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Abbreviations

ASI	Annual Services Inquiry
BEC	Broad Economic Classification
BESES	Broad Economy Sales and Export Statistics
CIP	Census of Industrial Production
CSO	Central Statistics Office
EU	European Union
FDI	Foreign Direct Investment
GB	Great Britain
NI	Northern Ireland
NISRA	Northern Ireland Statistics and Research Agency
NTB	Non-Tariff Barrier
ONS	Office of National Statistics
REU	Rest of European Union (i.e. excluding UK for Irish trade statistics or excluding Ireland for NI/UK statistics)
ROW	Rest of World
UK	United Kingdom
UN	United Nations
WTO	World Trade Organisation

Executive Summary

This report examines how the capacity of firms to absorb shocks can be assessed using detailed firm-level patterns of risk exposure across Ireland and Northern Ireland. Although we cannot make predictions on the response to cost or demand shifts for any individual firm, we can provide a broad sense of exposures by looking at combinations of some of the main measurable factors that determine firm performance and flexibility. Combining our shock absorption capacity indicators with information on cross-border and EU trade flows provides insight into how dispersed across firms a post-Brexit shock to trade costs might be. It also reveals the extent to which this might be clustered in firms that have varying abilities to deal with changes in their external environment.

The risk assessment method we adopt is a form of heat-map, which indicates the distribution of firms along two different dimensions, those performing strongly, and those that are most likely to be vulnerable to any negative shock to their demand or cost base. The dimensions used to categorise the firms are sales growth and profit margin. Firms are ranked by performance against these two factors from lowest to highest and divided into five groups according to their potential ability to absorb shocks to demand or costs. The five groups are:

Grp	Profit Margin + Growth Performance	Risk Matrix Group
1	Lowest margin / Lowest growth	Lowest Absorptive Capacity / Highest Risk
2	Medium-low / Medium-low	Low Absorptive Capacity / High Risk
3	Medium / Medium growth	Medium Absorptive Capacity / Medium Risk
4	Medium-high / Medium-high	High Absorptive Capacity / Low Risk
5	Highest margin / Highest growth	Highest Absorptive Capacity / Lowest Risk

In the discussion which follows, firms in high risk groups are considered to be groups 1 and 2 from the summary graphic above, with group 1 being the highest risk group. When noting firms in *all risk groups,* we consider groups 1 to 3 combined. Lower risk firms are groups 4 and 5, with 5 being the lowest risk group.

The key findings of this report include:

PRODUCTIVITY

- Goods firms tend to have higher levels of productivity than services firms and, amongst Irish firms, those which are foreign-owned show a much higher degree of productivity compared to domestic firms.
- Export participation is found to be a strong indicator of higher productivity for all firms in Northern Ireland and for services firms in Ireland.
- Irish goods firms have a productivity distribution similar to those in Northern Ireland when domestically-owned firms are considered. Foreign multinationals located in Ireland have considerably higher productivity.
- Firms exporting more broadly are systematically more productive.

See Sections 2.1 to 2.3

RISK BY FIRM SIZE

- A risk profile of firms based on profit margins and sales growth performance shows smaller firms tend to be more exposed to shocks.
- We find that the share of firms in the highest risk category (lowest absorptive capacity) is greater than the share of employment, meaning that smaller firms are more represented in this category. This pattern is found for both goods and services firms in Northern Ireland and Ireland.

See Sections 3.3 and 3.4

GOODS FIRMS SHOCK ABSORPTION CAPACITY

- 35.5% of Irish goods firms are in the lowest risk group, i.e. with the highest absorptive capacity, compared to 26.5% for Northern Irish goods firms.
- Conversely, 44.6% of Irish goods firms and 50.7% of Northern Irish goods firms are in an at-risk group.
- 5.5% of Northern Irish goods firms are in the highest risk category, with 7.4% of Irish goods firms in this highest risk group.

See Section 3.3

SERVICES FIRMS SHOCK ABSORPTION CAPACITY

- The proportion of services firms in at-risk groups is similar for Ireland and Northern Ireland (at 47.2% and 46.1% respectively).
- The share of Northern Irish service firms falling into the highest risk category is reasonably similar to that of goods firms, at 5.8%, although they represent a smaller share of the services employment at 3.6%. This suggests that in services, even more so than in goods, smaller firms are most exposed to shocks.
- Irish services firms show a slightly lower percentage of firms (4.4%) in the most at-risk category, accounting for 2.6% of employment in the sector.

See Section 3.4

CROSS BORDER TRADE SHOCK ABSORPTION CAPACITY

- North-South trade is quite dispersed across almost all levels of shock absorption capacity. This implies that any disruption to this trade flow would be widely felt across firms.
- 48.8% of Irish goods exports to the UK come from firms in the lowest risk group, compared to 14.1% of exports from Northern Ireland goods firms to Ireland.
- 30.3% of Irish goods exports to the UK are in overall at-risk categories (groups 1-3), compared to 62% of exports from Northern Ireland goods firms to Ireland.
- 26.5% of Northern Irish services exports to Ireland are accounted for by firms in the higher risk categories and a further 48.5% are carried out by firms in the medium-risk group[1].
- 72.8% of Northern Ireland's goods imports from Ireland are undertaken by firms in at-risk categories with 44.9% by firms in the higher risk categories, compared to 29% of Irish goods imports from the UK in overall at-risk categories (with 12.7% in higher risk categories). This suggests that any equivalent-sized shock would have more dispersed effects in Northern Ireland, with a greater share of firms exposed relative to Ireland.

See Section 4.3

EAST WEST TRADE SHOCK ABSORPTION CAPACITY

- Trade between Northern Ireland and Great Britain, and between Ireland and the UK is relatively highly concentrated in the lower risk groups of firms.
- 7.8% of Northern Ireland goods export sales to GB and 16.3% of imports are undertaken by firms in the higher risk categories. The data suggests that trade with Britain tends to be concentrated in firms with higher risk absorption, whereas cross-border trade is carried out across firms of all risk categories with a higher percentage in at-risk categories.
- For Irish goods firms, there is greater concentration of both exports and imports amongst firms with greater capacity to absorb shocks, with 48.8% of exports to the UK accounted for by the least at-risk group and 45.4% of imports accounted for by this highest capacity group.
- 12.7% of imports from the UK to Ireland are in the highest risk categories.

See Section 4.3

EU TRADE SHOCK ABSORPTION CAPACITY

- For NI goods firms, 43% of exports to the rest of the EU are accounted for by firms within the higher shock absorption capacity (lowest risk) groups. Firms in the lower risk absorption capacity (highest risk) groups, on the other hand, account for 10.9% of the exports of goods firms to the rest of the EU, with a total of 57% of exports to the rest of the EU being undertaken by firms in overall at-risk categories.
- The share of exports to the EU generated by NI services firms with a low-risk absorption capacity is greater, with 26.4% coming from higher-risk firms and 10.1% of exports coming from the lowest performance group. Overall, a total of 68.1% of services exporters to the EU are in an at-risk category.

See Section 4.4

Conclusions

The findings of the report imply that small, largely locally orientated firms with some cross-border trade are likely to be most exposed to any changes in trade costs.

[1]Equivalent service exports data for Ireland to Northern Ireland trade not available.

1. Introduction

The capacity of firms to adjust to an external shock (such as Brexit, but also to other sources of changes in demand or exchange rate fluctuations) will depend in part on the size of the shock to the overall economy. It will also depend on the level of exposure of the individual firm to the shock and on its capacity to absorb changes to its demand or cost base. Although the ability of any individual firm to react and adapt to shocks cannot be measured with certainty, an examination of the distributions of current firm performance can inform an assessment of the exposure of the economy to shocks of varying magnitudes and how dispersed they might be across firms.

This topic therefore examines some important determinants that underpin capacity to withstand shocks at the firm level. In doing this, we draw on international evidence on characteristics that have been shown to drive firm resilience in the face of external shocks. We then use observable firm characteristics to generate a risk exposure assessment for firms in Northern Ireland and in Ireland. As a fall in export demand in the context of Brexit is currently the most pressing potential source of an external shock to these firms, we look closely at how trade flows (across the border and with the UK and the rest of the EU) are dispersed across firms at different points in the shock absorption matrix.

This exploration of resilience to shocks at the firm level is based on detailed firm-level survey data from the Broad Economy Sales and Export Survey for Northern Ireland firms and the Census of Industrial Production and Annual Services Inquiry for firms in the Republic of Ireland.

The analysis of shock absorption capacity in this report builds on a series of work published over the past year by InterTradeIreland on enterprises and cross-border trade which, taken together, provide a comprehensive picture of participation in exporting at the firm level, the degree of cross-border integration of supply chains and the potential disruption to these established patterns that may be posed by changes to the cross-border trading environment following Brexit.[2]

This report is laid out as follows:

- Section 2 examines the distribution and dispersion of productivity across firms in Ireland and Northern Ireland. This helps us to assess the extent of low-productivity firms which would be particularly vulnerable to external shocks, and also, to examine how export participation affects the positioning of the productivity distribution, showing how exporting is linked to better overall performance.
- Section 3 develops a risk profile of firms in Ireland and Northern Ireland to represent the potential exposure of firms to differing degrees of economic shock. This is done by creating a risk matrix based on a combination of the current profit margin and sales growth performance of the firm.
- Section 4 examines how cross-border and EU trade are distributed across the risk categories developed in Section 3 in order to assess how wide-ranging a post-Brexit shock to trade costs might be.
- Section 5 summarises the key findings of the report and concludes.

