THE IMPACT OF UKTI TRADE SERVICES ON THE VALUE OF GOODS EXPORTED BY SUPPORTED FIRMS

Final Report

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Executive Summary

UK Trade and Investment (UKTI) provides a range of services to firms that are either currently exporting or looking to do so in the future. While the UKTI performance framework focuses on measuring the impact of these services on the performance of supported firms in terms of sales growth and productivity, and previous evaluations have studied impact on these outcomes, [1] the aim of this report is more specifically to assess the impact of UKTI services on the growth of firms' goods exports. To achieve this assessment, a set of research questions are outlined and addressed.

The questions examined in this study fall into two categories – descriptive and causal. The descriptive questions ((i) to (iv) below) examine correlations while questions ((v) to (vii) below) are designed to causally assess the impact of UKTI services.

   i.   To document the value and destination of goods exports by UKTI trade clients at the time of using UKTI trade services, and its subsequent trajectory, both at intensive and extensive margins;

  ii.   To document whether, how, and to what extent, the value and geographical pattern of goods exports by firms which have received UKTI support may differ significantly from non-users;

 iii.   To document comparison of the trajectory of goods exports growth over the period between the two groups, at the extensive and intensive margins;

  iv.   To document whether, how, and to what extent, the trajectory of change in the value and destination of goods exports by UKTI trade clients which have used multiple services over the period may differ significantly from those using the services only once;

   v.   To assess the impact of support on the goods export performance of supported firms, taking account of any selection effects; to determine the nature and extent of differences in impact across subgroups, including (a) by size of firm at time of support, and (b) by market or market group to which the support related;

  vi.   To provide quantified estimates of impact on goods export growth at both the extensive and intensive margins, for all supported firms, and separately for different sub-groups;

 vii.   To determine whether, and to what extent, use of multiple trade services may enhance the impact on export growth at the intensive and extensive margins; to provide quantified estimates of any such enhanced impact.

Finally, we extend our investigation to seek to measure the cost of custom formalities and paperwork in terms of foregone UK imports of goods, using our decomposition of trade into the extensive and intensive margins.

To answer the aforementioned questions we created a comprehensive dataset using four main sources of data covering the period 2008-2012: ORBIS, HMRC goods exports data, IP activity data, and UKTI data on support activities.

   1) ORBIS contains data on UK firms based on annual reports deposited at the Companies House and provides a large number of control variables, including size, industry, location, productivity as well as multinational and foreign owned status.

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[1] UKTI Annual Report (2014) Annexes A-C (Performance Framework; Technical Note; Note on Data Sources)

2) HMRC data includes data on firm-level exports by country, product and year. This allows distinguishing between the extensive margins (number of countries served and number of products sold per market) and the intensive margin (value of exports per product in a given country).

3) IP activity data comes from the Oxford Firm-Level Intellectual Property database ('OFLIP') for the period 2001-2007. We also use data on patents and trademarks for 2008-2010 provided by the International Patent Office (IPO). The 'OFLIP' and IPO datasets deliver information on firm IP activity by means of patents publications at the UK, EU, or World level as well as trademarks.

4) UKTI client records which are included here to identify users of UKTI services 2008-2010.

The unique dataset created from these four data sources allows us to answer the research questions listed above. Questions (i) through (iv) are addressed by focusing on correlations between relevant firm-level variables and hence provide a broad picture of the firms using UKTI services. In particular we find:

- A UKTI firm exports on average more than a non-UKTI firm. It exports more to more countries though not necessarily more products. Some of these differences in exports reflect differences in firm characteristics, such as size;
- Controlling for these differences in firm characteristics, UKTI firms export more, to more markets, and also export more products.
- Two years after receiving support UKTI firms exporting at the time of the support experience a stronger export growth than non-UKTI firms. This comes mainly from a stronger growth in the number of markets.
- Two years after receiving support UKTI firms NOT exporting at the time of the support export more, to more markets and more products than non-UKTI firms.
- UKTI firms are more likely than non-UKTI firms to export to each of the 8 markets we consider (EU, US, Other OECD, Brazil, China, India, Russia and rest of the World). This is true both in the year of support and two years later.
- Multiple-use (MU) UKTI firms export more, more products and (especially) to more markets than non-MU UKTI firms.
- MU UKTI firms do not seem to export more than non-MU UKTI firms after two years from support. This is true for both firms exporting and non-exporting at the time of UKTI support.
- MU UKTI firms are more likely to export to each of the 8 markets we consider than non-MU UKTI firms. This is true both in the year of support and two years later. EU as a market is a bit special, differences between MU UKTI and non-MU UKTI are weaker than for other markets.

Firms that use UKTI services are therefore not a random subset of all firms in the UK. As a consequence, estimating the causal effect of UKTI services on firms requires a rigorous econometric approach. This is why we use both a Heckman selection model (HSM) and a propensity score matching (PSM) technique. These two techniques rest on some strong

assumptions, especially concerning non-observables, but are the best available tools for a dataset like ours, which tracks firms over only a short time period. With these caveats in mind, we provide in the report a number of figures about the causal impact of UKTI services on firms' goods exports.

The HSM and PSM techniques allow us to draw some conclusions on the causal effects of UKTI services that were designed to help firms in their exporting activity. In particular we find:

- UKTI support helps firms to both start and continue exporting. The magnitude of this effect is similar across all firm size groups.
- UKTI support helps firms to both start with higher exports and to grow their current exports more. The number of destination markets and the intensive margin are particularly affected.
- UKTI support helps firms to both start and continue exporting in each of the 8 markets we consider. The magnitude of this effect is similar across markets.
- No conclusions can be drawn about effects on initial exports and exports growth when the analysis is done for sub-groups by firm size or by destination market.
- Market-specific UKTI support helps firms to both start and continue exporting in that market.
- In terms of effects on initial exports and on export growth, magnitudes of market-specific UKTI support are comparable to those obtained with other UKTI support; this suggests that UKTI support has an impact on firm exports spanning well beyond the specific market for which support has been obtained.
- The use of multiple UKTI services has larger impact on both the probability that firms will start exporting, and that they will continue exporting, than when a firm only uses one UKTI service. Results for impact of multiple use on initial exports and exports growth are very noisy and no conclusion can be drawn.

Overall, we do find strong evidence that the use of UKTI services positively affects firms' goods exports performance along different margins as well as across different markets and groups of firms. Another important feature of our analysis is that the impact of UKTI support spans on both prospective exporters and more established ones. On this point, we sometimes find stronger magnitudes for prospective exporters. One way of interpreting such result would see UKTI's best interest served by concentrating more efforts and resources on currently non-exporting firms rather than firms already exporting. However, we do not believe this would be a wise policy for the following reasons:

- First, as shown in Mion and Muûls (2013), the contribution to UK aggregate exports' growth over time is equal among current and prospective exporters meaning that the two firm types are equally important in generating growth in the total value of UK exports.

- Second, as shown in Mion and Muûls (2013), many new UK exporters do not keep exporting over a long period of time, and many established exporters also drop out of exporting each year. This means that a large cohort of new exporters is needed each year to generate a substantial long-term growth in exports.

- Last but not least, as shown in Mion and Muûls (2013), firms who start exporting trade much less than established exporters meaning that a larger percentage impact of UKTI services for new exports does not necessarily translate into a higher overall export value impact for them.

All in all these results suggest that the current policy of supporting all firms with a current or prospective interest in exporting irrespective of the exporting market and firm size or sector is the wisest policy.

We also attempt here to measure the cost of custom formalities and paperwork in terms of foregone UK imports of goods. This is meant to provide a contribution to HMRC functions and in particular to tax policy making and development which is one key HMRC function. In order to address this issue we build on the analysis and model developed in Mion and Muûls (2013). Compared to Mion and Muûls (2013) we extend the analysis to the product dimension.

All in all our findings indicate that the impact of custom formalities and paperwork on overall imports is mainly driven by Fuels and Semi-manufactures. The country margin is affected in all but one case (Food, beverages and tobacco) while the product margin is never affected. Last but not least the intensive margin response is particularly strong for Fuels. The differential impact of custom formalities and paperwork across products uncovered by these results calls for a product-specific policy to eventually reduce the current amount of UK imports paperwork.

1. Introduction

This report details the work carried out for the project 'The impact of UK Trade and Investment trade services on the value of goods exported by supported firms' on behalf of the UK Trade and Investment (UKTI).

The aim of this project is to gain further understanding of the impact of UKTI's trade services on supported firms with respect to the value of goods exported, the growth of their exports and their pattern across destination markets. This complements earlier UKTI reports that highlighted the impact of UKTI support on firm productivity as well as on overall overseas turnover and sales (see Breinlich et al. 2013). In this report, particular attention is paid to the issue of multiple services. Indeed, the intensity of support received by trade clients varies considerably, and can be as light as participation in a single short event.

To reach such a goal, we have created a unique dataset through meticulous matching work between four different sources of firm-level data. We then apply advanced econometric analysis to estimate to the causal impact of UKTI support on exports.

In Section 2 of this report we outline the research aims of the project. Section 3 presents the results. In section 3.1 we present a description of the different data sources we use and how they have been linked to create the dataset underlying the rest of our analysis. In section 3.2 we provide a number of descriptive results on the correlations and basic firm-level variables. In section 3.3 we present results of a regression analysis aimed at measuring the causal impact of using UKTI services on firm-level export performance. Section 4 contains some findings about the impact of paperwork on UK exports of goods that are meant to provide a contribution to HMRC functions. Finally, Section 5 draws conclusions from our research in order to provide recommendations on which firms should be targeted for UKTI support.

2. Aims of the Full Research Project

2.1 Background

UK Trade and Investment (UKTI) provides a range of services to firms that are either considering or currently exporting. As part of its annual programme of monitoring and evaluation research, UKTI has commissioned analytical research to gain further understanding of the impact of its trade services on supported firms with respect to the value of goods exported, as recorded by HMRC. More specifically, the impact of UKTI is here evaluated on the level of, and growth in, the value of exports of goods among supported firms. The analysis also seeks to determine the extent to which such growth has occurred at the intensive or extensive margin.

Findings from our previous project[2] suggest that just under half of the growth in the value of UK exports will be coming from *currently exporting firms expanding their country and product portfolios* as well as their exports to markets to which they are already selling. *New exporters* will, however, be as important as older exporters, accounting for 55% of underlined export value growth.

This project evaluates the effect of UKTI support on the value of goods exports for both new and established exporters who have used the services.

Previous research commissioned by UKTI has already investigated the links between IP activity, firm sales, overseas turnover, and UKTI support -- see Rogers and Helmers (2010) as well as Breinlich et al. (2012). We follow here the research design developed by these authors, but look at a finer outcome measure – the level of, and growth in, the value of exports of goods as recorded by HMRC micro data – allowing to distinguish between the extensive margins (number of countries served and products sold) and the intensive margin (value of exports of a product in a given country). Understanding whether the impact of UKTI support is at the extensive and/or intensive margins is needed to assess, for example, the relative importance of HMRC success in reducing those fixed information costs required to export as opposed to reducing the marginal costs of exporting. The balance between marginal and fixed costs reductions ultimately affects the number of exporting firms as well as the value of exports per firm and firm dynamics into the export activity.

Interestingly, for many of the trade services provided by UKTI, client records also identify the market to which the support related. Such information can in turn be matched to exports by destination to obtain a more precise correspondence between the support received from UKTI and the export performance of a firm. At the same time, however, our analysis is narrower in scope with respect to previous studies using overseas turnover information because the latter includes exports of goods, exports services as well as sales by foreign affiliates.

2.2 Research Questions

The questions examined in this study fall into two categories – descriptive and causal. The descriptive questions ((i) to (iv) below) are about correlations.

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[2] See Mion and Muûls (2013).

i.   To document the value and destination of goods exports by UKTI trade clients at the time of using UKTI trade services, and its subsequent trajectory, both at intensive and extensive margins;

ii.   To document whether, how, and to what extent, the value and geographical pattern of goods exports by firms which have received UKTI support may differ significantly from non-users;

iii.   To document comparison of the trajectory of goods exports growth over the period between the two groups, at the extensive and intensive margins;

iv.   To document whether, how, and to what extent, the trajectory of change in the value and destination of goods exports by UKTI trade clients which have used multiple services over the period may differ significantly from those using the services only once;

The second set of research questions is of a causal nature. Econometric tools from the program evaluation literature are used to address them, including a matching estimator and a Heckman selection model.

v.   To assess the impact of support on the goods export performance of supported firms, taking account of any selection effects; to determine the nature and extent of differences in impact across subgroups, including (a) by size of firm at time of support, and (b) by market or market group to which the support related;

vi.   To provide quantified estimates of impact on goods export growth at both the extensive and intensive margins, for all supported firms, and separately for different sub-groups;

vii.   To determine whether, and to what extent, use of multiple trade services may enhance the impact on export growth at the intensive and extensive margins; to provide quantified estimates of any such enhanced impact.

Finally, we extend our investigation to seek to measure the cost of custom formalities and paperwork in terms of foregone UK imports of goods, using our decomposition of trade into the extensive and intensive margins.

2.3 Terminology

In the literature on export growth, the terms '**intensive margin**' and '**extensive margin**' have been defined in different ways, often reflecting differences in the research aims or in the datasets used by different research teams. In our analysis and reporting we follow Mion and Muuls (2013), and use the following terminology:

Extensive margins:

- The number of exporting firms;
- The number of products exported;
- The number of countries (destination markets) to which a firm exports;

Intensive margin: The *average value* of exports per firm, per country, per product.[3]

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[3] This is the most detailed form of the 'intensive margin'. In the literature the term 'intensive margin' is also used to refer to the average value of exports across just one of these three elements, for example, to distinguish between the average value of exports per exporter to a given market as opposed to the number of exporters to that market.

'Decomposition of total exports': This refers to the arithmetical method by which we calculate each of the above margins, ensuring that when they are aggregated the sum is equal to the total value of exports. Details of how these margins are calculated are set out in section 3.2.2, in which we explain this decomposition.

Firm-years: This is calculated as the total number of observations of firms in the dataset, summed over all the years in the dataset. For example, a firm which is observed in only one of three years, will count as 1 firm-year, while a firm observed in each of 3 years will count as 3 firm-years. Thus our final dataset contains information on 309,762 firm-years, which represents just 117,371 firms; of these, 46,918 firm-years relate to data on 32,909 firms who were UKTI-supported.

In reporting, we are typically focusing on averages (means); in Tables 1-4, for instance, we use the following column headings, where column 2 and columns 5-9 refer to different extensive margins, and column 10 refers to the detailed 'intensive margin':

Column 2: Number of firm-years
Column 3: Total exports (is this average per year?), for each destination market
Column 4: Average exports per firm-year (mean, i.e. column 3 divided by column 2)
Column 5: Average products per country (mean number of products, per country per firm-year)
Column 6: Average countries per firm-year (mean number of countries per firm-year)
Column 7: Median value of exports per firm-year
Column 8: Median number of countries per firm-year
Column 9: Median number of products per country per firm-year
Column 10: Intensive margin (value exports per country-product-firm-year)

3. Results

3.1 Data Matching and Basic Data Description

The first step of our analysis creates a comprehensive dataset with information on firm-level characteristics, IP activity, exports and the use of the relevant UKTI services.

For this purpose, we combine data from four sources, as illustrated in Figure 1. First, we obtain data from the 'ORBIS' database provided by the Bureau van Dijk.[4] We collect data on over 5 million firms (active and inactive) covering the period from 2008 to 2010. The variables kept for the analysis include: Company House Register Number (CHRN), post-code, as well as the current and previous names of firms with the dates of change; and a number of control variables including firm age, NACE revision 1.1 industry, region of the UK, total assets, operating revenue, number of employees as well as indicators of whether the firm is a multinational and whether it is foreign owned. Out of 5,427,635 firms we only keep the 105,000 firms for which there is data on employment and revenue for at least one of the three years.[5] We also drop 6,000 firms for which there is no identifier attributable to a CHRN.

The Business Structure Database (BSD) would have provided a more accurate level of employment and probably a better match, however it is not made available to researchers using the HM Revenues and Customs (HMRC) datalab. Furthermore, most of the control variables we use and that have been shown to be crucial in understanding firm exporting behaviour[6] would not be reported in the BSD. This is why ORBIS was used. See Appendix H for a summary description of the ORBIS database.

Our second source of data includes firm-level trade statistics data from HM Revenues and Customs. Data contains information coming from UK firms' import and export declarations. These include monthly information on the value of trade (used for trade statistical purposes: Free on Board for Exports and Cost Insurance Freight for Imports) products (at the 8-digit Combined Nomenclature level and 5-digit SITC code), countries of destination or origin and mode of transport. For trade flows from and to countries outside the European Union, the data covers the period between 1996 and 2012, though for countries within the EU, data is available only for 2008 to 2012. This is the reason for focusing our results on the period 2008-2012 for which both EU and non-EU trade data is available at HMRC. If a firm does not appear in the HMRC data it means it does not export or import, or only does so at levels below the reporting thresholds. The HMRC Datalab is a Research Data Centre (RDC) that allows permits researchers to access anonymised HMRC data in a secure environment. The HMRC Datalab provides a look-up table of anonymised CHRNs to trade data identifiers. The ORBIS data is also anonymised to allow

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[4] The UK subsample of ORBIS is based on annual firm reports deposited at Companies House. Note that the 'Financial Analysis Made Easy' (FAME) database, used by many previous studies on the export behaviour of UK firms, is the UK subsample of ORBIS and our sample is thus identical to that used by such previous studies.

[5] These firms are likely to be larger as they will have been active and reporting their data for three years. This could introduce a bias in our analysis, however the information about the firms' employment is crucial as a control in the analysis.

[6] See Bernard et al. (2012).

matching it to the trade data. Given there are many-to-many matches[7], we aggregate the datasets to the most common denominator.

We drop all trade flows with countries that have that less than 30 firms exporting there over the five years of trade data. This corresponds to only 216 export flows (country-product-year) and 0.17% of export value.

For purposes of matching to the trade data, we used only our final sample of 309,762 firm-years, as shown in Figure 1. As explained above, this excludes firms for which there were no financial data. There are also some exporting firms for which there is no match to ORBIS, either because there is no identifier match in the look-up table or because there is no matching record in ORBIS. Due to this, exporters matched to ORBIS in our dataset represent 66% of total goods export value although only 31% of all exporting firms. This is consistent with smaller firms being less likely to be represented in our dataset, because they are much less likely to have reported financial variables to CH, as noted above.

