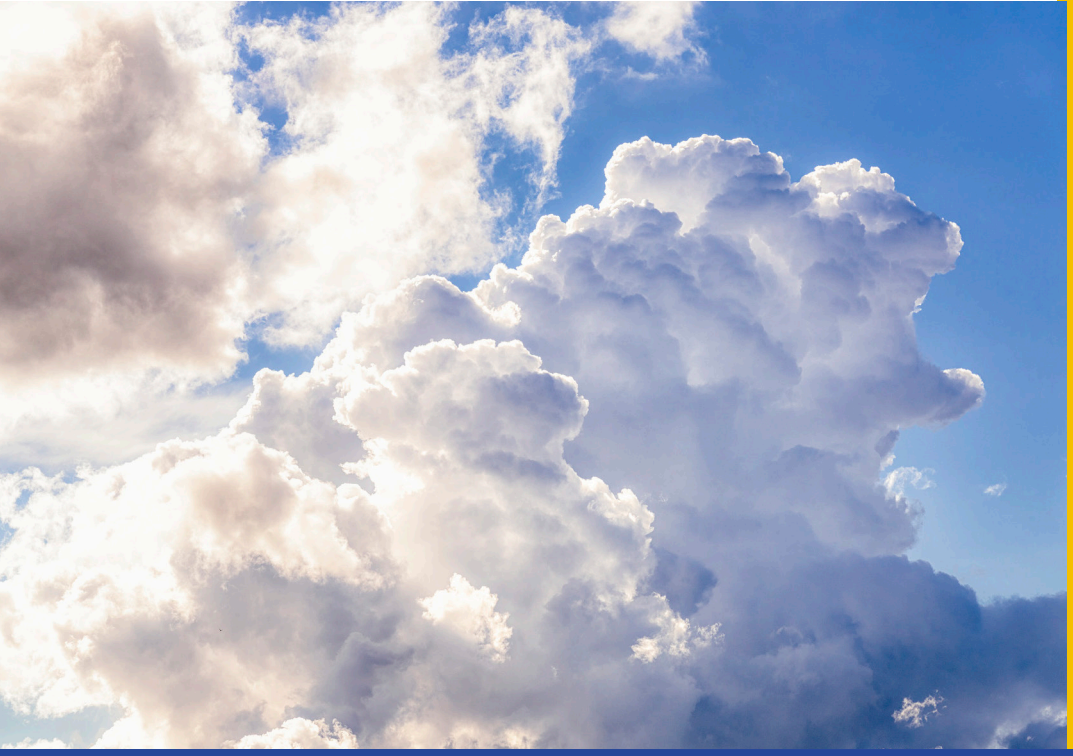
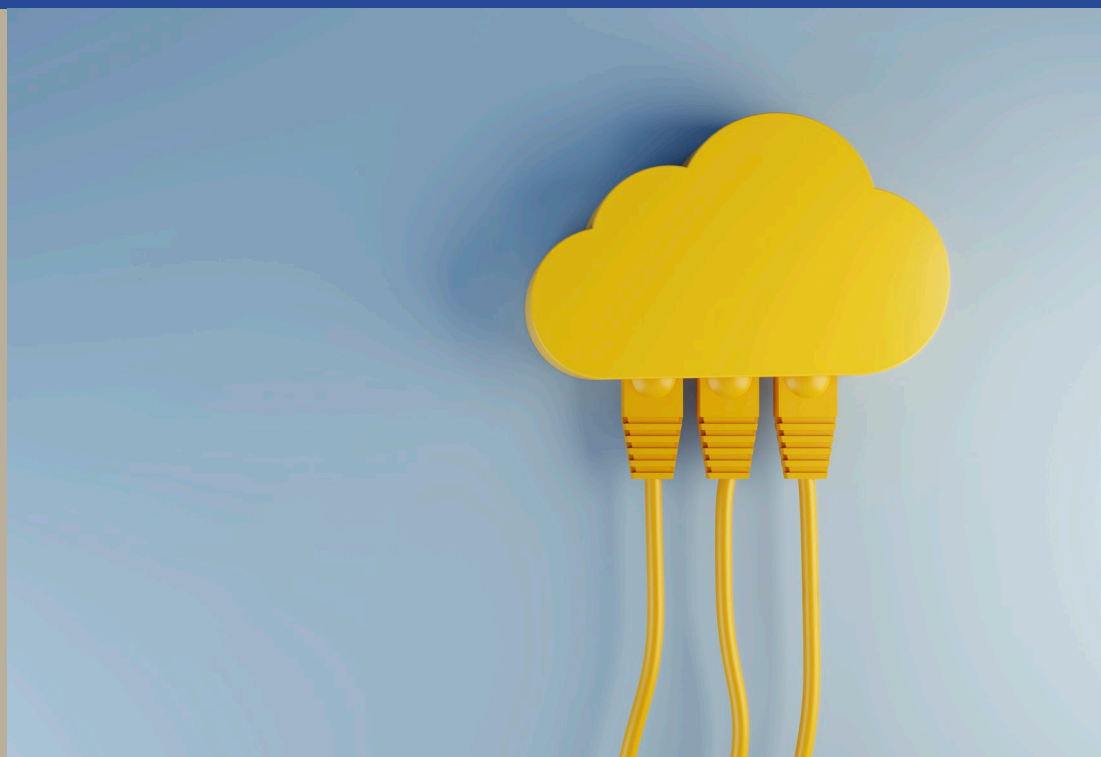


KOMMERSKOLLEGIUM
NATIONAL BOARD OF TRADE SWEDEN

# Cloud Services and Export Performance

## Evidence and implications for EU policy



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# Preface

The National Board of Trade was founded in the 1600s and over our nearly 400-year history, we have witnessed technological shifts from the industrial revolution to today's AI age. This has taught us several lessons. One being that technological progress tends to make societies more prosperous. Another being that accessing new technologies and sharing ideas across borders tends to speed up this process. In other words, international trade is essential. It was for the industrial revolution — and it remains so in the age of AI.

In this report, we have studied one important component of the AI age — namely cloud computing. Using a dataset of Swedish companies, we find that those who utilise cloud services also tend to be more internationalised by exporting more and to more markets. We also find that this effect appears strongest for smaller companies. Several conclusions can be drawn from this study, two important being I) that EU digital and trade policy should keep smaller companies' needs in mind and II) that working with key partners such as the U.S. will be an essential priority over the next EU term.

This report is written by Hannes Berggren and Patrik Karpaty. Valuable contributions have been provided by several colleagues at the National Board of Trade Sweden: Emma Sävenborg, Karin Atthof, Petter Stålenheim and Patrik Tingvall.

Stockholm, September 2024

Anders Ahnlid
Director-General
National Board of Trade Sweden

# Executive summary

This report investigates the relationship between firms' use of cloud services and their exports, for the first time using a dataset of Swedish firms. Since exporting firms are typically more productive than non-exporters, in this report, we first study whether Swedish companies that use cloud services are more productive and then investigate whether there is an additional channel (beyond productivity) between cloud computing and exports.

Our findings demonstrate that Swedish companies using cloud computing tend to be more internationalised, for example, by exporting more and to more markets. Moreover, while cloud services generally appear to be beneficial, it is smaller firms in particular that reap the largest export benefits from cloud services. Finally, we illustrate that some types of cloud services appear to be more important for internationalisation than others, specifically computing power to run software (CPU), customer information management software (CRM) and database services (DB).

We have previously reported the benefits of imports and argued that these are just as important as exports (National Board of Trade, 2023). Results from the current report constitute a practical example of how imports can benefit a country by helping its companies become more productive and internationalised.

Given that cloud services appear to be important for productive and internationalised European companies, not least smaller enterprises, the procurement of such services should not be unnecessarily impeded by policy. As such, the following conclusion are drawn.

