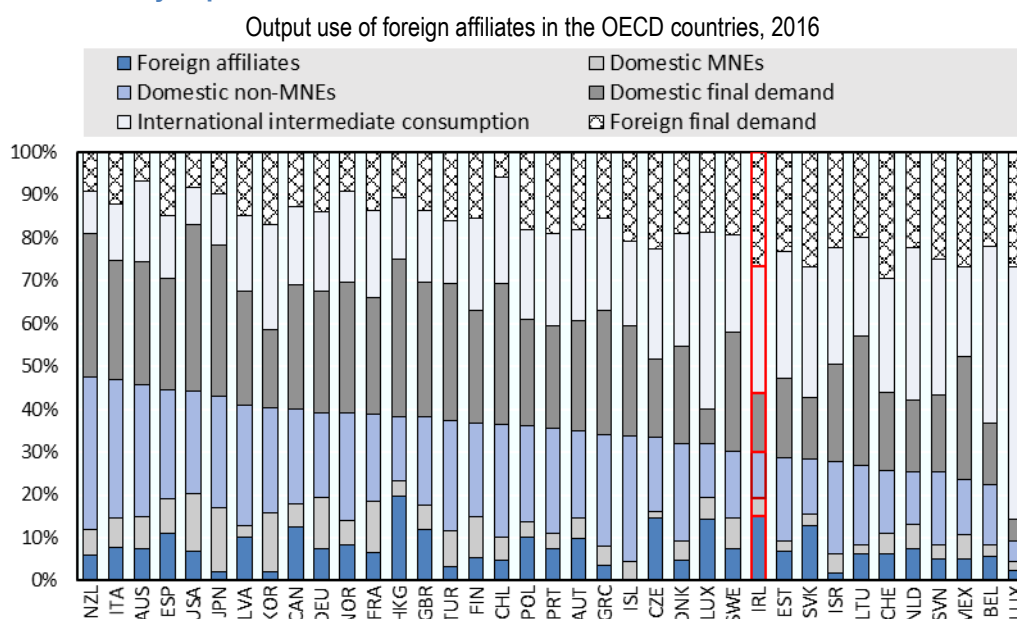
Figure 1.13. In Ireland, the production of foreign affiliates is more destined to international markets



Source: OECD elaborations based on the OECD Analytical AMNE database

Results by individual countries show interesting similarities between Ireland and other small open OECD economies (Figure 1.14). The production of foreign affiliates in Luxembourg, Belgium and the Netherlands is also destined primarily to international markets. As was the case for backward linkages, the size of the economy seems to matter also for forward linkages: countries with larger domestic markets like Japan, Italy and the United States are characterised by more important forward domestic linkages between foreign affiliates and domestic companies.

Figure 1.14. The output of foreign affiliates established in Ireland and in other small open OECD economies is mainly exported



Note: Data are not available for New Zealand and Israel.

Source: OECD elaborations based on the OECD Analytical AMNE database

1.5. Ireland is located towards the customer end of GVCs

As discussed earlier, the imported content in Ireland's exports, an indicator of backward participation in GVCs, increased between 2005 and 2016. Another indicator of GVC integration is the share of domestic (Irish) value added that is included in other countries' exports, i.e. a measure of forward participation in GVCs. Ireland's forward participation in GVCs was relatively unchanged from 2005 to 2015; in 2005, 12.5% of gross exports were accounted for by Irish value added that was embodied in other countries' exports, and by 2015, this had fallen slightly to 12.3%. Ireland had the fourth lowest forward participation in the OECD in 2015, after Mexico, Luxembourg, and New Zealand. This indicates that Irish enterprises increased their GVC integration over this period by extending their supply networks back to other countries. It also indicates that Irish enterprises are located towards the customer end of the supply chains that they participate in.

Most OECD countries are located at the end of supply chains. Most upstream activities are either in raw materials or in intangibles at the start of the production process. As a result, OECD countries that have large primary sectors, such as Australia, Norway, or Chile, or that are home to firms that lead GVCs, such as the United States, Japan, or Germany, have higher forward participation. Most downstream activities are in assembly or in customer services. Recent research from the OECD shows that a significant share of income is captured in the distribution stage of GVCs, particularly in buyer-driven value chains (OECD, 2019a).¹⁰ This is consistent with the high share of profits in foreign affiliates' value added discussed earlier and also indicates that this position in GVCs can directly support high-paying jobs in Ireland and with Ireland having a comparative advantage in marketing, distribution, and after-sales services and in publishing (OECD, 2017). To further examine Ireland's position, consider the value chain in media and publishing, an industry that is important to Ireland's exports. The value chain in publishing consists of several stages: content creation, production, aggregation, distribution, and, finally, consumption (Eden, 2016). Ireland's comparative advantage in publishing indicates that its exports are in the distribution stage while it relies on imports for content.

Within computer manufacturing and chemicals and pharmaceuticals manufacturing, about half of exports are of final goods. However, two-thirds of exports in other manufacturing (medical devices) are final goods. Within the information and communications sector, most exports are final goods in the publishing sector. Most exports are final goods in finance and insurance as well.

1.6. Role of MNEs in exporting

Exports of value added can be broken down into the part that is produced by foreign-owned firms and the part that is produced by domestic firms to provide important insights into the role of MNEs in the growth in Ireland's trade surplus following the global financial crisis.¹¹ Figure 1.15 shows that MNEs played a significant role in the increase in Ireland's export orientation; foreign-owned firms' exports of value added (sum of the green and cream bars) were equivalent to 23% of GDP in 2008 rising to 39% in 2015 while domestic firms' exports of value added varied between 24% and 27% over this time period.

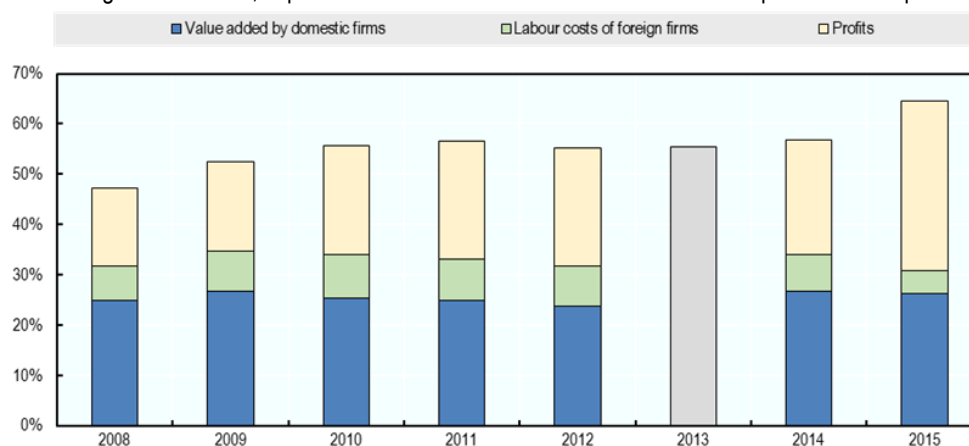
The exports of domestic value added varied across sectors between 2005 and 2015. In manufacturing, exports of value added more than doubled in chemicals and pharmaceuticals, more than tripled in other manufacturing (medical devices) but were flat in computer manufacturing. In information and communications, exports of value added more than quadrupled, with particularly strong growth in publishing and in IT and other information services. Exports of value added in finance and insurance increased slightly.

The exports of value added, for foreign owned firms, can be further broken down into labour compensation and gross operating surplus (or profits) to provide insights into the source of this increase in the value of exports.¹² In Ireland, profits grew more than labour compensation; the share of profits in value added

increased from 69% in 2008 to 88% in 2015. This value in 2015 is by far the highest among the OECD countries compiling AMNE/FATS statistics. Compared to other small advanced economies in the EU, in the Netherlands, the share of profits is 46%; in Denmark, it is 33%; and in Finland, it is 30%.

Figure 1.15. Exports of value added by ownership, 2008 to 2015

For foreign-owned firms, exported value added broken down into labour compensation and profits



Note: AMNE/FATS data are not available for 2013, therefore the breakdown of exports is not computed.

Source: OECD Trade in Value Added Database, OECD AMNE database for 2008 to 2012, and Eurostat FATS database for 2014-2015.

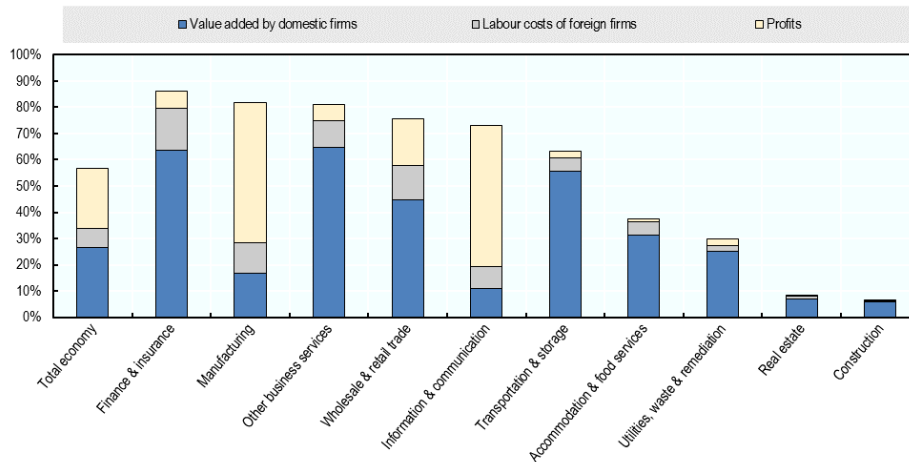
Unfortunately, most of the detail on profits by industry in the Irish FATS data are suppressed to protect the confidentiality of the respondents. However, IDA Ireland's Annual Business Survey of Economic Impact (ABSEI) can shed light on the pattern of profits at the companies they serve. These data show a pattern similar to that in Figure 1.15 for profits overall. Three industries—chemicals manufacturing, computer manufacturing, and information and communications – accounted for 80% of total profits in 2016. Profits in these industries dropped in 2008, recovered between 2009 and 2012, and fell again in 2013 and 2014, before picking up in 2015 and 2016. There were concerns that the profits of the pharmaceutical industry would fall as a result of several drug patents ending around 2011 and 2012 (Fitzgerald, 2014). With the loss of patent protection, the value of exports of these pharmaceuticals would likely fall even if the quantity of exports remained the same. The profits in chemicals in the ABSEI data do indeed show a peak in 2012; they fall from 2013 to 2015 before rising in 2016 but are still below the level in 2012. According to IDA data, 62 chemicals companies opened new operations in Ireland during the 2006 – 2016 period, primarily in the biologics space. By 2016, this cohort accounted for over 20% of the employment in its chemical's client base.

Figure 1.16 showed the overall importance to the economy of exports by sector, but it is also informative to look at the importance of exports to each sector of the economy by examining the share of value added in that sector that is exported (Figure 1.16). The first bar shows the value for the total economy and then sorts the sectors according to the share of their value added that is exported. Finance and insurance and manufacturing both have the highest shares of value added that is exported, followed closely by other business services, wholesale and retail trade, and information and communications.

To further explore the relationship between foreign-owned firms and export orientation, these major sectors are broken down between the value added of domestic and foreign-owned firms. For these sectors, foreign-owned firms play a dominant role in manufacturing and information and communications but a much smaller role in the other sectors. The foreign-owned share is further broken down between employee compensation and profits, and it shows that profits play a very large role in the exported domestic value added of foreign-owned firms in both manufacturing and information and communications.

Figure 1.16. Share of value added that is exported by sector, 2014

For foreign-owned firms, exported value added broken down into labour compensation and profits

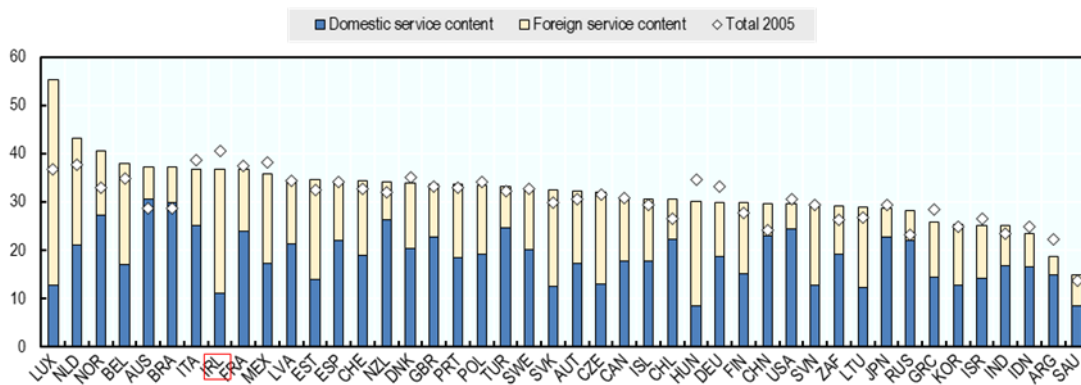


Source: OECD Trade in Value Added Database and Eurostat FATS Statistics Database.

Services imported by MNEs support Ireland’s manufacturing exports

One important takeaway from measuring trade in value added terms is the important role that services play in the exports of goods-producing industries. Because it is based on input-output tables, TiVA can identify purchased services that are used in the production and export of goods; this services content can be further broken down between imports and domestically produced services, highlighting the role that services play in GVCs. Figure 1.17 shows the services content embodied in manufacturing exports for OECD countries in 2005 (the diamond) and in 2015 (the bar). In 2015, Ireland had a relatively high services content in its exports, but this has fallen slightly from 2005. In Ireland, most of the services content is imported. The domestic services content was 30% of the total in 2015, and this too has fallen since 2005 when it was 39% of the total. These figures are supported with data from the ABSEI on the share of purchased services in Ireland by foreign-owned firms, which has fallen from 22% in 2005 to 11% in 2015. Again, it is important to note that while the TiVA data indicate a decline in the share of domestic services content embodied in exports from manufacturing over this period, overall the absolute value of the domestic content embodied in these exports increased.

Figure 1.17. Services content in exports from manufacturing, 2015



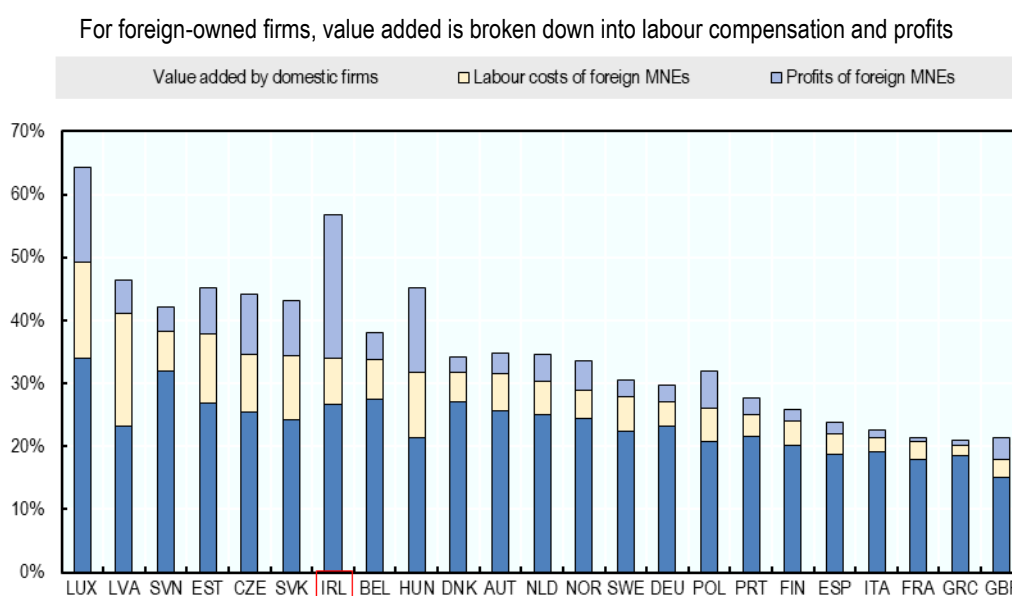
Source: OECD Trade in Value Added Database.

Accounting for the profits of MNEs in Ireland's exports

As noted above, the operations of foreign-owned firms play an important role in the Irish economy via exports and in integration into GVCs, but it is important to note that the income deriving from these operations does not fully remain in the domestic economy. This income accrues to the foreign investor and could be repatriated to the country where the investment originated. As a result, when foreign ownership is extensive in the economy, even trade measured in value added terms can overstate the impact of trade on the economy because foreign ownership of the means of production means that not all of the domestic value added may actually remain in the economy. Specifically, after paying corporation tax on profits, the remaining share of profits accruing to the foreign owners could be repatriated to home economies. Adjusting the measures of TiVA for these profits provides better measures of the impact of trade on the economy and moves towards a measure of trade related to GNI rather than GDP.

Figure 1.18 illustrates the importance of these flows for OECD countries by showing the value added in exports of domestically owned firms (dark blue bar) and the value added exports of foreign-owned firms broken down into labour compensation (yellow bar) and profits (light blue bar), which can be repatriated. The graph is sorted by the portion of exports of domestic value added that remain in the economy (exports by domestic firms and wages paid by foreign-owned firms). While Ireland ranked second highest by the share of domestic value added that is exported, it falls to seventh place when adjusting for the part of domestic value added that can be repatriated. While still high, this indicates that Ireland may not benefit as much from trade as the data initially indicated. This result is due not only to the very large role that foreign MNEs play in Ireland's economy and exports but also to the very high profits they earn in Ireland.

Figure 1.18. Exports by ownership and their contribution to income as a share of GDP, 2014



Source: OECD Trade in Value Added Database and OECD AMNE statistics.

The high profits that foreign investors earn in Ireland can be repatriated or reinvested in the affiliate. Indeed, reinvested earnings can be an important source of financing for sustaining and expanding the operations of affiliates. While it is not possible to link financing, such as reinvested earnings, to specific outcomes, it could be that the high profits earned in Ireland are supporting greater capital formation by foreign-owned enterprises. Therefore, it can be informative to examine the expenditures of foreign-owned firms on tangible capital and on intangible capital (in the form of R&D expenditures) to determine if these high profits

are associated with higher investment in capital. Such data are difficult to find, but the US Bureau of Economic Analysis publishes such data on the activities of US MNEs abroad; these data are particularly relevant for Ireland given that its FDI is dominated by US MNEs. It is possible to calculate an average capital intensity for 2009 to 2016, defined as the sum of capital expenditures and R&D expenditures over sales, for affiliates in Ireland and other countries. While it is true that a high share of FDI income is reinvested in Ireland by US firms, there is no evidence to support greater capital formation by US-owned affiliates in Ireland than US-owned affiliates elsewhere; the intensity of capital investment (sum of capital expenditures and R&D expenditures over sales) was 3.8% for affiliates in Ireland and 4.2% for all US-owned affiliates.

1.7. The US and the UK are the most important trade and investment partners

Statistics by partner country provide information on the trade and financial linkages and interdependencies between economies. It is important for policymaking to identify the most important partners. In addition, for relatively small economies like Ireland, macroeconomic developments and changes in policy in their major partners can have significant impacts on the foreign MNEs operating in their economies.

Traditional bilateral trade and FDI statistics are presented on an immediate country basis, but GVCs imply that trade statistics on an immediate partner country basis obscure the ultimate source and destination of a country's imports and exports, respectively. TiVA statistics address this by tracing a country's exports of value added to their ultimate destination and their imports of value added to their ultimate origin. For FDI, complex ownership structures of large MNEs can obscure the ultimate sources and destinations of FDI. FDI statisticians have begun to address this issue by presenting the statistics according to the ultimate investing country (UIC). In addition to identifying the ultimate source of the investment, the UIC presentation sheds light on the so-called 'round-tripping' phenomenon. Round-tripping occurs when funds that have been channelled abroad by resident investors are returned to the domestic economy in the form of FDI. Round-tripping will usually not provide many of the benefits normally associated with FDI, such as knowledge and technology transfers.

Bilateral trade is concentrated

Figure 1.19 shows Ireland's top export destinations on a gross and a value added basis (top panel), and Ireland's top sources for imports on a gross and a value added basis (bottom panel). Unlike for many countries, there are no large shifts in the top countries when moving to value added measures. The United States and the United Kingdom are the most important export market, at 35% of exports of value added, as well as the most important source of imports, at 50% of imports of value added.

Inward FDI is dominated by the United States and the United Kingdom

Bilateral FDI statistics on an immediate country basis indicate that the United States is the largest investor in Ireland but that it only accounts for 24% of the inward investment position (Figure 1.20). Overall, inward investment is highly diversified across a number of countries ('Other'), and the Netherlands and Luxembourg are significant investors, accounting for 13% and 12% of the inward position respectively. However, on a UIC basis, the United States dominates inward investment, accounting for 70% of the inward position (Figure 1.21). This indicates that US MNEs invest in Ireland through third countries, including the Netherlands, Luxembourg, and offshore financial centres, such as the Cayman Islands and Bermuda. Ireland is actually the second most important ultimate investor, with 12% of the position; according to the CSO, this round-tripping largely results from corporate inversions of formerly US corporations (CSO, 2018). Overall, inward investment is much less diversified than it appears on an immediate country basis.