Our third source of data is on intellectual property (IP) from the Oxford Firm-Level Intellectual Property database ('OFLIP') for the period 2001-2007. We complement this data with information on patents and trademarks for 2008-2010 provided by the International Patent Office (IPO). The 'OFLIP' and IPO datasets jointly deliver information on firm IP activity by means of patents publications at the UK, EU, or World level, as well as trademarks for the period 2001-2010. The data is provided with a matching code that allows attaching firm financial information coming from 'ORBIS'. The CHRN identifier was used to match the firm IP data to the ORBIS data and only 5 observations went without a match. An important feature of the IP data is that it is not a sample, but instead provides accurate and comprehensive coverage of the population of UK businesses which own these forms of IP. In what follows we consider as IP active a firm who has at least one patent and/or trademark in between 2006-2010[8].

Figure 1: Data construction and matching

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[7] Firms do not report their trade data at a consolidated national level, but rather at the VAT unit level. Large firms can also be composed of several subsidiaries that will therefore each have a different CHRN. Some of the VAT and CHRN overlap yielding a many-to-many match in the lookup table.

[8] Given the long time needed to innovate and then patent, the data on several years is needed to define whether a firm is innovating or not.

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┌─────────────────────────────┐        ┌─────────────────────────┐
│            Orbis            │        │     UKTI supported      │
│ UK firms (active or inactive│        │      (2008-2010)        │
│  between 2008 and 2010)     │        │     63,209 firms        │
│      5,427,635 firms        │        │                         │
└─────────────────────────────┘        └─────────────────────────┘
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┌──────────┐
│   No     │
│  CHRN    │
│ available │
│ (6,000   │
│ firms)   │
└──────────┘
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┌─────────────────────────┐
│   Orbis                 │
│ match                   │
│ but not                 │
│ in HMRC                 │
│ (1,808                  │
│ firms)                  │
└─────────────────────────┘
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┌─────────────────────────────┐        ┌─────────────────────────┐
│           Orbis             │        │ UKTI supported and Orbis│
│ (with employment and        │ ◄────► │         match           │
│ revenue for at least one year│        │     34,425  firms       │
│  between 2008 and 2010)     │        │                         │
│      105,000 firms          │        │                         │
└─────────────────────────────┘        └─────────────────────────┘
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┌──────────────────────────────────────────────────┐        ┌─────────────┐
│                 FINAL SAMPLE                     │        │  IP data    │
│              309,762 firm-years                  │        │ informa     │
└──────────────────────────────────────────────────┘        │ tion        │
                                                             │ from IPO    │
                                                             │ and         │
                                                             │ OFLIP       │
                        ┌──────────┐                         └─────────────┘
                        │ Exports  │
                        └──────────┘
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┌─────────────────┐   ┌─────────────────┐   ┌─────────────────┐   ┌─────────────┐
│ Exports towards │   │ Not in look-up  │   │   HMRC data     │   │  Imports    │
│ countries with less│ │ table or no Orbis│  │ Import and export│  └─────────────┘
│  than 30 firms  │   │    record       │   │  trade flows    │
│ exporting there │   │                 │   │                 │
└─────────────────┘   └─────────────────┘   └─────────────────┘
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In our fourth and final source of data we have obtained from UKTI data on business use of all of UKTI services such as OMIS (Overseas Market Introduction Service), 'Market Visit Support', 'Passport', advice provided by the International Trade Advisers in the English regions, etc. These are derived from client records for the 2008-2010 period. They have been made available to us by OMB Research, a market research firm which carries out regular telephone-based surveys of UKTI users. While matching the data from ORBIS to IP and trade data was straight forward, using UKTI services data and then matching it to the combined ORBIS+IP+Trade dataset led to a few complications. UKTI does not have a consistent approach to registering a firm's name and details. Thus simply putting together quarters, years, and services information for the same firm can be an issue as one single firm may end up being counted as many. To handle this problem we created a STATA[9] procedure to deal with the matching that standardized firm names, postcodes, and telephones. Firms were first matched by the standardised names and then by postcode-telephone pairs. The information on all three aspects was used to increase the validity of the match.[10] Using this algorithm also applied in Breinlich et al. (2012), we have first identified 63,209 UKTI supported firms over the period 2008-2010. We then find a match with ORBIS for 34,425 firms, i.e., for about 55% of UKTI supported firms. These firms correspond to 48,726 firm-year combinations and in a few cases (1,808) we cannot match them to the ORBIS version

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[9] STATA is a general-purpose statistical software package.
[10] The STATA code is available upon request from the authors of this report.

available at HMRC. In sum, we end up studying 46,918 firm-year combinations corresponding to some UKTI support received by a firm in a specific year in between 2008-2010.[11]

Our final dataset contains info on 309,762 firm-years (117,371 firms) of which 32,909 firms and 46,918 firm-years are UKTI-supported.[12] The sample displays positive export values for 58,259 firm-years. Balance sheet variables are fully available for 168,411 firm-years (87,604 firms) of which 37,755 firm-years display positive exporting. There are 18,941 firm-year couples (12,222 firms) in our data corresponding to UKTI exporting firms. We have balance sheet information for 6,498 of these firm-years. There are 27,977 firm-year couples (21,746 firms) in our data corresponding to firms that received UKTI support in a year they were not exporting. We have some balance sheet information for 2,537 of these firm-years.

Due to constraints in the data matching, and especially to limitations of the data available, noted above, such that financial data are more likely to be missing for smaller firms, we conclude that the resulting sample is composed of relatively large UKTI firms relative to the typical UKTI firm. However, this truncation of the business population also means that the size differences between UKTI firms and non-UKTI firms will be under-stated in our dataset, making the two groups appear more similar. For example, the mean (median) operating revenue for UKTI firms with balance sheet data is £70,871,650 (£ 16,663,000), and their mean (median) number of employees is 556 (109).

To summarize, in our sample, 32.5% of firms who exported goods in 2008-2010 were supported by UKTI (in terms of firm-years). UKTI firms we were able to identify accounted for about 26% of UK exports of goods in 2008-2010. Our control group accounted for about 34% of UK exports of goods in 2008-2010.

It should be noted that as we do not have data on UKTI support prior to 2008, we are not able to distinguish between exporters who are true non-users of UKTI, and those who are in fact **former** users of UKTI. Figures from a recent UKTI survey relate to exporters of both goods and services, suggest around 30% of current may have used the services at some point in recent years.[13]

3.2 Descriptive Analysis: Research Aims (i) to (iv)

Research aims (i) to (iv) are primarily of a descriptive nature. Accordingly, for most of our analysis, we focus on reporting descriptive statistics of relevant variables and some Ordinary Least Squares (OLS) regressions that provide a more sophisticated correlation between key variables.

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[11] It is assumed all unmatched ORBIS/HMRC firms are non-users of UKTI services.

[12] Together with the code needed for the matching of the datasets, the STATA code that performs the data analysis is available upon request from the authors. Access to the HMRC data is made possible to all researchers within the HMRC datalab (https://www.gov.uk/government/organisations/hm-revenue-customs/about/research). The ORBIS data is available within the HRMC datalab to researchers from institutions that subscribe to Bureau Van Dijk's datasets.

[13] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/358353/Internationalisation_Strategies__Barriers___Awareness_Survey_2014_-_Full....pdf The survey was carried out in 2014 and does not specify the time period of UKTI support.

3.2.1 Research aim (i)

"What is the value and destination of goods exports by UKTI trade clients at the time of using UKTI trade services, and its subsequent trajectory, both at intensive and extensive margins?"

A UKTI firm exports on average more than a non-UKTI firm. A UKTI firm also exports more to more countries. However, it does not export more products per country.

This first research aim is purely descriptive: To document the value and destination of goods exports, we divide the sample between UKTI and non-UKTI clients. In Tables 1 and 2, we report exported values for each of these two groups, both in total and broken down into the number of served destinations and products sold (extensive margins) and average exports per product-destination (intensive margin), using the terminology set out in section 2.3 above. We report both average (mean) and median for each of three extensive margins. A geographical breakdown of destination markets divides world countries into the following groups: the EU27, the US, other OECD countries, Brazil, China, India, Russia, and the rest of the World (RoW).

Table 1 shows exports for UKTI firms in the year they received support (year 't'), while Table 2 shows exports for non-UKTI firms in the same year.

Thus comparing the bottom row in column 3 in Table 1 with column 3 in Table 2, we see that a UKTI firm exports on average more than a non-UKTI firm (Total average exports per firm year of £10,213,107 per year, compared with £6,390,494 for non-UKTI.) Looking at columns 6 and 8, we see that UKTI firms also export to more countries, whether measured as the mean (14.8 countries vs 11.5) or the median (7 countries vs 5). However, looking at columns 5 and 9, we see that UKTI firms do not export more products.

The final column in these tables shows that the average value of exports per country per product per firm-year - the intensive margin – is also substantially higher for UKTI firms (roughly £234,000 as compared to £142,000).

Comparisons for each country group separately shows a similar picture. Note that in columns 6 and 8, figures shown for each country sub-group refer to the average and median number of countries within the subgroup, for firms who export to at least one country in the subgroup, so for sub-groups containing a single country both tables show 1 by definition.

Table 1. Exports by destination - UKTI firms (t ϵ [2008-2010])

	Number of firm-years	Total exports 2008-2010	Average exports per firm-year	Average prod. per country per firm-year	Average countr. per firm-year	Median exports per firm-year	Median countr. per firm-year	Median prod. per country per firm-year	Intensive margin (exports per country-product-firm-year)
EU	8,484	79,084,433,012	9,321,597	6	11.5	867,338	11	2	134,757
USA	11,576	40,231,568,795	3,475,429	6.5	1	45,472	1	3	531,981
OECD	13,883	24,215,157,595	1,744,231	2.6	3.6	53,903	3	1.9	188,025

	Number of firm-years	Total exports 2008-2010	Average exports per firm-year	Average prod. per country per firm-year	Average countr. per firm-year	Median exports per firm-year	Median countr. per firm-year	Median prod. per country per firm-year	Intensive margin (exports per country-product-firm-year)
Brazil	2,499	2,145,631,021	858,596	3	1	28,664	1	2	285,399
China	4,965	6,281,151,977	1,265,086	3.9	1	32,256	1	2	325,061
India	5,050	4,241,189,991	839,840	3.9	1	24,336	1	2	216,520
Russia	3,062	2,472,000,300	807,316	4	1	34,636	1	2	202,922
RoW	14,382	34,775,331,497	2,417,976	2.1	7.4	66,735	3	1.5	153,284
Total	18,941	193,446,464,188	10,213,107	2.9	14.8	285,516	7	1.8	233,768

Table 2. Exports by destination – non-UKTI exporting firms (t ϵ [2008-2010])

	Number of firm-years	Total exports 2008-2010	Average exports per firm-year	Average prod. per country per firm-year	Average countr. per firm-year	Median exports per firm-year	Median countr. per firm-year	Median prod. per country per firm-year	Intensive margin (exports per country-product-firm-year)
EU	20,822	131,524,007,111	6,316,589	7.8	8.8	1,126,471	7	2.1	92,090
USA	19,693	38,297,487,979	1,944,726	5.6	1	36,979	1	3	349,258
OECD	24,268	28,155,836,135	1,160,204	2.5	3.1	54,389	2	1.8	147,677
Brazil	3,727	2,074,636,446	556,651	3.0	1	28,469	1	2	186,652
China	7,994	6,151,275,453	769,487	3.4	1	31,057	1	2	228,970
India	7,610	4,542,641,415	596,931	3.4	1	25,000	1	2	177,648
Russia	4,637	3,266,230,837	704,384	3.8	1	44,201	1	2	183,054
RoW	25,345	37,249,331,901	1,469,692	2.2	5.9	56,473	3	1.5	115,079
Total	39,318	251,261,447,277	6,390,494	3.9	11.5	405,547	5	1.8	142,235

In Tables 3 and 4, the subsequent paths are compared by looking at exports two years after support, i.e., at exports of firms in t+2 ϵ [2010-2012] depending on whether the firm have received support (Table 3) or not (Table 4) in t ϵ [2008-2010].

Table 3. Exports by destination at t+2 - UKTI firms (t ϵ [2008-2010])

	Number of firm-years	Total exports 2008-2010	Average exports per firm-year	Average prod. per country per firm-year	Average countr. per firm-year	Median exports per firm-year	Median countr. per firm-year	Median prod. per country per firm-year	Intensive margin (exports per country-product-firm-year)
EU	8,410	90,010,999,248	10,702,854	6.1	12.1	1,008,755	12	2	144,654
USA	10,550	39,199,317,646	3,715,575	6.9	1	64,482	1	3	535,664
OECD	12,798	32,840,903,226	2,566,097	2.7	3.8	76,543	3	2	252,224
Brazil	2,672	2,544,070,248	952,122	3.4	1	34,326	1	2	280,740
China	4,997	9,991,803,926	1,999,561	4.1	1	40,750	1	2	492,425
India	4,954	5,740,213,802	1,158,703	4.0	1	28,911	1	2	288,207
Russia	3,071	3,301,512,445	1,075,061	4.2	1	47,051	1	2	253,650
RoW	13,135	44,019,104,731	3,351,283	2.2	7.8	93,427	4	1.5	195,444
Total	16,845	227,647,925,272	13,514,273	3.1	16.6	479,472	9	1.9	259,131

Table 4. Exports by destination at t+2 – non-UKTI firms (t ϵ [2008-2010])

	Number of firm-years	Total exports 2008-2010	Average exports per firm-year	Average prod. per country per firm-year	Average countr. per firm-year	Median exports per firm-year	Median countr. per firm-year	Median prod. per country per firm-year	Intensive margin (exports per country-product-firm-year)
EU	21,093	153,860,166,275	7,294,371	8.2	9.1	1,273,264	8	2.3	97,591
USA	19,169	43,870,482,074	2,288,616	5.6	1	46,087	1	2	410,907
OECD	24,207	37,181,918,600	1,535,999	2.5	3.1	65,160	2	1.8	193,207
Brazil	3,900	2,847,144,646	730,037	3.1	1	34,418	1	2	234,894
China	8,209	7,907,941,267	963,326	3.5	1	37,569	1	2	275,567
India	7,744	5,576,342,777	720,086	3.4	1	27,323	1	2	213,318
Russia	4,678	3,981,022,271	851,009	4.0	1	51,962	1	2	212,764
RoW	25,112	47,952,730,312	1,909,554	2.2	5.9	67,222	3	1.5	145,539
Total	38,660	303,177,748,222	7,842,156	4.2	11.9	503,264	5	1.9	156,350

Although, at this stage, no causality can be derived from these Tables, it appears that firms who received UKTI support export more two years later (on average) than firms that were not supported by UKTI at t (roughly 13.5 million as compared to 8 million). They also export more per country-product (final column: 259,131 vs 156,350) and to more countries (column 6: 16.6 vs 11.9). The median number of countries is also higher for UKTI firms (column 8: 9 vs 5). However the median value of exports per firm-year is slightly higher for non-supported firms, which suggests that the distribution of firm-level exports for UKTI clients is more skewed towards large exporters than that of non-UKTI firms.

It should be stressed that some of these differences between UKTI and non-UKTI firms are likely to reflect differences in firm characteristics, such as size, between the two groups. These differences are taken into account in the next section.

3.2.2 Research aim (ii)

"Is the value and geographical pattern of goods exports by firms which have received UKTI support significantly different from non-users, and to what extent?"

> **Conditional on controls, UKTI firms export more, to more markets, and more products. UKTI firms are more likely to export than non-UKTI firms to each of the 8 markets we consider. This holds both in the year of support as well as two years later.**

To answer this question, we use multivariate statistical tools to take account of differences between UKTI firms and non-UKTI firms in the characteristics which are likely to influence exports. For this part of the research we estimate a set of linear models to investigate what factors have significant influence on the value of total exports, and on each of the export margins.

We define our outcome variables by decomposing total exports **X** as in Mion and Muûls (2013) into the various extensive and intensive margins, in the following way:

$$\mathbf{X} = f * \bar{c} * \bar{p} * \bar{x}, \tag{1}$$

where f is the number of UK exporting firms, $\bar{c}$ is the average number of countries these firms export to, $\bar{p}$ is the average number of products firms export in a country, and $\bar{x} = \mathbf{X}/(f * \bar{c} * \bar{p})$ corresponds to average firm exports of a product in a country. Mion and Muûls (2013) refer to f, $\bar{c}$ and $\bar{p}$ as the extensive margins (firm, country and product margins, respectively) and to $\bar{x}$ as the intensive margin.

The advantage of such decomposition is that the number of served destinations multiplied by products sold per market multiplied by the intensive margin is equal to the firm's total exports. At the same time the log of the number of served destinations plus the log of the number of products sold per market plus the log of the intensive margin is equal to the log of the firm's total exports.

Given this decomposition, we answer this research aim, by employing simple regression techniques. These techniques do not investigate causality, but instead provide evidence on the extent to which the differences in export patterns observed above may be attributable to differences in firm characteristics between UKTI users and non-users.

We first consider several outcome variables including: the log of the level of export values and export margins during the year(s) in which the firm received UKTI support; log number of countries these firms export to; ; and log number of products sold per destination country (extensive margins); and log of the average exports per firm-year per product-destination country (intensive margin).

For each outcome variable we estimate via OLS a linear model where the outcome depends on a dummy indicating whether a firm has received UKTI support or not. We use the panel features of the data (varying both across firms and over time) and include year dummies to illustrate time trends. As an optional specification, we include a number of firm controls including industry affiliation, location, size (log employment), productivity (log apparent labour productivity), log firm age, as well as IP activity, Multinational and Foreign Owned status. Whilst other variables,

such as characteristics of the firm's management, are likely to effect exports, these are either not observable or not available in the data. In what follows we use robust standard errors in parentheses: * significant at 10% level; ** significant at 5% level; *** significant at 1% level.

