UK EU Exit: Trade Exposures of Sectors of the Irish Economy in a European Context

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Contents

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Executive Summary

This paper examines the trade exposures of sectors of the Irish economy and other European Union (EU) Member States to the United Kingdom (UK) in light of the UK's decision to exit the EU. This is done by applying sectoral size and proportional exposure measures to the UK across EU countries. The results show that Ireland is substantially more exposed in a number of the goods sectors, this is particularly marked in Agri-food. In services Ireland is in the upper range of the most exposed Member States, particularly in Financial Services. Disaggregating from the sector to the product level the analysis reveals that eleven of the top fifteen proportionally most exposed goods products to the UK are Irish exports and are predominantly from the Agri-food sector. It is also seen that contrary to the trend decline in the importance of the UK as export destination for overall Irish exports, the UK's export share has actually increased in a number of sectors over the past 15 years, including the Agri-food sector.

Next, the paper computes the revealed comparative advantage (RCA) for a number of sectors in Ireland, the UK, and internationally. A comparisons of these sectors with Ireland's sectoral exposures indicates there is a strong overlap between the most exposed sectors of the Irish economy and the UK's comparative disadvantage. This reveals a potential vulnerability for Irish exporters if the UK were to agree free trade agreements for third country imports in these sectors, increasing competition in the UK market.

1. Introduction

1.1. Context

This paper compares the trade exposure to the United Kingdom (UK) of sectors of the Irish economy to that of other European Union (EU) member states. It is of interest to compare the trade exposure at the sectoral level across Member States as one of the potential consequences of a UK exit is the imposition of tariffs between the EU and UK. An analysis at the sectoral level reveals that a diverse exporting relationship to the UK that exists among sectors in each country, and thus highlights what sectors could be most impacted by a restriction on free trade. This paper also calculates revealed comparative advantage at the sectoral level and across countries. The cross-country sectoral analyses complements the cross-country macroeconomic analysis's that compare the overall impact across Member States. A common finding in the macroeconomic literature, as will be discussed subsequently, is that Ireland will be particularly negatively impacted. This paper investigates whether Ireland is also uniquely impacted at the sectoral level and the sectors where the impact is greatest.

1.2. Sectoral Exposure Analysis

The diversity of the exposure to the UK among the sectors of the Irish economy has previously been outlined by the Department of Finance in Smith et al. (2016). That paper introduced measures of size and proportional exposure to quantify different aspects of sectoral trade exposure to the UK.[1] Exposure was quantified using two measures, size exposure and proportional exposure. Size exposure captures the importance of a sectors in a county's UK trade. Proportional exposure captures how important UK trade is to a sector in a country. On this basis the paper found that goods sectors were relatively more exposed than services sectors, and that within the goods sectors those related to Agri-food and Traditional Manufacturing would be the most exposed to any disruption to the trade relationship between Ireland and the UK.[2]

Using comparable international data, this paper applies these exposure measures at the sectoral level in each EU 27 Member State.[3] This will allow the trade exposure of Ireland's sectors to be quantified in a cross EU context.[4] Having computed the exposure measures this paper then computes the

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[1] Size exposure is the proportion of a country's UK exports accounted for by a particular sector. Proportional exposure is the proportion of a sectors global exports that go to the UK.

[2] While Smith et al. (2016) was primarily focused on export exposures, it also noted that these sectors had significant UK import concentrations and could also face disruption on the import side related from any disruption to supply chains.

[3] For a minority of country's sectors there is no data available.

[4] For a cross-European analysis at the product level see Lawless and Morgenroth (2016).

revealed comparative advantage (RCA) of these sectors which provides a snapshot of the relative export specialisation of sectors and countries.[5] As such, in this analysis, it is used to gauge which sectors in the Irish economy may be vulnerable to changes in international trade rules which could arise from the UK exit.

By comparing the exposure to the UK of each sector of the economy in each EU Member State it is found that Ireland is substantially more exposed to the UK in a number of sectors in both goods and services. This variation arises from the diverse exporting relationship to the UK among these sectors. It is also found that while Irish trade in general is less reliant on the UK than in the past, in some sectors this reliance has in fact increased over time. Disaggregating from the sector to the product level the analysis reveals that eleven of the top fifteen most exposed goods products to the UK under the proportional exposure measure are Irish exports and are predominantly from the Agri-food sector. These findings have implications for the prospects of these sectors in the context of future trade negotiations between the EU and the UK and their vulnerability to post-exit UK trade policy.

This RCA analysis in combination with the exposure analysis reveals that the Agri-food and Traditional Manufacturing sectors in Ireland have an additional vulnerability to a UK exit. This vulnerability arises as not only are these sectors highly exposed to the UK economy, these sectors are within the UK itself a small part of the economy, and are sectors in which the UK has a comparative disadvantage.[6] Outside of the EU and without a common customs union type agreement, the UK could negotiate alternative trade policies with third countries. The UK would have a particular incentive to pursue new trade deals, especially for those sectors in which it has a comparative disadvantage. Such a strategy could have substantial negative consequences for these most exposed sectors in the Irish economy as it would be a significant step change in the trading relationship that has developed since EU membership. Further to this, the exposure analysis reveals that Ireland has much to lose from such an outcome relative to all the other EU Member States.

1.3. Cross-Country Macroeconomic and Microeconomic Analysis

A common finding in the literature examining the potential economic impacts of a UK exit of the EU is that among the remaining EU-27 Member States Ireland will be particularly negatively affected. The International Monetary Fund (IMF) conducted a spillover analysis based on two scenarios, a limited and adverse UK exit (IMF 2016). The analysis was preformed using a structural model of the world

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[5] Ruane et al. (2013) include a revealed comparative advantage analysis as part of their investigation into Irelands exporting performance over the period 2002-2011.
[6] The UK's Agri-food and Traditional Manufacturing sectors contribution to UK Gross Domestic Product (GDP) is relatively small.

economy that contains extensive cross country linkages and was estimated for 40 countries. Results from the IMF model indicate that Ireland would experience the largest output losses in both scenarios. The IMF note that "Ireland is notable for the combination of substantial trade and financial linkages, and also labour force linkages" (IMF 2016).

In Dhingra et al. (2017), a global trade model is used to measure the cross country welfare losses from a UK exit with welfare measured by changes in household consumption. Their analysis finds countries where the UK is an important trading partner are the most impacted, with Ireland identified as the country that will experience the largest losses from a UK exit (Dhingra et al., 2017). The Organisation for Economic Cooperation and Development (OECD) used a global macro-econometric model to analyse financial market shocks emanating from a UK exit and found that not only is Ireland highly exposed to the UK economy, but even among the highly exposed group of nations, Ireland is an exception given the strength of its linkages with the UK economy (OECD 2016).[7] In Rojas-Romagosa (2016), the Netherlands Bureau for Economic Analysis employ their WorldScan model of the world economy to simulate a number of UK exit scenarios. Results from the model indicate that there will be significant output losses, and sectoral readjustments of output across a number of EU Member States, with the losses estimated for Ireland found to be higher than for any other Member State, except for the UK itself.[8] Given that Ireland is frequently found to be the most exposed country to a UK exit, as outlined by a number of international organisations in macroeconomic analysis, it would be expected that this would be reflected when comparing the sectors of the Irish economy to those of other Member States.

The sectoral level analysis in this paper also compliments and supports the results of a number of microeconomic studies on the impact of a UK exit. Most closely related is the analysis of Lawless and Morgenroth (2016) which uses detailed product level data to estimate the impact on the trade in goods between the UK and other EU members of the imposition of World Trade Organisation (WTO) tariffs. Their analysis shows a very wide range of impacts across countries, this depends on the composition of trade, tariff schedule and the elasticity of trade with respect to the price. In their analysis Ireland and Belgium are found to be the most exposed countries, losing 4 and 3.1 per cent of their trade respectively. Utilising the same approach as Lawless and Morgenroth (2016), that of

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[7] For an overview of cross country linkages of EU Member States with the UK economy see European Parliament (2017).
[8] It should be noted that of the cross country analysis, the most comparable with Ireland specific studies, in terms of scenarios and time horizons is Rojas-Romagosa (2016), which estimated a 3.7 per cent output fall for Ireland under a World Trade Organisation (WTO) scenario. These estimates are broadly similar to those of Bergin et al. (2016) at 3.8 per cent. Central Bank (2016) estimate the impact at 3.2 per cent. It should be noted Rojas-Romagosa (2016) use a CGE model while Bergin et al use a structural macro-econometric model.

applying the WTO tariff schedule, Lawless and Studnicka (2017) analyse the impact of WTO tariffs on North-South as well as Ireland-Great Britain trade in goods. In addition to the tariff schedule, the effects of exchange rate changes and non-tariff barriers are also incorporated. They find substantial variation in exposure among sectors and products with Agri-food highlighted as being particularly exposed. Barrett et al. (2015) focuses mainly on UK Ireland trade but also considers service trade by broad geographical destination as well as value added trade. Their analysis highlights the differential exposure of sectors, regions and different types of enterprises.

This paper contributes to the analysis of the UK exit by applying simple measures to qualify the exposure of sectors on a cross European basis and so allow the comparative exposure of sectors in Ireland to be seen. The paper applies this cross European analysis to both goods and services trade and also highlights how the reliance of Irish goods sectors on UK trade has changed over time. By calculating RCA at the sectoral level and comparing this to the exposure measures the paper highlights potential vulnerabilities to future UK trade policy.

The remainder of the paper will be structured as follows, Section 2 will discuss the data and methodology. Section 3 will present the results of the exposure analysis and revealed comparative advantage analysis for goods exports to the UK by sector and EU country. Section 4 repeats the exposure and revealed comparative advantage analysis for services exports to the UK by sector and EU country, finally Section 5 concludes.

2. Data and Methodology

2.1. Data

The data for the goods sectors for both the exposure and the RCA analysis come from the United Nations Conference on Trade and Development (UNCTAD) database. This dataset contains information on the exports of goods and services by product and destination.[9] To align the analysis with that of Smith et al. (2016) these products are aggregated into sectors according to the SITC reference codes.[10] Further detail of the SITC categorisations are presented in the Appendix. For services the data are taken from both the UNCTAD database and the OECD's International Trade and Balance of Payments data.[11]

To compliment the RCA analysis data from the OECD's Trade in Value Added (TiVA) database is used. The economic rationale for this check will be discussed in detail in Section 3. Despite its usefulness as a robustness check, the TiVA database does not provide the same level of detail as the UN data. Many sectors that are separately recorded in the UN data are merged in the TiVA database. In addition the TiVA database is currently only available to 2011 compared to the UN data which is available to 2015.

A further complication of using the TiVA and UN databases are that they are based on slightly different statistical frameworks. The UN data is based on SITC classifications and the OECD's TiVA data is broadly based on NACE classifications.[12] The comparison between the NACE and SITC methodologies is discussed in Smith et al. (2016), broadly speaking the difference is that NACE is based on an economic activity classification and SITC's are based on a product classification.

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[9] Available from UNCTAD (http://unctadstat.unctad.org/). Data on exports of goods and services are in US dollars. Note: the United Nations Conference on Trade and Development data for both goods and services for all EU countries is denominated in US dollars.
[10] SITC is defined as the Standard International Trade Classification which is a statistical classification of the commodities entering external trade. It is designed to provide the commodity aggregates required for purposes of economic analysis and to facilitate the international comparison of trade-by-commodity data. NACE is the "statistical classification of economic activities in the European Community" and is the subject of legislation at the European Union level, which imposes the use of the classification uniformly within all the Member States. It is a basic element of the international integrated system of economic classifications, which is based on classifications of the UN Statistical Commission (UNSTAT), Eurostat as well as national classifications; all of them strongly related each to the others, allowing the comparability of economic statistics produced worldwide by different institutions.
[11] EBOPS 2010 – Trade in Service by Partner Country. The 2014 version of this data is used as 2015 data was only provisional at the time of publication.
[12] The industries/sectors in the OECD database come from the Structural Analysis (STAN) database for Industrial Analysis that is based on the International Standard Industrial classification of all Economic Activities (ISIC Rev.3), see the OECD (2005) for more detail. This a different classification to the SITC classifications used in the UN datasets. As outlined in OECD (2005) the ISIC methodology is a close match to the NACE Rev.1 codes.