- Reducing friction that impedes access to cloud services can help improve EU competitiveness; reducing frictions in digital trade with the U.S. should therefore remain an EU priority.
- Improving European companies' access to data could help improve the export benefits of using cloud services.
- Digital and trade policy should be designed with small companies in mind.

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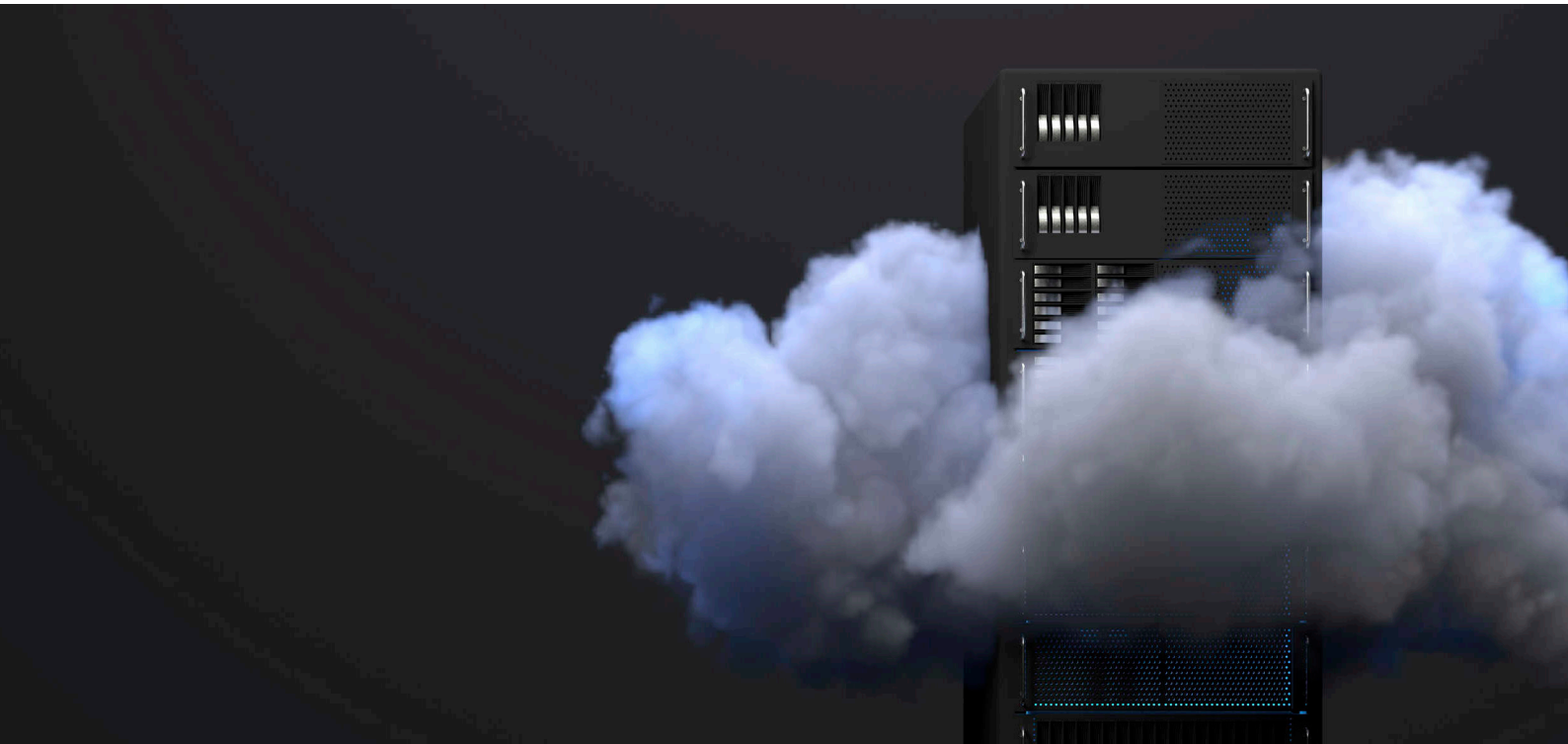
# 1 Introduction

The introduction of cloud services has improved business operations by providing companies with on-demand access to external providers of IT services with pay-as-you-go pricing. This has removed the need for companies to make large investments in hosting their own IT services, such as on-premises servers. Moreover, in contrast to traditional on-premises solutions, cloud computing presents advantages in international business operations – such as better flow of information – and enables the rapid integration of leading technologies, such as artificial intelligence (AI) and advanced data analytics. And, due to the economies of scale involved in cloud computing, companies often see benefits in pricing, energy efficiency and security compared to on-premises IT solutions (Biglaiser et al., 2024).

Advantages such as those listed above should theoretically improve the productivity of companies that use cloud computing. Furthermore, the consensus in trade literature states that the higher the productivity of a firm, the more likely the firm is to export (Breinlich et al., 2023; Wagner, 2007). Research on the use of cloud services by firms confirms that cloud computing can lead to increased productivity,[1] which, by extension, could increase exports. Moreover, recent research also shows that cloud computing can constitute a separate channel for increased exports in companies, beyond increased productivity (Wagner, 2024). This because cloud services introduce flexibility and provide access to tools that may be important for internationalisation.

Our report builds on previous research and investigates the relationship between firms' use of cloud services and their exports, using for the first time a dataset of Swedish firms. The dataset combines multiple data sources and therefore enables us to control for productivity and other characteristics. Since exporting firms are typically more productive than non-exporters, the objective of this report is to first investigate whether Swedish companies that use cloud services are more productive and then to analyse whether there is an additional channel (beyond productivity) between cloud computing and exports. In the report, we also investigate possible heterogeneity across firms, examining whether the results are sensitive to the type of cloud computing adopted in firms and whether the internationalisation of firms is impacted differently depending on the size of the firm.

1 See, e.g. De Stefano, Kneller & Timmis (2023)



The effects of cloud utilisation are of interest because it is a priority political goal. For example, the EU has adopted a goal for cloud adoption in its Digital Decade strategy, stating that 75 per cent of companies should adopt cloud services by 2030. Progress towards this goal currently stands at 45 per cent across the EU member states (Eurostat, 2023b).

The EU cloud market, however, is impacted by trade frictions stemming from regulatory divergence on digital policy with the U.S. The EU has tended to prioritise data protection regulation, with its landmark General Data Protection Regulation (GDPR), while the U.S. has tended to favour a more market-oriented approach, which has been complemented by law enforcement regulations such as the CLOUD Act. This divergence has been exacerbated by the cumulative effect of EU unilateral regulation on the digital economy (National Board of Trade, 2024).

Another cause for friction is the push by some member states for European digital sovereignty. This has taken aim at the supremacy of U.S. companies in the cloud computing market and argued for industrial policy that supports European competitors. However, it does not appear that this will be successful, since Europe lacks alternatives to replace American cloud service providers and developing such would be very costly (Meyers, Z., 2023; Bauer et al., 2024). As such, friction that reduces European companies' access to U.S. cloud computing services could harm EU competitiveness by leading to a lower degree of internationalisation among European companies.

# 2 Background

## 2.1 Cloud services

Over the past decade, there has been a noticeable change in the way companies use ICT services. While these services previously required significant investment, dedicated IT staff and physical infrastructure, they can now be accessed via the internet on demand via so-called cloud services. The key difference with traditional ICT provision is that cloud providers offer storage, processing and software as on-demand and pay-as-you-go services. Cloud services serve various purposes, spanning from basic data storage on servers to the utilisation of advanced data analytics and AI/ML solutions (Biglaiser et al., 2024).