Table 5. Exports and margins differences between UKTI and non-UKTI exporting firms (t ϵ [2008-2010])

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Total exports		Number of countries		Number of products per country		Intensive margin ln(exports per country per product)	
	ln(exports)		ln(# countries)		ln(# products)			
UKTI	-0.110	0.844	0.289	0.578	-0.059	0.114	-0.339	0.152
	(0.026)***	(0.035)***	(0.012)***	(0.017)***	(0.007)***	(0.010)***	(0.015)***	(0.022)***
Employment		0.472		0.150		0.101		0.222
		(0.010)***		(0.004)***		(0.003)***		(0.007)***
Productivity		0.768		0.158		0.075		0.536
		(0.016)***		(0.006)***		(0.004)***		(0.011)***
Firm age		0.070		0.121		0.017		-0.068
		(0.020)***		(0.009)***		(0.006)**		(0.013)***
Multinational[14]		0.376		0.308		0.070		-0.002
		(0.049)***		(0.022)***		(0.015)***		(0.030)
Foreign		0.635		0.270		0.123		0.242
		(0.028)***		(0.013)***		(0.009)***		(0.018)***
IP active		0.318		0.281		0.092		-0.055
		(0.031)***		(0.014)***		(0.009)***		(0.020)**
Observations	58259	37755	58259	37755	58259	37755	58259	37755
R-squared	0.00	0.30	0.01	0.25	0.00	0.12	0.01	0.23
Region control	NO	YES	NO	YES	NO	YES	NO	YES
Year control	YES	YES	YES	YES	YES	YES	YES	YES
Sector control	NO	YES	NO	YES	NO	YES	NO	YES

Table 5 shows that UKTI supported firms export 8.44% more, and 11.4% more products to more countries. These correlations appear in the first row, in columns (2), (4), (6) and (8) which report results for the models in which we control for other firm characteristics. These controls are needed as the trade literature has extensively documented that larger and more productive firms also export more and have higher export margins (Bernard et al, 2012). Whilst other controls, such as CEO management style or nationality, could be important, they are not available in the

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[14] 'Multinational' refers to a UK firm which has at least one overseas site.

datasets at hand. [15] As a robustness check, we run the regressions without the controls (odd number columns of Table 5) on the subsample of firms for which the controls were available. Indeed, Table 5 shows that without controls, the coefficient on the UKTI dummy is sometimes different from the one obtained when the controls are included in the regression; in addition, the R-squared values for the models without controls are mostly zero, showing that these models are not able to explain the observed variation in the data. One implication of this finding is that we should be very careful in comparing UKTI and non-UKTI firms and make full use of controls.

In Table 6, we report results from models in which we do not use controls, but instead we restrict the analysis to the sub-sample of firms for which controls are available (37,555 firm-years). Within this sub-group, the results for total exports (model 1) suggest that this already helps a lot as this is likely to restrict the control group to larger firms, more similar to UKTI users. However, results for models (2) – (4) in Table 6 still show negligible explanatory value. The values observed in row 1 for UKTI are also likely to be less reliable because of the omitted controls.

Table 6. Exports and margins differences between UKTI and non-UKTI (t $\in$ [2008-2010])

	(1) Total exports ln(exports)	(2) Number of countries ln(# countries)	(3) Number of products per country ln(# products)	(4) Intensive margin ln(exports per country per product)
UKTI	1.265	0.819	0.151	0.296
	(0.040)***	(0.018)***	(0.011)***	(0.024)***
Observations	37755	37755	37755	37755
R-squared	0.30	0.05	0.01	0.00
Region control	NO	NO	NO	NO
Year control	YES	YES	YES	YES
Sector control	NO	NO	NO	NO

In tables 7-8 we report results for the next step in our analysis, which is to consider more specifically country patterns. We estimate a set of four models, with the firm's export status in a given country group as the outcome variable to be explained by the same set of covariates as in Table 5 and estimated via a linear probability model.

More specifically we consider two models – with and without firm controls (using the same controls as for the analysis reported in Table 5) - for each of two cases:

(i) the outcome variable is the firm's export status in a given country group in year t $\in$ [2008-2010]: We use a dummy to distinguish firms who received UKTI support in t and

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[15] See Mion and Opromolla (2014) for an analysis of managers export experience and firm trade performance.

those who did not. Results for this UKTI use dummy are shown in the left panel of Table 7, while the left panel of Table 8 shows the results for the constant term in the same model;

(ii) the outcome variable is the firm's export status in a given country group in year t+2 ∈ [2010-2012]: We use a dummy to distinguish firms who had received UKTI support **two years before** and those who did not. Results for this dummy are reported in the right panel of Table 7, while the right panel of Table 8 shows the results for the constant term in the same model).

As in the case of Table 5, we provide figures both with and without using firm controls, in both Tables 7 and 8. We consider eight country groups as for research question (i): EU27, the US, other OECD countries, Brazil, China, India, Russia, and the rest of the World (RoW).

We thereby provide in Table 7 estimates of the additional probability of UKTI firms to be exporting in a specific country group, while in Table 8 we are reporting the average probability of all firms to be exporting to each country group, using the estimated constant term in the same set of models as for Table 7.

As can be noticed from Table 7, UKTI firms are more likely to export to each of the 8 markets we consider once we include firm-level controls. This is true both at the time of support and two years after support. Thus in Table 7, row 1, we see in columns (2) and (4) that UKTI firms are 6% more likely to export to EU in the year of support, and 6.4% more likely to be doing so 2 years later. Looking down the rows of the table, we see that the additional probability that a firm is exporting to the specific country group is substantially higher for most of the other country groups, both in the year of support (column 2) and two years later (column 4).

Table 7. Exports status in a given country group (t ∈ [2008-2010])

	(1)	(2)	(3)	(4)
	Additional Probability to Export to this Market		Additional Probability to Export to this Market	
	in the year of support		two years after support	
EU	-0.082	0.060	-0.045	0.064
	(0.004)***	(0.006)***	(0.005)***	(0.006)***
Brazil	0.037	0.068	0.059	0.079
	(0.003)***	(0.005)***	(0.003)***	(0.005)***
China	0.059	0.133	0.086	0.143
	(0.004)***	(0.006)***	(0.004)***	(0.006)***
India	0.073	0.132	0.095	0.136
	(0.004)***	(0.006)***	(0.004)***	(0.006)***
Russia	0.044	0.080	0.063	0.083
	(0.003)***	(0.006)***	(0.003)***	(0.006)***
USA	0.110	0.161	0.132	0.166
	(0.004)***	(0.006)***	(0.005)***	(0.006)***
OECD	0.116	0.129	0.135	0.140
	(0.004)***	(0.005)***	(0.004)***	(0.005)***

	(1)	(2)	(3)	(4)
ROW	0.115	0.136	0.131	0.143
	(0.004)***	(0.005)***	(0.004)***	(0.005)***
Observations	466072	302040	444040	299024
R-squared	0.51	0.56	0.52	0.56
Country group and year dummies	YES	YES	YES	YES
Firm controls	NO	YES	NO	YES

Interestingly, there is a higher probability that UKTI supported clients export to India, China and the US as compared to non-UKTI firms and conditional on firm characteristics.

To set these finding in context, in Table 8, we show as a benchmark the probability to export to a given region, regardless of whether the exporter is UKTI supported. Each column includes the samples of corresponding columns of Table 7 Thus we see from row 1 that the average probability that a firm is exporting to the EU in the year of support is 56.5% (column 2), and that 2 years later it is 57.9% (column 4); row 6 shows that the equivalent figures for the USA are similar to those for the EU, at 55.1% and 54.6%, while rows 2-5 show that the average probabilities that a firm is exporting to Brazil, China, India, and Russia are substantially lower, for both years.

Unsurprisingly, exporting firms are most likely to serve the EU, the US and the rest of the OECD.

Table 8. Benchmark probability of exporting to a given country group for samples from each column of Table 7 (t ϵ [2008-2010])

	(1)	(2)	(3)	(4)
EU	0.502	0.565	0.533	0.579
	(0.002)***	(0.003)***	(0.002)***	(0.003)***
Brazil	0.106	0.124	0.119	0.131
	(0.002)***	(0.002)***	(0.002)***	(0.002)***
China	0.222	0.247	0.239	0.256
	(0.002)***	(0.003)***	(0.002)***	(0.003)***
India	0.217	0.238	0.230	0.242
	(0.002)***	(0.002)***	(0.002)***	(0.003)***
Russia	0.132	0.149	0.141	0.152
	(0.002)***	(0.002)***	(0.002)***	(0.002)***
USA	0.536	0.551	0.536	0.546
	(0.002)***	(0.003)***	(0.002)***	(0.003)***
OECD	0.654	0.661	0.668	0.668
	(0.002)***	(0.003)***	(0.002)***	(0.003)***
ROW	0.681	0.684	0.690	0.686
	(0.002)***	(0.003)***	(0.002)***	(0.003)***
Observations	466072	302040	444040	299024
Country group and year dummies	YES	YES	YES	YES

Firm controls	NO	YES	NO	YES

3.2.3   Research aim (iii)

"How does the trajectory of goods exports growth over the period compare between the two groups, at the extensive and intensive margins?"

After two years UKTI firms exporting at the time of the support experience a stronger export growth than non-UKTI exporting firms. This comes mainly from a stronger growth in the number of markets. After two years UKTI firms *not* exporting at the time of the support export more, to more markets and more products than non-UKTI firms.

In order to answer this question, we report in Table 9 similar regressions to those reported in Table 5, except that now the dependent variables are the differences within two years in:

- log total exports (columns (1) and (2));

- log number of countries (columns (3) and (4));

- log number of products per country (columns (5) and (6));

- log intensive margin (columns (7) and (8)).

The sample is given by firms exporting in both t and t+2 with t $\in$ [2008, 2010], which means that for this analysis of export value growth we have excluded all those firms who began to export, or who dropped out of exporting during this period. Given that our outcome variable for these equations is the log of a variable in t+2 minus the log of a variable in t, our estimations are informative of growth rates.

Table 9 shows that firms that received UKTI support are more likely to have higher total exports' growth as compared to non-UKTI firms (4.6% higher) and more growth in terms of countries served (2.9% higher). There is no positive association in terms of the intensive margin growth or the change in the number of products once firm characteristics are controlled for.

It is interesting to note that these models show very low R2, indicating that most of the variation in the data remains unexplained. In particular, we see that productivity appears to play no role in growth of exports, either in total or on any of the margins, and the same is true for firm size (in terms of employees) except for a very small effect on the average number of products per country. While firm age and foreign ownership do appear to have some significant effect, these are very small, and in both cases are negative. These findings are consistent with the literature on export growth, as researchers as yet have had relatively little success in modelling the determinants of export growth at firm level.

Table 9. Differences in changes in exports and margins between UKTI and non-UKTI (t ϵ [2008-2010])

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Change Total exports		Change Number of countries		Change Number of products per country		Change Intensive margin	
	ln(exports)		ln(# countries)		ln(# products)		ln(exports per country per product)	
UKTI	0.122	0.046	0.060	0.029	0.005	0.005	0.057	0.011
	(0.014)***	(0.019)*	(0.006)***	(0.008)***	(0.004)	(0.006)	(0.010)***	(0.015)
Employment		0.008		0.004		0.009		-0.005
		(0.006)		(0.003)		(0.002)***		(0.005)
Productivity		-0.002		0.002		0.006		-0.011
		(0.010)		(0.004)		(0.003)*		(0.007)
Firm age		-0.065		-0.041		-0.022		-0.002
		(0.012)***		(0.005)***		(0.004)***		(0.009)
Multinational		-0.025		-0.032		0.004		0.003
		(0.026)		(0.011)**		(0.008)		(0.020)
Foreign		-0.110		-0.047		-0.005		-0.058
		(0.017)***		(0.007)***		(0.006)		(0.013)***
IP active		0.043		0.022		0.009		0.012
		(0.018)*		(0.008)**		(0.006)		(0.014)
Observations	47386	32212	47386	32212	47386	32212	47386	32212
R-squared	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00
Region control	NO	YES	NO	YES	NO	YES	NO	YES
Year control	YES	YES	YES	YES	YES	YES	YES	YES
Sector control	NO	YES	NO	YES	NO	YES	NO	YES

In Table 10 we report a similar analysis, except that now our sample includes **only** firms that do **not** export in the year in which they receive UKTI support. They are compared to firms that do not export in that year either, but do not receive support. The sample is therefore given by firms **not** exporting in t but who **are** exporting in t+2 where t ∈ [2008, 2010]. Thus we are not analysing the probability of beginning to export over this period, but instead the value of exports and the various margins conditional on the firm beginning to export during the period. In this case we consider the log of the value of total exports and the different export margins in t+2 as our dependent variables.

Comparable results are obtained here with UKTI support most strongly correlated with total exports and countries exported to, but not so much with the number of products. Interestingly, we do find here a sizeable impact on the intensive margin, though only significant at the 10% level. These are important findings which we analyse more carefully in the second part of this report by implementing a causal identification analysis.

By comparison with the models reported in Table 9, the models reported in Table 10 show slightly higher R2, although still suggesting that much of the variation in the data remains unexplained. However, in Table 10 we see that both productivity and firm size (in terms of employees) appear

to play a positive and significant role in explaining the amount firms begin exporting, as does being IP active, and, to a lesser extent, being foreign owned. By contrast firm age shows a significant negative contribution.

Table 10. Differences in exports and margins between UKTI and non-UKTI two years after the support (t ϵ [2008-2010])

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Starting Total exports		Starting Number of countries		Starting Number of products per country		Starting Intensive margin	
	ln(exports)		ln(# countries)		ln(# products)		ln(exports per country per product)	
UKTI	-0.086	0.507	0.101	0.225	-0.039	0.061	-0.148	0.221
	(0.066)	(0.126)***	(0.025)***	(0.049)***	(0.015)*	(0.028)*	(0.046)**	(0.089)*
Employment		0.163		0.048		0.030		0.085
		(0.023)***		(0.008)***		(0.006)***		(0.017)***
Productivity		0.366		0.062		0.023		0.280
		(0.034)***		(0.010)***		(0.009)**		(0.026)***
Firm age		-0.301		-0.052		-0.091		-0.158
		(0.049)***		(0.019)**		(0.014)***		(0.035)***
Multinational		-0.281		0.023		0.009		-0.313
		(0.143)*		(0.050)		(0.040)		(0.094)***
Foreign		0.208		0.103		0.105		0.000
		(0.080)**		(0.029)***		(0.022)***		(0.057)
IP active		0.326		0.235		0.084		0.006
		(0.086)***		(0.033)***		(0.022)***		(0.060)
Observations	8119	5166	8119	5166	8119	5166	8119	5166
R-squared	0.00	0.15	0.00	0.11	0.00	0.07	0.00	0.12
Region control	NO	YES	NO	YES	NO	YES	NO	YES
Year control	YES	YES	YES	YES	YES	YES	YES	YES
Sector control	NO	YES	NO	YES	NO	YES	NO	YES

3.2.4 Research aim (iv)

"To what extent has the trajectory of change in the value and destination of goods exports by UKTI trade clients which have used multiple services over the period been significantly different from those using the services only once?"

Multiple-use (MU) UKTI firms export more, more products and (especially) to more markets than non-MU UKTI firms. MU UKTI firms do not seem to perform better than non-MU UKTI firms two years after receiving support. This is true for both firms exporting and non-exporting at the time of UKTI support. Finally, MU UKTI firms are more likely to export to each of the 8 markets we consider than non-MU UKTI firms. This is true both in the year of support and two years later. EU as a

> **market is a bit special, differences between MU UKTI and non-MU UKTI are weaker than for other markets.**

To answer this descriptive research aim we perform similar analyses as for the three first research aims but comparing firms that have used multiple UKTI services to those that have used them only once in a single year. The sample for this part of the research thus includes only those firms who have been identified as UKTI users.

First we examine firms that have used UKTI services. We define "multiple-use (MU)" as using more than one UKTI service in the same year. Figure 2 shows the percentage of firms in the sample that use a certain number of UKTI services.

Figure 2: Distribution of the number of UKTI services used in a given year by UKTI firms
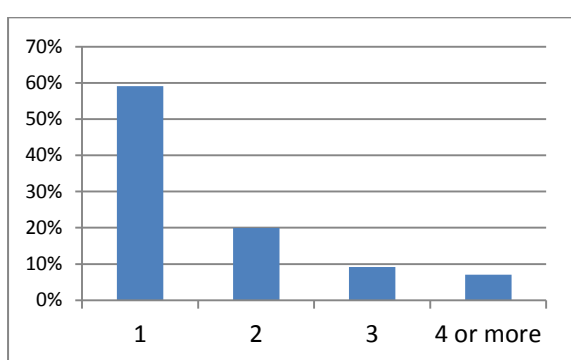
The models reported in Table 11 are structured in exactly the same way as for those reported in Table 5, except that here we are looking only at the sample of UKTI users, and the explanatory variable in which we are interested is 'MU UKTI', indicating that the firm is a multiple user as defined above.

Table 11 shows that MU UKTI firms export more, more products and to more markets than non-MU UKTI firms. As for Table 5, the firm controls are clearly important, and most are highly significant.