Figure 1.19. Exports and imports: gross and value added terms, by partner country, 2014

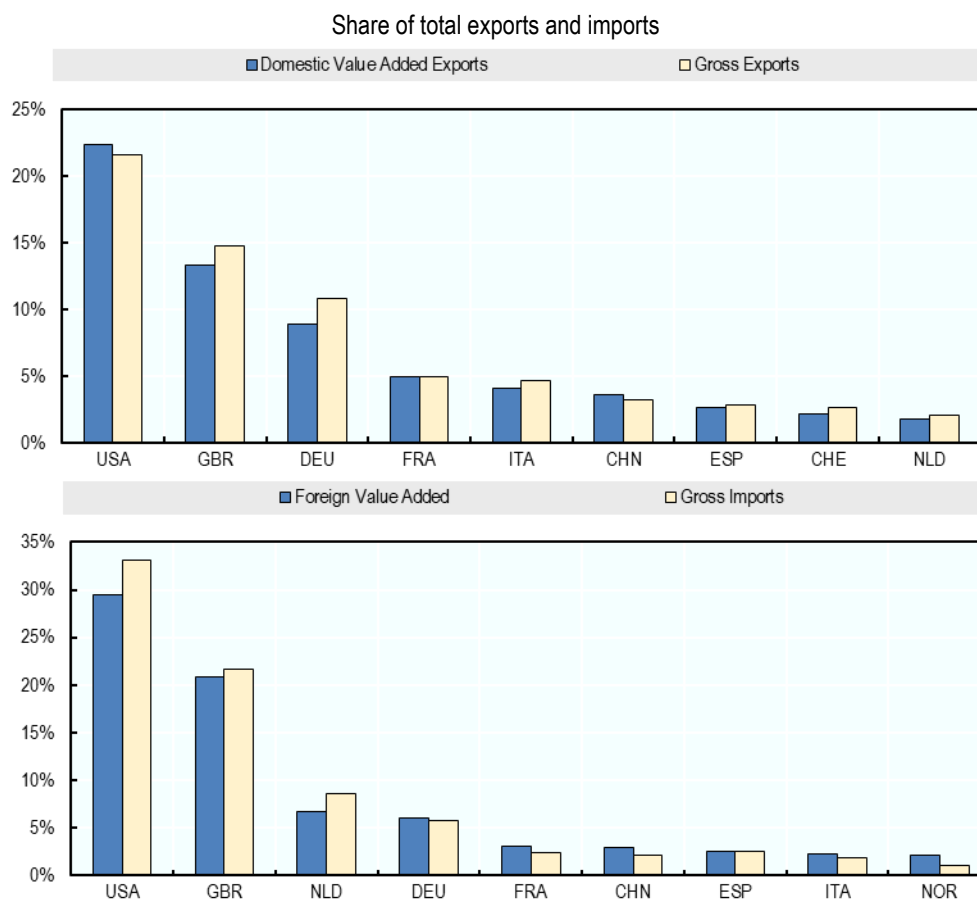
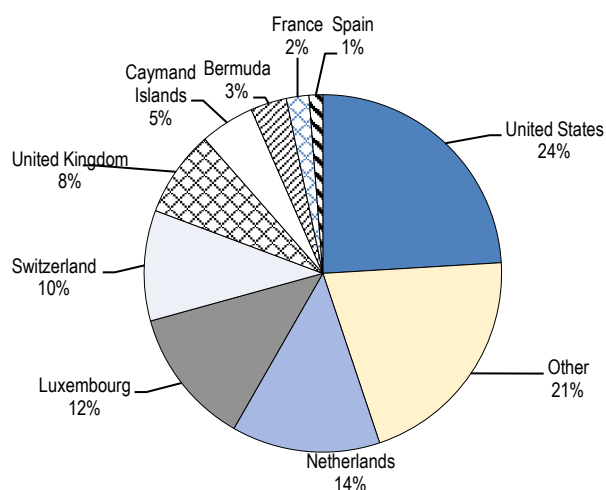
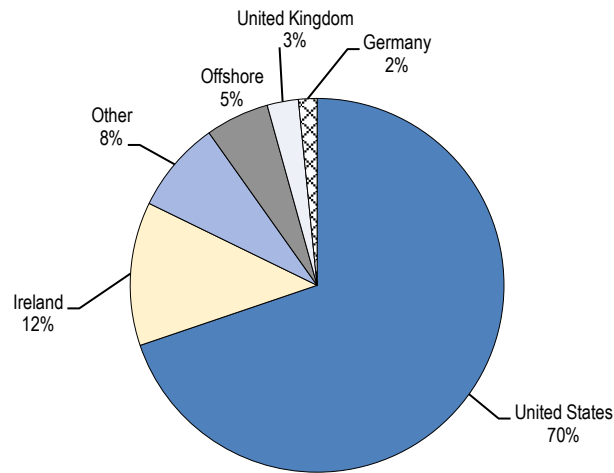


Figure 1.20. Inward FDI position by immediate investing country, 2017



Source: OECD FDI Statistics Database and Ireland Central Statistics Office

Figure 1.21. Inward FDI position by ultimate investing country, 2017

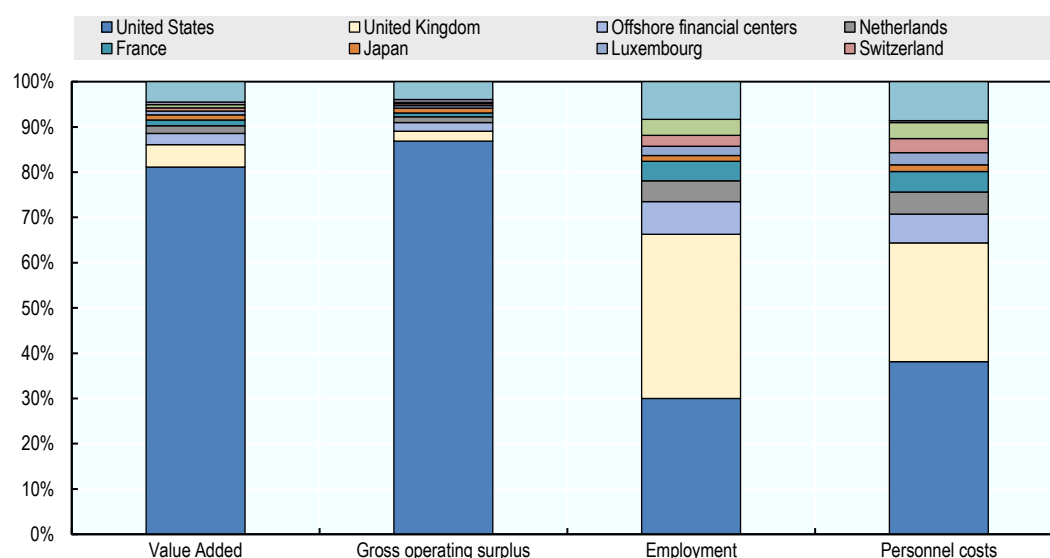


Source: OECD FDI Statistics Database.

AMNE/FATS statistics can shed further light on the sources of inward investment in Ireland. Figure 1.22 shows some of the key activity variables – value added, gross operating surplus (i.e., profits), employment, and employee compensation – by the country of the ultimate controlling investor of the enterprise. Investors from the United States are the most important investors in Ireland according to value added, gross operating surplus, and employee compensation but not by employment, for which investors from the United Kingdom account for the largest share. This indicates a few things about US MNEs' operations in Ireland. First, it is clear that US MNEs account for the highest share of profits in foreign-owned firms' value added. Second, US MNEs pay higher wages than other MNEs as they account for a much larger share of employee compensation than they do of employment. Finally, these US MNEs have higher levels of labour productivity measured as value added per employee than other MNEs given their much higher share of value added than of employment. Overall, employment at foreign-owned firms in Ireland is more diversified by country of investor than either the FDI statistics by UIC or other activity measures in AMNE/FATS statistics indicate. This is likely due to investments in the retail trade sector by investors from the United Kingdom, which tend to be labour-intensive. Nevertheless, the top two countries—the United States and the United Kingdom—account for two-thirds of employment.

An examination of IDA Ireland's employment survey did reveal some success in diversifying the countries that invest in Ireland. In particular, there were strong increases in employment at Chinese- and Indian-owned firms between 2006 and 2016, albeit from very low levels. For China, this increase was concentrated in information and communications and finance, while for India it was in information and communications and manufacturing. There were also signs of expansions and new investments from countries that have long had a presence in Ireland. Specifically, Japanese-owned firms (finance and manufacturing), French-owned firms (manufacturing and finance), and Italian-owned firms (finance and information and communications) all showed strong increases in employment. IDA Ireland included a focus on market diversification in its 2015-19 strategy, over the course of which employment by non-US companies grew 37%.

Figure 1.22. Value added, profits, employment, and employee compensation of foreign-owned firms by country of the ultimate investor, 2015



Note. Data for employment at Belgium-owned firms is unavailable for 2015.

Source: Eurostat FATS Database.

The United States benefits from its investments in Ireland

Given the important role that the United States plays as both a trading and investment partner, it is interesting to focus more on this relationship. In 2005, the United States accounted for 9% of the foreign value added in Ireland's final demand, and this share had grown to 12% by 2015. However, Irish demand only represented just over 1% of the United States' exports of value added in both years, which is not surprising given the relative sizes of the economies. Ireland also plays a role in channelling exports of US value added to other countries. In 2005, the United States accounted for 7% of the foreign value added in Ireland's gross exports; by 2016, this had grown to 9%.

The United States also benefits from the income that it receives from the operations it owns in Ireland. According to the US data, Ireland accounted for 11% of all US FDI income receipts in 2017, up from 6% in 2005.

The 2017 US tax reform provides an example of the impact that changes in policy in major investing partners can have on FDI in Ireland. The 2017 US Tax Cut and Jobs Acts (TCJA) contained several provisions having both immediate and likely long term impacts on direct investment. One key provision of the TCJA was the one-time tax on undistributed foreign earnings levied in the fourth quarter of 2017, which meant that US parent companies could repatriate the cash they were holding overseas in their foreign affiliates, without additional taxes, beginning in 2018. As a result, US MNEs repatriated large amounts of accumulated profits from their foreign affiliates in 2018, paying USD 665 billion of dividends.

However, the impact of these repatriations of past earnings on the foreign operations of US MNEs is likely to be minimal in the short term because they involve the sale or disposal of financial, as opposed to real, assets. Previously, there was a temporary lowering of tax rates on the repatriation of earnings from foreign affiliates under the 2004 American Jobs Creation Act. As a result, US MNEs repatriated more than USD 3.2 billion from their affiliates in Ireland, but with no discernible impact on the real operations of these affiliates as they continued to grow in terms of employment and value added.

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Annex 1.A. Methodology and data

Chapter 1 provides a macro-level analysis combining a number of data sources including IDA ABSEI, CSO Ireland, Eurostat FATS, OECD TiVA, OECD FDI Statistics, OECD AMNE statistics, US Bureau of Economic Analysis, and OECD National Accounts. Specifically, the estimations employ the following variables from each source:

- Exports, sales, value added, Irish- and non Irish- sourced materials, Irish- and non Irish- sourced services by sector, from ABSEI;
- Inward investment positions by Ultimate Investing Country, from several statistical releases¹³ from the CSO;
- Value added and Gross Operating Surplus from FATS (Eurostat)¹⁴;
- Share of domestic value added embodied in foreign final demand (Indicator 'VALU FFDDVA') and gross exports (EXGR) from the OECD TiVA 2018 release;
- FDI Income payments and receipts by partner country and FDI positions by partner country, from OECD FDI Statistics;
- Value Added by industry of the affiliate in Ireland, from US BEA AMNE statistics; and
- Gross value added and income by industry breakdowns, from OECD national accounts.

Some of the data required conversions using OECD annual period-average exchange rates. This annex describes the different calculations required for the estimates and charts presented throughout the report. All statistics were as of June 2019 unless otherwise indicated.

Exports by ownership and industry

Chapter 1 decomposes exports in value added terms into elements that 'stick' in the Irish economy and elements that could be repatriated to the parent countries of foreign parents. In particular, wages paid by foreign MNEs in Ireland stay in the Irish economy, as does the value added in exports by domestic firms. On the other hand, profits from exports by MNEs could be repatriated to the home country if they are not reinvested. This decomposition requires a number of estimation steps, as discussed in the following sections.

Exports by ownership in value added terms

The methodology to estimate exports by foreign-owned and domestic firms in terms of value added. It refers to data for the year 2014, the latest year with full data availability. The amount of foreign value added *in* the Irish economy is assumed to apply also to exports of value added *from* the Irish economy. In this sense, this method is an underestimation because foreign-owned firms are known to be more export intensive than domestic firms.

These lower bound estimates are computed using inward FATS statistics for MNEs operating in Ireland, by industry. Specifically, the method uses the ratio of value added controlled by 'World total except for the reporting country' to 'All countries of the world'. The estimates range from 10% in construction to 80% in manufacturing. Then, this percentage is multiplied by the corresponding TiVA industry share of domestic value added embodied in foreign final demand, to obtain a split of the value added by foreign and domestic firms embodied in foreign demand.

These estimates, referred to as 'value added by foreign firms embodied in foreign demand', range from 1% in construction to 65% in manufacturing. The domestic counterpart – the part of value added in exports that remains in the Irish economy – is obtained by subtraction. As FATS do not include data for the financial sector, the estimate for this industry is imputed from other sources, namely CSO positions by Ultimate Investing Country, US BEA data, and National Accounts.

The CSO data on inward FDI positions is used to calculate the proportion of stock that is controlled by the United States as Ultimate Investing Country. Then, this percentage (~70% for 2015) is combined with the BEA value added estimates for majority owned US affiliates operating in Ireland in the finance sector. This is done to rescale the level of value added to obtain total value added by foreign-owned firms in the finance sector. This number amounts to 26% of financial sector value added in the Irish national accounts data for 2015. Therefore, it is assumed that 26% of value added exports in the financial sector are by foreign-owned firms. It should be remarked that for finance, an alternative approach was also tested, using IDA data for value added. However, this estimate represented only 10% of national accounts financial value added and was considered too low.

Profits

The first step is to take the ratio of FATS (foreign firms) gross operating surplus to FATS (foreign firms) value added by industry in Ireland. The results range from 22% for accommodation and food service activities to 86% for IC. Then, this percentage is multiplied by the percentage estimate of value added by foreign firms embodied in foreign demand by industry (described earlier). The resulting estimate represents how much profit MNEs derive from their exporting activities in each sector. These shares range from 6% in construction to 54% in IC.

Labour costs

Wages paid by foreign firms make up a component that sticks in the Irish economy. Labour costs by foreign firms (embedded in exports, in value added terms) are calculated residually by subtracting profits from value added by foreign firms embodied in foreign final demand.

Statistics and definitions

Several different sets of macroeconomic statistics are used in this chapter to understand the role that MNEs play in the Irish economy.

Gross domestic product (GDP) is the market value of all the final goods and services produced in a country in a given time period, typically a quarter or a year. GDP by industry are classified according to Statistical Classification of Economic Activities in the European Community (NACE) Rev.2.

Gross national income (GNI) is GDP less income payments to the rest of the world plus income receipts from the rest of the world. It used to be called gross national product (GNP) and represents the total domestic and foreign output claimed by residents on a country.

Foreign direct investment (FDI) is defined as the establishment of a lasting interest in and significant degree of influence over the operations of an enterprise in one economy by an investor in another economy. FDI statistics consist of financial flows, income, and positions. FDI financial flows capture debt and equity investments between related parties in a specific period. Income represents the return on equity and debt investment to the direct investor in a specific period. Positions are the value of the accumulated direct investment at a specific point in time—it is also referred to as the stock of FDI. The most recent aggregate statistics are available through 2018 while the most recent detail by partner country and by industry is for 2017. The industry classification is based on International Standard Industry Classification (ISIC) Rev. 4.

AMNE/FATS statistics cover the operations of majority-owned foreign affiliates, including turnover, value added, employment, employee compensation, and gross operating surplus. Inward data cover the operations of foreign-controlled firms in the reporting economy, and outward data cover foreign firms controlled by residents of the reporting economy. These statistics are not available for all members of the OECD, and the most recent data are only available for EU countries. The most recent year available is 2015 as the 2016 inward FATS data published by the CSO only covered the 50 largest MNEs operating in Ireland. Due to significant suppressions to the industry detail to protect the confidentiality of respondents, 2014 is often the latest year for which industry detail is available. The statistics are classified by industry according to NACE Rev. 2.

Gross trade statistics from the Balance of Payments are defined as change in ownership of material resources and services between one economy and another. Data are available through the end of 2018 and are classified by product.

Trade in Value Added (TiVA) measures the value added by each country in the production of goods and services that are consumed worldwide. TiVA indicators are designed to better inform policy makers by providing new insights into the commercial relations between nations. Two key TiVA indicators discussed in this report measure the export orientation of an economy and its participation in GVCs. Export orientation is the share of a country's GDP that is exported. GVC participation is measured as the foreign value added embodied in a country's exports (that is, its backward linkages) plus its value added embodied in partners' exports and final demand (that is forward linkages). A full set of TiVA indicators is available from 2005 to 2015; a few indicators are available for 2016. The industry classification is based on ISIC Rev. 4.

Differences in classifications, coverage, and definitions can make it difficult to use these sets of statistics together, so assumptions have been made. This chapter uses conservative assumptions and looks for multiple pieces of evidence to support the conclusions.

Notes

¹ This uses a suite of official statistics, including GDP, trade, and FDI statistics, as well as statistics that have been developed to better understand the impact of MNEs on economies, including Activities of Multinational Enterprises/Foreign Affiliate Statistics (AMNE/FATS) and trade in value added (TiVA) statistics (see Annex 1.A for a description of the statistics). It also uses data that IDA Ireland collects from the firms that it serves.

² Domestic MNEs are MNEs headquartered in the domestic economy and domestic plants of these groups. Domestic non-MNEs are domestic firms that do not fall in this category. As in Ireland, SMEs account for the bulk of domestic companies, and, so, non-MNEs include mostly SMEs.

³ The comparison of FDI stocks to GDP is a useful lens to gauge the importance of FDI to an economy. The measure excludes FDI into special purpose entities (SPEs). SPEs are entities with little physical presence in their host economy but that play an important role in the financing structures of MNEs. Excluding SPEs provides a better measure of the FDI into an economy that is having a real impact on that economy.

⁴ FDI income receipts are the earnings and net interest direct investors in the reporting economy receive from their foreign direct investment enterprises; FDI income payments are the earnings and net interest direct investment enterprises in the reporting economy pay their foreign investors.

⁵ Authors' calculations using the latest inward FATS data for Ireland from Eurostat. Figures exclude the agriculture and finance sectors as these are not covered by AMNE/FATS statistics.

⁶ By definition, the balance on trade measured in value added terms is equal to the balance on trade measured in gross terms.

⁷ In standard trade statistics, the margins wholesalers and retailers earn on exports are included indistinguishably in the value of goods exported. However, because TiVA relies on input output tables, it identifies these margins in the value of exports and attributes these margins to the wholesale and retail trade industries. As a result, the value of services exports in TiVA is higher than in traditional trade statistics while the value of goods exports is lower as these margins are recognised as distributive services. It also highlights the role that wholesalers and retailers play in the exporting of goods.

⁸ The decline in 2015 for Ireland reflects the impact of contract manufacturing (see Box 2.1)

⁹ Part of foreign affiliates' value added is used to pay salaries of their (mostly local) employees and therefore 'stays' in the domestic economy. The remaining part, including earnings, may or may not leave the host economy.

¹⁰ Buyer-driven GVCs are those in which the lead firm is either a large retailer or a branded merchandiser that has outsourced the production process and captures value in the distribution stage.

¹¹ The method for breaking down trade in value added into the parts accounted for by foreign-owned firms and that by domestic firms is explained in Annex 1.A

¹² Value added can be measured from the production side as output less purchased inputs or from the cost side as the sum of labour compensation, depreciation costs, and profits. The latter two elements, called gross operating surplus, represent the income from capital; for ease of understanding, this is referred to as profits in the text.

¹³ See for example: <https://www.cso.ie/en/releasesandpublications/er/fdi/foreigndirectinvestmentannual2016/>

¹⁴ OECD AMNE also include statistics for Ireland, however, Eurostat reports the most recent data.

2. The role of FDI for productivity and labour market outcomes

This chapter examines the role of FDI on productivity, R&D expenditures and labour market outcomes such as employment growth and wages in Ireland. It first clarifies the distribution of FDI across sectors, also mentioning how FDI concentrates geographically within Ireland. The chapter then compares economic outcomes in FDI-intensive sectors with those in sectors exposed to less foreign firm activity. It shows that sectors dominated by foreign firms have higher productivity, R&D expenditures and employment growth and pay better wages. The chapter also examines how FDI-intensive sectors have contributed to the economic recovery from the financial crisis – in terms of value added, innovation capacity and employment.

2.1. Summary

Foreign MNEs are highly concentrated in just a few sectors in Ireland, regardless of the data used to conduct the analysis (FATS, official FDI data, IDA's Annual Business Survey of Economic Impact). According to IDA's Annual Business Survey, for example, almost 80% of total value added by foreign firms is concentrated in only three sectors: information and communications (IC) services, chemicals and electronics. Firms in these sectors strongly rely on agglomeration and urban centres, resulting in a high concentration of foreign firm activity in Dublin which attracts 40% of foreign firm value added in Ireland. Although the 60% of foreign firm value added outside of Dublin is also notable considering the lack of major urban centres of scale in the country other than the capital city.

Sectors dominated by foreign firms in Ireland are also those that involve higher value added activities and engage more in R&D activities relative to those sectors with less FDI. Similarly, FDI is concentrated in sectors with higher employment growth and wages, where the latter also reflects higher skill intensity in generally more sophisticated sectors such as information and communications and manufacturing activities, as physical production has shifted abroad, leaving foreign affiliates in Ireland to manage supply chains. FDI, thus, plays an important role for Ireland's economic sophistication and productivity.

Foreign affiliates also provided important support to the economic recovery from the financial crisis, especially in the information and communications sector, as production and employment in this sector grew throughout the recession. FDI also helped shift the economy to higher value added and higher paying services, not only in the information and communications sector, but also in services related to contract manufacturing and in finance and insurance. Together, these three FDI-intensive sectors accounted for 52% of Irish GDP in 2006, up from 39% in 2006. This shift to services boosted economic growth and labour productivity.

2.2. FDI is highly concentrated in terms of sectors and geography

Before explaining how FDI relates to outcomes such as productivity, innovation, jobs and wages, it is important to clarify the distribution of FDI across sectors and geography in Ireland. The analysis using Eurostat's FATS, official FDI data and IDA's Annual Business Survey shows that FDI is concentrated in just a few sectors, and Dublin and the rest of South and East, where the majority of the workforce is located, host the majority of foreign affiliates in Ireland.

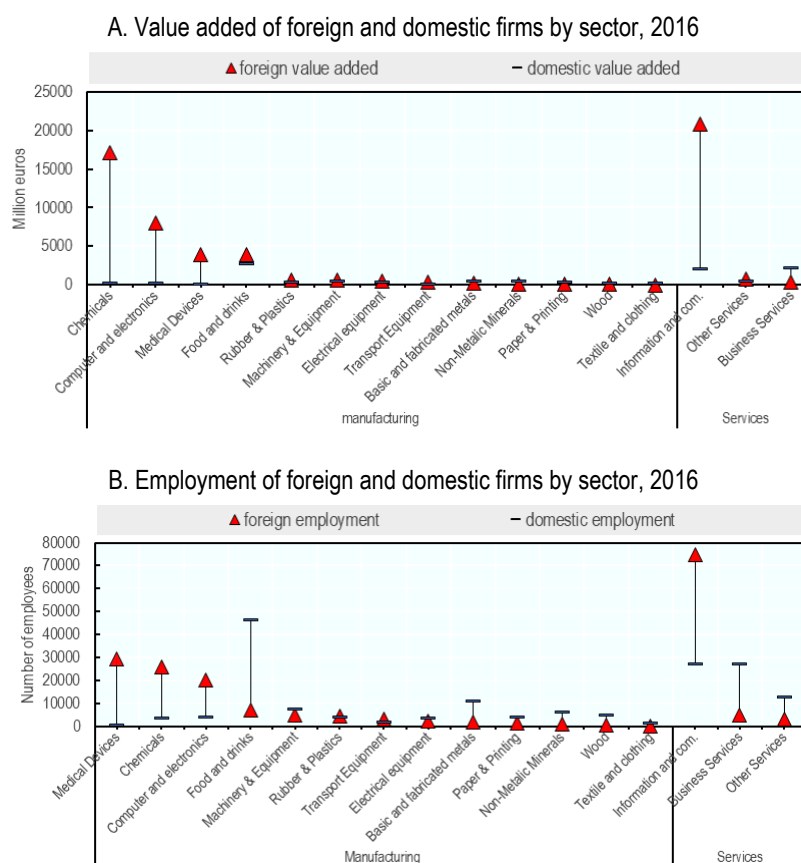
According to the FATS data, foreign MNEs in manufacturing, information and communications, and wholesale and retail trade account for 90% of value added, 95% of profits, and 66% of employment of foreign-owned firms in Ireland. In 2016, the CSO published inward FATS data for the 50 largest MNEs, allowing a comparison with the aggregate data for 2015 to get an idea of how much of FDI activity is concentrated in these 50 largest MNEs. The 2016 value added for these 50 largest MNEs was equal to 77% of the value added of all foreign MNEs in 2015, and their profits were equal to 80% of the profits of all MNEs. Employment appears to be somewhat less concentrated in these largest firms as their 2016 employment was only equal to 50% of the 2015 employment of all MNEs. Thus, the labour productivity of these large MNEs is higher than the rest of the MNEs, and they include those foreign MNEs operating at the global productivity frontier as discussed in Chapter 3.

