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Digital Adoption in Micro and Small Firms in Uruguay*

Florencia Jaccoud†

Abstract

This paper examines digital technology adoption among micro, small and medium size enterprises (MSMEs) in Uruguay, leveraging a unique database from the Check-Up Tool administered by the Agencia Nacional de Desarrollo (ANDE, Spanish acronym). It provides a comprehensive landscape of digital technology adoption by MSMEs in Uruguay and explores whether micro and small firms follow similar adoption patterns as larger firms, with findings suggesting sector- and technology-specific variations. For instance, micro and small firms in digitally intensive sectors adopt computers at comparable rates to large firms, but they lag significantly in E-commerce adoption due to challenges like insufficient managerial practices and limited training opportunities. This study highlights critical policy implications, emphasizing the need for targeted support to address skill gaps and enhance digital diffusion among smaller firms.

*We are grateful to the National Development Agency of Uruguay for their support in providing the data from the Check-up Tool, which made this research project possible. This document has also benefited from the invaluable comments by Belén Baptista and by the IDB team on previous versions.

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1 Introduction

In Latin America, micro enterprises account for roughly 3.2% of GDP, which is a significant difference compared to the 20% found in developed countries, even though they comprise nearly 99% of all firms (OECD/CAF, 2019). Additionally, recent decades have seen a decline in overall productivity in the region, with micro, small, and medium-sized enterprises (MSMEs) identified as major contributors to this trend (BID, 2022).

One of the primary causes often cited for this poor performance is low digital adoption. Although digital communication technologies have permeated global regions and industries, the benefits derived from them have not been uniform across all actors (World Bank, 2016). While digital technology adoption's aggregate effects have been moderate, evidence at the firm level indicates variations in penetration and implications across companies of different sizes. Existing literature suggests that larger firms not only tend to adopt more digital technologies but also reap the greatest gains from them (Andrews et al., 2016; Zolas et al., 2020). However, another line of research argues that micro and small firms can benefit from positive sectoral spillovers in highly digital-intensive sectors (Dedrick et al., 2003; Gal and Nicoletti, 2019).

A significant caveat is the limited focus on micro-firms in the existing literature, which has mainly concentrated on large and medium-sized enterprises. However, studies on digital adoption among micro and small enterprises (MSEs) suggest that productivity gains are to be made, although these benefits tend to be more pronounced for larger firms and are generally realized over a longer period (ILO, 2021).

Although blind spots with respect to the adoption of digital technologies among MSMEs are concerning, the lack of data on the upgrading of technology and productivity among micro-firms in Latin America is not necessarily unusual. Most innovation surveys in the region focus on companies with 10 or more employees, and Uruguay is one of the only countries in the region that has information on companies with between 5 and 9 employees (Crespi et al., 2022). Lack of data has led to an inability to confirm whether digital technology adoption among the smallest firms fundamentally differs from larger firms and whether the correlates of adoption among the larger firms are the same among the smallest. In fact, the very first question that needs to be addressed is whether the patterns of digital technology adoption in micro-firms follow the patterns of digital technology adoption by larger firms.

This paper utilizes a unique database on digital adoption among MSMEs in Uruguay, drawn from the Check-Up Tool.[1] The study has two primary objectives. First, it aims to

[1]The Check-up Tool is a program administered by the Inter-American Development Bank (IDB) and is currently implemented in 14 Latin American countries. For further information, refer to Section 3.

provide a comprehensive overview of the maturity of digital technologies among MSMEs in Uruguay. Second, it seeks to determine whether micro and small firms demonstrate similar patterns of digital adoption as larger firms in the country. To do this, the study relies on different sources, with varying time spans, and limited coverage. Thus, the analysis will primarily rely on descriptive statistics.

Our findings indicate that answering the question of whether micro and small firms mirror technology adoption trends seen in large firms is complex. This largely depends on the specific digital technologies and sectors in which they are implemented. For example, our research shows that micro and small firms resemble large firms in their use of computers, especially in digitally intensive sectors. However, their adoption patterns for E-commerce diverge significantly. One contributing factor to this discrepancy is inadequate managerial practices, which stem from limited opportunities for training. This gap highlights an area that policymakers should focus on, as targeted support could address the training needs of these firms.

The paper is structured as follows: Section 2 provides a brief review of the literature on the topic. Section 3 outlines the data sources used in the analysis. Section 4 provides an overview of the firms covered by the Check-up Tool. Section 5 presents the main findings on digital adoption, while Section 6 delves into comparing adoption patterns between micro and small *vis-à-vis* larger firms. Section 7 discusses challenges and considerations related to the scope of this research. Finally, Section 8 concludes and discusses some policy implications.

2 Related literature

Since the early 1980s, amidst the well-established Information and Communication Technology (ICT) revolution, scholars have debated why major technological developments have not been reflected in aggregate productivity. Solow's seminal quote from 1987, "*You see the computer age everywhere but in the productivity statistics*" sparked this discussion, leading to numerous studies at the aggregate level demonstrating either moderate effects or limited to specific periods (Basu et al., 2003; Timmer et al., 2011; Van Ark, 2016).

Interestingly, a micro-level examination reveals heterogeneous productivity impacts, especially at the firm level, which has driven much of this overall trend (Andrews et al., 2016; Gal and Nicoletti, 2019; Berlingieri et al., 2020; Anderton et al., 2023). The OECD (2021) report, for instance, highlights widening productivity gaps within digital-intensive sectors, where lagging firms struggle to keep pace with technological advancements achieved by frontier firms. Studies have shown that larger firms typically derive greater benefits from ICTs than smaller counterparts (Bloom et al., 2016; Goldfarb and Tucker, 2019). Similarly, Zolas

et al. (2020) finds that while certain technologies, like cloud computing, have been broadly adopted, more complex technologies remain concentrated among larger, established firms. In the U.S., digital capital accumulation is concentrated among "superstar" firms, as demonstrated by Tambe et al. (2021). By contrast, there are arguments suggesting that micro firms might emulate the digital adoption patterns of larger firms, particularly when benefiting from positive spillovers within their industry (Dedrick et al., 2003; Gal and Nicoletti, 2019). Nonetheless, it remains unclear whether micro and small firms adopt digital technologies in ways comparable to larger firms, largely due to a lack of comprehensive data on micro-enterprises.

The digital adoption literature, however, largely focuses on advanced economies. This focus overlooks developing regions like Latin America, where distinct productive structures and constraints shape the technology adoption landscape. Latin America, for instance, has a heterogeneous productive structure, marked by stark productivity gaps between large, technology-intensive firms and small and micro enterprises, which often lag in digital uptake (Cimoli et al., 2005; Cimoli and Porcile, 2013; Rivas and Stumpo, 2013). Studies show that this disparity is more pronounced in Latin America than in developed regions: in 2016, while MSMEs contributed 24.6% to production in Latin America, in Europe their contribution was as high as 56.2% (Correa et al., 2020). This feature seems to stem from the stagnant overall productivity in the region (BID, 2022). Nonetheless, MSMEs hold significant employment shares, representing over 61% of formal employment in Latin America (OECD/CAF, 2019; Correa et al., 2020), underlining their socioeconomic importance.

Evidence from Latin America reveals that ICT adoption benefits vary significantly by sector, with service firms generally seeing more gains than those in manufacturing (Aboal and Tacsir, 2018). This variation depends on how ICT adoption aligns with factors like human capital, innovation capacity, and organizational change within firms (Balboni et al., 2011; Cirera et al., 2021; Cathles et al., 2022). Further, another study suggests that larger firms in urban areas with more highly skilled employees are more likely to adopt ICTs , while it is also found that firms were more likely to adopt ICTs if they were operating in a country and sector where a larger share of firms were using ICTs (Grazzi and Jung, 2019).

Given the importance of MSMEs in Latin America's economic landscape and their pivotal role in employment, it becomes crucial to have a comprehensive understanding of the patterns of digital adoption among micro and small firms. In particular, this paper seeks to answer whether micro and small firms follow a similar pattern in technology adoption as large firms. Therefore, the objective of this paper is twofold. Firstly, to explore digital technology trends among the firms that participate in the Check-up Tool. Secondly, the goal is to provide a descriptive analysis to capture digital adoption trends in micro and small firms *vis-à-vis*

larger firms in Uruguay.

3 Data

This paper relies on three firm-level data sources. First, the main source for this analysis is the novel data collected from the Check-up Tool, which gathers information on firms' demographics as well as their digital maturity in Uruguay. Second, we complement our analysis with data from the MSMEs Directory to mitigate potential biases associated with micro-firms utilizing the Digital Check-up Tool. We leverage this source to obtain a more comprehensive landscape of coverage, which also allows us to understand the scope of our analysis and results. Finally, to examine whether micro firms mirror digital technology adoption from larger firms, we will resort to the Annual Survey of Economic Activity (Encuesta de Anual de Actividad Económica (EAAE, Spanish acronym)), which provides information on larger firms' digital adoption practices.

In the remainder of this section, we will describe in more detail each of the databases used in this analysis.

Digital Check-up Tool (Chequeo Digital) The Check-up Tool is a program administrated by the IDB which was conducted in 14 Latin American countries at the time of this research.

In the case of Uruguay, the 'Modo Digital' (hereinafter referred to as Check-up Tool) program was launched in April 2022. The Check-up Tool is administered by the National Development Agency (ANDE, Spanish acronym) with financial support from the Inter-American Development Bank (IDB). Its primary objective is to drive economic growth and enhance efficiency among Uruguayan MSMEs by fostering the adoption of digital technologies. This user-friendly tool empowers MSMEs to swiftly assess their digital technological level through a questionnaire, receiving immediate feedback on their maturity level. It provides personalized recommendations for short and medium-term implementation to incentivize or accelerate their digital transformation and augment their digital competencies. Firms can track their progress every three months, facilitating ongoing monitoring of improvements.

Between April 2022 and July 2023, a total of 1333 Uruguayan firms engaged with the Check-up Tool. It has information on the firms' basic characteristics such as RUT number (national identification number), the department where they are located, their ISIC Rev. 4 four-digit level code, size, age, sales, and the gender of the general manager and owner, among others.

The uniqueness of this database is that it offers a comprehensive array of questions,

enabling us to obtain a thorough overview of digital adoption patterns within MSMEs. For instance, it includes data on the types of digital technologies adopted by firms over the past five years, the software they use, and their plans for future adoption of various technologies. As the Check-up serves as a self-assessment tool for firms to evaluate their digital performance, the database also categorizes firms into four levels of digital maturity: initial, beginner, competent, and advanced. This classification will be used to analyze firms' digital maturity. Additionally, the database provides valuable insights into training efforts, detailing personnel training across nine distinct digital areas.

Uruguayan Directory of MSME Firms and Establishments This source encompasses the entirety of the country's productive units, or enterprises, and is compiled annually by the National Statistical Institute (INE, Spanish acronym) based on administrative records from the General Tax Directorate (DGI, Spanish acronym) and the Social Security Bank (BPS, Spanish acronym) of Uruguay. The most recent available edition at the time of this research corresponds to the year 2020. This dataset covers formal enterprises.

The dataset comprises 16 variables classified according to the ISIC Rev. 4 at the 5-digit level. Enterprises are categorized into four main types: micro, small, medium, and large firms. Micro-firms are defined as those with four or fewer employees and annual sales (excluding IVA/VAT) not exceeding 2,000,000 indexed units (I.U.).[2] Small firms are characterized by employing no more than 19 individuals and having annual sales (excluding IVA/VAT) below 10,000,000 indexed units. Meanwhile, medium enterprises encompass those employing a maximum of 99 individuals and registering annual sales (excluding IVA/VAT) under 75,000,000 indexed units.

This source will be helpful in providing a landscape of digital adoption. Given its granular information by department and industry, and considering that a subset of MSMEs utilizes the IDB's Check-up Tool, we leverage both sources to corroborate information obtained from the Check-up (see section 4). This merging is feasible due to the presence of the RUT identification number in both databases.

Annual Survey of Economic Activity (Encuesta de Anual de Actividad Económica (EAAE, Spanish acronym)) The EAAE is a panel-type survey aimed at firms with 10 or more employees, or with lower employee counts but with average monthly sales exceeding 175,794,198 pesos. Conducted by the INE since 1998, it is mandatory for enterprises with 50 or more employees, while information for smaller firms is collected via sampling. The survey

[2]It is noteworthy that this category also encompasses firms with only one employee. Thus, it includes freelancers, among which some individuals are self-employed but exclusively work for a single client and/or organization.

provides sectoral-level information aggregated at the 4-digit level according to ISIC Rev 4.[3] For this analysis, we use data from the 2020 wave, as it represents the latest year for which microdata was accessible at the beginning of this research project.

The sample is stratified along two dimensions: the main economic activity of the firm at the 4-digit level and the size, which is proxied by the number of employees registered in the BPS and/or sales declared to the DGI. As a result, each sector is stratified into three size strata.

Employing a rotating scheme, random firms, particularly small and medium-sized ones, remain in the sample for at least three years before being replaced by other firms from the same design stratum. This ensures the reliability of estimates from one period to the next, encompassing both the levels of different indicators and their variations.

This database includes a module on ICT including the following questions: number of employees using a computer, number of employees using digital devices (such as tablets, mobile devices, etc.), use (and different uses) of internet, existence of the firm's own website and its use, broadband speed, and e-commerce. The answers to these questions can be used to capture firm-level digital technology adoption.

Leveraging the Check-up Tool and the EAAE

In what follows, we will describe the variables that the Check-up Tool and the EAAE have in common and that can be used to assess the performance of micro and small firms *vis-à-vis* large firms. We will conduct this analysis at the industry level, given that both sources have information at ISIC 2-digit level.

It is important to highlight the timing difference between the two data sources. The Check-up Tool data is available only for 2022 and 2023, while the latest release of the EAAE used in this research is from 2020. This distinction is significant, as the EAAE provides pre-pandemic information, whereas the Check-up Tool reflects post-pandemic dynamics. As a result, the data for micro and small firms from the Check-up Tool likely captures the impacts of the pandemic, while the data for large firms does not. This key difference must be carefully considered when interpreting the results.

Table 1 presents a summary of the common variables between the EAAE and the Check-up Tool. These variables will be used to address our research question concerning digital adoption patterns between micro and small firms *vis-à-vis* large firms in Section 6.

[3]It excludes Agriculture, Forestry, and Fishing (A), Activities of Households as Employers (T), and Activities of Extraterritorial Organizations and Bodies (U).

Table 1: Common questions between EAAE and Check-up Tool

Variable	EAAE	Check-up tool
Sales	Continuous	Range
Computer use	People that used a computer (variable U.1.1)/Total employment (variable H.5)	Percentage of employees that used a computer (with internet connection). Self-declared
Devices	How many people used high capacity devices like tablets, mobile phones, PDAs (includes other devices like tablets, etc., variable U.2.1)/Total employment (H.5)	Percentage of employees that use a mobile phone with work apps to work (with internet connection). Self-declared
Internet type	Fix/mobile	From Q(14) we can also build fixed/mobile
E-commerce	Percentage of online sales	Percentage of online sales
Use of own website	Description of products, catalogs or price lists	Publications informing about goods and services
	Customers can order online	Customers can order online
Inputs	Did the firm purchase goods and services by internet?	Does the firm acquire inputs via internet?

Source: Own elaboration based on EAAE Dictionary and Check-up Tool questionnaire

4 Coverage of the Check-up Tool and overview of firms

In this section, we will present the results obtained from the Check-up Tool, a self-assessment tool designed to measure and enhance the digital skills of MSMEs, as highlighted in Section 3. While the information gathered by the program is extremely valuable and useful, it is essential to emphasize that it does not constitute an official data source. Therefore, results should be interpreted cautiously, considering the potential selection bias issues that may arise.

Between April 2022 and July 2023, 1333 firms responded to the questionnaire at least once. Out of these 1333, 18 firms declared having 0 employees[4], and 4 firms declared a negative number. For consistency reasons, we excluded these 22 firms, so our final sample consists of 1311 firms. In what follows, we will provide an overview of the characteristics of the firms that participated in the Check-up Tool.

Since the data source provides the RUT number, we can merge this source with the MSMEs Directory.[5] When merging the two sources, we could only match 858 firms, meaning that 453 are not present in the 2020 MSMEs Directory.[6] With this sample of firms, Table 2

[4]This is not possible, as the questionnaire explicitly instructs to include the person who is responding to the survey

[5]An important drawback is that we combine information from 2022/2023 with the 2020 MSMEs data, as it is the latest year for which we have information. This is significant, as 2020 is the year of the pandemic, while the data from the Check-up Tool is from after the pandemic.

[6]In Appendix B, more information on the mismatched firms is provided.

shows the distribution by department for total firms and for the different sizes.[7]

The proportion of firms located in Montevideo and Canelones is almost 47% in the case of the Check-up Tool, whereas it is around 61% in the MSMEs Directory. This indicates a slight bias towards firms in other departments. Given the nature of the Check-up, this result is reasonable, as firms further away from the metropolitan area might be in greater need of digital catch-up. This trend is even more pronounced for micro firms, as only 34.5% of them are located in Montevideo compared to 47.1% in the MSMEs Directory.

Furthermore, Table 2 also illustrates the distribution of firms in each department by size. For the total number of firms in the country, we observe that while 85.2% of the firms are classified as micro in the MSMEs Directory, the proportion is 63.1% in the case of the Check-up Tool. Therefore, we notice a bias towards small and medium firms in the latter data source.

[7]Given that the Check-up Tool also provides information by department, we were able to check the correspondence between the self-declared department in the Tool and the one in which firms are registered in the MSMEs Directory. There is a coincidence of 93.34%. Out of the 58 that did not match, 23 of them are registered in the Check-up Tool as located in Montevideo but in Canelones in the MSMEs Directory or vice versa. Although the mismatch is very small, we decided to work with the MSMEs classification for this exercise, as it is the official source.