Cloud services are usually divided into three categories: IaaS (infrastructure as a service), PaaS (platform as a service) and SaaS (software as a service). While traditional solutions require a company to manage its own IT infrastructure and software, IaaS offers a pay-as-you-go approach to storage, networking and virtualisation. PaaS includes additional services (e.g. hardware and software development tools) that are accessible via the web. SaaS gives customers the highest degree of vendor management by also "renting" complete software solutions (Biglaiser et al., 2024).

## 2.2 The EU cloud market

On the supply side, the cloud market is characterised by concentration, with the three largest companies (Amazon, Microsoft and Google) accounting for almost 70 per cent of the market share (Richter, 2024).[2] There have been concerns that relying heavily on a l imited number of providers could lead to challenges, such as lock-in effects and high switching costs, making it difficult for smaller providers to enter the market (Biglaiser et al., 2024).[3] As a response, ongoing efforts such as the Data Act from the European Commission aim to address these issues, for example, by regulating the costs of switching providers.[4] However, more detailed analyses of competition and market concentration on the EU cloud market are outside of the scope of this report.

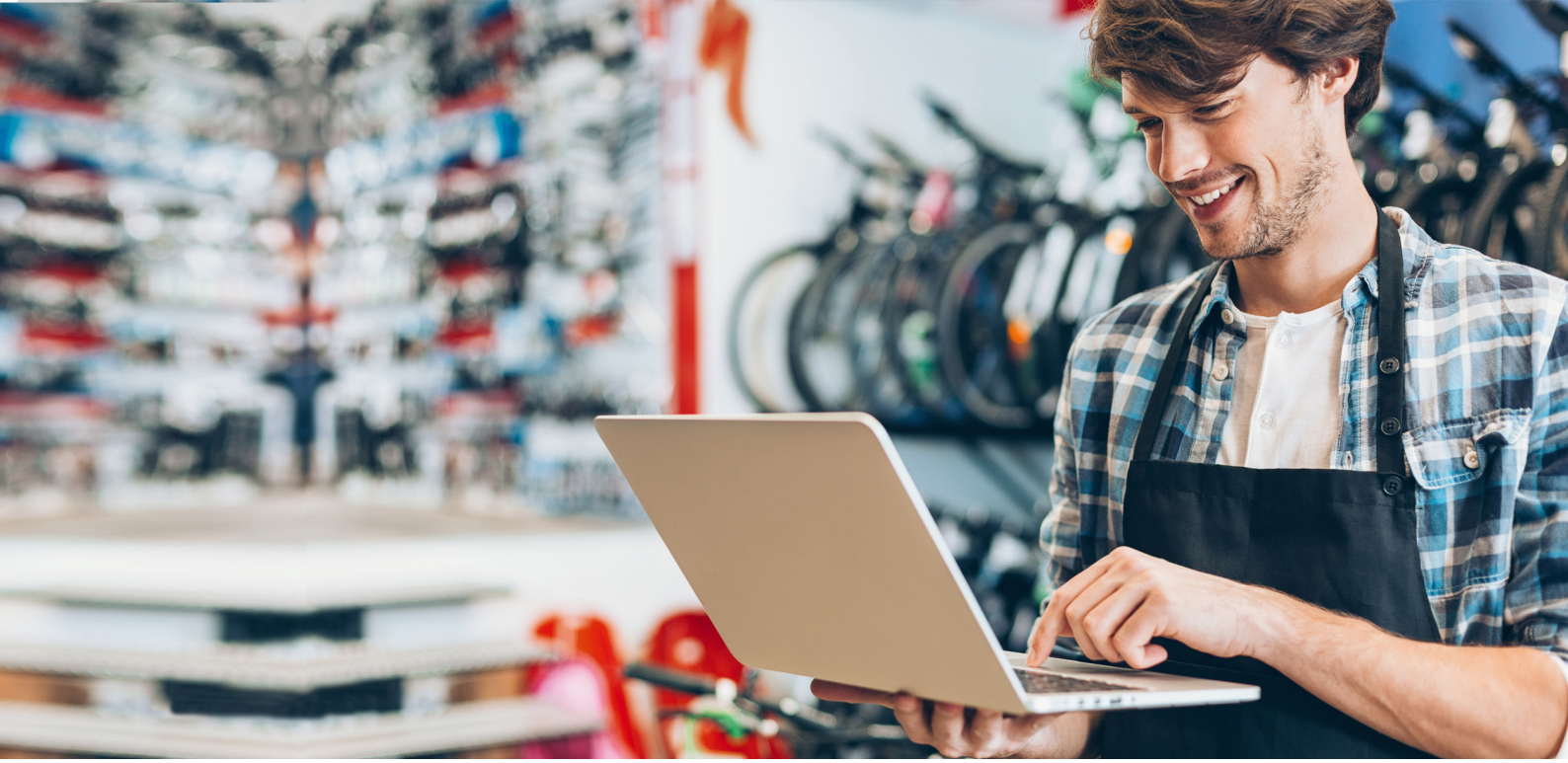
On the demand side, the previously discussed advantages of cloud adoption make cloud services attractive for businesses of all sizes. According to Eurostat, 54 per cent of Swedish companies reported a "high level of dependence" on cloud services, deeming them essential for their operations (Eurostat, 2023b). Moreover, Wernberg (2023) found similar demand from Swedish companies.

The high demand for cloud services, which is indicative of their value for companies, has made cloud adoption a political priority. For example, the EU has set a goal in its Digital Decade strategy that 75 per cent of companies will use cloud computing by 2030. However, in 2023, less than half of EU enterprises purchased cloud computing services (Eurostat, 2023b).

2 Market concentration appears more prevalent in Infrastructure as a service (IaaS) and Platform as a Service (PaaS), while Software as a Service (SaaS) has more market participants.

3 It may, however, be of interest that Wernberg (2023) did not find such concerns to be prevalent among Swedish companies.

4 The aim of the European Commission's Data act is to establish a fair regulatory framework covering access to data by companies, researchers and public authorities in the EU. However, this must be done in a way that also takes into account companies' property rights, trade secrets and security standards. The Data Act is intended to support the sharing of data between companies, which is necessary for product development and competitiveness (European commission, 2024).



Notably, Sweden boasts the second-highest cloud adoption rate in the EU at over 70 per cent (Eurostat, 2023b). However, this is partly a result of measuring the use of cloud services in a binary manner, where simply using an email server that is backed up on the cloud counts as cloud adoption (DIGG, 2023). The reliance on such a narrow metric is unfortunate, given that many of the benefits of using cloud services come from deeper use, such as CRM systems, database services or computing power to run software. Wernberg (2023) found that among the Swedish companies that purchased cloud services, most reported purchasing email services, while less than half purchased CRM systems, database services or computing power to run software. Moreover, Wernberg (2023) found that large enterprises in Sweden use cloud to a larger extent than smaller enterprises.

The EU cloud market is impacted by trade frictions stemming from regulatory divergence on digital policy with the U.S., which is typically the home country for cloud service providers. The EU has tended to prioritise regulation for personal data protection (e.g. through its landmark GDPR), while the U.S. has tended to favour a more market-oriented approach, which has been complemented by law enforcement and national security regulations (e.g. the Cloud Act, the Foreign Intelligence Surveillance Act and the Protecting Americans' Data from Foreign Adversaries Act) (Bradford, 2023; Propp, 2024).

This policy divergence has been bridged with the help of so-called adequacy decisions, which are unilateral approvals from the EU that the U.S. is safe for personal data transfers. Still, data flows have been disrupted following the so-called Schrems I & II decisions of the Court of Justice of the European Union (CJEU). However, after a few years of uncertainty following the Schrems II decision, more recent developments have decreased uncertainty to some extent. For example, with the 2023 EU-US Data Privacy Framework, the EU has extended a new adequacy decision to the U.S. This is important, since adequacy decisions granted to the U.S. have been empirically proven to improve EU digital trade (Ferracane et al., 2023).