[2] See links in the References section to InterTradeIreland (2017) for analysis of the impact of WTO-tariff scenarios on cross-border trade, InterTradeIreland (2018a) for measures of cross-border supply linkages and InterTradeIreland (2018b) for comparisons of export participation rates across firms and determinants of export market patterns.

2. Productivity Patterns

This section provides evidence on the distribution of productivity across firms in Northern Ireland and Ireland.

In the related InterTradeIreland (2018) report on firm participation in export activity, undertaken as part of this broad research programme, a performance gap between exporters and non-exporters was identified. This research found that *on average* exporters tended to be larger, sell more and also have higher output per worker. It also found that the extent of the exporting activity mattered, with firms selling into neighbouring markets (UK for Irish firms and Ireland for Northern Irish firms) having higher performance relative to firms with domestic sales, but also that the performance gap relative to non-exporters was larger again when firms export to a broader international market. This section looks beyond these average differences in performance by comparing across the entire distribution to look at how productivity differences manifest themselves at different points.

The section begins with a review of the international evidence on the importance of productivity at the firm-level for aggregate growth and the increasing concern about the performance gaps emerging between extremely high-productivity 'frontier' firms and the rest of the firm population. We then use detailed firm survey data from Northern Ireland and Ireland to generate productivity distributions and examine the differences between services and manufacturing firms and the role played by ownership for firms in Ireland. The final sub-section builds on the previous report in this series by examining differences across the full productivity distribution dependent on firm export participation.

2.1 EVIDENCE ON FIRM AND AGGREGATE PRODUCTIVITY DEVELOPMENTS

Productivity growth is the critical driver of long-run living standards across time and countries. Haldane (2017) estimates that almost all of the twenty-fold increase in living standards in the past 150 years resulted from increases in productivity, with increases in capital and labour capacity playing a very minor role. Since the financial crisis, however, productivity growth rates in many developed countries - most notably in the EU and UK - have remained relatively stagnant compared to their previous historical trends. This has created a raft of interest in what might be driving this 'productivity puzzle', with demographic trends of ageing populations and slowdowns in innovation rates identified as potential factors. Looking more specifically at developments within firms, Haldane points out there has always been a set of highly productive 'frontier' firms at one end of the productivity distribution, followed by the greater mass of firms at a lower level of efficiency and finally, a set of particularly low-productivity or 'laggard' firms at the other end of the distribution.

A striking feature of the aggregate productivity slowdown is that there does not appear to have been any reduction in growth at the higher end of the distribution, but rather, a widening of the gap between the most and least efficient firms. This suggests that a slowdown in diffusion of technologies across firms is an important factor underlying the country-level patterns. In a similar vein, Riley, Bondibene and Young (2014) looked at productivity dynamics amongst British businesses following the financial crisis and found that productivity slowdowns within firms played a significant role in the aggregate reduction in productivity growth. Some changes in growth rates of productivity between firms could be explained by credit access problems, particularly for smaller businesses in sectors traditionally dependent on banks for external financing requirements.

The Office of National Statistics (2017) investigated this issue of laggard firms by examining the features of firms in the bottom 10% of the labour productivity distribution in Great Britain between 2003 and 2015[3]. For the overall distribution of productivity, they found a broad dispersion in line with international evidence. In all years, there was a concentration of firms within a range of gross value added per worker of between £5,000 and £25,000. There was then a long 'tail' of smaller numbers of firms as the measure of productivity increased.

The ONS found that firms in the lower part of the productivity distribution were overwhelmingly small, with 90% of the laggard firms (i.e. those in the bottom 10% of productivity) employing fewer than ten people. A large share of the firms (40%) were younger than five years, although the share of young firms in the lower end of the productivity distribution was found to be declining over the period examined. Sector was proven to be an important feature with services firms, particularly those in distribution, hotels and restaurants, making up almost one-third of the lowest productivity set[4]. The bottom 10% of productivity frequently involved firms reporting negative values of gross value added per worker. When this occurred, the ONS found that these firms were significantly more likely to exit in the following years than other firms.

A recent, extremely detailed examination of firm productivity in Ireland was undertaken by O'Connor, Papa and Rehill (2018). They used a methodology developed by the OECD to estimate multi-factor productivity at the firm-level, which incorporates the amount of capital used by the firm to give a more nuanced picture of differences across firms than available from comparisons of output per worker. As capital stock information is not collected through any of the firm surveys in Ireland, they imputed an initial capital value for each firm using a perpetual inventory method based on the information available on firm investment rates and sector depreciation estimates.

Their focus was on the dynamics of productivity growth in Ireland in the pre and post-crisis years and they found that the productivity gap between the most productive firms operating at the most efficient frontier and the rest of the firm population widened during this period. As highlighted in the work by Haldane (2017), productivity distributions tend to always have a bulk of firms operating at a similar level of productivity and then a tail of small numbers of very high performers. This pattern is also found in the Irish data. O'Connor et al found that this pattern of dispersion grew further during the 2006 to 2014 period. They also discovered that these gaps between frontier firms and the rest of the population were present even when looking within narrower sectors of manufacturing or services (such as pharmaceuticals), showing that sector differences were less important than differences between firms operating in the same sectors.

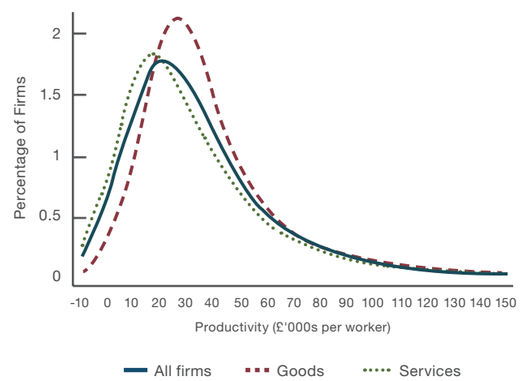
Looking within services firms, Minondo (2011) found that although few services firms participate in exporting, those that do export are considerably more productive than non-exporters along all points of the distribution. They also found that the more broadly a firm exports (comparing those selling locally only, those selling outside the region to other parts of Spain, to the EU and to the rest of the world), the more productivity shifts upwards.

2.2 PRODUCTIVITY DISTRIBUTIONS BY SECTOR AND OWNERSHIP

We look first at the productivity distribution of firms in Northern Ireland, measuring productivity as gross value added (turnover minus costs of inputs and wages) per employee. This is calculated at the firm-level using the Broad Economy Sales and Export Survey (BESES) collected by the Northern Ireland Statistics and Research Agency (NISRA). The data presented in Figure 1 shows the productivity distribution for all firms and also separately for services and goods firms. For each level of labour productivity along the horizontal axis, the corresponding percentage of firms can be read from the vertical axis.

The overall shape of the distribution is very much in keeping with those of the ONS-equivalent work for Great Britain (2017), with a large share of firms concentrated in the mid-range of the distribution, a small tail of laggard firms with negative values gross of value added per worker and a longer tail to the right of the graph representing firms with very high levels of productivity. Although the broad shape of the distribution is similar when we separate goods and services firms, there is a very noticeable gap in the positioning of the distributions. The goods firms have higher levels of productivity (the distribution is more to the right) and also have a greater concentrations of firms around the central peak value of approximately £30,000 gross value added per worker. The services peak is lower, with values more dispersed around it.

FIGURE 1: DISTRIBUTION OF PRODUCTIVITY BY BROAD SECTOR: NORTHERN IRELAND



Sources: Author's calculations using BESES statistics.

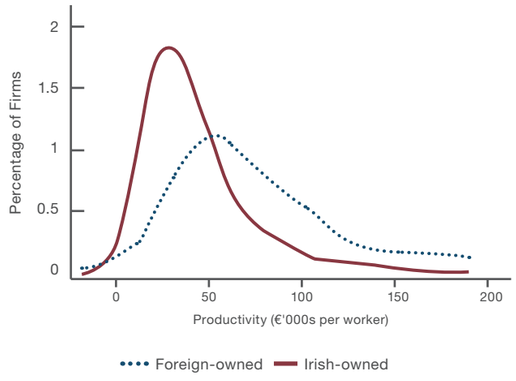
[3] The work by the ONS includes some breakdowns of variation in productivity distributions across regions within Great Britain but does not include any data on Northern Ireland.

[4] In terms of sectoral representation, the ONS (2017) report excludes the financial sector, real estate and public sector.

It is also evident at the bottom end of the distribution that there is a higher percentage of services than manufacturing firms in the negative productivity zone. This is consistent with the ONS findings of poorer productivity performance amongst services firms relative to manufacturing. At the same time, it should be noted that both groups contain similar number of firms in the upper regions of the distribution.

The data on firms in Ireland is drawn from two different sources, both collected by the Central Statistics Office. The Census of Industrial Production (CIP) covers firms in manufacturing sectors while the services data is collected through the Annual Services Inquiry (ASI). As there are some differences in methodology, we will therefore present the productivity distributions separately. Figure 2 shows the productivity distributions for goods firms in Ireland, distinguishing by nationality of ownership, which has a very striking impact on the patterns. While foreign direct investment (FDI) is also present in Northern Ireland, with over 2,000 jobs created by multinationals in 2015-16 (Department for International Trade, 2016) and US-owned firms being particularly active (Byrne, 2017), the 'dual' economic structure of a large share of exporting activity concentrated in a small number of multinational firms and a large number of much smaller domestic exporters that is found in Ireland is not observed as a dominant feature of the Northern Irish economy. As was emphasised in InterTradeIreland (2018), the companion piece to this report examining the features of exporting firms across the island, this makes it more appropriate to distinguish firm activity by ownership for firms located in Ireland compared to those in Northern Ireland and to make comparisons using domestically-owned firms rather than multinationals whenever the available data allows.