2.2. Methodology

This section provides a brief summary of the exposure measures used to conduct the analysis in this paper. These measures take into account two dimensions of export exposure to the UK. The size exposure measure is calculated as the value of the exports in each sector to the UK as a proportion of a country's total exports.[13] The proportional exposure measures represents the proportion of each individual sector's exports to the UK out of that sector's global exports. These two dimensions of exposure give a measure of both the importance of a sector in a country's overall exports to the UK and the importance of the UK to that sector, (see Box 1 below).[14]

Box 1: Measuring the concepts of *Size* and *Proportional* exposure

$$Size\ Exposure = \frac{X_j^{i,UK}}{\sum_i X_j^{i,World}} = \frac{Sector's\ Exports\ to\ the\ UK}{Total\ Country\ Exports\ to\ the\ World}$$

where $X_j^{i,UK}$ are exports in sector i from country j, exported to the UK. The denominator $X_j^{i,World}$ represents sum of total exports of all sectors from country j, exported to the world.

$$Proportional\ Exposure = \frac{X_j^{i,UK}}{X_j^{i,World}} = \frac{Sector's\ Exports\ to\ the\ UK}{Sector's\ Total\ Exports\ to\ the\ World}$$

where $X_j^{i,UK}$ are exports in sector i from country j, exported to the UK. The denominator $X_j^{i,World}$ represents total exports of sector i from country j, exported to the world.

These measures of export exposure to the UK are applied to goods and services exports in each country separately. These results are presented and discussed in Sections 3 and 4 respectively.

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[13] These sectors, or categories, are defined by the statistical reporting standard to which their publication is tied. Specifically, services exports are broken into ten sectors/categories by the CSO in their Balance of Payments publications– these are discussed in Annex 1. Goods exports are classified according to SITC classifications, of which there are also ten. Similarly, these are discussed in the Annex.

[14] In this paper the size exposure measure is adjusted compared to that used in Smith et al. (2016). When moving to a cross country comparison it is important to take into account the fact that the UK's overall importance as an export destination varies between countries in the EU 27. The size measure changes to reflect this and is taken as a sector's exports to the UK as a share of total exports to all countries.

2.3. Revealed Comparative Advantage

The comparative advantage, or disadvantage, of countries in trading different products is driven by their relative endowments of factors of production such as physical and human capital and the influence of the prevailing system of protections which govern countries trade. The revealed comparative advantage (RCA) measure, as used in this paper, does not try to measure these underlying endowment differences among countries, but takes the observed pattern of international trade as being a reflection of these differences (Balassa, 1979). RCA is taken as a measure of the relative export performance of sectors in countries. Countries will tend to export in sectors they have a comparative advantage in, and import in sectors they have a comparative disadvantage in, the RCA approach quantifies these comparative advantages using a single index measure and is calculated as:

$$RCA_j^i = \frac{X_j^i \Big/ \sum_i X_j^i}{\left(\sum_j X_j^i - X_j^i\right) \Big/ \left(\sum_i \sum_j X_j^i - \sum_i X_j^i\right)}$$

The numerator represents the percentage share of a given sector in national exports X_j^i are exports of sector i from country j. The denominator represents the percentage share of a given sector in world exports.[15] Thus, the RCA index provides a comparison of the national export structure (the numerator) with the world export structure (the denominator). For ease of interpretation, a standard approach is to transform the RCA into a symmetric index, which ranges from -1 to +1. In the remainder of the paper when referring to RCA it is this symmetric version that is being used, it is expressed as:

$$RCA_j^i = \frac{RCA_j^i - 1}{RCA_j^i + 1}$$

Where RCA_j^i > 0 indicates that country j is specialised (has a comparative advantage) in sector i relative to the world. RCA_j^i < 0 indicates that country j is not specialised (has a comparative disadvantage) in sector i relative to the world.[16] The RCA measure is a static measure derived from current production and trading patterns. In this paper RCA is applied to highlight sectors which may be vulnerable to the UK's exit from the EU and not as a predictor of the sectoral effects of possible future changes arising from the UK's exit.[17]

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[15] The country, j, itself is excluded from the measure for the world.
[16] For a discussion on measures of revealed comparative advantage see Laursen (2015) and French (2017).
[17] Barry and Hannon (2001) demonstrate the poor performance in predicting sectoral developments in Ireland.

3. Goods Exports to the UK by Sector and EU Country

3.1. Cross European Goods Size and Proportional Exposure

In this section the analysis turns to a detailed examination of the exposure of Ireland's goods sectors, along with those of other EU countries, to the UK. The larger goods sectors by the size exposure measure, "Food and Live Animals", "Chemicals and Related Products", "Manufactured Goods" and "Machinery and Transport Equipment" are presented.[18] As shown in Table 1, Irish goods exported to the UK account for just under 7 per cent of Ireland's total exports. This amounts to 14 per cent of Ireland's goods exports (Smith et al., 2016).

Table 1. Irish Goods Exports by Sector to UK in 2015

Irish Goods Sectors (Standard International Trade Classification Categories)	Irish Exports of Goods by Sector to UK as % of Total Irish Exports	Irish Exports of Goods by Sector to UK as % of Total Irish Exports to the UK
Food and live animals (SITC 0)	1.9	29
Beverages and tobacco (SITC 1)[19]	0.1	2
Crude materials, inedible, except fuels (SITC 2)	0.2	3
Mineral fuels, lubricants and related products (SITC 3)	0.2	3
Animal and vegetable oils, fats and waxes (SITC 4)	0.0	0.1
Chemicals and related products n.e.s. (SITC 5)	1.7	26
Manufactured goods classified chiefly by material (SITC 6)	0.5	7
Machinery & transport equipment (SITC 7)	1.1	17
Miscellaneous manufactured articles (SITC 8)	0.6	9
Commodities and transactions n.e.s. (SITC 9)	0.2	3
Total	**6.6**	**100**

Source: CSO External Trade and Balance of Payments data. Department of Finance analysis.

As illustrated in Figure 1 below, Ireland's Food and Live Animals sector is substantially more exposed to the UK in comparison to the other EU 27 Member States. This sector accounts for just under 30 per cent of Ireland's goods exports to the UK which, amounts to just over 4 per cent of Ireland's global goods exports, the size exposure. Approximately 45 per cent of the exports of this sector go to the UK, the proportional exposure. With the exception of Cyprus all other countries have a proportional exposure of less than 15 per cent. At the Agri-food sub-sectoral level, Ireland's Meat and Dairy Products sub-sectors are, in particular, substantially more exposed to the UK in comparison to the other EU 27 Member States (see appendix Figures 2 and 3).

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[18] The goods sectors as listed in Table 1, are provided in the appendix or are available on request.
[19] The exposure analysis of Ireland's Beverages and Tobacco sector compared with other EU Member States is show in Appendix Figure 1. Due to the aggregation of the UNCTAD data, the sectors Beverages and tobacco are reported together.

Figure 1. Food and Live Animals Export Exposure to the UK (2015)
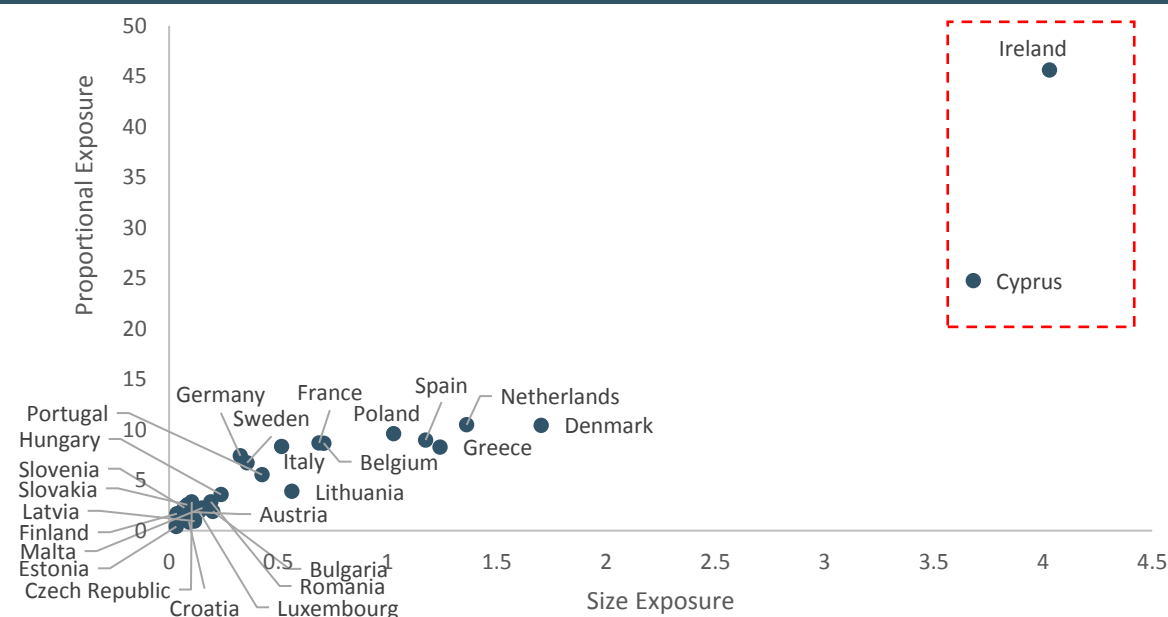
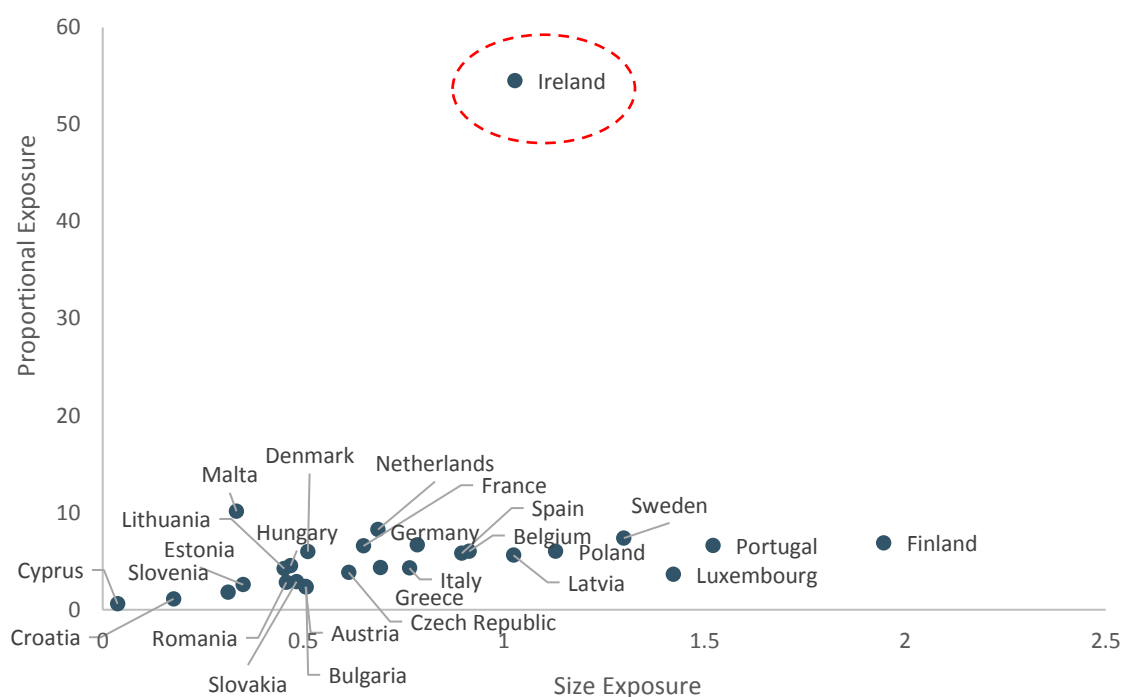Source: UNCTAD Statistics External Trade Goods data. Department of Finance analysis.

Figure 2 shows that in the Chemicals and Related Products sector Ireland stands out on the size exposure measure where, at just under four per cent of total goods exports, this trade with the UK is a greater share of national goods exports than in any other EU 27 Member State. In this sector Ireland has a similar proportional exposure to a number of other European countries. As noted in Smith et al. (2016) the lower proportional exposure of the Irish Chemicals sector compared to the Agri-food sector reflects the greater international diversity of the export portfolio of Ireland's Chemicals sector. The exports of the Agri-food sector are much more concentrated in the UK market.