Another cause of friction has been the push by certain member states for European digital sovereignty, which has taken aim at the supremacy of U.S. companies in the cloud computing market. EU industrial policy initiatives, such as Gaia-X, have attempted to develop European cloud competitors (Gooding, 2024). Moreover, proposals for EU cybersecurity legislation for cloud services that leaked in 2022 aimed to limit U.S. access to the EU market (Cerulus, 2022).5 This agenda appears unlikely to be effective, since Europe lacks

alternatives to replace American cloud service providers and developing these services would be very costly (Meyers, Z., 2023; Bauer et al., 2024). As such, creating barriers to the use of U.S. cloud computing services by European companies could harm the competitiveness of these companies (Frey & Presidente, 2024).

## 2.3 Cloud services and global trade rules

Digital services such as cloud services play an important role in modern trade. The WTO agreement regulating services trade is the General Agreement on Trade in Services (GATS). A general view of WTO members is that the GATS is technology neutral, as it does not contain any provisions that distinguish between the different technological means by which a service can be provided.

The EU (except for Malta and the Slovak Republic) has committed under the GATS to provide market access – including cross-border (or "mode 1") access – to foreign suppliers of computer and related services (CRS) without restrictions. They have also committed to treat these companies no less favourably than domestic suppliers. As such, policies regulating cloud services may be a legitimate way to secure privacy or national security but should not be discriminatory. Any measures hindering access to market for cloud services should thus undergo thorough analysis to ensure compliance with multilateral, plurilateral or bilateral trade agreements (Cory, 2022). Moreover, the EU's commitments under the Government Procurement Agreement (GPA) and – if implemented – the WTO e-commerce plurilateral also impact the measures it can take to regulate cloud services (Bauer & Lamprecht, 2023).

# 3 Cloud services and export performance

## 3.1 Literature review: Productivity and trade effects of cloud services

Cloud services may facilitate internationalisation by helping users improve productivity as well as through additional channels.[5] We will start by looking at productivity. As previously outlined, in comparison to traditional on-premises IT services, cloud computing offers various strategic and operational benefits. Cloud computing facilitates faster and more flexible applications with scalability that can readily accommodate fluctuations in demand. Additionally, cloud services provide access to cutting-edge technology without requiring upfront capital investment by the firms that use them (Boccia, Ferragina & Iandolo, 2022). By reducing fixed computing costs, even small and medium-sized enterprises (SMEs) can rapidly scale up or down and experiment with new products and features in different markets. This operational agility can be particularly valuable in competitive environments and when expanding into multiple markets.[6]

To date, several papers have been published that outline the economic and productivity effects of cloud computing on both the aggregate economy level and the firm level (see, e.g. Etro, 2009; Wauters et al., 2016; Brodny & Tutak, 2022; Chen & Martincus, 2022; DeStefano, Kneller & Timmis, 2023). Cloud computing appears to be positively correlated with higher productivity and growth both for the firm and the economy as a whole. For firms, this effect seems to be more pronounced for younger firms compared to more established firms.

While increased productivity may help companies increase exports, the inherent characteristics of cloud services may also play a role by allowing businesses to manage international operations more effectively. Cloud services can help reshape business processes to facilitate the flow of information and thus make it easier to maintain operations in different locations (Jin, Wang & Bai, 2022). Cloud computing also reduces the costs and maintenance associated with maintaining a web presence, which is linked to increased international business activity (Wagner, 2024).

Wagner (2024) examines cloud service premiums for business exports for 27 EU countries. He finds that firms using cloud services are more likely to be exporters and are more likely to export to multiple destinations and more diverse destinations. At the same time, Wagner discusses the difficulties in determining whether this correlation is due to exporting firms also choosing to use cloud computing to a larger extent, or whether increased exports is an effect of using cloud computing.

## 3.2 Descriptive analysis

A dataset of cloud service use among Swedish companies[7] illustrates that cloud adopters and non-cloud adopters differ in several respects. Cloud adopters are larger on average in terms of size (number of employees) and older. They are more capital intensive and have higher labour productivity.

The share of cloud users who export is higher, they have a higher export intensity, and they export to more countries. The share of exporters among cloud users is 40 per cent

5 The relationship between productivity and trade is well established (see, e.g. Holger et al., 2023).
6 For a more detailed description of the cloud benefits identified by Swedish firms, see Figure 9 in Wernberg (2023).
7 See Appendix I for further information on the dataset.

compared to 15 per cent among non-users. On average, cloud users export to 5.8 countries, while non-cloud users only export to 1.2 countries. Moreover, among firms that export goods, the share of firms that export to more than five markets is five times higher for cloud adopters than non-cloud adopters.

**Table 1. Difference between cloud adopters and non-cloud adopters 2020**

| Variable | Cloud adopters | Non-cloud adopters | Difference |
|---|---|---|---|
| **Employment** | 205 | 35 | 171[a] |
| **Labour productivity** | 932 000 | 709 000 | 223 000[a] |
| **Capital labour ratio** | 1 674 000 | 805 000 | 869 000[b] |
| **Age** | 22 | 17 | 5[a] |
| **Exporter** | 0.40 | 0.15 | 0.26[a] |
| **Export intensity** | 0.09 | 0.02 | 0.07[a] |
| **Export destinations** | 5.8 | 1.2 | 4.6[a] |

Note! Unweighted mean values and the difference between the two groups (superscripts a,b,c) indicate that the difference in the table is significant at $p < 0.01$, $p < 0.05$, $p < 0.1$.

**Table 2. Number of goods export destinations by cloud use in 2020[8]**

| Do not use cloud services | | | Use cloud services | | |
|---|---|---|---|---|---|
| No. of export destinations | Distinct no. of firms | Per cent (%) | No. of export destinations | Distinct no. of firms | Per cent (%) |
| 0 | 1 676 | 85 | 0 | 2 325 | 60 |
| 1 | 113 | 6 | 1 | 394 | 10 |
| 2 | 34 | 2 | 2 | 166 | 4 |
| 3 | 24 | 1 | 3 | 97 | 3 |
| 4 | 12 | 1 | 4 | 71 | 2 |
| 5 | 5 | 0 | 5 | 60 | 2 |
| 5+ | 102 | 5 | 5+ | 794 | 20 |
| **Total** | 1 966 | 100 | **Total** | 3 907 | 100 |

Source: Statistics Sweden (SCB) and own calculations. Percentages are rounded to the nearest whole number.

Moreover, the proportion of cloud adopters is lower among micro enterprises (45 per cent compared to an average of 60 per cent for all the companies surveyed in 2020).[9] Larger companies are also more likely than smaller companies to utilise the full benefits of cloud services, such as advanced data analytics or customer relation management (CRM) tools. These tools are used to communicate with customers and streamline sales and are therefore a potentially important tool when exporting (Dong & Salwana, 2022).

8 Unfortunately, the surveys on international trade in services and IT use among enterprises are based on different sampling strata, with very few overlapping observations, which prevents a deeper analysis of trade in services. This is unfortunate, as services and trade in services are becoming increasingly important in many developed countries like Sweden.

9 In terms of the overall picture, there appears to be a clear linear relationship between company size and cloud adoption. For financial software (e.g. bookkeeping, accounting or management), adoption is instead greater in smaller companies. This could indicate that the larger companies have the financial resources to purchase these services elsewhere. Alternatively, the larger companies may want to reduce the risk of important information spreading uncontrollably outside the organisation and choose instead to integrate these services within the group.

