

Article

# UK trade in goods and productivity: new findings

This research paper uses HM Revenue and Customs' administrative trade data to analyse the link between productivity and trader status for British businesses.

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# 1 . Main points

- A new dataset – linking business-level financial data with administrative trade data – suggests that UK businesses which declare international trade in goods were around 70% more productive on average than non-traders in 2016.
- Businesses which trade goods internationally are large: only around one in five UK businesses with more than 10 employees made trade in goods declarations in 2016, but trading businesses accounted for around 40% of all employment over the same period
- Most direct trade in goods is undertaken by the Manufacturing industry – which exported (imported) £149bn (£112bn) of goods in 2016 – and the Wholesale and retail industry – which exported (imported) £84bn (£222bn) over the same period; businesses in these industries also trade the largest number of products and have the greatest geographical reach.
- Businesses which report goods exports or imports were around 21% and 20% more productive respectively than businesses which do not trade after controlling for their size, industry and ownership status; among traders, more productive businesses export more products and import from more destinations than less productive traders.
- These effects appear to differ between the EU and non-EU markets: the productivity premia associated with trading with non-EU markets are considerably larger than those associated with EU trade, suggesting that lower productivity businesses find it easier to access EU than non-EU markets.

## 2 . Introduction

Despite a large international literature examining the link between business performance and trade in goods status at the firm-level (see Wagner 2007, 2012 for surveys), evidence of these relationships in the UK context has been hampered by data constraints. Information on business' financial performance is collected by the UK's large, structural business surveys such as the Annual Business Survey (ABS), conducted by the Office for National Statistics (ONS), and is gathered for distinct units within enterprises known as reporting units. Data on trade in goods is collected for administrative purposes by HMRC, and is linked to Value Added Tax (VAT) units which – for large businesses in particular – often do not align with the reporting unit structure of businesses. These differences have hampered the linking of these datasets, and have constrained analysis of the association between business performance and trade in goods in the UK.

[A discussion paper](#) published alongside this release by the Economic Statistics Centre of Excellence addresses this data gap directly. We use a new feed of HMRC's trade in goods declarations provided to ONS and data from the UK's Inter-Departmental Business Register (IDBR), as well as information from the ABS to create a new, linked dataset which carries financial and trade in goods data for a large sample of UK businesses for the 2008 to 2016 period. Building on ONS' recent efforts to improve trade in goods statistics and drawing on methods used by ONS to incorporate VAT data in the UK's National Accounts, we devise and implement a strategy which apportions the trade reported by a business' VAT units to its reporting unit structure. Although the resulting dataset is limited to direct trade in goods alone (and therefore does not capture trade in services, or the onward shipping of traded content through supply chains) and covers only EU trade collected on the Intrastat survey, to our knowledge it is the first large dataset for the UK economy which combines transaction level trade in goods data with business-level financial information.

We apply these data to produce statistics and analysis of relevance to existing policy debates. Firstly, in view of the UK's decision to leave the European Union and wider debates on trade policy, we set out detailed statistics on the prevalence of different forms of trade in goods behaviour for different types of businesses. We examine the value of trade in goods for different industries, the average number of products traded and the geographical reach of UK trade in goods, as well as the degree of concentration of trade in goods flows among businesses, using data for a large proportion of the UK business population.

Secondly, we apply these new data to the UK's productivity performance: examining the link between trade in goods behaviour and labour productivity at the business level. This work – drawing on recent ONS analysis of the drivers of productivity at the micro-level (ONS 2016, 2017a, 2017b, 2017c, 2017d, 2018) – seeks to explain differences in labour productivity across businesses (Figure 1) in relation to their trade in goods behaviour. We examine the link between productivity and trade at the extensive margin – whether a business trades or not – and the intensive margin – how much a business trades, using data for a large sample of business' in the non-financial business economy in Great Britain.

**Figure 1: Cumulative distribution of labour productivity across businesses, 2016**

Figure 1: Cumulative distribution of labour productivity across businesses, 2016



**Source: Office for National Statistics**

**Notes:**

1. Approximate Gross Value Added (aGVA) per worker.
2. ABS, weighted by employment and sample selection and grossing weights.

The full results of our analysis, details of the datasets we used and the matching and linking methodology are set out in the accompanying article. This publication provides a summary of our approach and highlights the main findings of our work. We welcome views and feedback on these experimental methods, as well as on the uses and usefulness of the resulting dataset.

### 3 . Data and methods

Data from several different sources are used in this analysis. Business-level data on employment and financial performance were taken from the Annual Business Survey (ABS). Transaction level data on trade in goods was taken from HM Revenue and Customs' (HMRC) customs and Intrastat declarations, and data from the Inter-Departmental Business Register (IDBR) is used to link these sources together.

#### Annual Business Survey (ABS)

The ABS is the main structural business survey conducted by the Office for National Statistics. It surveys around 65,000 businesses to collect financial information on firms in the production, construction, distribution and services industries, representing around two-thirds of the UK economy. The ABS provides the data for the labour productivity estimates used in this paper. These data include business level turnover, intermediate consumption and “approximate gross value added<sup>1</sup>” (aGVA) at basic prices. As the ABS has limited coverage of the agricultural and financial industries – as well as the public sector – we exclude these industries from our productivity analysis, and as equivalent historical data for Northern Ireland are not available at time of writing, the ABS analysis presented here only considers firms based in Great Britain<sup>2</sup>. The resulting dataset contains between 45,000 and 50,000 business-level observations of value added per year.

Estimates of employment at the business level are not collected on the ABS. Consistent with our earlier work with the ABS (ONS 2016, 2017c, 2017d, 2017f, 2018b), the estimate of labour input which we use in this analysis is total employment at the business – including both employees and working proprietors – taken from the Inter-Departmental Business Register (IDBR) at the time of their selection into the ABS. Employment information from the IDBR is derived from a number of different sources (including the Business Register Employment Survey (BRES), HMRC records and some imputation) and some of the employment information – especially for small businesses – may be several years old. This forms the denominator for our estimate of firm level labour productivity. Our measure of labour productivity (GVA per worker) is therefore calculated as approximate value added at basic prices divided by employment.

While the ABS provides detailed financial data on the performance of businesses, it offers limited information on their trading behaviour. Binary questions on whether a business imports or exports goods were added to the ABS in 2011, but no information on the value of trade in goods is collected. Finally, in common with most ONS surveys, the ABS asks for information at the reporting unit level of the corporate hierarchy. This feature and a range of other issues which accompany the use of these data impose some limitations on our analysis and are explored further in the limitations section.

#### Inter-Departmental Business Register (IDBR)

The Inter-Departmental Business Register (IDBR) is a comprehensive register of UK businesses. It is maintained by ONS as the sampling frame for UK business surveys, and covers around 2.8m businesses across all the industries of the economy. The primary source data used to maintain the IDBR is provided by HMRC. It includes all businesses registered with HMRC either for Value Added Tax (VAT), or for the operation of the UK's payroll tax system – Pay as You Earn (PAYE). As a consequence, the IDBR contains records on a large proportion of the UK's business population, excluding only those which do not have employees and those with turnover below the VAT registration threshold. We use quarterly snapshots of the IDBR.

At the core of the IDBR are a set of relational data or look up tables which link various firm-level identifiers together. These identifiers include a business' VAT registration and the reference numbers of units which ONS constructs to facilitate data collection: In most instances, “Local units” closely approximate the establishments of businesses, while “Reporting units” mostly comprise collections of local units which undertake similar activities. These relational data provide the key link between VAT units – for which we have information about trade in goods from HMRC – and reporting units – for which we have information about productivity from the ABS. Specifically, we match the trade reported by each VAT unit to all the reporting units which appear within the same enterprise group.

## Trade in goods

The third dataset used in this analysis is provided by HMRC, and contains transaction level information on trade in goods. These data are collected for administration and tax purposes, and form the basis of HMRC's Overseas Trade Statistics (OTS) publications. These substantial datasets cover a large proportion of UK trade in goods transactions between 2008 and 2016. We use data on two kinds of transactions.