Table 11. Differences in exports and margins between MU UKTI and non-MU UKTI in the year of the support (t ϵ [2008-2010])

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Total exports		Number of countries		Number of products per country		Intensive margin	
	ln(exports)		ln(# countries)		ln(# products)		ln(exports per country per product)	
MU UKTI	0.444	0.308	0.250	0.212	0.052	0.047	0.143	0.049
	(0.042)***	(0.061)***	(0.019)***	(0.029)***	(0.010)***	(0.018)**	(0.024)***	(0.038)
Employment		0.529		0.158		0.135		0.236
		(0.024)***		(0.011)***		(0.008)***		(0.015)***
Productivity		0.802		0.227		0.094		0.481
		(0.044)***		(0.017)***		(0.011)***		(0.029)***

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Firm age		0.094		0.175		0.013		-0.094
		(0.045)*		(0.022)***		(0.014)		(0.029)**
Multinational		0.392		0.273		0.053		0.066
		(0.090)***		(0.040)***		(0.026)*		(0.056)
Foreign		0.632		0.230		0.137		0.265
		(0.068)***		(0.032)***		(0.020)***		(0.042)***
IP active		0.206		0.170		0.088		-0.052
		(0.063)**		(0.030)***		(0.019)***		(0.040)
Observations	18941	6498	18941	6498	18941	6498	18941	6498
R-squared	0.01	0.33	0.01	0.26	0.00	0.17	0.00	0.23
Region control	NO	YES	NO	YES	NO	YES	NO	YES
Year control	YES	YES	YES	YES	YES	YES	YES	YES
Sector control	NO	YES	NO	YES	NO	YES	NO	YES

Table 12. Differences in exports and margins growth between MU UKTI and non-MU UKTI two years after the support (t ϵ [2008-2010])

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Change Total exports		Change Number of countries		Change Number of products per country		Change Intensive margin	
							ln(exports per country per product)	
	ln(exports)		ln(# countries)		ln(# products)			
MU UKTI	0.059	0.010	0.018	0.013	-0.000	0.001	0.041	-0.004
	(0.022)**	(0.032)	(0.010)	(0.014)	(0.007)	(0.010)	(0.016)*	(0.026)
Employment		-0.022		-0.007		0.004		-0.019
		(0.012)		(0.005)		(0.004)		(0.010)
Productivity		-0.021		-0.007		0.007		-0.020
		(0.025)		(0.009)		(0.008)		(0.018)
Firm age		-0.046		-0.034		-0.010		-0.003
		(0.024)		(0.010)***		(0.007)		(0.019)
Multinational		0.048		-0.039		0.011		0.076
		(0.043)		(0.018)*		(0.013)		(0.034)*
Foreign		-0.058		-0.027		0.012		-0.043
		(0.036)		(0.015)		(0.012)		(0.028)
IP active		0.064		0.037		-0.007		0.034
		(0.034)		(0.014)*		(0.011)		(0.027)
Observations	15050	6066	15050	6066	15050	6066	15050	6066
R-squared	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01
Region control	NO	YES	NO	YES	NO	YES	NO	YES
Year control	YES	YES	YES	YES	YES	YES	YES	YES
Sector control	NO	YES	NO	YES	NO	YES	NO	YES

However, Table 12 shows that when comparing their achievement two years later, MU UKTI firms that were exporting at the time of support do not seem to *grow* faster than non-MU UKTI

firms that were also exporting at the time of support. The models reported in Table 12 were again structured in exactly the same way as when we were comparing UKTI and non-UKTI firms in Table 9, except that now our sample includes only UKTI firms. Comparing Table 9 and Table 12, we again find that the models of export growth appear to explain very little of the observed variation in the data, and that productivity and firm size in particular appear to play no role in explaining export growth.

In Table 13 we compare the export *levels* after two years (and the three margins in which it decomposes into) between MU UKTI and non-MU UKTI firms. The sample is given by UKTI firms not exporting in t but exporting in t+2. Thus the models for Table 13 are structured as for those reported in Table 10.

It shows that also log total exports and log export margins levels at t+2, for those firms that did not export at the time of support, are not statistically different between MU UKTI and non-MU UKTI.

Consistent with the models reported in Table 10, the models reported in Table 13 show a positive and significant role for productivity and being IP active in explaining the number of countries to which firms begin exporting, and also on the starting total value of exports.

Table 13. Differences in exports and margins level between MU UKTI and non-MU UKTI two years after the support for non-exporters in t ϵ [2008-2010]

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Starting Total exports		Starting Number of countries		Starting Number of products per country		Starting Intensive margin	
	ln(exports)		ln(# countries)		ln(# products)		ln(exports per country per product)	
MU UKTI	0.269	0.268	0.039	0.107	0.016	0.046	0.213	0.114
	(0.115)*	(0.244)	(0.045)	(0.096)	(0.025)	(0.053)	(0.079)**	(0.171)
Employment		0.251		0.066		0.034		0.152
		(0.090)**		(0.029)*		(0.020)		(0.063)*
Productivity		0.395		0.191		0.032		0.172
		(0.133)**		(0.046)***		(0.023)		(0.098)
Firm age		-0.371		-0.011		-0.060		-0.300
		(0.179)*		(0.072)		(0.041)		(0.123)*
Multinational		-0.581		-0.107		-0.122		-0.352
		(0.350)		(0.126)		(0.072)		(0.248)
Foreign		0.356		0.211		0.124		0.021
		(0.301)		(0.116)		(0.071)		(0.203)
IP active		0.652		0.507		0.180		-0.035
		(0.248)**		(0.101)***		(0.051)***		(0.171)
Observations	1795	488	1795	488	1795	488	1795	488
R-squared	0.00	0.30	0.00	0.29	0.00	0.18	0.01	0.21
Region control	NO	YES	NO	YES	NO	YES	NO	YES
Year control	YES	YES	YES	YES	YES	YES	YES	YES
Sector control	NO	YES	NO	YES	NO	YES	NO	YES

Finally, in this section, in Tables 14 and 15 we report on a set of models which are structured as for those reported in Tables 7 and 8, with the probability of exporting to the specified market group as the dependent variable, and 'MU UKTI' as one of the explanatory variables. Thus Table 14 reports the results for the 'MU UKTI' dummy, while Table 15 reports the estimated results for the constant term in the same set of models.[16]

We compare export destinations for MU UKTI and non-MU UKTI firms and find that MU UKTI firms are more likely to be exporting to all regions of the world but Europe (Table 14). This is true both in the year of support (left panel of Table 14) and two years after the support (right panel of Table 14).

The corresponding benchmark probabilities to export in a given destination for all UKTI firms (i.e. both MU UKTI and non-MU) are reported in Table 15.

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[16] As for Tables 7 and 8, we repeat the number of observations and the column labels at the bottom of the two tables, for convenience, but report the R-Squared results only for Tables 7 and 14.

Thus looking at row 2 in Table 15 we see that the average probability that a UKTI firm is exporting to Brazil is similar for MU UKTI (23.1% - column 2) and non-MU UKTI (24.2% - column 4), while row 2 in Table 14 shows that MU UKTI firms have a slightly higher probability of exporting both in the year of support (3.3% higher – column 2) and 2 years later (4.5% - column 4).

Table 14. Exports status in a given country group for MU UKTI vs. non-MU UKTI (2008-2010)

	(1)	(2)	(3)	(4)
	Additional Probability to Export in the year of support		Additional Probability to Export two years after support	
EU	0.049	0.022	0.041	0.018
	(0.007)***	(0.011)*	(0.008)***	(0.011)
Brazil	0.026	0.033	0.029	0.045
	(0.005)***	(0.010)***	(0.006)***	(0.010)***
China	0.046	0.044	0.046	0.046
	(0.006)***	(0.012)***	(0.007)***	(0.012)***
India	0.052	0.048	0.059	0.060
	(0.006)***	(0.012)***	(0.007)***	(0.012)***
Russia	0.031	0.022	0.031	0.027
	(0.005)***	(0.010)*	(0.006)***	(0.010)*
USA	0.059	0.044	0.046	0.037
	(0.007)***	(0.011)***	(0.007)***	(0.011)***
OECD	0.048	0.030	0.045	0.040
	(0.006)***	(0.009)**	(0.007)***	(0.009)***
ROW	0.058	0.051	0.042	0.043
	(0.006)***	(0.009)***	(0.006)***	(0.009)***
Observations	151528	51984	134760	52432
R-squared	0.56	0.67	0.58	0.67
Country group and year dummies	YES	YES	YES	YES
Firm controls	NO	YES	NO	YES

Table 15. Benchmark probability of exporting to a given country group for samples of corresponding columns of Table 14 (2008-2010)

	(1)	(2)	(3)	(4)
EU	0.449	0.666	0.537	0.678
	(0.004)***	(0.007)***	(0.004)***	(0.007)***
Brazil	0.133	0.231	0.196	0.242
	(0.003)***	(0.006)***	(0.004)***	(0.006)***
China	0.263	0.408	0.334	0.421
	(0.004)***	(0.007)***	(0.004)***	(0.007)***
India	0.268	0.398	0.332	0.401

	(0.004)***	(0.007)***	(0.004)***	(0.007)***
Russia	0.163	0.266	0.220	0.267
	(0.003)***	(0.006)***	(0.004)***	(0.006)***
USA	0.612	0.735	0.664	0.729
	(0.004)***	(0.006)***	(0.004)***	(0.006)***
OECD	0.734	0.818	0.797	0.830
	(0.004)***	(0.006)***	(0.004)***	(0.006)***
ROW	0.760	0.848	0.817	0.851
	(0.004)***	(0.006)***	(0.004)***	(0.005)***
Observations	151528	51984	134760	52432
Country group and year dummies	YES	YES	YES	YES
Firm controls	NO	YES	NO	YES

3.3 Econometric Analysis: Results for Research Aims (v) to (vii)

Research aims (v)-(vii) are addressed with tools from the program evaluation literature. This allows us to move beyond correlations and determine whether there is evidence of a causal impact of UKTI services on goods export performance. The main evaluation techniques we use are propensity score matching (PSM) and a Heckman selection model (HSM) that controls for the selection of firms into export activity. In section 3.3.1, we describe the PSM approach and the way we combine it with HSM.[17]

PSM allows estimating the causal impact of UKTI services more convincingly than the OLS approach described above. However, it is based on a strong assumption: selection into the UKTI treatment is driven by observables and/or by uncorrelated unobservables. This assumption cannot be lifted without an instrumental variable, a natural experiment, a long panel data allowing for firm fixed effects, a regression discontinuity, or a randomized intervention, which is not the case here. In sum, although we combine PSM with HSM to get closer to a causal estimate, the method cannot conclusively 'prove' causality.

3.3.1 Econometric Techniques: PSM and HSM

The fundamental problem for evaluating an economic intervention is that ideally, one would need to know the difference between participants' outcomes with and without the intervention (the counterfactual). In the case of UKTI, we can observe the export performance of a firm which has benefited from UKTI's services. But, we cannot observe what the exports of the same firm would have been had it not used the service. Using a simple descriptive comparison with non-users is not an adequate solution, , because users and non-users would be likely to differ in their export choices and export performance even in the absence of UKTI's programs.

Propensity score matching seeks to address this problem by constructing a comparison group of non-users which are similar to UKTI users along a range of firm characteristics which are likely to influence export activity, but which are not directly influenced by the relevant intervention (here: participation in UKTI services). For example, UKTI services users might be larger on average than firms which have not used any UKTI services.[18] Yet, we also know that larger firms are more likely to be exporting more. So if we find that the total exports increase after participation in OMIS, this might simply be due to the fact that participants tend to be larger firms. The idea behind propensity score matching is to control for this effect by selecting a group of non-participants ('control group') of similar firm size to the group of participants ('treatment group'), so that subsequent outcome differences between these two groups cannot be driven by firm size. In this case, this is possible because although non-participants are smaller *on average*, there are still some non-participants which are as large as participants. Finding such non-participants is relatively straightforward because non-participants are much more numerous than participants in our sample.

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[17] A more exhaustive description of propensity score matching can be found in Caliendo and Kopeinig (2008).

[18] In our dataset the omission of firms without financial data in ORBIS has reduced this difference, as noted earlier. However, data from UKTI surveys of exporters suggest that the proportion of large firms is indeed smaller for the non-user population.

The approach just outlined can be done for a number of variables simultaneously. For example, we might want to select a control group which is similar to the treatment group along a number of characteristics (region, sector, employment etc). The problem that arises is that the availability of suitable control firms decreases as the number of matching variables increases (this is the so-called 'curse of dimensionality'). Propensity score matching tries to circumvent this problem by summarising the characteristics of treatment and control group with the so-called propensity score. Firms with the same propensity score will *on average* have similar characteristics (although not *all* firms will be similar in terms of *all* the chosen characteristics). Technically speaking, once we condition on the propensity score, the distribution of firm characteristics should be independent of whether a firm used UKTI services or not.

Below, we implement the propensity score matching procedure as follows:

First, we run a probit regression with a dummy variable indicating whether a firm has used UKTI services on the left-hand side, as the dependent variable. As our explanatory variables, we use data for a number of firm-level characteristics which are known in the literature as likely to influence a firm's export status and performance. These are the same variables which we used in section 3.2 above, and which we showed in Tables 5 and 11 to be significant in explaining export levels and margins (employment, age, productivity and dummies for having been an exporter in the previous year, for being IP active, a multinational, or foreign owned, as well as a set of year, sector and region controls). The propensity scores are computed as the predicted treatment probabilities from this regression; i.e. these models are predicting the probability that a given firm will be a UKTI user.[19]

Second, for each firm in the treatment group, we then select the firm amongst the non-UKTI users with most similar propensity score ('nearest neighbour matching'). Note that the same non-user might be the nearest neighbour to several treated firms.

Third, for each matched firm pair, we compute the difference in the outcome variable of interest. In sum, since the matching process has left us comparing pairs of firms who are as similar as possible with respect to all the other observable factors which might explain differences in these export outcomes, UKTI use is our only remaining explanatory variable. We therefore identify any remaining differences between the outcomes observed for the two matched firms as the UKTI treatment effect.

Finally, this difference for each matched pair is then averaged across all pairs to calculate the total effect of UKTI services (the so-called 'average treatment effect on the treated' or ATT).

This technique is well established, and our dataset is sufficiently large and robust to allow us to obtain relatively strong results. However, it should be noted that propensity score matching is not an infallible 'magic bullet' to solve the fundamental evaluation problem outlined above. This is due to the possibility that firms might choose to participate and use UKTI services for unobservable reasons or characteristics on which data is unavailable, and for which we can

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[19] As noted earlier, in our dataset we are only able to identify a firm as a UKTI user if the firm had used UKTI between 2008-2010. A source of 'noise' in our dataset therefore is that we cannot identify firms who had used UKTI at an earlier date.

therefore not control for via the propensity score matching approach. A classic example is management quality: it cannot be measured accurately with the data in our datasets. ; However, better managers are likely to be stronger at spotting business opportunities as well as support offered through services such as UKTI's. So their firms might have increased their exports faster, even if they had never used UKTI's services. On the other hand, it might be the case that better managed firms believe they will be able to enter export markets without UKTI support, and as a consequence only less well-managed firms use UKTI services. Without data on these management characteristics, we are not able to take them into account in our matching process.

In our context, however, there is one important source of unobserved heterogeneity for which we can control to some extent. This is the possibility that firms differ in their propensity to export because they are likely to benefit differentially from exporting. Those who know, or believe, that they will benefit more from exporting will, accordingly, be more likely to self-select into export status, and hence also are more likely to self-select into UKTI service use. This differential propensity to export is of course difficult to measure, but ideally we would like to also match treatment and control groups on this variable. To achieve an approximation of this, we derive an inverse Mills ratio. In a first step, we run a probit regression with a dummy variable indicating a firm's export status on a number of explanatory variables, including lagged export status (our exclusion restriction), participation in UKTI and our firm-level variables listed above. We use the estimation results to calculate the inverse Mills ratio as in a Heckman selection model. We then use this inverse Mills ratio as an additional variable on which to match UKTI users to non-UKTI users. As we will show in later sections of this report, estimation results indicate that the inverse Mills ratio is an important variable to be considered when applying PSM in that ATTs [Average Treatment effect on Treated firm] obtained without the inverse Mills ratio are to some extent different (typically smaller in absolute value).

3.3.2 Research aims (v) and (vi)

"What is the impact of support on the goods export performance of supported firms, taking account of any selection effects; what is the nature and extent of differences in impact across subgroups including: a)by size of firm at the time of support and b) by market group?"

and

"What is the impact on goods export growth at both the intensive and extensive margins, for all supported firms and separately for different sub-groups?"

> **UKTI support increases both the probability that firms start and continue exporting. This is true for firms of all sizes as well across any of the 8 markets we consider. The magnitude of the effects is similar across different subgroups of firms and markets.**
>
> **UKTI support also helps firms to both statrt with higher exports and to grow their current exports more. The destination and intensive margins are particularly affected. When differentiating by firm size or market, results are inconclusive.**
>
> **Market-specific UKTI support helps firms to both start and continue exporting in that market. In terms of initial exports and exports growth in the specific market there is positive effect spanning across all margins. Magnitudes are comparable to those obtained with non-specific support suggesting that UKTI support has an impact on firm exports spanning well beyond the specific market for which support has been obtained.**

We begin by analysing the impact of UKTI services on the goods export performance of firms. We do so by comparing firms which have used one or more UKTI services (the 'treatment group') to a control group of firms which have not used any UKTI services. This control group is constructed using the nearest neighbour matching approach as described in the previous Section.

We run separate estimations for firms that start and those that keep exporting at t+2 $\in$ [2010, 2012]. In the "keep exporting" case the population for our analysis is given by firms who were already exporting in the year of support: t $\in$ [2008, 2010]; For the "start exporting" case, the population for our analysis is given by firms who were non-exporting firms at the time of support: in t $\in$ [2008, 2010].

As a first step, in both cases we run a first stage regression to compute an inverse Mills ratio to be used as additional regressor in the second step where we employ PSM. Control variables are as for the analysis reported in previous sections: log of firm size (employment), log of apparent labour productivity, firm location and industry affiliation as well as log of firm age, IP activity, Foreign owned and MNE status. We use information on whether the firm was exporting or not in the year prior to the year t as an exclusion restriction.

In thefirst stage of our analysis, we separately consider as regression outcomes:

- the probability to start exporting two years after year t ∈ [2008, 2010], among firms who were not exporting at the time of support; and

- the probability to keep exporting two years after year t ∈ [2008, 2010], among firms who were exporting at the time of support. .

The key explanatory variable is a dummy indicating whether a firm has received UKTI support or not. Marginal effects estimated in these two first stage regressions are shown in **Table 16,** with the first column referring to the "keep exporting" firms and the second column to the "start exporting" ones.

The results presented in Table 16 show that, conditional on all these controls, UKTI support increases the probability of exporting two years after support, and also increases the probability that firms who were exporting at the time of support will still be exporting 2 years later. It is worth noting that the table also shows that while firms who were exporting one year before the year of support (t-1) are more likely also to be doing so two years after support, this is by no means the case for all firms. This reflects the fact that many firms are intermittent exporters.

Table 16. Research aim (v): First stage marginal effects for UKTI treatment effect

	(1) Keep exporting at t+2 (firms already exporting at t)	(2) Start exporting by t+2 (firms not exporting at t)
UKTI	0.071 (0.005)***	0.039 (0.002)***
Export at t-1	0.205 (0.005)***	0.077 (0.002)***
Employment	0.026 (0.001)***	0.010 (0.000)***
Productivity	0.028 (0.002)***	0.009 (0.000)***
Firm age	0.003 (0.003)	0.002 (0.001)**
Multinational	0.008 (0.006)	0.009 (0.002)***
Foreign	0.024 (0.004)***	0.026 (0.001)***
IP active	0.037 (0.004)***	0.024 (0.001)***
Observations	37,754	130,642
R^2	0.172	0.215
Region control	YES	YES
Year control	YES	YES
Sector control	YES	YES
Export in year of UKTI support	YES	NO

Note to Table 17: The average (baseline) for regression 1 is 0.8532 while for regression 2 it is 0.0395. This means that on average just over 85% of firms who were exporting in the year of support were also exporting two years later; for firms not exporting at time of support, nearly 4% were exporting two years later. Thus for those supported by UKTI, the probability of still exporting 2 years later rises from just over 85% to just over 92%; for those not exporting at time of support the probability of exporting 2 years later rises from just under 4% to nearly 8%.