FIGURE 2: DISTRIBUTION OF PRODUCTIVITY: IRISH GOODS FIRMS

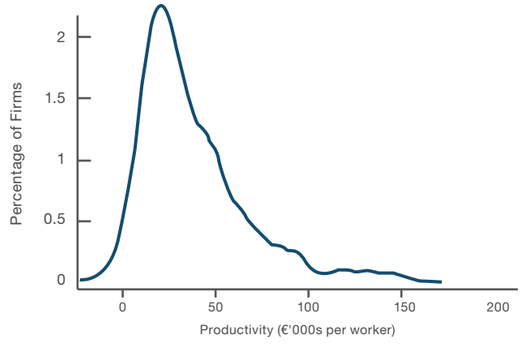


Sources: Author's calculations using CSO CIP data.

In terms of comparison with Northern Ireland, the shape of the distribution for Irish-owned firms is extremely similar, with a concentration around a mid-point with a small tail of under-performers and a long dispersion of small numbers of increasingly productive firms shown to the right of the distribution. This was also a feature of the O'Conner, Papa and Rehill (2018) analysis of the Irish firm-level data. The productivity distribution for foreign-owned firms shows a much higher degree of productivity, with a relatively large share of firms positioned in the upper part of the very high-performance end. This is consistent with the location in Ireland of very high-technology firms in sectors such as electronics and pharmaceuticals.

Figure 3 shows the productivity distribution for Irish-owned services firms (the number of foreign-owned firms in the survey sample being too small for accurate estimation along the full extent of the distribution). Here, we have a similar overall pattern, with a somewhat greater concentration around the peak point and an upper measure of frontier productivity that ends at a lower value than that for manufacturing firms.

FIGURE 3: DISTRIBUTION OF PRODUCTIVITY: IRISH-OWNED SERVICES FIRMS

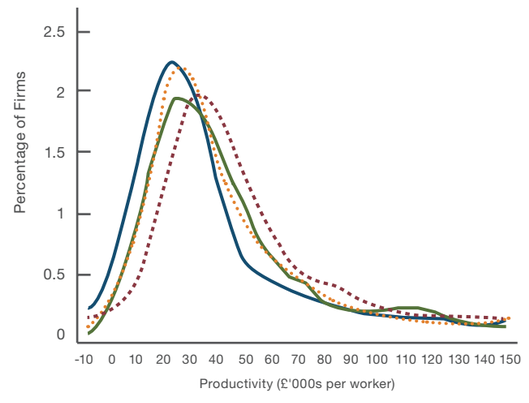


Sources: Author's calculations using CSO ASI data.

2.3 PRODUCTIVITY DISTRIBUTIONS BY EXPORT STATUS

One important element in research examining firm performance has been the finding that involvement in exporting tends to be associated with better outcomes across a range of firm characteristics. The encouragement and support to firms entering exporting from a policy perspective is based on this link between export participation and other positive outcomes. From a risk assessment perspective, some diversification of markets could help to insulate the firm from specific shocks to one location. This section looks at how the productivity distribution varies across firms depending on their export status. Figure 4 presents the distributions for Northern Irish goods firms and Figure 5 for Northern Irish services firms. In both, the firms are divided into four groups: those with all of their sales located in Northern Ireland, those with external sales to Great Britain, those with exports to Ireland and those with exports to markets beyond Ireland.[5]

FIGURE 4: DISTRIBUTION OF PRODUCTIVITY BY EXPORT STATUS: NORTHERN IRELAND GOODS FIRMS

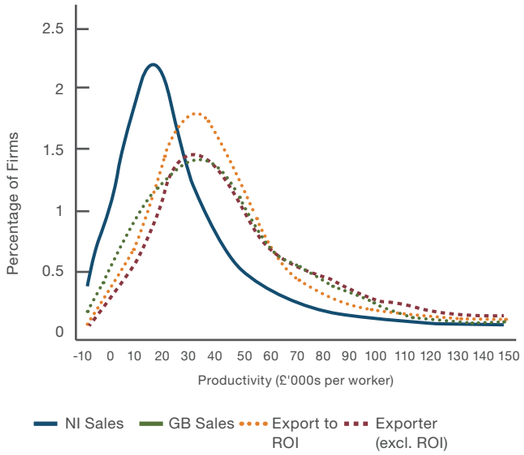


Sources: Author's calculations using BESES statistics.

This shows that while the same general shape holds for all firms, there are noticeable differences in the positioning of the distribution across firm export types. This is particularly striking for services firms, where the distribution shifts strongly to the right for firms with any type of external sales compared to firms with local sales only. For goods firms, exporters to Ireland have a higher concentration of firms around the peak of the distribution but otherwise, the lines largely overlap. Firms with exports beyond Ireland exhibit a fairly clear shift to higher levels of productivity compared to the other three groups. Firms with sales beyond Northern Ireland are also extremely unlikely to fall into the area of negative gross value added per worker.

[5] The 'GB sales' category relates to firms with sales in Great Britain but no other external markets. Where firms have sales in both GB and ROI, they are therefore regarded as being in the exporter grouping.

FIGURE 5: DISTRIBUTION OF PRODUCTIVITY BY EXPORT STATUS: NORTHERN IRELAND SERVICES FIRMS

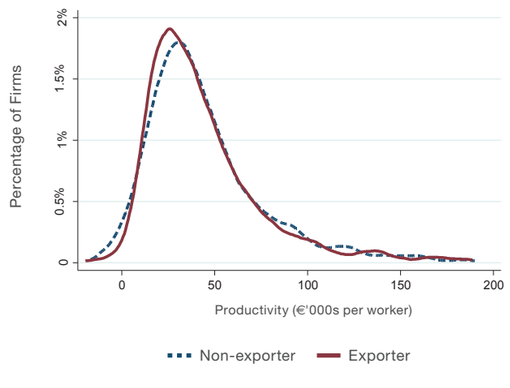


Sources: Author's calculations using BESES statistics.

For services firms, the gains to selling outside Northern Ireland are more marked, with a considerable shift to higher productivity of the entire distribution relative to firms with all of their sales in the local market. Once the firm is selling beyond Northern Ireland, the extent of the differences by market appears relatively minor, particularly in contrast to the clearer ordering evident for goods firms. The extent of the differences in distributions between exporters and non-exporters in services as compared to goods is likely to reflect to a large extent the less tradable nature of many services. The report published by InterTradeIreland (2018b) showed that export participation rates are approximately twice as high for goods firms than for services firms in Northern Ireland.[6] This pattern, whereby fewer firms in the services sector engage in international trade than in the goods sector, is commonly found across many countries and is likely to be related to the personal delivery inherent in many services.

Turning to the distributions for firms in Ireland, we focus on the patterns between exporters and non-exporters for domestically-owned firms. Figure 6 shows the patterns generated from the CIP data for manufacturing firms and Figure 7 for the services firms. Unlike for the Northern Irish data, here, we do not have enough information to disaggregate both by destination, so look just at exporting compared to non-exporting firms.

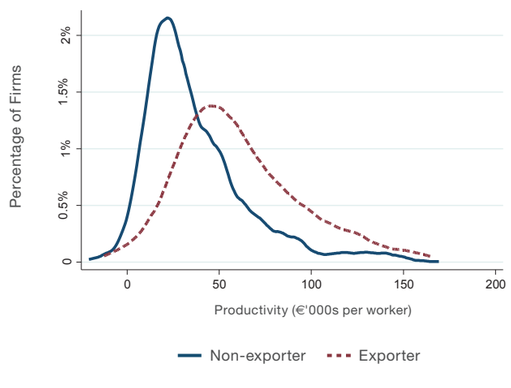
FIGURE 6: DISTRIBUTION OF PRODUCTIVITY BY EXPORT STATUS: IRISH GOODS FIRMS



Sources: Author's calculations using CSO CIP data.

For Irish-owed goods firms, there is surprisingly little difference in the overall shape or positioning of the productivity distribution between the two types of firms. This suggests that the greater productivity performance identified for indigenous Irish exporters in the previous work of InterTradeIreland (2018) is most likely being driven by a small number of very high performers amongst the exporters rather than a consistent shift in the distribution.

FIGURE 7: DISTRIBUTION OF PRODUCTIVITY BY EXPORT STATUS: IRISH SERVICES FIRMS



Sources: Author's calculations using CSO ASI data.

In contrast to the patterns for manufacturing firms, there is a substantial difference in the overall productivity distribution between exporters and non-exporters for services firms. The effect is very similar to that of the Northern Irish services distributions, with both showing quite considerable differences in performance for services firms that engage in exporting (or external sales) relative to those reliant on the domestic market. This difference in performance and diversification of sales is likely to give greater resilience to exporting firms in the event of negative shocks. The next section looks in more detail at how firm shock absorption capacity can be assessed.

[6] Firm-level participation in exporting is even lower amongst Irish-owned services firms, although data differences make the precise rates difficult to compare directly (see discussion in InterTradeIreland, 2018b).

