

*Brexit:
Sectoral Economic
Impact Analysis*

February 2019

Office of the Chief Economic Adviser

Scottish Government



Scottish Government
Riaghaltas na h-Alba
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Overview of Sectoral Economic Impact Analysis

Computable General Equilibrium (CGE) Modelling of the Scottish Economy

- This report outlines new economic analysis looking at the potential implications of Brexit for Scotland's economy. We use an Economic model of 21 sectors in Scotland and the Rest of the UK (rUK) to estimate the likely impact of Brexit on each sector in the Scottish economy in the long term.
- The model used is the Scottish Government's Computable General Equilibrium (CGE) model of the Scottish and rUK economies. The CGE model used by the UK Government in their most recent Brexit analysis¹ is part of the same family of models.
- We model the potential impact of Brexit related shocks on sectors in both Scotland and rUK – this is crucial to capturing the interlinkages between the two economies and the impact that a slowdown in rUK could have on Scotland.

Our Approach

- We provide estimates of the long term impacts of Brexit in 2030, compared to a counterfactual of remaining in the European Union (EU). This provides an illustration of the potential implications of Brexit on Scottish economy compared to continued membership of the EU.
- We assess the impact on 21 sectors on a sector by sector basis, taking into account the impact that Brexit may have on exporting to the EU, non-tariff barriers (NTBs) and migration. This is similar to the approach taken by the UK Government.
- In practice, the effects of Brexit will be specific to each sub – sector. Each product will face its own unique circumstances. The approach taken here is a top down approach, where industries have had to be aggregated to 21 sectors in total for modelling purposes.

¹ UK Exiting the European Union Publications: <https://www.gov.uk/government/publications/exiting-the-european-union-publications>

Overview of Sectoral Economic Impact Analysis

Presentation of our Results

- The analysis is not intended to provide point estimates of the impacts of Brexit. CGE modelling has its advantages in providing an indication of the relative magnitudes of impacts. This analysis aims to illustrate the areas of the Scottish economy are potentially most at risk of the Brexit-related economy shocks.
- Although we have attempted to aggregate industries into the 21 sectors in the most appropriate way, some asymmetries in the exposure to Brexit-related economic shocks may still exist. As a result, no results should be interpreted in isolation for any specific industry at a sub-sector level. For detailed individual industry analysis, partial equilibrium economic modelling has been found to be more appropriate. For examples, see below².
- The strengths of the analysis presented henceforth are that it provides a useful illustration of overall areas of the Scottish economy that could be most affected in absolute and relative terms, as well as highlighting which areas of the economy may be more affected by Brexit related shocks in Scotland compared to rUK.
- All results presented illustrate the potential *long run* impact of a modelled Free Trade Agreement (FTA) scenario, where all tariffs for sectors are eradicated but non-tariff costs remain for Scottish firms wanting to export to the European Union. In addition, as a result of the planned future migration system, it is assumed that Scottish firms have less available workers in the Scottish labour market to choose from compared to remaining in the EU.
- Recent Analysis by NIESR indicates that the UK Government's Chequers plan would be similar to that of a Canadian or Switzerland style Free Trade Agreement outcome³. This is the primary reason for analysis presented here focussing on an FTA scenario.

² Assessing the impact of alternative fish trade agreements post-Brexit: research; <https://www.gov.scot/publications/seafood-trade-modelling-research-project-assessing-impact-alternative-fish-trade/>

Impacts of Alternative Post-Brexit Trade Agreements on UK Agriculture: Sector Analyses using the FAPRI-UK Model; <https://www.afbini.gov.uk/sites/afbini.gov.uk/files/publications/FAPRI-UK%20Brexit%20Report%20-%20FINAL%20Clean.pdf>

³ The Economic Effects of the Government's Proposed Brexit Deal; <https://www.niesr.ac.uk/sites/default/files/publications/NIESR%20Report%20Brexit%20-%202018-11-26.pdf>

Methodology

- Similar to an approach taken in the UK Government’s EU Exit Analysis paper⁴, we examine the impact of the UK agreeing a Free-Trade Agreement with the EU, a scenario similar to that of the relationship between Canada and the EU. We compare this to a scenario in which the UK stays in the EU.
- The economic shocks introduced in the modelling reflect the differences in the two scenarios:

<i>Shocks Introduced</i>	Non-Tariff Barriers (NTBs)	Migration Shock (Restricted Labour Mobility)	WTO Tariffs	Productivity Shock
EU Membership	✘	✘	✘	✘
EU-UK FTA	✔	✔	✘	✘

- As presented in the table above, the differences we have modelled are non-tariff barriers (NTBs) to EU exports and the introduction of restrictions to EU labour mobility.
- The NTBs reflect the increased costs that UK firms exporting to the EU would likely experience. These reflect key barriers that might prevail such as customs costs, other border costs and regulatory costs. These are introduced on a by-sector basis, reflecting the differences sectors are likely to experience in the magnitude of NTBs under a FTA scenario. All NTB estimates used in the modelling derive from the UK Government’s Provisional EU Exit Analysis⁴.
- The migration shock modelled is a comparison of the ONS high migration scenario (assumed EU freedom of movement scenario) to the ONS principal projection scenario (assumed restricted EU migration scenario). The difference between these two projections – approximately 8,500 per year – is what we take as the Brexit-driven reduction in migration in Scotland. An identical process was taken for rUK.
- Given the economic modelling framework, all results from these shocks reflect the *long run impact by 2030* of the UK leaving the European Union and pursuing an EU-UK Free-Trade Agreement. As these are reflective of *long-run* impacts, it would be incorrect to interpret any results as immediate impacts or as a reduction in the economy/sector compared to today.
- All results reflect the differences in the economy between the UK staying in the European Union and the UK establishing a EU-UK FTA.

⁴ EU Exit Analysis, Cross Whitehall Briefing; <https://www.parliament.uk/documents/commons-committees/Exiting-the-European-Union/17-19/Cross-Whitehall-briefing/EU-Exit-Analysis-Cross-Whitehall-Briefing.pdf>

Free Trade Agreement Scenario Results

- The first element of this Brexit analysis answers three key questions using the Scottish Government's CGE model:
 1. Which sectors in Scotland may be the most directly impacted as a consequence of Brexit
 2. In which sectors could the impact in Scotland be proportionately larger than in the rUK
 3. Which sectors could be the most important in terms of their contribution to the overall decline in Scottish output. This takes account of the fact that sectors which are very large can make a significant contribution to the overall hit to Scotland's economy even if the percentage reduction in their output is small
- Following this discussion of the CGE results, the relative export strengths of Scotland are explored.

Summary of Key Insights

Percentage decline by Sector

- Goods sectors are the worst affected in terms of percentages.
- In other words, it is expected that they will be relatively the worse affected by Brexit related shocks.
- With two-thirds of Scottish exports to the EU being in Goods, these sectors are the most vulnerable to changes in non-tariff barriers.
- Chemicals and Pharmaceuticals, Mining and Quarrying, Metals, Rubber and Plastics and Textiles, Wood & Leather manufacturing are estimated to see largest declines in percentage terms.