FDI data are somewhat more diversified by industry. For 2017, the manufacturing sector accounted for 37% of the total inward position, with chemicals the largest manufacturing industry. Manufacturing was closely followed by the finance and insurance sector, accounting for 30% of the position. The next largest industries were professional, scientific, and technical services (13%); administrative and support services (8%); wholesale and retail trade (6%); and the information and communications sector (5%).

Data collected by IDA in its Annual Business Survey also reveal considerable concentration of foreign firms' activity in a few sectors. Almost 80% of total value added by foreign firms is in only three sectors: information and communications services, chemicals and electronics (Figure 2.1, Panel A).¹ The sectoral concentration of employment in foreign firms is somewhat less pronounced but remains considerable: 75% of all employees in foreign affiliates in manufacturing work in the production of medical devices, chemicals, and computer equipment and electronics (Figure 2.1, Panel B). In services, 90% of employment in foreign firms is in information and communication, although employment in the finance and insurance sector is not taken into account in this estimate.

The distribution of foreign firm activity across sectors in Ireland is not symmetric with that of domestic firms. For example, in manufacturing, the bulk of domestic firms' value added is generated in the food and drinks sector (Figure 2.1, Panel A). Employment generated by domestic firms is much more diversified across sectors in manufacturing and services. Business services, for example, employ as many workers as information and communication. The sectoral assessment also confirms the importance of the FDI sector for overall value added and employment in Ireland. Total value added of foreign firms in almost all sectors is higher than the total of all domestic firms (except in business services). This also holds for employment with the exception of food and drinks, business and other services as well as some smaller manufacturing sectors.

Figure 2.1. About 80% of foreign value added is concentrated in three sectors



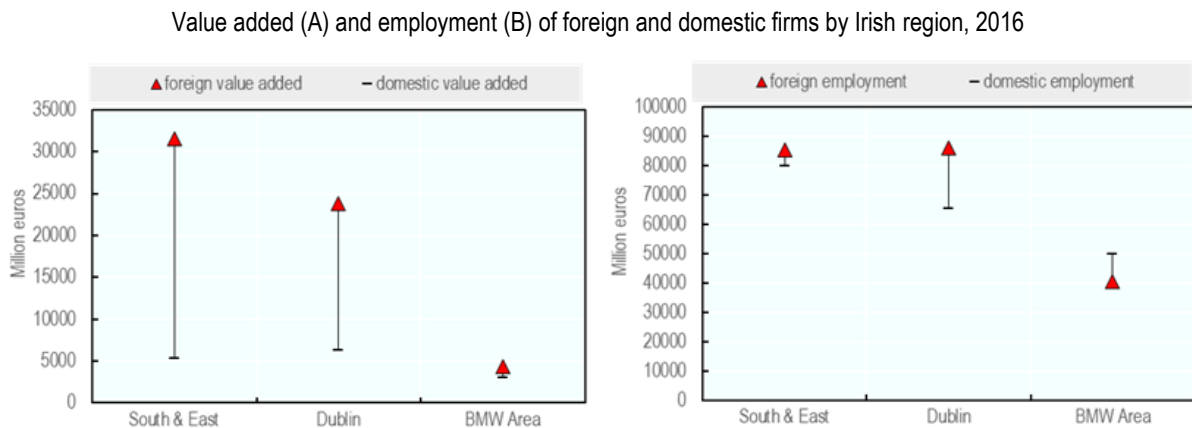
Note: Financial Services, Energy, Recycling and Waste, Construction, Agriculture, Mining and Education sectors are not covered in this analysis.
Source: OECD elaboration based on IDA's Annual Business Survey.

With respect to geographic distribution, strong agglomeration of foreign firm activity in Dublin is observed. IDA's Annual Business Survey data indicate that Dublin attracts a significant share of 40% of foreign firm

value added in Ireland. The remaining 60% is concentrated in the rest of the South and East region (53%) and only 7% is generated in the Border, Midland and Western (BMW) area (Figure 2.2, Panel A). A similar, although less pronounced, pattern holds for employment (Figure 2.2, Panel B). Dublin and the rest of South and East employ 40% of all workers in foreign businesses, respectively, while 20% of foreign firms' employment is in the BMW Area. The high concentration of FDI in Dublin is not surprising as main cities tend to possess a number of attractive factors such as good infrastructure and accessibility, a higher concentration of highly educated workers, good penetration of information and communication technologies and a larger pool of potential suppliers.

Comparing regional disparities in terms of value added and employment of the domestic sector shows that, on the one hand, value added is more evenly distributed across regions, while, on the other, employment is still dominated by Dublin and the rest of South and East. It also stands out that total value added of domestic firms across regions is much lower (except in BMW) but employment levels are closer to those of foreign firms. This points to significant capacity gaps of domestic firms, which will be further studied in Chapter 4.

Figure 2.2. FDI is highly concentrated in Dublin



Source: OECD elaboration based on IDA's Annual Business Survey.

2.3. FDI goes to high-value added, innovative and well paid activities

As shown above, FDI contributes considerably to economic activity in Ireland. Outcomes, such as productivity, innovation and wages are likely to vary across sectors depending on the level of sophistication and skill-intensity of these sectors. FDI, therefore, considerably affects economy-wide, aggregate outcomes by influencing Ireland's economic structure. Additionally, activities of foreign firms may influence industry-level outcomes directly (see this section and Chapter 3) or indirectly via spillovers on domestic firms (see Chapter 4).

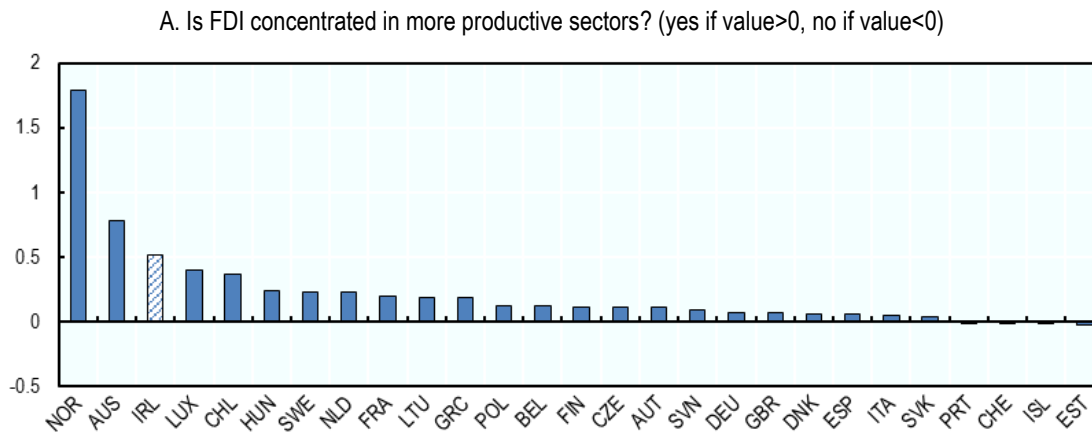
This section studies productivity, innovation capacity, employment growth and the quality of jobs (measured by wages) in sectors that receive relatively more FDI compared to those that receive less FDI in Ireland and compares these indicators with other countries. The indicators do not disentangle whether FDI affects sectoral composition or industry-level outcomes, but it provides useful insights into whether FDI goes to sectors with higher or lower outcomes and thus helps to identify potential policy priorities. The indicators build on the OECD's FDI Qualities Indicators and use Financial Times' fDi Markets data for the sectoral distribution of FDI in Ireland and other countries (OECD, 2019).²

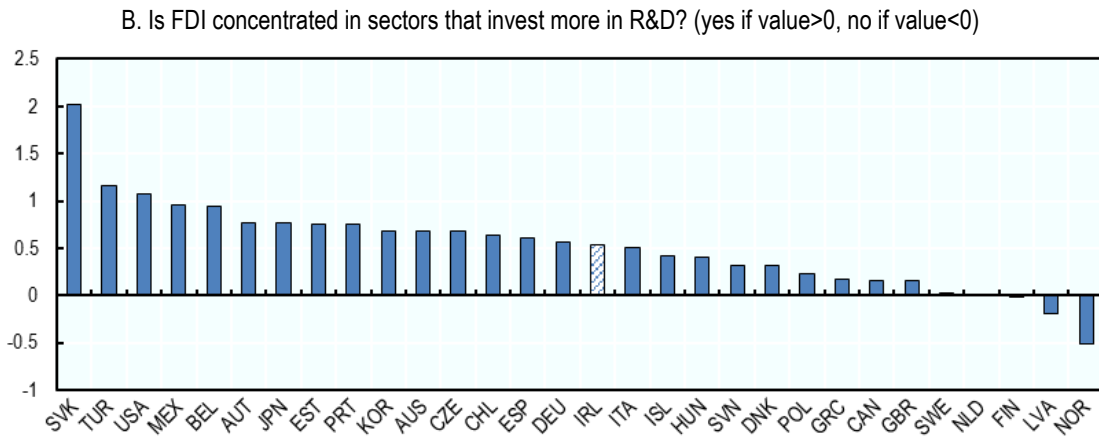
FDI is concentrated in sectors that are relatively more productive and invest more in R&D activities

In Ireland, as in the rest of the OECD, FDI is observed more in sectors where workers, on average, are relatively more productive, that is, they produce more value added than in other sectors (Figure 2.3, Panel A). In Ireland, a large share of FDI is concentrated in information and communication services, chemicals, electronics, food and medical devices. Workers in these sectors generated more value added relative to other sectors, which explains the positive association between FDI and productivity for Ireland.

A similar indicator combines industry-level FDI and expenditures on R&D per unit of value added, and examines whether sectors that receive larger FDI shares exhibit higher or lower R&D intensity. FDI is concentrated in sectors that invest more in R&D in Ireland (Figure 2.3, Panel B). FDI is associated with industries that have relatively higher R&D intensity in almost all OECD countries. In the United States, where the relationship is one of the most pronounced, high-tech and R&D-intensive manufacturing sectors (including computer equipment and electronics, chemicals, transport equipment, recycling and machinery), logistics and communications account for more than 50% of FDI. In each of these sectors, R&D intensity levels are at least twice as high in the US as the OECD average. In other countries, the distribution of FDI is less skewed towards R&D-intensive sectors (e.g. Netherlands, Sweden, and Finland). Norway and Latvia are the only exceptions in which the relationship between FDI and R&D-intensity is negative. In the case of Norway, this is a result of the exceptionally high share of FDI stocks in mining (almost 60%), one of the least R&D-intensive sectors (particularly when measured relative to value added generated by the sector). Taking out mining would reveal a different picture as Norway attracts significant FDI in logistics and information and communications, which are relatively R&D-intensive.

Figure 2.3. In Ireland, FDI is concentrated in sectors that are more productive and R&D-intensive





Note: See Annex 2.A for a description of the methodology and data. Labour productivity: value added per employee; R&D intensity: R&D expenditures per unity of value added.

Source: OECD based on Financial Times' fDi Markets database, OECD National Accounts and OECD MSTI database.

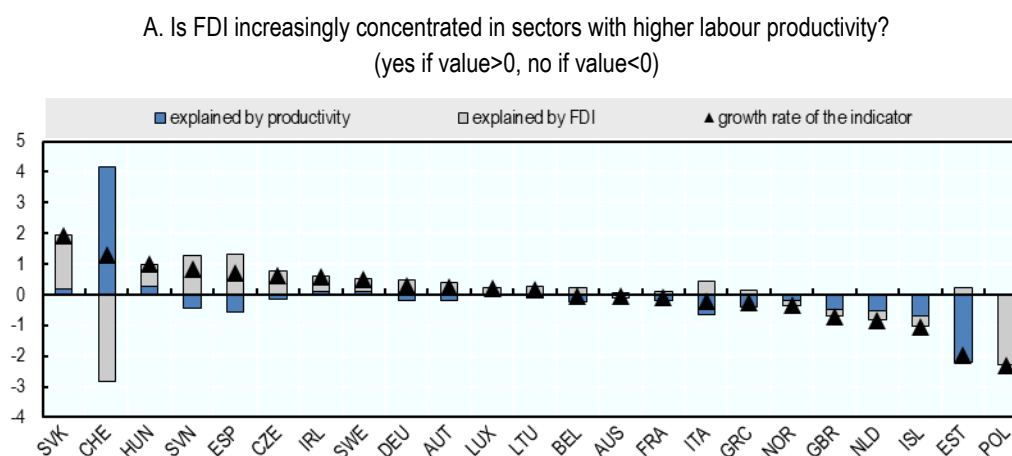
FDI has contributed to productivity growth over recent years

The above analysis relates the composition of FDI to productivity (and innovation). A positive indicator reflects FDI in more productive and innovative sectors (e.g. chemicals, finance, information and communications), and negative values indicate FDI in lower-value added sectors (e.g. food, healthcare, hospitality services). Introducing a time dimension and decomposing the evolution of the indicator into its various components sheds further light onto whether observed changes are explained by changes in sectoral productivity in FDI-intensive sectors or by changes in the structure of FDI.

The decomposition underlines that, in some OECD countries, changes in the sectoral structure of FDI explain an important part of changes in the association of FDI to productivity (Figure 2.4). For example, in Slovakia, Slovenia and Spain, a shift in the FDI composition to sectors with higher productivity over 2011-16 was responsible for a positive shift in overall productivity in these countries (see positive values of grey bars). In Ireland, FDI is concentrated in relatively more productive sectors and this FDI composition has not changed over recent years. Accordingly, the positive productivity contribution of FDI due to its concentration in high-valued added sectors remained broadly constant over 2011-16 and thus supported post-crisis economic recovery.

The indicator also shows the extent to which the relationship has changed over time as a result of productivity dynamics within sectors that have received the bulk of FDI (Figure 2.4, blue bars). For example, over 2011-16, Switzerland has benefited particularly from enhanced productivity within FDI dominated sectors (positive value of blue bar) while FDI has become less concentrated in the most productive economic sectors (negative value of grey bar). On the other hand, the UK, Netherlands, Iceland and Estonia have seen a decline in the positive FDI-productivity relationship, which is explained almost exclusively by negative productivity growth in FDI-intensive sectors. According to this indicator, productivity growth in Ireland has not been skewed to FDI-intensive sectors relative to sectors that received less FDI over 2011-16. However, sectoral productivity growth in FDI sectors still has a disproportionate effect on aggregate productivity growth due to their bigger weight in the economy (see extensive analysis of productivity dynamics of foreign MNEs in Chapter 3).

Figure 2.4. Productivity contribution of FDI remained broadly constant over time



Note: This figure measures the growth rate of the indicator in Figure 2.3, Panel A, over 2011-16 (years vary slightly by country). See Annex 2.A for a description of the methodology and data.

Source: OECD based on Financial Times' fDi Markets database and OECD National Accounts.

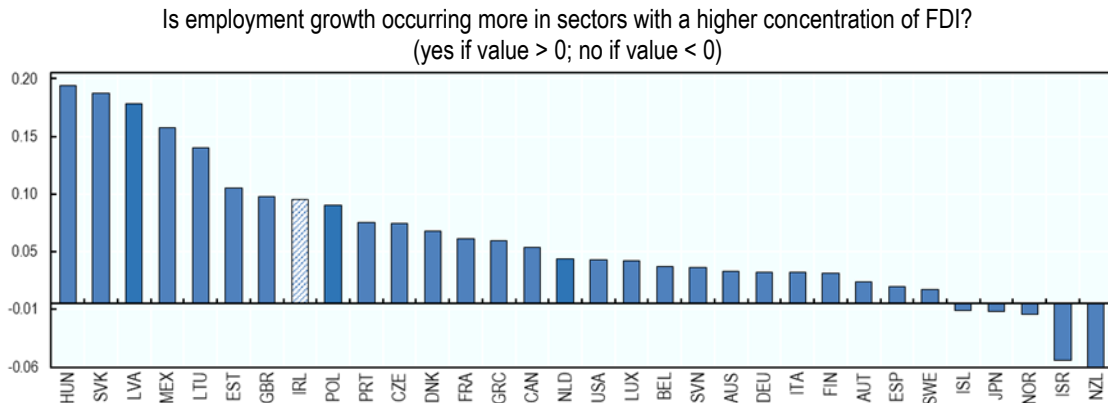
FDI is concentrated in sectors with higher employment growth and wages

FDI can have widespread effects on both home and host country labour markets. The establishment or relocation of a foreign investment and a change in the nationality of a firm's ownership cause changes in the demand for labour, thereby affecting employment, wages and the labour force composition (e.g. the gender balance or skill intensity). FDI can also have effects on wider labour market outcomes, such as on non-wage working conditions, including, but not limited to, job security due to the use of non-regular employment (e.g. incidence of temporary jobs), occupational health and safety at work, human and core labour rights. This sub-section examines two aspects of labour market outcomes and their relationship with FDI: employment growth and wages.

FDI can affect employment growth or contraction through changes in labour demand. FDI affects a host country's employment growth rate by increasing or decreasing the demand for labour. The direction and magnitude of the relationship depend on the type of foreign investment. Greenfield FDI projects have a positive *direct* effect on the demand for labour, leading to new jobs creation, while a foreign takeover of a domestic firm (M&A) could either have a positive or negative *direct* effect. The employment impact of FDI may also vary across different industries. One reason is that greenfield FDI tends to be overrepresented in manufacturing, relative to M&As (Davies et al., 2015). Irrespective of the entry mode, FDI may increase the relative demand for skilled labour due to foreign firms' higher productivity and technology advantages. Whether there will be net employment growth will also depend on the effects of FDI on domestic firms in the same labour market. For instance, foreign firms could introduce labour-saving techniques that are then adopted by domestic firms (imitation effects), leading to a transitory decline in labour demand, at least of low-skilled workers.

In almost all OECD countries, sectors with higher concentration of greenfield FDI in 2009, relative to the overall economy, witnessed stronger employment growth over time (Figure 2.5). This is particularly the case for Lithuania, Hungary and Slovakia. Only Iceland, Israel, Japan, New Zealand and Norway report a negative association. In these countries, FDI may have been concentrated in more capital-intensive sectors (e.g. utilities, finance, etc.), potentially limiting the expected impact of FDI on labour demand. In Ireland, FDI is also concentrated in sectors with relatively higher employment growth. The positive association is explained by stronger employment growth in FDI-intensive sectors such as business services, medical devices, and to some extent by the food sector.

Figure 2.5. In Ireland FDI is channelled to sectors with higher employment growth between 2009 and 2016



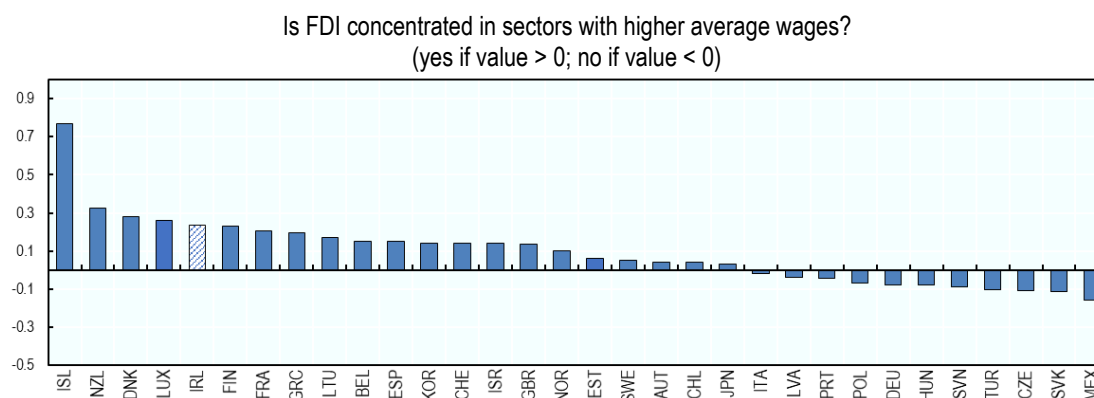
Note: See Annex 2.A for a description of the methodology and data.

Source: OECD based on Financial Times' fDi Markets database, OECD National Accounts and ILO.

FDI can affect wages and their distribution across firms and workers. In a competitive labour market, there is no reason why comparable foreign and domestic firms should pay different wages to their workers. In such a context, average wage differences between the two groups arise because of other firm- and industry-specific features (Hijzen et al., 2013). These include firms' size, productivity level, workforce skill intensity, product market power, and working conditions, such as job insecurity. Foreign firms may still pay higher wages to workers with similar skills and tasks, for example, to reduce turnover and lower the risk of technology transfer to competing firms through labour mobility (see Chapter 4). Beyond these direct effects, FDI may affect domestic firms' wages by raising the cost of labour or because of technology spillovers. Such effects may also occur in upstream or downstream firms having supply chain relationships with foreign affiliates. Spillovers can take the form of skill-biased technological transfer, thus increasing skilled wages while potentially reducing the ability of domestic firms to hire or retain skilled workers. As a result, FDI can lead to wage dispersions between foreign and domestic firms and raise overall wage inequality.

FDI is concentrated in sectors with higher average wages in the majority of OECD countries (Figure 2.6). The level of servicification of the economy appears to be a crucial determinant of the sign and magnitude of the relationship: countries with dominant and highly developed services, including as inputs into manufacturing sectors, also concentrate FDI in higher-wage services activities. This holds for Ireland as well as for Iceland, New Zealand, Denmark, and Luxembourg. OECD countries with strong industrial bases such as Germany, Turkey and Czech Republic host more FDI in sectors with lower average wages, but also with weaker skill-intensity (OECD, 2019). Thus, the inclusion of services is what explains such difference.

Figure 2.6. FDI is concentrated in higher paid sectors, mostly services



Note: See Annex 2.A for a description of the methodology and data.

Source: OECD based on Financial Times' fDi Markets database, OECD National Accounts and ILO.

2.4. FDI-intensive sectors contributed to the economic recovery from the financial crisis

This section goes one step further and shows that foreign MNEs directly provided support to the Irish economy during the financial crisis and helped with the recovery. FDI also helped with the transition to a greater role for services in the economy. This section examines the role that the FDI-intensive sectors (manufacturing, information and communications, and finance and insurance) played in the growth in value added, employment, and R&D following the financial crisis.

Irish GDP fell in 2008 and 2009 but recovered rather quickly, surpassing the 2007 level in 2011. The largest percentage declines in real value added were in the construction and real estate activities sectors, but there were also declines in most other sectors. One exception was the information and communications sector, which is FDI-intensive, where real value added continued to grow even during the crisis. Information and communications, along with the other two sectors where foreign MNEs play a substantial role, manufacturing and finance, helped move the economy to more high value added services following the crisis. Real value added in the finance and insurance sector exceeded the 2007 level by 2010 and, while growth has fluctuated since then, real value added in 2016 was about 60% higher than in 2007. While real value added in manufacturing struggled to recover following the financial crisis, a significant increase in contract manufacturing in 2015 finally pushed real value added above the 2007 level (Box 2.1). This increase was due to Irish companies arranging for the production of products overseas rather than the provision of manufacturing services in Ireland, and, thus, represents a move to services even in the manufacturing sector. By 2016, these three sectors (manufacturing, information and communications, and finance) together accounted for 52% of value added, up from 39% in 2006.