### Transactions between businesses based in the UK and the European Union (EU)

Information on the total value of trade in goods transactions of UK businesses is collected through the VAT returns of businesses. If the monthly value of this trade crosses an administrative threshold, the business is included in the monthly "Intrastat" survey for the following twelve months. By law, this survey is currently required to cover at least 93% of UK imports from the EU ("arrivals") and 97% of UK exports to the EU ("dispatches"). As the value of trade has changed, this threshold has also moved – as shown in Table 1.

### Transactions between UK based businesses and those outside the EU

These data are collected through the UK customs import and export declarations made by the importing or exporting businesses, predominantly through the Customs Handling of Import and Export Freight (CHIEF) system. These data are administrative and are consequently not collected through a survey, and cover a large proportion of UK trade with non-EU nations.

**Table 1: Threshold for inclusion of VAT unit in Intrastat survey**

Year	Imports from EU	Exports to EU
2007	£260,000	£260,000
2008	£260,000	£260,000
2009	£270,000	£270,000
2010	£600,000	£250,000
2011	£600,000	£250,000
2012	£600,000	£250,000
2013	£600,000	£250,000
2014	£1,200,000	£250,000
2015	£1,500,000	£250,000
2016	£1,500,000	£250,000

Source: HMRC

Notes:

1. EU imports and exports must be declared on VAT returns. Once a VAT unit exceeds the threshold in either direction, it is included in the next year's Intrastat survey, the mandatory survey of details on country and commodity.

These data are rich in detail – providing a wide range of information about the trade in goods transaction, including the port of entry or exit and data on some of the costs associated with shipping. Critically, for our purposes, we also almost always observe the VAT registration number of the UK based trading company. The exceptions – data collected directly (electricity and gas imports) and non-EU declarations made by businesses not registered for VAT – are a relatively small fraction of total trade in goods.

## Methods

The key methods used in this paper relate to the difficulty of linking data on trade in goods – provided on a VAT unit basis – to information on productivity – at the reporting unit level. This work is carried out in two steps: firstly, records from HMRC's trade in goods declarations were linked to snapshots of the Inter-Departmental Business Register (IDBR) and aggregated to the enterprise or enterprise group level. Secondly, an apportionment mechanism is used to divide total trade in goods across the reporting units which are linked to the enterprise. Readers seeking a detailed exposition of these methods – and our robustness and triangulation work – should consult the accompanying paper.

## Notes for: Data and methods

1. GVA from the ABS is referred to as aGVA to differentiate it from the national accounts measure, of which aGVA is a component. The differences between aGVA and the national accounts measure of GVA is discussed in Ayoubkhani (2014).
2. Northern Ireland is included in our analysis of the trade in goods datasets, but excluded from the analysis of the association between productivity and trader status. An upcoming article will examine the trading patterns of businesses based in Northern Ireland as detailed in HMRC's trade in goods records.

## 4 . Results

The dataset which results from these efforts combines information on businesses' financial performance with data from HMRC's trade in goods declarations. We apply these data to two policy questions. To support policy makers following the UK's decision to leave the European Union and wider debates about trade policy, we examine the prevalence of different types of trading behaviour in the UK. Secondly, we extend our analysis of the drivers of productivity to examine the link between output per worker and trade at the business level. This section provides a brief overview of some of our main findings.

### The characteristics of traders

Only a small proportion of businesses are traders, but these businesses account for a large proportion of total employment (Table 2)<sup>1</sup>. The first panel in Table 2 shows the proportion of the business population from whom we have identified trade in goods declarations for different kinds of trade. The second panel shows equivalent metrics for the population of businesses with more than nine workers, while the third panel shows the proportion of employment accounted for by businesses in different categories. Note that there is some evidence here that the changes in the thresholds for inclusion in HMRC's Intrastat survey (see Table 1) have some impact on the reported prevalence of importing. In particular, the increase of the thresholds in 2010, 2014 and 2015 are all associated with slight reductions in the prevalence of trading behaviour. These results should consequently be handled carefully.

**Table 2: Shares of firms by trade in goods based trader status: 2011 to 2016, IDBR basis**

	<b>All Businesses, %</b>									
	2008	2009	2010*	2011	2012	2013	2014*	2015*	2016	
No trade in goods declarations	94.7	94.9	94.9	95.1	95.1	95.2	95.3	95.4	95.4	
Traders	5.3	5.1	5.1	4.9	4.9	4.8	4.7	4.6	4.6	
of which										
Exporters only	1.1	1	1	1	1	1	1	1	0.9	
Importers only	2.2	2	2	1.9	1.9	1.8	1.8	1.8	1.8	
Exporters & Importers	2.1	2.1	2.2	2.1	2	2	2	1.9	1.8	
<b>Businesses with greater than 9 employment, %</b>										
	2008	2009	2010*	2011	2012	2013	2014*	2015*	2016	
No trade in goods declarations	77.9	79	79.5	79.5	79.6	80.3	80.7	81.2	81.1	
Traders	22.1	21	20.5	20.5	20.4	19.7	19.3	18.8	18.9	
of which										
Exporters only	3.2	3.1	3.1	3.1	3.2	3.1	3.1	3.1	3	
Importers only	6.3	5.8	5.3	5.1	5.2	5	4.9	4.9	5	
Exporters & Importers	12.6	12.1	12.1	12.2	12	11.6	11.3	10.8	10.8	
<b>Employment share by trade in goods declaration status, %</b>										
	2008	2009	2010*	2011	2012	2013	2014*	2015*	2016	
No trade in goods declarations	53.9	53.7	54.9	57	57.4	57.6	58.9	59.9	59.7	
Traders	46.1	46.3	45.1	43	42.6	42.4	41.1	40.1	40.3	
of which										
Exporters only	2	2	2.2	2.4	2.2	2.4	2.9	2.7	2.3	
Importers only	10.1	10.8	11.2	8.3	8.7	8.8	8.1	8	8.2	
Exporters & Importers	34	33.5	31.8	32.3	31.8	31.2	30.1	29.5	29.7	

Source: Office for National Statistics, HMRC

Notes:

1. Counts here are based on the reporting unit classifications of businesses.
2. Employment and firm size are both based on information from the IDBR.
3. Years are starred when there is a significant increase in the Intrastat threshold on EU imports and a reduction in the number of firms in the Intrastat survey, which likely explains the falls in the number of importers and employment at importers in these years.
4. Figures may not sum owing to rounding.

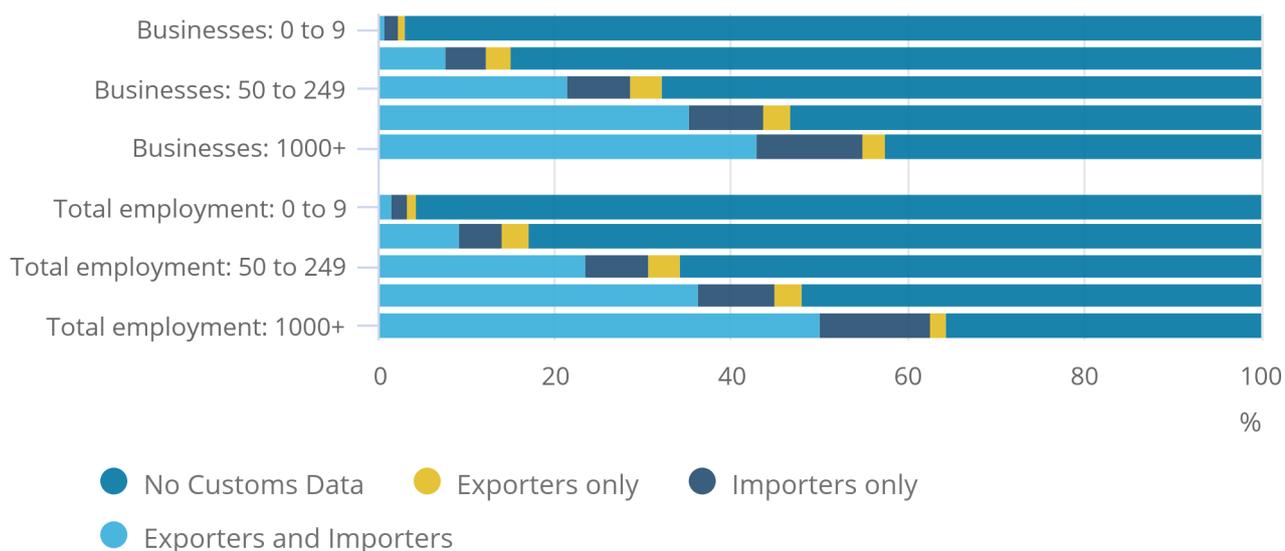
These results suggest that around 5% of UK businesses were active goods importers or exporters according to trade declarations over the 2008 to 2016 period, or between 22% and 19% of businesses employing at least ten workers over the same period. The most common form of trading behaviour was as both an exporter and an importer, although the gap is narrower for businesses in the population than for those with at least ten workers<sup>2</sup>.