Table 2: Share of firms by department. Comparison MSMEs Directory and Check-up Tool (in percentage)

Department	Check-up Tool					MSMEs Directory				
	Total	Micro	Small	Medium	Large	Total	Micro	Small	Medium	Large
ARTIGAS	2.3	2.4	1.8	3.8	n/a	1.4	1.5	1.2	0.7	0.3
CANELONES	7.1	7.6	6.7	6.2	n/a	12.5	12.7	11.5	11.0	7.9
CERRO LARGO	3.2	2.6	4.9	2.5	n/a	1.7	1.7	1.4	1.0	0.8
COLONIA	7.4	8.2	7.1	3.8	n/a	4.4	4.4	4.1	3.5	2.5
DURAZNO	1.5	2.0	0.4	n/a	8.3	1.3	1.3	1.3	0.9	0.8
FLORES	1.4	1.7	1.3	n/a	n/a	0.7	0.7	0.7	0.5	0.5
FLORIDA	3.3	2.4	4.9	5	n/a	1.8	1.9	1.7	1.5	0.3
LAVALLEJA	1.2	1.3	0.9	1.2	n/a	1.4	1.5	1.4	1.1	0.8
MALDONADO	3.9	4.6	3.1	1.2	n/a	7.0	7.0	6.9	5.5	2.7
MONTEVIDEO	39.8	34.5	45.8	52.5	83.3	48.2	47.1	52.3	60.7	74.4
PAYSANDU	2.5	2.8	1.8	2.5	n/a	3.1	3.1	2.9	2.4	1.4
RIO NEGRO	2.6	3.3	1.3	1.2	n/a	1.6	1.6	1.4	1.1	1.2
RIVERA	3.5	3.9	2.7	3.8	n/a	2.0	2.1	1.6	1.1	0.6
ROCHA	4.7	5.8	3.1	2.5	n/a	2.3	2.4	1.7	1.2	0.4
SALTO	3.7	2.8	5.3	6.2	n/a	2.5	2.5	2.4	2.5	1.7
SAN JOSE	4.0	5.0	1.8	3.8	n/a	2.8	2.9	2.5	1.9	1.8
SORIANO	4.2	3.9	4.9	3.8	8.3	2.2	2.2	2.2	1.4	0.9
TACUAREMBO	2.3	3.0	1.8	n/a	n/a	2.2	2.3	1.8	1.3	0.8
TREINTA Y TRES	1.5	2.2	0.4	n/a	n/a	1.1	1.2	1.0	0.7	0.4
TOTAL	100	63.1	26.3	9.3	1.4	100	85.2	12.0	2.4	0.4

Notes: This table shows the share of firms by department for the entire country and for micro, small, medium and large enterprises from two different sources: the MSMEs Directory and the Check-up Tool. The classification of firms corresponds to the one provided in the MSMEs Directory. See Section 3 for the definition. From the Check-up Tool we select the firms that have answered at least one time the questionnaire in 2022 or 2023. To be consistent with the Directory of MSME classification, we have merged the firms participating in the Check-up tool with the information from the Directory for 2020. Of the 1311 firms in the sample, 453 firms could not be matched. Therefore, the total number of observations in this Table is 858 for the Check-up Tool. Source: Own elaboration based on the Directory of MSME Firms and Establishments and the Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

When combining information from the Check-up Tool and the MSMEs Directory, significant discrepancies emerged between the sectors in which companies are registered in the latter and those they self-report in the questionnaire. Notably, the Check-up Tool shows a bias towards Other Service Activities (S) at the expense of Wholesale and Retail Trade and Repair (G). Consequently, when conducting industry-level analysis with data from the Check-up Tool (in Section 6), the sectoral classification from the MSMEs Directory is utilized. For further details on the Check-up Tool's coverage and the aforementioned mismatch, see Appendix B.

An additional aspect to consider is the case of one-person firms. These types of firms

may have the problem of including what is called false self-employment in the labour market literature (Grimshaw et al., 2016). This happens when the person is dependent on only one client or organization, so it is hiding an employee-employer relationship. Thus, these 'firms' can have a different dynamic in terms of digital adoption, so it could be argued that they should be either excluded or treated separately. However, to correctly assess whether this is the case, we should count on further information —i.e. if the firm works for only one client.

Since in the Check-up Tool there is a variable that indicates the number of employees firms have (counting the person who is answering the questionnaire), we can disaggregate the micro firms' category into one person firm and two or more.[8] Table 3 shows the share of firms in each of the five categories (micro one employee, micro 2 or more, small, medium and large) for the entire country and by department. It derives from this that 28.3% of the firms participating in the Check-up Tool have only one employee and almost 35% have two or more.[9] It follows from the Table that the distribution of micro-enterprises with only one employee is fairly similar to the one with two or more employees, except that there is slightly more concentration of the former in Canelones.

[8]It is important to make this distinction as micro firms with one employee have very different behavior in terms of technology adoption in comparison to micro firms with two or more employees. This will become clearer in Section 5.

[9]To contextualize, around 50% of the Uruguayan micro firms have only one employee according to estimations of the Ministry of Labour and Social Security in May 2023. Unfortunately, the breakdown by number of employees is not available in the MSMEs Directory, so a comparison with this data source is not possible.

Table 3: Share of firms by department for firms participating in the Check-up tool (in percentage)

Department	Total	Micro		Small	Medium	Large
		1 employee	2 to 4			
ARTIGAS	2.3	1.7	3.0	1.8	3.8	n/a
CANELONES	7.1	10.7	5.0	6.7	6.2	n/a
CERRO LARGO	3.2	3.3	2.0	4.9	2.5	n/a
COLONIA	7.4	7.4	8.7	7.1	3.8	n/a
DURAZNO	1.5	2.9	1.3	0.4	n/a	8.3
FLORES	1.4	0.4	2.7	1.3	n/a	n/a
FLORIDA	3.3	2.9	2.0	4.9	5	n/a
LAVALLEJA	1.2	0.8	1.7	0.9	1.2	n/a
MALDONADO	3.9	4.1	5.0	3.1	1.2	n/a
MONTEVIDEO	39.8	34.7	34.6	45.5	52.5	83.3
PAYSANDU	2.5	2.9	2.7	1.8	2.5	n/a
RIO NEGRO	2.6	2.9	3.7	1.3	1.2	n/a
RIVERA	3.5	3.7	4.0	2.7	3.8	n/a
ROCHA	4.7	4.1	7.0	3.1	2.5	n/a
SALTO	3.7	1.7	3.7	5.4	6.2	n/a
SAN JOSE	4.0	5.8	4.4	1.8	3.8	n/a
SORIANO	4.2	5.0	3.0	4.9	3.8	8.3
TACUAREMBO	2.3	3.3	2.7	1.8	n/a	n/a
TREINTA Y TRES	1.5	1.7	2.7	0.4	n/a	n/a
TOTAL	100	28.3	34.8	26.3	9.3	1.4

Notes: This table shows the share of firms in each department for the total firms and by size (micro with one employee, micro with two or more employees, small, medium and large enterprises). This includes firms that have answered at least one time the Check-up tool in 2022 or 2023. To be consistent with the Directory of MSME classification, we have merged the firms participating in the Check-up tool with the database from the Directory for 2020. Of the 1311 firms in the sample, 453 firms could not be matched. Therefore, the total number of observations in this Table is 858 for the Check-up Tool. The classification of firms is taken from the Directory of MSME Firms and Establishments. See Section 3 for the definition. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

5 Main results from Check-up Tool

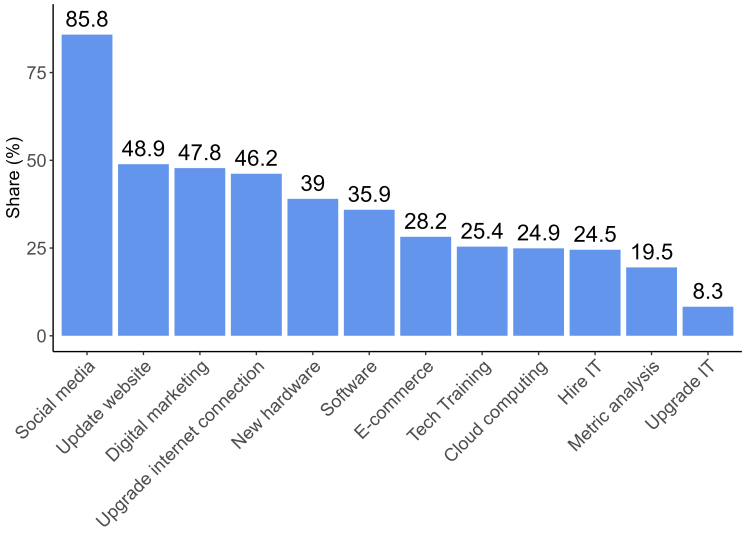
5.1 Digital adoption in MSMEs

In this section, we will present the preliminary results from the Check-up Tool. We will focus on the following aspects: overall digital adoption and the types of technologies adopted, both across all firms and by firm size. Overall, 94% of the firms that are incorporated in the Check-up Tool adopt at least one technology.

Figure 1 presents the frequency of adoption for different digital technologies. By far, social

media account creation is the most frequently adopted, as 85.8% of the firms have chosen this option. It is followed by website update at 48.9%, investment in digital marketing at 47.8 %, hiring an internet connection according to the firm's needs at 46.2% and investment in new hardware at 39%. These results are in line with the empirical evidence provided for the case of the Digital Check-up Tool in Chile, where digitalization in the communication and commercialization areas are the prevailing ones (Baptista, 2021).[10]

Figure 1: Digital technology adoption in the last 5 years (in percentage)



Notes: This figure presents the share of firms that have adopted each technology across the 1311 firms in the sample. The full label of each technology in the Check-up Tool is as follows (following the order in the graph): 'Creation of social media accounts'; 'Updated institutional website'; 'Investment in digital marketing'; 'Acquiring of an Internet connection according to the company's needs'; 'Hardware renewal processes (computer servers)'; 'New or updated software'; 'Use of e-commerce'; 'Training of your staff in technological issues'; 'Updating/upgrading of cloud systems'; 'Hiring of a technician or professional related to the technological area'; 'Metrics analysis of your digital channels (sales-products-customers, among others)'; 'Development of interoperability between your IT systems'. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

Table 4 shows the share of technologies adopted by firm size.[11] [12] It complements Figure C.1 as it allows us to see whether the most adopted technologies by micro firms diverge from

[10]It is also in line with the findings by Zolas et al. (2020) showing that smaller firms adopt more basic technologies.

[11]Firms are classified into micro, small, medium and large firms depending on the sales range that they declare (excluding VAT). In this sense, micro firms are the ones with up to Uruguayan pesos (UY) 10,300,800, small between UY 10,300,801 and 51,504,000, medium UY 51,504,001 to 386,280,000, and large over UY 386,280,000. We split the micro firms into firms with one employee and firms with two or more since the former normally have very different behavior and logic in comparison to the latter.

[12]Note that this classification differs from the one used both in section 4 and section 6. This is because in those cases we are comparing with other data —e.g. the MSMEs Directory and/or EAAE—and for consistency between the different sources we stick to the classification used in the MSMEs. However, as in Table 4 we are only looking at the Check-up Tool and we would like to analyze the entire sample of firms, we use an alternative classification. Otherwise, using the MSMEs Directory would restrict the sample to 858, so 453 would be missing. This is acceptable when comparing different databases as information should be as homogenous as possible between them.

the technology portfolio of the rest. The first finding derived from Table 4 is that, for most types of firms, the technology that is most adopted is creation of social media accounts. While the shares are not dramatically different between micro to medium size firms, as they all oscillate around 80%, it drops to 65.6% for large firms. When looking at the ranking of most chosen technologies, we notice that social media, improving internet connection, digital marketing and updating the firms' website are within the top four most chosen technologies for micro, small and medium firms; albeit differences in the shares. However, it is in large firms where we observe a different portfolio of digital technologies. For example, Table 4 demonstrates the importance of hardware renewal processes (computer servers) with 56.2% of large firms adopting this technology, while the share is 47.8% and 36.3% for small and micro firms with two or more employees, respectively. Another remarkable contrast is observed for training IT personnel, where 46.9% of large firms follow this strategy, while the percentage is 22.6% and 25.3% for micro firms with two or more employees and small firms, respectively. Nevertheless, Table 4 reflects that the adoption rate of advanced technologies, such as AI and machine learning, is substantially smaller for large firms. This is a somewhat unexpected finding. One possible explanation is that large firms, which tend to adopt simpler technologies more extensively–such as software for supply chain management, finance, and other operational areas–participate in the Check-up Tool to improve the adoption of more complex technologies. Another factor might be that the Check-up Tool questionnaire does not define these advanced technologies clearly, which could lead to misinterpretation of the scope and results in inaccurate responses. However, this warrants further investigation.

Table 4 also indicates that there is a sharp difference in the adoption shares when comparing micro firms with one employee and micro firms with two or more employees. Lastly, it is worth noting the share of technology adoption in small and medium-sized firms is fairly similar to each other for most of the digital technologies.

The fact that almost 36% of the companies declare updating or acquiring new software is particularly interesting as the richness of the questions allows us to explore further this aspect. Therefore, we identify which type of software is more commonly adopted, which is reflected in Table 5. The vast majority, 79.8% of the firms have adopted programs related to Microsoft Office, followed by cloud computing-related programs 60.2%, and communication 57.4%. Slightly more than a third of the firms use software related to security. Only 14.6% of them use software related to digital marketing and 3.7% use programs related to more advanced technologies such as AI and machine learning, among others.

All in all, we observe that there is a high share of firms that have adopted at least one digital technology, and most of them indicate the use of one or more software programs. Nevertheless, when breaking down by type of technology and programs, the majority of

Table 4: Technology adoption by firm size (in percentage)

Technology	Micro 1 emp	Micro 2 or more emp	Small	Medium	Large
Update website	25.4	52.0	59.3	55.5	51.6
Software	15.0	33.0	50.6	46.5	54.7
Social media	82.2	79.6	80.2	78.7	65.6
Digital marketing	34.1	46.6	51.4	50.3	54.7
E-commerce	24.2	25.6	27.3	32.9	26.6
New hardware	21.4	36.3	47.8	49.0	56.2
Cloud computing	13.5	21.1	32.8	31.6	45.3
Tech Training	16.3	22.6	25.3	34.8	46.9
Hire IT	12.0	24.2	31.2	32.9	26.6
Upgrade internet connection	31.6	43.7	52.6	51.0	51.6
Upgrade IT	2.5	6.5	10.3	14.2	25.0
Metric analysis	13.5	21.3	16.2	23.2	23.4
None	8.1	5.6	4.7	2.6	6.2
Total firms (N)	393 (30.0%)	446 (34.0%)	253 (19.3%)	155 (11.8%)	64 (4.9%)

Notes: This table shows the share of micro (with one and two or more employees), small, medium and large firms that have adopted each technology respectively. The total number of firms in the sample is 1311. Firms are classified into micro, small, medium and large firms depending on the sales range that they declare (excluding VAT) in the corresponding question in the Check-up Tool. Micro firms are the ones with up to Uruguayan pesos (UY) 10,300,800, small between UY 10,300,801 and 51,504,000, medium UY 51,504,001 to 386,280,000, and large over UY 386,280,000. We split the micro firms into firms with one employee and firms with two or more since the former normally have very different behavior and logic in comparison to the latter. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

adoption seems to be circumscribed to simpler technologies and or programs. However, this picture changes when zooming in by type of firms. Among MSMEs, we observe a higher concentration of simpler technologies, whereas the largest firms tend to adopt more complex technologies.

Table 5: Type of software programs used by firms

Program	% of firms
Processing and visualization of info. using MS Office	79.8
For file synchronization in the cloud (e.g. Google Drive, One Drive, Dropbox)	60.2
Communication (e.g. Zoom, Skype, Webex, etc)	57.4
Security programs (e.g. Avast, Norton, McAfee, etc)	34.7
For finance activities, supply chain, operations, commerce, HR (e.g. ERP systems, etc)	15.3
To organize team tasks, such as Confluence, Asana, Slack, etc	14.8
For digital marketing (e.g Hubspot, Marketing Hub, Mailchimp)	14.7
For E-commerce such as Shopify, Ecwid, GoDaddy eCommerce, etc	14.6
Don't use any of these programs	12.8
Info. processing for CRM (customer management, e.g. Bitrix24, HubSpot, Odoo, etc)	11.6
Info. processing for accounting, (e.g. Sage Accounting, Odoo, Wave)	10.5
Optimize/improve goods or services (e.g. Idea Drop, Miro, Meister, etc)	4.0
Advanced technologies such as AI, machine learning, deep learning, among others	3.7

Notes: This table shows the share of firms participating in the Check-up that adopted each program type. The total number of firms in the sample is 1311. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

Table 6 shows the most frequently adopted software by firm size.[13] In the case of the micro firms with one employee, almost 72% of them chose programs within MS Office (29), followed by cloud computing (32) at 51.4% and communication at 46.8% (30). The pattern of software adoption between small and medium sized firms mirrors the pattern of technology adoption, with similar percentages across the software categories. Like the rest of the firms, the large ones prioritize the adoption of programs related to MS Office, but also other programs such as communication, cloud computing and security programs.

[13]It is worth noting that this question in the Check-up Tool refers to the type of software that the firm uses on a regular basis, and not on the software that has been adopted in the last 5 years as in Table 4.