Figure 2. Chemicals and Related Products, n.e.s., Export Exposure to the UK (2015)
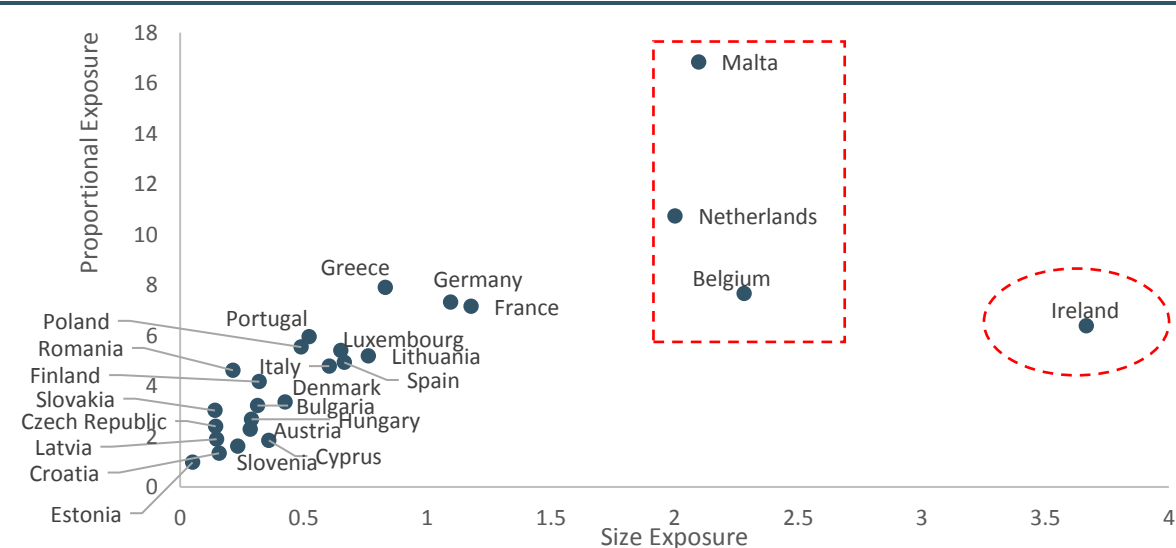
Source: UNCTAD Statistics External Trade Goods data. Department of Finance analysis.

The exposure of the Manufactured Goods and the Machinery and Transport Equipment sectors, are illustrated in Figures 3 and 4 below respectively. These figures again show that Ireland is substantially more exposed in terms of its proportional exposure in the Manufactured Goods sector, with over 50 per cent of its exports going to the UK. Ireland is also in the upper range of exposed countries in the Machinery and Transport Equipment sector, with over 16 per cent of the exports destined for the UK.

Figure 3. Manufactured Goods Export Exposure to the UK (2015)

For the Manufactured Goods sector, it is noteworthy, however that a number of Member States including Finland, Portugal and Luxembourg have a higher size exposure. Similarly for Machinery and Transport Equipment sector, several Member States have a higher size exposure than Ireland, including Belgium, Netherlands, Spain, and Germany, all with a size exposure in the range of 3-4 per cent.[20] This illustrates that these are relatively small sectors in comparison to Food and Live Animals and Chemicals.

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[20] It should be noted the Machinery and Transport Equipment sector contains a broad range of products including electrical and telecommunications. This is detailed in the appendix.

Figure 4. Machinery and Transport Equipment Export Exposure to the UK (2015)
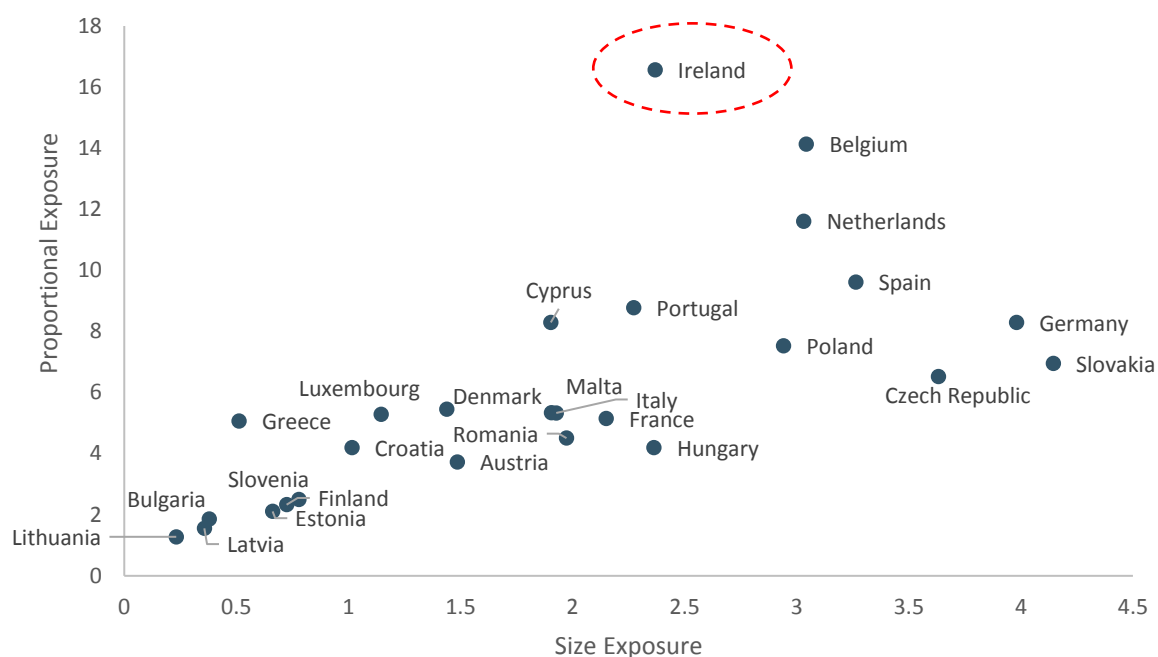
Source: UNCTAD Statistics External Trade Goods data. Department of Finance analysis.

Having looked at different dimensions of exposure, the results above show Ireland in the upper range of trade exposed countries to the UK in a number of sectors. Relative to other Member States Ireland's high degree of exposure is most pronounced in the Food and Live Animals sector.

3.2. Changes in Proportional Exposure over Time, 2000-2015

As noted in Smith et al. (2016) the importance of the UK as a destination market has declined over the last 40 years. In the early 1970's the UK accounted for over 50 per cent of total Irish exports where as in 2015 the UK accounted for just 17 per cent of total Irish exports. Given this aggregate trend, and the fact that the previous analysis has shown that it is generally the proportional measure that separates Ireland from other EU 27 countries in terms of UK trade exposure, it is of interest to examine how Ireland's proportional exposure has changed over time at the sectoral level.

Figure 5 below shows the proportional exposure of each of the goods sectors of the Irish economy in 2000 and in 2015. Starting with the largest, the sectors are ordered from left to right according to their size exposure. As can be seen, a number of sectors including Food and Live Animals and Manufactured Goods have had an increase over time in their dependence on the UK as an export market. For example; Ireland's exports to the UK in Food and Live Animals has increased from 38 per cent of the sectors total exports in 2000 to 46 per cent in 2015. Ireland's exports to the UK in Manufactured Goods

has also increased from 43 per cent of the sector's total exports in 2000, to 55 per cent 2015. The figures in this chart thus reveal that although at the aggregate level there is a long term trend decline in the UK export share, certain sectors still have a high exposure to the UK and for some this has increased over the past 15 years. By contrast the proportional exposure of the Chemicals sector has decreased over time.

Figure 5. Ireland's Proportional Exposure to UK (2000 & 2015)
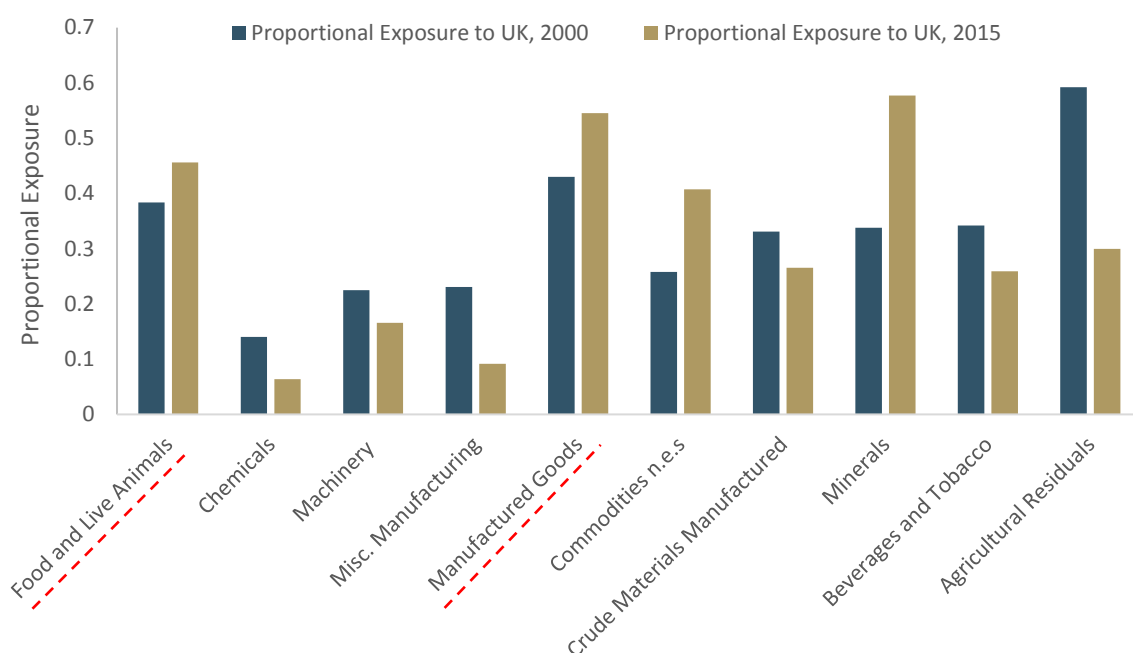
Source: UNCTAD Statistics External Trade Goods data. Department of Finance analysis.

3.3. Exposure at a Further Disaggregated Product level

The analysis thus far has been conducted with UNCTAD data aggregated into broad sectors. These sectors are now disaggregated to the next level of statistical classification detail. This is done to rank the proportionally most exposed products across all of the EU 27 countries at SITC 2-digit level. In this figure products that have a size exposure measure of less than one per cent are excluded. This is done to add some dimension of economic size to the proportional measure, which on its own can lead to small niche sectors dominating the ranking.

The proportionally most exposed SITC 2-digit products to the UK across all of the EU 27 countries are outlined in Figure 6 below. Eleven of the EU 27's top fifteen most exposed products to UK, on the proportional exposure measure, are Irish exports. Included in the top five are the Irish Agri-food sub-

sectors, Cereals, Vegetables and Fruit, and Live Animal products. These sectors would face some of the highest tariffs if the EU registered WTO tariff schedule was applied to EU-UK trade (Lawless and Morgenroth 2016), who find similar results.

**Figure 6. Top 30 Proportionally Most Exposed Products to the UK by Country (2 digit SITC) 2015**

Proportional Exposures to UK by Product and Country (2 digit SITC) 2015

Source: UNCTAD Statistics External Trade Goods data. Department of Finance analysis.