Employment in Ireland was also heavily affected by the financial crisis and took longer to recover than did value added.³ Total employment in Ireland did not surpass the total in 2008 until 2017. According to the Irish FATS data, the number of persons employed at foreign-owned firms in Ireland increased from around 269 000 in 2008 to around 313 000 in 2014, thereby contributing to the recovery in employment at the aggregate level.

Data on Business Expenditures on R&D (BERD) by ownership and separately by sector are available from 2009 to 2017 for odd-numbered years. Between 2009 and 2011, BERD were flat but have increased consistently since 2013. By 2017, total R&D expenditures increased by 48% from 2009, to EUR 2.8 billion. Over this period, foreign MNEs BERD grew 65% but domestic firms grew faster, at 94%, thanks to a

particularly large increase in 2013. As a result, the share of BERD accounted for by foreign MNEs fell from 72% in 2009 to a still very high 69% in 2017. Between 2015 and 2017, BERD of foreign MNEs increased 32% while that of domestic MNEs increased by only 6%.

The manufacturing and information and communications sectors account for most R&D expenditures, and it is likely that foreign MNEs account for most of the R&D expenditures in these sectors. From 2009 to 2017, BERD in manufacturing increased 68% and in information and communications, 57%. Foreign MNEs played an important role in these increases according to the ABSEI data. R&D expenditures by IDA clients in computer and medical device manufacturing both increased; in contrast, R&D expenditures in pharmaceutical manufacturing fell 28% but were still higher than other industries in manufacturing. There was also strong growth in R&D expenditures in information and communications; while R&D expenditures in all industries increased, there were particularly large increases in other IT and computer services and in computer programming.

Overall, the three FDI-intensive sectors—manufacturing, information and communications, and finance and insurance—played a significant role in the recovery following the financial crisis. Information and communications played a very important role and supported the recovery in value added and jobs, while manufacturing and finance and insurance contributed more to the recovery in value added. Information and communications and manufacturing are the most important sectors for R&D expenditures, particularly in industries where foreign MNEs predominate.

Box 2.1. Contract manufacturing in Ireland

One example of the fragmentation of production that has led to the creation of GVCs is contract manufacturing arrangements. Contract manufacturing occurs when a company arranges for a product to be manufactured by another company; it is key that the contracting company supplies some of the inputs to the manufacturing company. The contracting company is the owner of the product once manufacturing is completed, and sells it.

When the companies and customers are in different countries, it leads to international transactions. In the case where the contracting company is Irish, the following transactions would be recorded.

1. An import of manufacturing services from the country where the company manufacturing the good is located.
2. Any inputs, including the use of intangible assets, sourced from abroad that are used in the production of the good would be recorded as imports to Ireland.
3. If the good is sold to a customer abroad, it is recorded as an export by Ireland. In trade statistics, contract manufacturing arrangements are recorded as goods for processing.

Irish companies have long been involved in contract manufacturing arrangements as both contracting companies and manufacturing service providers. Through 2014, these arrangements resulted in nearly offsetting imports and exports (CSO, 2017). In Ireland, these imports included royalty payments for the use of intangible assets and management service fee payments as well as the processing fee. However, this changed in 2015 when the goods exported under contract manufacturing arrangements were no longer offset by imports leading to a large increase in the trade surplus. In addition, there was a relocation of a large value of intangible assets to Ireland by a foreign MNE in 2015 to support contract manufacturing being arranged by Irish firms. Taken together, these events resulted in a large increase in GDP between 2014 and 2015. It should be noted that, while these intangible assets are located in Ireland, they are used in conjunction with foreign labour in the production of the goods. As a result, there was no increase in employment in Ireland associated with either these increased exports of goods or the increase in GDP.

These events are reflected in the macroeconomic statistics used in this report. For example, the increase in exports is reflected in the trade measured in both gross and value added terms. Both sets of statistics record a large increase in the trade surplus in 2015. Specifically for TiVA, the increase in exports without an accompanying increase in imports is reflected in the decline in the foreign content of exports in 2015. Many of the figures in this chapter scale trade by GDP so the large increase in exports 2015 is not as visible because GDP also increased due, in part, to the increase in contract manufacturing exports. Further, the relocation of intangible assets is visible in the increase in the FDI position in 2015. The increase in GDP is evident in the labour productivity measures published by the CSO for 2015 (Chapter 3).

In response to the large increase in GDP with little accompanying impact on employment, the Irish Central Statistics Office convened the Economic Statistics Review Group (ESRG) to make recommendations for how to better meet the needs of domestic users of national statistics. The ESRG noted that GNI has long been considered superior to GDP as a measure of the size of the Irish economy and, indeed, for any highly globalised economy because it excludes profits generated in the domestic economy that accrue to foreign investors (while also recording the income receipts that domestic residents earn from abroad). The ESRG recommended a measure, called GNI*, that adjusted GNI for the impacts of cross-border movements in assets and companies redomiciled in Ireland as well as other aspects of globalisation.

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Annex 2.A. Methodology and data

Chapter 2 examines the distribution of FDI across sectors and Irish regions and the aggregated and sectoral contribution of FDI to selected development outcomes (productivity, employment growth, etc.) using a number of data sources including Eurostat FATS, IDA’s Annual Business Survey and Annual Employment Survey, Financial Times’ fDi Markets database, OECD National Accounts. Specifically, the analysis employs the following variables from each source:

- Value added, profits and employment from Eurostat FATS
- Value added and employment by sector, region and firm type from IDA’s Annual Business Survey and Annual Employment Survey
- Value added and number of hours worked from OECD national accounts
- Business expenditure on R&D from the OECD MSTI database
- Number of employees and mean nominal monthly earnings by sector from ILO
- Greenfield FDI project from the Financial Times’ fDi Markets database

Indicators in Figures 2.3, 2.5, and 2.6

The indicators in Figure 2.3, Figure 2.5 and Figure 2.6 show whether FDI is concentrated in sectors with higher or lower sustainable development outcomes (e.g. productivity), while controlling for the economic size of each sector.

These indicators requires sector-level information on FDI, GDP, and the development outcome considered (e.g. labour productivity), and compare two sector-weighted averages. The first weighted average (the “FDI-weighted” outcome) is a function of sector-level GDP and FDI. The second weighted average (the “baseline” outcome) only uses sector-level GDP shares as weights. The indicators are constructed as the proportional difference between the FDI-weighted and baseline outcomes:

$$Type\ 2 = \frac{\sum_s \omega_s Y_s - \sum_s \delta_s Y_s}{\sum_s \delta_s Y_s},$$

$$\omega_s = \frac{1}{\sum_s \frac{FDI_s}{FDI_{TOT}} \frac{GDP_s}{GDP_{TOT}}} \left(\frac{FDI_s}{FDI_{TOT}} \frac{GDP_s}{GDP_{TOT}} \right),$$

$$\delta_s = \left(\frac{GDP_s}{GDP_{TOT}} \right)$$

where Y_s is the average outcome of sector s ; ω_s is the weight corresponding to sector s constructed using the product of the GDP share and the FDI share of sector s ; δ_s is the GDP share of sector s . By controlling for sector-level GDP, the indicators provide information on the extent to which the relative distribution of FDI across sectors relates to economy-wide outcomes. The indicators take positive value if the FDI-weighted outcome is higher than the baseline; and vice versa.

The indicator based on growth rates in Figure 2.5 is constructed as level differences to avoid confusion with signs:

$$Type\ 2_{Gr} = \sum_s \omega_s Y_s - \sum_s \delta_s Y_s$$

Decomposition of the growth rate of the indicator in Figure 2.3 Panel A

The indicator in Figure 2.3 Panel A is decomposed into two driving factors in Figure 2.4: the outcome variable (productivity) and FDI (for simplicity sector value added shares are kept constant during this exercise). This decomposition disentangles the extent to which the indicator changes (1) as a result of changes in outcomes (labour productivity) in sectors that have received the bulk of FDI, or (2) as a result of shifts in FDI to sectors with different outcomes. In the first case, the outcome variable is changing in sectors that receive significant FDI, potentially as a result of FDI. In the second case, FDI may or may not influence sector-level outcomes, but affects the structure of the economy by expanding activity in certain sectors relative to others.

Mathematically, this implies totally differentiating the indicator in figure 2.3 Panel A (Y) with respect to FDI (FDI) and the outcome under analysis (OUT).

$$Y = F(FDI, OUT)$$

$$dY = F_{FDI}dFDI + F_{OUT}dOUT$$

where F_i corresponds to the partial derivative of Y with respect to variable $i = \{FDI, OUT\}$. The equation is then divided by Y and each change is converted into a growth rate:

$$\frac{dY}{Y} = \left(\frac{F_{FDI}FDI}{Y}\right) \frac{dFDI}{FDI} + \left(\frac{F_{OUT}OUT}{Y}\right) \frac{dOUT}{OUT} = \beta \frac{dFDI}{FDI} + \gamma \frac{dOUT}{OUT}$$

where β measures the change in the indicator explained by FDI, and γ denotes the variation in the indicator explained by the outcome variable.

Notes

¹ Financial Services, Energy, Recycling and Waste, Construction, Agriculture, Mining and Education sectors are not covered in this analysis.

² The Financial Times' fDi Markets database includes announced greenfield cross-border investment projects. The measure of FDI used in the OECD FDI Qualities Indicators is based on industry-level aggregates of these announced investment projects covering 39 sectors, and is available for all countries considered over 2003-2017. For each year between 2011 and 2017, FDI stock is calculated as the sum of annual investment flows and previous year capital stock (i.e. zero depreciation is assumed), where initial stock is approximated as the sum of investment flows over 2003 to 2010.

³ Data are from the OECD's National Accounts database, which covers 2008 to 2017.

3. Productivity and job dynamics of foreign MNEs in Ireland

This chapter studies productivity and employment of foreign MNEs operating in Ireland between 2006 and 2016. Specifically, the productivity dynamics of foreign owned firms are followed over time, and the role of firm entry and exit in terms of employment are analysed, using transition matrices. Focus is put on two strategic sectors: manufacturing and information and communication.

3.1. Summary

In the years from 2000 to 2016, the foreign sector in Ireland had an average annual labour productivity growth of 10.9% while the domestic (and other) sector grew at a 2.5% rate (CSO, 2018). Underlying the remarkable trends in the foreign MNE sector at the aggregate level are complex dynamics at the firm level. A firms' productivity can rise or fall relative to the industry in which it operates. Some large, resilient firms can maintain high levels of productivity and support employment for extended periods of time. Entries and exits, by providing a channel to reallocate resources among firms, also crucially affect aggregate productivity trends. In turn, increases in (labour) productivity can have important implications for the improvement of living standards. The extent to which firm dynamics create and support jobs at high productivity levels is thus worth investigating and is the focus of this chapter.

The work uses the Annual Business Survey of Economic Impact (ABSEI) and the Employment Survey, and focuses on two sectors that are key to the Irish economy: manufacturing, and information and communications (IC). The analysis employs transition matrices to answer the following questions: Are the incumbents at the top of the productivity ranking always the same, and what proportion of jobs do they account for? What proportion of jobs were at low-productivity firms that exited? Do high productivity firms exit? To what extent are low performing foreign firms able to 'climb the productivity ladder', and if so, how many jobs do they generate? Do firms enter at the top of the productivity distribution and, if so, what proportion of jobs do they account for?

Wide disparities in productivity, and uneven job creation across sectors

The range of productivity levels among foreign firms operating between 2006 and 2016 is very wide, with some stellar performers. A first glance at the overall distribution¹ of productivity levels reveals that the top 95th percentile² firms ('frontier firms') are almost ten times as productive as the median firms. Over 2006-16, there was a net job gain of more than 10 000 jobs, from a starting point of approximately 97 000 in 2006. Most of these gains were realised in the information and communications sector, across all levels of productivity. In manufacturing, the gains were all at the most productive firms.

Incumbents tend to remain at the top in manufacturing

The best performers in manufacturing, i.e. those at the top of the productivity distribution, held their positions throughout the years with little chance for other firms to climb upwards. In fact, 73% of jobs in the highest quintile in 2016 were at firms from that same quintile in 2006. These 'resilient' top performers were 21% of the total number of firms and also happened to be supporting the largest share of jobs overall (35%).

In manufacturing, dynamism is supported more by exits than entries. Exits happened at all levels of productivity, but for the most part, at the lower productivity segments (36% of total firms exiting came from the bottom quintile). A lower, 11% share of exits were from the highest quintile (most productive) firms and they accounted for 18% of jobs of exiting firms (around 2 000 jobs).

Up or out in information and communication

The information and communications sector is similar to manufacturing at the top end of the distribution, where a group of resilient firms supports high productivity jobs. For the firms starting at the top performance quintile, 74% of the jobs remained in the same quintile, but 20% dropped down to the 3rd quintile. It is new entrants that play an important role in the information and communications sector. Of the jobs at the middle quintile in 2016, for example, a fifth came from new establishments that entered in the years after 2006.

Resilient and climbing firms supported higher salaries

Overall, the most productive and resilient firms, i.e. those that maintained very high productivity throughout the years, exported more and paid, on average, higher salaries. The most upwardly mobile firms (i.e. firms that 'climbed' from the lowest quintile to the two highest quintiles) were those paying the highest wages at the end of the period.

The country of foreign investors matters, particularly in manufacturing

The United States, Denmark, Japan, followed at some distance by France, are the countries whose investments had the highest relative productivity over the period 2006-16.

3.2. Strong MNE productivity performance in Ireland: official statistics and IDA microdata

In the years from 2000 to 2016, the foreign sector in Ireland had an average annual labour productivity growth of 10.9% while the domestic (and other) sector grew at a 2.5% rate (CSO, 2018). The National Competitiveness Council³ argues that this gap in performance was (for the most part) driven by some highly productive foreign firms that pushed the productivity frontier of their industries. While these high-level estimates are helpful to set the scene, they do not address key patterns and potential dynamism within the group of foreign firms. The analysis on productivity in section 3.3 provides a much more detailed perspective by using IDA (ABSEI) microdata.

Prior to presenting the results based on the IDA microdata, it is worth assessing whether the data present similar trends as those disseminated by the CSO. Weighted labour productivity of foreign firms based on ABSEI appears to be aligned with official CSO estimates in the first 5 years of the period from 2006 to 2016 (Figure 3.1).⁴ After 2010, the estimates start to diverge although they maintain similar trends until 2015.

In 2015, the CSO data show a marked increase leading to labour productivity three times as high as the 2006 level, mainly due to relocations to Ireland of substantial intellectual property by foreign MNEs (see Box 3.1). The trends in ABSEI data are qualitatively similar to the official CSO estimates, with the difference that they do not show the same dramatic changes.⁵ This suggests that the IDA data provide a valid estimate of foreign firms' labour productivity trends for the period under study, and that this study can cover the period 2006-16, while many other studies stop at 2014 due to the discontinuity in 2015.

Box 3.1. Recent findings from the literature

A number of studies have analysed productivity trends in Ireland at various levels of detail, including breakdowns between domestic and foreign-owned firms, by sectors and size classes, and between frontier and lagging firms. Recent publications in this area have all pointed to a significant and growing productivity gap between foreign-owned and domestic firms (CSO, National Competitiveness Council, ESRI, and OECD).

The 2018 CSO Productivity report (CSO, 2018) highlights that from 2000 to 2016, the foreign sector in Ireland had an average annual labour productivity growth of 10.9%. At the same time, the domestic (and other) sector grew at a 2.5% rate. The last two years of the period (2015-16) were characterised by the relocation of 'entire balance sheets dominated by intellectual property products', which led to a

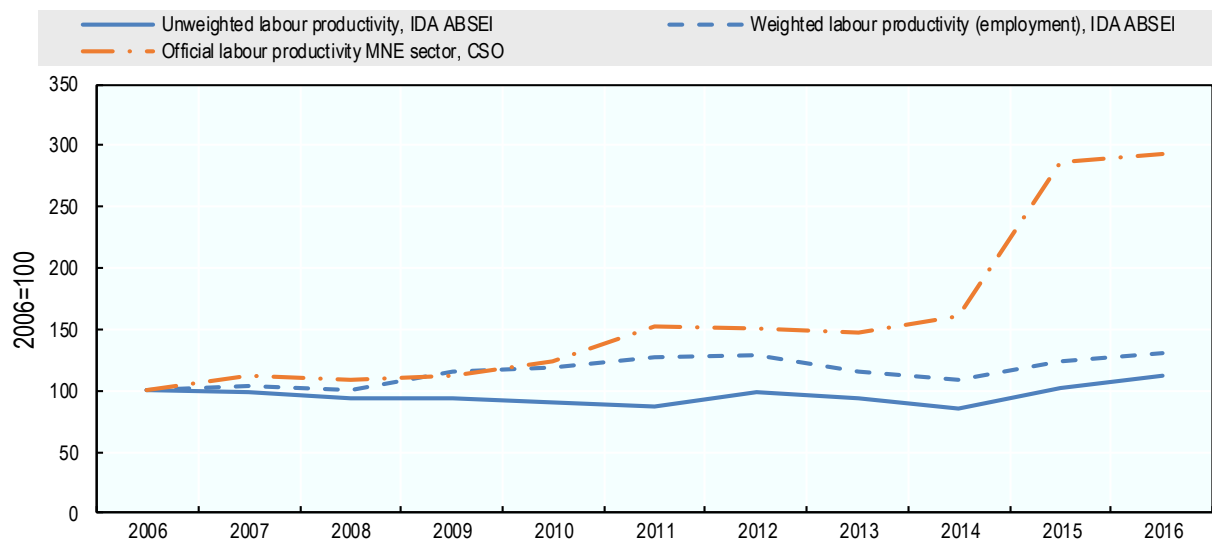
large increase in capital services, while labour inputs remained largely unchanged. This caused an 80% spike in labour productivity for 2015 for the foreign sector of the economy.

In a recent report, the ESRI shows that the foreign-domestic labour productivity gap between 2008 and 2014 was increasing and larger for services than for manufacturing. ESRI also shows that the gap is wider between domestic firms and non-EU owned foreign firms than between domestic firms and EU owned firms. This gap and the way it has evolved over time varies by sector. As of 2014, the food industry and pharmaceuticals were those where the foreign-domestic gap was the largest.

The OECD (Papa et al, 2018) provides detailed evidence that foreign-owned firms can be not only more productive, but also much larger: in the pharmaceutical sector, for example, foreign-owned firms have on average 2.8 times as many persons employed as their domestic counterparts, with an almost 400% productivity premium for 2014. Electronics and computer manufacturing shows an employment multiple of 15.1. In telecommunications, foreign firms have an employment multiple of 11, and, in information technology, of 13.9 (Papa et al, 2018).

The heterogeneity in performance and the spectacular productivity trends of some sectors are largely driven by the existence of a few large and very productive 'frontier' enterprises (National Competitiveness Council, 2018). This divergence is a well-documented finding, as discussed for example in the paper produced by the OECD (Papa et al, 2018) using CSO data, showing that the labour productivity gap between frontier and laggards is widening in both manufacturing and services. In terms of the labour market, the National Competitiveness Council notes in its 2018 Productivity Statement that this growing distance between frontier (foreign-owned) firms and lagging (domestic) firms is paired with large differences in wages (and skills), thus aggravating inequalities.

Figure 3.1. Labour productivity trends, 2006-16

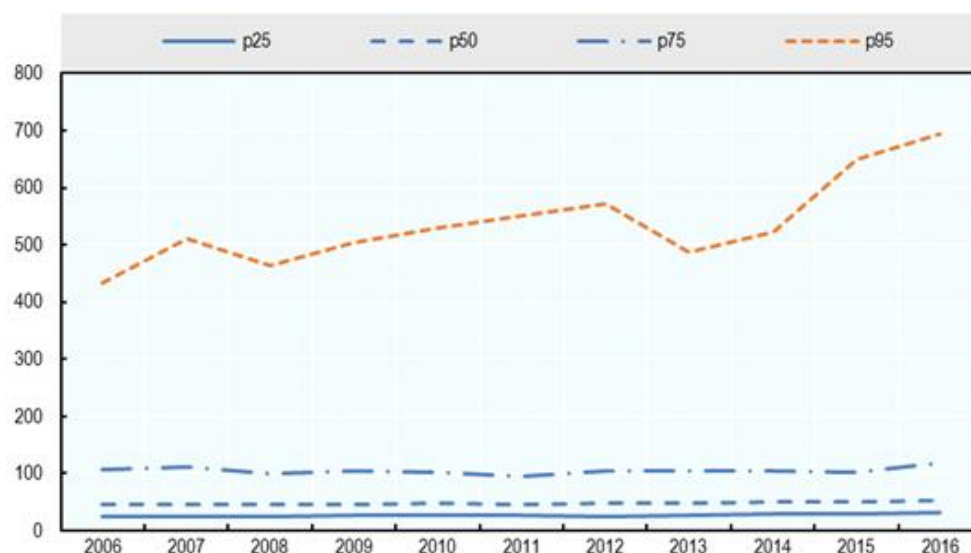


Source: Labour productivity of foreign-owned firms from the CSO and calculations from ABSEI.

A closer analysis of productivity by percentile⁶ shows a remarkable distance between the frontier firms and all other firms in the ABSEI data. Figure 3.2 displays selected percentiles, including the median (p50), and the frontier firms. It is immediately clear that there is a significant difference between the most productive and the median firm indicating that even within the population of foreign-owned firms, there is a group of

very productive firms that far outpace most of the others. For example, the firms at the 95th percentile are almost ten times as productive as the median firm. The gap has widened in recent years. These findings are in line with recent results from the literature, as discussed in (Box 3.1).

Figure 3.2. Selected percentiles of labour productivity based on ABSEI



Source: Authors' calculations on ABSEI data

3.3. Growing differences in relative labour productivity among foreign MNEs in Ireland

As firms in different sectors can have radically different levels of productivity, the dynamics of foreign firms need to be evaluated separately within those sectors. Hence, while the previous section focused on overall levels of labour productivity, this chapter and the rest of the analysis focus on *relative* labour productivity. This is measured as the ratio of each foreign firm's productivity to the median productivity of foreign firms in its sector (measured as value added per hour worked).⁷ The analysis focuses on two sectors: manufacturing and IC.⁸

The firms are ordered by their (increasing) relative productivity and divided into quintiles⁹ based on the number of firms for 2006, 2011, and 2016 (Table 3.1); in addition, Table 3.1 shows the 95th percentile.¹⁰ These results show that a small group of very productive firms is found in each of the sectors examined. In manufacturing, the difference between the 80th percentile and the 95th grows over time so that the 95th percentile is much more productive than the 80th percentile in 2016 than it was in 2006. This is not true for IC, where the gap decreases.

Marked productivity dispersion, even within highly granular sectoral data, is regularly found in empirical research. For example, Berlingieri et al (2017), show that for a subset of OECD countries, firms in the top decile can produce almost five times as much value added per worker as firms in the bottom decile in manufacturing, and more than seven times in services. Syverson (2011) provides a comprehensive review of the literature.