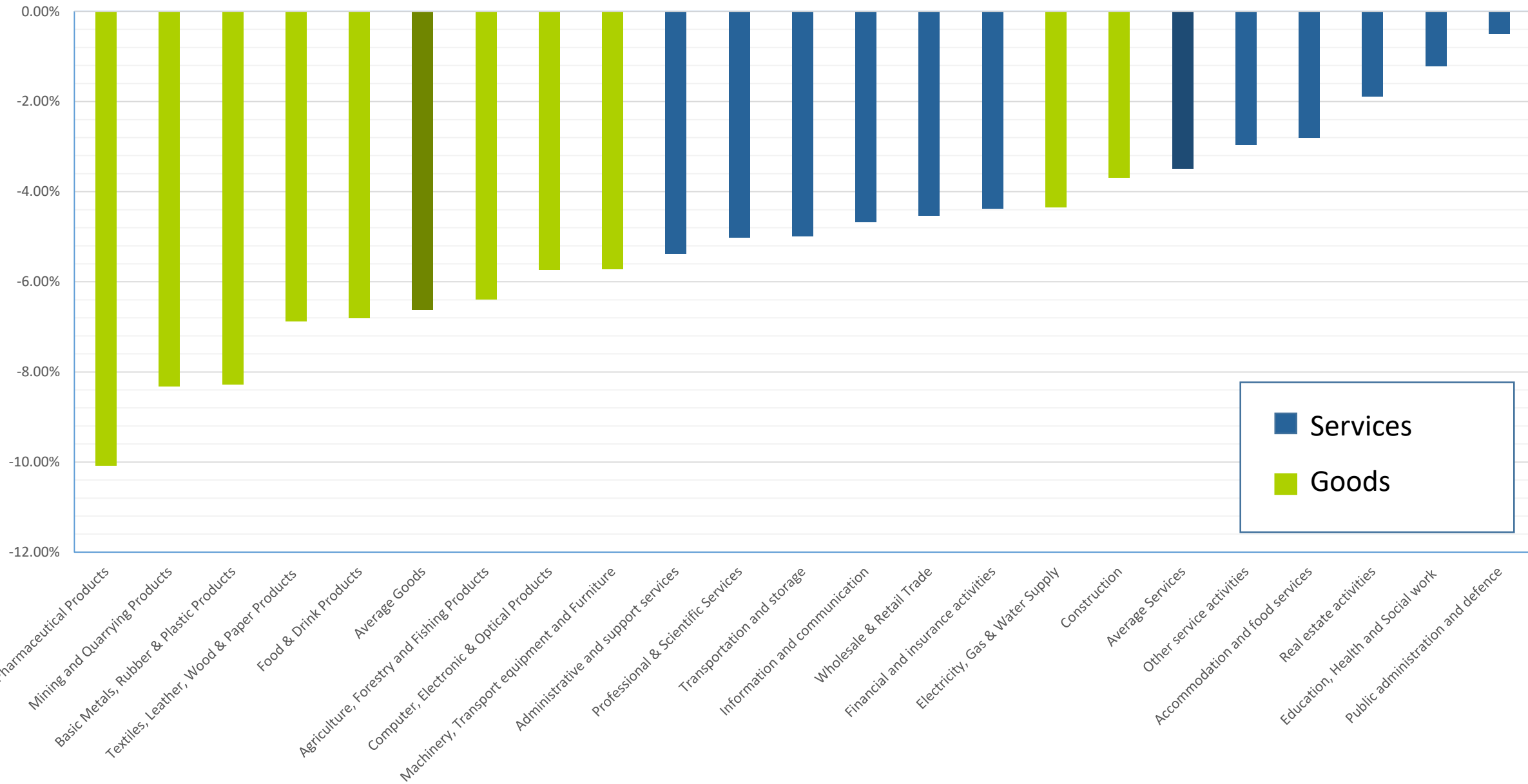
Scotland v rUK (Relative importance)

- The three sectors estimated to be of disproportionately greater importance to Scotland vis-a-vis the rUK are:
- **Agriculture, Fishing & Forestry** - reflects the concentration of activity in this sector in Scotland relative to rUK.
- **Food and Drink** - reflects a large proportion of output in this sector originates from export related activities with the sector. It is also more reliant on exports as a share of output than it is in rUK.
- **Electricity and Gas** - driven by the relative size of sector in Scotland relative to rUK. The sector is expected to have a small *direct* exposure to EU trade.

Impact on Scottish Economy

- Service sectors contribute the most to the overall decline in Scottish economy GVA.
- The largest contributors to the fall in Scottish GVA are - Wholesale and Retail, Professional Services, and Financial Services.
- Service sectors make up around 75% of the Scottish economy, so it unsurprising that they contribute the most to overall declines in GVA.
- This finding indicates that service sectors will also see the largest nominal declines in GVA internally.