3.4. Revealed Comparative Advantage: Goods Sectors

Figure 7 below shows the revealed comparative advantage of the goods sectors of the Irish and UK economies in 2000 and 2015.[21] It can be seen that for each country the RCAs of the sectors have not changed substantially over the 15 year period covered by the data.[22]

Figure 7. Ireland and the UK's RCA by Product Group (2000 & 2015)
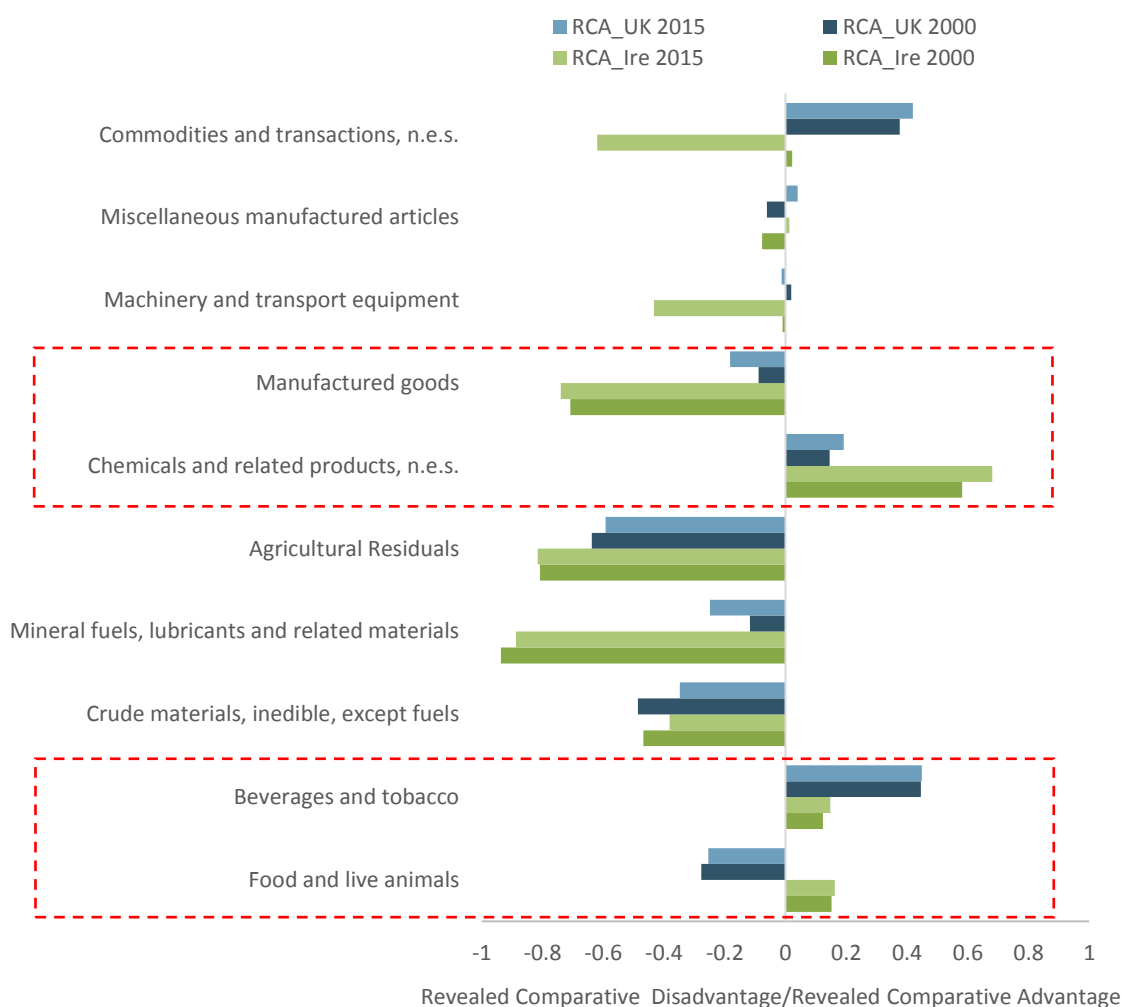
Source: UNCTAD Statistics External Trade Goods data. Department of Finance analysis.

As illustrated in Figure 7 above, both the UK and Ireland record a negative RCA in many of the goods sectors. Overall this pattern of RCA is intuitive and in line with the trend of advanced economies specialising in more high-tech sectors with more standard goods being produced in lower cost economies (Ruane et al. 2013). It is of interest to note that Ireland records a much larger RCA in the

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[21] This RCA is calculated for and relative to goods sectors only.
[22] This stability over time of the RCA measures for sectors in Ireland was also found in Central Bank of Ireland (2017).

Chemicals sector, which includes Pharmaceuticals, in comparison to the UK. As discussed previously, a negative RCA is indicative of a sector that a country is not internationally competitive in as an exporter, and given this, it is notable that in the Food and Live Animals sector Ireland records a positive RCA while the UK's RCA is negative.

The calculation of RCA presented in Figure 7 is based on gross exports, and this approach has the advantage of maintaining consistency in terms of data usage with the previous section which presented the size and proportional exposure measures. However, as discussed in Koopman et al. (2014) using gross figures can distort the measure of revealed comparative advantage due to double counting the value of intermediate goods. This can misrepresent the picture of a country's role in cross-border production/value chains and thereby the measurement of a country's revealed comparative advantage. This value chains effect can be particular high in smaller economies (OECD 2013).

As a robustness check on the gross RCA figures and to allow further cross country comparisons the OECD's TiVA dataset is used to calculate RCA based on domestic value added embodied in gross exports.[23] By using domestic value added this addresses the criticism of Koopman et al. (2014). This value-added approach is used in Barrett et al. (2015) to analyse Ireland-UK trade.

The TiVA data which measures domestic value added is currently only available to 2011, however given previous studies have found RCA measures to be relatively stable over time the 2011 figures should be comparable over the short time horizon considered here.[24] The addition of non-EU countries is done to add context for certain sectors, such as New Zealand, Brazil and Argentina for Agri-food. The cross country RCA's for these sectors are shown in Figures 8 and 9 below.[25]

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[23] Domestic value added content of gross exports includes the value added generated by the exporting industry during its production processes as well as any value added coming from upstream domestic suppliers that is embodied in the exports (OECD 2017).

[24] A further difference is that, as noted in Section 2, the OECD TiVA database is constructed on a different statistical methodology to the UN data. As a result, sectors are not directly comparable and so close proxies are used. For example, the UNCTAD Food and Live Animal and Chemicals and Related Products will be proxied by the TiVA sectors Food Products, Beverages and Tobacco and Chemicals and Chemical Products.

[25] It should be noted that within the broad sectors considered here there can be considerable diversity, for two countries can have a high RCA in Agri-food but this can be it very different products, e.g. crops, dairy.

Figure 8. Food Products, Beverages and Tobacco RCA's by Country (2011)
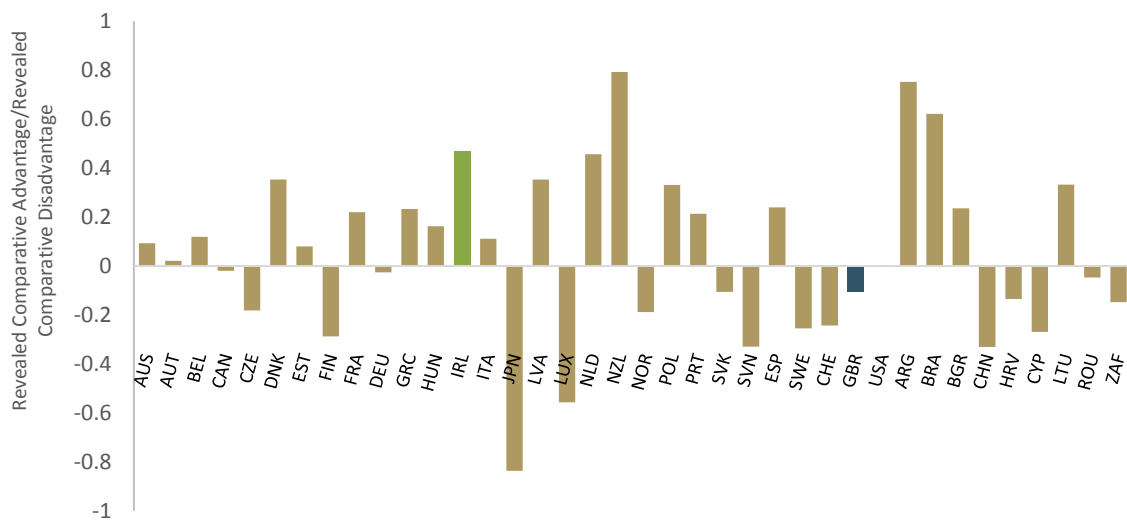
Source: OECD TiVA data. Department of Finance analysis.

Figures 8 and 9 show that even when taking into consideration the impact of global value chains using TiVA data, on a cross country basis Ireland's RCA in the Food and Chemicals sectors is high. Importantly for the analysis in this paper the pattern of Ireland and the UK's RCAs are similar to that calculated from the UN gross exports data. Ireland records the highest RCA in the food industry of any European country, and out of the sample of countries presented, which include European countries along with some larger advanced and emerging economies, is only lower than New Zealand, Argentina and Brazil.[26] In Chemicals Ireland's RCA is second only to that of Switzerland.[27]

Figure 9. Chemicals and Chemical Products RCA's by Country (2011)

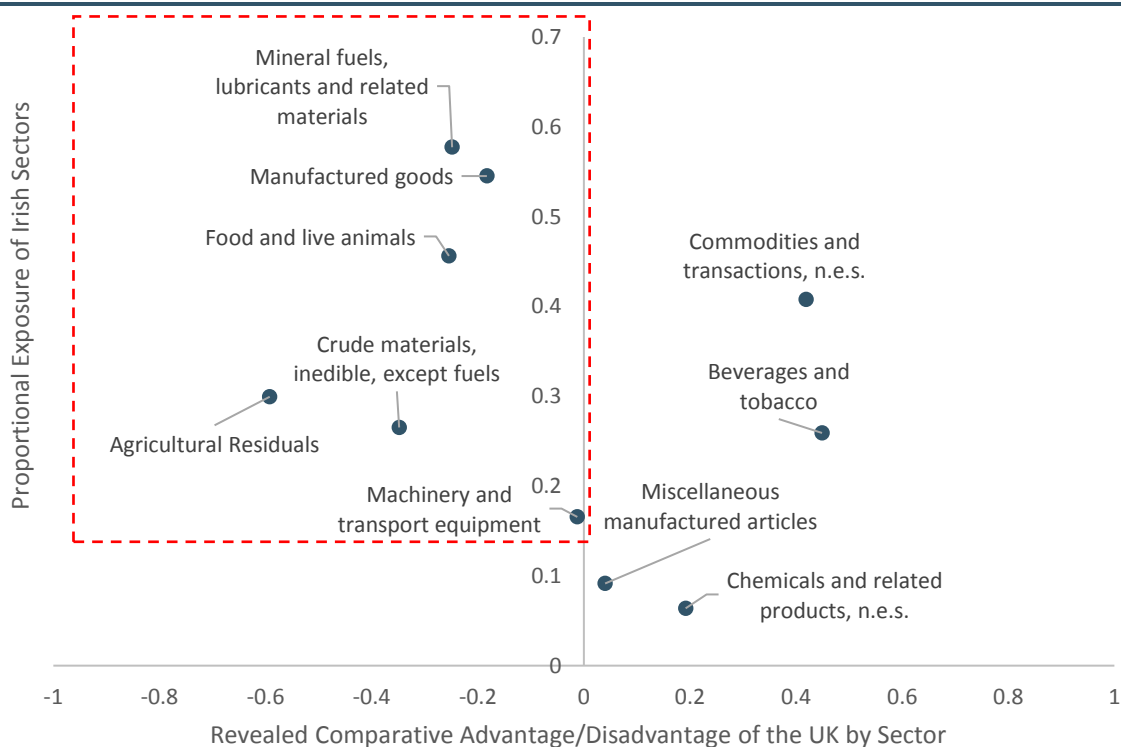Source: OECD TiVA data. Department of Finance analysis.

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[26] Out of the global sample from the OECD's TiVA data set Ireland's RCA in Food is also lower than that of Iceland, Vietnam, Thailand, Malaysia and Indonesia.

[27] Although Ireland's Chemicals sector has a high level of foreign value added this is true for the Irish economy as a whole so its relative importance in RCA changes little.

3.5 Revealed Comparative Advantage, Exposure and Post-Exit UK Trade Options

An insight from the sectoral exposure and RCA analysis is that a large overlap exists between the sectors that the UK has comparative disadvantages in and those sectors in Ireland with the highest exposure to the UK. This is shown in Figure 10, the proportional exposure for the sectors of the Irish economy are shown on the vertical axis and the RCA for the corresponding sectors of the UK are shown on the horizontal axis.[28] For example it can be seen that the Food and Live Animals sector is among the most exposed goods sector of the Irish economy to the UK under the proportional exposure measure and is also a sector of comparative disadvantage for the UK economy. This is important for Ireland as post exit the UK would have an incentive to seek trade agreements with third countries better aligned with its own comparative advantages and disadvantages. In other words to reach trade agreements to import in sectors which it has a comparative disadvantage in.

Figure 10. Revealed Comparative Advantage and Proportional Exposure (2015)

Source: UNCTAD Statistics External Trade Goods data. Department of Finance analysis.

