



Virtual Micro Data Laboratory Data Brief 2: Summer 2007

Business Utilisation of ICT: Insights from the Ecommerce Survey

Robert Gilhooly

The purpose of the ONS Ecommerce Survey is to collect information on which technologies UK businesses have, how these technologies have been used and the level of that use. This data brief provides an overview of the Ecommerce data set that is accessible to researchers through the Virtual Microdata Laboratory (VML). We firstly summarize the content of the Ecommerce survey, including the years in which the survey was conducted, the main topics covered by the survey, the years for which data is available, the available sample size and the nature of links that can be made to other ONS data sets. We then provide a brief summary of previous research undertaken using this data. We finally present the results of statistical analysis which considers the factors contributing to firms' decisions to adopt electronic networks as part of their business model.

1. The Ecommerce Survey

The first Ecommerce survey was conducted in 2000. The survey covers UK businesses (including foreign owned businesses) except where the coverage is specified as Great Britain or Northern Ireland only. The business unit is the company, partnership, sole proprietorship or firm. The 2000 survey covered businesses with more than ten in employment whilst the 2001 and 2002 surveys covered businesses of all sizes. The ONS Inter-Departmental Business Register is used as the sampling frame. The survey refers to the year from 1 January to 31 December.

The 2000 and 2001 surveys are classed as "experimental" and were subject to significant revisions. A feature of the ecommerce survey is that the survey has been subject to a number of revisions each year. The surveys for 2002 onwards exhibit the greatest degree of continuity. The 2005 survey asks businesses about their use of ICT, including issues surrounding IT security, internet access and type of connection, the availability of a website, use of ICT by staff, remote access and perceptions of skill gaps with respect to use of ICT. The survey then asks how businesses use ICT in the placing and receipt of orders, whether these ordering systems link automatically to other business systems and how these systems have replaced postal mail. Finally, businesses are asked whether they have used the internet to interact with public authorities.

Table 1 presents the available sample sizes from the Ecommerce survey. It can be seen that following its introduction in 2000, the realized sample for ecommerce was approximately 9,500-10,000. However, in 2005 the sample size fell to 7,200, comparable to the size of the first Ecommerce survey in 2000. Due to the sample design, it is possible to create panel data sets based upon the ecommerce data set. Table 1 also shows the number of occurrences with which individual units appear within later surveys. The numbers of occurrences do not necessarily relate to sequential observations, but can also relate to units who appear in the sample intermittently. It can be seen that of the 6,200 reporting units appearing within the 2004 survey, over half also appeared within the 2005 survey.

Table 1: Ecommerce Survey Sample

	Number of times a Reporting Unit appears in the survey ¹						Total
	1	2	3	4	5	6	
2000	3,592	1,654	892	416	394	371	7,319
2001	5,673	1,721	892	548	589		9,423
2002	5,353	1,739	667	909			8,668
2003	5,972	2,360	1,602				9,934
2004	6,226	3,578					9,804
2005	7,231						7,231

1. Reporting Unit will be synonymous with the Business Unit in a majority of cases.

2. Links to Other Business Surveys

The IDBR is the key sampling frame for business surveys within ONS. Enterprises appearing within ONS surveys are assigned a unique IDBR reference number which can facilitate linking of information on the same enterprise between surveys. Such linking provides the opportunity to explore additional research questions that otherwise would not have been possible. The largest and most comprehensive ONS business survey is the Annual Business Inquiry. This survey includes information on turnover, costs, employment and investment. Due to the size and content of this survey, the ABI generally forms the spine against which most linking activity takes place. Responses to the Ecommerce survey can therefore be linked to information on these organizations collected from the ABI.

Within the VML, information from the ABI is held in the Annual Respondents Database (ARD). To reduce compliance costs, the ABI is not a census of all businesses, with smaller reporting units being sampled. Within the ARD there are therefore two types of enterprise. Information collected directly from the survey returns of the ABI are held on the 'selected files' of the ARD. Information on those organizations included within the ABI survey universe but which are not included within the actual survey during a given year are held on the 'non-selected' files. By including information from the 'non-selected' ARD files, the coverage of the ARD is broadened considerably. However, the range of data items held on the non-selected files is more limited. Measures of employment and turnover derived directly from the data sources used to construct the IDBR are available. The quality of this information is, however, inferior to that collected directly from the survey returns of the ABI.