3. Risk Profiling: Profit Margins and Sales Growth

This section develops a risk profile of firms in Ireland and Northern Ireland in order to represent in a practical way the potential exposure of firms to differing degrees of economic shock. Accurate prediction of exposure to risk of an individual firm and its ability to survive negative shocks is infeasible, as the shock absorption capacity of each firm will depend on a great many unobservable features of the firm itself, its customer base and the competitive environment it faces. However, at a slightly broader level, it is possible to assess the overall distribution of exposure to negative shocks and generate a sense of the shares of firms and employment that are currently operating at a level that may make them vulnerable to adverse shifts in demand or costs.

We do this by creating a risk matrix based on two easily observable characteristics of firms – their current profit margin and sales growth performance. We combine the two indicators to create a broad ranking of exposure to shocks containing 25 categories (five profit margin groups combined with five sales growth groups). This gives flexibility to interpretation, as firms that are in the category of lowest profit margin and lowest sales growth would potentially be exposed to relatively minor shocks, whereas one can move outwards through the matrix to assess what share of firms and employment might be exposed to negative shocks of increasing size.

3.1 INTERNATIONAL EVIDENCE ON FIRM RISK CHARACTERISTICS

The most intense shock to hit European firms in recent times was the financial crisis and associated recession which impacted a wide number of countries during 2008 and 2009, with longer-run negative impacts in a smaller set of countries such as Ireland and Greece. To examine how this wide-ranging shock affected individual firms, a large-scale survey of over 14,000 firms across seven countries was funded by the European Commission and analysed by Békés, Halpern, Koren and Muraközy (2011).[7] Despite the widespread nature of the economic shock, the researchers found significant variation in the degree to which individual firms were impacted. They found that in this particular instance exports tended to fall more than domestic sales: although in most analyses, exporters are found less exposed to negative shocks due to their larger size and more diversified markets, in this case the global nature of the shock meant that the diversification across markets did not work as usual in mitigating the impact on exporting firms.

Flexibility in adjusting imported inputs and being able to outsource some elements of production were two factors that appeared to help firms adjust, both of which were more evident methods of adjustment for larger firms. Firms which made final goods that were sold to a broad range of customers had less of a decline in sales or exports compared to those making more specialised products or those reliant on a small set of large customers. Likewise, having a broad network of suppliers seemed to leave firms less exposed than being reliant on a narrow set of supply chain links. In terms of how the shock to firms was passed through to the labour market, the research found that firms which had to reduce their workforce did so by laying off temporary workers initially and then lower-skilled workers. They suggest that this shows firms prioritise the retention of human capital when faced with a shock and that the uneven impact on different types of worker is an important policy concern in this type of broadly based downturn.

Looking at the same period of the 2008 financial crisis, Bartz and Winkler (2016) drilled into how it impacted on the growth performance of small and young businesses in Germany. This research focused on the question as to whether these firms were particularly vulnerable to the effects of a financial crisis or if they might, in some cases, be more flexible and able to respond quickly to external challenges than larger firms. They discovered differing effects with regards to the age and size of firms. In contrast to normal times, younger firms were found to grow more slowly during a crisis, with entrepreneurial firms most negatively impacted. Small firms, however, were found to grow somewhat more quickly than larger firms, during both stable and crisis periods. This suggests that although negative shocks impede entrepreneurship and early-stage business development, small firms have a degree of flexibility which gives them some resilience to shocks.

Looking at an earlier period of economic stress, Hallward-Driemeier, Dwor-Frécaut and Colaço (2000) examined the impact of the Asian financial crisis of the late 1990s on firms in Indonesia, Korea, Malaysia, the Philippines and Thailand, drawing on a survey of 4,000 firms carried out by the World Bank. They found that cash flow was a critical element in a firm's ability to withstand the impacts of the crisis. Firms with limited access to external funds were most susceptible to short-run reductions in demand, particularly when combined with increases in the cost of imported inputs due to macroeconomic and exchange rate developments. At the same time, increases in interest rates were a negative factor in the performance of firms with outstanding loans. Exporters were generally more resilient, with less of a reduction in capacity enforced due to demand slowdown, despite a devaluation of the currencies of the affected countries.

The analysis of the experience of firms during the Asian crisis also showed that those firms exporting to neighbouring countries were more affected by the crisis – which impacted a number of countries in the same region – than exporters with a broader range of markets. The export fall was reported by more small firms than large firms, perhaps because large firms are more likely to have a broader set of export markets, providing some insulation from the regional demand fall. Close to half of the firms had to reduce their workforce to some extent as a response to the fall in domestic demand and higher import costs.

The differential impact of economic swings across firms was also examined by Crouzet and Mehrotra (2017). Using evidence from balance sheet records from US firms over a 37-year timespan, they found that the growth of small firms was considerably more sensitive to aggregate economic developments (specifically GDP growth) compared to larger firms. The largest firms tended to be most stable in their growth path, with smaller firms growing faster in good economic times, but also more liable to sales reductions in downturns. They also found a similar pattern in firm investment rates and inventory holdings, with smaller firms experiencing larger swings over the business cycle than larger firms. The extent of the higher sensitivity to economic swings amongst smaller firms can be offset to some degree by export participation and also, by having a varied set of customers (in particular having customers in multiple sectors). Both methods of diversification help to insulate firms from localised shocks. In contrast to some other work, they found that financial frictions appear to explain little of this variation in sensitivity to economic fluctuations across firm size groups.

The role of the financial sector is more strongly emphasised by Vlieghe (2001) in his model of the determinants of corporate liquidations in the UK, where he found that a rise in indebtedness was a major factor in driving the increase in the rate of liquidations throughout the 1990s. Aggregate economic developments and interest rates were also found to be significant factors in explaining the risks of a firm going into liquidation.

High levels of outstanding debt, largely incurred in the boom years, were also found to be a major risk factor in the exposure of firms in Ireland to the financial crisis that hit severely in 2008. McQuinn and McCann (2017) found that in 2013, almost 8% of Irish firms had debt levels exceeding their turnover, but that this was reduced to less than 3% by 2017. In keeping with a number of the other papers cited above, they found that being an exporter gives some degree of protection from domestic downturns. Specifically in relation to debt levels, they discovered that services firms tended to carry lower amounts of debt, as they were less capital-intensive. In relation to firm size, they found that medium-sized firms were the most exposed, partly because smaller firms had less opportunity to incur significant debt levels, while large firms tended to have more ability to use internal funds as a source of financing.

3.2 DESCRIPTION OF RISK MATRIX APPROACH

The risk assessment method we adopt here is a form of heat-map, which indicates the distribution of firms along different dimensions, those performing strongly, and those that are most likely to be vulnerable to any negative shock to their demand or cost base. This method allows us to include all firms in the heat-map rather than to identify only those in a lower tail and therefore does not tie the assessment to any particular prior estimate of the size of the shock – a minor shock might impact those only in the most vulnerable group but one can work outwards to also generate estimates of an at-risk population for increasing degrees of shock.

We chose two dimensions across which to categorise the firms – sales growth and profit margin. Although the literature discussed above includes other risk factors, such as debt and productivity, these are not always available in firm surveys and in some cases, might be difficult or unclear for the firms themselves to estimate. The choice was therefore made to use the most accessible and easily measurable indicators of performance to give as robust a set of assessment as

[7] The countries covered were Austria, France, Germany, Hungary, Italy, Spain and the United Kingdom.

possible and one that should be easily replicated as new data is collected over time. The data is aggregated from firm-level sources, coming from the Broad Economy Sales and Exports Survey (BESES) collected by NISRA for Northern Irish firms, the Census of Industrial Production (CIP) for Irish goods firms and the Annual Services Inquiry (ASI) for Irish services firms (both collected by the CSO).

The heat-map is structured as follows: firms are ranked by their rate of sales growth from lowest to highest and divided into five groups. Firms in the bottom sales grouping experienced year-on-year declines in their sales as reported in the BESES survey return and the CIP. Firms categorised as having medium-low sales growth had sales change by less than 5%. Medium sales growth was between 5% and 10%. At the higher end of the scale, the medium-high growth firms reported sales increases of between 10% and 20%, while the top cohort grew their sales by more than 20%.

The same approach is taken to divide firms into five profit margin groups. The profit margin measure is based on income and expenditure which can be identified in the firm survey data. It is effectively a gross margin measure which subtracts total purchases and wages from turnover and then divides this by the level of turnover.

As firms would generally subtract a range of other expenses (depreciation, interest payments and so on) to reach a net profit margin figure, it should be noted that the cut-off points between categories used here may appear rather high when compared to other sources of information, such as the InterTradeIreland All-island Business Monitor. However, as the key focus of the risk matrix is to indicate an ordering of firms, the use of this somewhat more basic measure of profitability should not pose any significant issues in the application of the method. The lowest margin group of firms had gross profits of under 3%, those in the medium-low group had profits of between 3% and 11% of turnover, medium profits were between 11% and 20%, medium-high profits were between 20% and 31% and the highest profitability firms were those reporting gross margins greater than 31%.

Combining the two measures gives a matrix of 25 cells for different combinations of growth and margin. If both characteristics were perfectly correlated, then most firms should be along the central diagonal of the matrix, which would correspond to having the same ranking in both measures. However, it is clear from Table 1 that this is not the case and firms are represented in all possible combinations.

Each table contains two panels, with the top panel indicating the share of firms in each cell of the heat-map while the lower panel aggregates the data to show the share of employment in each cell. The colour-coding system adopted shows the most at-risk firms as being those with both the lowest growth rate and the lowest margin. The next most at risk have either the lowest growth rate combined with a medium-low or medium margin, or the lowest margin combined with a medium-low or medium margin.