Figure 10 fits in with a frequently noted post exit trade policy option for the UK. That of unilateral free trade in certain sectors, with free trade in agriculture in particular often cited as potentially yielding a substantial economic benefit to the UK given the UK is a net food importer. Much of this argument is

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[28] This RCA is from the UN data, but as shown this pattern remains broadly similar when global value chains are accounted for using TiVA. The proportional exposure measure reflects the dependence of the sector on the UK as an export destination.

summarised in Minford et al. (2015) and IMF (2016). In Minford et al. (2015) European agricultural policy is viewed as imposing substantial costs on the UK and European economy with its distortion to trade resulting in food prices elevated above world prices.[29] Reflecting the revealed comparative advantage findings in this paper, Minford et al. (2015) state that the benefit to the UK of a move towards world prices "reflects the comparative advantage of other sectors of the UK economy relative to agriculture".[30]

Any new UK trade policy towards trade in Agri-food that increases competition from third countries in the UK market for Irish exporters would have implications for Ireland given the high exposure measure. This would potentially be a considerable disruption as it would represent a significant step change in a long established system of trade rules. A further issue is that these potential trade agreements may not have to be bilateral but could be less complex unilateral trade deals covering broad sectors.

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[29] For an overview of the issues see Wichern (2004) and Borrell and Hubbart (2000).
[30] Although from a macroeconomic perspective this deregulation may not cover the costs from the UK loss of access to the single market it is still a potential strategy (IMF 2016).

4. Services Exports to the UK by Sector and EU Country

4.1. Cross European Services Size and Proportional Exposure

This section replicates for the services sectors the size and proportional exposure analysis conducted for the goods sector.[31] As shown in Table 2, Irish Services exports to the UK account for 10 per cent of Ireland's total exports. This amounted to 19 per cent of Ireland's total of services exports in 2015 (Smith et al., 2016).[32] Figures 11 to 14 show the cross country size and proportional exposure measures for the following service sectors; Financial Services, Insurance and Pension Services, Telecommunications, Computer and Information Services, and Other Business Services.[33] The results show that Ireland is in the upper range of the most exposed countries in a number of services sectors.

Table 2. Irish Services Exports by Sector to UK in 2015		
Irish Services Sectors (Balance of Payment Categories)	Irish Exports of Services by Sector to UK as % of Total Irish Exports	Irish Exports of Services by Sector to UK as % of Total Irish Exports to the UK
Transport (BOP 1)	2.0	20
Tourism and travel (BOP 2)	0.4	4
Communications (BOP 3)	0.1	1
Insurance (BOP 4)	1.1	11
Financial services (BOP 5)	1.6	16
Computer services (BOP 6)	3.0	29
Royalties/licences (BOP 7)	0.2	2
All business services (BOP 8)	1.3	13
Other services not elsewhere stated (BOP 9)	0.4	4
Repairs and processing (BOP 10)	0.0	0.02
Total (%)	**10.1**	**100**

Source: CSO External Trade and Balance of Payments data. Department of Finance analysis.

Looking at the size exposure for Financial Services, at 2.7 per cent, the importance of this sector's exports to the UK for Ireland's total services export portfolio is only exceeded by that of Luxembourg, at 7 per cent. On the proportional exposure measure, 33 per cent of Ireland's Financial Services exports are to the UK. The next most exposed Member State on the proportional measure is Greece

[31] The data for services is not as complete as that for goods, a number of countries for which data is available on the good side have to be omitted from the services analysis. It should also be noted that trade in services is more difficult to measure than trade in goods (Lipsey 2009). Results should be taken in this context.
[32] Caution should be taken in interpreting services data as due to additional complications, such as transfer pricing, large value may not necessarily imply large employment in the sector. We would like to thank a reviewer for highlighting this point.
[33] Exposure analysis of the Transport Services sector is shown in Appendix Figure 4, other service sectors as detailed in Table 2 are available on request.

at 27 per cent. However in terms of size, Financial Services exports to the UK are less than 0.2 per cent of Greece's total service exports.[34]
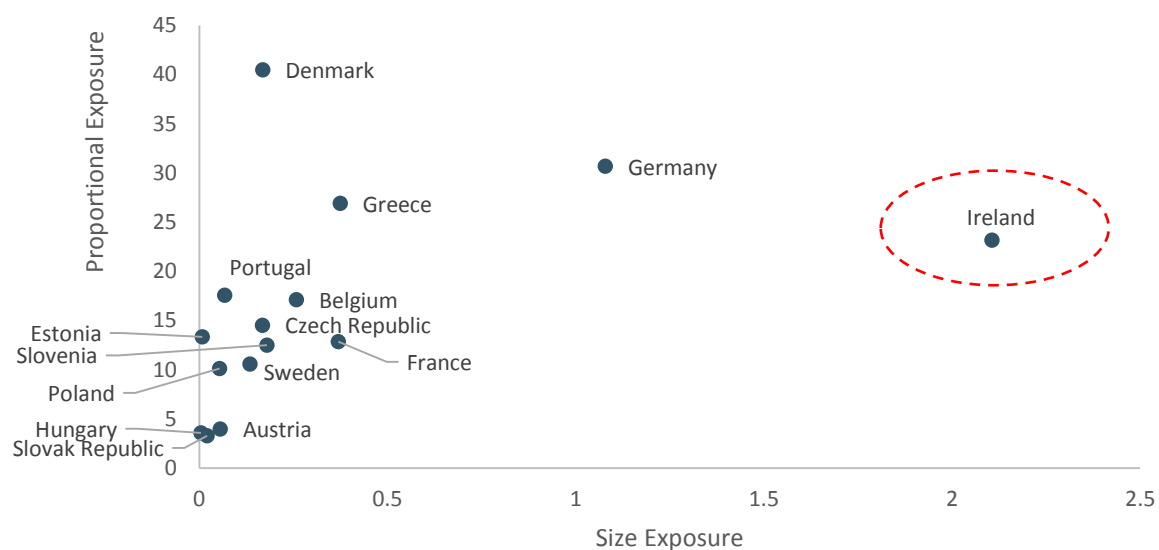
Figure 11. Financial Services Exposure to the UK (2014)

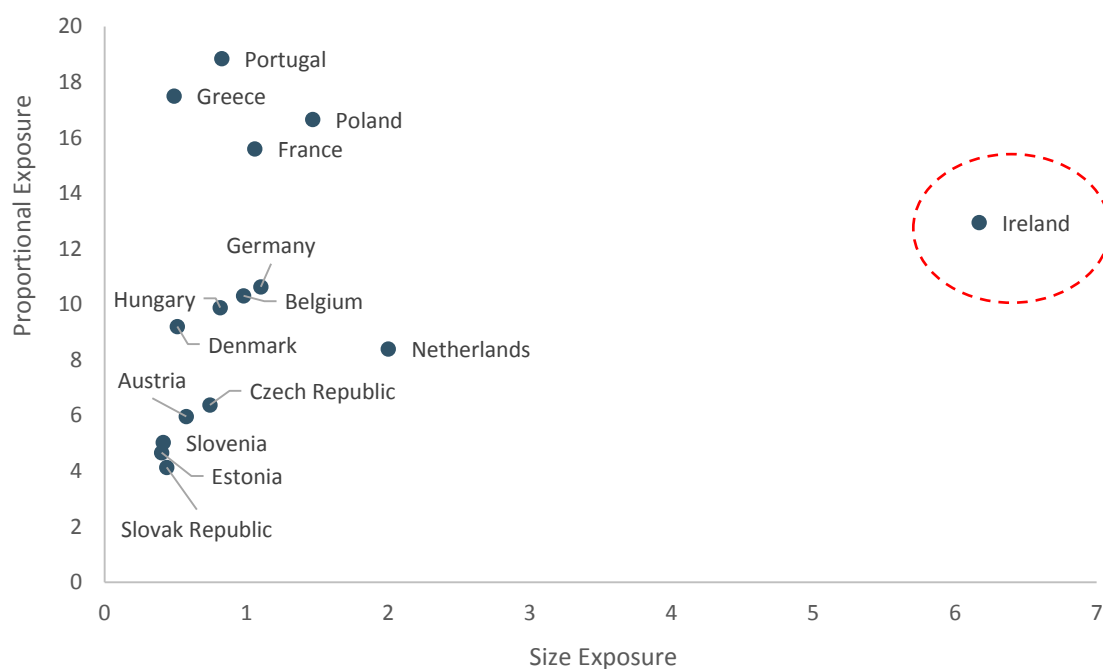Source: OECD Balance of Payments data. Department of Finance analysis.

As illustrated in Figure 12 below the size exposure of the Insurance and Pension Services sector illustrates the importance of the sector in terms of Ireland's overall exports and at 2.1 per cent of total service exports, it has the largest size exposure of all Member States. However in terms of the proportional measure, 23 per cent of the exports of Ireland's Insurance Sector go to the UK. This is lower than the share for Germany, Greece and Denmark. Therefore in this sector it is the size exposure that drives Ireland's high level of exposure relative to other Member States.

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[34] This definition of the Financial Services sector excludes Insurance and Pension Services.

Figure 12. Insurance and Pension Services Exposure to the UK (2014)

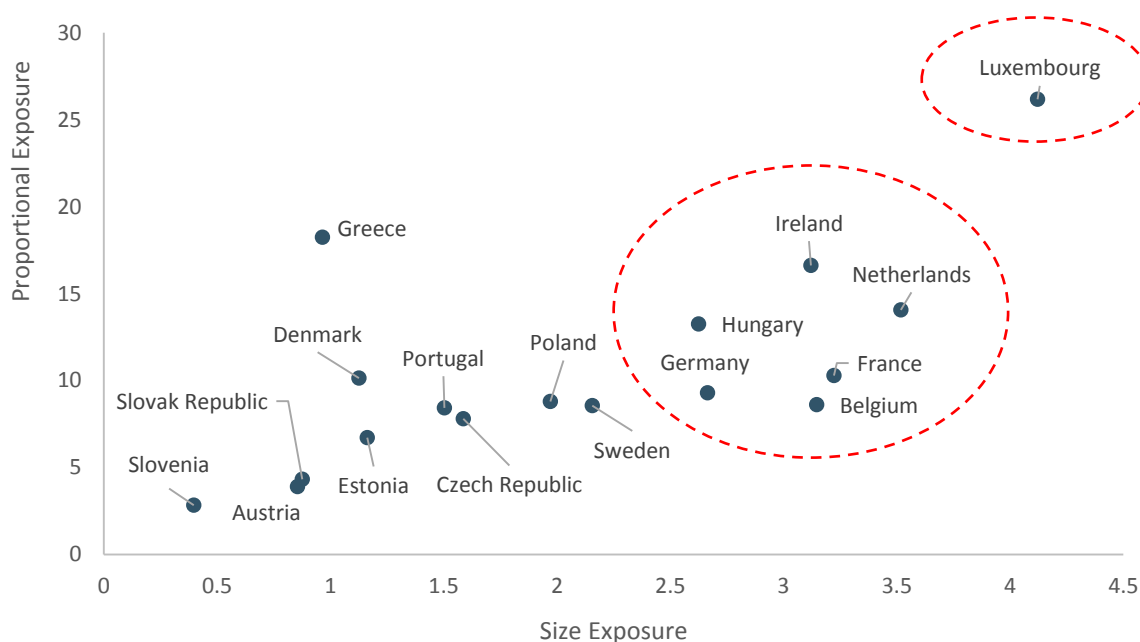Source: OECD Balance of Payments data. Department of Finance analysis.

Figure 13 shows Ireland's exposure in Telecommunications, Computer, and Information Services. In terms of size exposure this sector's exports to the UK account for over six per cent of Ireland's total services exports. This is four percentage points higher than the Netherlands, the next county in terms of size exposure. In terms of proportional exposure 13 per cent of Ireland's exports from this sector are destined for the UK, in the mid-range of Member States.

Figure 13. Telecommunications, Computer, and Information Services Exposure to the UK (2014)

Source: OECD Balance of Payments data. Department of Finance analysis.

Figure 14 below shows the Other Business Services Sector. Contained in this sector are activities such as Research and Development, Renting of Equipment and Machinery, and Computer Services. Exports to the UK in this sector accounts for just over three per cent of Ireland's total services exports. Within this sector the UK accounts for 17 per cent of its global export portfolio. Although this places Ireland comparatively high in terms of exposure, in this sector, by these measures, Luxembourg displays the highest degree of exposure with a proportional exposure of 26 per cent and a size exposure of 4 per cent.

**Figure 14. Other Business Services Exposure to the UK (2014)**

Source: OECD Balance of Payments data. Department of Finance analysis.