**Table 3. Use of cloud services in 2020 by type of cloud service and company size**

| Type of cloud services and firm size | Micro 0–9 | Small 10–49 | Medium 50–249 | Large 250+ |
|---|---|---|---|---|
| | | Per cent of adopters (%) | | |
| **Cloud adopters (general)** | 45 | 73 | 88 | 91 |
| **E-mail (EM)** | 78 | 82 | 81 | 79 |
| **Office software (SOFT)** | 54 | 65 | 72 | 74 |
| **Financial software, etc. (FACC)** | 62 | 63 | 57 | 48 |
| **Software to manage customer information (CRM)** | 24 | 37 | 45 | 48 |
| **Database services (DB)** | 45 | 61 | 64 | 65 |
| **File storage (FIL)** | 74 | 81 | 77 | 82 |
| **Computing power (CPU)** | 29 | 40 | 49 | 57 |

Source: Statistics Sweden (SCB) and own calculations.

Cloud adoption in the Swedish business sector varies significantly between different industries. As Table 4 shows, it is mainly companies in Paper and pulp that used cloud services, where the share was almost 87 per cent. The industry where the second highest number of companies used cloud services was Manufacture of motor vehicles, etc., where the share was just over 80 per cent.[10] In these industries, many of the companies are multi-national enterprises (MNEs) with operations around the world. Therefore, there is great potential in being able to use cloud services to facilitate the management and monitoring of operations around the world. The industry that bought the least cloud services was the Hotel and restaurant industry, where the share was roughly 40 per cent. However, there may be booking services (SaaS) that fall outside of the scope of the SCB data that we use here.

10 Moreover, Table 3 illustrates that the use of cloud services is very high in the services industries. Of the top ten industries with very high cloud usage, seven are service industries.

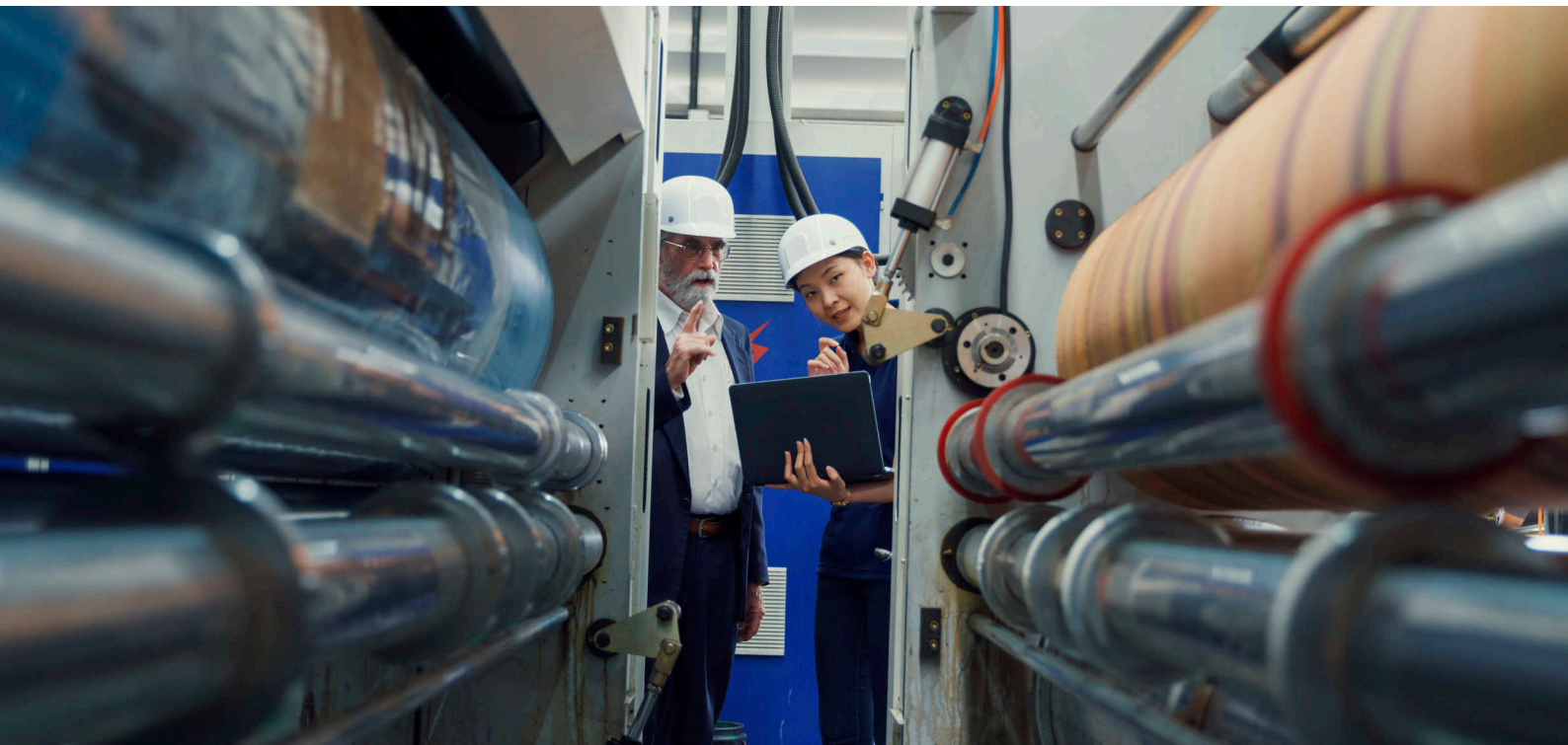


**Table 4. Adoption of cloud services by industry in 2020, SNI 2007**

| Industries with high adoption rate | Per cent (%) High—Low | Industries with low adoption rate | Per cent (%) Low—High |
|---|---|---|---|
| Manufacture of paper and paper products | 87 | Hotels and restaurants | 40 |
| Manufacture of motor vehicles, trailers and semi-trailers | 80 | Land transport and transport via pipelines | 43 |
| Computer programming, consultancy and related activities | 79 | Services to buildings and landscape activities | 51 |
| Scientific research and development | 77 | Real estate activities | 53 |
| Publishing activities | 77 | Construction of buildings | 54 |
| Legal and accounting activities | 76 | Specialised construction activities | 57 |
| Manufacture of machinery and equipment n.e.c. | 75 | Manufacture of textiles | 57 |
| Wholesale and retail trade and repair of motor vehicles and motorcycles | 75 | Retail trade, except of motor vehicles and motorcycles | 57 |
| Architectural and engineering activities; technical testing and analysis | 74 | Manufacture of fabricated metal products, except machinery and equipment | 57 |
| Retail trade; repair of motor vehicles and motorcycless | 73 | Repair and installation of machinery and equipment | 58 |

Source: Statistics Sweden (SCB) and own calculations. Percentages are rounded to the nearest whole number.

## 3.3 Statistical analysis

The descriptive analysis above showed differences between the companies that use cloud services and those that do not. This chapter investigates whether these results hold even after considering firm size, productivity, industry, etc. The analysis relies on probit and OLS regressions in line with the approach described in Wagner (2024) to examine different cloud service premiums for the probability of being an exporter, the export intensity and the number of export markets. Since the aim is to investigate whether cloud services can add a separate channel to firms' exports, we control throughout for firm productivity.[11] Specifically, the following relations are analysed:

- how the use of cloud services correlates with exports,
- the relationship between different types of cloud services and exports,
- differences between small and large firms with respect to the combined use of cloud services and exports.