In examining the nature of links that can be made between the Ecommerce survey and the ARD, it is important to take into account whether these links can be made to the selected or non-selected files. In Table 2 we consider the links that can be made

between the Ecommerce Survey and the ARD at the level of the reporting unit. It can be seen from Table 2 that 75-85% of firms in the first three Ecommerce surveys can be linked to the ARD; this figure subsequently rises to 95% for the 2003 and 2004 surveys. Only 25% of firms can be linked to the selected ARD files from the 2000 survey; however, the matching rate improves in the following years to 35-40%.

Table 2: Ecommerce Survey Sample and Links to the Annual Respondents Database

year	Ecommerce Sample	Links to the Annual Respondents Database		Total Links
		Selected Files	Non-selected Files	
2000	7,319	1930	4365	6295
2001	9,423	3450	3579	7029
2002	8,668	2847	3922	6769
2003	9,934	3692	5771	9463
2004	9,804	3834	5489	9323
2005	7,231	n.a. ^a	n.a. ^a	n.a. ^a

a) 2005 ARD data was not available at the time of writing

3. Overview of Previous Research

Within ONS there has been a programme of analysis to examine the effects of e-commerce adoption on business behaviour and performance. The initial programme investigated three main areas:

- technological use and adoption over time;
- the influence of electronic networks, and e-business use, on innovation (i.e. Research & Development) and its contribution to the returns on innovation;
- linking data on electronic network use by firms to productivity - building on work undertaken by the US Census Bureau (see Atrostic & Nguyen, 2002).

Early work on productivity was limited to the ARD data set due to the large degree of “turbulence” (i.e. firms entering and exiting) in the Ecommerce survey. Nevertheless, Criscuolo & Waldron (2003) found significant productivity gains associated with the use of electronic procurement systems. This topic was followed up by Clayton & Goodridge (2004) where improvements in the Ecommerce data facilitated analysis based on linked Ecommerce/ARD data. Criscuolo & Waldron’s earlier work was limited to a narrower analysis of firms’ commercial infrastructure. However, the potential of electronic networks lies in how they can transform operations (i.e. linking production, distribution, procurement and sales), not solely a firm’s transactions. Using this larger linked data set Clayton & Goodridge (2004) were able to explore these issues concluding that a key factor affecting productivity gains is different value chains across sectors.

Recently, the ONS programme has shifted its focus to consider, more broadly, the effects of Information Communication Technology (ICT) on productivity. This work continues to examine the effects of electronic networks and computer/internet use by employees; however, it also investigates the impact of IT capital (software & hardware) and telecommunications on productivity. A review of this work is provided by Farooqui (2005). Key messages from this research include the gains associated with spending on telecommunications, and the compounding effect that this spending has on the gains possible from IT investment.

Academic research using the Ecommerce data set within the VML tended to focus on the reasons for firms' adoption of ICT and the effects of ICT on firm level productivity. The following provides an overview of the work completed in the VML:

- **Abramovsky & Griffith (2006)** investigate whether the relationship between ICT and outsourcing of services are technological complementarities, i.e. positively related to productivity. Initial findings are consistent with the presence of technological complementarities between ICT and the *external* reorganisation of the firms as measured by purchases of services.
- **Rincon, Robinson & Vecchi (2005)** consider the impact of e-commerce on establishment level productivity for all sectors of the economy. After accounting for selectivity bias amongst enterprises that use e-commerce, both e-buying and e-selling have significant and positive impacts on productivity.
- **Crespi, Mahdi, & Patel (2004)** explore the factors influencing eCommerce adoption in the UK. It finds that the main factors influencing a firm's decision to adopt ICT are: the price of ICT, firm size, network externalities, and learning externalities.
- **Matteucci, O'Mahony, Robinson & Zwick (2005)** use a growth accounting framework and micro data from Germany, Italy and the UK to examine the impact of ICT on productivity. Whilst direct comparisons between the national findings are difficult to make, the UK experience with ICT appears to have been more akin to the US than other continental European countries.
- **Sadun, Van Reenen, Clayton & Farooqui (2005)** examine patterns of broadband exposure by regions and by sectors over time.