Table 6: Software adoption by firm size

Program	Micro 1 emp	Micro 2 to 4 emp	Small	Medium	Large
Processing and visualization of info. using MS Office	71.8	82.1	87.7	80.0	81.2
For files synchronization in the cloud (e.g. Google Drive, One Drive, Dropbox)	51.4	63.5	65.6	63.9	65.6
Communication (e.g. Zoom, Skype, Webex, etc)	46.8	61.7	62.5	59.4	68.8
Security programs (e.g. Avast, Norton, McAfee, etc)	27.5	34.5	39.9	38.7	53.1
For finance activities, supply chain, operations, commerce, HR (e.g. ERP systems, etc)	5.6	11.2	22.9	27.1	46.9
To organize team tasks, such as Confluence, Asana, Slack, etc	11.2	16.8	15.4	16.8	17.2
For digital marketing (e.g Hubspot, Marketing Hub, Mailchimp)	11.2	15.5	16.6	17.4	21.9
For E-commerce such (e.g. Shopify, Ecwid, GoDaddy eCommerce, etc)	12.5	16.4	13.4	16.1	17.2
Don't use any of these programs	18.8	11.2	7.1	12.3	10.9
Info. processing for CRM (customer management, e.g. Bitrix24, HubSpot, Odoo, etc)	5.9	13.7	13.8	12.3	26.6
Info. processing for accounting, (e.g. Sage Accounting, Odoo, Wave)	4.8	10.5	13.8	16.8	18.8
Optimize/improve goods or services (e.g.Idea Drop, Miro, Meister, etc)	3.6	3.4	4.3	4.5	9.4
Advanced technologies such as AI, machine learning, deep learning, among others	3.8	3.8	3.6	4.5	1.6
Total firms	393	446	253	155	64

Notes: This table shows the share of micro (with one and two or more employees), small, medium and large firms participating in the Check-up that adopted each program type. The total number of firms in the sample is 1311. Firms are classified into micro, small, medium and large firms depending on the sales range that they declare (excluding VAT) in the corresponding question in the Check-up Tool. Micro firms are the ones with up to Uruguayan pesos (UY) 10,300,800, small between UY 10,300,801 and 51,504,000, medium UY 51,504,001 to 386,280,000, and large over UY 386,280,000. We split the micro firms into firms with one employee and firms with two or more since the former normally have very different behavior and logic in comparison to the latter. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

Broadly speaking, firms that participate in the Check-up Tool tend to adopt simpler technologies and software. When we break down the analysis by firm type, a more nuanced picture emerges. While digital adoption generally becomes more sophisticated as firm size increases, some specific patterns stand out. Tables 4 and 6 reveal that micro firms with a single employee adopt significantly fewer technologies than those with two or more employees.

This is unsurprising, as the dynamics of a one-person firm differ greatly from those of other micro firms. As mentioned in Section 4, in some cases single-employee firms work with one or two clients, resulting in different technological needs and portfolios compared to micro firms with additional staff. Lastly, the technology and software adoption profiles of small and medium firms show minimal differences, suggesting a similar approach to digital adoption across these two firm types.

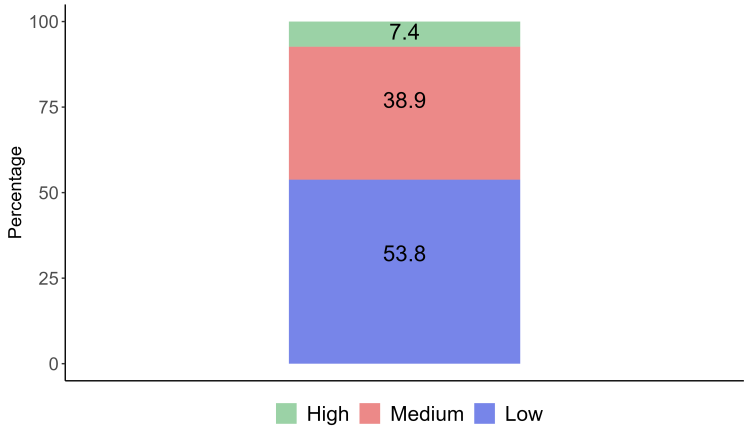
5.2 Digital intensity in MSMEs

The type of technologies that firms adopt provide an interesting picture of how firms behave. However, they are insufficient to show the total degree of adoption. Therefore, in this section, we will explore this further by looking at two indicators that summarize the overall technology adoption: the intensity of adoption and the digital maturity of firms. Concerning the former, given that the Check-up Tool provides several options for technology incorporation, we classify firms into low, medium and high adopters depending on the number of technologies that they choose. In this sense, and following the Eurobarometer (2020) methodology, low adopters are the ones that incorporate 0 to 3 technologies, medium 4 to 7 and high adopters when they adopt 8 or more. We consider the sets of technologies displayed in Figure 1.[14] The second indicator is the digital maturity classification that is given by the Check-up Tool. Based on firms' responses to the general questionnaire, they are classified into four categories: initial, beginner, competent, and advanced. Therefore, we take this classification as an alternative indicator to assess the technological content of firms participating in the Check-up Tool.

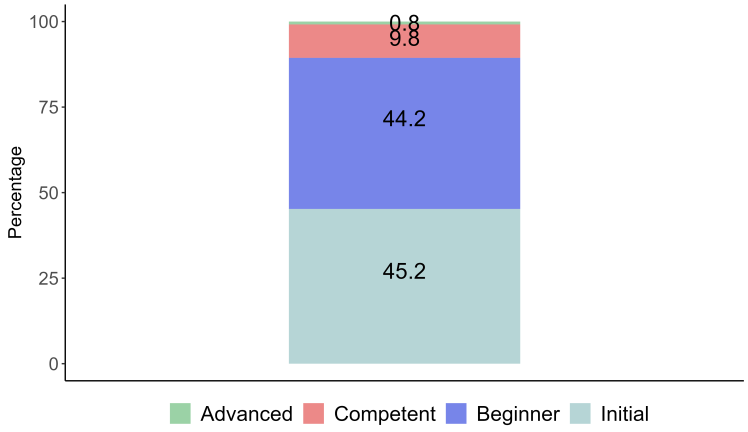
Figure 2a presents the distribution of firms by digital intensity adoption. It indicates that 53.8% of firms participating in the Check-up Tool exhibit low digital intensity adoption, 38.9% have a medium level, and only 7.4% demonstrate high technology adoption, (that is, adopt 8 or more technologies). Figure 2b shows the same but taking the digital maturity from the Check-up Tool. It derives from this that 45.2% of the firms fall under the initial category, while 44.2% fall into the beginner category, and only 9.8% of the firms are considered competent and 0.8% advanced.

[14]The only difference is that we exclude from this analysis two options: Training of your staff in technological issues and Hiring of a technician or professional related to the technological area, as they are not technologies per se but rather activities related to them.

Figure 2: Share of firms by intensity adoption and digital maturity (in percentage)



(a) Intensity adoption



(b) Digital maturity

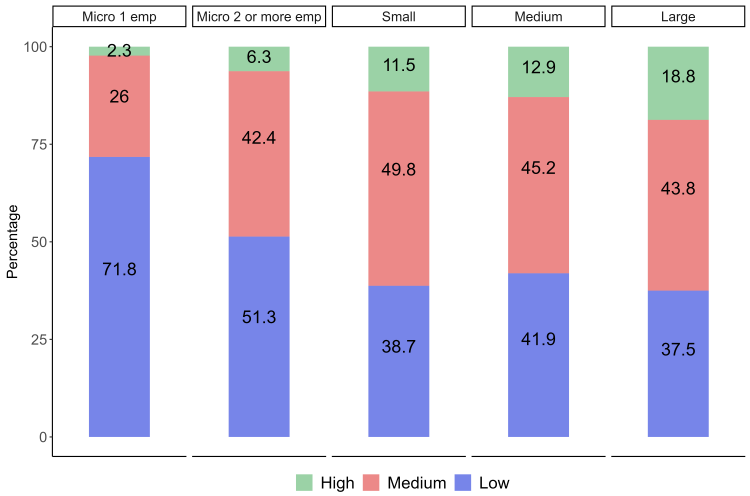
Notes: This figure presents the share of firms by intensity adoption (2a) and by digital maturity (2b). Digital intensity adoption is defined as low if the firm has adopted between 0 and 3 technologies, medium when the range is between 4 to 7, and high when the number of technologies adopted is equal to or greater than 8. The digital maturity classification comes from the indicator elaborated by the Check-up Tool based on the firms' responses to the questionnaire. The total number of firms in the sample is 1311. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

The literature indicates that there is great heterogeneity in terms of technology adoption when considering different dimensions such as size, age, gender and other characteristics (Cirera et al., 2021; Gal and Nicoletti, 2019). Furthermore, in the previous section, we have also observed different technological portfolios between firms of different sizes. Therefore, in what follows, we will explore further the digital maturity and digital intensity of firms considering size, age of the firm and geographical location.[15] One of the most important dimensions

[15]In the Appendix C we provide further descriptives considering the sex of the owner, manager and number of employees.

to consider is the size of the firm. Therefore, Figure 3 shows the share of digital intensity by firm size. Not surprisingly, the Figure shows that the share of high-intensity adoption increases as we move towards larger firms. It is quite outstanding the sharp difference between micro firms with one employee and with two or more, as the share of low-intensity firms falls from almost 72% to 51.3%, while the share of medium digital intensity firms increases from 26% in micro firms with one employee to 42.4% in micro firms with two or more employees. There is also a remarkable difference when comparing the shares of micro with two or more employees and small firms, as only 38.7% of the small firms have a low adoption. Interestingly, the digital intensity composition between the small and medium firms does not vary substantially. It is only when looking at large firms that we observe that around 19% of the firms have a high digital intensity.

Figure 3: Digital intensity composition by firm size (in percentage)



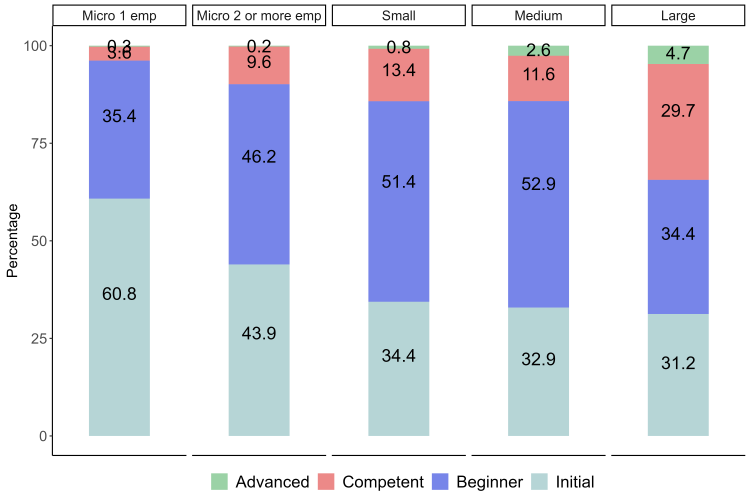
Notes: This figure shows the digital intensity composition (in percentage) by firm size. Digital intensity adoption is defined as low if the firm has adopted between 0 and 3 technologies, medium when the range is between 4 to 7, and high when the number of technologies adopted is equal to or greater than 8. Firms are classified into micro, small, medium and large firms depending on the sales range that they declare (excluding VAT) in the corresponding question in the Check-up Tool. Micro firms are the ones with up to Uruguayan pesos (UY) 10,300,800, small between UY 10,300,801 and 51,504,000, medium UY 51,504,001 to 386,280,000, and large over UY 386,280,000. We split the micro firms into firms with one employee and firms with two or more since the former normally have very different behavior and logic in comparison to the latter. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

Figure 4 shows the digital maturity composition by firm size, and the same conclusions can be inferred concerning the digital intensity index. Almost 61% of the micro firms with one employee are initial and 35.4% beginners. There is a remarkable difference between the two types of micro firms, as for the ones with two or more employees the share of beginner companies increases to 46.2% and the percentage of competent is around 9.6%. Once again in this case we observe that the shares in small and medium firms are extremely similar, indicating that they show a very similar digital profile. Interestingly, the distribution of

digital maturity within small and medium firms is quite similar in both cases, where around half of them are beginners, approximately a third initial and slightly over 10% are advanced. Once again, the greater contrast appears with the large firms, where almost 30% are classified as competent, 34.4% as beginner and 31.2% as initial. They also show the largest percentage of advanced at 4.7%, which is quite sizeable if we compare it to the 0.86% of advanced firms in the whole sample.

Given that we observe quite similar results when looking at either the digital intensity or the digital maturity, in the rest of the section we will focus on the digital intensity indicator.

Figure 4: Share of maturity level by firm size



Notes: This figure shows the digital maturity composition (in percentage) by firm size. The digital maturity classification is provided in the Check-up Tool, where firms are classified into initial, beginner, competent, and advanced according to their responses in the survey. Firms are classified into micro, small, medium and large firms depending on the sales range that they declare (excluding VAT) in the corresponding question in the Check-up Tool. Micro firms are the ones with up to Uruguayan pesos (UY) 10,300,800, small between UY 10,300,801 and 51,504,000, medium UY 51,504,001 to 386,280,000, and large over UY 386,280,000. We split the micro firms into firms with one employee and firms with two or more since the former normally have very different behavior and logic in comparison to the latter. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

Figure 5 depicts the digital intensity adoption by age of the firm. To compute the age of the firm, we subtract the year of creation of the firm from the year in which the firm answers the questionnaire. Next, to build the categories, we split the variable age into quartiles, where we named 'new' to the firms that fall in the first quartile, 'starters' the ones that belong to the second, 'young' the firms that correspond to the third and 'mature' the ones that are grouped in the fourth quartile.[16] As expected, we observe that the percentage of firms with high digital technology adoption increases with the age of the firm. While 11.4% of mature firms have a high-intensity adoption, the share is 5.7% for the new and 3.3% for starters. The share of medium-intensity adopting firms is 41.4% for starters, in comparison

[16]Refer to Table C.3 in Appendix C for the descriptive of the age of the firm by age range.

to only 26.6% for the new.[17]

Finally, Figure 6 reflects the digital intensity adoption by geographical area, where the Montevideo and Canelones departments are one group and the other is comprised of the rest of the departments of the country. As expected, the share of low-adopting firms is 11.9 percentage points lower in the metropolitan area in relation to the rest of the country. Most of this difference is translated into a greater share of medium-intensity adoption in the case of Montevideo and Canelones, as the share of high-technology adopting firms is only 2.4 percentage points higher in this case.[18]

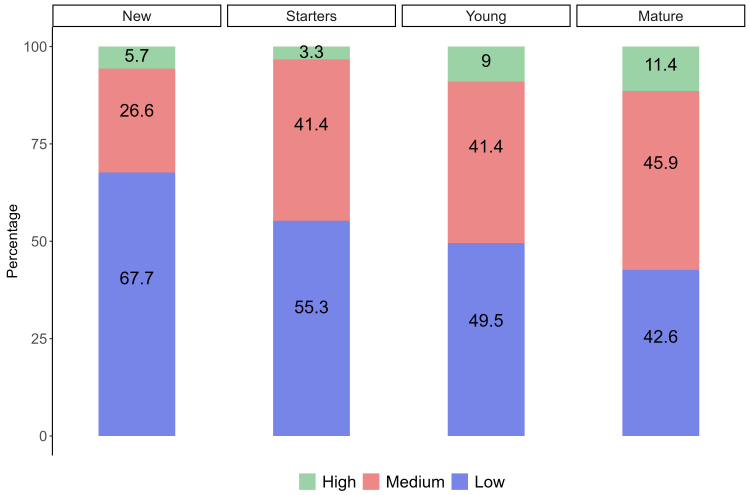
Overall, we observe a fairly low rate of digital intensity and maturity in the firms that participate in the Check-up Tool. Further, we corroborate that both measures provide very similar results when it comes to the level of technology adoption in all firm types.[19] In terms of size, age, and geographical location the results from the Check-up Tool are in line with what is generally observed in the literature on the topic. That is, larger, older firms located in metropolitan areas have a higher propensity to adopt digital technologies. Nevertheless, it is interesting to highlight that the digital profiles of the small and medium firms that are included in the Check-up Tool are very similar.

[17] It is worth noting that there is a fairly high dynamic rate of firm births and deaths, where the probability of survival is also related to the size of the firm —i.e. larger firms have greater chances of survival. In this sense, it is not surprising that digitalization patterns by age mirror Figure 3, where the digital intensity by size is shown.

[18] Figures C.3 to C.5 in Appendix C show further combinations of digital intensity and firm demographics.

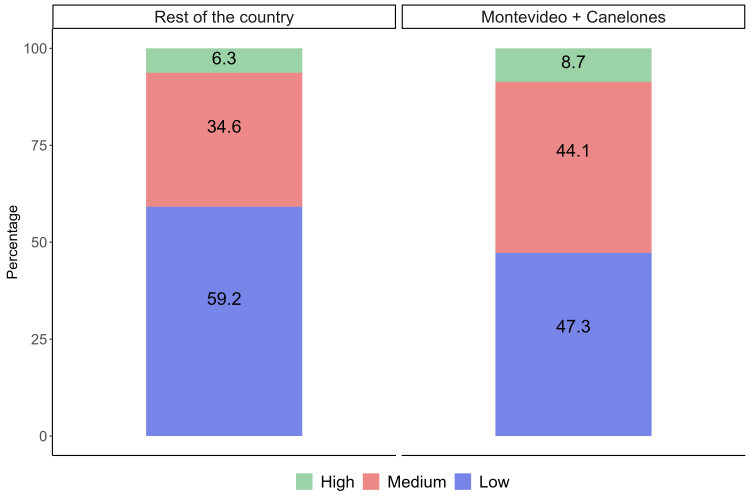
[19] It is worth emphasizing that the sum of the shares of beginners and initial is similar to the sum of the low and medium intensity. For instance, in Figures 3 and 4, almost 77% of the micro firms with one employee are classified as low and medium digitally intensive, and around 76% of the firms are initial and beginner when looking at the maturity level.