11 For a more extensive methodological overview, see Appendix I.

The analysis therefore estimates the premium in terms of both the extensive and the intensive margin. The equations are:

**The probability of being an exporter**

$$Exporter_i = a + \beta\, cloud_{ic} + control_i + industry + e_i \qquad (1)$$

**The export intensity of the firm**

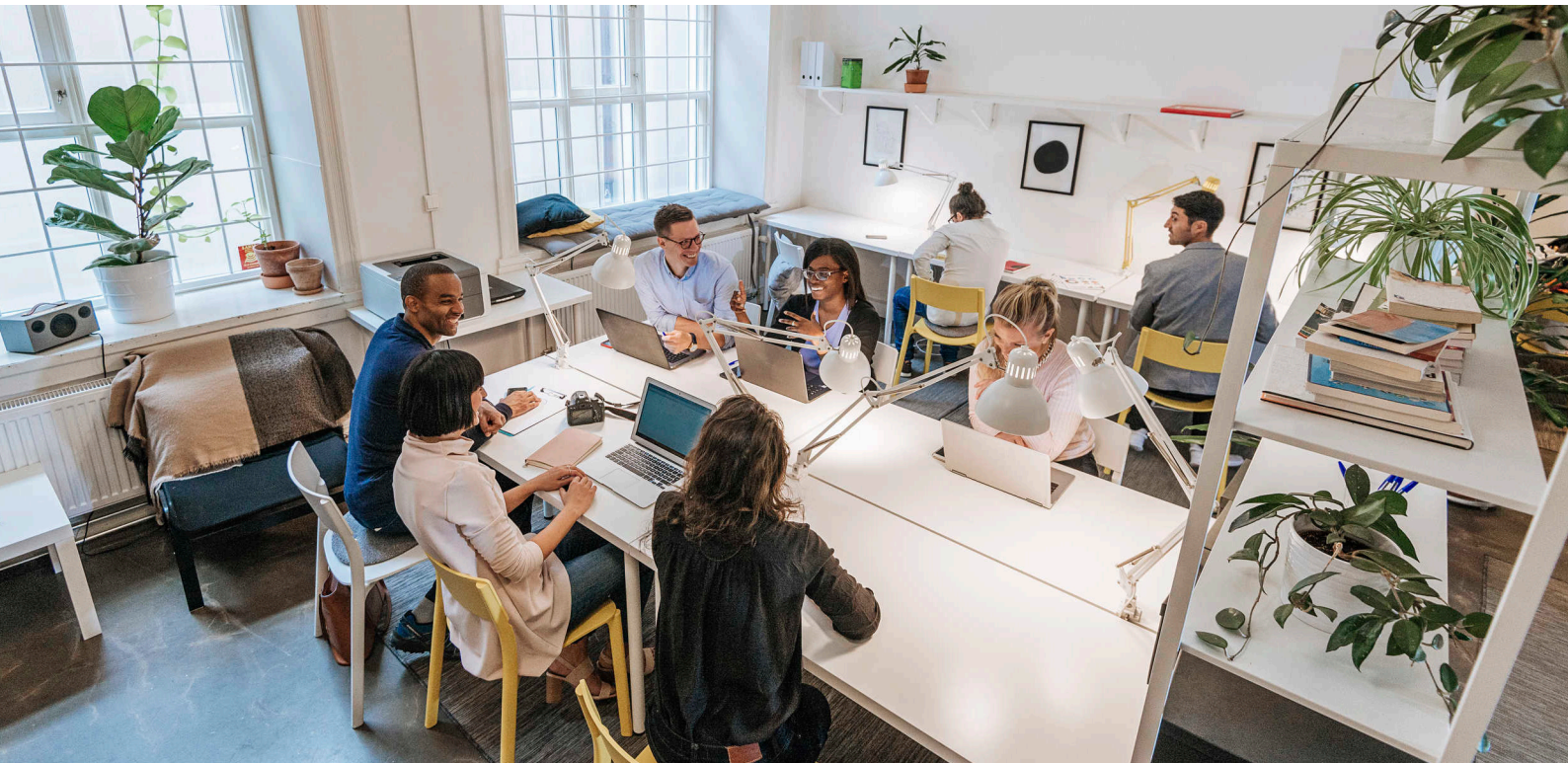
$$Export\ ratio_i = a + \beta\, cloud_{ic} + control_i + industry + e_i \qquad (2)$$

**The number of export destinations**

$$No.\ of\ export\ markets_i = a + \beta\, cloud_{i,c} + control_i + industry + e_i \qquad (3)$$

Where, for each firm *I*, "Exporter" is a binary variable of whether the firm exports or not, "Export ratio" is the value of goods exports to total sales and "No. of export markets" is a count variable that sums the number of export destinations per company. Cloud is the main variable of interest and is a binary variable of whether the firm uses cloud computing of type *c*. The cloud premium is the estimated coefficient $\beta$ and can vary between the seven different types of cloud services. A vector of control variables: labour productivity (value added per employee), firm age, size and capital labour ratio, are always included. A full set of industry dummies at the SNI 2-digit level are included, and $e_i$ is the error term.

To examine the hypothesis that cloud computing is more important for the internationalisation of smaller firms, the sample is then also divided into four groups based on firm size. Since the sample is relatively small, a rather rough division is chosen, where firms from zero up to and including nine employees are defined as micro firms. Those with between 10 and 49 employees are defined as small firms. Enterprises with between 50 and 249 employees are defined as medium-sized enterprises and those with more than 250 employees as large enterprises.



## 3.4 Results

The analysis, which matches an SCB (2024) survey on cloud computing with firm-level data and international trade data, finds a positive correlation between the use of cloud computing and various indicators of exports among firms. Cloud computing is positively associated with a firm being an exporter, the number of markets it exports to and export intensity. Moreover, the results suggest that micro and small firms have the most to gain from increasing their use of cloud services.[12]

The results also indicate varied effects between different types of cloud computing:

- In terms of the likelihood of exporting, cloud services computing power (CPU), customer information management software (CRM), database services (DB) and office software, such as a word processing service or cloud spreadsheet programmes (SOFT), are the most important tools.
- For the number of export destinations, most types (except financial software) are significant. Moreover, CPU and CRM appear to be the most important tools.
- For export intensity, only database services (DB) are significant.

Based on the data used in this study, no comment can be made regarding causality. Therefore, the observed correlation should not be interpreted as evidence of a direct causal effect. Moreover, there is a risk for endogeneity, which in this context may arise from several sources. For example, there may be omitted variable bias, where unobserved factors influencing both cloud computing and exports are not accounted for. Unmeasured variables, such as the uptake of other ICT or broadband access, which may influence both cloud computing and exports, could lead to an overestimation or underestimation of the true relationship between cloud computing and exports. However, given Sweden's nearly universal access to broadband and other forms of basic ICT infrastructure, this should not be significant.

Moreover, the SCB data that we use captures a limited part of the wider phenomenon of software-based services described in this report. This means that, on the one hand, the empirical investigation may underestimate the effect that cloud services in a broad sense have on Swedish businesses and their exports and, on the other hand, that the results may omit other effects linked to cloud services. However, when looking at similar studies that are based on Swedish empirical evidence, there is no obvious reason to believe that the results presented in this study overestimate the phenomenon. Wernberg (2023), for example, found that a significant proportion of companies that use digital platform services sell to customers outside Sweden, that a significant portion of companies are dependent on cloud services for their core business and that many companies report that they use platform and cloud services to expand into new markets.

12 For a more detailed presentation of the results, see Appendix II.

# 4 Conclusions and policy recommendations

By using a dataset of Swedish companies, we have shown that there is a link between companies' use of cloud services and their internationalisation. While causality cannot be determined, our results show that companies using cloud services tend to be more productive, export more and are active on more markets. This effect is stronger for smaller companies and for specific cloud service tools, such as computing power to run software (CPU), customer information management software (CRM), database services (DB) and office software (SOFT). Given that cloud services appear to be important for the productivity and internationalisation of European companies, the procurement of such services should not be unnecessarily impeded by policies. As such, several conclusions of relevance to EU trade and digital policy can be drawn from our results.

**First, reducing friction that impedes access to cloud services can help improve EU competitiveness.** The European Commission should therefore implement a data flow test of all new legislation. The European Commission could also consider how to better guide companies in complying with challenging legislation, such as the GDPR, when they use digital technologies such as cloud services.