Table 3.1. Industry patterns in percentiles of relative productivity, by year

2006					
	p20	p40	p60	p80	p95
Manufacturing	0.52	0.83	1.27	2.98	8.33
Information and Communication	0.46	0.72	1.36	4.59	23.40
Total	0.50	0.79	1.30	3.64	14.47
2011					
	p20	p40	p60	p80	p95
Manufacturing	0.53	0.81	1.19	2.81	9.51
Information and Communication	0.35	0.82	1.26	2.52	12.49
Total	0.46	0.82	1.22	2.69	10.72
2016					
	p20	p40	p60	p80	p95
Manufacturing	0.52	0.78	1.28	2.80	12.44
Information and Communication	0.37	0.73	1.29	3.03	15.65
Total	0.45	0.76	1.28	2.90	13.75

Source: Authors' calculation based on ABSEI

A close-up on the quintiles of relative productivity

To identify mobility in productivity in the IDA data, firms are first ranked in terms of relative productivity and are assigned a quintile from 1 (lowest) to 5 (highest).

Table 3.2 shows the quintiles by year and by sector, based on both counts of firms active in the year and by employment. The quintiles refer, respectively, to the starting quintile in 2006 and the ending quintile in 2016, with their respective employment levels and firm counts. The 2006 data also include exits, and the 2016 data include entries.¹¹ It is immediately apparent that quintiles of counts are evenly split in the sample. On the other hand, employment need not be evenly distributed across quintiles as firms are of different sizes.

Table 3.2. ABSEI firms and employment by quintile

quintile	2006				2016			
	employment	counts	employment % (within sector)	counts % (within sector)	employment	counts	employment % (within sector)	counts % (within sector)
Manufacturing								
1	7 667	45	11%	20%	6 420	37	10%	17%
2	13 634	45	20%	20%	12 828	41	19%	19%
3	13 778	45	20%	20%	12 622	45	19%	21%
4	10 976	45	16%	20%	11 155	44	17%	21%
5	23 522	44	34%	20%	23 547	45	35%	21%
Information and Communication								
1	5 075	22	18%	20%	5 902	35	14%	23%
2	7 843	22	29%	20%	11 329	30	27%	20%
3	5 328	21	19%	19%	8 164	29	20%	19%
4	3 091	22	11%	20%	5 633	28	14%	19%
5	6 172	21	22%	19%	10 248	28	25%	19%
Total (all sectors and quintiles)	97 086	332			107 848	362		

Source: Authors' calculations based on ABSEI.

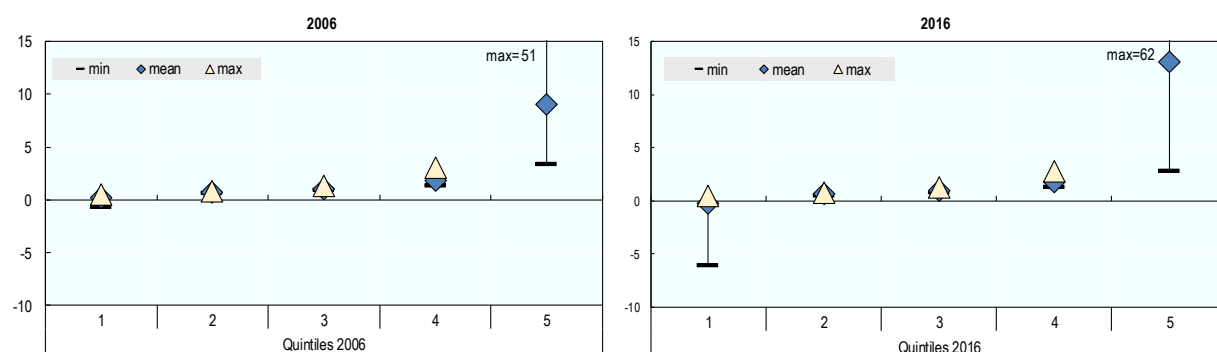
The two sectors do display different dynamics. In manufacturing, high productivity firms supported from the start a large share of jobs and maintained the level of employment over time. On the other hand, fewer jobs were supported by low productivity firms (some of which also exited, as shown in the next sections). In this industry in 2016 more than half the jobs were supported by highly productive firms (35% plus 17% from quintile 5 and 4).

In information and communications, net job creation was positive at all levels of the distribution and the end of the period, the top (quintile 4 and quintile 5) productivity firms gained a more prominent role in terms of employment shares (from 33% to 39%, summing quintile 4 and quintile 5).

Also *within* quintiles there can be significant variation in productivity levels Figure 3.3 and Figure 3.4 show the spread in productivity *within* quintiles in 2006 and 2016 for manufacturing and IC, respectively.

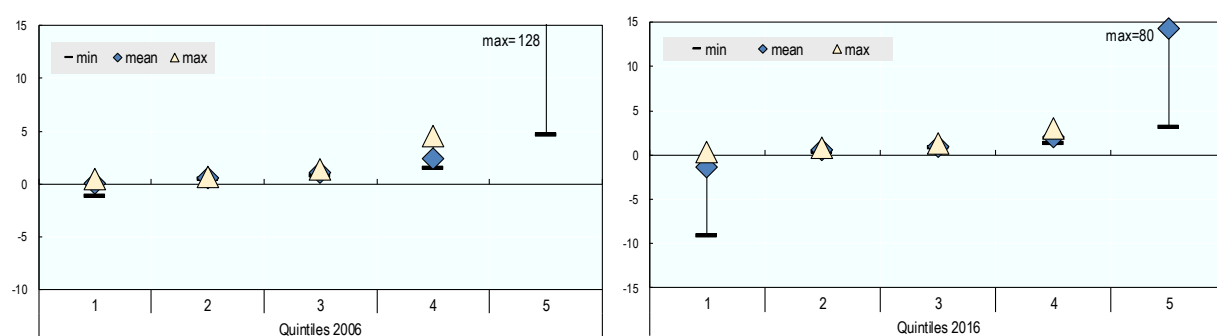
At the lower tails, for both sectors, there are more negative values in 2016 than in 2006, as evident from the minima in quintiles 1. The relative productivities within quintiles 2 and 3 appear to be broadly stable between the years. Quintile 5, the top performance group, shows greater variance. In manufacturing, the trends are generally upwards: the dispersion in values is higher, with a firm capable of reaching productivity 60 times higher than the median. In the information and communications sector, the dispersion decreases and although relative productivities remain significant, the top firm in 2016 is 80 times more productive than the median.

Figure 3.3. Quintiles of relative productivity in manufacturing, 2006 and 2016



Note: Maxima for quintile 5 are not graphically shown for clarity.
Source: Authors' calculations based on ABSEI

Figure 3.4. Quintiles of relative productivity in Information and Communication, 2006 and 2016



Note: Maxima for quintile 5 are not displayed for clarity.
Source: Authors' calculations based on ABSEI

3.4. How transition matrices help describe productivity mobility across foreign firms

By improving their processes and expanding their scale of production firms can move up the productivity distribution of their industry. In some industries, new entrants contribute to productivity growth not only by delivering innovative products and services but also by increasing the level of competition. Other industries may be more difficult to enter; for example, high barriers to entry such as networks, brand power, or high fixed costs, make it more likely for incumbents to remain at the top of the productivity distribution. From a broad perspective, exits are not necessarily a negative outcome, as they can contribute to an increase in aggregate productivity by freeing up resources for more productive firms.

Transition matrices are a useful tool to assess these dynamics. The matrices summarise the movement of firms, with their corresponding employment shares, from one labour productivity quintile to another (or to an exit) from 2006 to 2016.

To compile the transition matrix, for each firm, the starting quintile (2006) and ending quintile (2016) are recorded, together with starting and ending levels of employment. While the majority of the firms in the sample are present throughout, entries and exits into and out of each quintile for the years in between are also monitored. Table 3.3 shows how movements are summarised in the matrix, providing numbers for one quintile for demonstration.

Table 3.3. Components of the transition matrix – an example:

2006 quintiles	Where they went to:								2006 quintiles	Where they came from:							
	2016 quintiles									2016 quintiles							
		5	4	3	2	1	Exits	Total			5	4	3	2	1	Exits	Total
5	40%	20%	15%	10%	5%	10%	100%	5	45%	..	..	..	..	..	..	100%
4	..	..	..	..	..	..	100%	4	15%	..	..	..	..	..	..	100%
3	..	..	..	..	..	..	100%	3	15%	..	..	..	..	..	..	100%
2	..	..	..	..	..	..	100%	2	10%	..	..	..	..	..	..	100%
1	..	..	..	..	..	..	100%	1	10%	..	..	..	..	..	..	100%
Entries	..	..	..	..	..	..	100%	Entries	5%	..	..	..	..	..	..	100%
								Total	100%	100%	100%	100%	100%	100%	100%	100%	

Source: Authors' elaborations based on Baily (1992).

The left hand matrix can be read from left to right, to see how firms from each 2006 starting quintile fared over the period. Of the firms that started in quintile 5 in 2006: 40% remained in the same quintile, 20% dropped to quintile 4, 15% dropped to quintile 3, 10% to 2, 5% to 1, and 10% exited in a year prior to 2016. The rows thus add up to 100% horizontally. The last row denominated as 'births' shows how well the new entrants (enterprises that entered the market *after* 2006) performed compared to the incumbents.

Looking at the right hand matrix, data need to be read vertically. The columns describe the composition of each 2016 quintile in terms of the origin of the firms. So, 45% of the firms that ended up in the top performance quintile were already there in 2006; 15% came from quintile 4, 5% were new entrants (births) and so on.

What transition matrices tell us about the economy

In an economy where the diagonal cells (from top left to bottom right) are very 'bulky', there is little mobility. This means that incumbent firms are resilient and are not likely to lose their advantage. Larger off-diagonal

values mean higher turnover. Looking at the left matrix again, if the bottom left off-diagonal values are high, it means that many low productivity firms managed to climb upwards. Conversely, if the top right off-diagonal values are relatively larger, that means that many high productivity firms dropped down. Large birth components in the bottom row tending to the top would imply that productive firms are entering the Irish economy close to the frontier.

When translating what the transition rates mean in terms of jobs, it is important to remember that firms have different sizes. Firms could stay in the *same* relative productivity quintile throughout the period, but grow or shrink in employment. Additionally, when firms do move up or down, there is a corresponding shift in jobs (expressed as percentages of the total employment) landing in a *different* quintile of the productivity distribution.

The next sections present the transition matrices in terms of jobs for the manufacturing and information and communications firms served by IDA. The percentages refer to the share of starting or resulting employment in the sector as opposed to the number of firms.¹²

Incumbents tend to remain at the top in the manufacturing sector

Looking at manufacturing in Table 3.4, the left hand matrix indicates the share of jobs at firms starting in each 2006 quintile and ending at each 2016 quintile. The lack of mobility at the top is immediately evident as a very large share (73%) of the top quintile jobs in 2006 stayed in that same quintile in 2016. While not many of the firms in the top quintile dropped down to lower quintiles, it is notable that 9% of the jobs at these firms in 2006 were at firms that exited by 2016, suggesting that poor performance did not cause these firms to exit. There is more dynamism when looking at quintile 3, as 22% of jobs in quintile 3 transitioned to quintile 4.

There is a significant contribution by some new, highly productive firms that entered post-2006 and were able to be highly competitive in little time. Most of the jobs at firms that entered after 2006 (entries) were in quintiles 3 and 4 (15% plus 41%) by 2016. The low productivity group (quintile 1) experienced a lot of turnover, with exits accounting for 47% of jobs at firms with the lowest relative productivity. The corresponding shares are much lower for other quintiles.

Table 3.4. Transition matrix for jobs in manufacturing

Highest productivity: quintile 5; lowest productivity: quintile 1															
		Where they went to:						Where they came from:							
		2016 quintiles						2016 quintiles							
		5	4	3	2	1	Exits			5	4	3	2	1	Exits
2006 quintiles	5	73%	8%	2%	6%	2%	9%	2006 quintiles	5	80%	19%	4%	16%	12%	18%
	4	18%	37%	8%	18%	2%	17%		4	8%	54%	25%	2%	7%	16%
	3	3%	22%	25%	4%	25%	20%		3	1%	7%	25%	12%	14%	24%
	2	15%	4%	10%	27%	34%	10%		2	7%	10%	5%	22%	22%	12%
	1	11%	2%	7%	14%	18%	47%		1	1%	3%	22%	39%	32%	31%
Entries		9%	15%	41%	20%	15%		Entries		2%	8%	19%	9%	13%	

Note: Left panel to be read left horizontally; right panel to be read vertically.

Source: Authors' calculations based on ABSEI data.

The right matrix identifies the share of jobs in 2016 in that quintile that originated from each quintile in 2006. For example, 80% of jobs in the top quintile in manufacturing in 2016 were at firms from that same quintile in 2006, 8% were from firms in quintile 4 in 2006, and so on. 2% of the jobs in quintile 5 in 2016 were from entries. Most of the jobs in quintile 4 in 2016 were not due to growth from lower quintiles but

rather from top quintile firms with lower relative productivity (19%) or those that remained in quintile 4 (54%).

Up or out in the information and communications sector

In the information and communications sector, the highest productivity firms were also highly resilient. When compared to manufacturing, the information and communications sector is similar at the top end (5th quintile) of the distribution, with three quarters of jobs staying where they were at the start (Table 3.5). However, in contrast to the manufacturing industry, the lower productivity firms were more likely to progress upwards in this industry.

The lowest productivity group had only 8% of jobs staying in firms in the same quintile at the end of the period, and, exits accounted for 27% of jobs as opposed to 47% in manufacturing. Instead, almost two thirds of jobs were at firms that moved up the distribution (33% to the second quintile, and the rest to the third and fourth). In manufacturing, only a third of the firms moved up. For the firms starting at the top performance quintile, 74% of the jobs remained on the same quintile, but 20% dropped down to the 3rd and 5% to the lowest quintile.

Considering the right matrix, a feature that stands out is the importance of entries. Of the jobs at the 3rd quintile in 2016, for example, a fifth came from new establishment that entered in the years after 2006. The fifth and fourth quintiles were not entirely inaccessible to new entrants, with shares of 6% and 14% of jobs respectively. The share of jobs from births landing in quintile 2 is the largest at 46%.

Table 3.5. Transition matrix for jobs in information and communication

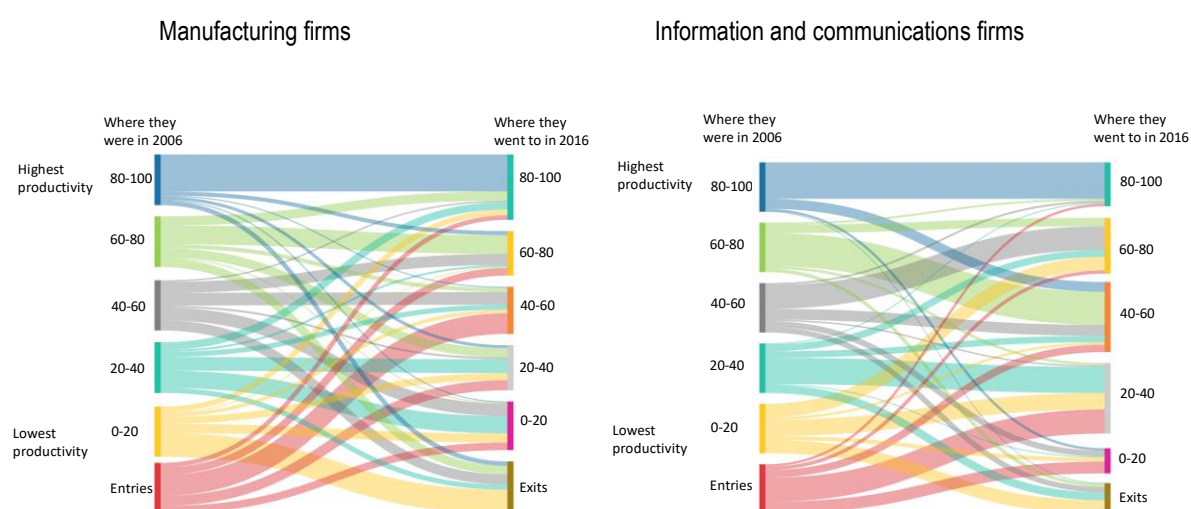
		Where they went to:						Where they came from:							
		2016 quintiles						2016 quintiles							
		5	4	3	2	1	Exits			5	4	3	2	1	Exits
2006 quintiles	5	74%	0%	20%	0%	5%	1%	2006 quintiles	5	78%	4%	3%	0%	2%	2%
	4	4%	17%	67%	5%	0%	7%		4	0%	59%	10%	4%	11%	9%
	3	4%	48%	22%	3%	12%	11%		3	16%	16%	55%	1%	10%	9%
	2	2%	14%	13%	53%	2%	16%		2	0%	3%	12%	44%	34%	57%
	1	0%	27%	5%	33%	8%	27%		1	0%	4%	0%	5%	1%	23%
Entries		5%	7%	15%	49%	24%		Entries		6%	14%	20%	46%	43%	

Note: Highest productivity: quintile 5; lowest productivity: quintile 1. Left panel to be read left horizontally; right panel to be read vertically.

Source: Authors' calculations based on ABSEI data.

Figure 3.5 shows the information in the left panels of Table 3.4 and Table 3.5 graphically, making it easier to compare the dynamics in the manufacturing sector (left panel) and the information and communications sector (right panel). As mentioned, a large portion of the employment at the highest productivity firms remained at the top of the distribution in both sectors, but a higher share of employment in the highest productivity quintile came from firms that were initially in lower productivity quintiles in manufacturing than in information and communications. In addition, a larger portion of employment in the higher quintiles came from entrants in manufacturing than in information and communications. However, a greater portion of employment was at firms that either exited or were in the lowest productivity quintile in 2016 in manufacturing than in information and communications.

Figure 3.5. Enterprises by productivity quintile in 2006: Where did they end up?



Source: Author's calculations based on ABSEI data. Charts created using SankeyMATIC.

The MNE sector in Ireland appears less dynamic compared to international evidence, due to lower exit rates and high resilience at the top

The extent of dynamism in a country and industry can be measured, but it is difficult to assess. There is no 'optimal level of dynamism', but the fact that some firms can rapidly progress upwards is desirable, as high growth is generally associated with job creation and is often found in innovative firms (Henrekson and Johansson, 2010).

Estimates available from the literature are not comparable to the present case, as the studies do not differentiate between foreign and domestic firms, they encompass other measures of productivity, and mostly focus on firm counts rather than jobs. Some examples based on firm counts are reported to contextualise the estimates.

Overall, the MNE sector in Ireland appears more static than the evidence below, particularly due to lower exit rates and larger high performing firms remaining at the top. This, however, is also linked to fundamental differences between the MNE sector and the domestic sector, with foreign firms most often leading the frontier of productivity, as pointed out earlier in Box 3.1. Matrices for firm counts are in Annex 3.A.

- The influential paper by Baily (1992) on US manufacturing plants showed a lot of movement of firms in both directions throughout the 1970s. Less than a third of the top performers were still at the same quintile of productivity at the end. 18% of firms at quintile 3 managed to reach quintile 4 over the span of 5 years. In addition, not all entrants came into the market with high productivity levels (12% entered at quintile 1) and not all firms that exited had low productivity (14% exited from quintile 5).
- In New Zealand about 41% of firms that were on the frontier in 2000 remained on the frontier in 2011, but exit rates reached 56% (Conway et al, 2015).
- Dutch research (van Heuvelen et al, 2018) for the years 2006-2015 shows that exits are substantial even at the top decile (58%) and that highly productive firms, when they survive, are the most likely to remain at the top productivity decile (41%).

- A Belgian study (Dumont, 2011) finds that in the years 2000-2008 and depending on the industry, between 60% and 80% of firms from the highest quartile were still there at the end of the period and that even high productivity firms were likely to exit.
- Dynamism should hence be seen as a complement to the large investments that have traditionally supported jobs over long time horizons. The IDA microdata have indeed shown the value of large and resilient firms in maintaining high levels of employment in very productive segments of the economy. On the other hand, as discussed in the first chapter, the lack of diversification can pose challenges and sensitivity to policy changes. More research and extensive data would be required to assess how the dynamism of the foreign sector compares (and interacts) with that of the domestic Irish sector.

3.5. Defining features along the productivity distribution

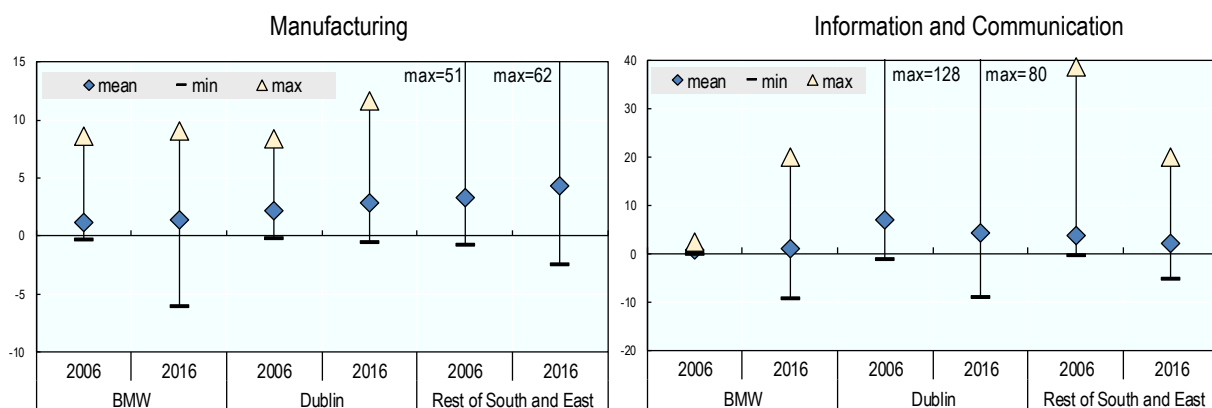
This section examines in greater detail some of the characteristics of the firms across the different points of the distribution of relative productivity.

Manufacturing is mostly successful in Rest of South and East; information and communications champions concentrate in Dublin

The manufacturing champions are located in the Rest of South and East region (without Dublin), where the highest relative productivity is attained consistently throughout the years (Figure 3.6). Less dispersion is seen in the Border, Midland and Western region, where a firm is on average very close to the median productivity level in the industry. Dublin is the region in between, as manufacturing firms located here are on average twice as productive as the median.

Much more disparity is found in the information and communications sector, whose top performers are located in Dublin. Even disregarding the frontier (maximum) firms, in the city, firms were on average seven times more productive than the median in 2006, while the average decreased to four times in 2016.

Figure 3.6. Regional distributions of relative productivity, 2006-16



Note: Some maxima are not displayed for clarity.