Figure 5: Share of firms by intensity adoption and age of the firm (in percentage)



Notes: This figure shows digital intensity composition (in percentage) of firms by age of the firm. Digital intensity adoption is defined as low if the firm has adopted between 0 and 3 technologies, medium when the range is between 4 to 7, and high when the number of technologies adopted is equal to or greater than 8. To compute the age of the firm, we subtract the year of creation of the firm from the year in which the firm answers the questionnaire. Next, to build the categories, we split the variable age into quartiles, where we named 'new' the firms that fall in the first quartile, 'starters' the ones that belong to the second, 'mature' the firms that correspond to the third and 'old' the ones that are grouped in the fourth quartile. See Table C.3 in appendix C for the descriptive of the age of the firm by age range. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

Figure 6: Share of firms by intensity adoption and geographical area (in percentage)



Notes: This figure shows digital intensity composition (in percentage) of firms by geographical location of the firm. Digital intensity adoption is defined as low if the firm has adopted between 0 and 3 technologies, medium when the range is between 4 to 7, and high when the number of technologies adopted is equal to or greater than 8. We group together Montevideo and Canelones, and the rest of the country is comprised of the remaining 17 departments. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

6 Patterns of digital adoption between MSMEs and large firms

As mentioned in Section 2, there is not only a gap in the literature regarding how micro firms behave concerning digital adoption but also about how adoption patterns are when compared to larger firms. Do micro-firms mirror digital adoption of larger firms? In this Section, we will address this question. Recalling from Section 3, to do so, we will combine information from different sources. We use the EAAE to compare with large firms, given that the Check-up Tool is mainly for micro and small firms. As seen in section 5, only 5.3% of the Check-up Tool firms can be classified as large. By contrast, as mentioned in Section 3, the EAAE surveys the entirety of large firms universe, enabling a more accurate comparison. From the Check-up Tool we will retrieve information on digital adoption for micro and small firms.[20] Further, as stated in Section 3, the analysis will be conducted at the industry level (ISIC 2-digit level). Therefore, we will compare how micro, small and large firms in the same sector behave in terms of digital technology adoption.

We will use variables that are present in both data sources, described in section 3. These variables are: computer use by employees, use of own website (for product description and for online sales), ordering inputs online and e-commerce.[21] Given that micro firms with one employee have a very different logic and behavior than the ones with two or more employees, in the rest of this Section, we will exclude one-person micro firms from the analysis. Lastly, it is important to remember the differences in timing between the two data sources, as stated in Section 3. The most recent release of the EAAE at the time of this research is 2020, whereas the only data available from Check-up Tool is from 2022 and 2023. This difference is not minor, as the former has information from before the pandemic and the latter from after. The COVID-19 pandemic likely affected the firms' digital adoption patterns, but we cannot capture this with the wave of the EAAE used in this analysis.[22]

We will first start by looking at the share of employees using a computer. In the case of the Check-up Tool, the answer to these questions is already given in percentage by the survey respondents. In contrast, in the case of the EAAE we need to compute it using the variables mentioned in Table 1.

Figure 7 illustrates the sectoral correlation of the average percentage of employees using

[20] It is important to note that although the EAAE covers small firms, it only covers a small part of them. Those with 10 or more employees. Given that the Check-up Tool also covers the lower bound of these firms, we will use the information from this data source.

[21] It is worth mentioning that in Appendix D we also compare with employees using devices. Furthermore, we do not analyze the type of internet as it has become more basic nowadays.

[22] This can be updated in future research.

a computer (at the 2-digit ISIC level) for large firms compared to micro and small firms. We employ the digital intensity taxonomy elaborated by Calvino et al. (2018) to characterize sectors. This approach classifies sectors into four categories: high, medium-high, medium-low and low digital-intensive sectors.[23]

Figure 7a shows the correlation when comparing micro and large firms. It indicates a fairly high correlation at 42%. While we observe that high and medium-high digital-intensive sectors have similar (and large) adoption shares–such as Activities of head offices; management consultancy activities (70), Programming and broadcasting activities (60), Telecommunications (61), Computer programming, consultancy and related activities (62) and Activities auxiliary to financial service and insurance activities (66)–, there are other high and medium-high digital sectors in which the adoption by micro firms is lower. This is the case for Office administrative, office support and other business support activities (82) and Civil engineering (42).

In the case of the comparison between large and small firms, from Figure 7b, a lower correlation of 33% can be observed. It is particularly outstanding that the share of computer use in high digital sectors is larger in the case of small firms than in large firms.[24] Further, the Figure also suggests that the adoption rates are fairly similar for low and medium-low intensive sectors.

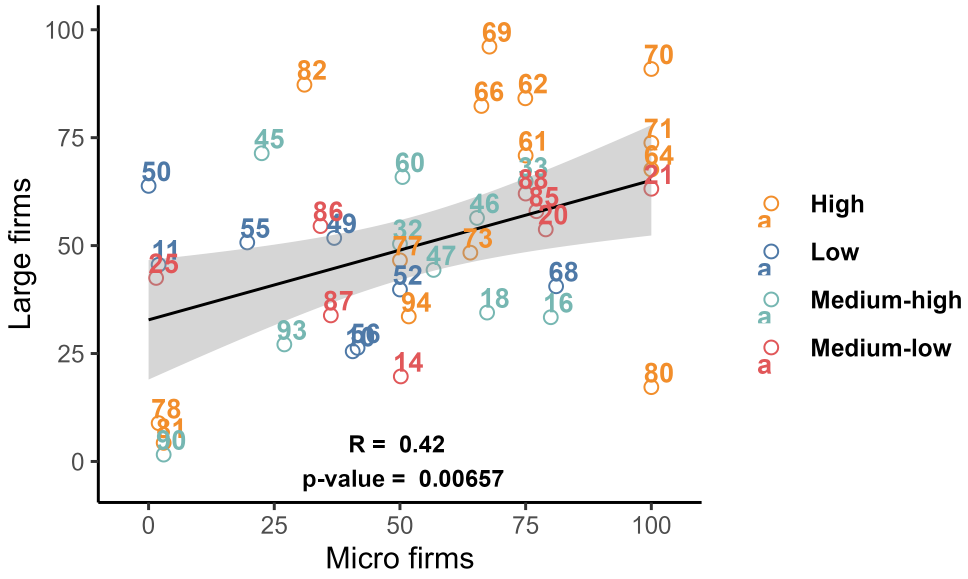
Figure D.1 in Appendix D displays the same charts as in Figure 7, but the variable is the share of employees using a device. In general, we observe that while the sectoral correlation tends to be positive, it is lower.[25]

[23]The authors elaborate a global sectoral taxonomy of digitally intensive sectors by combining different indicators: share of ICT tangible and intangible (i.e. software) investments, the share of intermediate purchases of ICT goods and services, stock of robots per hundreds of employees, the share of ICT specialists in total employment, and the share of turnover from online sales (Calvino et al., 2018). It has been created based on information from OECD countries, and it provides insightful information on the characteristics of the sectors in terms of digital adoption. Although we cannot assume that sectors in Uruguay behave in the same way as the ones from the OECD countries, we use it as a benchmark to describe general sectoral characteristics.

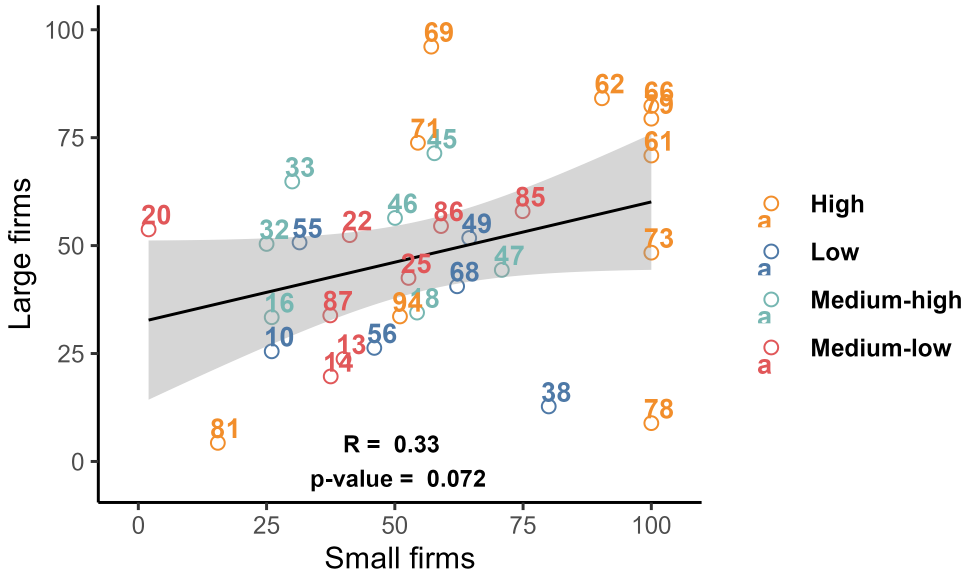
[24]Nevertheless, this effect may be related to the time difference between the two data sources used in the analysis, as the information for large firms is derived from the 2020 EAAE. Additionally, it may stem from the fact that large firms tend to have a higher proportion of support personnel, whereas small firms in highly digital sectors typically employ primarily technical staff, outsourcing support services.

[25]It should be noted that in the case of the question of devices, there is more discrepancy between the two data sources. In the case of the EAAE, the question is 'How many employees used high-capacity portable devices such as personal assistants (PDAs), tablets or smartphones during the reporting period'. In the case of the Check-up Tool, the question is 'The percentage of employees who have cell phones with dedicated work applications and Internet connection is approximately...'. It follows from this that the latter has a narrower scope as it is only confined to smartphones, whereas the scope of the EAAE is wider, including other types of devices such as tablets, among others.

Figure 7: Sectoral correlation of the share of employees that use a computer



(a) Large vs Micro



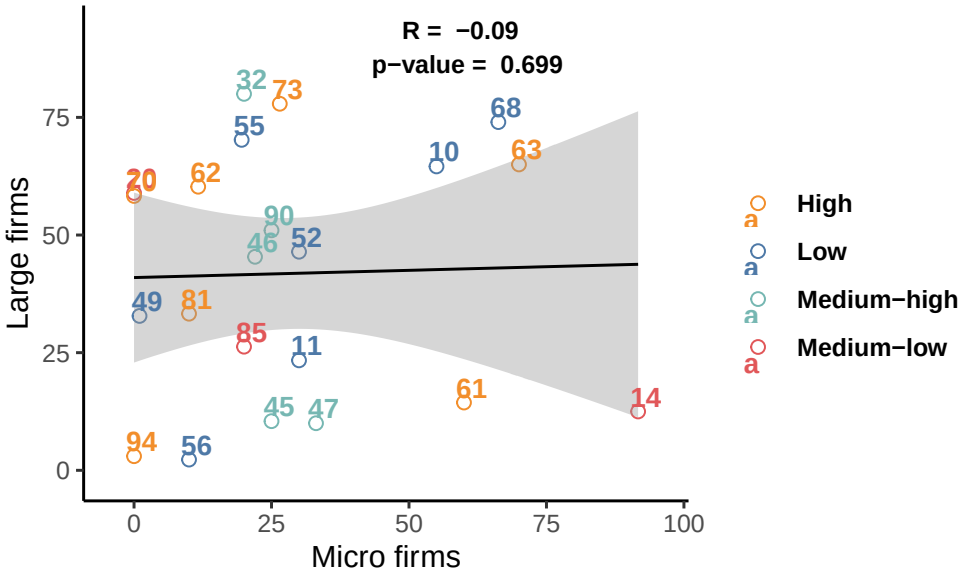
(b) Large vs Small

Notes: Figure 7a presents the correlation between the average share of E-commerce sales by by large firms (y-axis) and micro firms (x-axis), and Figure 7b presents the correlation between the share of employees using a computer by large firms (y-axis) and small firms (x-axis). The results for large firms are sourced from EAAE and are weighted using the weights provided in the survey. The results for micro and small firms come from the Check-up Tool and the sample excludes firms with one employee. The indicator is the average share of employees using a computer in each sector at ISIC 2-digit levels. The classification of firms into micro and small categories is derived from the MSMEs Directory (see section 3). We are restricting the sample to the firms that match with the MSMEs Directory 2020 to avoid sectoral misclassification in the Check-up Tool. Therefore, these shares have been computed over a sample of 858 firms. We use the taxonomy elaborated by Calvino et al. (2018) to classify sectors into high, medium-high, medium-low, and low digital-intensive sectors. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB) and the EAAE 2020.

Next, we will analyze the patterns of E-commerce sales between micro and small firms *versus* large. Figure 8 shows the correlation of the average percentage of E-commerce sales by sector (at ISIC 2-digits levels) for large firms *vs* micro and small.[26] Figure 8a depicts that there is no correlation of the share of E-commerce sales between micro and large firms. While Figure 8b shows a positive correlation between small and large firms, it is not statistically significant.

It can be derived from this that micro and small firms do not follow similar E-commerce practices as large firms. Further, there is no clear pattern with respect to the type of sectors, as opposed to what was observed for the case of computer use. The general low use of E-commerce in micro and small firms *vis à vis* the large ones is also confirmed in Figures C.14 and C.15 in Appendix C, where the distribution of the E-commerce sales is displayed. It becomes clear that while most firms participating in the Check-up Tool have no E-commerce at all, the picture is quite different for the companies surveyed in the EAAE.[27]

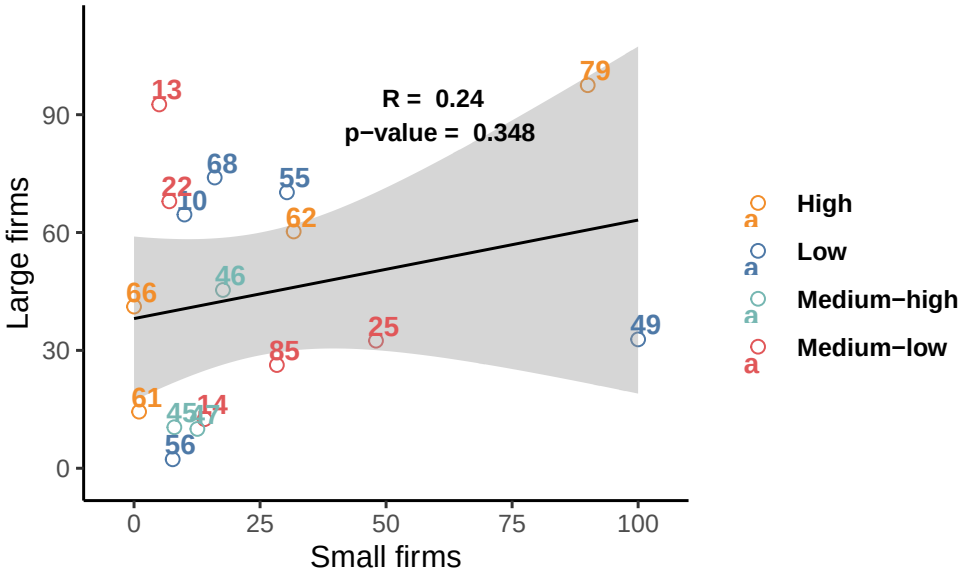
Figure 8: Share of E-commerce sales



(a) Large firms vs micro

[26] It is worth highlighting that for E-commerce we restrict the sample of firms from the Check-up Tool to the ones that have adopted E-commerce.

[27] This discrepancy may be rooted in the fact that firms that participate in the Check-up Tool are actively seeking to improve their technological capabilities —i.e. they depart from a fairly low base. In this respect, even in more digitally intensive sectors, firms that take the Check-up Tool may be incentivized to improve their digital skills to catch up with the rest of the firms. Table C.2 in Appendix C shows further descriptive statistics of the percentage of E-commerce sales where it is possible to appreciate that the median is 0 for total firms, even when breaking down the analysis by firm size.



(b) Large firms vs small

Notes: Figure 8a presents the correlation between the average percentage of E-commerce sales by large firms (y-axis) and micro firms (x-axis), and Figure 8b presents the the average percentage of E-commerce sales by large firms (y-axis) and small firms (x-axis). The results for large firms are sourced from EAAE and are weighted using the weights provided in the survey. The results for micro and small firms come from the Check-up Tool and the sample excludes firms with one employee. The indicator is the average share of E-commerce sales in each sector at ISIC 2-digit levels. The classification of firms into micro and small categories is derived from the MSMEs Directory (see section 3). We are restricting the sample to the firms that match with the MSMEs Directory 2020 to avoid sectoral misclassification in the Check-up Tool. Therefore, these shares have been computed over a sample of 858 firms. We use the taxonomy elaborated by Calvino et al. (2018) to classify sectors into high, medium-high, medium-low, and low digital-intensive sectors. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB) and the EAAE 2020.

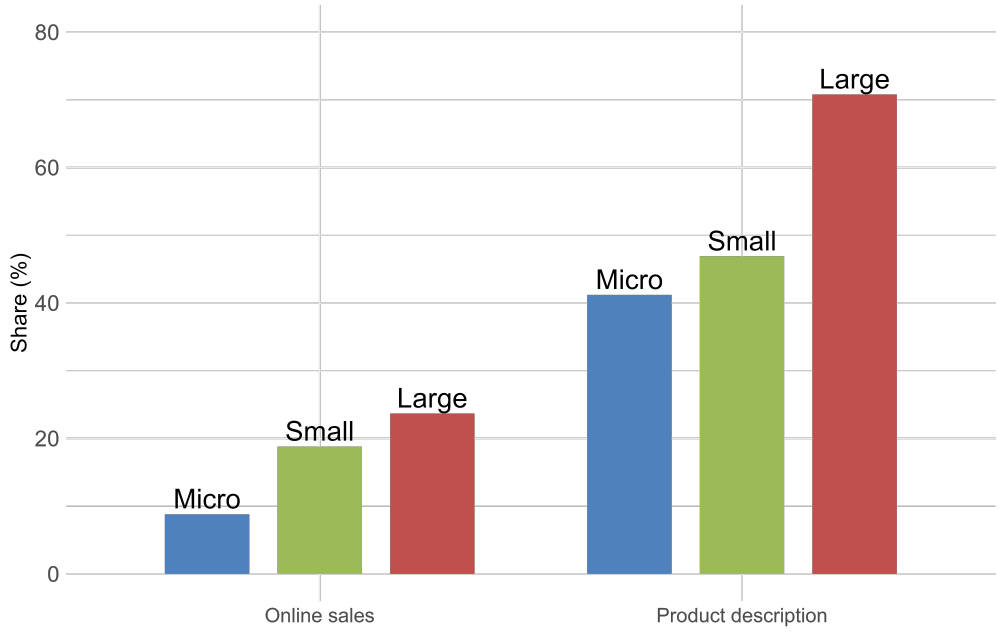
Next, we will proceed to analyze the use that firms make of their own website. Figure 10 shows the share of firms that use their website for online sales and product description. Not surprisingly, in line with the very low correlations observed for E-commerce, Figure 9 shows that less than 10% of the micro firms provide online sales. Further, there is not much difference when comparing small and large firms. By contrast, regarding the use of their own website for product description, we do observe a substantial difference between micro and small *versus* large firms. While almost 70% of large firms provide their customers with online information about their products, the figure is almost 40% and 55% for micro and small firms, respectively.