4. Which organizations choose to use electronic networks?

Electronic networks have the potential to transform companies operations giving them a competitive edge over other firms. Using electronic networks to link orders to production and procurement enables firms to adjust faster in a dynamic market place and negotiate the best prices from suppliers. This raises the question of which firms choose to use electronic networks. The following descriptive statistics illustrate how the use of electronic networks has changed over time by firms. We might expect their use to have increased due to falling capital prices, or for first movers to have used this new technology to increase their market power. Likely outcomes will vary by industry and the potential for firms to benefit from this technology.

Figure 1 illustrates the wide variation in the use of electronic networks across industries between 2001 and 2004. The incidence of electronic networks is highest within the food, motor vehicle and finance sectors, whilst the incidence is lowest within construction, wood processing and the public sector. Figure 2 shows that use of electronic networks appears to be much more prevalent in foreign-owned companies, although both have increased their use of network technologies over the time frame examined. It may be that Multinational Enterprises (MNEs) have greater linkages to the rest of the world and, hence, can extract greater benefits from implementing networks.

Figure 1: Use of Electronic Networks: by Industry

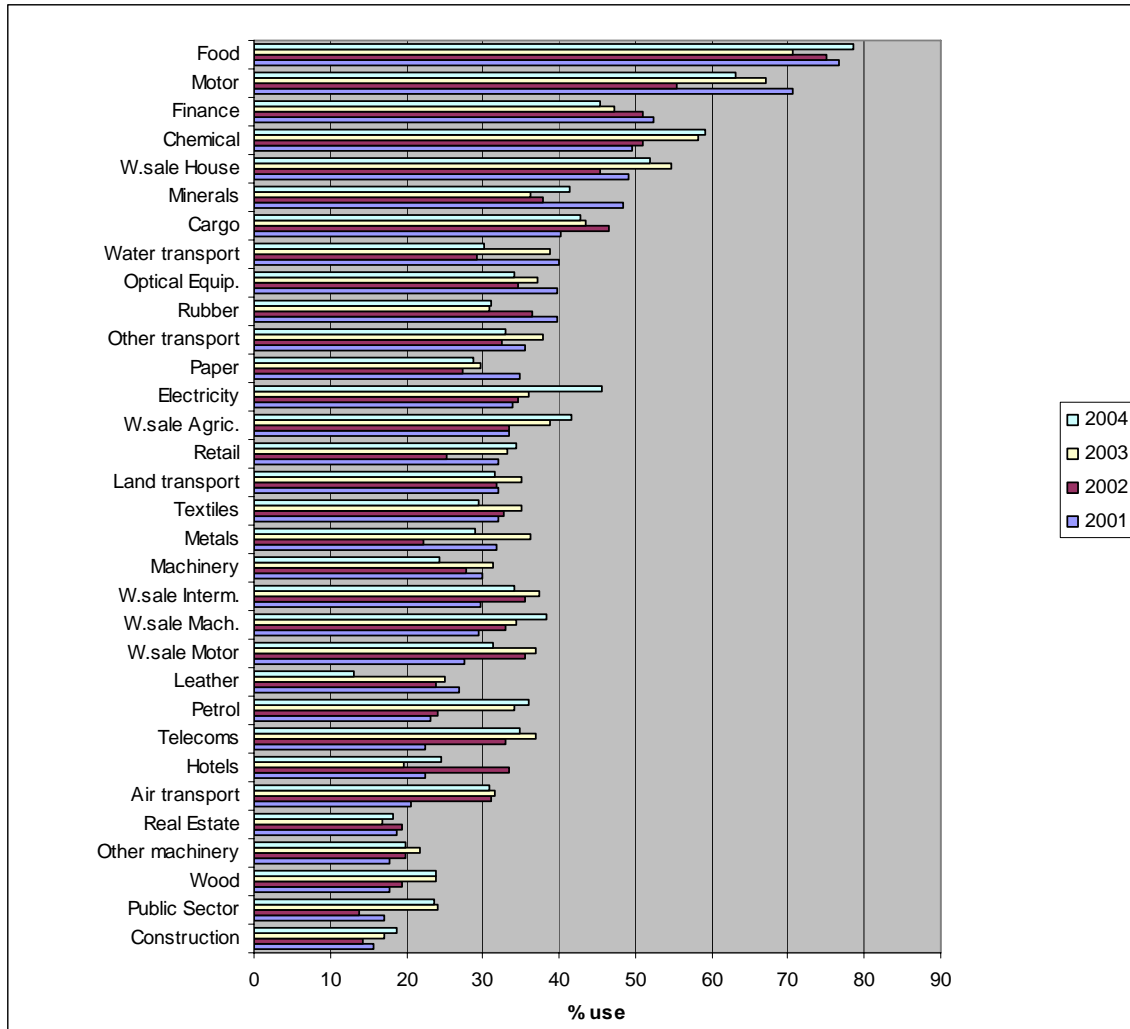
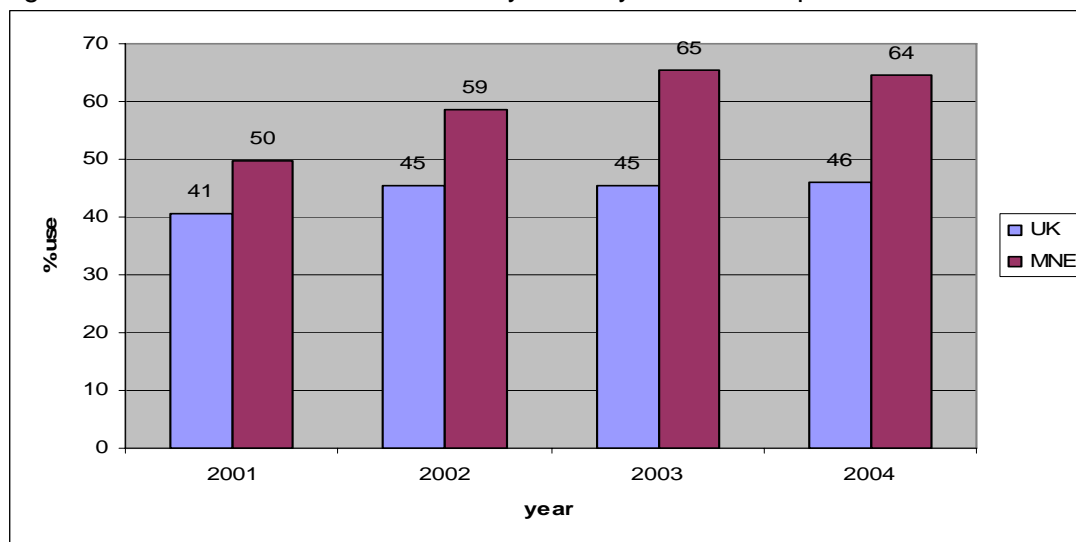