4.2. Revealed Comparative Advantage: Services Sectors

The RCAs of Ireland's services sectors for 2015, along with those of the UK, are illustrated in Figure 15 below. The UK has a significantly higher comparative advantage in Financial Services compared to Ireland, though in the Insurance sector Ireland has an RCA that is slightly higher than the UK.[35] Ireland has a positive RCA in the Communications sector compared to the UK's negative RCA, or comparative disadvantage, in that sector.[36]

[35] A similar finding is observed in Goldman Sachs (2017).
[36] For completeness all sectors are included in these RCA calculations, however it should be noted that not all sectors are tradable to a significant extend (for example, Government goods and services, Construction), and so RCA measures have little relevance.

Figure 15. Ireland & the UK's Services Sectors Revealed Comparative Advantage, in 2015
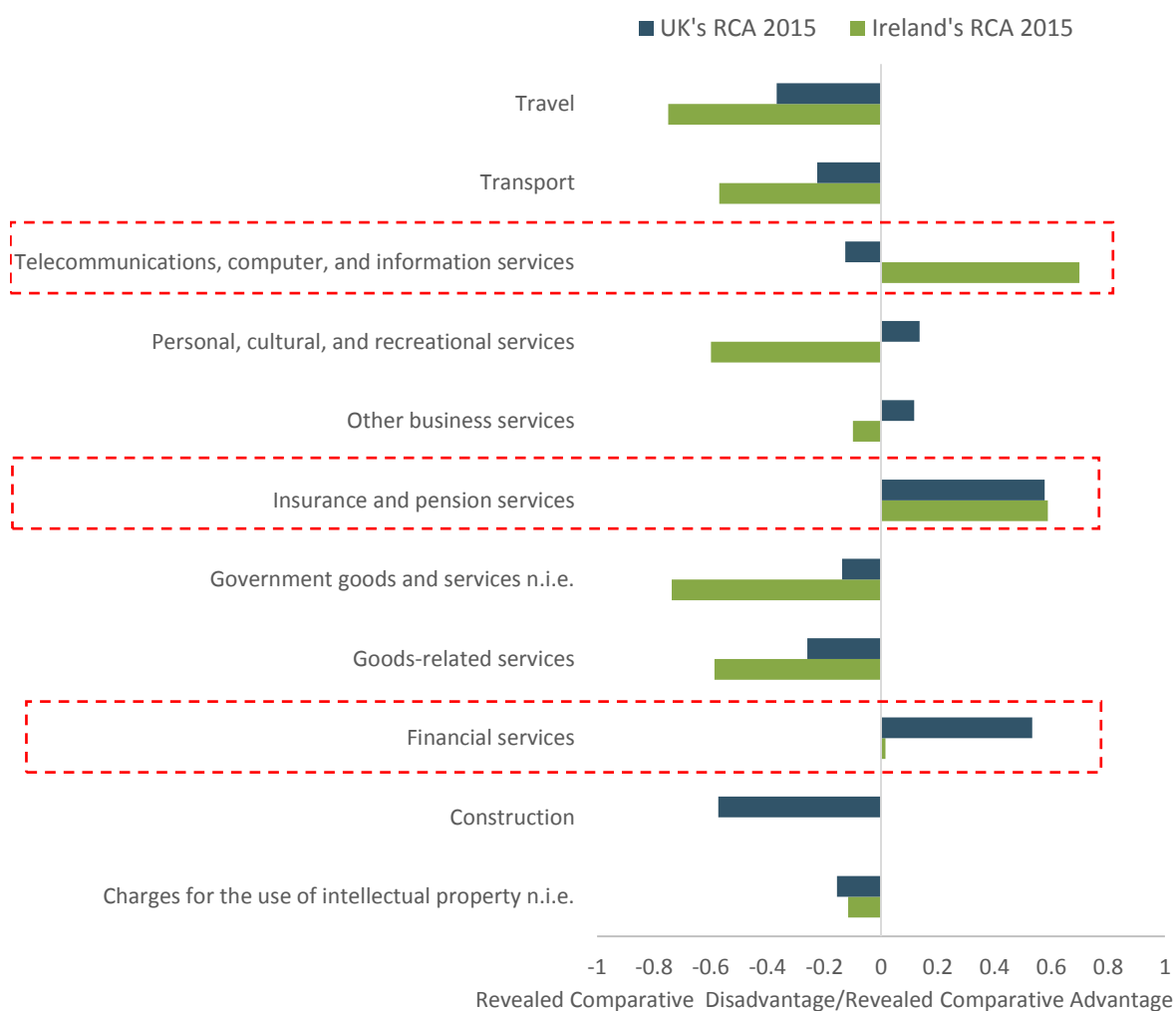

Source: UNCTAD Statistics External Trade Goods data. Department of Finance analysis.

As with the goods sectors, we also calculate RCA's based on domestic gross value added as a robustness check. The cross country revealed comparative advantage for the Financial Intermediation sector, as a proxy for Financial Services, and the Computer and Related Services sector, as a proxy for Telecommunications, Computer and Information Services, are shown below in Figures 16 and 17.[37] Ireland's value added RCA in Financial Intermediation is high by international standards, exceeded only by Luxembourg, Switzerland, the UK and Cyprus. For the Computer and Related Services sector Ireland records the highest RCA of any country in the sample.

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[37] With the change of data source it is not possible to separate Financial Service and Insurance and Pension Services.

Figure 16. Financial Intermediation RCA's by Country (2011)
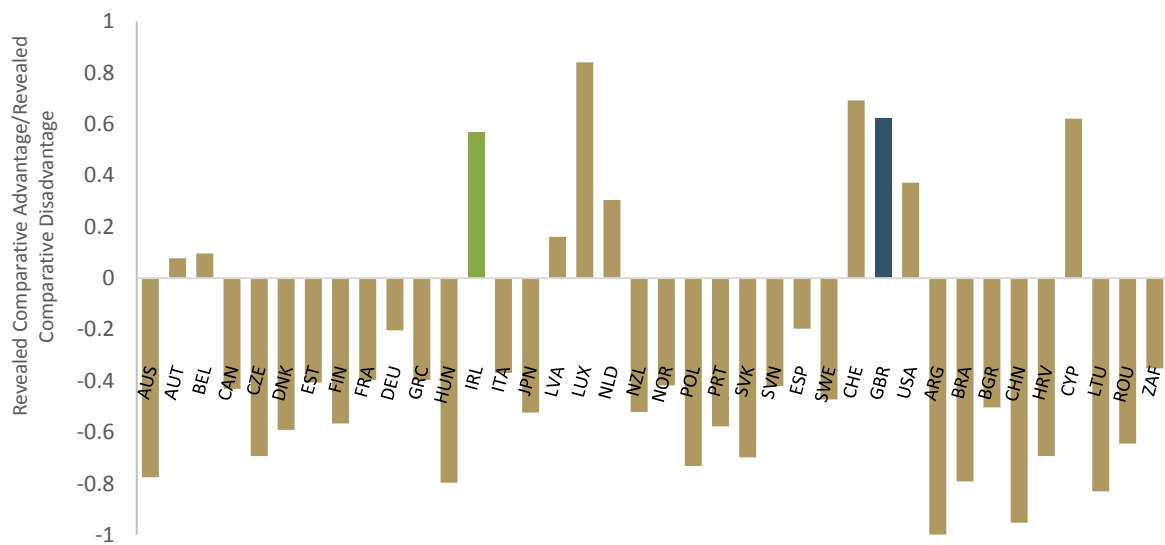
Source: OECD TiVA data. Department of Finance analysis.

Figure 17. Computer and Related Services RCA's by Country (2011)
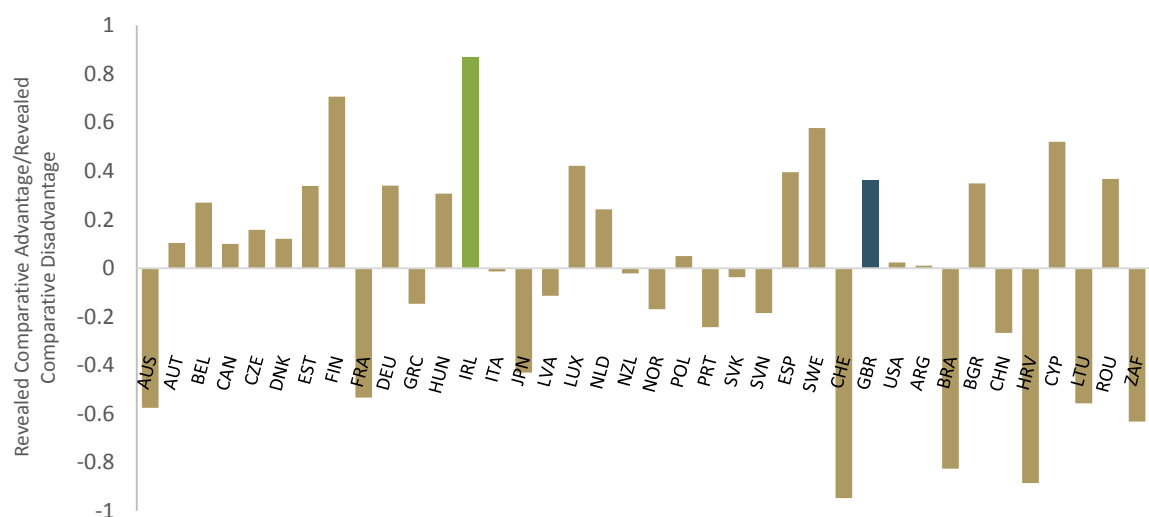
Source: OECD TiVA data. Department of Finance analysis.

4.3. Potential Impact on the Services Sectors – Financial Services

Given that Financial Intermediation is an important sector in the Irish economy, as shown by the RCA measures, it along with the Insurance/Pensions sector, is highly exposed to the UK and so could be particularly affected by a UK exit. The extent and nature of this disruption is influenced by many factors at both the macro and firm level.

One aspect is the extent to which Financial Services exports in Ireland and the UK compete with one another. As outlined in Goldman Sachs (2017), when separating Financial Service trade by EU Member

States into intra-EU and extra-EU trade, the UK is relatively more concentrated on extra-EU trade. This trade would likely not be impacted by the process of the UK exit.

A particular issue for services trade from a UK exit is that there is no fall back option equivalent to the WTO rules like there is for goods trade and Financial Services are generally not part of free trade agreements. This could mean that in the future Financial Services could be exposed to unspecified tariff and non-tariff barriers between the UK and EU. There is particularly uncertainty about the future of "Passporting" in the EU for UK Financial Services firms. On the basis of the size and proportional measures, the loss of access to the UK services markets, would mean that other things equal, Ireland would be one of the most adversely affected Member States.

Another aspect is the extent to which Financial Services activities in Ireland are part of a global value chain linked in a complementary way to Financial Service activity in the UK. If this was the case any reduction in activity or disruption in accessing the UK market for Irish based Financial Services firms in the UK could, at least in the short term, have a negative impact on activity in Ireland. Another possible outcome is that Ireland could receive increased FDI from firms in which EU market access is a primary motivation and that would have otherwise have located in the UK (Lawless and Morgenroth 2016b).

Over the longer term, as discussed in Minford (2016) and noted in Goldman Sachs (2017) the UK and EU could begin to operate different regulatory frameworks in service markets with UK regulatory rules diverging compared to European competitors. Future regulatory developments in the EU, if not adapted in the UK in Financial Services, or if existing regulations are repealed in the UK, could have an impact on the competitive position of this sector in Ireland.

Generally it should be noted that of UK Financial Services sector is a European and global centre for this sector. Given a well-functioning Financial Sector is a key facilitator of economic activity, a disruption to its operation could impact trade in other sectors with spillovers to other economies. This transmission mechanism is noted as a contributing factor to the slowdown in world trade that accompanied the global financial crisis (Bemis et al., 2013). As discussed in Corzet and Hinz (2016) financial disruptions can have a substantial impact on trade far in excess of direct product barriers. Much of this analysis has been undertaken in the context of unexpected financial disruptions. Given the lead in time to the UK's exit, UK firms, including those which Irish firms are linked to through value chains, should have sufficient time to adapt and overcome potential funding issues given that for Ireland access to other financial institutions within the EU will be retained.

5. Conclusions

This paper presents a comparison of the trade exposure of EU Member States to the UK in both goods and services. This is done through the application of measures of size and proportional trade exposures of EU countries to the UK. The results highlight that relative to other Member States Ireland is substantially more exposed in a number of goods sectors. This exposure is particularly marked in the Agri-food sector which records the highest share of sectoral exports accounted for by the UK (proportional exposure) and the largest UK share to total country exports (size exposure) of any Member State.