Analysis of sectoral correlations in Figure 10a shows that there is no alignment in sectoral adoption rates between micro and large firms for online sales, and this trend is evident across most sectors. Interestingly, sector Office administrative, office support and other business support activities (82) is an exception, in which most of the micro firms engage in offering online sales. Figure 10b suggests a positive but insignificant correlation. Notably, in most high-tech sectors, large firms have a larger share of online sales in comparison to small firms. Interestingly, there are a few sectors for which the proportion of firms offering online sales is similar for both large and small companies. One such sector is Food and Beverage Service Activities (56), where more than 60% of small firms provide this feature compared to about 50% of large firms. Additionally, in certain low-tech sectors, the percentage of firms with online sales is higher among small firms than among larger ones. These sectors include Real Estate Activities (68) and the Manufacture of Food Products (10).

Figure 11a illustrates the relationship between the percentage of large firms using their own website for product descriptions and that of micro firms. Notably, there is a positive and statistically significant correlation of 30%. However, a clear sector pattern is not evident. While a considerable number of micro firms in high and medium-high technology sectors utilize this feature, the overall percentage of micro firms adopting various technologies remains relatively low compared to large firms.

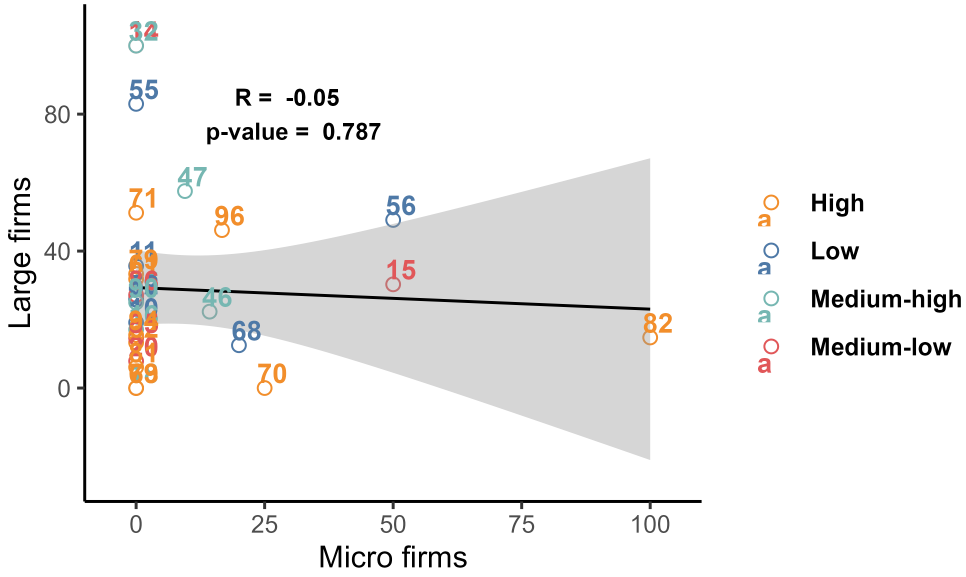
In Figure 11b, we see a similar comparison for small firms versus large firms. In this instance, the correlation is positive but not statistically significant. Interestingly, there is a stronger alignment in the adoption rates within the high-technology sectors.

Figure 9: Percentage of firms that use own website for product description and E-commerce

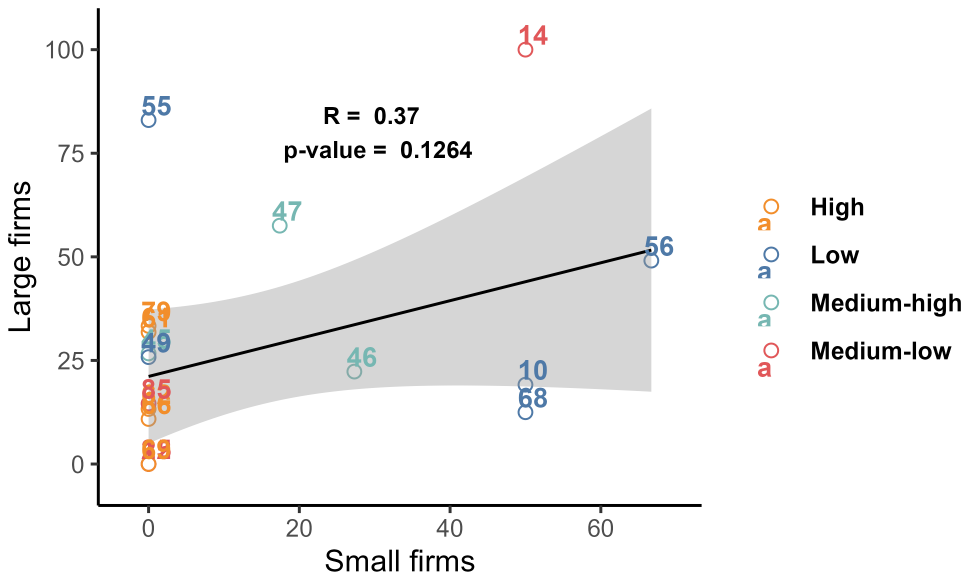


Notes: This figure shows the share of firms that use their own website for product description and for online sales (E-commerce) for micro, small and large firms. The information in micro and small firms comes from the Check-up Tool. Further, the sample is restricted to firms with two or more employees. The information for large firms is retrieved from the EAAE and results are weighted with the sampling weights provided in the survey. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB) and the EAAE 2020.

Figure 10: Sectoral correlation of the share of firms using their website for ordering online



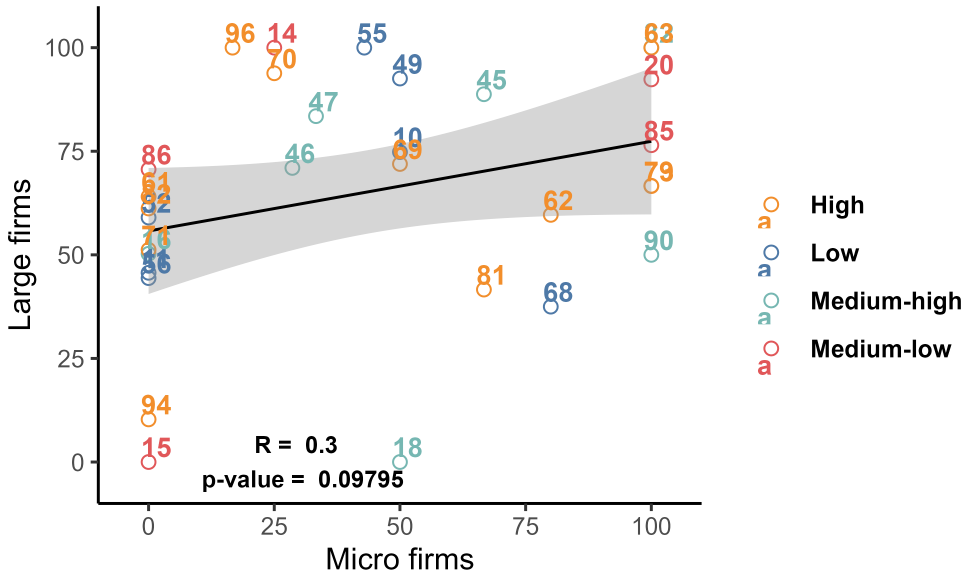
(a) Large vs Micro



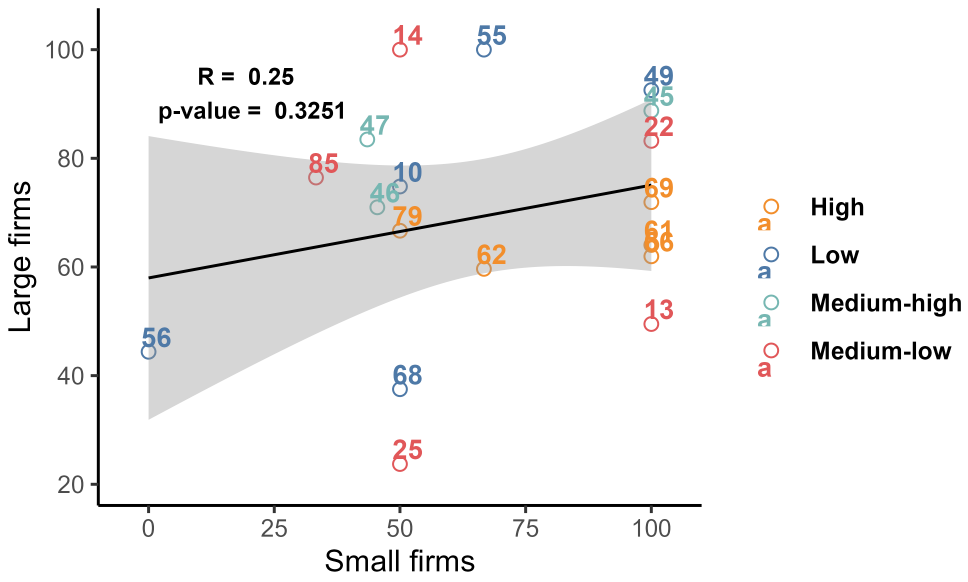
(b) Large vs Small

Notes: Figure 10a presents the correlation between the share of firms using their website for ordering online by large firms (y-axis) and micro firms (x-axis), and Figure 10b presents the correlation between the share of firms using their website for ordering online by large firms (y-axis) and small firms (x-axis). The results for large firms are sourced from EAAE and are weighted using the weights provided in the survey. The results for micro and small firms come from the Check-up Tool and the sample excludes firms with one employee. The indicator is the average share of firms that use their website for online sales in each sector (at ISIC 2-digit levels). The classification of firms into micro and small categories is derived from the MSMEs Directory (see section 3). We are restricting the sample to the firms that match with the MSMEs Directory 2020 to avoid sectoral misclassification in the Check-up Tool. Therefore, these shares have been computed over a sample of 858 firms. We use the taxonomy elaborated by Calvino et al. (2018) to classify sectors into high, medium-high, medium-low, and low digital-intensive sectors. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB) and the EAAE 2020.

Figure 11: Sectoral correlation of the share of firms using their website for product description



(a) Large vs Micro

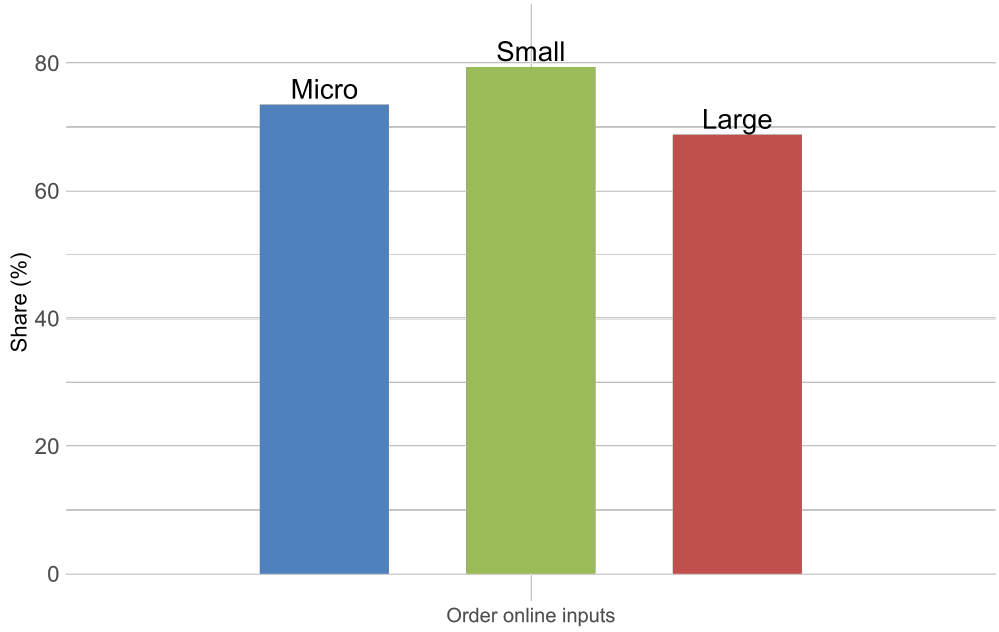


(b) Large vs Small

Notes: Figure 11a presents the correlation between the share of firms using their website for product description by large firms (y-axis) and micro firms (x-axis), and Figure 11b presents the correlation between the share of firms using their website for product description by large firms (y-axis) and small firms (x-axis). The results for large firms are sourced from EAAE and are weighted using the weights provided in the survey. The results for micro and small firms come from the Check-up Tool and the sample excludes firms with one employee. The indicator is the average share of firms that use their website for online sales in each sector (at ISIC 2-digit levels). The classification of firms into micro and small firms comes from the MSMEs Directory (see section 3). We are restricting the sample to the firms that match with the MSMEs Directory 2020 to avoid sectoral misclassification in the Check-up Tool. Therefore, these shares have been computed over a sample of 858 firms. We use the taxonomy elaborated by Calvino et al. (2018) to classify sectors into high, medium-high, medium-low, and low digital-intensive sectors. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB) and the EAAE 2020.

Lastly, we compare the frequency of firms that order inputs online. Interestingly, Figure 12 shows that for this variable, the dynamic is higher for micro and small firms. Almost 80% of small firms order their inputs online, while the share is slightly above 75% for the micro firms. However, it is worth noting that ordering inputs online largely depends on the technology adoption level of suppliers rather than that of the purchasing firms. Therefore, this explains the divergent pattern between Figure 9 and Figure 12.

Figure 12: Percentage of firms ordering online inputs



Notes: This figure shows the share of firms that order inputs online for micro, small and large firms. The information in micro and small firms comes from the Check-up Tool. Further, the sample is restricted to firms with two or more employees. The information for large firms is retrieved from the EAAE and results are weighted with the sampling weights provided in the survey. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB) and the EAAE 2020.

In this section, our objective was to investigate whether micro and small firms mirror the adoption behaviors of large firms across various dimensions indicative of digital uptake: computer use, E-commerce, use of own website, and online purchase of inputs. Specifically, we sought to address the question: Do micro and small firms replicate the digital adoption trends observed in large firms? Our analysis reveals that providing a definitive answer to this question proves elusive, as it predominantly hinges on the interplay between the specific technology and industry sector. For instance, our findings indicate that while micro and small firms exhibit greater resemblance to large firms in terms of computer usage, particularly within digitally intensive sectors, their patterns diverge significantly when it comes to E-commerce adoption. Remarkably, this deviation persists irrespective of the sector's digital

intensity. Among the underlying factors that can be driving this feature, there can be an effect induced by the pandemic in combination with poor managerial practices that prevent firms from successfully implementing an E-commerce strategy. The insufficient managerial practices are presented in Figure C.6. This figure illustrates the extent to which firms provide e-commerce training to their employees. It reveals that nearly half of micro firms with two or more employees and small firms express a need for such training but report lacking the opportunity to implement it. This gap underscores a potential area of focus for policymakers, suggesting targeted support could help bridge this training need.

7 Challenges

In this section, we critically examine the primary challenges encountered in our work thus far, recognizing that utilizing multiple data sources introduces inherent limitations.

Firstly, it is important to acknowledge a potential bias within the data derived from the Check-up Tool questionnaire. Since firms engaging with this tool actively seek technical assistance to enhance their digital performance, the dataset is inherently skewed towards firms that are digitally fragile. This can also be reflected in having firms with lower capabilities than the average.

Secondly, a notable issue arises from the sectoral disparity between the Check-up Tool and the MSMEs Directory, as previously discussed in Section 4. However, we have addressed this concern by aligning the sectoral classifications of the MSMEs Directory with those that matched from the Check-up Tool, as detailed in Section 5. This adjustment, albeit reducing our sample size to 858 firms, ensures greater accuracy in our analysis given the substantial discrepancies in sectoral classifications.

Thirdly, a significant constraint lies in the temporal difference among the utilized data sources. While information from the MSMEs Directory and the EAAE is derived for 2020, data from the Check-up Tool spans over 2022 and 2023, with the COVID-19 pandemic likely influencing digital technology adoption trends. Although this effect is implicitly captured for firms engaging with the Check-up Tool, it is absent for those in the EAAE, presenting a noteworthy limitation that warrants cautious interpretation of our findings.

Our comparison of digital adoption patterns between micro and small firms (using the Check-up Tool) and large firms (using the EAAE) involves variables of varying complexity. Some variables, such as the percentage of employees using computers, are straightforward. In contrast, others, like the inclusion of smartphones in the Check-up Tool compared to other devices in the EAAE, require more nuanced interpretation. However, variables such as the proportion of E-commerce sales and the use of a company's own website provide valuable

insights into digital behavior across different firm sizes.

Finally, the databases used in this paper rely on different sample procedures, including dissimilarities with respect to firm size and sectoral coverage. This constrains the scope of this research, so it would be desirable to complement this study with qualitative approaches to expand the information on microenterprises.