FTA Results – Percentage Decline in Individual Sector GVA

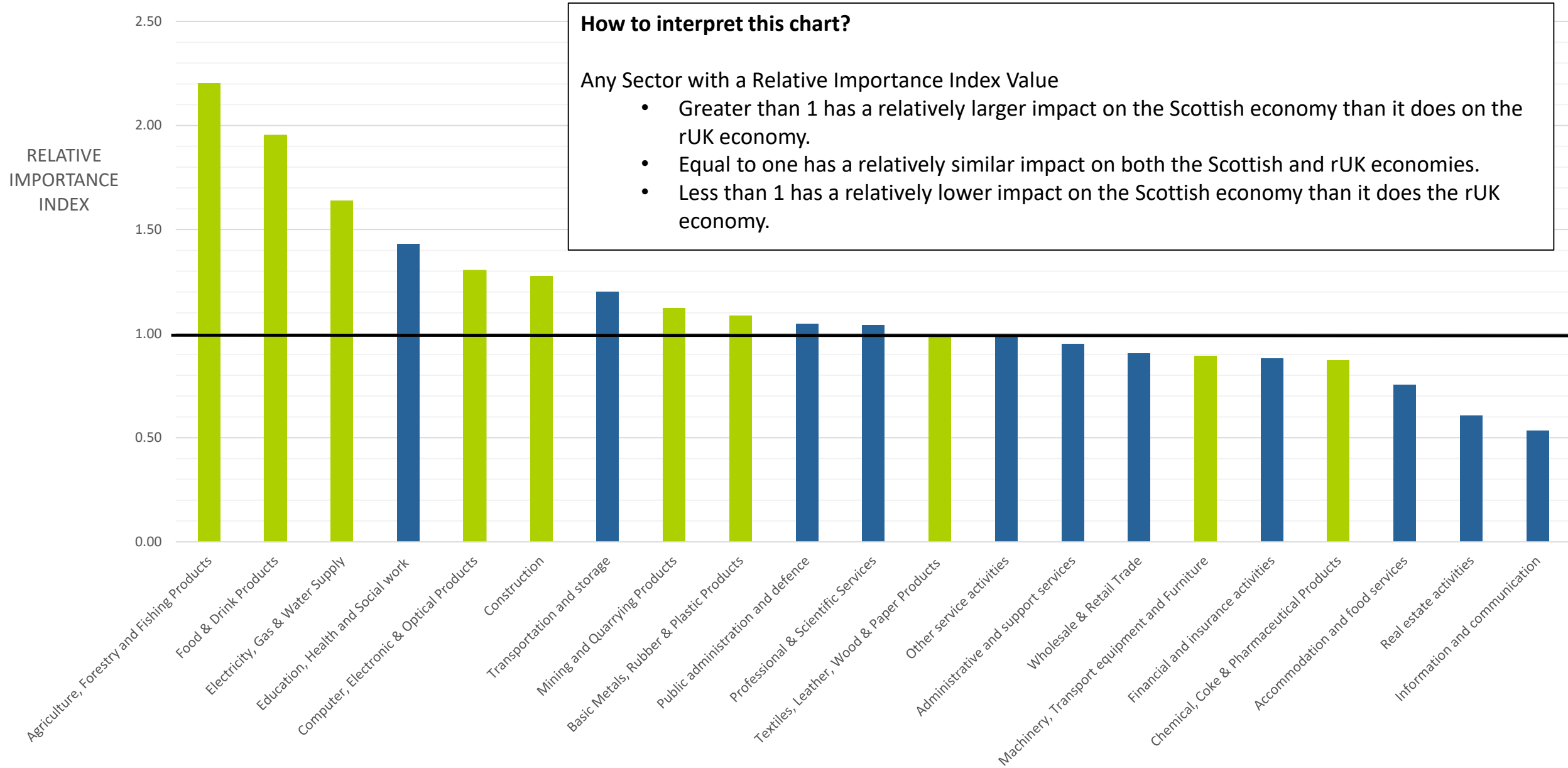


FTA Results by Sector – Percentage Decline

- The sectors expected to see the largest percentage declines as a share of sector output are summarised in the following table.
- Largest impacts seen in manufacturing and production sectors, reflecting the fact that exports to the EU make up a larger proportion of their output.
- The GVA Impact Index gives an indication of the sectors that are worse impacted in Scotland than in the Rest of the UK. E.g. an index of 1.2 indicates that the hit to Scotland is 20% larger than to rUK.
- 17 sectors in Scotland see a proportionately larger impact than their rUK counterparts. 9 of these experience an impact 20% greater than the equivalent rUK sector. *This is largely reflective of the fact that restrictions on EU migration are expected to have a greater impact in Scotland.*
- This expectation of the impact of changes to migration comes directly from comparing the ONS high migration population projection (assumed EU freedom of movement scenario) with the ONS principal population projection (assumed restricted EU migration scenario).