While traders are a minority of businesses, they are the largest employers. The results in the third panel suggest that, in 2016, businesses with trade declarations accounted for around 40% of all employment. Businesses reporting both exports and imports accounted for around 30% of employment, while businesses with only exports declarations and only imports declarations accounted for 2.3% and 8.2% of total employment respectively.

This finding is confirmed by Figure 2, which shows the proportion of businesses (Panel A) and employment (Panel B) in each of five size-classes by their trade in goods declarations status. On this basis, very few of the smallest businesses engage in trade: fewer than 4% of businesses with fewer than ten employees made a submission to HMRC in 2016 to report trade in excess of the reporting thresholds. Moving up the business size distribution, the prevalence of trade increases markedly. Around one in six businesses with between 10 and 49 workers reported trade to HMRC, while approximately half of businesses employing between 250 and 999 workers reported trade over the same period. Among the largest businesses – defined as those with more than 1,000 workers – almost 60% reported some measure of exports or imports over this period. Overall around one in five businesses with 10 or more workers declared some trade in 2016.

**Figure 2: Trade in goods reporters by firm size, 2016, IDBR basis**

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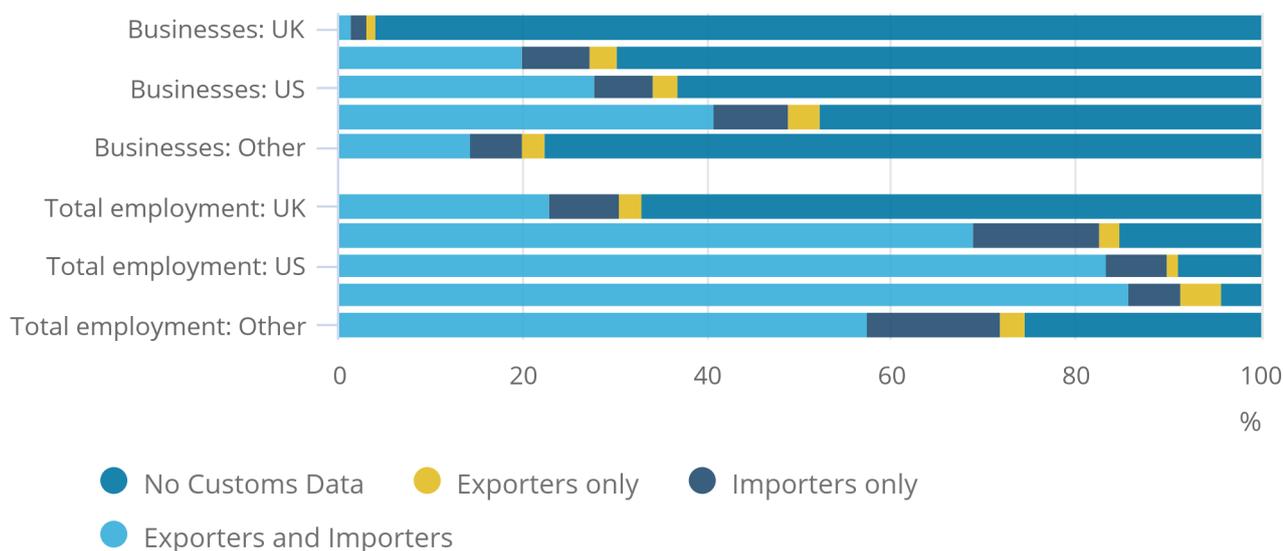


Source: Office for National Statistics

In common with the international literature on trade in goods, our analysis suggests that foreign-owned businesses are more likely to be active traders than domestically held traders (Figure 3). Among the British-owned business population, fewer than 5% of businesses declared trade in goods in 2016. By contrast, around 30% of UK businesses owned by companies in the EU reported some trade to HMRC over the same period, as well as 37% of UK businesses owned in the US. Businesses with Japanese owners are the most likely to trade, and the 48% of non-trading, Japanese-owned businesses only account for just 4% of total employment in Japanese-owned businesses.

**Figure 3: Trade in goods reporters by country of ultimate ownership, 2016, IDBR basis**

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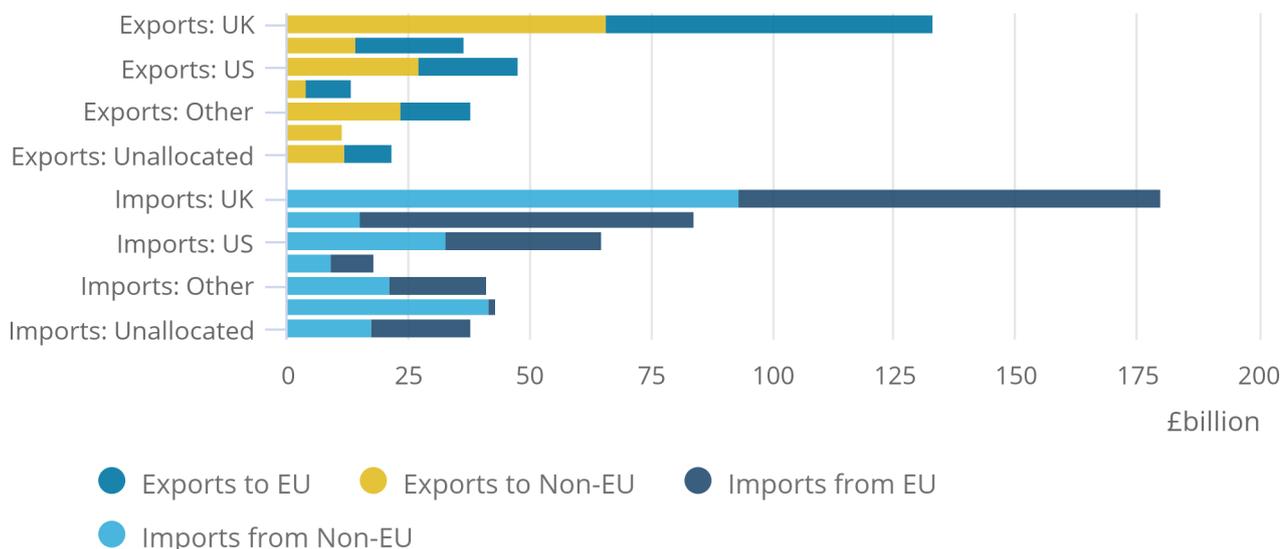


Source: Office for National Statistics, HMRC

EU and US-owned businesses in the UK also appear to have strong connections to their “home” markets relative to domestically owned firms (Figure 4). In 2016, the goods exports and imports of UK businesses divided fairly evenly between the EU and non-EU countries: around 50.4% of the export declarations and 48.2% of the import declarations of these businesses by value were accounted for by the EU. However, businesses where the ultimate foreign owner is based in another EU country have trade that is more oriented towards the EU, with 60.1% of reported exports going to the EU and 81.7% of reported imports coming from the EU in 2016. Similarly, US-owned firms are slightly more orientated towards the non-EU. These businesses imported from the EU and outside the EU equally (50.5% and 49.5%), but sent 57.6% of reported exports to outside the EU in 2016. These results suggest some degree of “home market” bias in the behaviour of these businesses. However, by contrast, Japanese-owned businesses were the opposite, reporting a similar value of imports from EU and non-EU countries (47.8% and 52.2%), but sending 70% of reported exports to the EU in 2016.