**Second, reducing frictions in digital trade with the U.S. should remain an EU priority.** EU industrial policy that aims to develop local champions to replace American cloud service providers appears to be ineffective (Gooding, 2024; Meyers, Z., 2023; Bauer et al., 2024). Accordingly, ensuring access to U.S. cloud service providers remains especially important for EU export performance. In this regard, securing the stability of the EU adequacy decision (which enables EU-U.S. data transfers) should be considered an absolute minimum. Moreover, the European Commission should ensure that its economic security agenda does not limit access to leading technologies, such as U.S. cloud services. Finally, the EU should pursue a deeper digital partnership with the U.S. that includes rules on cross-border data flows.

**Third, improving European companies' access to data could help improve the export benefits of cloud services.** The benefit of cloud services comes from the data they help process and manage. In this regard, the EU could strengthen its competitiveness by ensuring the free flow of data in the Single Market.13 Moreover, competitiveness can be improved by ensuring that free flow of data provisions are included in more FTAs and that more partner countries can obtain an adequacy decision.

**Fourth, digital policy and trade policy should be designed with small companies in mind.** In terms of export performance, small companies in particular seem to benefit from the use of cloud services. Accordingly, these are the companies that may lose competitiveness in international markets without access to cloud services. At the same time, this group of businesses may have less influence over EU policies. Trade policy and digital policy should therefore be designed with the needs of small companies – not least startups – in mind.

**Fifth, the specific tools cloud services offer that are most relevant to export performance illustrate that the depth of cloud service usage matters.** While the EU prioritises cloud adoption through its Digital Decade programme, the metric used in that programme allows member states to track cloud usage in a binary manner and ignores the depth of cloud utilisation. Our results indicate that CRM systems, database services and computing power to run software are particularly important for internationalisation. Better data on cloud usage could thus lead to better policy that helps reap the export benefits of cloud services. This will likely become more important in the age of AI, since the competitiveness of companies that develop AI-related products and services will partly depend on their access to deeper cloud services (e.g. machine-learning software and advanced data analytics).

13 See, e.g. Ferrance et al., 2016; Ferracane et al., 2020

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# Appendices

## Appendix I: Structure, data and method

To better understand which cloud services firms are using and how this affects the firm, we combine a number of firm level datasets from Statistics Sweden (SCB) to present descriptive statistics.

- International trade in goods
- Data on the balance sheet and profit and loss account of firms
- IT and cloud service use in firms

In the third part, empirical analysis is done on a matched business dataset for the year 2020. For this purpose, several register datasets from Statistics Sweden have been merged. These include:

(**i**) **Structural Business Statistics** (**SBS**) – covers all Swedish enterprises, government agencies and organisations (excluding the financial and insurance sector). The SBS provides information on the turnover of enterprises, age, employment, physical capital, etc.

(**ii**) **Cloud computing** – statistics on usage per enterprise come from a survey on IT usage in enterprises. This is a stratified sample survey where the choice of stratum is based on industry and firm size, where the largest companies in terms of turnover or trade are always included.

(**iii**) **Foreign trade statistics** – data on foreign trade in goods are register-based statistics and include all trade with companies outside the EU in Extrastat data from the Swedish Customs. For intra-EU trade, the data come from Intrastat.[14]

Statistics Sweden's (SCB) surveys cover both small and large enterprises, but the smallest enterprises (0-9 employees) do not have to answer the questions on cloud computing every year due to their limited resources. In order to be able to include 'micro' companies in our study, we chose the 2020 survey, which is the most recent survey covering these companies. In addition, the survey is not standardized over time, so the questions asked may vary to some extent between different years. For these reasons, we do not attempt to set up a longitudinal panel or to identify causal links between IT use and our various outcome measures.

However, our analysis can give us an idea of the type of companies that are using cloud services and whether they differ significantly from others in terms of, for example, productivity, export intensity and number of export markets.

SCB uses surveys in an attempt to capture the different ways cloud services are used. However, surveys may not be the best instrument to describe the diverse ways cloud services are used. The surveys ask broad questions about cloud services and create a general picture of the types of cloud services used, which are not necessarily correlated with higher productivity and internationalisation. One problem is that SCB does not distinguish between EU and non-EU providers or whether the cloud is public or private. However, since non-EU providers account for such a large share of the market, it is reasonable to assume that most companies using cloud services use non-EU providers. To test our hypothesis, we analyse the datasets described above to see which companies use

14 Intrastat is an all-items survey with a cut-off point and covers companies with annual exports (imports) of goods to (from) the EU of at least SEK 4.5 million (SEK 9 million).

cloud services and how this could be related to trade. We are aware of the limitations of the sample and data collection methods of the SCB surveys, but they still give an indication of the use of cloud computing.

### The types of cloud computing services covered in the survey

| Type of cloud service purchased by firms | |
|---|---|
| DB | Database services. |
| CPU | Computing power to run software. |
| EM | Email. |
| FIL | File storage. |
| SOFT | Office software, such as a word processing service or cloud spreadsheet programmes. |
| CRM | Customer information management software, CRM for marketing. |
| FACC | Financial software, e.g. bookkeeping, accounting or management. |

# Appendix II: Additional Results

## Export Probability

Table 5 shows that even after controlling for labour productivity, capital intensity, firm age, size and industry, cloud adopters still appear to have a higher probability of being exporters than non-cloud adopters[15]. Table 6 shows the effect of cloud services on the firms' probability of exporting, depending on size. It shows that the marginal effect is 9 per cent for micro firms, 7 per cent for small firms and no significant effect for medium and large firms (50 or more employees).[16]

**Table 5. Export probability, marginal effects, by cloud tool**

| | (1) CC | (2) CRM | (3) DB | (4) EM | (5) FACC | (6) FIL | (7) SOFT | (8) CPU |
|---|---|---|---|---|---|---|---|---|
| **Cloud usage 1=yes; 2=no** | 0.14[a] (0.06) | 0.05[a] (0.06) | 0.06[a] (0.05) | -0.01 (0.07) | -0.01 (0.05) | 0.01 (0.06) | 0.05[a] (0.06) | 0.05[a] (0.05) |
| **Observations** | 5 090 | 3 576 | 3 576 | 3 577 | 3 577 | 3 580 | 3 577 | 3 577 |
| **Pseudo R2** | 0.39 | 0.38 | 0.38 | 0.38 | 0.38 | 0.38 | 0.38 | 0.38 |

Source: Statistics Sweden (SCB) and own calculations.
Note: Average marginal effect of x on the predicted probability of y = 1 after probit. Robust standard errors in parentheses. In all regressions, we control for labour productivity, capital labour ratio, age, size and industry (NACE 2-digit) fixed effects. Superscripts a,b,c indicate that the coefficients in the table are significant at $p < 0.01$, $p < 0.05$, $p < 0.1$.

15 However, it is crucial to interpret these findings with caution due to potential endogeneity issues.
16 When merging the groups from four into two groups, there is significance for both groups, but the size is still smaller and less significant for the larger firms.

**Table 6. Export probability, marginal effects by firm size**

| | (1) CC micro | (2) CC small | (3) CC medium | (4) CC large |
|---|---|---|---|---|
| **Cloud usage** | 0.09[a] | 0.07[a] | 0.01 | 0.23 |
| **1=yes; 2=no** | (0.07) | (0.05) | (0.04) | (0.23) |
| **Observations** | 1 197 | 1 563 | 758 | 564 |
| **Pseudo R2** | 0.32 | 0.36 | 0.36 | 0.35 |

Source: Statistics Sweden (SCB) and own calculations.
Note: Average marginal effect of x on the predicted probability of y = 1 after probit. Robust standard errors in parentheses. In all regressions, we control for capital labour ratio, age, size and industry (NACE 2-digit) fixed effects. Superscripts a,b,c indicate that the coefficients in the table are significant at $p < 0.01$, $p < 0.05$, $p < 0.1$.