Disaggregating down from goods sectors to goods products the exposure analysis applied at the product level across all Member States reveals that eleven of the top fifteen most exposed products to the UK are Irish exports and are predominantly from the Agri-food sector. A further finding in this paper is that although the aggregate long term trend of Irish exports has been of a decreasing concentration to the UK. This is shown not to be true of all sectors with the share of total exports going to the UK increasing for the Agri-food and Traditional Manufacturing sectors over the past 15 years.

Overall in terms of services it should be noted that in this paper the analysis for the goods sector is clearer in terms of conclusions than that for the services sector. This is due to the uncertainty around the default position for services trade as no broad benchmark, such as the detailed WTO rules, exist for services and services tend not to be covered in bilateral free trade agreements. The data is also relatively less detailed than for goods. In the services sectors Ireland is again shown to be in the upper range of the most exposed Member States. This exposure is driven by the fact that in Financial Services the share of sectoral exports accounted for by the UK is higher than any other Member State. In the Insurance and Pension services sector the importance of the UK in overall exports is also higher than that of any other Member State.

This paper also presents a cross country calculation of revealed comparative advantage. It is shown that there is a substantial overlap between the goods sectors that the UK has a comparative disadvantage in and the sectors in which Ireland has the highest UK trade exposure in. This overlap has implications for the potential impact on Ireland of future UK trade policy, as the UK would have the incentive to seek new trade arrangements with third countries covering these sectors. These trade agreements could be unilateral in nature, covering broad sectors, and thus less complex than bilateral

arrangements. Irish exporters would be exposed to increased competition on two fronts, there would be higher entry costs in accessing the UK market and increased competition from third country producers. From the analysis in this paper Ireland could be disproportionately affected relative to other Member States with the Agri-Food sector being particularly at risk.

The services analysis showed that both Ireland and the UK, even at a global level, have a strong comparative advantage in the Financial Services sector. As services are not covered by international trading rules to the same extent as goods, there is more uncertainty about the future trading arrangement between the UK and EU in this sector.

In terms of further analysis, in this paper the focus was on export exposures to the UK at the sectoral level. Another dimension of exposure is that related to intermediate imports. Further work could thus explore the potential impact of the UK's EU exit on the Irish economy stemming from its reliance on UK imports used in the production process. Another issue highlighted in this paper is the broad range of potential impacts on the services sectors.[38]

This paper contributes to the analysis of the economic impact of a UK exit on the Irish economy by providing a sectoral level cross country comparison of Ireland's trade exposure to the UK. By using cross country trade data across EU Member States and internationally, it has been shown that Ireland is substantially more trade exposed than other Member States in a number of sectors. Through combining this sectoral exposure analysis with measures of revealed comparative advantage, which show a country's sectoral strengths and weakness, this paper also highlights those sectors of the Irish economy likely to be most at risk from a hard Brexit scenario in which the UK may seek alternative trade agreements with third countries.

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[38] It is the understanding of the authors that, as part of ongoing firm level analysis by sector, the Department of Jobs Enterprise and Innovation will also examine import exposures and impacts. See Brexit: Firm-level Impact on Enterprise. IGEES Conference, Dublin Castle, June 8th 2017.

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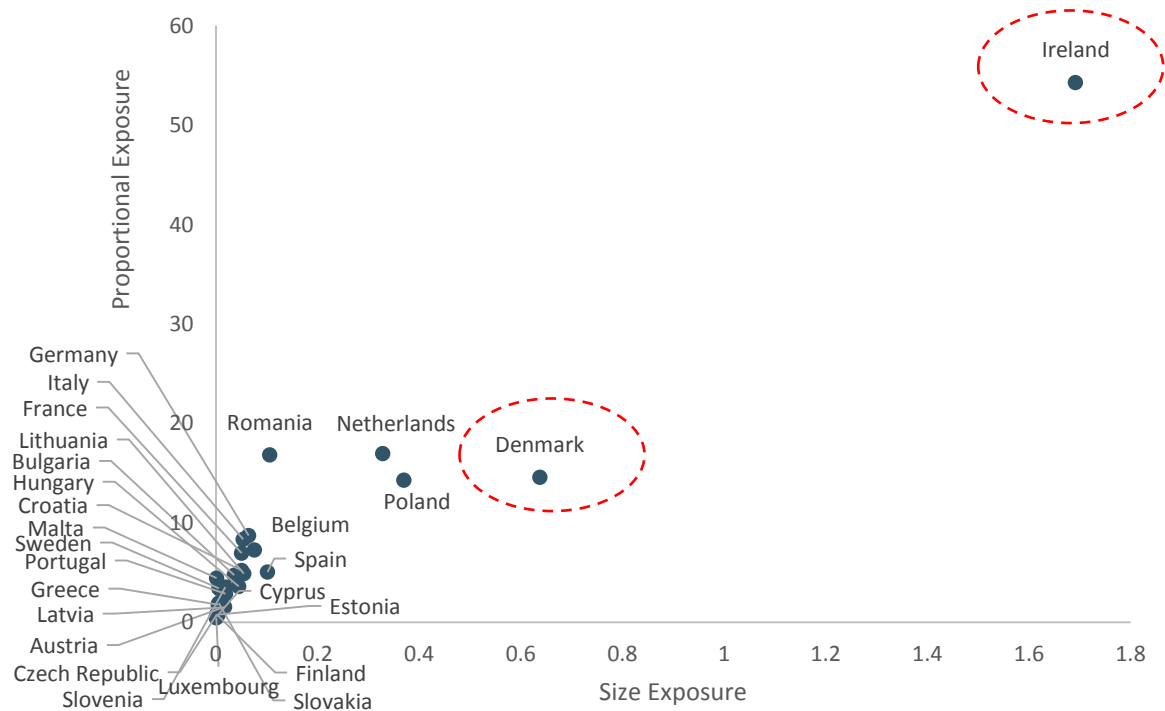# 7. Appendix

Appendix Figure: Goods Exposures to the UK

Appendix Figure 1. Beverages and tobacco Export Exposure to the UK (2015)
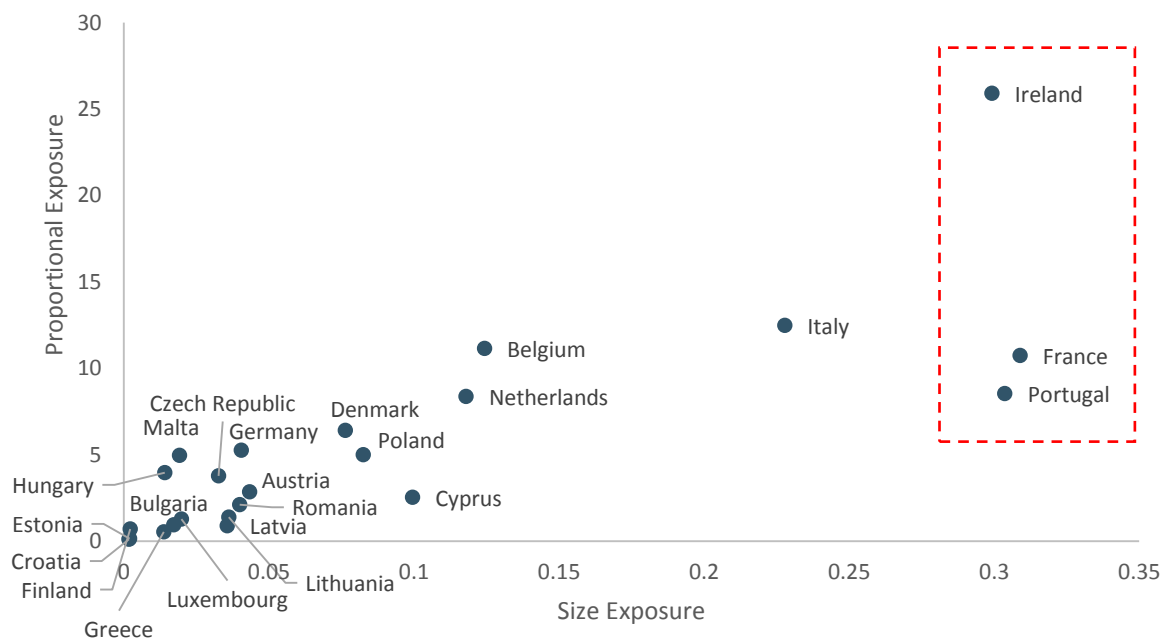
Source: UNCTAD Statistics External Trade Goods data. Department of Finance analysis.

Appendix Figure 2. Meat and Meat Preparations Export Exposure to the UK (2015)

Source: UNCTAD Statistics External Trade Goods data. Department of Finance analysis.

Appendix Figure 3. Dairy Products and Birds' Eggs Export Exposure to the UK (2015)

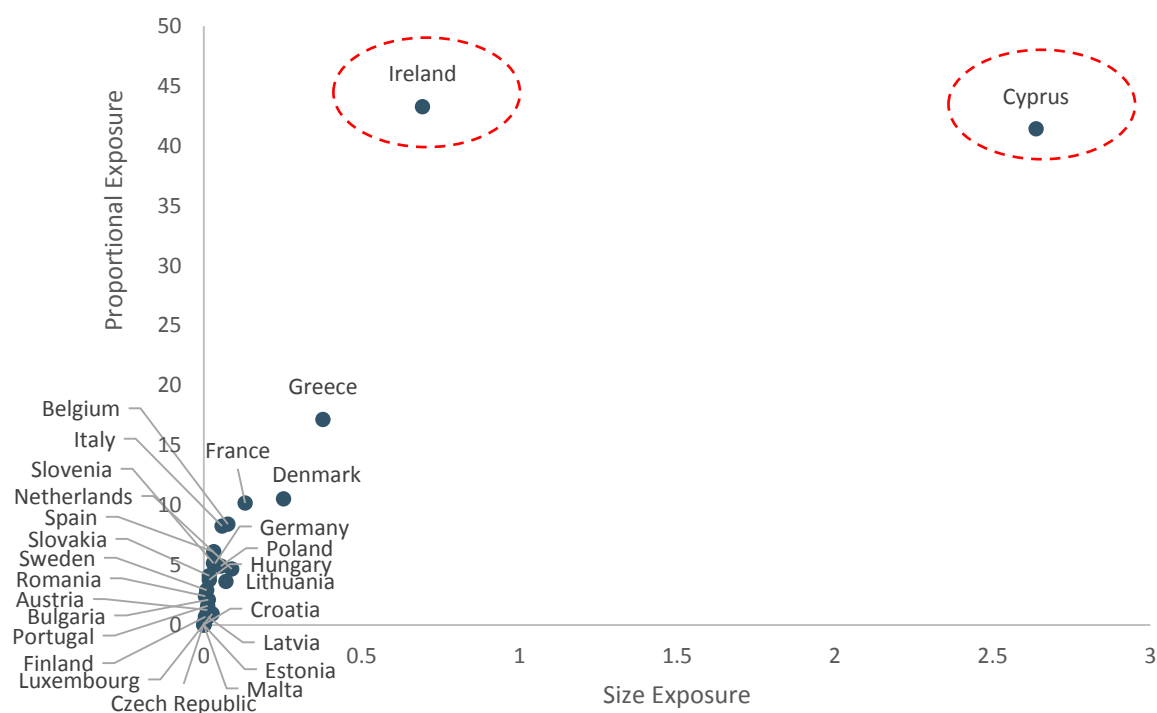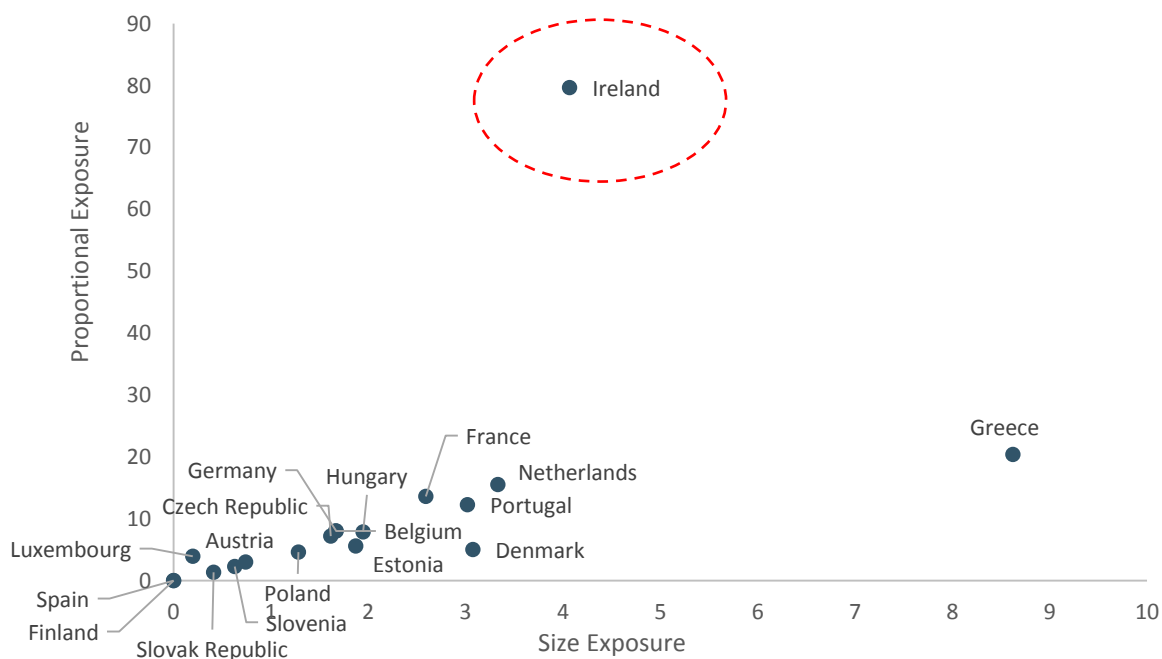Source: UNCTAD Statistics External Trade Goods data. Department of Finance analysis.