Firms with higher margins but low growth are regarded as having an intermediate level of risk, although this will depend on their ability to trade off reductions in sales against the margin being made. Likewise, an intermediate ranking has been given to firms with higher growth rates but low margins, while accepting that for some firms, this may be part of a deliberate growth strategy. Firms that are simultaneously in the upper ends of both the sales growth and profit margin rankings are classified as low-risk as they are the most likely to have the capacity to absorb a certain degree of adverse events.

We generate the risk matrices separately for four categories of firms: goods firms in Northern Ireland and Ireland (discussed in Section 3.3) and services firms in Northern Ireland and Ireland (discussed in Section 3.4).

3.3 RISK MATRIX RESULTS FOR GOODS FIRMS

Looking first at goods firms, Table 1 presents the risk matrix for Northern Ireland and Table 2 for domestically-owned firms in Ireland. In Northern Ireland, if we sum the dark-green cells, we find that 26.5% of firms are in this lowest-risk group and a further 22.7% are in the light-green low-risk group. There are 5.5% of firms in the highest risk group (red) and a total of 20.6% in the combined red and dark-orange high-risk categories.

In the lower panel of the table, we see that the 5.5% of high-risk firms represent 4.1% of employment, indicating that smaller firms are more likely to be in this category. Firms with medium-high rates of growth but relatively low margins, which account for 14.7% of firms (5.8 + 8.9), represent slightly more than one-quarter of employment (10.5 + 14.7).

TABLE 1: FIRM SHOCK ABSORPTION PERFORMANCE INDICATORS: NI GOODS FIRMS

Share of Firms

Lowest margin	5.5%	4.8%	3.5%	5.8%	4.2%
Medium-low	4.4%	6.1%	5.8%	8.9%	4.8%
Medium	2.4%	5.1%	5.0%	7.1%	5.6%
Medium-high	2.1%	3.1%	3.6%	3.7%	4.4%
Highest margin	1.0%	0.9%	0.4%	0.8%	0.9%

Share of Employment

Lowest margin	4.1%	5.2%	4.8%	14.7%	3.0%
Medium-low	3.1%	5.2%	10.0%	10.5%	8.8%
Medium	0.8%	4.7%	3.4%	5.5%	3.9%
Medium-high	0.3%	2.4%	1.4%	2.5%	2.3%
Highest margin	0.1%	1.3%	1.3%	0.2%	0.5%

Sources: Author's calculations using BESES statistics.

We repeat the same exercise by generating a heat-map for firms in Ireland. Table 2 shows that amongst goods firms in Ireland, the high-risk group for goods firms represents a larger share of firms than the Northern Irish calculations, with 7.4% of firms categorised as having both low margins and low sales and 22.3% in combined red and dark-orange high-risk categories. The highest risk group represents 5.8% of employment, again providing evidence that the risk group is made up disproportionately of smaller firms. At the opposite end of the spectrum, we see that 35.5% of Irish goods firms are in the lowest risk group, equating to 35.8% of employment. For Northern Ireland, 26.5% of firms were in the lowest risk category, accounting for 17.6% of employment.

TABLE 2: FIRM SHOCK ABSORPTION PERFORMANCE INDICATORS: IRISH GOODS FIRMS

Share of Firms					
Lowest margin	7.4%	4.0%	3.1%		3.0%
Medium-low	4.0%	3.8%	3.9%		4.7%
Medium	3.8%	4.3%	3.7%	3.4%	4.8%
Medium-high	2.5%	3.3%	4.2%	5.9%	4.2%
Highest margin	2.3%	4.7%	5.1%	4.6%	3.3%

Share of Employment					
Lowest margin	5.8%	2.6%	3.4%	2.0%	3.6%
Medium-low	3.2%	5.9%	4.2%	5.2%	7.9%
Medium	3.5%	3.7%	3.4%	3.7%	6.9%
Medium-high	1.5%	4.0%	3.2%	3.0%	3.3%
Highest margin	1.8%	2.6%	3.7%	8.0%	4.0%

Sources: Author's calculations using CSO CIP data.

3.4 RISK MATRIX RESULTS FOR SERVICES FIRMS

Turning to services firms, Table 3 shows the same heat-map representation for Northern Irish services firms and Table 4 for Irish firms. For Northern Ireland, the share of firms falling into the highest risk category is reasonably similar to that of goods firms, at 5.8%, although they represent a smaller share of the services employment of 3.6%. This suggests that in services, even more so than in goods, it is smaller firms that are most exposed to shocks.

TABLE 3: FIRM SHOCK ABSORPTION PERFORMANCE INDICATORS: NI SERVICES FIRMS

Share of Firms					
Lowest margin	5.8%	5.3%	4.5%	3.3%	2.5%
Medium-low	2.5%	4.4%	4.7%	3.7%	3.7%
Medium	2.6%	4.2%	4.5%	4.5%	3.8%
Medium-high	2.3%	3.7%	5.4%	4.3%	3.5%
Highest margin	4.0%	3.8%	4.4%	4.3%	4.4%

Share of Employment					
Lowest margin	3.6%	6.6%	7.9%	5.2%	2.7%
Medium-low	1.7%	4.6%	10.9%	9.7%	4.3%
Medium	1.7%	4.9%	7.3%	5.9%	3.5%
Medium-high	1.3%	2.2%	4.1%	4.4%	2.2%
Highest margin	1.5%	0.8%	0.8%	1.2%	1.0%

Sources: Author's calculations using BESES statistics.

The distributions across risk categories for Irish services firms shown in Table 4 reveals a slightly lower percentage of firms (4.4%) in the most at-risk category, which represents 2.6% of employment in the sector. The share of firms in the lowest risk grouping (the total of the dark-green cells) is rather lower in Ireland, at 30.7%, relative to the total in this lowest risk group in Northern Ireland services of 34.6%. However, the share of employment accounted for by these low-risk firms is higher in Ireland (36.9%) than in Northern Ireland (23.1%).

TABLE 4: FIRM SHOCK ABSORPTION PERFORMANCE INDICATORS: IRISH SERVICES FIRMS

Share of Firms					
Lowest margin	4.4%	3.1%	3.6%	3.8%	4.7%
Medium-low	4.8%	3.4%	3.1%	4.4%	4.0%
Medium	3.4%	5.2%	4.9%	3.0%	3.4%
Medium-high	3.2%	4.6%	5.0%	4.2%	3.6%
Highest margin	4.5%	4.2%	3.2%	4.4%	3.9%
Share of Employment					
Lowest margin	2.6%	2.0%	4.7%	4.8%	5.4%
Medium-low	3.3%	3.9%	6.2%	5.4%	5.0%
Medium	2.5%	3.6%	4.5%	2.7%	6.9%
Medium-high	1.6%	3.5%	5.4%	5.6%	3.9%
Highest margin	1.8%	2.1%	3.9%	5.3%	3.2%

Sources: Author's calculations using CSO ASI data.

This section has provided a framework for assessing the likely extent of exposure to shocks of differing magnitudes by using a heat-map approach to allocate firms to different levels of capacity to absorb risks. Comparing heat-maps based on the number of firms with those based on employment shows that in the main, there is a concentration of smaller firms in the highest risk category.

The next section will look further at the relative shares of sales, exports and imports in the different risk groups.

4. Shock Absorption Capacity and International Trade

This section takes the risk heat-maps compiled in Section 3 and looks at how each group contributes to total sales and trade across both goods and services in Ireland and Northern Ireland. In looking at trade shares, we will distinguish further between trade with the adjoining country market (i.e. Ireland for Northern Irish firms as well as external sales to Great Britain and exports to the UK for Irish firms) and also look at export shares to the broader EU market. These distributions are of immediate policy interest, given that the most significant near-term shock firms may have to face is a change in trade costs following the UK's exit from the EU. This section therefore gives a sense of the degree to which UK-EU trade is being undertaken by firms with the most or least capacity to withstand additional costs or changes in demand.

4.1 SHARES OF SECTOR SALES BY RISK GROUPS

We begin by looking at the contributions firms in each risk cohort make to overall sales of either goods or services in Northern Ireland and in Ireland (see Table 5). The firms with the least capacity to absorb shocks – those with the lowest profit margins and lowest sales growth rates – make up 3.8% of total sales of goods firms in Northern Ireland and 4.7% of services firm sales. The concentration of sales in the highest risk category is lower in Ireland, with these firms being responsible for 2.5% of goods sales and 2.4% of services sales.

At the other end of the scale, the firms with the strongest ability to withstand shocks – all of the groups marked as dark-green in the table – combine to account for 39.3% of sales in NI goods and 46.1% of Irish goods sales. The strongest performing firms therefore make up a large share of overall sales. The share of sales in services amongst the least at-risk group of firms is lower, with 17.2% of NI services sales being accounted for by this group and 35.7% of Irish services sales. Services firms would therefore appear to be at higher risk in the event of a negative shock, particularly in Northern Ireland.