**Figure 4: Total trade by country of ultimate foreign ownership, 2016, IDBR basis**

Figure 4: Total trade by country of ultimate foreign ownership, 2016, IDBR basis



Source: Office for National Statistics

Notes:

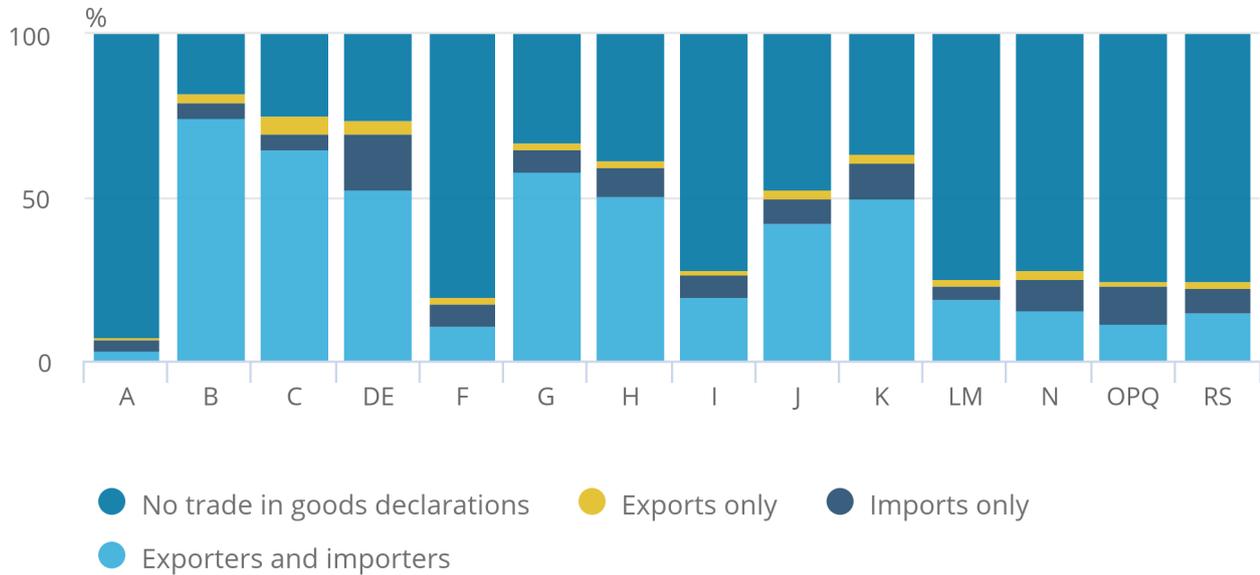
1. A proportion of total UK trade cannot be allocated to IDBR businesses, and is marked as unallocated.
2. NMG = non-monetary gold, which is also excluded.

Trading propensity also varies significantly by industry. Businesses in the Manufacturing (C), Wholesale and retail (G), Mining and quarrying (B, including oil extraction) and Electricity, gas, and steam, and water supply, Sewerage and waste collection (D and E) industries are most likely to be traders. However, even among the most active trading industries, traders account for less than one-quarter of businesses. The smallest fractions of businesses which trade according to trade in goods declarations are in the Agricultural (A), Accommodation and food services (I) and Construction (F) industries.

While these results suggest that a minority of businesses in each high-level industry declared trade in goods in 2016, differences in the prevalence of large businesses across industries mean that the proportions of employment accounted for by traders across industries are markedly different (Figure 5). The presence of large, trading businesses in Manufacturing (C), Mining and quarrying (B), and Wholesale and retail (G) means that the proportions of employment accounted for by traders is considerably higher in these industries than their share of all businesses. In Manufacturing – where 20% of businesses reported either exports or imports during 2016 – the share of employment accounted for by businesses with trade in goods declarations was 75%. In Mining and quarrying, which in the UK is mostly oil and gas extraction, the employment share accounted for by traders is around 82%, while in Wholesale and retail (G), the 15% of businesses declaring trade in goods accounted for about two-thirds of employment in that industry in 2016.

**Figure 5: Trade in goods reporters by industry, percentage of total industry employment, 2016, IDBR basis**

Figure 5: Trade in goods reporters by industry, percentage of total industry employment, 2016, IDBR basis



Source: Office for National Statistics, HMRC

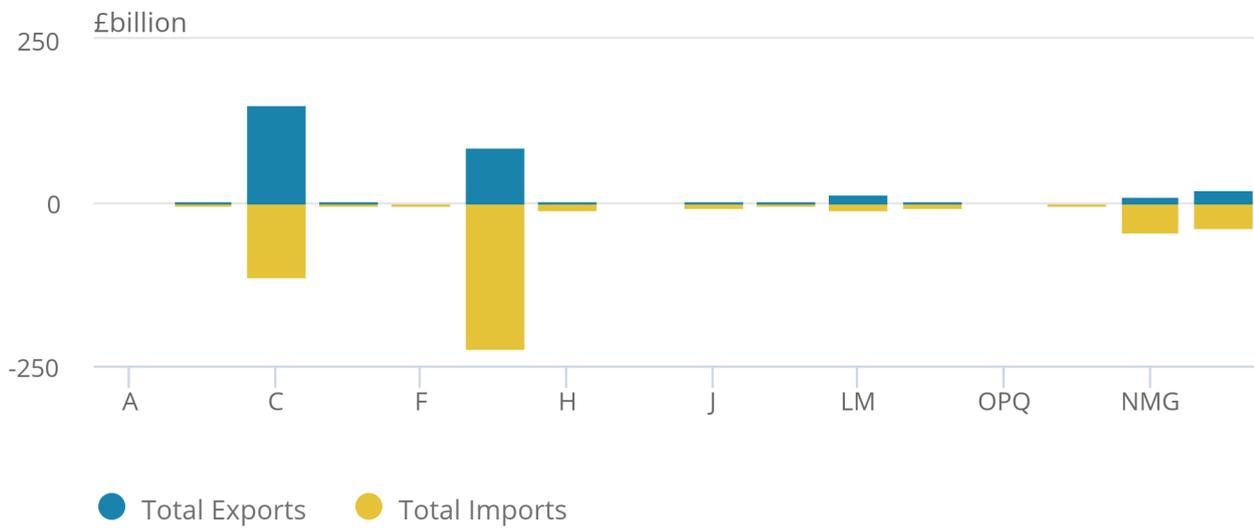
Notes:

1. A, Agriculture, Forestry & Fishing;
- B, Mining & Quarrying, i.e. oil extraction;
- C, Manufacturing;
- D, Electricity, Gas & Steam;
- E, Water Supply, Sewerage & Waste Management;
- F, Construction;
- G, Wholesale & Retail;
- H, Transport & Storage;
- I, Accommodation & Food Service;
- J, Information & Communication;
- K, Finance & Insurance;
- L, Real Estate;
- M, Professional, Scientific & Technical;
- N, Administrative & Support Services;
- O, Public Administration, Defence & Compulsory Social Security;
- P, Education;
- Q, Human Health and Social Work;
- R, Arts, Entertainment & Recreation;
- S, Other Services.

The results of our linking methodology can also be used to produce industry level estimates of exports, imports and trade in goods balance. These results are similar to data published by HMRC on a different basis<sup>3</sup>, and capture only direct trade flows: they do not capture intermediation of traded content through supply chains. This analysis suggests that direct trade in goods is dominated by the Manufacturing and Wholesale and retail industries (Figure 6<sup>4</sup>). On this basis, UK manufacturing industries are estimated to have run a substantial trade surplus in 2016: exporting almost £150bn and importing £112bn over this period. By contrast, the Wholesale and retail industry ran a trade in goods deficit, importing £222bn while exporting £84bn of goods in 2016. Among the remaining industries – whose direct trade values are an order of magnitude smaller than Manufacturing and Wholesale and retail, the Real estate activities and Professional, scientific and technical services (LM) and Mining and quarrying (B) industries were the only other industries to run trade in goods surpluses of more than £400 million over this period. Based on the allocated proportion of trade, a small goods surplus was also run by the utilities industries (Electricity, gas and steam, and Water supply, sewerage and waste management, D and E). The other industries ran small trade in goods deficits.