8 Final remarks and future work

In this paper, we have analyzed brand-new information on the adoption of digital technology by MSMEs in Uruguay using data provided by the Check-up Tool. These data come from a program implemented by ANDE in cooperation with the IDB. The possibility of combining this source with other Uruguayan firm-level data sources offers a unique opportunity not only to understand patterns of adoption among micro firms but also to compare their performance with larger firms, a facet that remains relatively unexplored in the existing literature.

From our study, several intriguing insights emerge regarding digitalization within MSMEs. Firstly, we observe that firms engaging with the Check-up Tool predominantly adopt simpler technologies, such as the creation of social media accounts. This is evidenced by the low intensity of adoption, with approximately 54% of firms classified as exhibiting low-intensity adoption. This trend is further corroborated by the digital maturity classification provided by the Check-up Tool.

Secondly, considering the disparities arising from firms with diverse characteristics, we delve into adoption intensity across various demographics, including size, age, and geographical location. Our findings in Section 5 indicate that the intensity of adoption and digital maturity tend to increase with firm size and age. These findings underscore a high level of heterogeneity consistent with existing literature on firm-level technology adoption. Thus, this conveys a positive message regarding the reliability of the Check-up Tool.

Thirdly, our results provide novel evidence concerning digital technology adoption in micro firms, which is a group of firms that tend to be overlooked in the empirical analysis– largely due to lack of data. We note a significant contrast within micro firms, with one-person micro firms demonstrating dramatically lower adoption rates than micro firms with two or more employees.

Fourthly, addressing our primary research question regarding the extent to which micro and small firms mirror the digital adoption patterns of the larger ones reveals mixed results. The empirical evidence suggests that the answer highly depends on the specific technology and sectoral characteristics. While there exists a relatively high correspondence in computer usage between micro and small firms compared to large firms, this correspondence is more

pronounced in sectors characterized by high and medium-high digital intensity such as consultancy activities, programming and broadcasting activities and computer and consulting services. However, for variables such as online sales, micro and small firms appear to lag behind, irrespective of sectors. It is important to note that this gap may potentially be wider than reported due to the temporal discrepancy between data from the Check-up Tool (post-pandemic) and the EAAE (pre-pandemic).

Furthermore, this study paves the way for future research questions. Bridging the time gap between the Check-up Tool and the EAAE data is imperative, particularly as more recent waves of the latter become available. This would facilitate a comparative analysis of digital adoption patterns post-pandemic. Additionally, given the varying degrees of similarity or discrepancy in digital adoption levels across sectors and firm sizes, further exploration in future analyses is needed. Moreover, efforts should be directed towards elucidating disparities in digital adoption between large firms and MSMEs.

From a policy perspective, several key messages emerge. In principle, the substantial difference in digital technology adoption within firm size indicates the necessity of tailored policies to address the specific needs even within micro firms. Further, while a notable proportion of firms report adopting or planning to adopt new software, the reliance on relatively simple programs highlights the need for policy initiatives to promote diverse software usage. Similarly, the willingness of a significant portion of firms to invest in staff training underscores the importance of understanding software and training-related needs for informed policy design. Moreover, the relatively low prevalence of e-commerce adoption and sales among firms, alongside limited usage of e-commerce-related software, requires further investigation to address potential underlying issues.

The last two points are especially important given the proactive interest of firms. The Check-up Tool consists of companies that voluntarily signed up for the Digital Mode platform and completed a self-diagnosis test regarding their digitalization status. This indicates their genuine interest in enhancing their digital capabilities. It also highlights the potential for collaboration between the private and public sectors to develop policy responses that support digitalization efforts among firms.

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Appendices

A Data

A.1 Characterization of enterprises in Uruguay

In this section we will provide a characterization of the productive structure in Uruguay. This will set the ground to understand the importance of MSMEs in the country and the context in which the Check-up Tool operates. Moreover, it will be useful for section 5 as it will help in understanding the coverage of the Check-up Tool.

For this study, we will rely on the MSMEs database from the Directory of Firms and Establishments, which is a register of all the formal enterprises in Uruguay. This database is a unique source that serves to characterize the structure of enterprises in the country, as it covers every firm. In 2020, there were 190592 firms in Uruguay. Figure B.1a shows that there is a remarkable geographical concentration as 48.2% of the firms are located in the Montevideo department.[28] Montevideo, Canelones, Colonia and Maldonado together account for more than 70% of the firms in the country (see Table A.4 for the detailed shares).

Considering the composition, Table A.1 shows the share of firms by size for the total country and by department. Out of the overall 190592 firms in Uruguay, 85.2% are micro firms, and 12% small.[29] Medium and large firms account for only 2.4% and 0.4% of the total firms. Moreover, from Table A.1 it is observed that these shares are fairly stable across the different departments.

Nevertheless, when exploring the distribution of firms across departments, a different picture is observed. Table A.1 shows the share of firms in each department for the total number of firms in the country as well as for micro, small, medium and large companies. As the firm size increases, we observe a greater concentration of firms in Montevideo. While 47.1% and 12.7% of micro firms are located in Montevideo and Canelones respectively, the shares are 74.4% and 7.9% in the case of the large firms. Consequently, from Table A.1 it is possible to conclude that, not only is there a general concentration of firms in the Uruguayan metropolitan area, but it also tends to increase as the size of the firm increases. This is probably related to the fact that in the bigger cities, there is a better infrastructure that facilitates the logistics of the firms.

[28] It is worth highlighting that the location registered in the MSMEs Directory is the fiscal address, which may not necessarily be the location where the principal productive activity takes place.

[29] It is important to point out that within micro firms there are also self-employed persons, who cannot be strictly considered as a firm —i.e. professionals, freelancers and what is called in the literature as 'false self-employment' (when the person depends only on one client/organization (Grimshaw et al., 2016)). In this sense, Table A.1 has the caveat of not being able to distinguish between micro firms with only one employee and those with more due to the lack of employment data in the MSMEs database.

Table A.1: Share of firms by department (entire country and by size) (in percentage). 2020

Department	Total	Micro	Small	Medium	Large
ARTIGAS	1.4	1.5	1.2	0.7	0.3
CANELONES	12.5	12.7	11.5	11.0	7.9
CERRO LARGO	1.7	1.7	1.4	1.0	0.8
COLONIA	4.4	4.4	4.1	3.5	2.5
DURAZNO	1.3	1.3	1.3	0.9	0.8
FLORES	0.7	0.7	0.7	0.5	0.5
FLORIDA	1.8	1.9	1.7	1.5	0.3
LAVALLEJA	1.4	1.5	1.4	1.1	0.8
MALDONADO	7.0	7.0	6.9	5.5	2.7
MONTEVIDEO	48.2	47.1	52.3	60.7	74.4
PAYSANDU	3.1	3.1	2.9	2.4	1.4
RIO NEGRO	1.6	1.6	1.4	1.1	1.2
RIVERA	2.0	2.1	1.6	1.1	0.6
ROCHA	2.3	2.4	1.7	1.2	0.4
SALTO	2.5	2.5	2.4	2.5	1.7
SAN JOSE	2.8	2.9	2.5	1.9	1.8
SORIANO	2.2	2.2	2.2	1.4	0.9
TACUAREMBO	2.2	2.3	1.8	1.3	0.8
TREINTA Y TRES	1.1	1.2	1.0	0.7	0.4
TOTAL	100	85.2	12.0	2.4	0.4

Notes: This table shows the share of firms by department for the total country and for micro, small, medium and large enterprises. The classification of firms corresponds to the Directory of MSME Firms and Establishments. See Section 3 for the definition. Source: Own elaboration based on Directory of MSME Firms and Establishments.

Concerning the sectoral distribution, Table A.2 shows the sectoral share of firms by industry at ISIC Rev 4 1-digit level for the total country and by firm size. In terms of broad sectors, services (G to S) account for aproximately 84% of the companies, while industry (C to F) comprises around 14% of the firms and the rest is agriculture and mining. The pattern is fairly similar for micro, small and medium firms, while it differs for large firms.

When taking a closer glimpse into the sectors, we observe from Table A.2 that around 33% of the firms are from the Wholesale and Retail (G) sector, followed by Transport and Storage (H) which accounts for 11.2% of firms. However, for larger firms almost 20% are in manufacturing. There is also a greater share of large firms (around 10%) in Administrative and support service activities, Education, and Human health and social work.

Table A.2: Sectoral share of firms at 1-digit level (in percentage). 2020

ISIC	Description	Total	Micro	Small	Medium	Large
A	Agriculture, forestry and fishing	0.9	0.9	0.7	0.7	0.9
B	Mining and quarrying	0.1	0.1	0.3	0.3	0.1
C	Manufacturing	9.1	8.4	12.8	14.1	19.8
D	Electricity	0.0	0.0	0.1	0.2	0.1
E	Water supply	0.3	0.3	0.4	0.8	1.7
F	Construction	4.6	4.9	3.1	2.3	1.9
G	Wholesale and retail trade; Reparing	32.9	33.0	32.9	30.6	17.2
H	Transportation and storage	11.2	11.3	11.2	8.3	7.0
I	Accommodation and food service activities	4.3	4.0	6.8	3.2	0.8
J	Information and communication	3.4	3.5	2.5	3.7	4.0
K	Financial and insurance activities	1.2	1.2	1.4	1.6	2.1
L	Real estate activities	4.2	4.2	4.2	2.2	1.2
M	Professional, scientific and technical activities	6.9	7.3	5.0	3.7	3.6
N	Administrative and support service activities	5.1	5.0	5.0	6.9	12.3
P	Education	2.8	2.4	3.6	9.1	10.6
Q	Human health and social work activities	3.3	3.0	5.0	7.1	10.6
R	Arts, entertainment and recreation	1.8	1.8	1.8	1.7	2.5
S	Other service activities	8.0	8.8	3.5	3.4	3.5

Notes: This table shows the sectoral share of firms for micro, small, medium and large firms (the sum of each column is equal to 100%). The classification of firms corresponds to the Directory of MSME Firms and Establishments. See Section 3 for the definition. Source: Own elaboration based on Directory of MSME Firms and Establishments.

Comparison between the MSMEs Directory and EAAE From Table A.1, we derive the importance that micro firms have in Uruguay, as they account for more than 80% of the firms. Nevertheless, the official firm-level datasources generally do not cover micro firms. Such is the case of the EAAE. This is one of the main firm-level sources in Uruguay and provides detailed information about firms' behavior, including ICTs characteristics. As mentioned in section 3, this will be one of the databases we will use to compare the patterns of digital adoption between micro and large firms in section 5.

Since the EAAE covers SMEs and large firms, this means that this survey targets less than 14.8% of the Uruguayan firms.[30] Table A.3 manifests this blind spot, as it displays the share of firms by size in Uruguay for 2020 comparing the MSMEs Directory and the

[30]Although the EAAE covers small firms, it only includes firms with more than 10 employees meaning that it does not cover the lower layer of companies that are categorized as small.

EAAE.[31] For comparison reasons, we classified the firms in EAAE into small, medium and large following the MSMEs definition.[32]

Table A.3: Composition of firms: Comparison between EAAE and MSMEs Directory (in percentage). 2020

Source	Micro	Small	Medium	Large
MSMEs directory	85.2	12.0	2.4	0.4
EAAE		28.4 (*)	54.9	16.6

Notes: This table shows the share of small, medium and large enterprises (in percentage) for the two data sources respectively. We have classified the firms from EAAE according to the SMEs definition from the MSMEs Directory. See Section 3 for the definition. Source: Own elaboration based on EAAE and the Directory of MSMEs.
* It is worth reiterating that the EAAE does not cover micro firms or the portion of small firms with less than 10 employees.

[31] It is important to bear in mind when interpreting these results that they are influenced by the structure of each datasource. While the MSMEs Directory is a register for all the formal firms in the country, the sample selection for the EAAE is quite different. For this source, all large and medium-sized firms with more than 49 employees are included in the sample, whereas the medium-sized and small firms with 10 or more employees are selected on the basis of stratified random sampling. For more details on the sampling design of the EAAE refer to section 3.

[32] The EAAE has information on sales and VAT (originated in sales), so we first computed net sales by subtracting the VAT from sales. Next, we converted the value, which is in current Uruguayan pesos, into indexed units. To do this, we computed the yearly average index taking the historical series of the indexed units elaborated by Instituto Nacional de Estadística (INE).

A.2 Further descriptives from the MSMEs Directory

Table A.4: Share of firms by department (in percentage). MSMEs Directory 2020

Department	Micro	Small	Medium	Large
ARTIGAS	88.4	10.3	1.2	0.1
CANELONES	86.6	11.1	2.1	0.3
CERRO LARGO	88.2	10.2	1.5	0.2
COLONIA	86.6	11.3	1.9	0.2
DURAZNO	86.5	11.6	1.6	0.2
FLORES	86.4	11.7	1.6	0.3
FLORIDA	86.6	11.4	1.9	0.1
LAVALLEJA	86.5	11.4	1.8	0.2
MALDONADO	86.1	11.9	1.9	0.2
MONTEVIDEO	83.3	13.1	3.0	0.6
PAYSANDU	86.3	11.6	1.9	0.2
RIO NEGRO	87.4	10.6	1.6	0.3
RIVERA	88.9	9.6	1.3	0.1
ROCHA	89.9	8.8	1.2	0.1
SALTO	85.7	11.6	2.4	0.3
SAN JOSE	87.4	10.8	1.6	0.3
SORIANO	85.8	12.5	1.6	0.2
TACUAREMBO	88.5	9.9	1.4	0.1
TREINTA Y TRES	87.8	10.7	1.4	0.1
TOTAL URUGUAY	85.2	12.0	2.4	0.4

Notes: This table shows the share of firms by department (the row sums are equal to 100%). Source: Own elaboration based on Directory of MSME Firms and Establishments.

Table A.5: Composition of firms by sector at 1-digit level (in percentage). MSMEs Directory 2020

Section	Description	Micro	Small	Medium	Large
A	Agriculture, forestry and fishing	88.06	9.57	1.95	0.43
B	Mining and quarrying	69.53	24.73	5.38	0.36
C	Manufacturing	78.59	16.86	3.66	0.88
D	Electricity	58.62	25.86	13.79	1.72
E	Water supply	77.36	14.99	5.70	1.95
F	Construction	90.61	8.02	1.20	0.17
G	Wholesale and retail trade; Reparing	85.58	12.01	2.19	0.21
H	Transportation and storage	85.93	12.07	1.75	0.25
I	Accommodation and food service activities	79.25	18.93	1.75	0.07
J	Information and communication	87.95	8.94	2.63	0.49
K	Financial and insurance activities	82.66	13.71	2.96	0.68
L	Real estate activities	86.70	11.94	1.25	0.11
M	Professional, scientific and technical activities	89.87	8.64	1.27	0.21
N	Administrative and support service activities	83.90	11.89	3.23	0.99
P	Education	75.11	15.54	7.79	1.57
Q	Human health and social work activities	75.81	17.88	5.01	1.29
R	Arts, entertainment and recreation	84.85	12.25	2.33	0.57
S	Other service activities	93.63	5.20	0.99	0.18
TOT	Total Uruguay	85.20	12.00	2.40	0.40

Notes: This table shows the composition of firms by sector (the row sums are equal to 100%). The classification of firms corresponds to the Directory of MSME Firms and Establishments. See Section 3 for the definition. Source: Own elaboration based on Directory of MSME Firms and Establishments.

Table A.6: Composition of firms by sector at 2-digit level (in percentage). MSMEs Directory 2020

Section	ISIC 2 digits	Description	Micro	Small	Medium	Large
A	01	Crop and animal production, hunting and related service activities	87.77	10.54	1.45	0.24
A	02	Forestry and logging	82.4	13.6	1.6	2.4
A	03	Fishing and aquaculture	91.94	3.3	4.4	0.37
B	07	Mining of metal ores	66.67	33.33	n/a	n/a
B	08	Other mining and quarrying	70	25.2	4.4	0.4
B	09	Mining support service activities	64.71	11.76	23.53	n/a
C	10	Manufacture of food products	72.21	21.7	4.57	1.52

Continued on next page

Section	ISIC 2 digits	Description	Micro	Small	Medium	Large
C	11	Manufacture of beverages	68.21	25.14	4.62	2.02
C	12	Manufacture of tobacco products	n/a	50	n/a	50
C	13	Manufacture of textiles	86.84	10.24	2.74	0.18
C	14	Manufacture of wearing apparel	90.43	8	1.35	0.22
C	15	Manufacture of leather and related products	87.44	9.55	2.76	0.25
C	16	Manufacture of wood	79.84	17.78	2.04	0.34
C	17	Manufacture of paper and paper products	59.14	22.58	13.98	4.3
C	18	Printing and reproduction of recorded media	83.6	13.92	2.22	0.27
C	19	Manufacture of coke and refined petroleum products	83.33	16.67	n/a	n/a
C	20	Manufacture of chemicals and chemical products	59.33	24.87	13.47	2.33
C	21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	33	22	32	13
C	22	Manufacture of rubber and plastics products	51.41	32.75	13.73	2.11
C	23	Manufacture of other non-metallic mineral products	78.09	16.61	4.95	0.35
C	24	Manufacture of basic metals	78.07	17.22	4.01	0.71
C	25	Manufacture of fabricated metal products, except machinery and equipment	81.36	16.73	1.76	0.15
C	26	Manufacture of computer, electronic and optical products	66.53	26.27	5.51	1.69
C	27	Manufacture of electrical equipment	62.3	27.05	10.66	n/a
C	28	Manufacture of machinery and equipment n.e.c.	69.88	26.1	3.61	0.4
C	29	Manufacture of motor vehicles, trailers and semi-trailers	56.99	29.03	8.6	5.38