TABLE 5: DISTRIBUTION OF SECTOR SALES BY FIRM PERFORMANCE GROUP

Margin	Sales growth	NI Goods	NI Services	ROI Goods	ROI Services
Low	Low	3.8%	4.7%	2.5%	2.4%
Low	Medium low	1.9%	1.0%	0.6%	3.2%
Low	Medium	0.4%	0.9%	0.9%	4.1%
Medium low	Low	5.3%	9.5%	1.5%	2.5%
Medium	Low	3.8%	10.9%	2.8%	1.0%
Sum high risk firms		**15.2%**	**27.0%**	**8.3%**	**13.2%**
Low	Medium-high	0.1%	1.0%	0.6%	12.7%
Low	High	0.0%	0.6%	1.5%	14.6%
Medium-low	Medium-low	3.7%	6.0%	3.6%	2.3%
Medium-low	Medium	4.4%	3.5%	2.1%	4.0%
Medium	Medium-low	6.8%	11.9%	3.1%	1.7%
Medium-high	Low	10.9%	9.2%	1.1%	0.6%
High	Low	2.5%	3.6%	12.6%	0.9%
Sum medium-risk firms		**28.4%**	**35.8%**	**24.6%**	**36.8%**
Medium-low	Medium-high	1.2%	1.5%	3.6%	4.6%
Medium-low	High	0.7%	2.6%	7.3%	5.4%
Medium	Medium	2.0%	3.8%	2.6%	2.0%
Medium-high	Medium-low	7.1%	8.7%	4.1%	1.2%
High	Medium-low	6.2%	3.4%	3.5%	1.1%
Sum low-risk firms		**17.2%**	**20.0%**	**21.1%**	**14.3%**
Medium	Medium-high	0.7%	3.1%	2.6%	1.5%
Medium	High	28.3%	1.0%	5.3%	5.4%
Medium-high	Medium	3.3%	4.4%	2.7%	2.2%
Medium-high	Medium-high	2.0%	3.1%	4.8%	2.8%
Medium-high	High	0.1%	0.9%	2.6%	1.7%
High	Medium	2.5%	2.1%	2.8%	3.5%
High	Medium-high	2.1%	1.4%	15.3%	4.3%
High	High	0.3%	1.2%	10.0%	14.3%
Sum very low risk firms		**39.3%**	**17.2%**	**46.1%**	**35.7%**

Sources: Author's calculations using BESES data for Northern Ireland, CSO CIP data for Irish goods firms and CSO ASI data for Irish services firms.

4.2 SHARES OF SECTOR EXPORTS BY RISK GROUPS

With the most immediate potential shock to firms across the island of Ireland coming from the currently uncertain changes to trade flows after the UK leaves the EU, the exposure to trade cost changes across firms of different degrees of shock absorption capacity is of central policy interest. Previous work in this series of research on cross-border trade looked at the potential impact of tariffs and other trade costs on cross-border trade and trade between Ireland and the rest of Britain (InterTradeIreland, 2017). It also addressed the extent of supply chain linkages (InterTradeIreland, 2018a). The central message of both these reports was that the composition of cross-border trade (particularly with the high share of trade accounted for by the dairy and other food sectors), combined with strong cross-border linkages in supply chains, mean that firms engaging in cross-border trade are considerably more exposed to cost increases, in the event of the imposition of tariffs, than firms in Ireland or Northern Ireland trading with other markets.

The remaining tables in this section look at how exports and imports are distributed across firms of different shock absorption capacities. They therefore present a more detailed picture of whether these shocks would be distributed evenly across firms, or if they would be concentrated in any particular risk cohort. We look firstly at overall trade and then specifically at cross-border trade and trade with Great Britain. We then finish the section by looking at risk exposure to changes in trade patterns with the other countries of the EU.

Table 6 shows that the allocation of overall sector exports follows a broadly similar pattern to that of sales, with the striking exception of exports from Irish services firms, which are strongly concentrated in the lowest risk group of firms. Summing over the low-risk (dark-green) category for Irish goods firms also shows a large share (47%) of trade is being undertaken by firms with different combinations of high or medium-high margins and sales growth. Table 6 shows that overall, 55.3% of NI goods exports are by firms in an at-risk category (either dark or light-orange), 67.7% for NI services and significantly lower for Ireland, with 33.6% of goods and just 9.8% of service exports by firms at risk.

The distribution of exports across firm shock absorption categories is rather more evenly spread for Northern Irish firms in both goods and services than is the case for Irish firms. With more exports being accounted for by firms with lower shock absorption capacity, this suggests that a negative shock to exports would be more broadly felt across firms than an equivalent-sized shock in Ireland. The appendix gives a sense of the approximate numbers of firms represented by each group.

TABLE 6: DISTRIBUTION OF SECTOR EXPORTS BY FIRM PERFORMANCE GROUP

Margin	Sales growth	NI Goods	NI Services	ROI Goods	ROI Services
Low	Low	5.2%	7.3%	2.4%	0.7%
Low	Medium low	1.7%	1.7%	0.4%	0.4%
Low	Medium	0.3%	1.8%	0.6%	0.4%
Medium low	Low	5.1%	6.6%	0.9%	1.0%
Medium	Low	4.5%	7.0%	3.1%	0.4%
Sum high risk firms		**16.8%**	**24.4%**	**7.4%**	**2.9%**
Low	Medium-high	0.1%	0.5%	0.3%	0.5%
Low	High	0.0%	0.5%	1.0%	2.8%
Medium-low	Medium-low	3.0%	6.9%	2.8%	0.5%
Medium-low	Medium	9.4%	3.2%	1.1%	1.7%
Medium	Medium-low	8.5%	5.1%	3.4%	0.7%
Medium-high	Low	15.0%	21.2%	1.2%	0.2%
High	Low	2.5%	5.9%	16.4%	0.5%
Sum medium-risk firms		**38.5%**	**43.3%**	**26.2%**	**6.9%**
Medium-low	Medium-high	2.8%	0.6%	1.8%	1.3%
Medium-low	High	2.0%	0.2%	6.7%	2.2%
Medium	Medium	2.6%	0.6%	2.6%	0.7%
Medium-high	Medium-low	7.5%	12.9%	4.7%	0.0%
High	Medium-low	6.4%	2.7%	3.5%	0.7%
Sum low-risk firms		**21.3%**	**17.0%**	**19.3%**	**4.9%**
Medium	Medium-high	0.3%	4.0%	2.8%	0.5%
Medium	High	7.6%	0.2%	6.0%	11.5%
Medium-high	Medium	4.6%	2.8%	1.0%	1.7%
Medium-high	Medium-high	4.2%	1.8%	2.8%	4.8%
Medium-high	High	0.1%	0.5%	2.9%	1.1%
High	Medium	3.0%	3.9%	3.2%	0.8%
High	Medium-high	3.7%	1.8%	15.8%	2.0%
High	High	0.1%	0.3%	12.5%	62.9%
Sum very low risk firms		**23.6%**	**15.3%**	**47.0%**	**85.3%**

Sources: Author's calculations using BESES data for Northern Ireland, CSO CIP data for Irish goods firms and CSO ASI data for Irish services firms.

4.3 TRADE WITH IRELAND AND UK/GB BY RISK GROUPS

As any Brexit-related changes in trade relationship would mainly impact on those firms trading specifically with Ireland for Northern Irish firms and with the UK for Irish firms, we next look at how similar these patterns are to those shown for total exports above. Table 7 looks at the distribution across risk groups of exports and Table 8 presents the analogous calculations for imports. For Northern Irish firms, the distribution of external sales and purchases with Britain is also included for comparison purposes. The calculations for Irish firms is restricted to goods firms due to an absence of information on destinations of exports and imports for services.

The key finding in these tables is that trade between Northern Ireland and Ireland, both in terms of exports and imports, is much more dispersed across firms (and hence different levels of shock absorption capacity) than trade with Britain, which is more concentrated in the lower risk groups of firms. We also note that the distribution of exports and external sales by services firms is quite evenly spread across firms in all performance groups when compared to the distribution of sales for goods firms.

To illustrate this, if we look at the lowest level of shock absorption capacity (the red and dark-orange bands) in Table 7, we find that firms in these groups account for 29.5% of exports from Northern Ireland goods firms to Ireland and 26.5% of services. The next level of risk group (the light-orange rows) of Northern Irish goods firms have exports to Ireland of 32.5% and services firm exports of 48.5%. Trade to the rest of Britain for these groups of firms contribute 7.8% of external sales by goods firms and 31.8% of external sales by services firms for the red and dark-orange risk bands. There is a corresponding 18.5% of goods external sales and 29.3% of services external sales for the light-orange, medium-risk bands.