In the next stage of our analysis we use the results of the analysis reported in Table 16 to compute an inverse Mills ratio for each of the two sample groups, which we will use as an additional explanatory variable, to control for an unobserved propensity to export, as explained in the previous section. We use this ratio as a control variable both in the probit regressions to estimate the propensity scores for UKTI treatment (Table 17) and in the final step of the analysis to obtain the estimated treatment effects (Table 18).

Table 17 shows the results of the probit regression which we estimated to obtain the propensity scores for UKTI treatment, as the next step of the matching procedure described above. The outcome variable here is a dummy indicating that the firm was identified as a UKTI user between 2008-2010. Column (1) shows results for firms who were already exporting in the year of support, while column (2) shows results for firms who were not yet exporting.

As expected, the variables which were shown in Tables 5 and 11 to be significant in explaining export outcomes are also highly significant in helping to explain the probability that the firm will be a UKTI user. The table also shows that the 'inverse Mills ratio', which we use to pick up the unobservable propensity to export, as described above, is indeed highly significant. The pseudo-R^2 is not low, yielding credibility to the PSM estimation.

In the second stage, we then estimate the UKTI treatment effects for firms who are exporting two years after UKTI support, again carrying out separate analysis for those who were exporting at the time of support (group 1), and those who were not (group 2). Table 18 reports the results of a PSM estimator, with the key explanatory variable being a dummy indicating whether a firm has received UKTI support or not, and the same control variables as for Table 17, including the inverse Mills ratio.

As shown in the first column of Table 18, our outcome variables are: log export level (for firms in the "start exporting" group) and log export growth (for firms in the "keep exporting" group), and the product, country and intensive margins they decompose into, as separate outcome variables. (This is of course conditional on the firm exporting two years after receiving UKTI support.)The results presented in columns two and three are the estimated UKTI treatment effects (Average Treatment effect on the Treated, or 'ATT').

Table 17. Research aim (v): Second stage logit predicting propensity scores for UKTI treatment effect

	(1)	(2)
	Exported in year of UKTI support	
	YES	NO
Employment	-0.020	-0.155
	(0.007)**	(0.007)***
Productivity	-0.227	-0.240
	(0.009)***	(0.009)***
Firm age	-0.151	-0.142
	(0.013)***	(0.014)***
Multinational	0.319	0.255
	(0.026)***	(0.040)***
Foreign	-0.214	-0.534
	(0.018)***	(0.028)***
IP active	0.141	-0.084
	(0.018)***	(0.027)**
Inverse Mills ratio	-3.759	-1.926
	(0.079)***	(0.027)***
Constant	1.571	3.996
	(0.088)***	(0.111)***
Observations	37755	130656
R^2	0.157	0.328
Year control	YES	YES

The estimated causal impacts in Table 18 show that participation in UKTI services has a significantly positive effect on total firm exports, helping firms to both starting exporting with higher values and to grow their exports more. Thus the first row shows that UKTI support results in 8.8% more growth in the value of goods exports for firms already exporting, and 46.4% more exports for new exporters.

Most of this overall impact on exports comes from the country margin, which shows a 3.5% increase in the average number of countries for firms already exporting, and 19.6% for new exporters (row 3, 'Change Number of countries'). The remaining portion is attributable to the intensive margin (5% for those already exporting, and 24.3% for new exporters), while the product margin is not significant.

These numbers translates into a significant increase in exports as measured in pounds. For example, given the descriptive statistics presented in **Table 19**, UKTI support would increase exports of the median (mean) previously exporting firm by £152,490=1,732,844X0.088 (£1,056,000=12,000,000X0.088). It would also imply that the median (mean) non-exporters receiving UKTI help would be exporting two years later £7,090=15,279X0.464 (£580,155=1,250,336X0.464) more.

It is worth highlighting that while the effects reported in Table 18 appear larger for the new to export group, once these are translated into export values the position is reversed, since new exporters typically export smaller values. Over a 5-6 year period, however, the contribution of new exporters to export growth is at least as large as that of established exporters, as highlighted earlier.

Table 18. Research aim (v): Propensity score matching estimators for UKTI treatment effect

	Nearest neighbour matching (random draw)	
	Average treatment effect on the treated (ATT)	
	Export in year of UKTI support	
Outcome variable for treatment	YES	NO
Change Total exports	0.088	0.464
ln(exports)	(0.029)***	(0.210)**
Change Number of countries	0.035	0.196
ln(# countries)	(0.012)***	(0.078)**
Change Number of products per country	0.002	0.026
ln(# products)	(0.010)	(0.051)
Change Intensive margin	0.050	0.243
ln(exports per country per product)	(0.022)**	(0.142)*
Treated observations	6066	488
Untreated observations	4167	390

Table 19. Research aim (v): Descriptive statistics of controls for non-treated firms.

	Non-treated exporters (4,167 firms)			Non-treated non-exporters (390 firms)		
	Exports value (GBP)	Revenue (GBP)	Employees	Exports value (GBP)	Revenue (GBP)	Employees
Mean	12,000,000	65,671,950	554	1,250,336	69,670,000	502
Median	1,732,844	21,682,000	135	15,279	17,494,000	118

Robustness testing

In order to validate the PSM approach, Table 20 shows that the balancing properties are overall met as indicated by the B and R statistics,[20] whereas Figures 3 and 4 show the degree of overlap is satisfactory.

Table 20. Research aim (v): Balancing properties of PSM of Table 18

	Propensity Score R²	Likelihood Ratio chi-square	p> Chi-square	Mean Bias	Median Bias	B	R	% Variation
Exporting in year of UKTI support	0.042	711.66	0.000	14.4	15.4	49.5	1.27	50
Not exporting in year of UKTI support	0.05	6.84	0.654	4.8	4.5	16.8	1.15	25

Figure 3: Estimated propensity score for treated and control in the case of firms exporting in the year of UKTI support (10,233 firms)
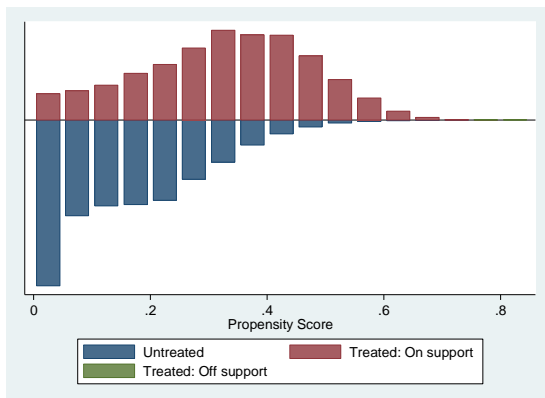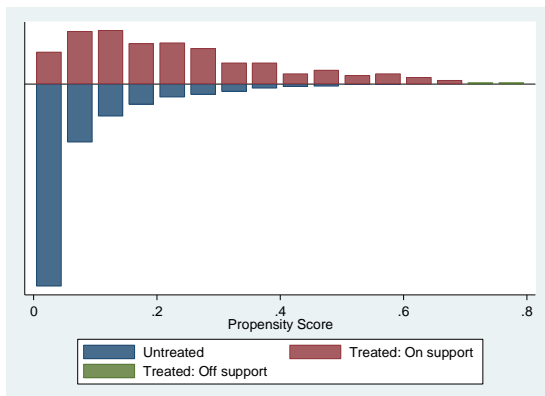

Figure 4: Estimated propensity score for treated and control in the case of firms not exporting in the year of UKTI support (878 firms)

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[20] Balancing issues arise as long as B>25% and/or R is outside [0.5; 2].

In all our specification we imposed common support. In addition, we also experimented with omitting the inverse Mills ratio from our PSM specification (see Table 21), and find that mainly results on firms starting to export hold. On the one hand this confirms the importance of controlling for self-selection into export via the inverse Mills ratio. On the other hand, Table 21 provides robustness of the UKTI impact on firms who start exporting as well as on the expansion of the country margin for those already exporting.

As additional robustness checks, alternative matching algorithms are presented in the Appendices B to D. Caliper, Radius and Kernel matching confirm the results of the nearest neighbour matching presented in Table 18. In Appendix A we instead follow Ichino, Mealli and Nannicini (2006) framework and look at whether our results are sensitive to the introduction of unobservables by means of a binary confounder constructed from covariates (we use firm size to construct the confounder). This is implemented by the STATA command sensatt whose results provided in Tables A1 and A2 confirm the overall picture emerging from Table 18.

Table 21. Research aim (v): Propensity score matching estimators for UKTI treatment effect. Robustness

Outcome variable for treatment	Nearest neighbour matching (random draw) Average treatment effect on the treated (ATT) Export in year of UKTI support	
	YES	NO
Change Total exports	0.016	0.442
ln(exports)	(0.028)	(0.186)**
Change Number of countries	0.021	0.229
ln(# countries)	(0.012)*	(0.068)***
Change Number of products per country	-0.007	0.006
ln(# products)	(0.009)	(0.045)
Change Intensive margin	0.002	0.207
ln(exports per country per product)	(0.022)	(0.126)
Treated observations	6066	488
Untreated observations	4897	446

Research aims (v) and (vi): UKTI Treatment effects by size bands

We then carry out the same analysis for different subgroups of our sample. Thus Table 22 reports analysis of the probability that the firm is exporting in year t+2, separately by whether the firm was exporting in the year of support, and distinguishing between firms of different sizes: less or equal to 50 employees, 51 to 100 employees and 101 employees or more. The structure of these models is as described for Table 16.

Thus table 22 presents the marginal effects of the first stage regression for each of these subgroups, with the first three columns referring to firms that keep exporting and columns (4) to (6) to those that start exporting. As can be seen in row 1, UKTI support helps firms of all sizes to both start and continue exporting, even when controlling for the different firm characteristics.

Magnitudes are similar across firm size groups and also comparable to those found in Table 18, except for small new exporters where the effect of UKTI support is smaller. Thus UKTI supported firms with 1-50 employees who were exporting at the time of support, are 9.7% more likely to still be doing so two years later, controlling for firm characteristics and for whether or not the firm had been exporting 1 year before support (n-1). Firms in the same size band who were not exporting at the time of support are 2.7% more likely to be doing so two years later, compared with 6.5% and 7.2% for the larger size bands.

Table 22. Research aim (vi): First stage marginal effects for UKTI treatment effect by size bands.

	(1)	(2)	(3)	(4)	(5)	(6)
	Export in year of support			Does not export in year of support		
Dependent variable	Dummy variable for positive exports at t+2					
Size band	1-50 employees	51-100 employees	101+ employees	1-50 employees	51-100 employees	101+ employees
UKTI	0.097	0.062	0.061	0.027	0.065	0.072
	(0.012)***	(0.011)***	(0.006)***	(0.003)***	(0.007)***	(0.006)***
Export at n-1	0.239	0.194	0.180	0.057	0.120	0.130
	(0.009)***	(0.009)***	(0.006)***	(0.002)***	(0.006)***	(0.006)***
Productivity	0.033	0.024	0.017	0.006	0.013	0.019
	(0.003)***	(0.004)***	(0.003)***	(0.000)***	(0.002)***	(0.002)***
Firm age	0.020	-0.001	-0.003	0.002	0.004	0.012
	(0.005)***	(0.005)	(0.003)	(0.001)*	(0.002)	(0.002)***
Multinational	0.012	0.023	0.014	0.009	0.013	0.022
	(0.018)	(0.015)	(0.006)*	(0.003)**	(0.009)	(0.006)***
Foreign	0.007	0.042	0.036	0.020	0.044	0.043
	(0.007)	(0.008)***	(0.005)***	(0.001)***	(0.005)***	(0.004)***
IP active	0.063	0.051	0.032	0.019	0.038	0.051
	(0.009)***	(0.008)***	(0.005)***	(0.002)***	(0.005)***	(0.004)***
Observations	13772	7692	16251	88712	16633	25198
R2	0.123	0.182	0.185	0.191	0.157	0.162
Region control	YES	YES	YES	YES	YES	YES
Year control	YES	YES	YES	YES	YES	YES
Sector control	YES	YES	YES	YES	YES	YES
Export in year of UKTI support	YES	YES	YES	NO	NO	NO

Table 23. Research aim (vi): Propensity score matching estimators for UKTI treatment effect by size

	(1)	(2)	(3)	(4)	(5)	(6)
	Export in year of support			Does not export in year of support		
	Propensity score					
Size band	1-50 employees	51-100 employees	101+ employees	1-50 employees	51-100 employees	101+ employees
Productivity	-0.304	-0.207	-0.193	-0.145	-0.115	-0.286
	(0.015)***	(0.022)***	(0.015)***	(0.009)***	(0.025)***	(0.021)***
Firm age	-0.323	-0.129	-0.081	-0.101	-0.069	-0.175

	(0.026)***	(0.027)***	(0.017)***	(0.020)***	(0.034)*	(0.025)***
Multinational	0.117	0.325	0.342	0.270	0.377	0.122
	(0.082)	(0.067)***	(0.030)***	(0.070)***	(0.093)***	(0.057)*
Foreign	-0.185	-0.294	-0.239	-0.374	-0.249	-0.615
	(0.034)***	(0.041)***	(0.025)***	(0.037)***	(0.064)***	(0.051)***
IP active	0.007	0.198	0.150	0.185	0.045	-0.355
	(0.040)	(0.039)***	(0.024)***	(0.040)***	(0.058)	(0.044)***
Inverse Mills ratio	-4.784	-3.181	-3.560	-1.440	-1.458	-2.247
	(0.154)***	(0.159)***	(0.110)***	(0.029)***	(0.050)***	(0.053)***
Constant	2.923	1.136	0.986	1.934	1.447	4.174
	(0.156)***	(0.158)***	(0.102)***	(0.112)***	(0.199)***	(0.196)***
Observations	13772	7710	16273	88768	16683	25205
Year control	YES	YES	YES	YES	YES	YES
Export in year of UKTI support	YES	YES	YES	NO	NO	NO

Table 23 reports the Propensity Score second stage results, with the outcome variable being the probability that the firm had received UKTI support, as explained above for Table 17, Comparing the two tables, we see that Table 17 has size as a control variable, while here size does not appear as a control because we are carrying out the analysis separately for each size band. As in Table 17, we see that the coefficients on the inverse Mills ratio are again highly significant.

Finally, Table 24 reports the ATT estimations for the same firm size groups, using the same controls and model structure and reporting format as for Table 18. In terms of initial exports and exports growth, results are mixed mainly due to large standard errors (bearing in mind that the number of observations is smaller for most of these subgroups, as can be seen by comparison with Table 18) and no general conclusion can be drawn. Having said that, it seems if any that UKTI support helps larger exporting firms, as well as firms starting to export, to export more via the expansion of the country margin.

Table 24. Research aim (vi): Propensity score matching estimators for UKTI treatment effect by size (common support and no matching on size)

	(1)	(2)	(3)	(4)	(5)	(6)
			Nearest neighbour matching (random draw)			
			Average treatment effect on the treated			
			(ATT)			
	Export in year of support			Does not export in year of support		
Outcome variable for treatment	1-50 employees	51-100 employees	101+ employees	1-50 employees	51-100 employees	101+ employees
Change Total exports	-0.136	-0.065	0.068	0.119	0.753	0.330
ln(exports)	(0.098)	(0.063)	(0.038)*	(0.376)	(0.412)*	(0.332)
Change Number of countries	(0.024)	-0.002	0.032	0.341	0.344	0.209
ln(# countries)	0.043	(0.027)	(0.016)**	(0.112)***	(0.173)*	(0.118)*
Change Number of products per country	-0.001	0.018	-0.009	-0.075	0.109	-0.026
ln(# products)	(0.034)	(0.019)	(0.013)	(0.109)	(0.101)	(0.092)
Change Intensive margin	-0.159	-0.081	0.045	-0.147	0.300	0.147
ln(exports per country per product)	(0.074)	(0.048)*	(0.030)	(0.298)	(0.272)	(0.227)
Treated observations	1255	1264	3547	128	103	257
Untreated observations	838	903	2352	109	76	161

We then perform a similar analysis by export destination market, differentiating between the EU, USA, other OECD countries, Brazil, China, India, Russia and the Rest of the World. Tables 25 and 26 report first stage marginal effects for the continue exporting case and the start exporting case, respectively. Thus the analysis reported in Tables 25-26 uses the same structure as for Tables 16 and 22, with one important exception: By 'continuing exporters' we are now referring to firms who were already exporting to the specific country group at the time of support, and by 'start exporting', we refer to those who were not exporting to that market at the time of support. This contrasts with the terminology used for Tables 16 and 22, above, where we were referring to exporting or starting to export in general (i.e. to any destination).

Tables 25 and 26 show that UKTI support helps firms to both start and continue exporting in each of the 8 markets we consider, whether they are continuing exporters or starters. Magnitudes are roughly similar across markets.