Continued on next page

Section	ISIC 2 digits	Description	Micro	Small	Medium	Large
C	30	Manufacture of other transport equipment	61.7	31.91	4.26	2.13
C	31	Manufacture of furniture	89.97	8.28	1.59	0.17
C	32	Other manufacturing	90.05	9.09	0.86	n/a
C	33	Repair and installation of machinery and equipment	88.41	10.29	1.06	0.24
D	35	Electricity, gas, steam and air conditioning supply	58.62	25.86	13.79	1.72
E	36	Water collection, treatment and supply	84.62	15.38	n/a	n/a
E	37	Sewerage	100	n/a	n/a	n/a
E	38	Waste collection, treatment and disposal activities; materials recovery	76.06	15.67	5.99	2.29
E	39	Remediation activities and other waste management services	80.43	10.87	8.7	n/a
F	41	Construction of buildings	88.37	9.89	1.48	0.26
F	42	Civil engineering	67.74	24.19	7.53	0.54
F	43	Specialized construction activities	92.37	6.64	0.87	0.12
G	45	Wholesale and retail trade and repair of motor vehicles and motorcycles	85.38	13.08	1.46	0.07
G	46	Wholesale trade, except of motor vehicles and motorcycles	70.21	23.37	5.78	0.65
G	47	Retail trade, except of motor vehicles and motorcycles	89.12	9.26	1.48	0.13
H	49	Land transport and transport via pipelines	86.58	11.93	1.33	0.16
H	50	Water transport	53.52	28.17	16.9	1.41
H	51	Air transport	44.44	33.33	22.22	n/a
H	52	Warehousing and support activities for transportation	71.51	22.08	5.41	1
H	53	Postal and courier activities	96.11	3.03	0.65	0.22
I	55	Accommodation	71.9	24.64	3.08	0.38
I	56	Food and beverage service activities	80.68	17.82	1.49	0.01

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Section	ISIC 2 digits	Description	Micro	Small	Medium	Large
J	58	Publishing activities	92.09	7.19	0.72	n/a
J	59	Motion picture, video and television-production, etc	94.74	4.64	0.62	n/a
J	60	Programming and broadcasting activities	58.4	35.86	4.51	1.23
J	61	Telecommunications	76.57	12.81	8.17	2.45
J	62	Computer programming, consultancy and related activities	90.87	6.5	2.28	0.35
J	63	Information service activities	90.33	6.58	2.88	0.21
K	64	Financial service activities, except insurance and pension funding	74.89	18.83	4.71	1.57
K	65	Insurance, reinsurance and pension funding, except compulsory social security	70.31	20.31	6.25	3.12
K	66	Activities auxiliary to financial service and insurance activities	84.95	12.24	2.43	0.38
L	68	Real estate activities	86.7	11.94	1.25	0.11
M	69	Legal and accounting activities	83.45	15.38	0.87	0.3
M	70	Activities of head offices; management consultancy activities	92.06	6.51	1.25	0.17
M	71	Architectural and engineering activities; technical testing and analysis	92.27	6.26	1.39	0.08
M	72	Scientific research and development	80	14	3	3
M	73	Advertising and market research	88.95	9.03	1.91	0.11
M	74	Other professional, scientific and technical activities	94.05	4.67	1.13	0.15
M	75	Veterinary activities	77.44	21.16	1.4	n/a
N	77	Rental and leasing activities	85.83	12.94	1.09	0.14
N	78	Employment activities	66.73	20.47	10.04	2.76
N	79	Travel agency, tour operator, reservation service and related activities	86.92	10.84	2.24	n/a
N	80	Security and investigation activities	74.35	13.99	7.98	3.68

Continued on next page

Section	ISIC 2 digits	Description	Micro	Small	Medium	Large
N	81	Services to buildings and landscape activities	88.8	8.11	2.39	0.69
N	82	Office administrative, office support and other business support activities	80.34	17.49	1.86	0.3
P	85	Education	75.11	15.54	7.79	1.57
Q	86	Human health activities	85.8	9.74	3.06	1.4
Q	87	Residential care activities	36.58	50.82	11.82	0.78
Q	88	Social work activities without accommodation	60.87	25.69	11.86	1.58
R	90	Creative, arts and entertainment activities	95.94	3.21	0.57	0.28
R	91	Libraries, archives, museums and other cultural activities	86.36	11.36	2.27	n/a
R	92	Gambling and betting activities	56.4	40.7	2.62	0.29
R	93	Sports activities and amusement and recreation activities	83.73	12.19	3.28	0.81
S	94	Activities of membership organizations	76.34	17.06	5.7	0.89
S	95	Repair of computers and personal and household goods	96.96	2.83	0.17	0.03
S	96	Other personal service activities	95.63	3.85	0.43	0.09
TOT		Total Uruguay	85.2	12	2.4	0.4

Note: This table shows the composition of firms by sector (the row sums are equal to 100%).

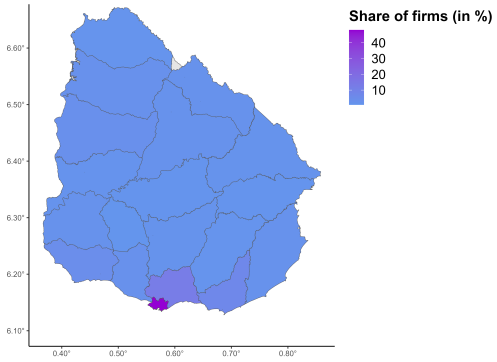
The classification of firms corresponds to the Directory of MSME Firms and Establishments.

See Section 3 for the definition. Source: Own elaboration based on Directory of MSME Firms and Establishments.

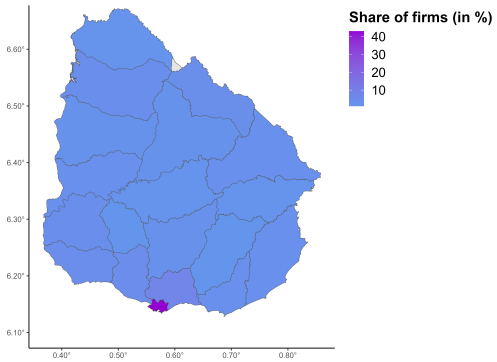
B Coverage of Check-up Tool

B.1 Coverage

Figure B.1: Share of firms by department (in percentage).



(a) MSMEs Directory



(b) Check-up Tool

Notes: This figure presents the share of firms in each department with respect to total number of firms at the national level from two data sources, the MSMEs Directory and the Check-up Tool. Source: Own elaboration based on Directory of MSMEs Firms and Establishments and Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

B.2 Mismatched firms

As was mentioned in section 5, there were 453 firms that participated in the Check-up Tool but were not present in the 2020 MSMEs Directory. This could be due to the fact that these companies were created either in 2020 or later, so that is why they are not included in the

Table B.1: Year of creation of firms that are not present in the Directory MSMEs

year	No. of firms	share
2002	31	6.8
2012	32	7.1
2013	7	1.5
2014	4	0.9
2015	11	2.4
2016	13	2.9
2017	19	4.2
2018	18	4.0
2019	23	5.1
2020	41	9.1
2021	125	27.6
2022	90	19.9
2023	39	8.6
Total	453	100.0

Notes: This table shows the number of firms by creation year of the 453 firms that were not present in the 2020 Directory of MSMEs. The share is in percentage. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

administrative data. While Table B.1 demonstrates that around 65% of these firms were created from 2020 onward and 35% were created before 2020.[33]

[33]Given that the MSMEs Directory data is from 2020, some firms established before that year may have temporarily closed at the start of the pandemic, which could explain the discrepancy.

Table B.2: Year of creation of firms that are not present in the Directory MSMEs with a focus on one-person firms

Year	No. of firms with 1 employee	Share	No. of firms that did not matched	Share
2002	3	1.3	31	6.8
2012	10	4.2	32	7.1
2013	1	0.4	7	1.5
2014	2	0.8	4	0.9
2015	6	2.5	11	2.4
2016	10	4.2	13	2.9
2017	11	4.6	19	4.2
2018	8	3.4	18	4.0
2019	14	5.9	23	5.1
2020	16	6.8	41	9.1
2021	65	27.4	125	27.6
2022	63	26.6	90	19.9
2023	28	11.8	39	8.6

Notes: This table shows the number of firms by creation year of the 453 firms that were not present in the 2020 Directory of MSMEs. The share is in percentage. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

Table B.3: Firm size by department. Comparison MSMEs Directory and Check-up Tool (in percentage)

	MSMEs Directory				Check-up Tool			
Deparment	Micro	Small	Medium	Large	Micro	Small	Medium	Large
ARTIGAS	88.4	10.3	1.2	0.1	65.0	20.0	15.0	0.0
CANELONES	86.6	11.1	2.1	0.3	67.7	24.2	8.1	0.0
CERRO LARGO	88.2	10.2	1.5	0.2	51.9	40.7	7.4	0.0
COLONIA	86.6	11.3	1.9	0.2	70.3	25.0	4.7	0.0
DURAZNO	86.5	11.6	1.6	0.2	84.6	7.7	0.0	7.7
FLORES	86.4	11.7	1.6	0.3	75.0	25.0	0.0	0.0
FLORIDA	86.6	11.4	1.9	0.1	46.4	39.3	14.3	0.0
LAVALLEJA	86.5	11.4	1.8	0.2	70.0	20.0	10.0	0.0
MALDONADO	86.1	11.9	1.9	0.2	75.8	21.2	3.0	0.0
MONTEVIDEO	83.3	13.1	3.0	0.6	54.5	30.3	12.4	2.9
PAYSANDU	86.3	11.6	1.9	0.2	71.4	19.0	9.5	0.0
RIO NEGRO	87.4	10.6	1.6	0.3	83.3	12.5	4.2	0.0
RIVERA	88.9	9.6	1.3	0.1	70.0	20.0	10.0	0.0
ROCHA	89.9	8.8	1.2	0.1	78.0	17.1	4.9	0.0
SALTO	85.7	11.6	2.4	0.3	48.5	36.4	15.2	0.0
SAN JOSE	87.4	10.8	1.6	0.3	80.0	11.4	8.6	0.0
SORIANO	85.8	12.5	1.6	0.2	58.3	30.6	8.3	2.8
TACUAREMBO	88.5	9.9	1.4	0.1	80.0	20.0	0.0	0.0
TREINTA Y TRES	87.8	10.7	1.4	0.1	92.3	7.7	0.0	0.0
TOTAL URUGUAY	85.2	12.0	2.4	0.4	63.3	26.1	9.3	1.4

Notes: This table shows the share of micro, small, medium and large firms by department in Uruguay from two different sources: the MSMEs Directory and the Check-up Tool. The classification of firms corresponds to the one provided in the MSMEs Directory. See Section 3 for the definition. From the Check-up Tool we select the firms that have answered at least one time the questionnaire in 2022 or 2023. To be consistent with the Directory of MSME classification, we have merged the firms participating in the Check-up tool with the information from the Directory for 2020. Of the 1311 firms in the sample, 453 firms could not be matched. Therefore, the total number of observations in this Table is 858 for the Check-up Tool. Source: Own elaboration based on the Directory of MSME Firms and Establishments and the Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

Table B.4: Firm size by department for firms participating in the Check-up tool (in percentage)

Department	Micro - # of employees		Small	Medium	Large
	One	Two or more			
ARTIGAS	20.0	45.0	20.0	15.0	0.0
CANELONES	42.6	24.6	24.6	8.2	0.0
CERRO LARGO	29.6	22.2	40.7	7.4	0.0
COLONIA	28.6	41.3	25.4	4.8	0.0
DURAZNO	53.8	30.8	7.7	0.0	7.7
FLORES	8.3	66.7	25.0	0.0	0.0
FLORES	8.3	66.7	25.0	0.0	0.0
LAVALLEJA	20.0	50.0	20.0	10.0	0.0
MALDONADO	30.3	45.5	21.2	3.0	0.0
MONTEVIDEO	24.3	30.2	30.2	12.3	2.9
PAYSANDU	33.3	38.1	19.0	9.5	0.0
RIO NEGRO	31.8	50.0	13.6	4.5	0.0
RIVERA	30.0	40.0	20.0	10.0	0.0
ROCHA	24.4	53.7	17.1	4.9	0.0
SALTO	12.5	34.4	37.5	15.6	0.0
SAN JOSE	40.0	40.0	11.4	8.6	0.0
SORIANO	33.3	25.0	30.6	8.3	2.8
TACUAREMBO	40.0	40.0	20.0	0.0	0.0
TREINTA Y TRES	30.8	61.5	7.7	0.0	0.0
TOTAL URUGUAY	28.3	34.8	26.3	9.3	1.4

Notes: This table shows the share of micro, small, medium and large firms by department for firms that have answered at least one time the Check-up tool in 2022 or 2023. To be consistent with the Directory of MSME classification, we have merged the firms participating in the Check-up tool with the database from the Directory for 2020. Of the 1311 firms in the sample, 453 firms could not be matched. Therefore, the total number of observations in this Table is 858 for the Check-up Tool. The classification of firms is taken from the Directory of MSME Firms and Establishments. See Section 3 for the definition. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

B.3 Comparing the Check-up Tool with the rest of the datasets

In order to further analyze the coverage of the Check-up Tool, Table B.5 shows the share of firms by sector in this source, the MSMEs Directory and the EAAE.[34] In general, there are no substantial differences between EAAE and the MSMEs Directory, except for Education and Human Health where the share is greater in the first source. This is probably due to the fact that a greater share of large firms tend to be allocated in this sector (as it has been

[34]It is worth mentioning that the EAAE does not provide information for Agriculture, Forestry and Fishing or for Mining and Quarrying.

noted in Table A.5). However, we do observe a greater difference between the Check-up Tool and the MSMEs Directory, as almost 20% of the firms that participate in the Check-up Tool are from Other service activities–more specifically, from Other personal services activities, see Table B.6.[35] Further, Tables B.7 and B.8 also tell us that this difference holds, even when breaking down the share by firm size.[36]

Most likely, the abovementioned discrepancy comes from a self-reporting issue, given that in the Check-up Tool firms self-declared their sector. We have observed that out of the 858 firms that match with the MSMEs Directory, 428 declared a different sector from the one that appears in the Directory at 1-digit level, while 536 firms differ when comparing 2-digits. Table B.9 provides an example with the sector Other Service Activities (S). In total, 185 firms declared to be in this sector in the Check-up Tool, but only 23 are actually registered in that sector in the MSMEs Directory.

[35]It is worth highlighting that we are including all the firms in the Check-up Tool, irrespective of them appearing in the MSMEs Directory or not.

[36]In Tables B.7 and B.8 we only include firms that are present in both the Check-up Tool and Directory. Therefore, the reason for this discrepancy is not related to the 453 that are not possible to match.

Table B.5: Sectoral share of firms. Comparison of all datasets at 1-digit level (in percentage)

Section	Description	MSMEs Directory	Check-up Tool	EAAE
A	Agriculture, forestry and fishing	0.86	7.57	n/a
B	Mining and quarrying	0.15	n/a	n/a
C	Manufacturing	9.08	13.03	13.98
D	Electricity	0.03	0.22	0.1
E	Water supply	0.35	0.15	0.35
F	Construction	4.58	1.8	n/a
G	Wholesale and retail trade; Reparing	32.85	19.03	32.5
H	Transportation and storage	11.20	1.42	8.81
I	Accommodation and food service activities	4.30	6.52	5.48
J	Information and communication	3.35	3.9	3.7
K	Financial and insurance activities	1.24	1.2	1.33
L	Real estate activities	4.17	3.52	1.28
M	Professional, scientific and technical activities	6.92	8.91	3.79
N	Administrative and support service activities	5.06	1.27	7.98
P	Education	2.75	2.02	7.61
Q	Human health and social work activities	3.33	4.79	8.03
R	Arts, entertainment and recreation	1.76	3.97	1.92
S	Other service activities	8.03	20	3.12

Notes: This table shows the sectoral share of firms (in percentage) in the three datasets: MSMEs Directory, EAAE and Check-up tool. In the second column (Check-up Tool), the sectors that show the greatest differences compared to other data sources are highlighted in red. Source: Own elaboration based on Directory of MSME Firms and Establishments, EAAE and Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

Table B.6: Sectoral share of firms. Comparison of all datasets at 2-digits level (in percentage)