TABLE 7: DISTRIBUTION OF SECTOR EXPORTS BY DESTINATION AND FIRM PERFORMANCE GROUP

ABILITY TO ABSORB SHOCKS: LOW → HIGH

		NI Goods		NI Services		ROI Goods
Margin	Sales growth	Exports to Ireland	Sales to Britain	Exports to Ireland	Sales to Britain	Exports to UK
Low	Low	1.5%	1.9%	8.0%	7.1%	4.4%
Low	Medium low	2.8%	1.0%	1.1%	0.9%	1.5%
Low	Medium	0.6%	0.1%	0.9%	1.0%	1.4%
Medium low	Low	11.9%	2.3%	9.2%	12.9%	2.2%
Medium	Low	12.7%	2.5%	7.3%	9.9%	1.2%
Sum high risk firms		**29.5%**	**7.8%**	**26.5%**	**31.8%**	**10.7%**
Low	Medium-high	0.2%	0.1%	0.3%	0.2%	1.5%
Low	High	0.0%	0.0%	0.3%	0.6%	2.0%
Medium-low	Medium-low	5.2%	3.0%	6.7%	5.5%	5.0%
Medium-low	Medium	2.5%	1.9%	2.8%	3.8%	3.6%
Medium	Medium-low	12.4%	5.7%	5.2%	4.4%	1.4%
Medium-high	Low	9.3%	6.2%	25.7%	10.7%	1.2%
High	Low	2.9%	1.6%	7.5%	4.1%	4.9%
Sum medium-risk firms		**32.5%**	**18.5%**	**48.5%**	**29.3%**	**19.6%**
Medium-low	Medium-high	0.3%	0.3%	0.7%	1.4%	4.3%
Medium-low	High	0.1%	0.1%	0.2%	0.9%	8.8%
Medium	Medium	2.4%	1.0%	0.8%	1.2%	5.2%
Medium-high	Medium-low	12.9%	5.7%	10.6%	11.9%	0.6%
High	Medium-low	8.2%	5.7%	3.0%	4.2%	2.0%
Sum low-risk firms		**23.9%**	**12.8%**	**15.3%**	**19.6%**	**20.9%**
Medium	Medium-high	0.4%	0.5%	0.7%	1.2%	3.0%
Medium	High	0.2%	55.1%	0.2%	1.4%	2.4%
Medium-high	Medium	6.8%	1.7%	2.7%	5.1%	2.8%
Medium-high	Medium-high	1.5%	0.6%	1.3%	3.3%	9.4%
Medium-high	High	0.0%	0.0%	0.2%	0.9%	1.9%
High	Medium	3.8%	1.6%	2.7%	3.2%	2.2%
High	Medium-high	1.2%	0.9%	1.5%	2.9%	11.1%
High	High	0.2%	0.4%	0.3%	1.1%	16.0%
Sum very low risk firms		**14.1%**	**60.8%**	**9.6%**	**19.1%**	**48.8%**

Sources: Author's calculations using BESES data for Northern Ireland, CSO CIP data for Irish goods firms. Irish services exports not available by destination.

TABLE 8: DISTRIBUTION OF SECTOR IMPORTS BY DESTINATION AND FIRM PERFORMANCE GROUP

			NI Goods		NI Services		ROI Goods
	Margin	Sales growth	Imports from Ireland	Purchases from Britain	Imports from Ireland	Purchases from Britain	Imports from UK
LOW ABILITY TO ABSORB SHOCKS HIGH	Low	Low	1.7%	6.6%	8.3%	4.7%	4.0%
	Low	Medium low	5.3%	2.0%	1.6%	0.8%	1.0%
	Low	Medium	0.6%	0.3%	0.5%	0.4%	1.1%
	Medium low	Low	20.8%	3.7%	7.5%	13.2%	1.8%
	Medium	Low	16.5%	3.7%	10.9%	12.2%	4.8%
	Sum high risk firms		**44.9%**	**16.3%**	**28.8%**	**31.3%**	**12.7%**
	Low	Medium-high	0.1%	0.1%	0.4%	1.0%	1.0%
	Low	High	0.0%	0.0%	0.1%	0.1%	1.3%
	Medium-low	Medium-low	3.9%	5.0%	7.2%	5.2%	3.2%
	Medium-low	Medium	1.3%	6.9%	4.0%	3.9%	3.7%
	Medium	Medium-low	4.2%	8.9%	9.6%	16.4%	2.7%
	Medium-high	Low	14.1%	22.9%	16.3%	7.7%	0.6%
	High	Low	4.3%	3.1%	13.4%	1.9%	3.8%
	Sum medium-risk firms		**27.9%**	**46.9%**	**51.0%**	**36.2%**	**16.3%**
	Medium-low	Medium-high	0.2%	1.0%	0.5%	1.4%	3.8%
	Medium-low	High	0.1%	0.7%	0.1%	0.2%	8.8%
	Medium	Medium	1.6%	1.4%	1.0%	3.1%	3.6%
	Medium-high	Medium-low	12.9%	10.0%	9.8%	13.0%	4.9%
	High	Medium-low	5.5%	9.2%	2.4%	2.9%	4.3%
	Sum low-risk firms		**20.3%**	**22.3%**	**13.8%**	**20.6%**	**25.4%**
	Medium	Medium-high	0.5%	0.5%	0.7%	2.8%	1.5%
	Medium	High	0.0%	0.4%	0.4%	0.3%	2.4%
	Medium-high	Medium	2.1%	4.8%	3.8%	4.1%	3.9%
	Medium-high	Medium-high	1.4%	1.5%	0.2%	2.3%	5.1%
	Medium-high	High	0.0%	0.0%	0.0%	0.2%	1.4%
	High	Medium	2.6%	2.6%	0.9%	1.2%	3.7%
	High	Medium-high	0.2%	4.6%	0.5%	0.8%	24.4%
	High	High	0.0%	0.1%	0.1%	0.1%	3.0%
	Sum very low risk firms		**6.8%**	**14.5%**	**6.6%**	**11.8%**	**45.4%**

Sources: Author's calculations using BESES data for Northern Ireland, CSO CIP data for Irish goods firms. Irish services exports not available by destination.

A similar pattern applies to imports in Table 8, with 44.9% of imports by Northern Irish goods firms from Ireland being undertaken by firms in the lowest absorptive capacity groups (red and dark-orange) compared to 16.3% of purchases from Britain being accounted for by this group of goods firms. For services, the import patterns are more in line with the patterns of purchases from Britain, but there is still a greater share of purchases by services firms coming from Ireland for firms in at-risk groups, relative to the patterns of import flows from Britain to Northern Ireland. These findings are compatible with the companion piece of research in this series on export participation, published by InterTradeIreland (2018b), which showed a large share of small firms in Northern Ireland trading solely with Ireland. These small, mostly locally-orientated firms with some cross-border trade, are likely to be those most exposed to any changes in trade costs. It should also be noted that many firms simultaneously import and export, as was shown in the research on the extent of cross-border supply linkages published by InterTradeIreland (2018a).

Looking at the patterns for Irish firms, there is greater concentration of both exports and imports amongst firms with greater capacity to absorb shocks, with close to half of exports to the UK accounted for by the least at-risk groups and a similar share of imports (45.4%) also accounted for in these groups. This suggests that any equivalent-sized shock would have less dispersed effects in Ireland than in Northern Ireland, where a greater share of firms would be exposed. At the same time, a substantial share of firms (12.7%) are in the two highest risk categories, so the level of exposure is still considerable.

4.4 TRADE WITH EU BY RISK GROUPS

For firms in Northern Ireland, the exit of the UK from the EU also brings exposure to trade patterns with these countries. Table 9 therefore shows how broader trade (both exports and imports) with the EU is distributed across firm risk groups, with Irish firms also included for the sake of comparison. The patterns of Northern Irish trade with the rest of the EU shows that a greater share of this trade, particularly in terms of exports, is accounted for by firms with a greater shock absorption capacity, as would be expected from the previous analysis by InterTradeIreland (2018b), which showed firms trading only across the border tended to be smaller in size with relatively modest amounts of export sales.

TABLE 9: DISTRIBUTION OF SECTOR TRADE WITH REST OF EU BY FIRM PERFORMANCE GROUP

		NI Goods		NI Services		ROI Goods	
Margin	Sales growth	Exports to REU	Imports from REU	Exports to REU	Imports from REU	Exports to REU	Imports from REU
Low	Low	2.0%	7.6%	10.1%	5.8%	2.6%	3.2%
Low	Medium low	2.0%	1.7%	3.5%	1.4%	0.4%	0.7%
Low	Medium	0.3%	0.8%	2.2%	1.0%	0.6%	1.7%
Medium low	Low	4.0%	8.4%	4.8%	8.5%	0.8%	1.0%
Medium	Low	2.6%	8.5%	5.8%	9.7%	3.2%	5.3%
Sum at risk firms		**10.9%**	**27.0%**	**26.4%**	**26.4%**	**7.6%**	**11.9%**
Low	Medium-high	0.0%	0.0%	0.8%	0.5%	0.1%	0.4%
Low	High	0.0%	0.0%	1.9%	0.0%	1.1%	0.5%
Medium-low	Medium-low	2.7%	6.6%	8.8%	7.0%	3.3%	2.9%
Medium-low	Medium	6.2%	6.6%	3.6%	4.0%	1.0%	1.1%
Medium	Medium-low	12.7%	13.1%	6.6%	18.6%	1.4%	10.6%
Medium-high	Low	18.3%	11.5%	18.7%	12.7%	1.7%	4.1%
High	Low	6.2%	5.6%	1.3%	4.7%	27.6%	5.1%
Sum medium-risk firms		**46.1%**	**43.4%**	**41.7%**	**47.5%**	**36.2%**	**24.7%**
Medium-low	Medium-high	0.4%	0.6%	0.4%	0.3%	1.7%	2.2%
Medium-low	High	0.7%	0.1%	0.1%	0.0%	6.8%	9.7%
Medium	Medium	6.1%	1.7%	0.6%	0.8%	2.7%	6.0%
Medium-high	Medium-low	9.3%	12.2%	7.9%	7.9%	5.9%	1.7%
High	Medium-low	5.7%	6.9%	2.0%	4.9%	2.8%	3.5%
Sum low-risk firms		**22.2%**	**21.5%**	**11.0%**	**13.9%**	**19.9%**	**23.1%**
Medium	Medium-high	0.5%	0.4%	9.5%	3.0%	3.4%	3.7%
Medium	High	0.4%	0.0%	0.3%	0.4%	5.2%	7.4%
Medium-high	Medium	6.1%	3.0%	4.1%	3.8%	1.1%	1.2%
Medium-high	Medium-high	4.5%	2.3%	0.7%	1.1%	2.1%	3.2%
Medium-high	High	0.1%	0.0%	1.6%	0.1%	2.3%	3.4%
High	Medium	3.5%	2.2%	2.8%	2.4%	1.6%	1.8%
High	Medium-high	5.6%	0.1%	1.7%	1.1%	14.9%	10.9%
High	High	0.1%	0.0%	0.2%	0.1%	5.6%	8.7%
Sum very low risk firms		**20.8%**	**8.0%**	**20.9%**	**12.0%**	**36.2%**	**40.3%**

Sources: Author's calculations using BESES data for Northern Ireland, CSO CIP data for Irish goods firms. Irish services exports not available down by destination. Note that REU refers to Rest of the European Union and excludes trade with the UK for Irish firms and trade with Ireland for the Northern Irish firms.