Figure 6: Trade in goods by industry, 2016, IDBR basis

Figure 6: Trade in goods by industry, 2016, IDBR basis



Source: Office for National Statistics, HMRC

Notes:

1. NMG = Non-monetary gold. Unall. = Total unallocated trade to industries, some portion of which is likely due to DE.
2. A, Agriculture, Forestry & Fishing;  
B, Mining & Quarrying, i.e. oil extraction;  
C, Manufacturing;  
D, Electricity, Gas & Steam;  
E, Water Supply, Sewerage & Waste Management;  
F, Construction;  
G, Wholesale & Retail;  
H, Transport & Storage;  
I, Accommodation & Food Service;  
J, Information & Communication;  
K, Finance & Insurance;  
L, Real Estate;  
M, Professional, Scientific & Technical;  
N, Administrative & Support Services;  
O, Public Administration, Defence & Compulsory Social Security;  
P, Education;  
Q, Human Health and Social Work;  
R, Arts, Entertainment & Recreation;  
S, Other Services.

Our estimates also suggest that direct trading behaviour is very unequally distributed, with the largest traders responsible for the bulk of trade. Table 3<sup>6</sup> presents some simple statistics on the degree of concentration of trade: of total UK exports, 35% to 40% were reported by the 50 largest exporting enterprise groups between 2008 and 2016; of total UK imports, 30% to 35% are reported by the 50 largest importing enterprise groups. These results also suggest that trade in goods is more concentrated for exports than for imports. The top 50 and top 100 enterprise groups for exports make up a higher share of total UK exports than do the top 50 and top 100 importing enterprise groups. 43% to 51% of exports are declared by the largest 100 exporter enterprise groups over this period, compared with 37% to 42% of imports.

**Table 3: Percentage of UK total of largest traders, enterprise groups, IDBR, 2008 to 2016****Percentage of total UK exports due to enterprise groups that are in the top:**

	50 exporters	100 exporters	500 exporters	2000 exporters
2008	35.7	43.9	62.4	76.6
2009	34.9	42.9	61.8	76.6
2010	36.9	44.9	63.2	76.8
2011	38.9	46.5	63.8	76.7
2012	37.2	44.7	62.3	75.8
2013	44.2	51.2	66.5	78.4
2014	38.7	46.1	62.8	76.3
2015	40.0	47.3	64.2	77.7
2016	37.6	45.2	63.2	77.7

**Percentage of total UK imports due to enterprise groups that are in the top:**

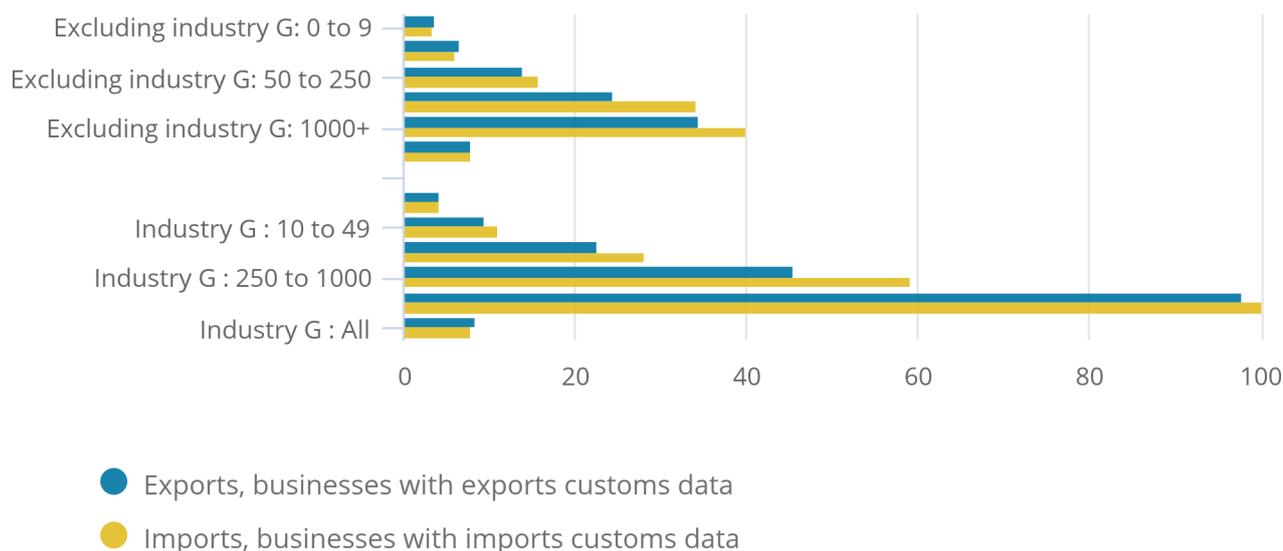
	50 importers	100 importers	500 importers	2000 importers
2008	25.8	7.5	45.2	23.5
2009	26.0	7.2	45.0	22.5
2010	28.5	7.9	48.1	23.9
2011	29.5	7.7	48.8	23.3
2012	30.9	8.0	50.4	23.5
2013	32.1	8.0	50.7	23.2
2014	34.9	7.2	53.0	22.1
2015	36.5	7.2	54.1	21.5
2016	32.5	7.7	50.8	22.8

Source: Office for National Statistics, HMRC

Our new data also provide some measures of the intensive margin of trade – the amount that a business trades, the number of products traded and the number of markets traded with. This analysis suggests that larger businesses and larger trade volumes tend to be associated with more complex trading arrangements. Figure 7 shows the mean number of products<sup>6</sup> imported or exported by firm size, dividing reporting units with trade in goods declarations into those in the Wholesale and retail industry (second panel) and those in all other industries (first panel). This figure shows that the relationship between size and products traded is particularly striking in the wholesale industry – in which the largest businesses export and import around 100 unique product categories on average. It also shows that the mean number of product categories exported tends to be higher than the mean number of products imported for a given size-band.

**Figure 7: Mean number of product categories traded, by firm size, businesses reporting goods exports, businesses reporting goods imports, 2016, IDBR basis**

Figure 7: Mean number of product categories traded, by firm size, businesses reporting goods exports, businesses reporting goods imports, 2016, IDBR basis



Source: Office for National Statistics, HMRC

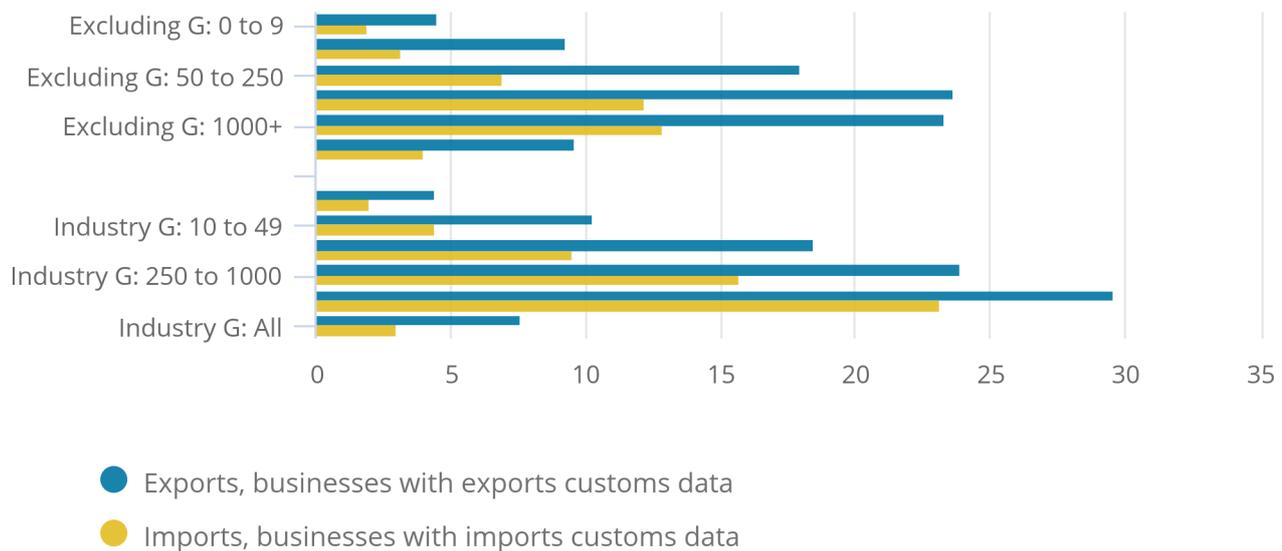
Notes:

1. Product category is 4-digit commodity code.

As the size of business and the value of business-level trade increases, so too does the number of trading partners. Figure 8 shows the mean number of export destinations for exporters and the mean number of import origin countries for importers by size-band. The first panel shows that the mean number of countries exported to (imported from) rises from fewer than 5 (2) for the smallest businesses to around 24 (12) for businesses of between 250 and 999 workers outside Wholesale and retail. In contrast to the results for the number of products, the complexity of trade levels off above this point – with no substantial change between the 250 to 999 worker businesses and the largest businesses. Among Wholesale and retail businesses, average complexity increases monotonically with size.

**Figure 8: Mean number of destinations exported to and imported from by firm size, businesses reporting goods exports and businesses reporting goods imports respectively, IDBR basis**

Figure 8: Mean number of destinations exported to and imported from by firm size, businesses reporting goods exports and businesses reporting goods imports respectively, IDBR basis



Source: Office for National Statistics, HMRC

## Productivity and trade in goods

Levels of labour productivity are considerably higher for businesses which declare trade than for businesses which do not. Table 4 shows the median (first panel) and mean (second panel) levels of output per worker at businesses which have different trader statuses in the HMRC trade in goods data, excluding the very largest traders. Median labour productivity among businesses which both export and import was around £40,000 per worker per year in 2016, compared with around £22,000 per worker per year at businesses which have no trade declarations. Businesses which only report exports or imports – which are an unusual group of businesses – had output per worker of £45,000 and £33,000 per worker per year in the same period respectively. On a mean basis – which is considerably affected by a few very high-productivity businesses – the gap is similarly stark: businesses with export and import trade in goods declarations had labour productivity almost 70% higher than that of businesses without trade in goods declarations in 2016.

**Table 4: Labour productivity, ABS basis, employment weighted**

	Employment weighted				
	No trade in goods declarations	Exports only	Imports only	Both	All businesses
<b>Median</b>					
2008	19.7	33.7	25.5	32.4	23
2009	18.6	35.5	23.6	31.7	22.2
2010	20.2	38	23.3	33.4	24
2011	20.5	39.5	26.8	35.3	24.3
2012	20.3	39.5	27	37.6	24.5
2013	20.6	34.5	29.7	38.1	25.2
2014	21.1	37.2	31.2	37.8	26.3
2015	22.2	40.4	33.2	40.3	27.5
2016	22	44.6	32.8	40.2	26.6
<b>Mean</b>					
2008	30.6	45.6	39.9	48.7	36.3
2009	28.5	45.5	38.4	45.3	34
2010	31.8	49.4	39.5	49.7	37.4
2011	32.6	53.5	44.5	51.3	38.6
2012	32.7	57.9	45.8	51.7	38.9
2013	34.2	57.6	48.5	57.1	41.2
2014	36.4	55.3	54.8	60.1	43.8
2015	37.7	54.8	54.3	62.4	45
2016	37.2	64.9	55.3	62.9	44.3

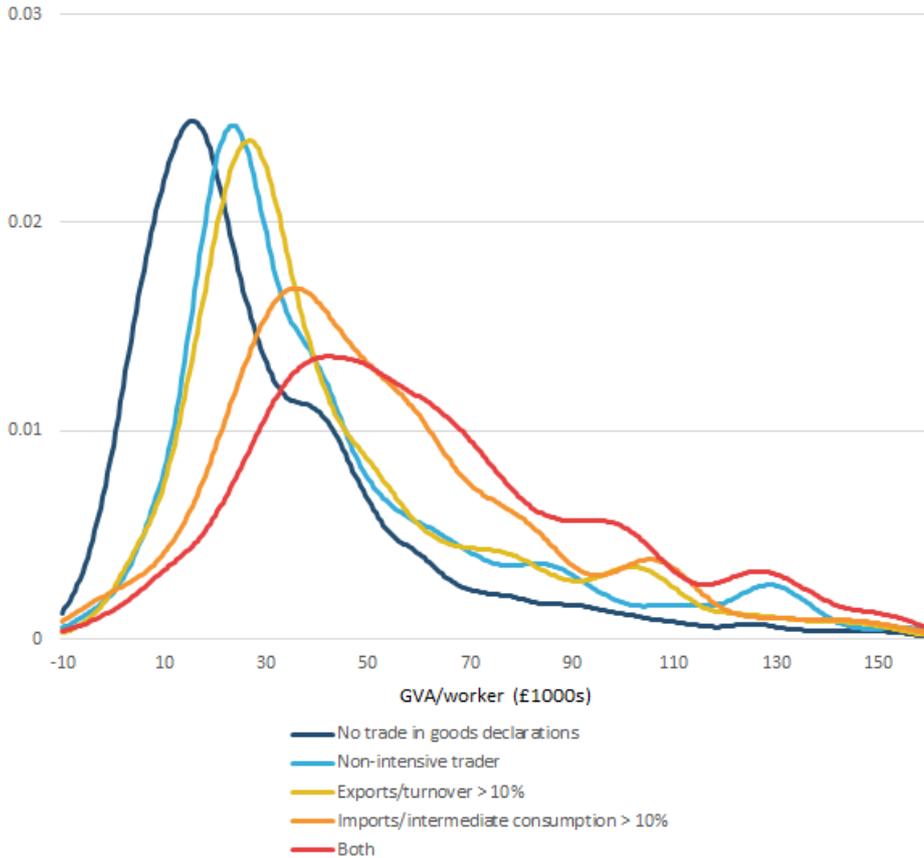
Source(s): Office for National Statistics, HMRC

Note:

1. Excludes the top 2% of exporters and the top 2% of importers

To examine differences in the productivity in more detail, Figure 9 shows the distribution of labour productivity for non-traders and for businesses which trade to varying degrees, for 2008, 2011, 2014 and 2016. Traders whose goods exports (imports) account for more than 10% of their turnover (intermediate consumption) are labelled as “intensive” traders; traders who fall into neither (both) of these categories are also separately identified. In these figures, the rightwards shift of the labour productivity distribution for intensive traders is particularly apparent. The distributions of labour productivity for non-intensive exporters and importers are also shifted rightwards albeit to a lesser extent, while in each year the distribution of output per worker for non-traders is furthest to the left. While there are considerable overlaps in these distributions – highlighting the presence of some high-productivity non-traders, for example – it is clear that higher productivity among traders arises from a rightwards shift of the entire distribution, rather than by the presence of significant outliers.

**Figure 9: Distribution of labour productivity by trader status, employment weighted, 2016, ABS basis**



Source: Office for National Statistics, HMRC

**Notes:**

1. Weighted by employment and survey sample and grossing weights.
2. 'Intensive' exporters are those businesses which have an export to turnover ratio of more than 10%. 'Intensive' importers are those businesses which have import values larger than 10% of their intermediate consumption.
3. Excludes the top 2% of exporters and the top 2% of importers by value. Businesses with export intensity greater than 110% or import intensity greater than 200% are excluded due to lack of survey and administrative data comparability (due to e.g. timing).