		Scotland	Rest of UK	GVA Impact Index
1	Chemical, Coke & Pharmaceutical	-10.1%	-8.4%	1.2
2	Mining and Quarrying	-8.3%	-9.4%	0.9
3	Basic Metals, Rubber & Plastic	-8.3%	-6.3%	1.3
4	Textiles, Leather, Wood & Paper	-6.9%	-6.4%	1.1
5	Food & Drink	-6.8%	-5.8%	1.2
6	Agriculture, Forestry and Fishing	-6.4%	-6.1%	1.1
7	Computer, Electronic & Optical	-5.7%	-4.4%	1.3
8	Machinery, Transport equipment and Furniture	-5.7%	-5.3%	1.1
9	Administrative and support services	-5.4%	-4.5%	1.2
10	Professional & Scientific Services	-5.0%	-3.5%	1.4

FTA Results – Relative Importance (Scotland compared to rUK)



FTA Results by Sector – Relative Importance

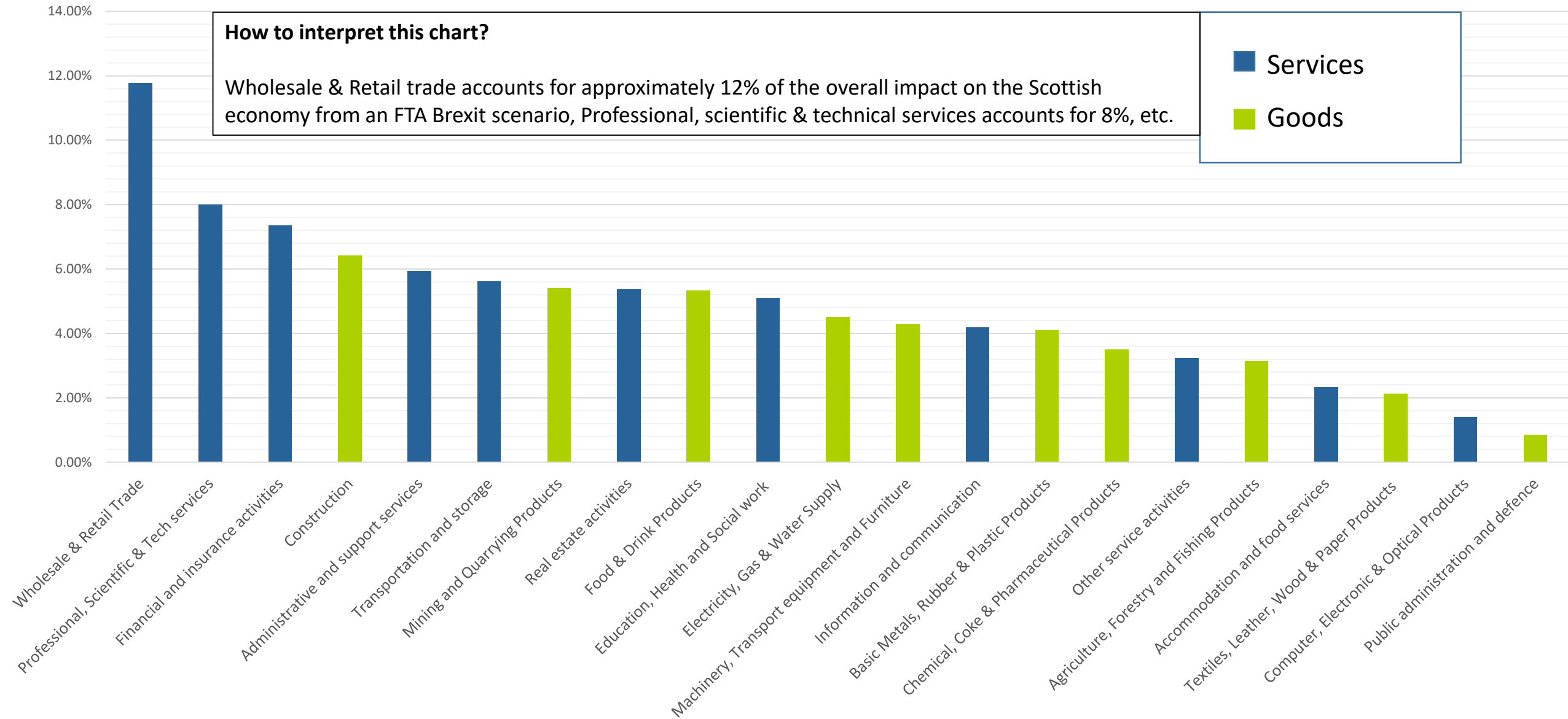
- Table shows those sectors of the Scottish economy that may be more affected than rUK.
 - For example, the Agriculture, Forestry & Fishing sector contributes 3.1% to the decline in economy wide GVA in Scotland, and only 1.4% to the decline in economy wide GVA in rUK.
- The importance of Agriculture – largely reflects the concentration of activity in this sector in Scotland relative to the UK.
- From the previous table it can be seen that Agriculture declines by a similar amount in both rUK and Sco. But because of the larger footprint in Scotland, it is more important in terms of its contribution to the overall decline in GVA.
- Food and Drink – reflective of activity but also the fact that a large proportion of output in this sector originates from export related activities with the sector also more reliant on exports as a share of output than it is in rUK.