Appendix Figure: Services Exposures to the UK

Appendix Figure 4. Transport Services Exposure to the UK (2014)

Source: OECD Balance of Payments data. Department of Finance analysis.

Appendix Table 1. SITC Codes and Division Descriptions

SITC Division Codes	SITC Economic Division Descriptions
(0) Food and Live Animals	00 Live animals other than animals of Division 03 01 Meat & meat preparations 02 Dairy products & birds' eggs 03 Fish, crustaceans, molluscs and preparations thereof 04 Cereals & cereal preparations 05 Vegetables & fruit 06 Sugar, sugar preparation & honey 07 Coffee, tea cocoa, spices & manufactures thereof 08 Feeding stuff for animals (excl. unmilled cereals) 09 Miscellaneous edible products & preparations
(1) Beverages and tobacco a.k.a. "Beverages/Tobacco"	11 Beverages 12 Tobacco & tobacco manufactures
(2) Crude Materials Manufacturing, inedible, except fuels a.k.a. "Crude Materials Manufacturing"	21 Hides, skins & fur skins, raw 22 Oil seeds & oleaginous fruits 23 Crude rubber (include synthetic & reclaimed) 24 Cork & wood 25 Pulp & waste paper 26 Textile fibres & their wastes 27 Crude fertilisers & minerals, excl. coal, petroleum etc. 28 Metalliferous ores & metal scrap 29 Crude animal & vegetable Materials Manufacturing nes
(3) Mineral fuels, lubricants and related products a.k.a. "Minerals"	32 Coal, coke & briquettes 33 Petroleum, petroleum products & related Materials Manufacturing 34 Gas, natural & manufactured 35 Electric current
(4) Animal and vegetable oils, fats and waxes a.k.a. "Agricultural Residuals"	41 Animal oils & fats 42 Fixed vegetable fats & oils 43 Animal or vegetable Materials Manufacturing nes
(5) Chemicals and related products nes a.k.a. "Chemicals"	51 Organic chemicals 52 Inorganic chemicals 53 Dyeing, tanning & colouring Materials Manufacturing 54 Medical & pharmaceutical products 55 Essential oils, perfume Materials Manufacturing; toilet & cleansing preps 56 Fertilisers (other than those of Division 27) 57 Plastics in primary forms 58 Plastics in non-primary forms 59 Chemical Materials Manufacturing & products nes
(6) Manufactured Goods classified chiefly by material a.k.a. "Manufactured Goods"	61 Leather; leather manufactures nes; dressed furskins 62 Rubber manufactures nes 63 Cork & wood manufactures (excl. furniture) 64 Paper, paperboard & articles thereof 65 Textile yarn, fabrics, made-up articles & related products 66 Non-metallic mineral manufactures nes 67 Iron & steel 68 Non-ferrous metals 69 Manufactures of metals nes
(7) Machinery & transport equipment a.k.a. "Machinery"	71 Power generating machinery & equipment

	72 Machinery specialised for particular industries
	73 Metalworking machinery
	74 General industrial machinery & equipment nes & parts nes
	75 Office machines & automatic data processing machines
	76 Telecommunications & sound equipment
	77 Electrical machinery, apparatus & appliances nes & parts
	78 Road vehicles (include. air-cushion vehicles)
	79 Other transport equipment
(8) Miscellaneous manufactured articles a.k.a. "Misc. Manufactured"	81 Prefab buildings; plumbing & electrical fixtures & fittings
	82 Furniture & parts thereof; bedding, cushions etc
	83 Travel goods, handbags & similar containers
	84 Articles of apparel; clothing accessories
	85 Footwear
	87 Professional, scientific & controlling apparatus nes
	88 Photographic apparatus; optical goods; watches clocks
	89 Miscellaneous manufactured articles nes
(9) Commodities and transactions not classified elsewhere a.k.a. "Commodities n.e.s."	91 Postal packages not classified according to kind
	93 Special transactions and commodities not classified according to kind
	96 Coin (other than gold coin), not being legal tender
	97 Gold, non-monetary (excluding gold ores and concentrates)
	98 Gold coin and monetary gold
	99 All other commodities and transactions

Source: UNCTAD Statistics External Trade Goods data. Department of Finance analysis.

Appendix Table 2. Balance of Payments Categories of Services Sectors

10 Service Sectors	*BOP Service Export Sectors*
1	*Transport*
2	*Tourism and Travel*
3	*Communications*
4	*Insurance Services*
5	*Financial Services*
6	*Computer Services*
7	*Royalties and Licences*
8	*All Business Services*
9	*Other Services not elsewhere specified*
10	*Repairs and Processing.*

Source: UNCTAD Statistics and CSO Balance of Payments data. Department of Finance analysis.

Some specific points of note in relation to the Balance of Payment Services ten categories are:

1) *Transport* adjusted to include freight element of merchandise imports that are valued on a *free on board (*f.o.b.) basis rather than a *cost, insurance and freight* (c.i.f.) basis. Note; ***Merchandise*** exports and imports are valued f.o.b. (*free on board*) for BOP purposes. While imports are valued c.i.f. (*cost, insurance and freight*) in the official external trade statistics, adjustments are made to reflect an estimated f.o.b. valuation. These adjustments result from the application of different c.i.f./f.o.b. conversion ratios to the values of imports from within the European Union and from outside the European Union. In addition and in line with EU and ECB requirements, merchandise imports from within European Union Member States are compiled on the basis of country of consignment rather than country of ultimate origin (as was the case formerly). Some adjustments are also made to the official

merchandise trade statistics to conform to the BOP change of ownership and market valuation principles.

2) For *tourism/travel* the credit item represents the receipts of residents from non-resident visitors other than passenger fare receipts of Irish passenger carriers from non-residents; the latter are included under *transport* credits. The *tourism/travel* debit item represents foreign expenditure by Irish residents on foreign travel. Because of the difficulty of separately distinguishing passenger fares paid to non-resident carriers this element of expenditure is generally included in the *tourism/travel* debit item (rather than being more appropriately categorised as a debit item under *transport*. Payments made to Irish passenger carriers by Irish residents are excluded.

3) *Communications* covers postal and courier services and telecommunications services. Postal and courier services include the pick-up, transport and delivery of letters, postcards, printed matter, parcels and packages. Telecommunications services include the transmission of sound, images and other information by telephone, radio and television broadcasting, electronic mail, facsimile services and by satellite delivery. Also included are cellular telephone services and internet access services. Details of expenditures by resident enterprises on services purchased from non-residents are obtained from the BOP surveys of these enterprises. Information on receipts from non-residents in respect of their purchases of Irish-produced communications services are obtained from resident service providers.

4) The value of *insurance Services* provided to non-residents by resident insurers (credit) is estimated as the value of direct and supplementary premiums earned less the value of claims payable less increases in the actuarial element of insurance technical reserves. Supplementary premiums consist of investment income earned on investing the insurance technical reserves. For BOP purposes, this income is attributed to the policy holders and is also treated as being paid back to the insurance company by them. To obtain the value of insurance services purchased from non-resident insurers (debit), the ratio of the estimated service charge to total premiums for insurance exports is applied to the total premiums payable to non-resident insurers. Reinsurance transactions (e.g. premiums and claims) are recorded on a gross basis and, hence, insurance service credits and debits are accordingly higher than they would have been if recorded on a net basis. This gross recording treatment of reinsurance transactions has no net impact on the insurance service balance as the reinsurance element on the credit and debit sides are offsetting. In relation to merchandise imports, the freight insurance element of the c.i.f. to f.o.b. adjustment referred to above under *merchandise* is recorded under *insurance*.

5) *Financial Services* covers non-interest receivables and payables in respect of financial intermediary and auxiliary services (other than those of insurance enterprises and pension funds). Also included are margins between interest payable and the reference rate on loans and deposits (called financial intermediation services indirectly measured (FISIM).

6) *Exports and imports of computer software* which is embedded in hardware or carried on other physical media are not included in *Computer Services* but under *merchandise*. Sales and purchases of software transmitted electronically as well as exports of certain software licences are recorded under *Computer Services.* This item also includes receipts and payments in respect of computer software licence fees as a conscious CSO departure from the international recommendations and as referenced under item (vi) above.

7) *Royalties/Licences* include franchises and similar rights as well as other royalties and licence fees. Franchises and similar rights comprise international payments and receipts of franchising fees and the royalties paid for the use of registered trademarks. Other royalties and licence fees includes international payments and receipts for the authorised use of intangible, non-produced, non-financial assets and proprietary rights (such as patents, copyrights and industrial processes and designs) and with the use, through licensing agreements, of produced originals or prototypes (such as manuscripts, and cinematographic works and sound recordings). As a conscious CSO departure from the international recommendations, receipts and payments in respect of computer software licence fees are not included under *royalties and licence fees* but are instead included under *Computer Services* (see item (viii) below). A further deviation from the international standards is that royalty receivables and payables in connection with the entertainment industry (mainly concerning film distribution and musical recordings and performances) are currently excluded from *royalties and licence fees* and included under *other services not elsewhere specified*.

8) *All Business Services* covers receivables and payables for (a) *research and development,* (b) *operational leasing* and (c) *miscellaneous business services. Research and development* services cover those services

that are associated with basic research, applied research and experimental development of new products and processes. Activities in the physical sciences, social sciences and humanities are covered, including the development of operating systems that represent technological advances. Also included is commercial research related to electronics, pharmaceuticals and biotechnology. Outright sales and purchases of the results of research and development (such as patents, copyrights and industrial processes) are included. These transactions tend to occur infrequently but the amounts involved can vary substantially. Amounts payable and receivable for use of such proprietary rights are included under royalties/licences *(see above)*. *Operational leasing* covers rental receivables and payables in respect of leasing (other than financial leasing) and chartering, without operators, of aircraft, ships and other transport or other equipment and plant. *Miscellaneous business services* covers legal, accounting, management consulting, public relations, advertising and marketing and other professional and technical services as well as agricultural services. It also covers inter-affiliate management fees and other trade related services such as commissions earned by resident agents or paid to non-resident agents in connection with imports or exports.

9) ***Other Services not elsewhere specified*** covers construction services, personal and cultural services (e.g. fees and royalties for film, television and musical recordings and performances), educational services and government services. The last sub-category includes credit and debit entries for (a) the estimated expenditures of embassy and consular staff in the host countries, (b) non-labour expenditures by governments towards the provision of embassy and consular services in the host countries, and (c) receipts i.e. credits, in respect of collection of Ireland's budgetary contributions to the EU).

10) ***Repairs and processing*** covers processing and repair work by residents on goods that are owned by non-residents (and vice versa). The value includes any parts or Materials Manufacturing supplied by the repairer and included in the charge.

Further details in relation to the Balance of Payment categorisations can be found at the following: http://www.cso.ie/en/media/csoie/surveysandmethodologies/surveys/bop/documents/pdfs/BopBkgdnotes.pdf