## Export intensity

Table 7 shows that the coefficient for "Cloud usage" is positive and highly significant, indicating that there is a cloud computing premium. However, for the different types of cloud services, we find only weak significance for firms that purchase database services as cloud services. Table 8 shows that it is the micro and small firms that benefit the most in export intensity from using cloud services.

**Table 7. Export intensity (Exports-to-Total Sales), by cloud tool**

| | (1) CC | (2) CRM | (3) DB | (4) EM | (5) FACC | (6) FIL | (7) SOFT | (8) CPU |
|---|---|---|---|---|---|---|---|---|
| **Cloud usage** | 0.05[a] | 0.02 | 0.02[c] | -0.01 | -0.01 | -0.01 | 0.01 | 0.01 |
| **1=yes; 2=no** | (0.00) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) |
| **Observations** | 5 127 | 3 622 | 3 622 | 3 623 | 3 622 | 3 626 | 3 623 | 3 621 |
| **R-squared** | 0.14 | 0.14 | 0.15 | 0.14 | 0.14 | 0.15 | 0.14 | 0.14 |

Source: Statistics Sweden (SCB) and own calculations.
Note: Robust standard errors in parentheses. In all regressions, we control for labour productivity, capital labour ratio, age, size and industry (NACE 2-digit) fixed effects. Superscripts a,b,c indicate that the coefficients in the table are significant at $p < 0.01$, $p < 0.05$, $p < 0.1$.

**Table 8. Export Intensity (Exports-to-Total Sales), by firm size**

| | (1) CC micro | (2) CC small | (3) CC medium | (4) CC large |
|---|---|---|---|---|
| **Cloud usage** | 0.02[a] | 0.04[b] | 0.03 | -0.01 |
| **1=yes; 2=no** | (0.00) | (0.02) | (0.43) | (0.02) |
| **Observations** | 1 672 | 1 743 | 949 | 763 |
| **R-squared** | 0.11 | 0.06 | 0.30 | 0.54 |

Source: Statistics Sweden (SCB) and own calculations.
Note: Robust standard errors in parentheses. In all regressions, we control for labour productivity, capital labour ratio, age, size and industry (NACE 2-digit) fixed effects. Superscripts a,b,c indicate that the coefficients in the table are significant at $p < 0.01$, $p < 0.05$, $p < 0.1$.

## Export destinations

Table 9 shows the number of markets to which firms export and shows that cloud services are very important for the number of destinations to which firms export. The coefficients for cloud computing are positive and highly significant in all columns, except for the 'Software for Finance' category (column 5). 'CPU' and 'CRM' tools contribute most to the number of destinations to which firms export. Table 10 shows that for the number of export destinations, it is also smaller firms that drive results. There is no significant effect of cloud computing for medium or large firms.

**Table 9. Export destinations, by cloud tool**

| | (1) CC | (2) CRM | (3) DB | (4) EM | (5) FACC | (6) FIL | (7) SOFT | (8) CPU |
|---|---|---|---|---|---|---|---|---|
| **Cloud usage 1 = yes; 2 = no** | 2.75[a] | 2.69[a] | 1.63[a] | 1.05[a] | -0.06 | 1.74[a] | 1.52[a] | 2.71[a] |
| | (0.34) | (0.41) | (0.40) | (0.50) | (0.41) | (0.48) | (0.42) | (0.40) |
| **Observations** | 5 127 | 3 622 | 3 621 | 3 623 | 3 622 | 3 626 | 3 623 | 3 621 |
| **R-squared** | 0.34 | 0.38 | 0.38 | 0.38 | 0.38 | 0.38 | 0.37 | 0.38 |

Source: Statistics Sweden (SCB) and own calculations.
Note: Robust standard errors in parentheses. In all regressions, we control for labour productivity, capital labour ratio, age, size and industry (NACE 2-digit) fixed effects. Superscripts a,b,c indicate that the coefficients in the table are significant at $p < 0.01$, $p < 0.05$, $p < 0.1$.

**Table 10. Export destinations, by firm size**

| | (1) CC micro | (2) CC small | (3) CC medium | (4) CC large |
|---|---|---|---|---|
| **Cloud usage 1 = yes; 2 = no** | 0.46[a] | 1.04[b] | 0.75 | 1.12 |
| | (0.11) | (0.40) | (1.26) | (2.03) |
| **Observations** | 1 672 | 1 743 | 949 | 763 |
| **R-squared** | 0.14 | 0.26 | 0.50 | 0.55 |

Source: Statistics Sweden (SCB) and own calculations.
Note: Robust standard errors in parentheses. In all regressions, we control for labour productivity, capital labour ratio, age, size and industry (NACE 2-digit) fixed effects. Superscripts a,b,c indicate that the coefficients in the table are significant at $p < 0.01$, $p < 0.05$, $p < 0.1$.

# Sammanfattning på svenska
## Summary in Swedish

Denna rapport undersöker sambandet mellan svenska företags användning av molntjänster och deras export. Eftersom exporterande företag vanligtvis är mer produktiva än icke-exportörer, studerar vi i denna rapport först om svenska företag som använder molntjänster är mer produktiva och undersöker sedan om det finns en ytterligare kanal (utöver produktivitet) mellan molntjänstanvändning och export.

Våra resultat visar att svenska företag som använder molntjänster tenderar att vara mer internationaliserade, till exempel genom att exportera mer och till fler marknader. Dessutom ser vi att det särskilt är mindre företag som drar de största exportvinsterna av att använda molntjänster. Slutligen visar vi att vissa typer av molntjänster framstår som viktigare för internationalisering än andra. Specifikt är dessa tjänster: beräkningskapacitet för att köra programvara (CPU), programvara för kundinformationshantering (CRM) och databastjänster (DB).

Kommerskollegium har tidigare påvisat fördelarna med import och argumenterat för att dessa är lika viktiga som export (National Board of Board 2023). Resultaten från den här rapporten utgör ett praktiskt exempel på hur import kan gynna ett land genom att hjälpa dess företag att bli mer produktiva och internationaliserade.

Med tanke på att molntjänster framstår som viktiga för produktiva och internationaliserade europeiska företag, inte minst mindre företag, bör upphandlingen av sådana tjänster inte hindras i onödan av lagstiftning. Därför bör EU:s politik rikta in sig på att minska friktion som begränsar företags användning av molntjänster. Till exempel drar vi följande slutsatser:

- Att minska handelsfriktion som hindrar tillgången till molntjänster kan bidra till att förbättra EU:s konkurrenskraft. I det avseendet bör en prioritering för EU vara att minska friktionerna i den digitala handeln med USA.
- Att förbättra europeiska företags tillgång till data kan bidra till att förbättra exportfördelarna med att använda molntjänster.
- Digital politik och handelspolitik bör utformas med små företag i åtanke.

**The National Board of Trade Sweden** is the government agency for international trade, the EU internal market and trade policy. Our mission is to facilitate free and open trade with transparent rules as well as free movement in the EU internal market.

Our goal is a well-functioning internal market, an external EU trade policy based on free trade and an open and strong multilateral trading system.

We provide the Swedish Government with analyses, reports and policy recommendations. We also participate in international meetings and negotiations.

The National Board of Trade, via SOLVIT, helps businesses and citizens encountering obstacles to free movement. We also host several networks with business organisations and authorities which aim to facilitate trade.

As an expert agency in trade policy issues, we also provide assistance to developing countries through trade-related development cooperation. One example is Open Trade Gate Sweden, a one-stop information centre assisting exporters from developing countries in their trade with Sweden and the EU.

Our analyses and reports aim to increase the knowledge on the importance of trade for the international economy and for global sustainable development. Publications issued by the National Board of Trade only reflect the views of the Board.

The National Board of Trade Sweden, September 2024. ISBN: 978-91-89742-40-6

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