To provide further weight to these descriptive statistics, we conduct conditional analysis designed to examine the link between labour productivity and trade declarations status after controlling for other characteristics of the business. Table 5 presents the results of a regression of logged firm-level labour productivity on trade in goods declarations-based trader status (specification 1), and sequentially adds business-level characteristics up to the most detailed specification (6), which includes controls for location of the ultimate foreign owner of the business, year and two-digit industry fixed effects. Consistent with practice in the literature, we exclude the top 2% of importers and exporters from this analysis, as well as cases where the underlying consistency of the ABS and HMRC data is in question. These outlying cases are very unusual, large traders and would otherwise likely bias our results.



**Table 5: Labour productivity and trade in goods declaration status, ABS basis, 2008 to 2016**

	1	2	3	4	5	6
	ln(prod)	ln(prod)	ln(prod)	ln(prod)	ln(prod)	ln(prod)
i.Exp.	0.35 <sup>***</sup> (56.1)	0.35 <sup>***</sup> (56.4)	0.24 <sup>***</sup> (41.8)	0.21 <sup>***</sup> (35.9)	0.21 <sup>***</sup> (34.6)	
i.Imp.	0.25 <sup>***</sup> (43.2)	0.26 <sup>***</sup> (44.5)	0.27 <sup>***</sup> (49.5)	0.22 <sup>***</sup> (37.2)	0.20 <sup>***</sup> (33.8)	
ln(employment)				0.021 <sup>***</sup> (24.8)	0.017 <sup>***</sup> (20.3)	0.019 <sup>***</sup> (22.2)
i.Ownership: EU					0.14 <sup>***</sup> (16.6)	0.15 <sup>***</sup> (17.4)
i.Ownership: USA					0.18 <sup>***</sup> (18.2)	0.19 <sup>***</sup> (19)
i.Ownership: Japan					0.35 <sup>***</sup> (9.85)	0.35 <sup>***</sup> (9.89)
i.Other foreign own					0.15 <sup>***</sup> (16.4)	0.15 <sup>***</sup> (16.5)
i.Exp.-EU						0.043 <sup>***</sup> (5.85)
i.Exp-Non-EU						0.19 <sup>***</sup> (30.2)
i.Imp-EU						0.017 <sup>**</sup> (2.62)
i.Imp-Non-EU						0.18 <sup>***</sup> (30.7)
Year F.E.	No	Yes	Yes	Yes	Yes	Yes
Industry F.E.	No	No	Yes	Yes	Yes	Yes
Adjusted R2	0.049	0.054	0.202	0.203	0.205	0.204
N	369,807	369,807	369,041	369,041	369,041	369,041

Source: Office for National Statistics

Notes:

1. Excludes the top 2% of exporters and the top 2% of importers. Businesses with export intensity greater than 110% or import intensity greater than 150% are excluded on comparability grounds.
2. Results are weighted by employment and sample selection and grossing weights.
3. Ownership refers to country of ultimate foreign ownership – UK-owned is the baseline.
4. Variables prefixed with i are binary indicator variables, or interactions thereof.
5. t statistics in parentheses, \* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001

The results of these regressions suggest a strong, consistent, positive link between labour productivity and trade in goods-based trader status. While the coefficients on export- and import-status are reduced somewhat as we add more business-level characteristics, both are positive and significant in each specification. According to specification (5), businesses which export are around 21% more productive than businesses which do not, while businesses which import are around 20% more productive, after controlling for an array of their characteristics.

The market with which a business trades also appears to be important. Specification (6) unpacks these extensive margin effects by estimating productivity premia by geographical market. These results suggest that businesses which export to (import from) the EU are around 4.3% (1.7%) more productive than otherwise equivalent non-traders. However, these effects are much smaller than the equivalent estimates for non-EU trade: businesses which export to (import from) non-EU nations are around 19% (18%) more productive than equivalent non-traders. This result could reflect relative reporting thresholds but is consistent with the theory that increased barriers to trade are only surmounted by more productive firms: producing for the domestic market is “easiest”, trading within the EU presents some additional barriers, but is easier than trading with the non-EU. We plan to investigate this finding - including whether reporting thresholds play a role in this result - in future work.

These results are also consistent with our earlier findings (ONS 2017f) that foreign-owned businesses are more productive than domestic businesses. While the effects estimated here are somewhat smaller than in our earlier work, they suggest that businesses owned in the EU and the US are around 15% and 19% more productive than UK owned businesses. UK firms which are ultimately owned in Japan are around 35% more productive than their domestically held equivalents.

Finally, we assess the extent to which these productivity premia are driven by how much a business trades, as compared with whether they trade. These results are complex. All the estimated specifications suggest that traders are more productive than non-traders, however, the amount which they trade – the “intensive margin” – can moderate or enhance this premium. These effects also seem to vary considerably by geography and product:

1. The number of markets with which a business trades is related to their level of labour productivity. Each additional EU nation to which a business exports is associated with a labour productivity premium of around 0.4%, while each additional non-EU nation a business imports from is associated with a 0.6% boost to their level of labour productivity. Each additional EU nation imported from is associated with a 0.7% reduction in labour productivity.
2. The number of products that a business trades is also related to its level of labour productivity. Each additional product category exported is associated with a productivity premium of around 0.1% – although this effect is stronger for the number of products traded with the non-EU than with the EU. Additional imported varieties are associated with small reductions in labour productivity.
3. Businesses which source a larger proportion of their inputs from overseas tend to have higher productivity on average than businesses which obtain more of their inputs from domestic sources. As before, this effect varies by geography, and is slightly larger for EU imports than for non-EU imports. Higher export to turnover ratios are associated with lower labour productivity.

## Notes for: Results

1. Unless otherwise specified, businesses here refers to reporting units.
2. These figures are notably lower than those published as part of ONS' Annual Business Survey importers and exporters' release, which estimates that around 4.6% and 6.5% of businesses were exporters and importers respectively in 2016. The reasons for this difference are varied and examined at length in our companion paper, and include (a) the capture of below threshold trade on the ABS, which is excluded from our analysis by the nature of the data and (b) the weighting used to aggregate ABS to the business population, which can only partly take account of trader status. However, there are other discrepancies between the HMRC trade in goods declarations and the ABS reported trader status, as well as potential issues introduced by our apportionment methodology which will also have a bearing on these results. The trends shown in the "importers and exporters" release – particularly around trader status and employment, and foreign ownership, are largely consistent with our results.
3. Specifically, HMRC's Trade by Business Characteristics statistics present information on trade in goods by industry and size, based on the markers attached to the enterprise, rather than the reporting unit.
4. Figure 6 also shows exports, imports and trade balance for (a) the trade of non-monetary gold and (b) unallocated trade. The former category we exclude from our analysis on the basis that these transactions likely have little bearing on the productivity of businesses; the latter cannot be linked to individual businesses, and so in common with HMRC, we include an "unallocated" group.
5. Note that this table is provided for Enterprise Groups, and not reporting units, so as to show the proportion of independent businesses which account for different portions of UK trade as recorded in trade in goods transactions.
6. These are highly detailed breakdowns - for instance 8508, "vacuum cleaners", or 2002, "tomatoes prepared or preserved otherwise than by vinegar or acetic acid". The [full range of product categories](#) is available.

## 5 . Limitations

The results presented in this paper depend on several new data sources and methods, which impose some limitations on our analysis. This section presents the most significant of these, grouped under three headings: data, methods and analysis.

### Data

Firstly, the data used in this paper impose some constraints and limitations on our work. Some of these constraints are familiar from earlier ONS work on productivity (ONS 2016, 2017a, 2017b, 2017c, 2017d, 2018) and include the timeliness and relevance of the firm-level employment estimates for micro-data analysis as well as the industrial and geographical coverage of our ABS data. Sample size restrictions also prevent analysis by very detailed industries, which in principle the HMRC trade in goods data can support. To alleviate these issues and to provide more detailed analysis, ONS intends to make use of data collected for Value Added Tax (VAT) purposes alongside these trade in goods declarations in future work.