		Scotland (% of total shock)	Rest of UK (% of total shock)	Relative Importance
1	Agriculture, Forestry and Fishing	3.1%	1.4%	2.2
2	Food & Drink	5.3%	2.7%	2.0
3	Electricity, Gas & Water Supply	4.5%	2.8%	1.6
4	Education, Health and Social work	5.1%	3.6%	1.4
5	Computer, Electronic & Optical	1.4%	1.1%	1.3
6	Construction	6.4%	5.0%	1.3
7	Transportation and storage	5.6%	4.7%	1.2
8	Mining and Quarrying Products	5.4%	4.8%	1.1
9	Basic Metals, Rubber & Plastic	4.1%	3.8%	1.1
10	Public administration and defence	0.8%	0.8%	1.1

Contribution to Total Decline in Scottish GVA

- So far we have discussed
 - The Scottish sectors that are affected the most.
For example: GVA in the Chemicals sector is over 10% lower under an FTA scenario
 - The sectors that affect the Scottish economy more than the rUK economy.
For example: The Food & Drink sector's relative impact on the Scottish economy is twice as large as the impact on the rUK economy.
- Next we discuss the sectors that affect the Scottish economy most overall:
 - *For example: some sectors that suffer the most are very small in the overall economy (e.g. Chemical sector).*
 - *Large sectors which suffer moderately will impact the Scottish economy much worse overall (Wholesale & Retail trade).*

FTA Results – Contribution to Total Decline in Scottish GVA



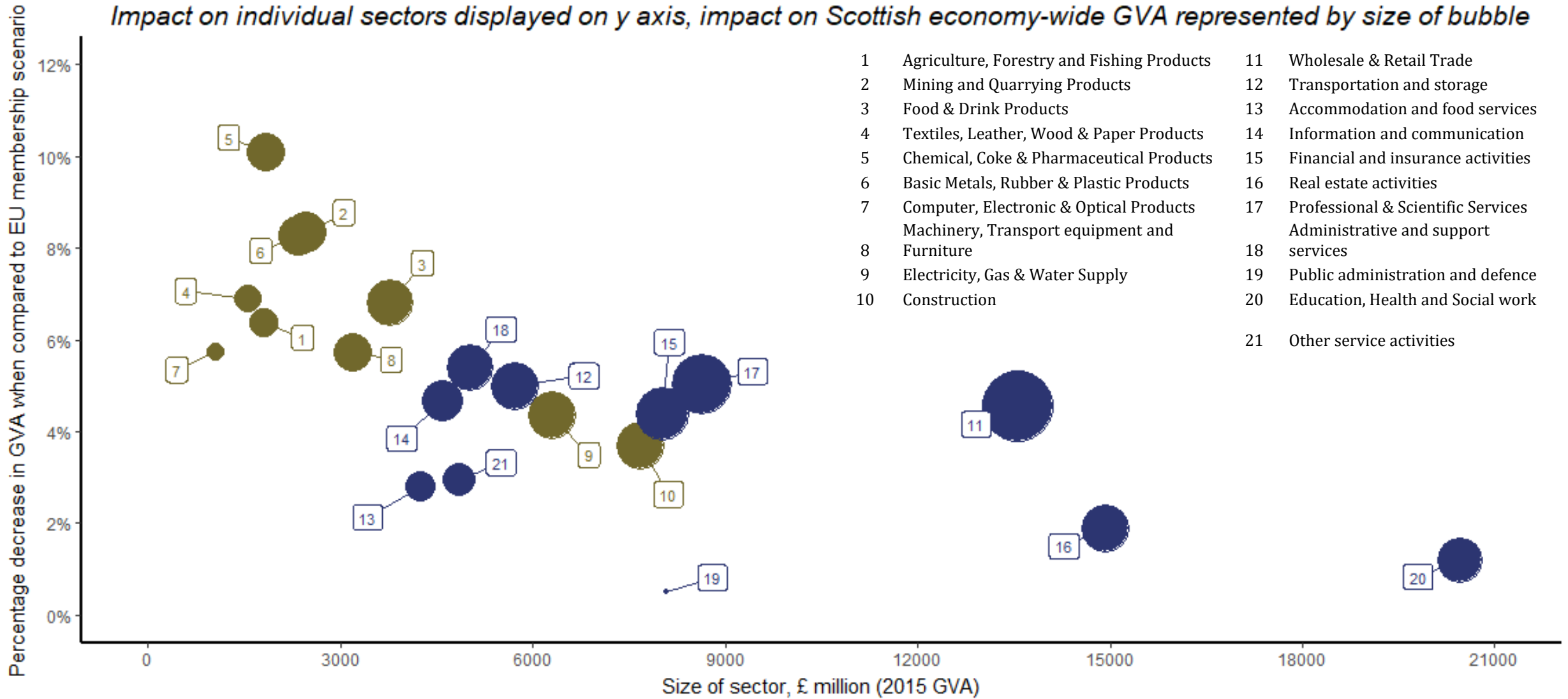
FTA Results by Sector – Contribution to total GVA decline