Table 25. Research aim (vi): First stage marginal effects for UKTI treatment effect by region – continuing exporters.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Export in year of support				
Dependent variable				Dummy variable for positive exports at t+2				
World Region	EU	USA	OECD	Brazil	China	India	Russia	RoWorld
UKTI	0.045	0.081	0.091	0.051	0.072	0.073	0.049	0.088
	(0.006)***	(0.007)***	(0.006)***	(0.014)***	(0.010)***	(0.010)***	(0.014)***	(0.006)***
Export at n-1	0.140	0.305	0.249	0.313	0.278	0.296	0.290	0.252
	(0.007)***	(0.007)***	(0.006)***	(0.014)***	(0.010)***	(0.010)***	(0.015)***	(0.006)***
Employment	0.028	0.022	0.024	0.023	0.027	0.022	0.028	0.024
	(0.002)***	(0.002)***	(0.002)***	(0.005)***	(0.003)***	(0.003)***	(0.005)***	(0.002)***
Productivity	0.028	0.010	0.022	0.022	0.012	0.014	0.040	0.023
	(0.002)***	(0.003)**	(0.003)***	(0.008)**	(0.005)*	(0.005)**	(0.008)***	(0.002)***
Firm age	-0.000	0.006	0.002	0.016	0.016	0.011	-0.029	0.008
	(0.003)	(0.004)	(0.003)	(0.009)	(0.006)*	(0.007)	(0.009)**	(0.003)*
Multinational	0.020	0.027	0.029	0.011	0.050	0.019	0.024	0.018
	(0.008)*	(0.009)**	(0.008)***	(0.018)	(0.014)***	(0.014)	(0.017)	(0.008)*
Foreign	0.004	0.024	0.018	0.034	0.015	0.019	0.010	0.003
	(0.005)	(0.006)***	(0.005)***	(0.013)**	(0.009)	(0.009)*	(0.013)	(0.005)
IP active	0.034	0.031	0.033	0.037	0.035	0.037	0.043	0.048
	(0.005)***	(0.006)***	(0.005)***	(0.014)**	(0.009)***	(0.010)***	(0.013)**	(0.005)***
Observations	21251	20711	24869	4608	9240	8900	5564	25759
Region control	YES	YES	YES	YES	YES	YES	YES	YES
Year control	YES	YES	YES	YES	YES	YES	YES	YES
Sector control	YES	YES	YES	YES	YES	YES	YES	YES
Export in year of UKTI support	YES	YES	YES	YES	YES	YES	YES	YES

Table 26. Research aim (vi): First stage marginal effects for UKTI treatment effect by region – starters.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Do NOT export in year of support				
Dependent variable				Dummy variable for positive exports at t+2				
World Region	EU	USA	OECD	Brazil	China	India	Russia	RoWorld
UKTI	0.020	0.030	0.034	0.011	0.017	0.016	0.011	0.034
	(0.001)***	(0.002)***	(0.002)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.002)***
Export at n-1	0.034	0.059	0.065	0.028	0.040	0.038	0.030	0.064
	(0.002)***	(0.002)***	(0.002)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.002)***
Employment	0.005	0.009	0.008	0.003	0.004	0.004	0.003	0.008
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Productivity	0.007	0.006	0.008	0.003	0.004	0.004	0.003	0.008
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Firm age	-0.000	0.001	0.004	0.001	0.002	0.002	0.001	0.003
	(0.000)	(0.001)	(0.001)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.001)***
Multinational	-0.003	0.010	0.006	0.002	0.004	0.006	0.005	0.009
	(0.002)	(0.002)***	(0.002)**	(0.001)**	(0.001)**	(0.001)***	(0.001)***	(0.002)***
Foreign	0.011	0.022	0.019	0.006	0.009	0.010	0.006	0.017
	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***
IP active	0.013	0.015	0.018	0.004	0.010	0.009	0.005	0.020
	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***
Observations	147088	147681	143474	163724	159098	158937	162775	142637
Region control	YES	YES	YES	YES	YES	YES	YES	YES
Year control	YES	YES	YES	YES	YES	YES	YES	YES
Sector control	YES	YES	YES	YES	YES	YES	YES	YES
Export in year of UKTI support	NO	NO	NO	NO	NO	NO	NO	NO

In a similar fashion to Tables 23 and 24, Tables 27/28 and 29/30 report the second stage PSM propensity scores and ATT estimations for the different countries for continuing exporters and starters, respectively. As can be appreciated, there are no strong effects of UKTI services in a particular country.[21] This seems to contrasts with the results presented above where we do find an impact of UKTI services when considering countries altogether. One possible way to reconcile the two results is the following. From Table 18 it emerges that UKTI services impact firm exports mainly through the expansion in the number of destination countries. Therefore, when considering

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[21] Exceptions are China and India in Table 29 and other OECD countries and the US in Table 30. This might reflect the larger market potential offered by these countries and regions, to which firms already exporting are being further exposed through UKTI support.

a specific market one can fail to find an impact because UKTI impacts exports across rather than within a market. This is the more so given that here we are not considering a market-specific UKTI support as we do later on.

Table 27. Research aim (vi): Propensity score matching estimators for UKTI treatment effect by destination- continuing exporters.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Export in year of support				
				Propensity score				
Size band	EU	USA	OECD	Brazil	China	India	Russia	RoWorld
Employment	-0.086	0.036	-0.019	0.105	0.018	0.064	0.054	-0.023
	(0.010)***	(0.008)***	(0.008)*	(0.016)***	(0.012)	(0.012)***	(0.015)***	(0.008)**
Productivity	-0.262	-0.056	-0.186	0.030	-0.072	-0.033	-0.084	-0.188
	(0.013)***	(0.012)***	(0.012)***	(0.025)	(0.018)***	(0.017)	(0.024)***	(0.011)***
Firm age	-0.069	-0.126	-0.147	-0.119	-0.135	-0.123	0.041	-0.196
	(0.016)***	(0.016)***	(0.015)***	(0.029)***	(0.021)***	(0.022)***	(0.027)	(0.015)***
Multinational	0.219	0.140	0.124	0.233	0.179	0.216	0.296	0.212
	(0.032)***	(0.031)***	(0.030)***	(0.053)***	(0.041)***	(0.041)***	(0.049)***	(0.029)***
Foreign	-0.171	-0.291	-0.278	-0.320	-0.248	-0.299	-0.195	-0.147
	(0.022)***	(0.022)***	(0.021)***	(0.042)***	(0.031)***	(0.031)***	(0.038)***	(0.021)***
IP active	0.073	0.187	0.088	0.135	0.167	0.138	0.089	-0.017
	(0.024)**	(0.023)***	(0.022)***	(0.044)**	(0.031)***	(0.032)***	(0.041)*	(0.022)
Inverse Mills ratio	-4.923	-2.402	-4.118	-1.011	-1.544	-1.703	-1.346	-4.067
	(0.140)***	(0.064)***	(0.086)***	(0.087)***	(0.075)***	(0.069)***	(0.092)***	(0.085)***
Constant	2.138	0.666	1.925	-0.319	0.835	0.356	0.234	2.075
	(0.132)***	(0.100)***	(0.106)***	(0.211)	(0.151)***	(0.149)*	(0.205)	(0.105)***
Observations	21252	20713	24869	4615	9241	8903	5564	25760
Year control	YES	YES	YES	YES	YES	YES	YES	YES
Export in year of UKTI support	YES	YES	YES	YES	YES	YES	YES	YES

Table 28. Research aim (vi): Propensity score matching estimators for UKTI treatment effect by destination- starters.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Do NOT export in year of support				
				Propensity score				
Size band	EU	USA	OECD	Brazil	China	India	Russia	RoWorld
Employment	-0.007	-0.204	-0.104	-0.068	-0.047	0.004	-0.057	-0.148
	(0.005)	(0.006)***	(0.006)***	(0.005)***	(0.005)***	(0.004)	(0.005)***	(0.006)***
Productivity	-0.197	-0.232	-0.192	-0.168	-0.140	-0.067	-0.178	-0.266
	(0.007)***	(0.008)***	(0.007)***	(0.006)***	(0.006)***	(0.006)***	(0.006)***	(0.008)***
Firm age	-0.060	-0.109	-0.181	-0.155	-0.154	-0.014	-0.159	-0.190
	(0.011)***	(0.012)***	(0.012)***	(0.010)***	(0.010)***	(0.009)	(0.010)***	(0.013)***
Multinational	0.639	0.080	0.309	0.191	0.276	0.219	0.035	0.193
	(0.029)***	(0.033)*	(0.033)***	(0.025)***	(0.026)***	(0.026)***	(0.025)	(0.035)***
Foreign	-0.100	-0.796	-0.404	-0.397	-0.250	-0.164	-0.326	-0.446
	(0.019)***	(0.024)***	(0.023)***	(0.017)***	(0.017)***	(0.017)***	(0.017)***	(0.024)***
IP active	0.158	-0.142	-0.019	0.118	0.028	0.241	0.123	-0.091
	(0.019)***	(0.022)***	(0.022)	(0.016)***	(0.017)	(0.016)***	(0.016)***	(0.023)***
Inverse Mills ratio	-1.294	-2.358	-1.799	-1.908	-1.598	-1.200	-1.769	-2.037
	(0.017)***	(0.025)***	(0.021)***	(0.017)***	(0.017)***	(0.013)***	(0.018)***	(0.025)***
Constant	2.420	5.540	3.702	4.901	3.458	1.478	4.536	4.737
	(0.082)***	(0.104)***	(0.091)***	(0.081)***	(0.079)***	(0.061)***	(0.083)***	(0.104)***
Observations	147159	147698	143542	163796	159170	159508	162847	142651
Year control	YES	YES	YES	YES	YES	YES	YES	YES
Export in year of UKTI support	NO	NO	NO	NO	NO	NO	NO	NO

Table 29. Research aim (vi): Propensity score matching estimators for UKTI treatment effect by destination- starters.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Export in year of support				
				Nearest neighbour matching (random draw)				
				Average treatment effect on the treated				
				(ATT)				
Outcome variable for treatment	EU	USA	OECD	Brazil	China	India	Russia	RoWorld
Change Total exports	0.026	0.026	-0.024	0.089	0.149	-0.018	0.035	0.056
ln(exports)	(0.029)	(0.046)	(0.048)	0.093	(0.070)**	(0.067)	(0.082)	(0.044)
Change Number of countries	0.020		0.018					0.028
ln(# countries)	(0.013)		(0.016)					(0.018)
Change Number of products per country	0.017	0.027	0.024	0.050	0.051	0.056	0.043	0.028
ln(# products)	(0.012)	(0.022)	(0.017)	0.037	(0.029)*	(0.029)**	(0.038)	(0.014)**
Change Intensive margin	-0.012	-0.001	-0.066	0.039	0.098	-0.074	-0.008	-0.001
ln(exports per country per product)	(0.025)	(0.040)	(0.039)	0.082	(0.062)*	(0.060)	(0.071)	(0.036)
Treated observations	3956	4039	4760	1076	2055	1975	1201	4919
Untreated observations	2570	2521	2567	699	1326	1242	782	2698

Table 30. Research aim (vi): Propensity score matching estimators for UKTI treatment effect by destination- starters.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Do NOT export in year of support				
				Nearest neighbour matching (random draw)				
				Average treatment effect on the treated				
				(ATT)				
Outcome variable for treatment	EU	USA	OECD	Brazil	China	India	Russia	RoWorld
Change Total exports	-0.308	0.527	0.214	-0.345	-0.069	-0.090	0.099	0.123
ln(exports)	(0.183)	(0.210)**	(0.150)	(0.238)	(0.147)	(0.131)	(0.179)	(0.225)
Change Number of countries	0.132		0.106					0.077
ln(# countries)	(0.081)		(0.038)***					(0.072)
Change Number of products per country	-0.254	0.128	0.024	-0.087	-0.044	-0.051	-0.023	0.076
ln(# products)	(0.081)	(0.069)*	(0.035)	(0.064)	(0.043)	(0.041)	(0.066)	(0.044)*
Change Intensive margin	-0.186	0.399	0.084	-0.258	-0.026	-0.039	0.122	-0.030
ln(exports per country per product)	(0.151)	(0.180)**	(0.121)	(0.217)	(0.132)	(0.117)	(0.157)	(0.183)
Treated observations	443	691	633	466	656	607	502	610
Untreated observations	319	437	445	234	403	404	280	431

Following on the previous line on enquiry, the detail of the data is exploited even further by investigating whether market-specific UKTI support has an impact on exports to that particular market. Table 31 contains marginal effects of the first stage probit model for continuing (column (1)) and starting (column (2)) exporting in a particular destination at time t+2. The structure of the model is as for Table 16, except that here the outcome variable is whether the firm exported to the specific market at t+2, and the main regressor is a dummy indicating whether a firm received UKTI support for that specific region in year t or not. In this case the exclusion restriction consists in having exported in that specific destination at time t-1 (i.e. a year before the support - shown as 'n-1' in the table).

Thus the first row shows that a firm which was already exporting to the market to which the market-specific support related, is 4.7% more likely to still be doing so 2 years later, while if the firm was not already exporting to that market, the additional probability that it will be doing so 2 years later is smaller, at 2.1%.

Table 31. Research aim (v): First stage marginal effects for region-specific UKTI treatment effect on region-specific exports.

	(1)	(2)
	Export at t+2	
	Exported to the destination in year of UKTI support	
	yes	no
UKTI	0.047	0.021
	(0.006)***	(0.000)***
Export at n-1	0.214	0.043
	(0.003)***	(0.001)***
Employment	0.025	0.005
	(0.001)***	(0.000)***
Productivity	0.022	0.005
	(0.002)***	(0.000)***
Firm age	0.007	0.002
	(0.002)***	(0.000)***
Multinational	0.003	0.005
	(0.005)	(0.001)***
Foreign	0.022	0.012
	(0.003)***	(0.000)***

IP active	0.034	0.010
	(0.003)***	(0.000)***
Observations	95861	1225426
R2	0.101	0.222
Region control	YES	YES
Year control	YES	YES
Sector control	YES	YES
Export in year of UKTI support	YES	NO

The marginal effects reported show that market-specific UKTI support helps firms to both start and continue exporting in that market. Comparing the results with Table 16 shows that these effects are somewhat smaller than when the outcome variable was whether the firm was exporting at all (i.e. to any market) in t+2.

Table 32. Research aim (v): Second stage for region-specific UKTI treatment effect on region-specific exports: logit predicting propensity scores for UKTI treatment

	(1)	(2)
	Propensity score	
	Export to the market in year of UKTI support	Do not export to the market in year of UKTI support
Employment	0.075	-0.130
	(0.005)***	(0.002)***
Productivity	-0.097	-0.275
	(0.008)***	(0.003)***
Firm age	-0.065	-0.185
	(0.010)***	(0.005)***
Multinational	0.295	0.199
	(0.020)***	(0.012)***
Foreign	-0.229	-0.556
	(0.015)***	(0.009)***
IP active	0.293	-0.074
	(0.015)***	(0.008)***
Inverse Mills ratio	-0.815	-2.374
	(0.049)***	(0.010)***
Constant	-0.982	7.032
	(0.094)***	(0.049)***
Observations	95862	1225426
R2	0.0876	0.4188
Year control	YES	YES
Region control	YES	YES

Table 33. Research aim (vi): Propensity score matching estimators for market-specific UKTI treatment effect.

	Nearest neighbour matching (random draw)	
	Average treatment effect on the treated	
	(ATT)	
	Export to the market in year of UKTI support	
Outcome variable for treatment	YES	NO
Change Total exports	0.078	0.246

ln(exports)	(0.031)**	(0.069)***
Change Number of countries	0.004	0.063
ln(# countries)	(0.010)	(0.019)***
Change Number of products per country	0.031	0.050
ln(# products)	(0.012)***	(0.020)**
Change Intensive margin	0.044	0.132
ln(exports per country per product)	(0.026)*	(0.055)**
Treated observations	4153	3074
Untreated observations	3832	2288

Tables 32 and 33 presents the second-stage propensity score and PSM ATT results to be compared with results obtained with non-specific UKTI support in Tables 17 and 18.

In Table 32, it is interesting to note that the marginal effects for the inverse Mills ratio are again highly significant. As for Table 17, all of our other firm controls are also highly significant, but there is a greater difference between the R2 for the two groups of firms, with the model for firms **not** already exporting to the market – column (2), in Table 32 - showing a much higher R2 than for those who were already exporting to that market. This suggests that un-observed variables play a larger role in determining the probability of using this type of support for this group.[22]

Table 33 shows that in terms of initial exports and exports growth magnitudes are comparable to those obtained with non-specific support (reported in Tables 18 for exports to all markets, and Tables 29-30 for exports to each of the 8 country groups individually). Compared with results for exports to all markets, the marginal effects reported in Table 33 are smaller – an increase of 7.8% for firms already in the market, and 24.6% for those new to the market, but there is now a significant positive effect on the number of products exported to that country. At the same the dividing line between specific and non-specific UKTI support seems to lie in the product margin: market-specific UKTI support has a significant impact on the product margin for both exports level and growth.

When the comparison is with Tables 29-30, however, we see that while UKTI support in general did not have significant effects on exports to a specific country group, when the support is market specific we do find significant impact. Thus while Table 29, row 1, shows no significant effect on the value of exports to any of the 8 country groups, for firms already exporting to that country group, in Table 33 we do see significant effects for those already in the market. This suggests that UKTI support has an impact on exports to a specific market only if the support is focused on that specific market.

Balancing properties of the PSM are presented in Table 34 and in the following two figures.[23] Furthermore, Appendices E to G provide additional results obtained with other matching

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[22] It is also possible that firms who had used UKTI support prior to 2008, and who are therefore classified as non-users for our sample, could be more prominent in the group already exporting to that market by t, thus creating more 'noise' in the data for this group.

[23] Balancing issues arise as long as B>25% and/or R is outside [0.5; 2].

algorithms as well as the outcome of the confounder analysis. These additional results overall confirm findings of Table 33.

Table 34. Research aim (v): Balancing properties of PSM of Table 32

	Propensity Score R^2	Likelihood Ratio chi-square	p> Chi-square	Mean Bias	Median Bias	B	R	% Variation
Exporting in year of UKTI support	0.001	7.40	0.965	0.9	0.9	6.0	1.10	100
Not exporting in year of UKTI support	0.002	16.53	0.417	2.1	1.7	10.4	0.91	75

Figure 4: Estimated propensity score for treated and control in the case of firms exporting in the year of UKTI support (7,985 firms)
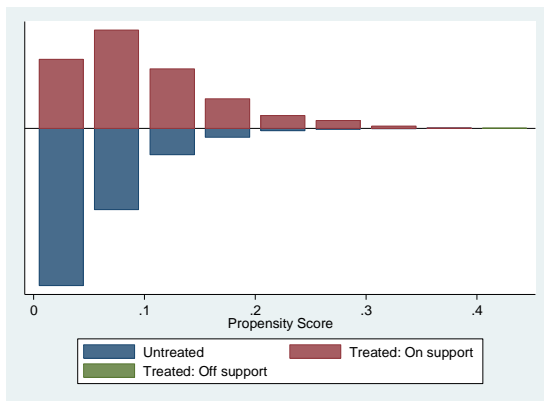
Figure 5: Estimated propensity score for treated and control in the case of firms not exporting in the year of UKTI support (5,362 firms)
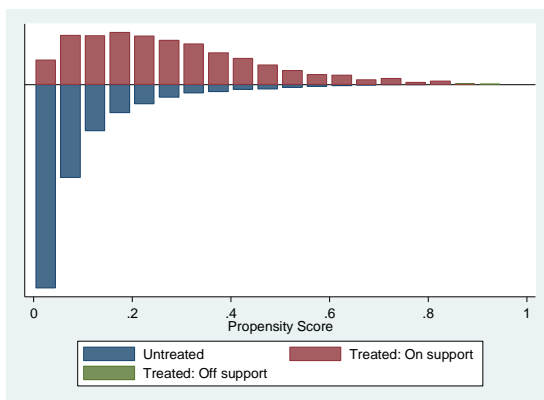
3.3.3   Research aim (vii)

"Does the use of multiple trade services enhance the impact on export growth at the intensive and extensive margins? and to what extent? What would be quantified estimates of any such enhanced impact?"