The use of trade in goods transactions data from HMRC also imposes some limitations on our work, the impact of which is difficult to quantify. While this dataset offers a very detailed picture of trade in goods, changes in the Intrastat survey eligibility threshold – in particular for imports – complicate analysis of changes in trading behaviour through time. As set out previously, it is difficult to establish the extent to which changes in prevalence of trading behaviours reflect changes in economic conditions or changes in these thresholds. The lack of a comprehensive picture of below threshold trade with the EU in particular also imposes some challenges for our work – missing out transactions of a select group of businesses. Future, more comprehensive deliveries of data from HMRC's VAT system may enable the impact changes in the Intrastat thresholds to be quantified, however, at present it is difficult to say how much of an impact this has on the results of our analysis. Finally, the consistency of these administrative and survey data is examined in depth in our accompanying article, but may also constrain our analysis.

## Methods

The main contribution of this paper is an experimental set of trade in goods data at the reporting unit level, combining information from HMRC and the Inter-Departmental Business Register (IDBR). This rests on several detailed assumptions which are set out in the accompanying article. To the extent that these assumptions do not hold, this approach will undermine our results. While we report some sensitivity analyses, it is not possible to quantify this effect at present.

Secondly, the ABS data on which our productivity analysis depends is collected in a survey which is stratified to deliver estimates by industry, size and region which reflect the UK's business population. The weights consequently do not take trader status into account. As a result, the prevalence of different forms of trading behaviour are likely to differ across our business-register based estimates and those implied by our analysis of ABS. Future work may consider producing an adjusted set of weights for the ABS which account for trader status, which would eliminate some of these effects.

## Analysis

The analysis presented here is limited by the nature of the data collected. Perhaps the key limitation on our analysis is in the direct nature of the trade in goods transactions which are collected by HMRC. These data capture, for example, the import of an intermediate good by one company, but do not capture the onwards purchases of the good to UK household or business. This is most obvious in the data for the Wholesale and retail industry, which appears to act as gateway industry for goods coming into and leaving the UK. As a consequence, the data presented here do not capture the "final" dependence of particular industries on trade: instead, they capture the extent of direct trading of businesses in different industries. Capturing these secondary flows at the business level is a considerable challenge, and beyond our capability at present.

The absence of business-level prices prevents analysis of how the productivity of trading and non-trading businesses has changed over time. Examination of real productivity growth requires price indices which can deflate industry level output. These are typically constructed using domestic and export prices for the products produced by an industry: weighting these together to deliver an average industry-level deflator. As businesses vary in their export intensity, an ideal firm-level deflator would vary across businesses with the share of domestic and export sales. This is an area for future work: in this paper we limit ourselves to cross-sectional analysis of the levels of productivity at trading and non-trading businesses, rather than changes through time.

Finally, the results presented here are silent on the matter of causation. Specifically, it cannot be established from these results whether businesses which trade are more productive because they trade, or whether more productive businesses are more likely to trade. In the literature on this matter, there is considerably more evidence that more productive businesses choose to enter international markets. Evidence of the "learning through trade" channel – which posits that businesses become more productive as a consequence of exposure to international markets – is scarcer. Establishing the relative importance of these different effects we leave to future work.

## 6 . Conclusions and discussion

Despite a large international literature on the relationship between firm-level trading behaviour and business performance (see Wagner 2007, 2012 for surveys), evidence on this link for the UK has been hampered by long-standing data issues. A paper published by the Economic Statistics Centre of Excellence alongside this release addresses this data gap: developing a dataset which combines information from the ONS' Annual Business Survey (ABS), the Inter-Departmental Business Register (IDBR) and HMRC's trade in goods trade in goods declarations.

[As set out in the companion piece](#), the linking of these datasets is not straightforward, hampered by differences in the units for which data are collected by statistical surveys and for administrative purposes. Building on ONS' recent efforts to improve trade in goods statistics and drawing on methods used by ONS to incorporate VAT data in the UK's National Accounts, we devise and implement a strategy which apportion the trade reported by a business' VAT units to its reporting unit structure.

Although the resulting dataset is limited to direct trade in goods alone (and therefore does not capture trade in services, or the onward shipping of traded content through supply chains) and excludes below threshold trade with the EU, to our knowledge this is the first time that data on financial performance and transaction level trade data have been combined in a large sample for the UK economy. Comments on our methods and approach are welcome, as is feedback on the potential uses and usefulness of these data.

We apply this dataset to two contemporary policy debates. Firstly to support policy makers following the UK's decision to leave the European Union and wider debates regarding trade policy, we document the prevalence of different forms of trading behaviour for different types of businesses. We examine the value of trade in goods for different industries, the average number of products traded and the geographical reach of UK trade in goods, as well as the degree of concentration of trade in goods flows among businesses.

The results of this analysis show that large businesses and those which are foreign-owned are most likely to trade goods directly. Among businesses with 10 or more workers, only around one-in-five firms report trade in goods to HMRC, but these businesses accounted for 40% of all employment in 2016. Most trade in goods is undertaken by the Manufacturing industry – which exported (imported) goods worth almost £150bn (£112bn) in 2016 – and the Wholesale and retail industry – which exported (imported) goods worth £84bn (£222bn) over the same period. Large businesses in the Wholesale and retail industry also appear to have some of the most complex trading arrangements with the EU. Our analysis also suggests that trade in goods is strikingly concentrated: 38% of the value of UK goods exports was accounted for by the top 50 exporting businesses in 2016, while the top 50 importers accounted for 34% of the value of imports over the same period.

Secondly, we examine the link between business-level productivity and trade in goods behaviour. We draw on recent ONS analysis to examine the drivers of productivity at the micro-level (ONS 2016, 2017a, 2017b, 2017c, 2017d, 2018) – seeking to explain differences in labour productivity across businesses in relation to their trade in goods behaviour. We examine the link between productivity and trader status – whether a business trades or not – and the amount of trade which they undertake – how much a business trades – using data for a large sample of business' in the non-financial business economy in Great Britain.

Our analysis suggests that the productivity of UK businesses which declare international trade in goods was around 70% higher on average than for businesses which did not in 2016. After controlling for their size, industry and foreign ownership status, businesses which declare goods exports and imports have labour productivity premia relative to non-traders of around 21% and 20% respectively. These extensive margin effects also appear to vary by geography: the labour productivity premia associated with EU trade (4.3% and 1.7% for EU exports and imports respectively) are notably smaller than those associated with non-EU trade (19% and 18% for exports and imports respectively). These results may reflect relative reporting thresholds, but are consistent with lower barriers to EU goods trade enabling relatively less productive businesses to access these markets, while only a considerable productivity advantage enables access to wider markets with varying goods trade regulations.

The results of our analysis of the link between labour productivity and how much a business trades is more complex. Businesses which source a large proportion of their inputs abroad, which export more products, or which export to more countries tend to be more productive than other traders. However, these initial findings suggest that how much a business trades can have quite a complicated relationship with their productivity, and will be subject of future work.

The use of these data and the nature of this analysis places some limits on our work. In particular, our results are not causal: they cannot say whether these businesses are more productive because they trade or whether they trade because they are more productive. Secondly, they cannot take account of indirect traded content – where a wholesaler acts as an intermediary, exporting or importing content purchased in other industries. As a result, it is difficult to say exactly how “dependent” any specific industry is on traded goods, as the role of wholesalers is considerable. Thirdly, we avoid estimating rates of productivity growth for non-traders and traders, as this requires firm-level pricing information which is not yet available. Despite these limitations, the results provide a detailed picture of the types of businesses which engage directly in trade, they highlight the important role of intermediation, and they give a sense of which businesses are most likely to be affected by future changes in the UK's trading relationships.

The development of these data creates the potential for a wide range of analytical applications. ONS is actively pursuing several themes using these data. In particular, we are developing a production system that will support regular updates on detailed statistics on trade in goods by industry, product and destination. We are also exploring the product dimension of these data and combining this information with the data supplied by businesses on their VAT forms, so as to produce a more holistic range of information on trade intensity by industry. A natural extension of this work is to include information on trade in services in our analysis, to identify the association between productivity and trade as a whole. Finally, we are also interested in the dynamic effects of trade, and better understanding how aggregate productivity growth has evolved for non-traders and traders respectively over the past decade. For this, a set of firm-level deflators which reflects the varying trade intensity of each business is required, which will need more work. These areas will be the subject of further analysis and research.

## 7 . References

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