- This shows the same as the chart on previous slide but includes a RUK comparison.
- Service sectors are the worst affected in nominal GDP terms.
- Overall decline is largest in Wholesale and Retail, Professional Services, Financial Services and Construction.
- These 4 sectors combined account for around 40% of the overall decline in GVA in Scotland.
- High degree of alignment in terms of nominal impact across Scotland and rUK - 4 of the top 5 sectors.

		Scotland	Rest of UK
1	Wholesale & Retail Trade	11.8%	13.0%
2	Professional & Scientific Services	8.0%	7.7%
3	Financial and insurance activities	7.4%	8.4%
4	Construction	6.4%	5.0%
5	Administrative and support services	5.9%	6.3%
6	Transportation and storage	5.6%	4.7%
7	Mining and Quarrying	5.4%	4.8%
8	Real estate activities	5.4%	8.9%
9	Food & Drink	5.3%	2.7%
10	Education, Health and Social work	5.1%	3.6%

GVA impact on the Scottish economy under a FTA Brexit Scenario

Impact on individual sectors displayed on y axis, impact on Scottish economy-wide GVA represented by size of bubble



Industry a Goods a Services

Nominal decrease in GVA, £ million ● 200 ● 400 ● 600

GVA Impact on Scottish economy: Key Points

- Chart shows the relationship between the *size* of each Scottish sector, the ***percentage impact on each sector***, and the ***impact of each sector on the Scottish economy*** under a FTA Brexit scenario.
 - ***Size of Bubbles***: Impact on Scottish economy demonstrated by the size of each sector bubble, with the sectors with the largest bubbles impacting the overall economy most.
 - ***Percentage impact on each sector***: Y axis represents the percentage decline in each sector. Top left cluster of sectors dominated by Goods/manufacturing sectors, expected to be worse affected in percentage terms. This is due to their high *direct* EU exposure.
 - ***Impact of each sector on the Scottish economy***: Horizontal middle region of sectors mainly Service sectors. They are less impacted in percentage terms, but up make a large element of the overall impact on the Scottish economy.

Revealed Comparative Advantage

- The second element of this Brexit analysis explores the relative export strengths of Scotland and rUK.
- Revealed Comparative Advantage (RCA) is a useful statistic in looking at the goods where Scotland currently enjoys an advantage in trading relative to the rest of the world.
- If a particular good accounts for a larger share of Scottish exports, than it does to global exports, Scotland is said to have a comparative advantage in that sector.
- For example, Whisky accounts for a far higher share of Scottish exports, than overall global exports. Scotland is therefore said to have a comparative advantage in whisky
- An RCA greater than 1 implies that Scotland has a comparative advantage in that sector when compared to the world as a whole.
- If Scotland's RCA for a given sector is larger than the UK's, that sector is proportionately more important to Scotland than to the UK as a whole.
- All Revealed Comparative Advantage indicators were calculated using 2017 HMRC Regional Trade Statistics (RTS)⁵.