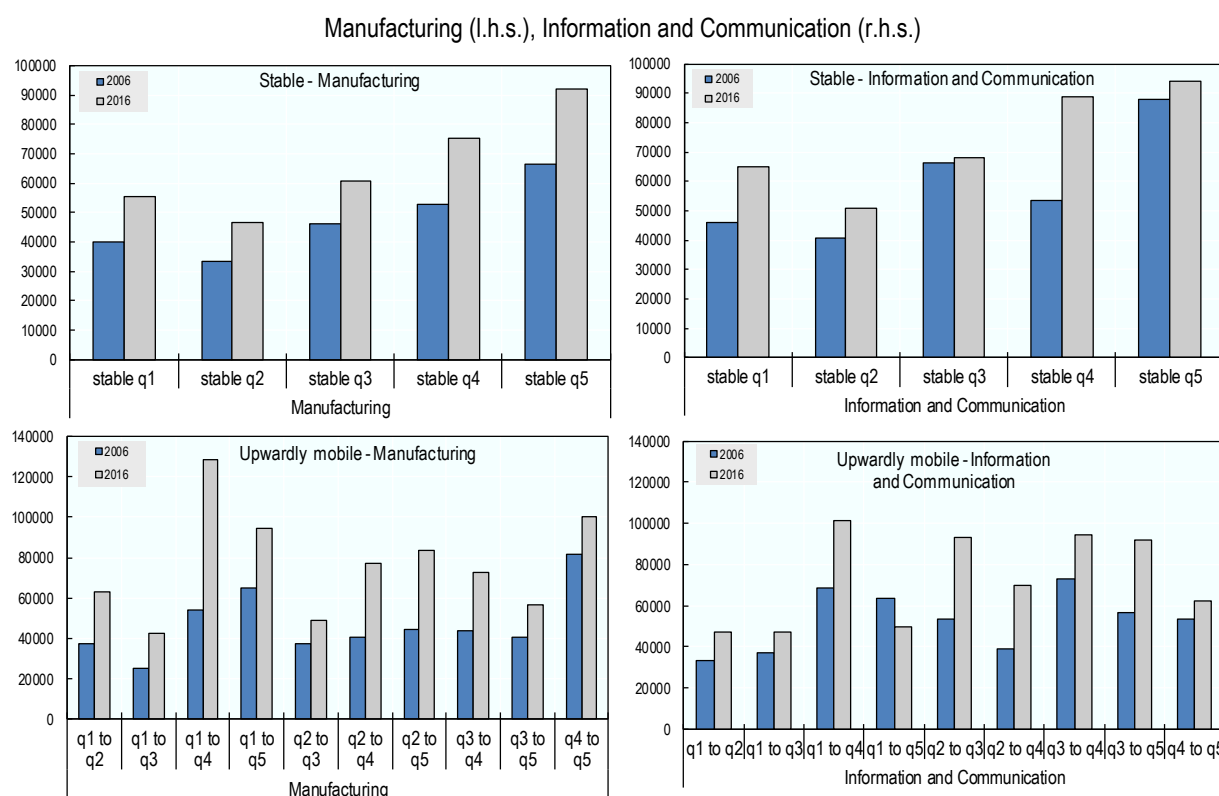
Source: Authors' calculations based on ABSEI data.

Wages align with productivity, but even more with dynamism

Figure 3.7 shows average wages by sector and year, with manufacturing firms in the left panel and information and communications in the right panel. The first five bars in the figure for both sectors show average wages for firms that remained in the same quintiles of productivity throughout the period, for two years (2006 and 2016). In both industries, there appears a growing trend with higher wages paid in more productive, resilient firms, although there is a dip in quintile 2. This behaviour is unchanged over time for manufacturing, while it has less consistency in the information and communications sector, where quintile 4 firms paid lower wages than quintile 3 in 2006.

Additional bars show the wages paid by the dynamic firms that managed to proceed up the productivity ladder. The results reflect the fact that some highly performing firms were not only able to ‘jump’ to very high levels of performance, but they also paid, on average, very high salaries. This is the case of firms that went from quintile 1 to quintile 4, in both industries. In manufacturing, firms at quintile 2 and 3 paid almost the same wages at the start, but the increases were visibly different by 2016.

Figure 3.7. Average salaries by year and quintile, stable and upwardly mobile firms, 2006 and 2016

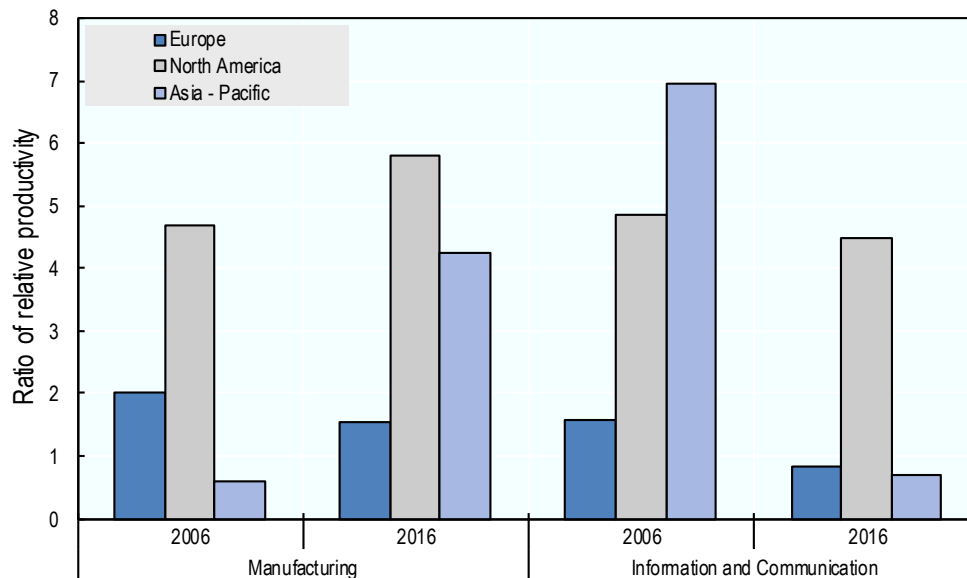


Note: Calculations are performed on firms that were either ‘stable’ or moved to any higher quintile of productivity throughout the period 2006-16. So, “q1 to q2” indicates firms that started off at quintile 1 in 2006 and ended in quintile 2 in 2016.
 Source: Authors’ calculations based on ABSEI data.

Origin of investment matters

The region of foreign investors matters. In manufacturing, North American investors appear to be those that consistently had the highest relative productivity over the period 2006-16 (Figure 3.8). Explaining the improved performance of Asia-Pacific in 2016, is the entry of some countries, such as Japan, with highly productive investments. The drop in the European region ratio from 2006 to 2016 is driven for the most part by countries that saw their relative productivity fall, such as the United Kingdom and Luxembourg.

Figure 3.8. Relative productivity by sector and region of investor, 2006-16



Note: Some countries have been excluded due to insufficient observations. Data are weighted by employment.

Source: Authors' calculations based on ABSEI data.

Looking at information and communications, Asia-Pacific investments appear volatile, with a remarkable level of performance at the beginning of the period, driven by very few investments, and then a subdued performance in 2016 compared to the other regions. North America is in the lead throughout the period, and this performance is driven largely by the United States. In terms of European investors, the performance is lower and, similar to the manufacturing sector, with a decreasing trend.

Investors apply various degrees of R&D investment and intensity

R&D intensity, measured as total R&D spending as a share of sales, is generally low and not all firms perform R&D. Within the sample, one in two firms reports some (non-zero) amount of R&D.

First looking at R&D investment, 72% of firms in manufacturing that were upwardly mobile (i.e. those that moved up the productivity matrices between 2006 and 2016) performed some R&D in 2006 and were more likely to have had some R&D related expenditure in 2006 than those that were downwardly mobile (64%) or firms that exited the sample (51%), but less like than firms that remained stable in the same quintile over the 10 years (77%). This finding did not hold in information and communications.

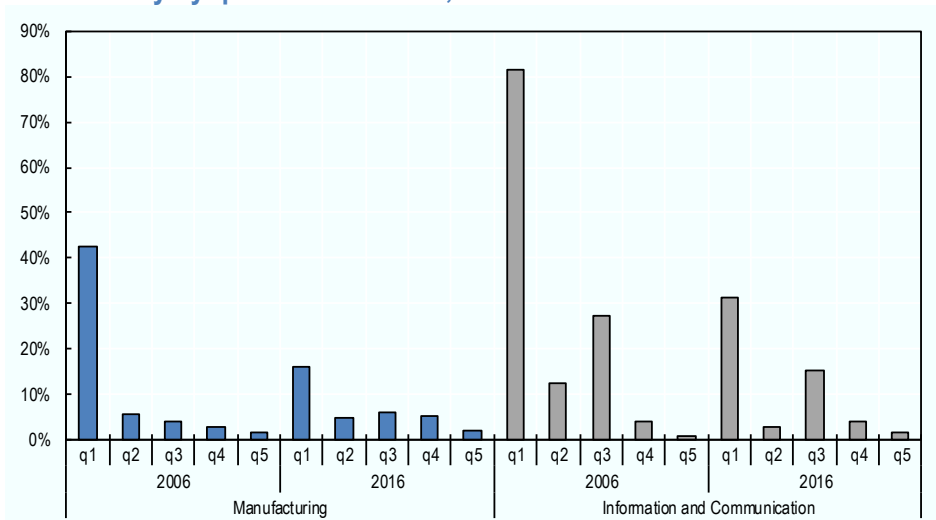
Across both manufacturing (86%) and information and communications (57%), firms in the top quintile in 2016 were most likely to perform R&D. Notably in manufacturing, 70% of firms in the lowest quintile in 2016 had some R&D activity, a similar proportion to firms in the 4th quintile.

Overall, R&D intensity is higher in 2006 than in 2016 in both the manufacturing and information and communications sectors. Some outliers may have affected the results shown in Figure 3.9, as there is no clear pattern within the industries, but there are signs that, at least in manufacturing, the lower productivity firms may often be the ones showing higher R&D intensity in their Irish operations. In information and communications, the top quintile firms are consistently those investing less in R&D, while there is less clarity at the bottom of the distribution.

A further question is whether any distinction can be made between firms that remained stable and those that were able to move upwards. Not all firms had R&D data in both years, and some firms exited, therefore

the results in Figure 3.10 should be interpreted with caution. In manufacturing, the first quintile firms were consistently those with the highest R&D intensity. The upwardly mobile, low productivity sub-groups, such as the ones going from quintile 1 to quintile 3 or 5, or the ones from quintile 2 to 5, had the overall highest levels at the start of the period. In the information and communications sector, although R&D intensity is generally higher than in manufacturing, the data are missing for a number of subgroups, making it difficult to draw any conclusions.

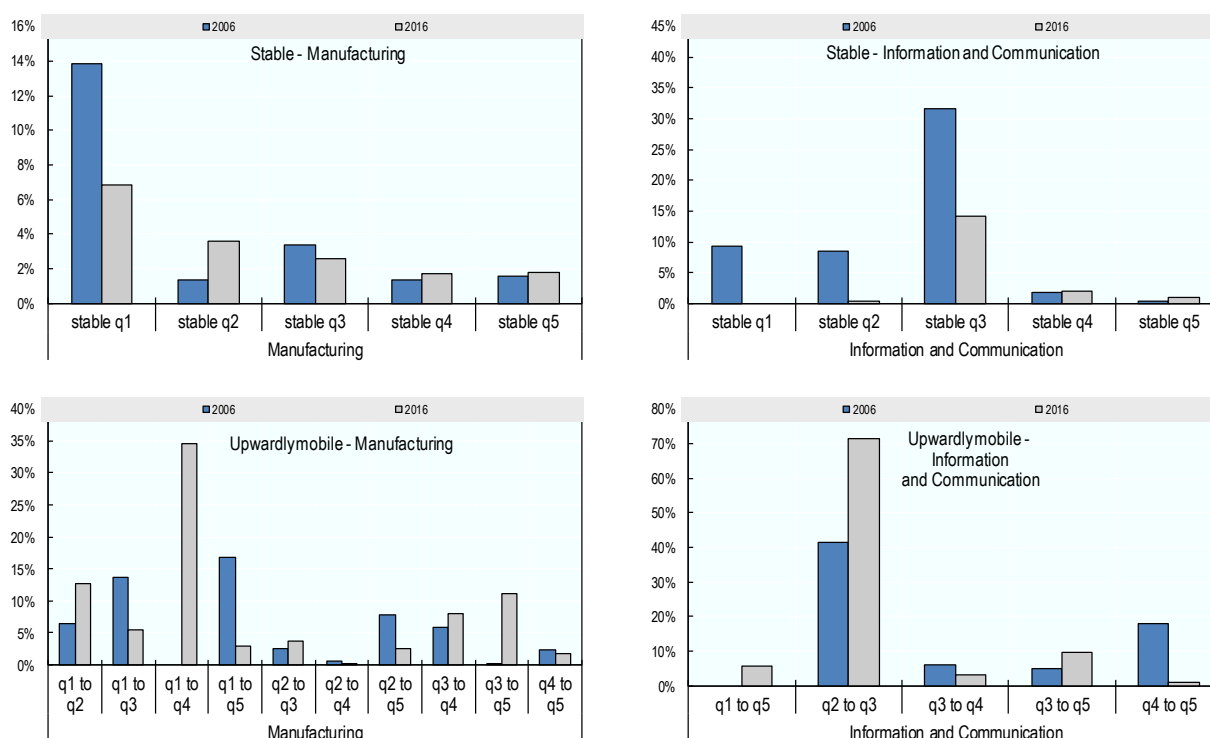
Figure 3.9. R&D intensity by quintile and sector, 2006-16



Note: The chart refers only to firms that report some amount of R&D (~50% of the sample)

Source: Authors' calculations based on ABSEI data.

Figure 3.10. R&D intensity of stable and upwardly mobile firms, 2006-16



Note: Calculations are performed on firms that were either 'stable' or moved to any higher quintile of productivity throughout the period 2006-16. So, "q1 to q2" indicates firms that started off at quintile 1 in 2006 and ended in quintile 2 in 2016. The chart refers only to firms that report some amount of R&D (~50% of the sample). Some categories were excluded as results were driven by outliers.

Source: Authors' calculations based on ABSEI data.

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Annex 3.A. Methodology and data

Glossary of statistical terms used in this chapter

Median: The median is that value which divides the total frequency of a variable into two halves.

Percentiles: The set of partition values which divide the total frequency into one hundred equal parts

Quantiles: The class (n-1) partition values of a variate which divide the total frequency of a population or a sample into a given number n of equal proportions. For example, if n=4 the n-1 values are the quartiles although the central variate value is generally termed the median.

Quintiles: The set of four values which divide the total frequency of a variable into five equal parts.

Relative productivity: the ratio between an enterprise's labour productivity and the median, calculated at the sector level.

Methodology and data

Much of the methodology for this chapter draws from an influential paper by Baily et al (1992) that applied different decompositions, including transition matrices, to determine the contribution of 'stayers', 'entries' and 'exits' to labour productivity growth of US manufacturing plants.

The analysis in this report used IDA data from the Annual Business Survey of Economic Impact (ABSEI) and the Annual Employment Survey (AES). The ABSEI covers firms served by IDA Ireland with more than 10 employees and has a response rate of about 60%. A relatively simple cleaning routine was applied to the data, combining checks for outliers and consistency with the IDA Employment survey. The AES is broader in scope as it includes not only companies under the remit of IDA Ireland (of any size), but also Enterprise Ireland and Údarás na Gaeltachta.

Overview

The analysis covers the years from 2006 to 2016. All data were anonymised and accessed solely at IDA secured premises.

Two sectors were the focus of the study

- Manufacturing includes all section C industries (NACE codes from C10 to C33)
- Information and Communication (IC) includes all section J industries (NACE codes from J58 to J63)

Then, for the analysis at a more granular level which is shown in this annex, the key industries were:

- C21 - manufacture of basic pharmaceutical products and pharmaceutical preparations, combined with C32.5 - manufacture of medical and dental instruments and supplies
- C26 - manufacture of computer, electronic and optical products
- J62 - computer programming, consultancy and related activities

The survey initially also included other sectors: Distributive services groups together section G (wholesale and retail trade, from G45 to G47), H (transportation and storage, from H49 to H53), and I (accommodation and food services, from I55 to I56); Financial and insurance activities i.e. section K industries (from K64 to K66); and Professional services groups i.e. both section M (professional, scientific and technical activities, M69 to M75) and N (administrative and support service activities, N78 to N82).

After careful inspection of the data and due to limited sample sizes, these sectors were excluded from the analysis, together with a handful of firms in the agriculture and in the education sectors.

A focus on Labour Productivity

Labour productivity is chosen as the unit of analysis because it is considered to be tied closely to living standards. However, it does not differentiate between changes due to capital deepening, due to technological change, and due to changes in workers' abilities. Data needed to examine the role of capital formation on the evolution of productivity were not available in the ABSEI data for the time period covered in the analysis.

Labour productivity in this paper is computed as value added per (annual) hour worked.

The Annual Employment survey data was combined with the CSO usual hours of work data to obtain an estimate for the hours of work at IDA firms. Specifically, the table used was 'Average Usual Hours Worked per Week by Persons aged 15 years and over in Employment (ILO) (Thousand) by NACE Rev 2 Economic Sector and Quarter'.

Quarterly data were averaged to obtain yearly levels. Then, based on an estimate from National Accounts, the number of weeks worked was assumed to be on average 48.6. Then, annual hours worked were obtained by multiplying weekly labour hours by sector by the number of weeks and by employment at each firm.

Labour productivity was then calculated by dividing value added (an estimate produced by IDA Ireland) by annual hours worked. Value added in ABSEI is calculated as: $(Sales - (Total\ Materials\ Cost + Total\ Services\ Cost))$. Productivities based on output per hour were also computed but were not the focus of this work. Unless otherwise stated, the analysis is based on labour productivity measured as value added per labour hour.

Outlier checks

A criticism to the Baily et al. paper was that the examination of the productivity distribution should be done including outliers because much of the movement over time is often attributable to firms that lie at the tails. Therefore, in this paper, care was taken in identifying outliers. The removal of outliers was not focused on the variable of analysis itself (labour productivity) but rather on a (conservative) inspection of implausible values of other variables. This is pursued in two steps:

- First, the average earnings of firms in each industry were examined to determine particularly implausible records. Earnings by industry were computed at sector level (therefore, at a more granular level than the transition matrices). The sector codes were listed earlier in this appendix and range from C to N. Where a firm's average earning was 4 times as large or less than a quarter of the industry average wage, the firm was excluded.
- Secondly, to ensure consistency in the computation of labour productivity, the employment data from ABSEI were compared with the records from the Employment survey, excluding the category

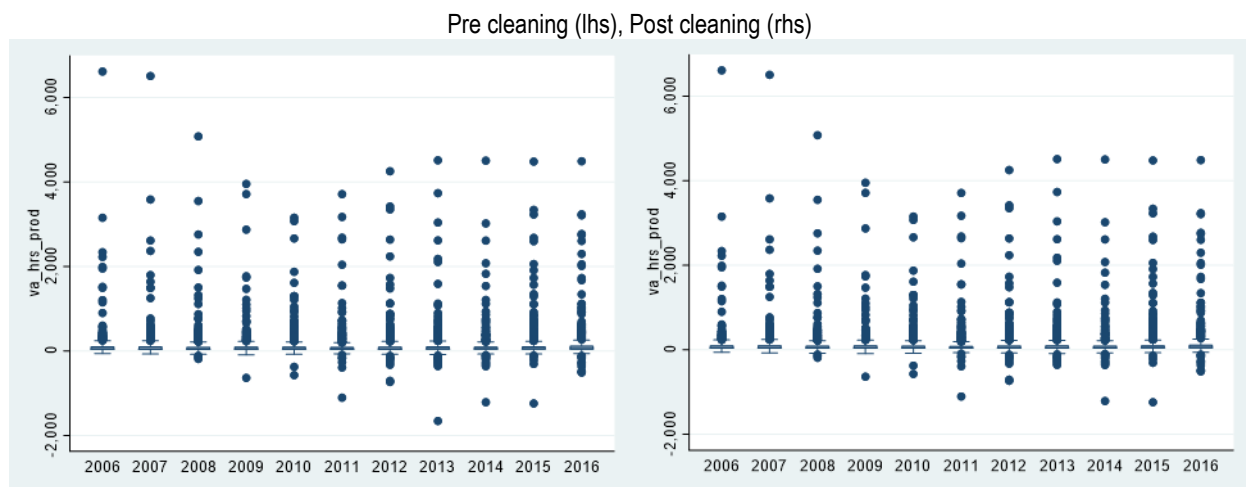
'other' and thus focusing only on full-time or part time jobs. If the ratio of the ABSEI employment to the Employment survey data was higher than three or less than a quarter, the firm was dropped.

In addition to the checks, the routine dropped any firm operating in sectors other than manufacturing or IC. One observation that had negative output was also dropped.

Following the cleaning, for each year between 2006 and 2016, the resulting panel contains around 360 observations of which about 65% are in the manufacturing sector and the remaining 35% are in the information and communications sector.

The charts below show the impact of this cleaning exercise by year- and by industry-level distributions of productivity. As can be noted the routine determined the exclusion of very few firms.

Annex Figure 3.A.1. Impact of removal of outliers in labour productivity, pre and post, by year



Source: OECD elaboration based on ABSEI

Quintiles of relative productivity – methodological issues

As explained in the main body of this report, the transition matrices represent movements of firms between quintiles of relative productivity.

Relative productivity is computed as the ratio between an enterprise's productivity and the median at the sector level. Ratios at a more granular industry level were not feasible due to the small samples, except for the three industries mentioned in chapter 3.

In the absence of birth information, an entry is proxied with the first non-missing observation for employment. This is the firm's earliest response to the employment survey, which is, in effect, assumed to be equivalent to its entry in the Irish market. Similarly, exit is the first year of definitive missing employment¹³, but may not always amount to an exit from the Irish market. In fact, exits from ABSEI can occur for a number of reasons. The firm could reduce its size thus falling below the 10-employee threshold; the firm could be subject to a merger or acquisition event and as a result change location or cease to be foreign-owned.

Unlike the Baily paper, the IDA sample does not present any shifts of firms from one industry to another throughout the period, and, so, this dimension did not have to be captured in the matrices here.

Transition matrices

This section presents all transition matrices by sector for employment and counts of firms respectively, starting with the most detailed sector categories.

Annex Table 3.A.1. Transition matrix for jobs in Manufacture of computer, electronic and optical products

		Where they went to:						Where they came from:									
		2016 quintiles						2016 quintiles									
2006 quintiles		5	4	3	2	1	Exits	2006 quintiles		5	4	3	2	1	Exits		
		5	82%	15%	0%	0%	0%		3%		5	94%	0%	0%	0%	0%	20%
		4	0%	28%	7%	0%	0%		65%		4	5%	49%	0%	0%	0%	24%
		3	0%	0%	19%	40%	34%		7%		3	0%	19%	23%	0%	87%	9%
		2	0%	0%	0%	1%	93%		6%		2	0%	0%	53%	1%	0%	7%
		1	0%	0%	10%	0%	0%		90%		1	0%	0%	16%	94%	0%	40%
	Entries	82%	15%	0%	0%	0%	3%		Entries	0%	32%	8%	5%	13%			

Note: Highest productivity: quintile 5; lowest productivity: quintile 1

Source: Authors' calculations based on ABSEI.