Figure 2: Use of Electronic Networks: by Country of Ownership



Figures 3 and 4 show how the use of networks also reflects the size of firms. The percentage of firms who use networks shows a marked rise as firm size increases, whether this is measured in terms of the number of employees (Figure 3) or the number of local units (i.e. firm sites) a firm has (Figure 4). While these measures show a slight rise in the adoption of network technologies over the years, the broad pattern appears more stable.

Figure 3: Use of Electronic Networks: by Number of Employees

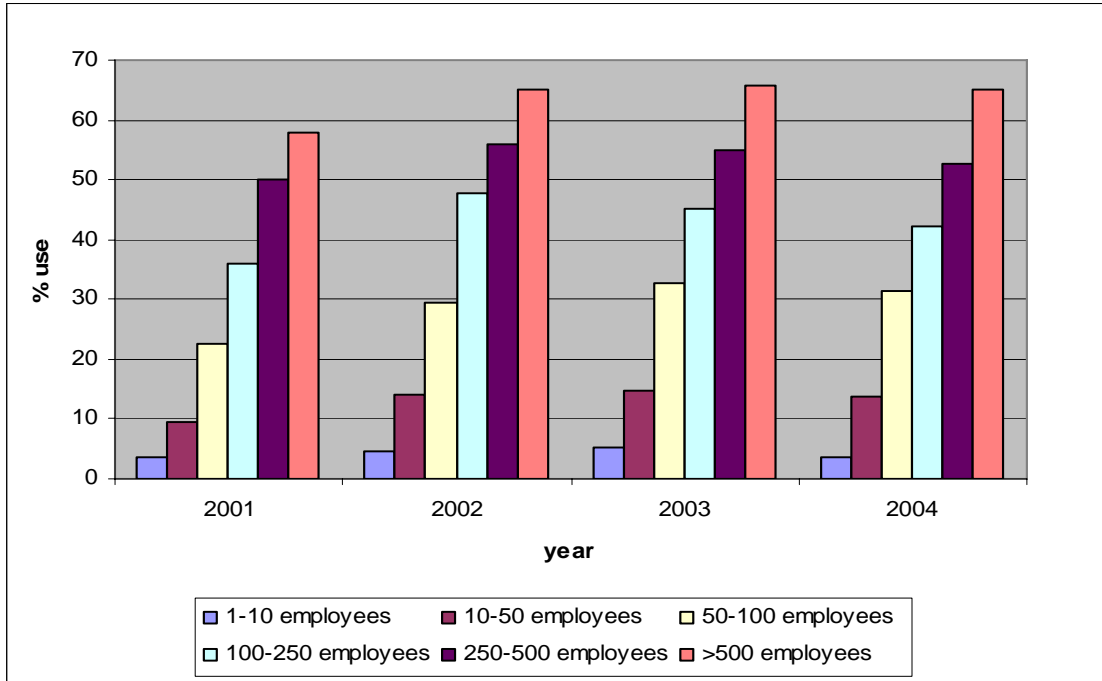
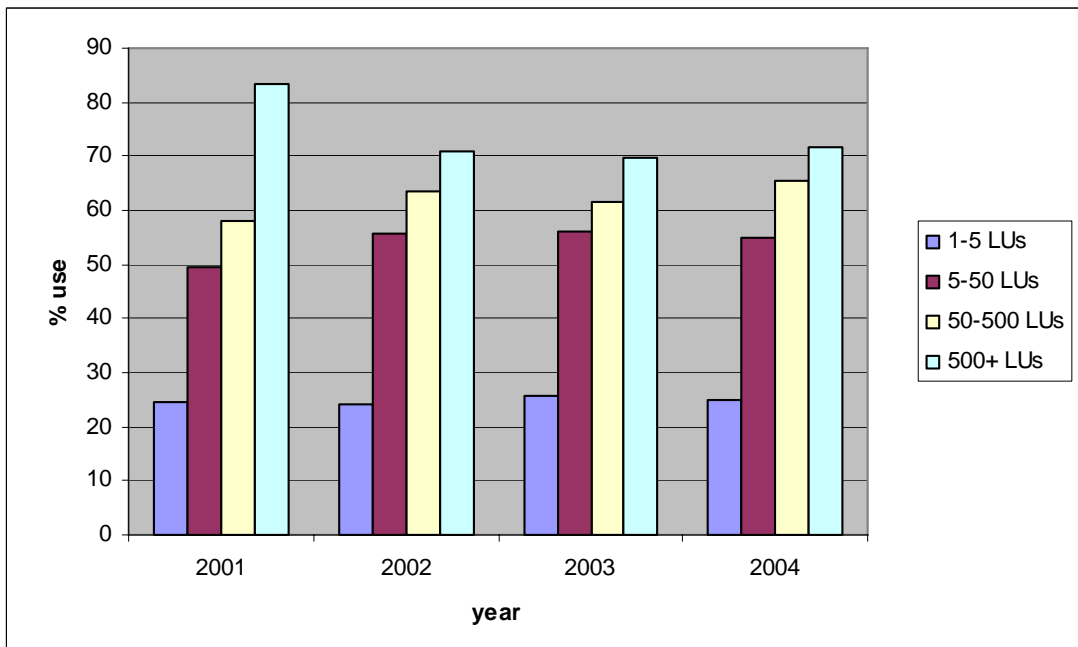