The use of multiple UKTI services helps firms to both start and continue exporting more than a less intensive use. In terms of initial exports and exports growth results are very noisy and no conclusion can be drawn.

In this section, we investigate whether the effect of UKTI services is enhanced when making use of more than one UKTI service in the same year. This research aim is analytical in nature. We use the same methodology of research aims v) and vi) while building on the relevant thresholds identified for research aim iv) to measure multiple use and employ it as the relevant policy treatment.

We again use HSM and PSM for our estimations while restricting the sample to UKTI users. The treated group consist here of MU UKTI firms while the control group consists of the 'nearest neighbour' among non- MU UKTI firms.

We again carry out separate analysis for the group who were already exporting at the time of support (t), 'continuing exporters' for which results are shown in column (1), and those not exporting at time t, shown in column (2). For this analysis, as for Tables 16 and 22, we are defining 'continuing exporters' and new exporters in terms of exports to any market.

Table 35. Research aim (vii): First stage marginal effects for multiple-use UKTI treatment effect on exports.

	(1)	(2)
	Export at t+2	
	Exported at time of support	
	Yes	no
MU UKTI	0.010	0.047
	(0.006)	(0.015)**
Export at n-1	0.130	0.157
	(0.009)***	(0.022)***
Employment	0.014	0.035
	(0.002)***	(0.005)***
Productivity	0.014	0.023
	(0.003)***	(0.006)***
Firm age	0.006	-0.021
	(0.004)	(0.011)
Multinational	-0.007	0.007
	(0.008)	(0.024)
Foreign	0.009	0.038
	(0.006)	(0.018)*
IP active	0.027	0.045
	(0.006)***	(0.016)**
Observations	6438	2536
R2	0.220	0.115
Region control	YES	YES
Year control	YES	YES
Sector control	YES	YES
Export in year of UKTI support	YES	NO

Table 36. Research aim (vii): Propensity score matching estimators for multiple-use UKTI treatment effect.

	(1)	(2)
	Propensity score	
	Export in year of UKTI support	Do not export in year of UKTI support
Employment	0.047	-0.129
	(0.012)***	(0.019)***
Productivity	0.041	-0.109
	(0.012)***	(0.022)***
Firm age	-0.089	0.034
	(0.018)***	(0.038)
Multinational	-0.028	-0.115
	(0.025)	(0.083)
Foreign	0.132	-0.182
	(0.045)**	(0.065)**
IP active	-0.212	-0.012
	(0.035)***	(0.060)
Inverse Mills ratio	0.176	-1.336
	(0.033)***	(0.093)***
Constant	0.323	2.690
	(0.147)*	(0.256)***
Observations	6498	2537
Year control	YES	YES

Table 35 reports marginal effects of the first stage probit model and shows that the use of multiple UKTI services helps firms to both start and continue exporting more as compared to firm using only one service. However, in terms of initial exports and exports growth (Table 37) there are no statistically significant coefficients and no conclusive statement can be made.

Table 37. Research aim (vii): Propensity score matching estimators for multiple-use UKTI treatment effect.

	Nearest neighbour matching (random draw)	
	Average treatment effect on the treated	
	(ATT)	
	Export in year of UKTI support	
Outcome variable for treatment	YES	NO
Change Total exports	-0.016	-0.243
ln(exports)	(0.044)	(0.458)
Change Number of countries	-0.008	-0.008
ln(# countries)	(0.019)	(0.179)
Change Number of products per country	-0.005	0.074
ln(# products)	(0.014)	(0.085)
Change Intensive margin	-0.004	-0.309
ln(exports per country per product)	(0.034)	(0.300)
Treated observations	3185	248
Untreated observations	1638	120

4. Measuring the cost of custom formalities and paperwork on UK imports at the product level

In this Section we attempt to measure the cost of custom formalities and paperwork in terms of foregone UK imports of goods. This is meant to provide a contribution to HMRC functions and in particular to tax policy making and development which is one key HMRC function. In order to address this issue we build on the analysis and model developed in Mion and Muûls (2013) that we briefly explain below. Compared to Mion and Muûls (2013) we extend here the analysis to the product dimension.

Mion and Muûls (2013) derive an econometric model based on the decomposition of exports into four margins provided by equation (1) above and subsequently estimate it using UK goods exports data over the period 2005-2011.[24] In the case of the intensive margin $\bar{x}$, one can start from the firm-country-product-year combinations x_{icpt} indicating export values of firm i in country c of product p in year t and, while bearing in mind that $\bar{x}$ is nothing else that the average of x_{icpt}, estimate the following (log-linear) model:

$$x_{icpt} = const * \mathbf{FC_{it}}^{\boldsymbol{\beta 1}} * \mathbf{CC_{ct}}^{\boldsymbol{\beta 2}} * \mathbf{PC_p}^{\boldsymbol{\beta 3}} * \mathbf{e}^{\boldsymbol{\delta t}} * \varepsilon_{icpt}, \tag{2}$$

where ε_{icpt} is an idiosyncratic error component. Mion and Muûls (2013) use the following vectors of controls:

- Firm characteristics $\mathbf{FC_{it}}$. They use firm size (measured by employees' number categories) and industry (measured by two-digit NACE rev 1.1 codes). Whenever information on firm size or industry is not available they associate observations to corresponding residual categories.
- Country characteristics $\mathbf{CC_{ct}}$. They use GDP per capita in current £, total GDP in current £, distance between country **c** capital and London, a common language dummy, an ex-colony dummy and country groups dummies referring to the following markets: the EU27, the US, other OECD countries, Brazil, China, India, Russia, the rest of the World (RoW).[25]
- Product characteristics $\mathbf{PC_p}$. They use product groups dummies referring to the following aggregates: Food, beverages and tobacco (SITC 0 + 1), Basic materials (SITC 2 + 4), Fuels (SITC 3), Semi-manufactures (SITC 5 + 6), Finished manufactures (SITC 7 + 8) and Miscellaneous (SITC 9).
- Time dummies $\boldsymbol{\delta_t}$.

Model (2) is log-linear and could in principle be estimated via OLS once taking logs of both sides. However, since Mion and Muûls (2013) are interested in reproducing closely export values rather than log exports values a Poisson model is used. More specifically, a Quasi-Maximum-Likelihood estimator is implemented along with robust standard-errors.

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[24] For exports towards EU countries Mion and Muûls use data over 2008-2011 only.
[25] GDP level and per capita data for the period 2005-2011 come from the World Outlook Database provided by the IMF. Data on distances, common language and ex-colonial status come from the CEPII database.

In the case of the product margin $\bar{p}$, Mion and Muûls (2013) start from the firm-country-year triples p_{ict} indicating the number of exported products of firm i in country c in year t and, while bearing in mind that $\bar{p}$ is nothing else that the average of p_{ict}, estimate the following model:

$$p_{ict} = const * \mathbf{FC_{it}}^{\beta 1} * \mathbf{CC_{ct}}^{\beta 2} * \mathbf{e}^{\delta t} * \varepsilon_{ict}, \tag{3}$$

where ε_{ict} is an idiosyncratic error component, $\mathbf{FC_{it}}$ and $\mathbf{CC_{it}}$ are the same firm and country covariates described above and $\boldsymbol{\delta_t}$ are time dummies. For the very same reasons as above they consider a Poisson model and estimate equation (3) in levels using a Quasi-Maximum-Likelihood estimator while considering robust standard-errors.

For the country margin a similar methodology applies:

$$c_{it} = const * \mathbf{FC_{it}}^{\beta 1} * \mathbf{e}^{\delta t} * \varepsilon_{it}, \tag{4}$$

where c_{it} indicates the number of countries firm i exports to in year t, $\bar{c}$ is the average of c_{it}, $\mathbf{FC_{it}}$ are the same firm covariates described above, ε_{it} is an idiosyncratic error component and $\boldsymbol{\delta_t}$ are time dummies. Again, Mion and Muûls (2013) use a Poisson model estimated via Quasi-Maximum-Likelihood while considering robust standard-errors.

The model Mion and Muûls (2013) develop can be used to evaluate the impacts of custom formalities and paperwork on the different margins of UK imports of goods, and to derive estimates of the potential impact on customs revenues which would be likely to result from changes in these customs formalities, so contributing to tax policy making and development which is one key HMRC function.

There is a literature in international trade documenting the importance of custom formalities and paperwork on trade volumes. Though, little evidence has so far been provided on the impact of custom formalities and paperwork on the different margins of trade: number of trading firms, traded products, number of markets and intensive margin. Whether custom formalities affect more the extensive or intensive margins is important to understand the costs and benefits, both static and dynamic, of their reduction, and the consequent likely effects on the flow of customs revenues and on the administrative costs for HMRC.

Suppose, for example, that custom formalities negatively affect the intensive margin only. In such a scenario, reducing them would simply have a static, i.e., once for all positive impact on trade values and, besides the cost cut due to the reduction of paperwork, virtually no change in the administrative burden for HMRC that will still provide custom services to the same exporting firms.

If custom formalities negatively affect also the extensive margin(s) there would be an additional static boost of trade (more firms trading more products to more countries) as well as some positive dynamic effects arising in the medium/long term. In this respect there are indeed a number of papers showing that exporting to one market opens up the door to exporting to other markets: sequential exporting, learning about demand, fixed costs sharing across similar markets.

Furthermore, the increase in the extensive margins will call everything else equal for a greater need of custom services by HMRC.

In order to provide a contribution to HMRC functions, and more precisely to tax policy making and development, Mion and Muûls (2013) have considered an additional regressor in the econometric models (2) to (4): the number of documents necessary to import which is part of the World Development Indicators and is provided by the World Bank for several countries and years. In their analysis they consider UK exports of goods across countries. However, UK exports represent imports for the receiving countries and are then subject to such documents. Therefore, by considering how this additional regressor affects imports of UK goods across countries, one can measure the impact of custom formalities and paperwork on the different margins of trade (country, product and intensive). By applying the estimated coefficients on UK imports of goods they ultimately obtain an estimate of the cost of UK custom formalities and paperwork in terms of foregone imports and related custom duties.

Mion and Muûls (2013) estimations indicate that each additional document decreases the intensive margin by roughly 4% and the country margin by roughly 4%. No significant effect is found for the product margin. These figures can be applied to extra-EU trade only and, reversing these estimations to UK imports, they get that the 4 documents currently required to import in the UK (7 documents is the world average with 2 documents for France and 5 for the US) correspond to (4+4) X 4=32% less imports from extra-EU countries. From HMRC revenue perspective, considering that collected customs duties in 2011/2012 amount to roughly 3 billion £, eliminating one of such four documents would increase revenues from custom duties by 240 million £.

Three comments one these numbers are made in Mion and Muûls (2013):

- First, this figure might well be considered an upper bound to the cost of formalities for UK imports. Nevertheless, its order of magnitude raises an important question about the cost of formalities in terms of foregone trade and custom revenues.
- Second, custom formalities and paperwork represent a compromise between different needs. On the one hand firms may dislike them. On the other hand formalities are needed, besides other things, to ensure tax compliance and the safety for UK consumers.
- Third, there is perhaps room for a policy change involving ways of simplifying the documentation such that the practical burden could be reduced, while still covering the same things.

Compared to Mion and Muûls (2013) we extend here the analysis to the product dimension. More specifically we estimate models (2) to (4) for each of the aggregate product categories used in Mion and Muûls (2013) and uncover significant differences. Below are the significant (at 10% confidence level) results we find:

1. Food, beverages and tobacco (SITC 0 + 1). No significant impact on any margin.

2. Basic materials (SITC 2 + 4). -3% on the country margin

3. Fuels (SITC 3). -30% on the intensive margin, -3% on the country margin

4. Semi-manufactures (SITC 5 + 6). -4.6% on the intensive margin, -5.5% on the country margin

5. Finished manufactures (SITC 7 + 8). -5.7% on the country margin

6. Miscellaneous (SITC 9). -4.6% on the country margin

All in all our findings indicate that the impact of custom formalities and paperwork on overall imports is mainly driven by Fuels and Semi-manufactures. The country margin is affected in all but one case (Food, beverages and tobacco) while the product margin is never affected. Last but not least the intensive margin response is particularly strong for Fuels. We believe the differential impact of custom formalities and paperwork across products that we uncover here calls for a product-specific policy to eventually reduce the current amount of UK imports paperwork.

5. Conclusions

This report uses firm-level trade data for the UK to gain a better understanding of whether the use of UKTI services impacts the level of, and growth in, the value of exports of goods among supported firms. It further decomposes the effect on the different export margins: number of countries, number of products per country, and the intensive margin. It explores in particular how these effects may vary across markets and size of exporters and differentiates between the intensity of use of services from UKTI.

Our descriptive statistics confirm that even when controlling for other firm characteristics, UKTI support is positively correlated with export activity. The main descriptive findings are:

- A UKTI firm exports on average more than a non-UKTI firm. It exports more to more countries though not more products. [Tables 1 and 2]

- Conditional on firm-level controls UKTI firms export more, to more market, and more products. [Table 5]

- Two years after receiving support UKTI firms exporting at the time of the support experience a stronger export growth than non-UKTI firms. This comes mainly from a stronger growth in the number of markets. [Table 9]

- Two years after receiving support UKTI firms NOT exporting at the time of the support export more, to more markets and more products than non-UKTI firms. [Table 10]

- UKTI firms are more likely to export than non-UKTI firms to each of the 8 markets we consider. This is true both in the year of support and two years later. [Table 7]

- Multiple-use (MU) UKTI firms export more, more products and (especially) to more markets than non-MU UKTI firms. [Table 11]

- MU UKTI firms do not seem to perform better than non-MU UKTI firms after two years from support. This is true for both firms exporting and non-exporting at the time of UKTI support. [Tables 12 and 13]

- MU UKTI firms are more likely to export to each of the 8 markets we consider than non-MU UKTI firms. This is true both in the year of support and two years later. EU as a market is a bit special in that differences between MU UKTI firms and non-MU UKTI firms are weaker than for other markets. [Table 14]

An econometric model using an HSM and a PSM was implemented to investigate the causal effect of UKTI support. We find that using UKTI services has an impact on a firm's goods exports. The analysis shows that:

- UKTI support helps firms to both start and continue exporting. [Table 16]
- UKTI support helps firms to both start with higher exports and to grow their current exports more. The destination and intensive margins are particularly affected. [Table 18]

- UKTI support helps firms of all sizes to both start and continue exporting. Magnitudes are pretty similar across firm size groups. [Table 22]

- UKTI support helps firms to both start and continue exporting in each of the 8 markets we consider. Magnitudes are pretty similar across markets. [Tables 25 and 26]

- When differentiating by firm size or by destination market, no strong statement can be made about initial exports and exports growth. [Tables 24, 29 and 30]
- Market-specific UKTI support helps firms to both start and continue exporting in that market. [Table 31]
- In terms of initial exports and exports growth magnitudes for market-specific UKTI support are comparable to those obtained with non-specific support suggesting that UKTI support has an impact on firm exports spanning well beyond the specific market for which support has been obtained. [Table 33]
- Use of multiple UKTI services helps firms to both start and continue exporting more than a less intensive services use. In terms of initial exports and exports growth results are very noisy and no conclusion can be drawn. [Tables 35, 36 and 37]

Overall, we do find strong evidence that the use of UKTI services positively affects firms' goods exports performance along different margins as well as across different markets and groups of firms. Another important feature of our analysis is that the impact of UKTI support spans on both prospective exporters and more established ones. On this point, we sometimes find stronger magnitudes for prospective exporters. For example, in Table 18 we find that UKTI services increase exports growth of current exporters by 8.8% while increasing the level of exports of new exporters by 46.4%. One way of interpreting such result would see UKTI's best interest served by concentrating more efforts and resources on currently non-exporting firms rather than firms already exporting. However, we do not believe this would be a wise policy. First, as shown in Mion and Muûls (2013), the contribution to UK aggregate exports' growth over time is equal among current and prospective exporters meaning that the two firm types are equally important in generating exports' growth. Second, as shown in Mion and Muûls (2013), new UK exporters typically struggle to keep exporting over a long period of time meaning that many such firms are needed to generate a substantial long-term exports growth. Last but not least, as shown in Mion and Muûls (2013), firms who start exporting trade much less than established exporters meaning that a larger % impact of UKTI services for new exports does not necessarily translate into a higher overall export value impact for them.

All in all we believe that the current policy of supporting all firms with a current or prospective interest in exporting irrespective of the exporting market and firm size is the wise policy.

In Section 4 we attempt to measure the cost of custom formalities and paperwork in terms of foregone UK imports of goods. This is meant to provide a contribution to HMRC functions and in particular to tax policy making and development which is one key HMRC function. In order to address this issue we build on the analysis and model developed in Mion and Muûls (2013). Compared to Mion and Muûls (2013) we extend the analysis to the product dimension.

Our findings indicate that the impact of custom formalities and paperwork on overall imports is mainly driven by Fuels and Semi-manufactures. The country margin is affected in all but one case (Food, beverages and tobacco) while the product margin is never affected. Last but not least the intensive margin response is particularly strong for Fuels. We believe the differential impact of custom formalities and paperwork across products that we uncover here calls for a product-specific policy to eventually reduce the current amount of UK imports paperwork.

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Appendix

A. Sensitivity analysis of PSM: Confounder estimations

Applying the approach developed by Ichino, Mealli and Nannicini (2006), Tables A1 and A2 report the ATT as well as the outcome effect and the selection effect of the simulated confounder effect. The ATT on total exports is 6.1% instead of 8.8% reported in Table 19.