Annex Table 3.A.2. Transition matrix for jobs in Manufacture of basic pharmaceutical products and pharmaceutical preparations; manufacture of medical and dental instruments and supplies

		Where they went to:						Where they came from:									
		2016 quintiles						2016 quintiles									
2006 quintiles		5	4	3	2	1	Exits	2006 quintiles		5	4	3	2	1	Exits		
		5	75%	15%	4%	0%	23%		26%		5	63%	13%	7%	0%	2%	15%
		4	20%	20%	15%	23%	3%		19%		4	13%	20%	31%	19%	0%	22%
		3	5%	40%	27%	5%	14%		8%		3	7%	34%	36%	10%	7%	10%
		2	0%	21%	9%	25%	43%		2%		2	0%	23%	3%	20%	30%	4%
		1	21%	0%	8%	13%	12%		46%		1	1%	2%	12%	45%	32%	37%
	Entries	12%	19%	38%	22%	10%			Entries	4%	7%	14%	6%	9%			

Note: Highest productivity: quintile 5; lowest productivity: quintile 1

Source: Authors' calculations based on ABSEI.

Annex Table 3.A.3. Transition matrix for jobs in Computer programming, consultancy and related activities

		Where they went to:						Where they came from:									
		2016 quintiles						2016 quintiles									
2006 quintiles		5	4	3	2	1	Exits	2006 quintiles		5	4	3	2	1	Exits		
		5	74%	0%	20%	0%	5%		1%		5	78%	4%	1%	0%	2%	2%
		4	4%	48%	22%	3%	12%		11%		4	0%	60%	12%	4%	11%	9%
		3	2%	20%	67%	5%	0%		7%		3	16%	16%	55%	2%	10%	9%
		2	0%	10%	22%	33%	7%		27%		2	0%	3%	12%	46%	35%	57%
		1	2%	14%	13%	53%	2%		16%		1	0%	4%	0%	4%	1%	23%
	Entries	6%	7%	16%	48%	24%			Entries	6%	12%	20%	44%	42%			

Note: Highest productivity: quintile 5; lowest productivity: quintile 1

Source: Authors' calculations based on ABSEI.

Annex Table 3.A.4. Transition matrix for firm counts in Manufacturing

		Where they went to:						Where they came from:							
		2016 quintiles						2016 quintiles							
		5	4	3	2	1	Exits			5	4	3	2	1	Exits
2006 quintiles	5	50%	18%	2%	7%	7%	16%	2006 quintiles	5	49%	16%	4%	2%	5%	11%
	4	16%	27%	20%	16%	2%	20%		4	18%	27%	20%	5%	8%	15%
	3	4%	20%	24%	13%	16%	22%		3	2%	20%	24%	17%	14%	16%
	2	2%	4%	16%	27%	22%	29%		2	7%	16%	13%	29%	14%	21%
	1	4%	7%	11%	11%	18%	49%		1	7%	2%	16%	24%	22%	36%
	Entries	16%	16%	20%	18%	29%			Entries	18%	18%	22%	22%	38%	

Note: Highest productivity: quintile 5; lowest productivity: quintile 1

Source: Authors' calculations based on ABSEI.

Annex Table 3.A.5. Transition matrix for firm counts in Information and Communication

		Where they went to:						Where they came from:							
		2016 quintiles						2016 quintiles							
		5	4	3	2	1	Exits			5	4	3	2	1	Exits
2006 quintiles	5	67%	0%	14%	0%	10%	10%	2006 quintiles	5	50%	11%	10%	0%	3%	8%
	4	14%	24%	33%	5%	0%	24%		4	0%	29%	17%	10%	9%	15%
	3	14%	36%	14%	5%	14%	18%		3	11%	11%	24%	7%	6%	19%
	2	5%	14%	9%	27%	9%	36%		2	0%	4%	3%	23%	17%	27%
	1	0%	14%	9%	32%	14%	32%		1	7%	11%	0%	10%	6%	31%
	Entries	13%	15%	19%	22%	31%			Entries	32%	36%	45%	50%	60%	

Note: Highest productivity: quintile 5; lowest productivity: quintile 1

Source: Authors' calculations based on ABSEI.

Annex Table 3.A.6. Transition matrix for firm counts in Manufacture of computer, electronic and optical products

		Where they went to:						Where they came from:							
		2016 quintiles						2016 quintiles							
		5	4	3	2	1	Exits			5	4	3	2	1	Exits
2006 quintiles	5	60%	20%	0%	0%	0%	20%	2006 quintiles	5	60%	0%	0%	0%	0%	10%
	4	0%	40%	20%	0%	0%	40%		4	20%	40%	0%	0%	0%	20%
	3	0%	0%	17%	50%	17%	17%		3	0%	20%	17%	0%	50%	10%
	2	0%	0%	0%	20%	60%	20%		2	0%	0%	50%	20%	0%	10%
	1	0%	0%	17%	0%	0%	83%		1	0%	0%	17%	60%	0%	50%
	Entries	60%	20%	0%	0%	0%	20%		Entries	20%	40%	17%	20%	50%	

Note: Highest productivity: quintile 5; lowest productivity: quintile 1

Source: Authors' calculations based on ABSEI Table

Annex Table 3.A.7. Transition matrix for firm counts in Manufacture of basic pharmaceutical products and pharmaceutical preparations; manufacture of medical and dental instruments and supplies

		Where they went to:						Where they came from:							
		2016 quintiles						2016 quintiles							
		5	4	3	2	1	Exits			5	4	3	2	1	Exits
2006 quintiles	5	58%	14%	6%	0%	11%	7%	2006 quintiles	5	61%	17%	11%	0%	6%	6%
	4	17%	33%	17%	17%	6%	11%		4	16%	29%	24%	5%	0%	14%
	3	6%	22%	33%	11%	11%	17%		3	11%	14%	35%	14%	21%	21%
	2	0%	6%	17%	28%	39%	11%		2	0%	14%	12%	24%	21%	14%
	1	11%	0%	21%	21%	16%	32%		1	5%	5%	12%	33%	16%	43%
Entries		10%	25%	10%	25%	30%	0%	Entries		11%	24%	12%	24%	32%	

Note: Highest productivity: quintile 5; lowest productivity: quintile 1

Source: Authors' calculations based on ABSEI.

Annex Table 3.A.8. Transition matrix for firm counts in Computer programming, consultancy and related activities

		Where they went to:						Where they came from:							
		2016 quintiles						2016 quintiles							
		5	4	3	2	1	Exits			5	4	3	2	1	Exits
2006 quintiles	5	67%	0%	14%	0%	10%	10%	2006 quintiles	5	50%	11%	7%	0%	3%	8%
	4	14%	36%	14%	5%	14%	18%		4	0%	30%	22%	7%	9%	15%
	3	10%	29%	33%	5%	0%	24%		3	11%	11%	26%	11%	6%	19%
	2	0%	9%	14%	36%	9%	32%		2	0%	4%	4%	29%	18%	27%
	1	5%	14%	9%	27%	9%	36%		1	7%	11%	0%	7%	6%	31%
Entries		15%	15%	18%	21%	32%	0%	Entries		32%	33%	41%	46%	59%	

Note: Highest productivity: quintile 5; lowest productivity: quintile 1

Source: Authors' calculations based on ABSEI.

Notes

¹ To create the productivity distribution, firms are ordered by their (increasing) relative productivity and divided into groups with equal number of firms. The “median” firm is the one that sits at the very middle of the distribution or the 50th percentile. This implies that in a hypothetical sample of 100 firms, 50 (half) firms are less productive, and 50 are more productive than the median firm.

² The 95th percentile includes the group of top 5% performers (from 95 to 100), leaving the remaining 95% of firms at lower productivity levels.

³ National Competitiveness Council Productivity Statement 2018

⁴ The weights are based on annual hours of employment by firm. Details on the computation are provided in the Annex 3.A.

⁵ The changes shown at the macro level are due to the recording of depreciation of these large IP assets. Value added in micro data from financial statements would not reflect this.

⁶ Percentiles are groups of firms each containing 1% of the sample, ordered in increasing productivity. The 25th percentile, for example, is the cut-off value separating the lowest 25% of the sample from the remaining 75% of the sample.

⁷ One advantage of the use of relative productivity measures is that they do not depend on the output deflator. In any given year, all observations are being measured in the same euros. This means that one can look at how firms move in the rankings over time without worrying about the deflator, but growth rates cannot be calculated (Baily, 1992).

⁸ In addition, within manufacturing, three industries are also examined: “manufacture of computer, electronic and optical products”, “manufacture of basic pharmaceutical products and pharmaceutical preparations” combined with “medical and dental instruments and supplies”; and “computer programming, consultancy and related activities”. These industries were selected because they are significant in the Irish MNE sector in terms of both output, jobs, and number of firms. The results are shown in the annex to this chapter.

⁹ Quintiles are groups of firms each containing 20% of firms in the sample, ordered in increasing productivity. For example, the first quintile collects firms that have the lowest productivity, from the minimum value up to the observation to cover 20% of the sample. The fifth quintile is at the opposite end and thus collects the highest performers.

¹⁰ It should be noted that in this table, firms are not followed over time, so the values in the table represent the cut-off values to be recorded in that percentile.

¹¹ Entries and exits in this analysis refer to the appearance or absence of the firm in the Employment survey. While it is reasonable to assume that the vast majority of the instances of exits are ‘true’ exits from the market, there can be further, alternative instances: there could be a relocation of the activities of a firm to a different, but already existing, location (due to a merger, for example); the acquisition of the foreign firm by a domestic firm; the loss of the firm from the survey. Entries are less likely to have distortions.

¹² Annex 3.A also reports the results for the three manufacturing sub-industries that were analysed separately, as well as the transition matrices for the counts of firms, for all sectors and industries.

¹³ Care was taken to ensure that the exit was definitive and not a sporadic non-response year. This was done by identifying instances of missing employment followed by non-missing instances. Only the very definitive missing point was classified as an exit. There were no records with more than one consecutively missing data point.

4. Factors driving FDI spillovers in Ireland

The potential for spillovers of FDI on productivity and innovation in host economies, and particularly on domestic firms, is determined by a variety of factors. While spillovers are not directly measured in this chapter, it examines a few indicators to study factors often associated with the extent and potential for spillovers, including: the capabilities gap between domestic and foreign firms; the 'proximity' to foreign firms, such as through business linkages; and the movement of labour from foreign to domestic firms. The chapter also examines a specific type of labour mobility, namely the mobility of patent inventors, and associated FDI spillovers in Ireland.

4.1. Summary

The potential for spillovers of FDI on productivity and innovation in host economies, and particularly on domestic firms, is determined by a variety of factors. While spillovers are not directly measured in this chapter, a few indicators shed some light on the potential for productivity and innovation spillovers.¹ Research has shown that the extent of spillovers is affected by several factors, including: the capabilities gap between domestic and foreign firms; the 'proximity' to foreign firms, such as through business linkages; and the movement of labour from foreign to domestic firms.

The capabilities gap reflects the ability of domestic firms to adopt foreign technology and to benefit from FDI spillovers. There are significant productivity gaps between domestic and foreign firms, but the size of the gaps varies across sectors. Foreign firms in chemicals were ten times more productive than the few domestic firms in this industry, but only 1.5 times more productive than domestic firms in transport equipment manufacturing. Foreign firms are also more productive than domestic firms in all regions, with the largest gap in the South and East where foreign firms were five times more productive.

While capacity gaps as measured in this report are not precise enough to provide concrete guidance, the assessment shows in which sectors and regions gaps are higher and catching up efforts may be more warranted. Gaps are particularly high in some sectors and regions where domestic firms might be less present (e.g. chemicals) or where global frontier firms are responsible for disproportionate performance gaps and for productivity disparities even within the group of foreign affiliates (e.g. in manufacturing in the rest of South and East, or in information and communications in Dublin). As such, it might prove useful to target policy efforts to 'secondary' foreign affiliates with which domestic firms have lower capacity gaps, are more likely to engage in business linkages, and from which they are more likely to learn. Recent research shows that innovation spillovers on domestic firms from 'secondary' foreign firms are more likely to materialise than those from the global frontier innovators (Crescenzi, 2017). Finally, and importantly, one needs to recall that higher performance of foreign firms across sectors and regions directly and positively contributes to the Irish economy. This finding underpins a conclusion made in Chapter 2 that foreign firms are not only concentrated in higher productivity sectors but they are also outperforming domestic peers within sectors.

Business linkages can increase domestic firms' productivity by enabling domestic firms to reduce costs and innovate. Foreign affiliates' sourcing from domestic firms is discussed in Chapter 1 (Section 1.4) in the context of Ireland's integration in global value chains (GVCs). It shows that foreign affiliates source less domestically and their domestic sourcing benefits less domestic companies compared to foreign affiliates in the OECD overall. Similar results hold for other small open economies such as Luxembourg, Belgium and the Netherlands. Therefore, strengthening the capabilities of domestic firms is essential to enhance spillovers from FDI. A collaborative approach between IDA and other government agencies in charge of enterprise development, trade, innovation, and skills development is important to design and implement policies that support the development of domestic firms' capabilities and linkages.

Another important channel for spillovers between foreign and domestic firms is the movement of workers. When workers move from foreign firms to domestic firms, they can bring knowledge and skills that can enhance the domestic firms' performance. Between 2009 and 2015, more than one out of every four employees at foreign firms either moved to a domestic firm or became self-employed. In addition, more than one in three start up founders previously worked at a foreign firm. This movement of workers between foreign and domestic firms promotes knowledge spillovers.

The chapter includes a dedicated section on the role of FDI on patents, and relatedly on mobility of researchers associated with patents. Foreign MNEs are responsible for the bulk of patenting in Ireland: about 80% of all patents granted in Ireland were filed by foreign MNEs. Inventors in foreign affiliates are on average 20% more likely to file a patent than inventors in domestic firms, even though domestic firms,

in general, are more likely to engage in R&D activities. Beyond the important role of FDI for innovation outputs (in the form of patents) in Ireland, it is shown that Irish-based inventors are very likely to move corporate affiliations. One out of two inventors changed employer at least once over 2006-16 and they thereby enable knowledge spillovers across organisations. As most inventors are based in foreign MNEs, FDI spillovers related to inventor mobility also play an important role in Ireland.

4.2. Identifying domestic firms' productive capacities

Spillovers from MNEs to the host economy do not occur automatically and might not materialise at all (Smeets, 2008). An important factor determining whether FDI spillovers take place is the extent of capabilities of domestic firms – involving quality standards, human capital, etc. – to capture and absorb knowledge from foreign affiliates and interact with them through business linkages (see Chapter 1, Section 1.4). Absorptive capacities are often measured in terms of performance gaps between foreign and domestic firms, including with respect to differences in labour productivity, R&D activities and human capital development (Box 4.1).

Productivity premia of foreign firms are high in some sectors and regions

Building on the OECD's FDI Qualities Indicators (OECD, 2019), an estimate of the productivity gap between foreign firms and Irish companies is produced across sectors and regions. In most sectors, foreign firms have a productivity premium over Irish firms (Figure 4.1, Panel A). This productivity gap varies widely across sectors. For instance, in chemicals where few domestic firms operate, foreign firms are almost 10 times more productive than domestic firms, while in transport equipment manufacturing the gap is much lower. In both sectors, value added produced by domestic firms is relatively low compared to other sectors (indicated by dotted bars in the figure) and thus illustrates that the contribution of domestic firms and their capabilities are rather limited in these industries, potentially explaining productivity gaps with foreign firms.

This gap analysis also shows that foreign firms have higher productivity levels relative to Irish companies in all regions (Figure 4.1, Panel B). The gap is considerably higher in the rest of the South and East region where workers employed by foreign firms are almost five times as productive as those in Irish firms. This gap is still significant but lower in Dublin and the Border, Midland and Western region.

Box 4.1. Role of domestic firm's characteristics and absorptive capacity

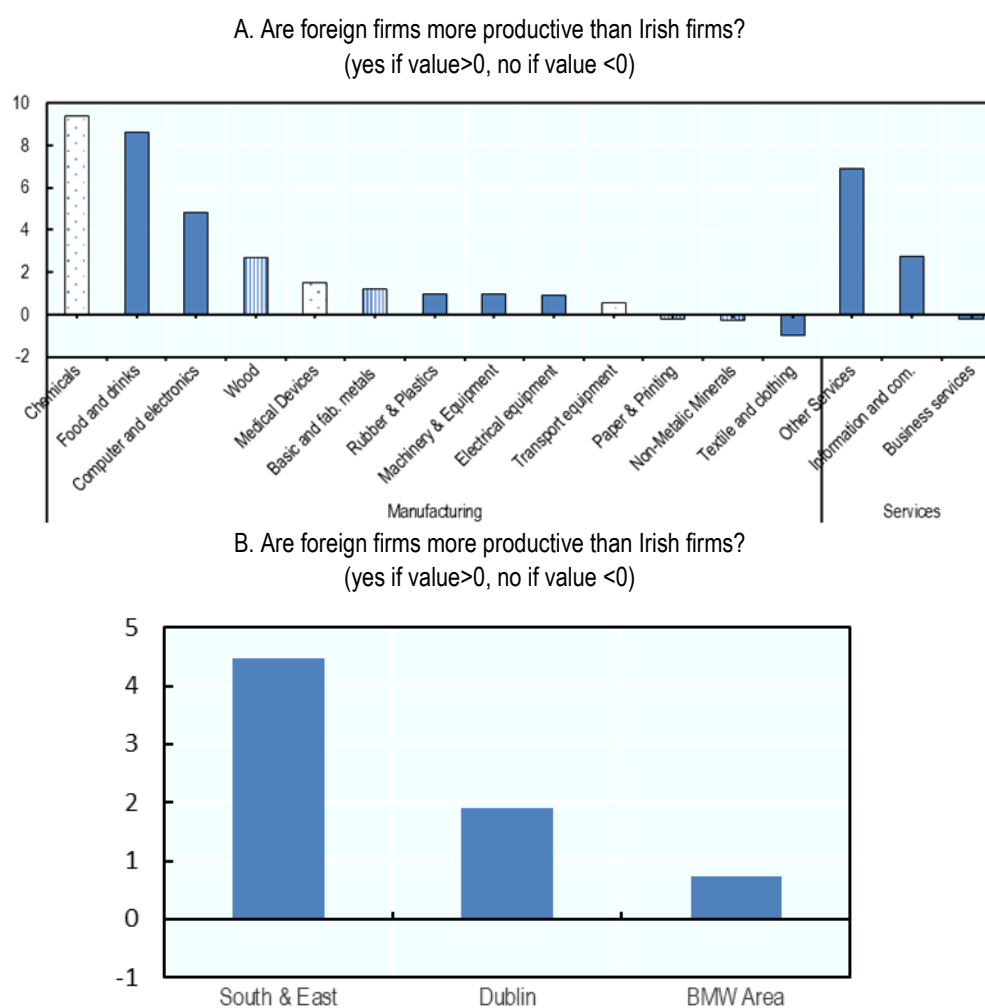
Several studies suggest that the transfer of technology is more effective when firms possess previously accumulated knowledge and innovative capacities. This set of knowledge and skills is identified by the literature as absorptive capacity. Specifically, absorptive capacity is the ability to utilise available information or knowledge that is transferred from other firms (Cohen and Levinthal, 1990). It involves the capacity to acquire, assimilate and exploit the value of the information and knowledge (Todorova and Durisin, 2007). Absorptive capacity is determined by firm-specific factors and is a function of the technology gap between domestic and foreign firms.

A number of studies show that FDI is more likely to generate positive productivity spillovers when the technology gap between foreign and domestic firms is not too large and domestic firms have enough absorptive capacity (Halpern and Murakozy, 2007; Hamida and Gugler, 2009; Abraham et al., 2010; Girma et al., 2006). The technology gap between foreign and domestic companies is often measured by the gap between their respective productivity levels. Several studies show that relatively high productivity is needed for domestic firms to reap FDI related spillovers (Keller and Yeaple, 2009, Nicolini and Resmini, 2006). However, other studies argue that less productive firms have the potential to benefit more from FDI spillovers (Castellani and Zanfei 2003).

The literature identifies a number of characteristics that seem to affect the absorptive capacity of domestic firms. Several studies highlight positive FDI spillovers in companies that invest in human capital and invest in research and development as opposed to companies that do not (Meyer and Sinani, 2005; Ben Hamida and Gugler, 2009; Girma et al., 2006). An additional determinant of absorptive capacity identified by the literature is company size (Knell and Rojec, 2007). Bigger firms tend to have higher level of absorptive capacity (Ornaghi, 2006, Tusha et al. 2017) and are also more innovative (Veugelers and Cassiman, 1999).

Another key factor which affects the ability of domestic firms to reap the benefits of foreign spillovers is their geographical distance from foreign affiliates. Domestic firms located near foreign firms are more likely to benefit from knowledge spillovers than other firms (Görg and Greenaway, 2004; Girma and Wakelin, 2002; Halpern and Murakozy, 2007; San Filippo and Seric, 2016). Geographical proximity is required to facilitate knowledge spillovers, especially as far as tacit knowledge is concerned (Jacobs, 1993).

Figure 4.1. Foreign firms have a productivity premium in most sectors and regions



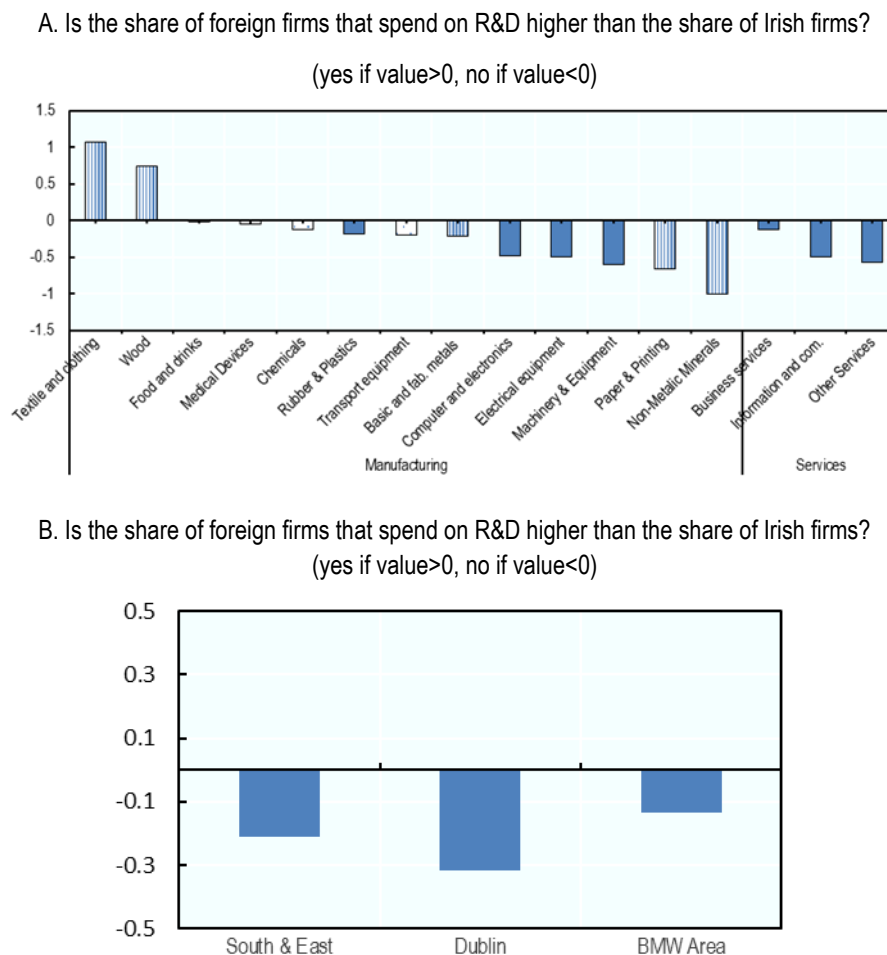
Note: The chart shows the proportional difference between average foreign productivity and average domestic productivity by sector and region. Data refer to 2016. In Panel A, bars with dots (stripes) indicate that domestic (foreign) value added in those sectors is below EUR 250 million. Less than 3 foreign companies operate in Food; Textile and clothing; and Paper and printing. Agriculture, mining, construction, energy, miscellaneous manufacturing and financial services are excluded. Labour productivity is defined as value added per employee.