Figure 4: Use of Electronic Networks: by Number of Local Units

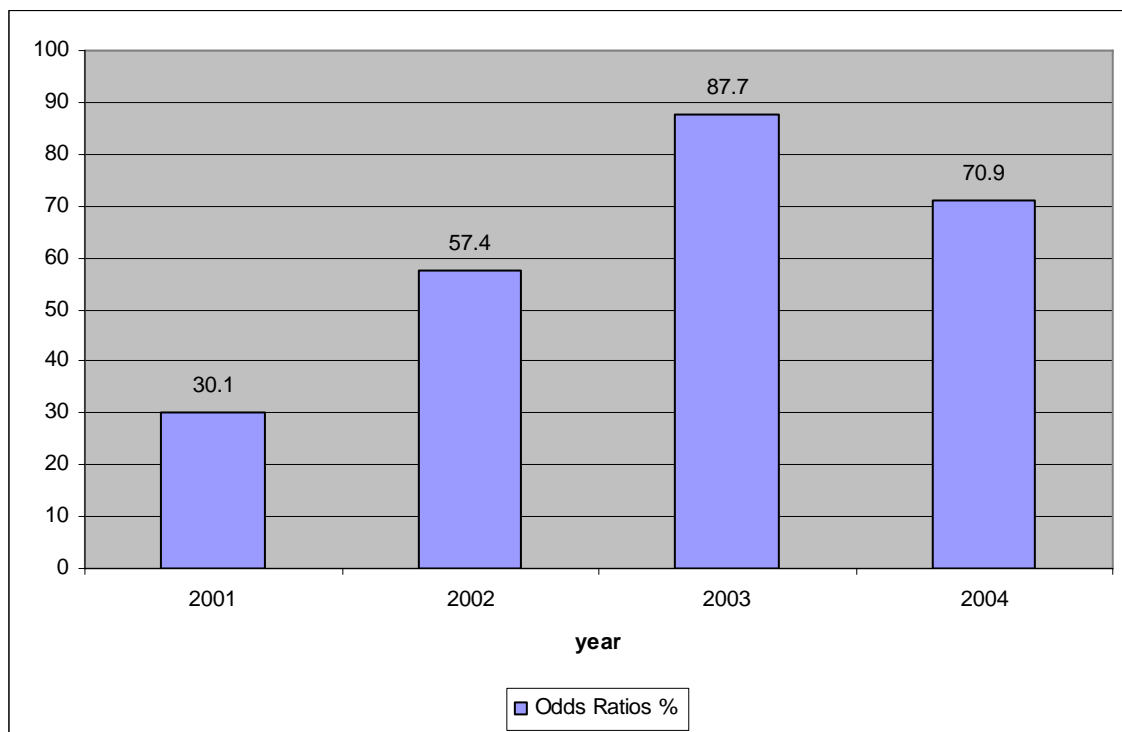


The above descriptive analysis of the Ecommerce survey shows that the adoption of electronic networks varies considerably across industry, size and ownership status. We observe that business units that are part of multinational enterprises are more likely to adopt electronic networks. However, such analyses do not identify the individual contribution of each of these characteristics, holding all other characteristics constant. For example, does being part of a multinational enterprise increase the likelihood of a business unit utilizing electronic networks, or do these enterprises differ in other characteristics that may also make them more likely to adopt such technologies, such as size or sector.

To do this, we employ logistic regression analysis to estimate the additional and independent effect of a range of firm and market characteristics on the probability that the firm will utilize electronic networks. Using a logistic regression we can estimate the additional and independent probability of an MNE choosing to use networks after having controlled for other observable characteristics. Explanatory variables were also included to control for firm size (employment, number of local units), firm age, industry, firm type and region.

Figure 5 shows how the probability of a foreign-owned firm using electronic networks has changed in recent years. After controlling for other influences, the probability of foreign owned enterprises using electronic networks compared to UK owned enterprises has increased notably since 2001. In 2001, MNEs were estimated to be 30% more likely than UK owned enterprises to utilize electronic networks. This differential increased to almost 90% by 2003, with a lower 70% differential being estimated within 2004.

Figure 5: Effect of Foreign Ownership on the Probability of Adopting Electronic Networks



Examining the type of networks used in more detail revealed that the probability of a foreign-owned enterprise having their production system linked using electronic networks is roughly 30% higher compared to a UK-owned firm. The probability of a MNE having their logistics system linked using electronic networks was about 40% higher in 2001 and 2002, while the probability jumps to 75% for 2003 and 2004.¹

¹ The dependent variables used in the logistic regressions were q34 “electronic networks”, q185 “production networks” and q186 “logistic networks”.

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