In both goods and services, Northern Ireland firms with the highest level of risk absorption capacity (lowest risk groups) account for approximately 21% of exports to the rest of the EU. The second highest risk absorption group makes up a further 22% of exporting firms in goods and 11% in services. Firms with the lowest risk absorption capacity (highest risk groups), on the other hand, account for 10.9% of the exports of goods firms to the rest of the EU, with an additional 46% in the second-highest risk category.

The share of exports to the EU generated by firms with a low-risk absorption capacity (highest risk groups) for services firms is 26.4%, coming from high-risk firms. Overall, a total of 68.1% of services exporters to the EU are in an at-risk category, compared to 57% of goods exports. It should be recalled, however, that services exports to the EU overall are around one-quarter the value of those of goods (£425m worth of services were exported from Northern Ireland to the EU in 2016, compared to £1,909m of goods, according to NISRA, 2018).

Exposure on the import side is rather more evenly distributed by sector, with goods firms in the highest and second-highest risk categories accounting for 7.6% and 19.4% of EU imports respectively. The equivalent shares for services firms are 5.8% and 20.6%.

For comparison, the structure of Irish trade with the rest of the EU (excluding trade to the UK) is shown to be relatively more concentrated in firms in lower risk categories compared to the Northern Irish pattern. For Irish firms, 56.1% of exports to the EU and 63.4% of imports are accounted for by low-risk firms in the higher absorptive capacity categories. Just 2.6% of exports and 3.2% of imports are by firms within the lowest risk absorption capacity (red) group.

5. Conclusions and Policy Implications

This report examines how the capacity of firms to absorb shocks can be assessed using detailed firm-level patterns of risk exposure across Ireland and Northern Ireland. It should, of course, be emphasised that predictions cannot be made on how any individual firm will respond and adapt to an external shock, as this will depend on a very wide variety of unobservable firm-specific characteristics as well as the precise source, size and nature of the shock itself. However, a broad sense of exposures can be gained at a slightly higher level by looking at combinations of some of the main measureable factors that determine firm performance and flexibility in the face of changes in their external environment.

We first examine how productivity levels are distributed across firms and then use combinations of profit margin and sales growth rates to create risk matrices for different types of firm in each country. To bring in the potential exposure patterns to the most imminent (although as yet still considerably uncertain) change in firm environments from Brexit, we examine how imports and exports are distributed over our 25 categories of shock absorption.

We find that the overall shape of the productivity distribution is highly skewed for all firm types, with a large share of firms concentrated in the mid-range of the distribution, a small tail of laggard firms with negative values of gross value added per worker and a longer tail representing firms with very high levels of productivity. For Northern Irish firms, we find that goods firms tend to have higher levels of productivity than services firms, with the services distribution tending to be more dispersed and to have a higher percentage of firms in the area of negative productivity values. This is consistent with the findings of the ONS on productivity distributions across Great Britain, which found evidence of poorer productivity performance amongst services firms relative to manufacturing. For domestically-owned firms in Ireland, a similar degree of dispersion was found, while the productivity distribution for foreign-owned firms showed a much higher degree of productivity, with a relatively large share of firms positioned at the very high-performance end.

Export participation was found to be a strong feature of higher productivity firms for all firms in Northern Ireland and for services firms in Ireland. For Northern Irish goods firms, there is relatively little difference between the productivity distributions of firms selling to Great Britain and those exporting to Ireland as the only destination. However, firms with exports beyond Ireland had consistently higher levels of productivity compared to those selling locally or into the Irish or British markets. Firms with sales beyond Northern Ireland are also extremely unlikely to fall into the area of negative gross value added per worker. For services firms, the increase in the productivity distribution for firms selling outside Northern Ireland was even stronger than for goods firms. Somewhat surprisingly, this pattern did not apply to Irish-owed goods firms, where the productivity distributions were very similar between exporters and non-exporters. The difference in the overall productivity distribution between exporters and non-exporters for services firms, on the other hand, was substantial.

The core of the report develops a risk profile of firms in Ireland and Northern Ireland. The approach used is to generate a risk matrix based on two reasonably easily observable characteristics of firms – their current profit margin and sales growth performance. The two indicators are combined to create a broad ranking of exposure to shocks containing 25 categories and are presented as a form of heat-map. This allows us to assess the spread of firms along different dimensions of vulnerability or resilience to shocks of varying sizes.

The heat maps are expressed both as shares of firms and shares of employment. The difference between the two ways of presenting the distributions suggest that it is smaller firms that are most exposed to shocks. This is seen with the highest risk category representing 5.5% of firms amongst Northern Irish goods firms, but with a somewhat lower share of employment (4.1%) falling into this category. The pattern is replicated across the other firm types, with the shares of firms in the highest risk categories being consistently greater than the associated share of employment (7.4% of firms and 5.8% of employment for Irish goods firms, 5.8% of firms and 3.6% of employment for Northern Irish services firms and 4.4% of firms and 2.6% of employment for Irish services firms).

Sector sales tend to be dominated by firms in the better performing and hence less at-risk categories. The firms categorised as having very low-risk exposures account for 39.3% of sales of Northern Irish goods firms and 46.1% of Irish goods firms. The share of sales amongst firms with the lowest ability to absorb shocks is by comparison 15.2% and 8.3% for these firms respectively. Amongst services firms, the spread of sales across firms of all risk levels is slightly more diverse, with 27% of sales by high risk firms for Northern Irish services and 13% for Irish services.

We then examine how cross-border and EU trade are distributed across the risk categories, which gives us new insight into how wide-ranging a post-Brexit shock to trade costs might be. This information on the extent to which changes in the external trading environment would hit firms with the weakest capacity to withstand significant changes in costs gives a new angle to previous work undertaken as part of this research programme, which looked at how overall trade flows and those of individual sectors might be affected.

Our key finding in this regard is that trade between Northern Ireland and Ireland, both in terms of exports and imports, is quite dispersed across almost all levels of shock absorption capacity. This means that there is a higher percentage of at-risk firms engaged in this cross-border trade compared to when we look at the risk profile of firms trading between Northern Ireland and Britain or Ireland and the UK. These latter trade flows all tend to be more concentrated in the lower risk groups of firms. For Irish firms, we find that a higher proportion of export and import flows are accounted for by firms with higher levels of shock absorption capacity.

Close to half of exports by Irish-owned goods firms to the UK come from firms in the lowest risk group, whereas 14% of exports from Northern Ireland goods firms to Ireland are accounted for by this group, with the greatest shock absorption capacity. This suggests that any equivalent-sized shock would have more dispersed effects in Northern Ireland, with a greater share of firms exposed relative to Ireland, although the exposure of firms in Ireland is also quite substantial. These findings reinforce what was found in other recent research by InterTradeIreland (2018b), showing a large share of small firms in Northern Ireland trading solely with Ireland. These small, largely locally-orientated firms with some cross-border trade, are likely to be those most exposed to any changes in trade costs.

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Appendix

DISTRIBUTION OF NUMBER OF EXPORTING FIRMS BY SECTION AND FIRM PERFORMANCE GROUP

Margin	Sales growth	NI Goods	NI Services	ROI Goods	ROI Services
Low	Low	301	162	728	113
Low	Medium low	311	143	408	54
Low	Medium	194	148	267	73
Medium low	Low	243	83	379	134
Medium	Low	96	59	353	86
Low	Medium-high	375	106	252	111
Low	High	207	154	368	273
Medium-low	Medium-low	366	116	445	91
Medium-low	Medium	373	163	453	172
Medium	Medium-low	263	82	475	62
Medium-high	Low	105	51	178	67
High	Low	18	83	126	46
Medium-low	Medium-high	662	162	434	117
Medium-low	High	308	169	523	220
Medium	Medium	278	80	401	87
Medium-high	Medium-low	175	40	304	20
High	Medium-low	32	50	520	92
Medium	Medium-high	414	126	419	90
Medium	High	381	140	624	99
Medium-high	Medium	150	46	356	88
Medium-high	Medium-high	233	129	709	127
Medium-high	High	236	127	542	93
High	Medium	7	63	557	196
High	Medium-high	27	59	475	119
High	High	34	55	304	136
Total Exporters		**5791**	**2596**	**10602**	**2766**

Sources: Author's calculations using BESES data for Northern Ireland, CSO CIP data for Irish goods firms and CSO ASI data for Irish services firms. Note that firms categorise in BESES as exporting both goods and services have been allocated into goods or services for the purposes of this table.

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