Table A1. Research aim (v): Sensitivity analysis for firms exporting in the year of UKTI support

	Change Total exports	Change Number of countries	Change Number of products per country	Change Intensive margin
ATT	0.061	0.037	0.004	0.020
	(0.028)**	(0.012)***	(0.010)	(0.022)
Outcome effect of the simulated confounder	1.031	1.030	1.131	0.993
Selection effect of the simulated confounder	1.940	1.954	1.936	1.935
Observations	10233	10233	10233	10233

Table A2. Research aim (v): Sensitivity analysis for firms not exporting in the year of UKTI support

	Total exports	Number of countries	Number of products per country	Intensive margin
ATT	0.391	0.280	0.001	0.110
	(0.208)*	(0.076)***	(0.051)	(0.151)
Outcome effect of the simulated confounder	1.052	1.250	1.054	1.018
Selection effect of the simulated confounder	1.853	1.830	1.863	1.880
Observations	878	878	878	878

B. Robustness of PSM: Caliper matching algorithm

Table B1. Research aim (v): Caliper matching

	Nearest neighbour matching (random draw) no IM	
	Average treatment effect on the treated (ATT)	
	Export in year of UKTI support	
Outcome variable for treatment	YES	NO
Change Total exports	0.044	0.474
ln(exports)	(0.028)	(0.184)**
Change Number of countries	0.016	0.240
ln(# countries)	(0.012)	(0.068)***
Change Number of products per country	0.013	0.014
ln(# products)	(0.009)	(0.046)
Change Intensive margin	0.016	0.220
ln(exports per country per product)	(0.021)	(0.128)*
Treated observations	6109	489
Untreated observations	4923	436

Figure B1: Estimated score for treated and control in the case of firms exporting in the year of UKTI support (11,032 firms)
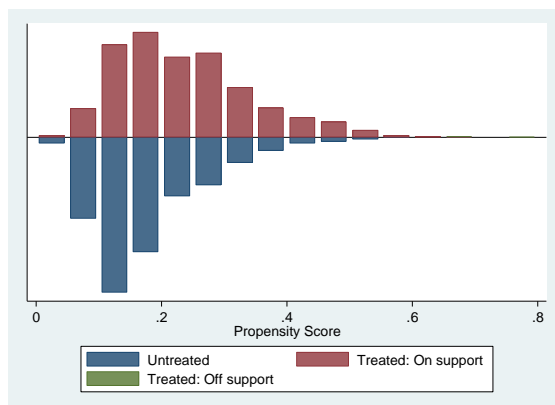
Figure B2: Estimated score for treated and control in the case of firms not exporting in the year of UKTI support (925 firms)
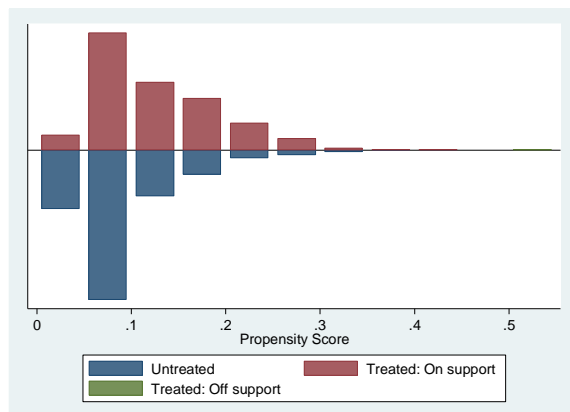
Table B2. Balancing properties of Caliper matching in Table B1

	Propensity Score R^2	Likelihood Ratio chi-square	p> Chi-square	Mean Bias	Median Bias	B	R	% Variation
Exporting in year of UKTI support (11,032 firms)	0.000	4.19	0.840	1.0	1.0	3.7	0.98	33
Not exporting in year of UKTI support (925 firms)	0.004	5.97	0.650	4.5	3.4	15.7	0.92	33

C. Robustness of PSM: Radius matching algorithm

Table C1. Research aim (v): Radius matching

	Radius Matching Average treatment effect on the treated (ATT)	
	Export in year of UKTI support	
Outcome variable for treatment	YES	NO
Change Total exports	0.075	0.331
ln(exports)	(0.019)***	(0.140)***
Change Number of countries	0.034	0.229
ln(# countries)	(0.008)***	(0.054)***
Change Number of products per country	0.011	0.012
ln(# products)	(0.006)*	(0.029)
Change Intensive margin	0.030	0.090
ln(exports per country per product)	(0.015)**	(0.094)
Treated observations	6066	488
Untreated observations	25912	4113

Table C2. Balancing properties of Radius matching in Table C1

	Propensity Score R^2	Likelihood Ratio chi-square	p> Chi-square	Mean Bias	Median Bias	B	R	% Variation
Exporting in year of UKTI support (31,978 firms)	0.037	618.21	0.000	12.9	3.8	46.0	1.31	75
Not exporting in year of UKTI support (4,601 firms)	0.005	7.37	0.598	3.4	3.0	17.4	1.65	25

Figure C1: Estimated score for treated and control in the case of firms exporting in the year of UKTI support (31,978 firms)
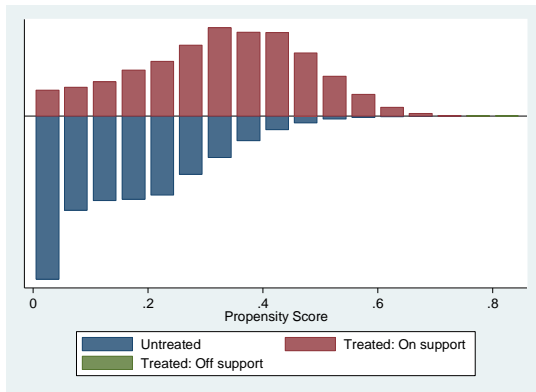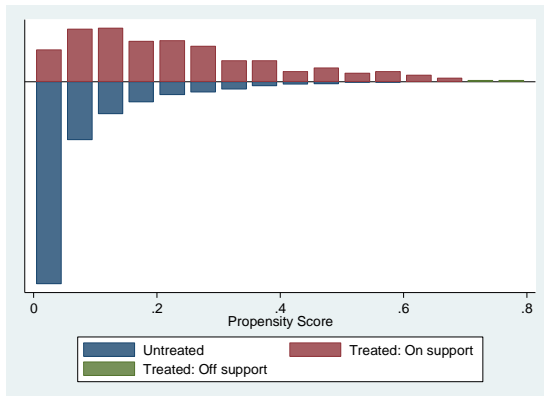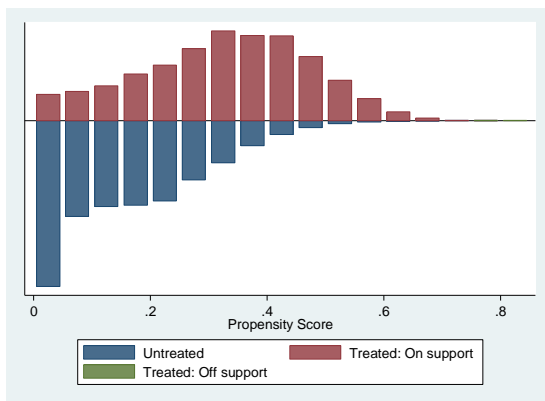

Figure C2: Estimated score for treated and control in the case of firms not exporting in the year of UKTI support (4,601 firms)

D. Robustness of PSM: Kernel matching algorithm

Table D1. Research aim (v): Kernel matching

	Kernel Matching Average treatment effect on the treated (ATT)	
	Export in year of UKTI support	
Outcome variable for treatment	YES	NO
Change Total exports	0.060	0.471
ln(exports)	(0.021)***	(0.200)**
Change Number of countries	0.032	0.273
ln(# countries)	(0.009)***	(0.049)***
Change Number of products per country	0.007	0.028
ln(# products)	(0.005)	(0.035)
Change Intensive margin	0.022	0.170
ln(exports per country per product)	(0.012)*	(0.074)**
Treated observations	6066	488
Untreated observations	25912	4113

Table D2. Balancing properties of Kernel matching in Table D1

	Propensity Score R²	Likelihood Ratio chi-square	p> Chi-square	Mean Bias	Median Bias	B	R	% Variation
Exporting in year of UKTI support (31,978 firms)	0.027	461.68	0.000	9.0	8.7	39.4	1.36	100
Not exporting in year of UKTI support (4,601 firms)	0.018	24.54	0.004	7.4	5.6	31.9	0.95	50

Figure D1: Estimated score for treated and control in the case of firms exporting in the year of UKTI support (31,978 firms)

Figure D2: Estimated score for treated and control in the case of firms not exporting in the year of UKTI support (4,601 firms)
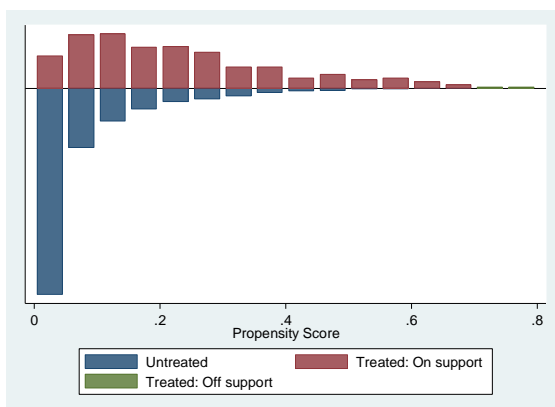
E. Robustness of PSM for market specific UKTI support: Radius matching algorithm

Table E1. Research aim (vb): Radius matching

	Radius matching Average treatment effect on the treated (ATT)	
	Export in year of UKTI support	
Outcome variable for treatment	YES	NO
Change Total exports	0.054	0.166
ln(exports)	(0.022)**	(0.044)***
Change Number of countries	0.008	0.016
ln(# countries)	(0.006)	(0.013)
Change Number of products per country	0.022	0.036
ln(# products)	(0.008)***	(0.013)***
Change Intensive margin	0.024	0.114
ln(exports per country per product)	(0.019)	(0.035)***
Treated observations	4153	3074
Untreated observations	66155	20668

Table E2. Balancing properties of Radius matching in Table E1

	Propensity Score R²	Likelihood Ratio chi-square	p> Chi-square	Mean Bias	Median Bias	B	R	% Variation
Exporting in year of UKTI support (70,308 firms)	0.009	99.23	0.000	5.6	4.9	21.9	0.85	50
Not exporting in year of UKTI support (23,742 firms)	0.004	33.39	0.007	3.4	3.1	14.8	0.99	50

Figure E1: Estimated score for treated and control in the case of firms exporting in the year of UKTI support (70,308 firms)
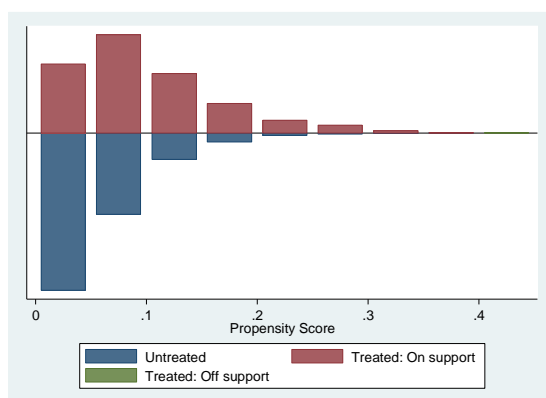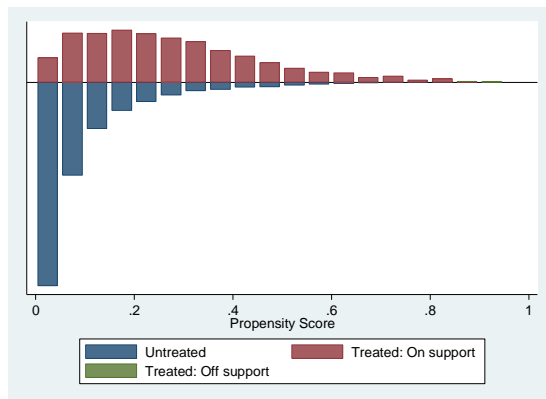
Figure E2: Estimated score for treated and control in the case of firms not exporting in the year of UKTI support (23,742 firms)

F. Robustness of PSM Extra RQ5: Kernel matching algorithm

Table F1. Research aim (vb): Kernel matching

	Kernel matching Average treatment effect on the treated (ATT)	
	Export in year of UKTI support	
Outcome variable for treatment	YES	NO
Change Total exports	0.053	0.173
ln(exports)	(0.025)*	(0.058)**
Change Number of countries	0.008	0.050
ln(# countries)	(0.006)	(0.011)***
Change Number of products per country	0.021	0.027
ln(# products)	(0.007)**	(0.010)**
Change Intensive margin	0.024	0.097
ln(exports per country per product)	(0.017)	(0.024)***
Treated observations	4153	3074
Untreated observations	66155	20668

Table F2. Balancing properties of Kernel matching in Table F1

	Propensity Score R^2	Likelihood Ratio chi-square	p> Chi-square	Mean Bias	Median Bias	B	R	% Variation
Exporting in year of UKTI support (70,308 firms)	0.047	546.43	0.000	13.5	12.7	52.2	0.89	100
Not exporting in year of UKTI support (23,742 firms)	0.011	93.55	0.000	5.3	4.6	24.8	0.94	75

Figure F1: Estimated score for treated and control in the case of firms exporting in the year of UKTI support (70,308 firms)
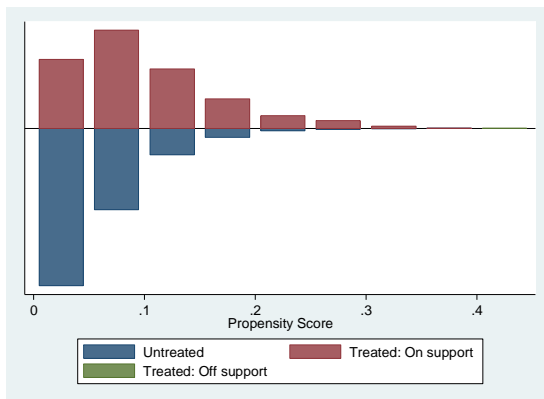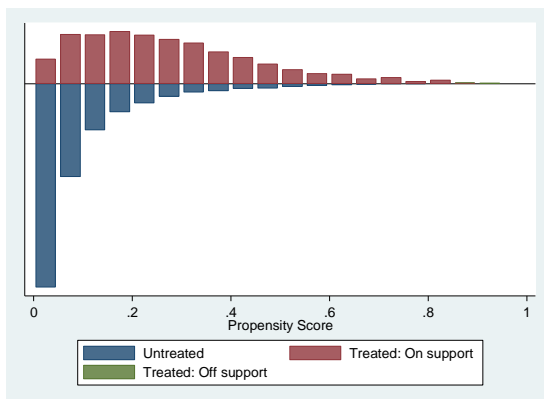

Figure F2: Estimated score for treated and control in the case of firms not exporting in the year of UKTI support (23,742 firms)

G. Sensitivity analysis of PSM: Confounder estimations

Table G1. Research aim (vb): Sensitivity analysis for firms exporting in the year of market specific UKTI support

	Change Total exports	Change Number of countries	Change Number of products per country	Change Intensive margin
ATT	0.032	0.006	0.018	0.009
	(0.031)	(0.010)	(0.012)	(0.026)
Outcome effect of the simulated confounder	1.009	0.912	0.916	1.012
Selection effect of the simulated confounder	1.899	1.888	1.909	1.901
Observations	7985	7985	7985	7985
Treated	4153	4153	4153	4153

Table G2. Research aim (vb): Sensitivity analysis for firms not exporting in the year of UKTI support

	Change Total exports	Change Number of countries	Change Number of products per country	Change Intensive margin
ATT	0.192	0.064	0.030	0.099
	(0.069)***	(0.019)***	(0.020)*	(0.056)*
Outcome effect of the simulated confounder	0.995	0.868	1.093	0.983
Selection effect of the simulated confounder	1.836	1.853	1.862	1.888
Observations	5362	5362	5362	5362
Treated	3074	3074	3074	3074

Appendix H: Orbis Database

What information does orbis contain?

The reports are in a standard format with up to 10 years' history.* There are various default reports and you can create your own.

- General contact information and summary of company's details and incorporation including address, phone number, email address, URL plus a link to the company's location on Google maps

- Unique identifiers: crucial for integration projects, each company in Orbis has a BvD ID number, created from its national company number. We're working with parties involved in the LEI project and Orbis includes the CICI number (CFTC Interim Compliant Identifier).

- Industry and activities including primary and secondary codes in several local and international classifications plus trade description

- Links to: the EIU Country Profile with indicators about the company's country such as population and GDP, EIU Country Outlook offering opinion on issues such as political stability and international relations

- Overview – millions of companies have a detailed overview covering history, activities, scope of operations, business lines and so on

- Financials, in specific formats for corporates, banks and insurance companies. The corporate format is:
  - Balance sheet   26 items
  - P&L account   25 items
  - Ratios   26 ratios

- Own data section where you can create your own ratios and create your own data fields to populate with data you hold

- Graphs within the report show key financial variables over time

- Financial strength section, includes various indicators such as probability of default and propensity to be sold

- Board members, management, contacts, auditors and advisors

- Mergers and acquisitions deals and rumours from our Zephyr database. The full Zephyr database is also within Orbis, with its searching and analysis options

- A news service that collates stories from sources such as Reuters, the Financial Times, Newsedge, Zephyr and Dow Jones Newswires. The service is updated every 15 minutes.

Not all report sections are complete due to country specific legal restrictions. Some companies have summary reports, some have no financial data.

* We can provide more years of data on application.

- Corporate ownership information
  - Shareholdings and subsidiaries
  - Direct and indirect ownership
  - Ultimate owner
  - Independence indicator
  - Corporate group, all companies with the same ultimate owner as the subject company
  - Company tree diagrams
  - Beneficial ownership section
  - Ability to calculate ownership using either 'bottom up' or 'top down' approaches
  - Ability to edit definitions of owership

- Independent industry and market research from various providers, including SWOT analyses

- Peer group report – automatically compares the subject company to suggested peers

- Original documents – a vast library of locally filed "scanned images", PDFs of annual reports plus links to documents filed at registries

- Royalty Agreements – information on licensing agreements and royalty rates involving the company

- Graphics – illustrate the balance sheet, profit and loss account and any financial item over time as a value or index

- Patents associated with companies

- Private equity portfolios

Listed companies have the following additional sections:

- Description and history
- Segment data
- Cash flow
- More detailed accounts
- Customers, competitors and future outlook
- Stock data including security and price details, current stock data, annual stock data, current stock valuation, monthly, weekly and daily pricing series
- Full-colour scanned, annual, interim and quarterly reports plus Corporate and Social Responsibility Reports. These are also available for many delisted companies
- Ratings, updated daily