⁵ HMRC RTS: <https://www.uktradeinfo.com/Statistics/RTS/Pages/default.aspx>

Revealed Comparative Advantage in Scotland

RCA for Top 10 Exports Products for Scotland			
	Description	Scotland RCA	rUK RCA
1	Beverages	23.1	1.8
2	Fish & Seafood	4.3	0.3
3	Petroleum and related products/materials	4	0.7
4	Power-generating machinery and equipment	2.9	3.4
5	Leather & related products	2.4	0.4
6	Crude rubber & related products	1.9	0.3
7	Transport equipment	1.9	2.8
8	Chemical materials and products, n.e.s.	1.8	1.3
9	Animal oils and fats	1.5	1.6
10	Live animals other than fish & seafood	1.3	1.4

Source: HMRC RTS 2017

- This table displays the top 10 goods Scotland has the largest revealed comparative advantage in exporting.
- This is compared to rUK, to illustrate how we compare to our neighbours.
- Scotland has a clear *global* advantage in exporting Beverages and Fish & Seafood products.

Revealed Comparative Advantage in rUK

RCA for Top 10 Export Products for rUK (England, Wales & Northern Ireland)			
	Description	rUK RCA	Scotland RCA
1	Power-generating machinery and equipment	3.4	2.9
2	Transport equipment	2.8	1.9
3	Miscellaneous manufactured articles	2.1	0.6
4	Essential oils, resinoids and related products	1.8	0.4
5	Beverages	1.8	23.1
6	Medicinal & pharmaceutical products	1.6	0.5
7	Animal oils and fats	1.6	1.5
8	Dyeing, tanning and colouring materials	1.5	0.7
9	Road vehicles (including air-cushion vehicles)	1.5	0.1
10	Live animals other than fish & seafood	1.4	1.3
Source: HMRC RTS 2017			

- This table displays the top 10 goods rUK has a revealed comparative advantage in exporting.
- This is compared to Scotland, to illustrate how we compare to our neighbours.
- rUK has several significant advantages in the exporting of manufactured machinery and transport goods.

What does Revealed Comparative Advantage tell us?

Advantages

- RCA is important for highlighting the relative importance of given sectors in Scotland.
- This allows us to compare Scottish sectors to the World Average. In the prior example, this allowed us to compare Scottish sectors with rUK Sectors.
- It answers the question “Compared to the World average, how much better is Scotland at exporting Good Y”.

Disadvantages

- RCA tells us little about the absolute importance of exporting Scottish goods.
- For example, Scotland has an RCA in the exporting of the following goods:
 - *Leather manufacturing: 2.1*
 - *Other Transport Equipment: 1.3*
- However, according to HMRC Regional Trade Statistics, in 2017 Scotland exported:
 - *£110 million worth of Leather manufacturing goods*
 - *£1.2 billion worth of Transport Equipment*

Key Messages: Sectoral Economic Impact Analysis

Complexities of the Scottish Economy

- A straight forward way to look at potential exposure across sectors to Brexit would be to look at those sectors most exposed to trade with the EU.
 - For example: Chemicals, Food and Drink, Wholesale and Retail, Professional Services.
- However Brexit has indirect impacts through both domestic supply chains and interaction with the rUK economy as well as wider implications for investment, wages, labour availability etc.
- The new sectoral modelling approach used in this analysis accounts for these complexities, and therefore provides the most detailed insight into the impact on sectors across the Scottish economy.

Key Findings

- Capturing these complexities across the Scottish economy, we find;
- The Sectors that are **affected most as a share of sector output** - Chemicals, Mining and Quarrying, and Metals and Rubber.
- The Sectors that **contribute most to the decline in Scottish GVA**; Wholesale and Retail, Professional Services, Financial Service, Construction.
- The sectors that are **relatively most important to Scotland relative to the UK** – Agriculture, Forestry and Fishing, Food and Drink, Electricity and Gas.
- A **majority of Scottish sectors suffer worse than rUK sectors** as a result of the migration restrictions imposed under FTA and WTO type scenarios.

Revealed Comparative Advantage Analysis

- Evidence using HMRC Regional Trade data allows us to assess the advantages Scotland has in exporting certain goods globally.
- In particular, Scotland has a strong advantage in the global exporting of particular Beverages and Fish & Seafood products.
- This analysis also allows us to provide insight into what Scotland has a Revealed Comparative Advantage in exporting in comparison to rUK.
- Revealed Comparative Advantage has its advantages in highlighting the relative importance of given sectors in Scotland, but does not inform on the absolute importance in the exportation of particular Scottish goods.