Source: OECD elaboration based on IDA's Annual Employment Survey and Annual Business Survey.

Irish firms are more likely to invest in R&D than foreign affiliates...

The capacity gaps of Irish firms in terms of labour productivity stand in contrast with more extensive R&D activities of domestic firms compared to foreign affiliates across sectors and sub-national regions. In all sectors with the exception of textiles/clothing and wood, the share of Irish firms investing in R&D is higher compared to the share of foreign firms (Figure 4.2, Panel A). These differences are rather small in sectors like medical devices, electronic equipment, chemicals, business sectors, rubber and plastic, transport equipment, and basic metals, while they are more pronounced in electrical equipment, computer activities, financial services, and machinery and equipment. The share of Irish firms investing in R&D is also higher in a regional comparison (Figure 4.2, Panel B). The gap appears to be larger in Dublin and the rest of South and East region compared to the Border, Midland and Western region.

Figure 4.2. The share of Irish firms investing in R&D tends to be higher than that of foreign firms, both across sectors and regions



Note: The chart shows the proportional difference between the share of foreign firms that invest in R&D and the share of domestic firms by sector and region. Data refer to 2016. In Panel A, bars with dots (stripes) indicate that domestic (foreign) value added in those sectors is below EUR 250 million. Less than 3 foreign companies operate in Food; Textile and clothing; and Paper and printing. Agriculture, mining, construction, energy, miscellaneous manufacturing and financial services are excluded.

Source: OECD elaboration based on IDA's Annual Business Survey.

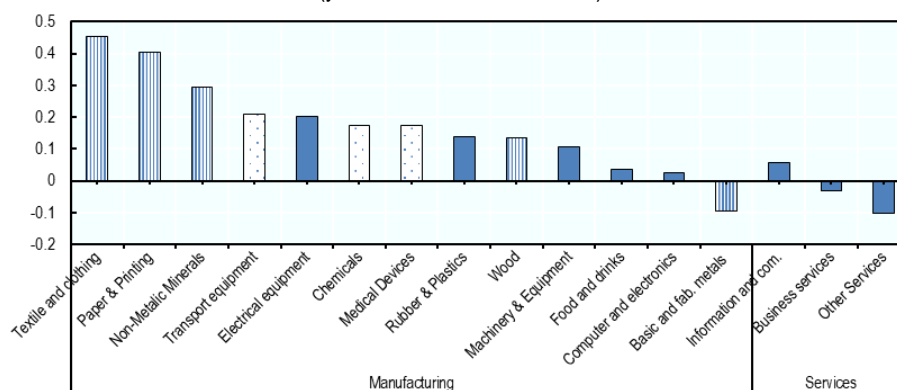
This finding is consistent with patenting dynamics in Ireland (further studied in Section 4.4). While foreign affiliates are responsible for the bulk of patents that are filed from firms operating in Ireland, foreign affiliates are not necessarily conducting R&D activities within Ireland. More than half of the individuals associated with Irish patents are based outside Ireland.

...but less likely to invest in training of workers

Research has also shown that firms that invest in human capital are more likely to benefit from FDI presence (Box 4.1). Comparing the likelihood of foreign firms to spend on training of workers with that of Irish firms provides another indicator on absorptive capacity. Foreign firms outperform Irish firms in almost every sector, except business services, basic and fabricated metals and other services (Figure 4.3, Panel A). The differences between foreign and domestic are however rather small across sectors; which also holds for the regional assessment (Figure 4.3, Panel B).

Figure 4.3. The share of foreign firms with expenditure in formal training is higher in almost every sector

A. Is the share of foreign firms with expenditure on training higher than the share of Irish firms?
(yes if value>0, no if value<0)



B. Is the share of foreign firms with expenditure on training higher than the share of Irish firms?
(yes if value>0, no if value<0)



Note: See Annex B in OECD (2019) for a description of the methodology. The chart shows the proportional difference between the share of foreign firms that invest in R&D and the share of domestic firms by sector and region. Data refer to 2016. In Panel A, bars with dots (stripes) indicate that domestic (foreign) value added in those sectors is below EUR 250 million. Less than 3 foreign companies operate in Food; Textile and clothing; and Paper and printing. Agriculture, mining, construction, energy, miscellaneous manufacturing and financial services are excluded.

Source: OECD elaboration based on IDA's Annual Business Survey.

While capacity gaps as measured in this report are not precise enough to provide concrete guidance, the assessment shows in which sectors and regions gaps are higher and catching up efforts may be more warranted. Gaps are particularly high in some sectors and regions where domestic firms might be less present (e.g. chemicals) or where global frontier firms are responsible for excessive performance gaps and for productivity disparities even within the group of foreign affiliates (e.g. in manufacturing in the rest of South and East, or in information and communications in Dublin).

It might prove useful to target policy efforts to 'secondary' foreign affiliates with which domestic firms have lower capacity gaps, are more likely to engage in business linkages, and from which they are more likely to learn. Recent research shows that innovation spillovers on domestic firms from 'secondary' foreign firms are more likely to materialise than those from the global frontier innovators (Crescenzi, 2017).

Finally, and importantly, one needs to recall that higher performance of foreign firms across sectors and regions directly and positively contributes to the Irish economy. This finding underpins a conclusion made

in Chapter 2 that foreign firms are not only concentrated in higher productivity sectors but they are also outperforming domestic peers within sectors.

Labour mobility from foreign MNEs to Irish companies

Another important channel for spillovers between foreign and domestic firms is the movement of workers. When workers move from foreign firms to domestic firms, they can bring knowledge and skills that can enhance the domestic firms' performance. Workers at foreign firms can also use the knowledge and skills they have gained to found new businesses.

Data from the Irish Revenue Commissioners indicates that movement of labour from foreign MNEs to domestic companies can be significant. The Irish Revenue Commissioners tracked 426 000 employments from foreign MNEs in 2009 over the subsequent six years. They found that 247 000, or 58%, of these workers remained employed by foreign MNEs in 2015, with three-quarters remaining with the same employer. However, there was significant movement to domestic firms as 81 000, or 19%, were employed by a domestic company.

The employees of foreign MNEs can also support the creation of new businesses. The Irish Revenue Commissioners' study found that more than 23 700, or 6%, of these employees had become self-employed by 2015, and a further 5 900, or 1%, were registered as proprietary directors (Irish Revenue Commissioners, 2018). Enterprise Ireland confirms the potential for employees of MNEs to start new businesses; they estimated that 37% of the high potential start-up founders that they supported between 2002 and 2017 had previously worked at an MNE.²

4.3. Role of FDI on patenting and inventor mobility

This section builds on the gap analysis and labour mobility analysis discussed above by focusing on one specific type of potential FDI spillover on the Irish economy; namely technology innovation in the form of patents. This is done both by comparing foreign and Irish firms in terms of patenting outputs, but also, by examining (labour) mobility of inventors which may enhance spillover effects. The analysis is based on the PATSTAT database. PATSTAT is administered by the European Patent Office (EPO) and provides detailed information on patents granted by various patent offices around the world.³

Firms that are operating in Ireland and engaging in R&D can apply for patents either in Ireland at the Irish Patent Office (IPO), or elsewhere in the world to protect their intellectual property in respective markets. Typically, firms would patent their inventions in large markets for selling, such as in the United States (US Patent Trademark Office, USPTO) and in the European Union (European Patent Office, EPO): from 2006 to 2016, 60% of all patents granted to firms in Ireland (Irish-owned and foreign-owned) were applied at USPTO, 30% at EPO and just 10% at IPO.⁴ The FDI stock in Ireland is dominated by investments from the United States and to some extent the United Kingdom (see Chapter 1). Given the origins of FDI and assuming that foreign affiliates remain connected with their home countries and therefore seek protection of intellectual property in those markets, this patent distribution is not surprising.

Each patent is assigned to a World Intellectual Property Organization (WIPO) technological class. WIPO uses 35 fields of technologies. Table 4.1 reports shares of patents in the top 10 technological classes that are applied to IPO, USPTO and EPO, respectively. It reveals significant differences as to what technologies are relatively more often protected at a given patent offices. Computer technologies, medical technologies and pharmaceuticals are classes that are often protected in all the three patent offices.

Table 4.1. Depending on technology type, intellectual property is protected elsewhere

Top 10 technologies protected by IPO, USPTO, EPO: Share of total patents over 2006-16

IPO	%	USPTO	%	EPO	%
Civil engineering	14.32	Computer technology	22.8	Medical technology	16.34
Other special machines	10.68	Medical technology	14.6	Computer technology	10.26
Furniture, games	7.03	Pharmaceuticals	10.57	Pharmaceuticals	9.79
Medical technology	6.86	IT methods for management	5.5	Digital communication	7.18
Thermal processes and apparatus	5.25	Digital communication	5.36	Organic fine chemistry	5.47
Pharmaceuticals	5	Textile and paper machines	3.92	Biotechnology	4.74
Computer technology	4.58	Audio-visual technology	3.7	IT methods for management	3.83
Transport	4.24	Organic fine chemistry	3.53	Electrical machinery, apparatus, energy	3.51
Handling	3.56	Biotechnology	3.42	Measurement	3.14
Chemical engineering	3.31	Telecommunications	2.82	Civil engineering	2.47
Other	35.17	Other	23.78	Other	33.27

Source: OECD elaboration based on PATSTAT.

Foreign MNEs are responsible for the bulk of patenting in Ireland

PATSTAT does not provide information on the origin of firms that apply for patents. Using Bloomberg, company websites and general internet sources, origin countries of patent applicants in Ireland are identified and classified into foreign MNEs and domestic Irish firms. This exercise reveals that 80% of all patents granted to firms in Ireland are filed by foreign MNEs.⁵

In terms of technological distribution, the data reveal that foreign MNEs and domestic firms in Ireland are engaging in patenting in broadly the same technological classes. Among the top 10 technological classes for which patents are applied most often by Irish and non-Irish firms, 7 technological classes are overlapping; namely, other special machines, medical technology, pharmaceuticals, civil engineering, thermal processes and apparatus, food chemistry, and electrical machinery, apparatus, energy (Table 4.2). This illustrates that there are potential synergies in Irish-based R&D operations between foreign affiliates and domestic firms.

Table 4.2. Irish firms are patenting in similar technology classes as foreign MNEs

Irish	%	Foreign MNEs	%
Other special machines	10.92	Civil engineering	14.31
Medical technology	8.4	Medical technology	10.41
Pharmaceuticals	8.4	Computer technology	7.06
Furniture, games	7.56	Other special machines	6.88
Civil engineering	6.72	Pharmaceuticals	6.32
Thermal processes and apparatus	5.88	Thermal processes and apparatus	6.13
Food chemistry	5.04	Measurement	5.2
Control	4.2	Chemical engineering	4.46
Electrical machinery, apparatus, energy	4.2	Food chemistry	3.35
Environmental technology	4.2	Electrical machinery, apparatus, energy	2.6

Source: OECD elaboration based on PATSTAT.

The important role of FDI for patenting activity in Ireland is further illustrated by examining the correlation between foreign MNE activity and patenting across sectors over the period 2006-16. Foreign MNE activity is defined by the number of partnerships involving foreign-owned firms in Ireland, as well as, alternatively, by the number of cross-border mergers & acquisitions (M&A) deals in Ireland.⁶ The results indicate strong and statistically significant positive correlation.⁷

Inventors in foreign MNEs tend to be more productive

Human capital is a critical asset to firms to gain competitive advantage (Coff, 1997). Individuals have proven to be fundamental in knowledge-intensive industries. Economic and organisational literature suggest that knowledge resides in individuals and combining knowledge of individuals enables innovative activities (Grant, 1996; Kogut and Zander, 1992). Specific attention to the activities of corporate inventors (i.e. individuals involved in patenting activities) is critical in this regard (see, for example, Agarwal et al. 2007; Almeida and Kogut, 1999).

Table 4.3 shows the distribution of inventors by the number of patents filed during 2006-16, both for inventors working in Irish-owned firms and those working in foreign affiliates. Results show that, considering the patents applied in IPO from 2006 to 2016, inventors in foreign MNEs produced on average 1.7 patents while those in Irish firms produced 1.4 patents. This suggests that inventors in foreign affiliates are on average 20% more productive. In fact, inventors in Irish firms are more likely to be associated with one-patent productivity (76% of all inventors) compared to those in foreign affiliates (65% of all inventors).

Table 4.3. Inventors working for foreign MNEs in Ireland are more productive than those in Irish firms

Inventor productivity in terms of patenting over 2006-16

Irish firms		Foreign MNEs	
# patent	% of inventors	# patent	% of inventors
1	75.9	1	65.56
2	15.46	2	13.89
3	4.12	3	12.22
4	2.32	4	3.89
>=5	2.2	>=5	4.45

Source: OECD elaboration based on PATSTAT.

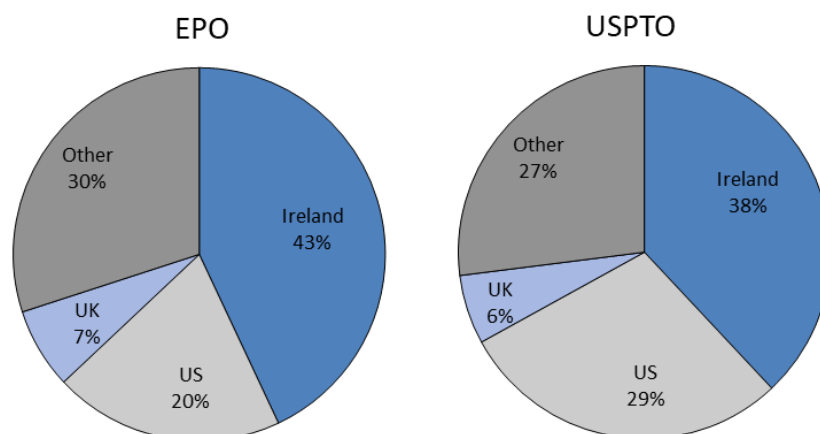
More than half of the inventors are based outside Ireland

It is also important to examine whether inventors associated with patents filed by firms in Ireland are themselves based in Ireland. Analysing patents applied to EPO and USPTO by Ireland-based firms reveals that only 43% of the inventors are based in Ireland for EPO applications; only 38% for USPTO applications (Figure 4.4). The United States is the most frequent foreign location of inventors associated with patents filed by firms in Ireland (20% for EPO and 29% for USPTO), and United Kingdom the second most important location (7% and 6%, respectively). These three nationalities cover the location of approximately 3 out of 4 inventors associated to patents applied in both EPO and USPTO.

It would be important to investigate further what is driving relatively low inventor location in Ireland for patents filed from Irish-based firms. It could be associated with limited availability of R&D skills in Ireland. Efforts to strengthen the supply of R&D skills and enhance incentives for firms to locate R&D staff in Ireland could be envisaged.

Figure 4.4. Most inventors are based outside Ireland

Inventor location for patents filed by Irish-based firms over 2006-16: EPO and USPTO



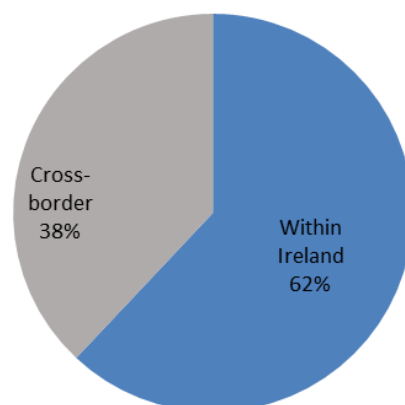
Source: OECD elaboration based on PATSTAT.

About half of inventors are moving organisations at least once

To what extent inventors move organisations during their career? Inventor mobility may encourage the transfer of knowledge and technology across firms. All inventors that have at least two patents and have been associated at least once with a patent while being based in Ireland over the period 2006-16 are investigated.⁸ The mobility rate is 48% among Irish based inventors. This means that one out of two inventors changed employer at least once over 2006-16. Among those inventors that moved organisations, 62% move within Ireland while 38% involved mobility across national borders; i.e. they included at least one move from/to another country than Ireland (Figure 4.5).

Figure 4.5. About 60% of inventors that are changing employer remain in Ireland

Inventor mobility within Ireland and across borders



Source: OECD elaboration based on PATSTAT.

Cross-border mobility of inventors (38% of all moves) can be decomposed further into the following patterns:

- Pattern 1: moving from Ireland to another country (13%)
- Pattern 2: moving to Ireland from another country (8%)
- Pattern 3: moving to Ireland, stay in Ireland, then move to another country (11%)
- Pattern 4: moving from Ireland to another country, then move back to Ireland (6%)

Exploring the source and recipient countries of the mobility events reveals that the United Kingdom is both the primary recipient for Pattern 1 (63%) and the primary source for Pattern 2 (52%), followed by United States with 24% and 31% of the mobility instances, respectively. Similar results are found also for Pattern 3. For Pattern 4, the United States is the primary recipient of temporary moves from and back to Ireland (51%), followed by the United Kingdom (34%).

The results point to a fairly dynamic inventor environment in Ireland: The majority of inventors move within Ireland; much of the cross-border mobility actually involves mobility to Ireland. This finding is encouraging and could be a trigger for efforts to attract additional inventors.

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Annex 4.A. Methodology and data

Chapter 4 studies performance gaps between foreign and domestic firms and the mobility of patent inventors and associated FDI spillovers in Ireland. It combines several data sources, namely IDA's Annual Business Survey and Annual Employment Survey and PATSAT. Specifically, the chapter employs the following variables from each source:

- Value added, share of firms investing in R&D, share of firms with expenditure on training by sector, region and firm type from the Annual Business Survey.
- Employment by sector, region and firm type from IDA's Annual Employment Survey.
- Number of patents by technology class and patent office; number of inventors by technology class and location from PATSTAT

Indicators in Figures 4.1, 4.2, and 4.3

Indicators in Figures 4.1, 4.2 and 4.3 measure how foreign firms perform relative to domestic firms for a given outcome (e.g. productivity). They take positive value if foreign firms have higher outcomes than domestic firms and negative value if foreign firms have lower outcomes, on average. The indicators are constructed as the proportional difference between average outcomes of foreign firms and average outcome of domestic firms:

$$Type\ 1 = (\bar{Y}_F - \bar{Y}_D) / \bar{Y}_D$$

where \bar{Y}_F is the average outcome of foreign firms and \bar{Y}_D is the average outcome of domestic firms.

Notes

¹ The identification of spillovers is often not possible as it requires large firm-level datasets, both on foreign and domestic firms, which have not been available for the purpose of this study. These datasets would further require information on supply chain and other linkages of domestic firms with foreign affiliates as well as information to disentangle how domestic firms, even without explicit FDI linkages, are affected by the presence of foreign affiliates.

² High potential startups are internationally focused companies with the potential to employ at least 10 people and generate at least €1 million in revenues within 3 years of starting.

³ This section is based on a background note by Francesco Di Lorenzo from Copenhagen Business School. Technical details are available upon request.

⁴ The total number of patents is the sum of patents applied to USPTO, EPO and IPO. Firms in Ireland may also apply to patent offices elsewhere in the world.

⁵ This number is based on the total number of patents granted by IPO. The distribution of patents owned by foreign MNEs and domestic firms in Ireland is likely to be similarly skewed towards foreign MNEs if one considered patents from USPTO and EPO.

⁶ Data on partnerships and M&A deals are taken from Thomson Reuters.

⁷ Correlation coefficients are above 0.65 in both estimates and statistically significant at the 95% level.

⁸ This analysis is based on the methodology developed and previously applied in Di Lorenzo and Almeida (2017); Hoisl, (2007); and Palomeras and Melero, (2010).

5. Key conclusions and policy implications

This study of the impact of foreign investment in Ireland between 2006 and 2016 has been finalised in the midst of the COVID-19 pandemic. The study shows that foreign investment played a key role in assisting Ireland to recover from another event with similarly negative consequences for the global economy – the financial crisis and subsequent “great recession” of 2007-2009.

Despite the fact that the report was prepared before the COVID-19 crisis, observing trends in 2020, the foreign-owned sector in Ireland has demonstrated a remarkable resilience in the face of the pandemic and all the indications are that the portfolio of foreign investors managed by IDA Ireland will register positive net employment growth for 2020. This growth will be lower than that experienced in 2019 but will still exceed the expectations of many knowledgeable observers who were expecting a net loss or at best a neutral outcome. Some of the reasons for this performance undoubtedly relate to various aspects of the character, structure and performance of the foreign sector in Ireland that have been analysed in this report.

This study has highlighted that foreign investment in Ireland is deeply integrated into Global Value Chains (GVCs) and is a major contributor to trade, productivity, innovation, value-added and employment. Multinational Enterprises (MNEs) operating in Ireland are one of the principal reasons why the country is among the most globalised and export-oriented economies in the world. That said, many of the linkages between MNEs operating in Ireland and both import and export markets during the study period are strongly Anglo-American. The bilateral trade of the foreign sector is quite concentrated.

The analysis also makes clear that the MNEs operating in Ireland are a heterogeneous group comprising a sub-group of “frontier firms” whose performance across a range of variables is a multiple of that of the median foreign affiliate. The foreign sector is an important source of knowledge and other spillovers to the domestic economy, while the links between MNEs and domestic firms are in line with the experience of other small open economies. Significantly, entrepreneurs who once worked in the foreign-owned sector are an important source of new firm formation in the domestic SME sector. Limitations on the “absorptive capacity” of domestic enterprises, the very high export orientation of MNEs and the practical consequences of participation in global value chains arguably acts as a constraint on further “embeddedness” within the domestic economy.

While the study identifies and acknowledges the numerous benefits of foreign investment in Ireland, it also highlights the presence of a degree of “concentration risk”. Many of the benefits of foreign investment are derived from a small number of sectors especially Information and Communications and Biopharmaceuticals and a small number of home countries particularly the United States. In this context, IDA Ireland should continue its commitment to portfolio diversification in terms of the sectoral and geographical sources of future investment. In addition, concentration risk can also be diluted by continuing to expand and broaden the number and types of foreign firms establishing in the jurisdiction, undertaking R&D, staff training, building more linkages in the domestic economy and moving up the productivity performance ladder. In this way, the multinational sector will be able to maximise its contribution to Ireland’s recovery from the negative impact of the pandemic and play a role not dissimilar to the one it performed more than a decade ago. Continuing and strengthening a collaborative approach between IDA Ireland and

other government agencies in charge of enterprise development, trade, innovation, and skills development is important to design and implement policies that support the development of domestic firms' capabilities and linkages.