Section	ISIC 2 digits	Description	MSMEs Directory	Check-up Tool	EAAE
A	01	Crop and animal production, hunting and related service activities	0.65	7.42	n/a
A	02	Forestry and logging	0.07	0.15	n/a
A	03	Fishing and aquaculture	0.14	n/a	n/a
B	07	Mining of metal ores	0.01	n/a	n/a
B	08	Other mining and quarrying	0.13	n/a	n/a
B	09	Mining support service activities	0.01	n/a	n/a
C	10	Manufacture of food products	2.69	2.92	6.44
C	11	Manufacture of beverages	0.18	0.45	0.51
C	12	Manufacture of tobacco products	0.00	0.07	n/a
C	13	Manufacture of textiles	0.29	1.5	0.25
C	14	Manufacture of wearing apparel	0.70	1.65	0.3
C	15	Manufacture of leather and related products	0.21	0.3	0.24
C	16	Manufacture of wood	0.46	0.3	0.47
C	17	Manufacture of paper and paper products	0.05	0.3	0.24
C	18	Printing and reproduction of recorded media	0.59	0.3	0.62
C	19	Manufacture of coke and refined petroleum products	0.00	0.07	0.01
C	20	Manufacture of chemicals and chemical products	0.20	0.15	0.79
C	21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	0.05	0.15	0.5
C	22	Manufacture of rubber and plastics products	0.15	0.82	0.75
C	23	Manufacture of other non-metallic mineral products	0.30	0.07	0.53
C	24	Manufacture of basic metals	0.22	0.15	0.18
C	25	Manufacture of fabricated metal products, except machinery and equipment	1.02	0.45	0.95
C	26	Manufacture of computer, electronic and optical products	0.12	n/a	n/a
C	27	Manufacture of electrical equipment	0.06	0.07	0.05
C	28	Manufacture of machinery and equipment n.e.c.	0.13	0.3	0.08
C	29	Manufacture of motor vehicles, trailers and semi-trailers	0.05	n/a	0.09
C	30	Manufacture of other transport equipment	0.02	n/a	n/a
C	31	Manufacture of furniture	0.63	0.75	0.38
C	32	Other manufacturing	0.31	2.02	0.13
C	33	Repair and installation of machinery and equipment	0.64	0.22	0.47
D	35	Electricity, gas, steam and air conditioning supply	0.03	0.22	0.1
E	36	Water collection, treatment and supply	0.02	n/a	0.05
E	37	Sewerage	0.01	n/a	n/a
E	38	Waste collection, treatment and disposal activities; materials recovery	0.30	0.15	0.3
E	39	Remediation activities and other waste management services	0.02	n/a	n/a
F	41	Construction of buildings	1.42	0.07	n/a
F	42	Civil engineering	0.10	0.07	n/a
F	43	Specialized construction activities	3.07	1.65	n/a
G	45	Wholesale and retail trade and repair of motor vehicles and motorcycles	3.51	2.1	2.4
G	46	Wholesale trade, except of motor vehicles and motorcycles	5.45	3.15	13.31
G	47	Retail trade, except of motor vehicles and motorcycles	23.89	13.78	16.79
H	49	Land transport and transport via pipelines	8.82	0.75	5.56
H	50	Water transport	0.04	n/a	0.19
H	51	Air transport	0.02	0.07	0.11
H	52	Warehousing and support activities for transportation	1.10	0.45	2.59
H	53	Postal and courier activities	1.21	0.15	0.35
I	55	Accommodation	0.70	2.32	1.45
I	56	Food and beverage service activities	3.60	4.19	4.03
J	58	Publishing activities	0.07	0.45	0.21
J	59	Motion picture, video and televisionproduction, etc	0.34	0.22	0.06
J	60	Programming and broadcasting activities	0.26	0.15	0.6
J	61	Telecommunications	0.19	0.15	0.59
J	62	Computer programming, consultancy and related activities	2.24	1.8	1.99
J	63	Information service activities	0.25	1.12	0.27
K	64	Financial service activities, except insurance and pension funding	0.23	0.45	0.33
K	65	Insurance, reinsurance and pension funding, except compulsory social security	0.03	0.52	n/a
K	66	Activities auxiliary to financial service and insurance activities	0.97	0.22	1
L	68	Real estate activities	4.17	3.52	1.28
M	69	Legal and accounting activities	1.39	1.12	1.09
M	70	Activities of head offices; management consultancy activities	1.51	1.12	0.44
M	71	Architectural and engineering activities; technical testing and analysis	0.68	0.75	0.49
M	72	Scientific research and development	0.10	0.22	0.14
M	73	Advertising and market research	0.94	0.22	0.94
M	74	Other professional, scientific and technical activities	2.08	5.09	0.58
M	75	Veterinary activities	0.23	0.37	0.12
N	77	Rental and leasing activities	0.39	n/a	0.4
N	78	Employment activities	0.27	n/a	0.97
N	79	Travel agency, tour operator, reservation service and related activities	0.28	n/a	0.31
N	80	Security and investigation activities	0.59	n/a	1.94
N	81	Services to buildings and landscape activities	2.50	0.07	3.07
N	82	Office administrative, office support and other business support activities	1.04	1.2	1.28
P	85	Education	2.75	2.02	7.61
Q	86	Human health activities	2.59	2.77	3.59
Q	87	Residential care activities	0.61	1.57	3.26
Q	88	Social work activities without accommodation	0.13	0.45	1.11
R	90	Creative, arts and entertainment activities	0.56	3.45	0.04
R	91	Libraries, archives, museums and other cultural activities	0.05	0.15	n/a
R	92	Gambling and betting activities	0.18	n/a	0.47
R	93	Sports activities and amusement and recreation activities	0.98	0.37	1.41
S	94	Activities of membership organizations	0.94	2.32	1.92
S	95	Repair of computers and personal and household goods	1.56	0.67	0.1
S	96	Other personal service activities	5.54	17	1.11

Notes: This table shows the sectoral share of firms (in percentage) in the three datasets: MSMEs Directory, EAAE and Check-up tool. Source: Own elaboration based on Directory of MSME Firms and Establishments, EAAE and Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

Table B.7: Sectoral share of firms: Check-up tool and Directory MSMEs at 1-digit level (in percentage)

		Check-up Tool			MSMEs Directory		
Section	Description	Micro	Small	Medium	Micro	Small	Medium
A	Agriculture, forestry and fishing	2.54	2.2	4.94	0.89	0.69	0.71
C	Manufacturing	11.62	11.45	24.69	8.37	12.75	14.1
D	Electricity	0.36	n/a	n/a	0.02	0.07	0.18
E	Water supply	0.18	0.44	n/a	0.32	0.44	0.85
F	Construction	1.63	2.64	1.23	4.87	3.06	2.34
G	Wholesale and retail trade; Reparing	22.87	22.47	25.93	32.99	32.85	30.57
H	Transportation and storage	1.45	1.32	6.17	11.29	11.25	8.32
I	Accommodation and food service activities	5.81	7.05	3.7	3.99	6.77	3.18
J	Information and communication	3.81	4.41	3.7	3.46	2.49	3.74
K	Financial and insurance activities	0.73	1.32	1.23	1.2	1.42	1.56
L	Real estate activities	5.63	3.52	n/a	4.24	4.15	2.2
M	Professional, scientific and technical activities	8.71	7.93	n/a	7.3	4.98	3.74
N	Administrative and support service activities	0.73	1.76	n/a	4.98	5.01	6.92
P	Education	1.81	3.96	4.94	2.42	3.56	9.08
Q	Human health and social work activities	3.27	10.57	11.11	2.96	4.95	7.07
R	Arts, entertainment and recreation	4.17	0.44	n/a	1.75	1.8	1.74
S	Other service activities	24.32	17.62	12.35	8.83	3.48	3.38
T	Activities of households	0.36	n/a	n/a	n/a	n/a	n/a
U	Extraterritorial activities	n/a	0.88	n/a	n/a	n/a	n/a
	Total number of firms	551	227	81	162438	22887	4495

Notes: This table shows the sectoral share for micro, small and medium-size firms in (in percentage) in the MSMEs Directory and the Check-up tool. Source: Own elaboration based on Directory of MSME Firms and Establishments and Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

Table B.8: Sectoral share of firms: Check-up tool and Directory MSMEs at 2-digits level (in percentage)

			Check-up Tool			MSMEs Directory		
Section	ISIC 2 digits		Micro	Small	Medium	Micro	Small	Medium
A	01		2.36	2.2	4.94	0.67	0.57	0.4
A	02		0.18	n/a	n/a	0.06	0.07	0.04
C	10		1.45	3.08	8.64	2.28	4.85	5.21
C	11		0.54	0.44	n/a	0.15	0.38	0.36
C	13		1.45	n/a	n/a	0.29	0.24	0.33
C	14		2.54	0.44	n/a	0.74	0.47	0.4
C	15		0.54	n/a	n/a	0.21	0.17	0.24
C	16		0.18	0.88	1.23	0.43	0.69	0.4
C	17		0.54	n/a	1.23	0.03	0.09	0.29
C	18		0.18	0.88	n/a	0.58	0.69	0.56
C	19		n/a	n/a	1.23	0	0	n/a
C	20		0.18	n/a	n/a	0.14	0.42	1.16
C	21		0.18	n/a	n/a	0.02	0.1	0.71
C	22		n/a	2.2	3.7	0.09	0.41	0.87
C	24		n/a	0.44	n/a	0.2	0.32	0.38
C	25		0.18	0.88	2.47	0.97	1.42	0.76
C	28		0.36	0.44	n/a	0.11	0.28	0.2
C	31		0.73	0.44	n/a	0.66	0.43	0.42
C	32		2.18	1.32	4.94	0.32	0.23	0.11
C	33		0.36	n/a	1.23	0.67	0.55	0.29
D	35		0.36	n/a	n/a	0.02	0.07	0.18
E	38		0.18	0.44	n/a	0.27	0.39	0.76
F	43		1.63	2.64	1.23	3.32	1.7	1.13
G	45		2	1.32	12.35	3.52	3.82	2.18
G	46		2.18	6.17	4.94	4.49	10.6	13.35
G	47		18.69	14.98	8.64	24.98	18.43	15.04
H	49		1.09	0.88	1.23	8.96	8.76	4.96
H	51		n/a	0.44	n/a	0.01	0.07	0.22
H	52		0.36	n/a	3.7	0.93	2.03	2.54
H	53		n/a	n/a	1.23	1.37	0.31	0.33
I	55		2.54	3.52	1.23	0.59	1.43	0.91
I	56		3.27	3.52	2.47	3.41	5.34	2.27
J	58		0.73	n/a	1.23	0.08	0.04	0.02
J	59		0.18	0.44	n/a	0.38	0.13	0.09
J	60		0.18	n/a	n/a	0.18	0.76	0.49
J	61		0.18	0.44	n/a	0.17	0.21	0.67
J	62		1.45	2.64	n/a	2.38	1.21	2.16
J	63		1.09	0.88	2.47	0.27	0.14	0.31
K	64		0.18	n/a	n/a	0.21	0.37	0.47
K	65		0.54	0.44	1.23	0.03	0.06	0.09
K	66		n/a	0.88	n/a	0.97	0.99	1
L	68		5.63	3.52	n/a	4.24	4.15	2.2
M	69		0.91	2.2	n/a	1.36	1.77	0.51
M	70		1.27	n/a	n/a	1.63	0.82	0.8
M	71		0.73	0.88	n/a	0.74	0.35	0.4
M	72		0.18	0.44	n/a	0.1	0.12	0.13
M	73		0.36	n/a	n/a	0.98	0.7	0.76
M	74		4.9	4.41	n/a	2.3	0.81	1
M	75		0.36	n/a	n/a	0.21	0.4	0.13
N	81		0.18	n/a	n/a	2.6	1.69	2.54
N	82		0.54	1.76	n/a	0.98	1.52	0.82
P	85		1.81	3.96	4.94	2.42	3.56	9.08
Q	86		2.9	3.96	7.41	2.6	2.1	3.36
Q	87		0.18	6.61	1.23	0.26	2.57	3.05
Q	88		0.18	n/a	2.47	0.09	0.28	0.67
R	90		3.45	0.44	n/a	0.63	0.15	0.13
R	91		0.18	n/a	n/a	0.05	0.04	0.04
R	93		0.54	n/a	n/a	0.96	0.99	1.36
S	94		2.72	1.76	1.23	0.84	1.33	2.27
S	95		0.36	0.88	n/a	1.77	0.37	0.11
S	96		21.23	14.98	11.11	6.22	1.78	1
T	98		0.36	n/a	n/a	n/a	n/a	n/a
U	99		n/a	0.88	n/a	n/a	n/a	n/a
	Total number of firms		551	227	81	162438	22887	4495

Notes: This table shows the sectoral share for micro, small and medium-size firms in the MSMEs Directory and Check-up tool. Source: Own elaboration based on Directory of MSME Firms and Establishments and Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

Table B.9: Difference in self-reported sector from Check-up Tool and sector registered in MSMEs Directory. An example with Other Service Activities (S).

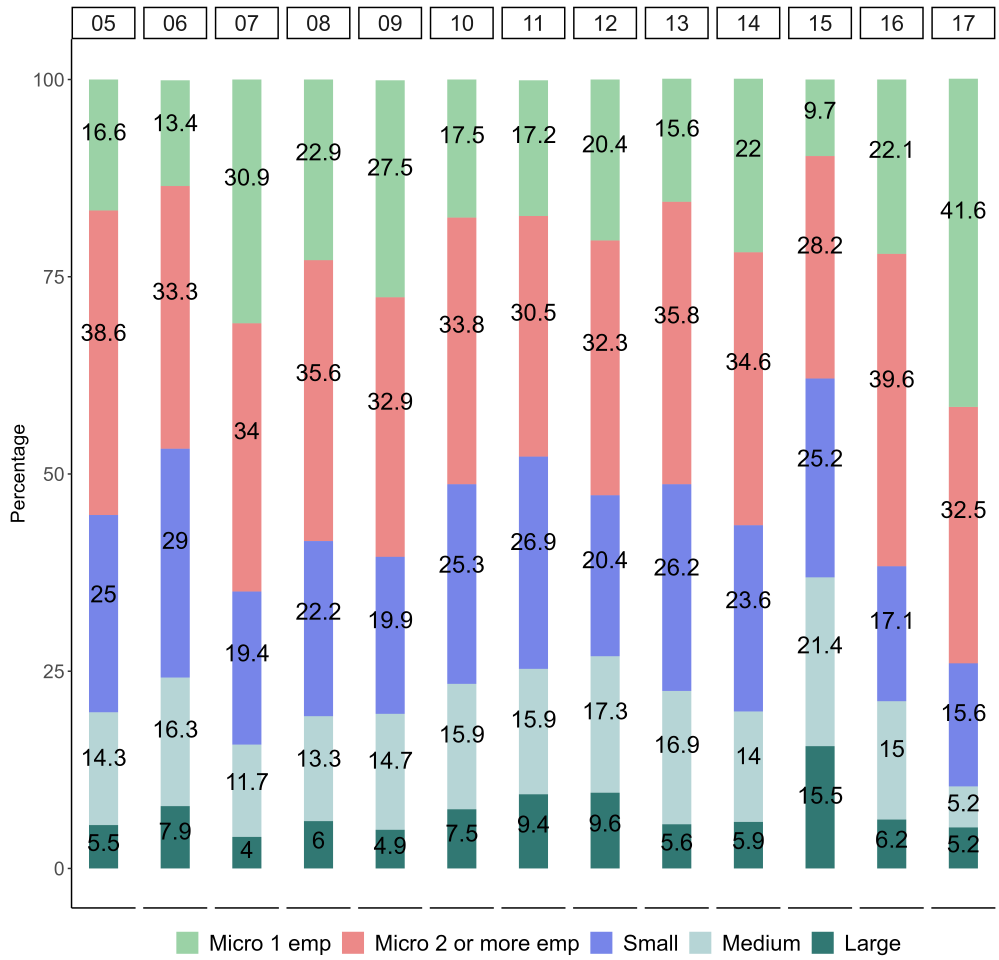
Sector Check-up	Sector MSMEs Dir	Number of firms
S	G	58
S	S	23
S	H	8
S	M	21
S	N	16
S	R	3
S	L	5
S	F	3
S	I	9
S	J	15
S	C	20
S	P	1
S	K	2
S	E	1
S	Total	185

Notes: This table shows an example of the self-declaration issue that arises from the Check-up Tool. More specifically, it displays how the firms that self-declared to be in sector S (in the Check-up Tool) are classified in the MSMEs Directory. For example, 54 of the firms that self-declared to be in sector S in Check-up Tool are actually registered in sector G in the MSMEs Directory. Source: Own elaboration based on Directory of MSME Firms and Establishments and Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

C Further descriptive statistics

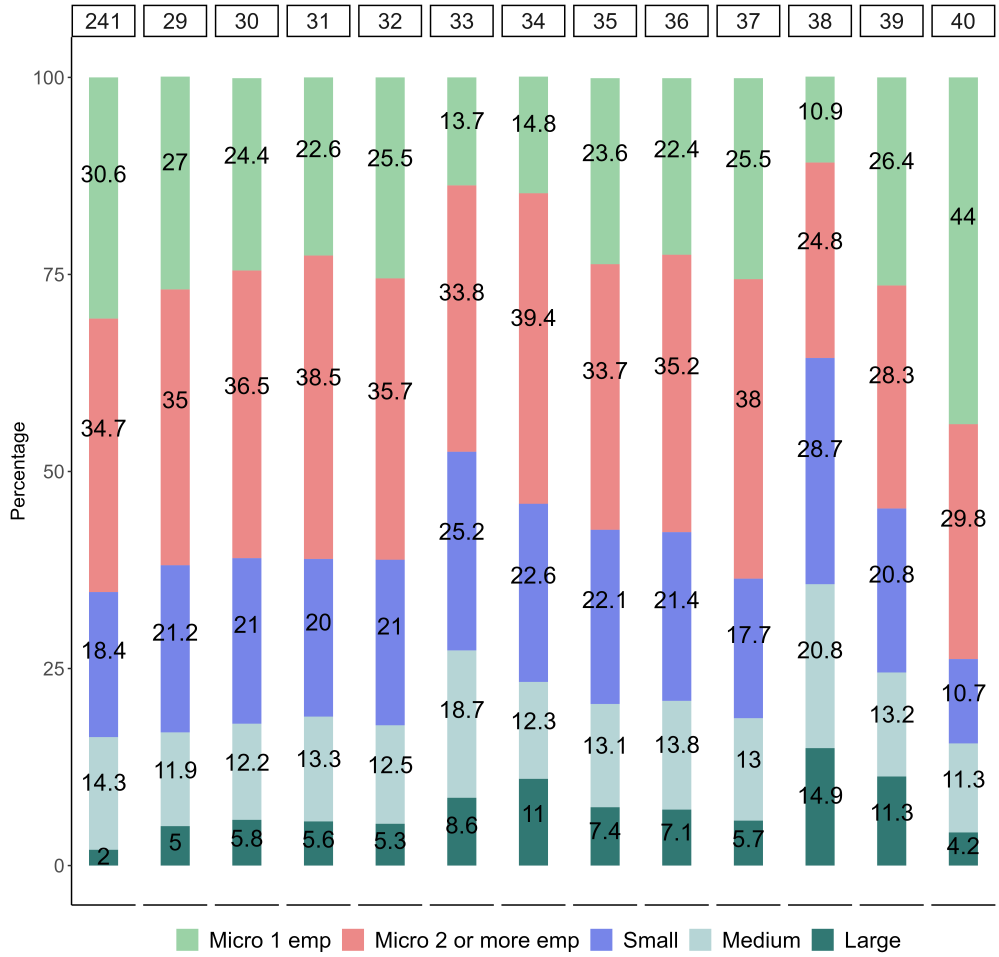
C.1 Technology adoption

Figure C.1: Share of firm size by technology adoption



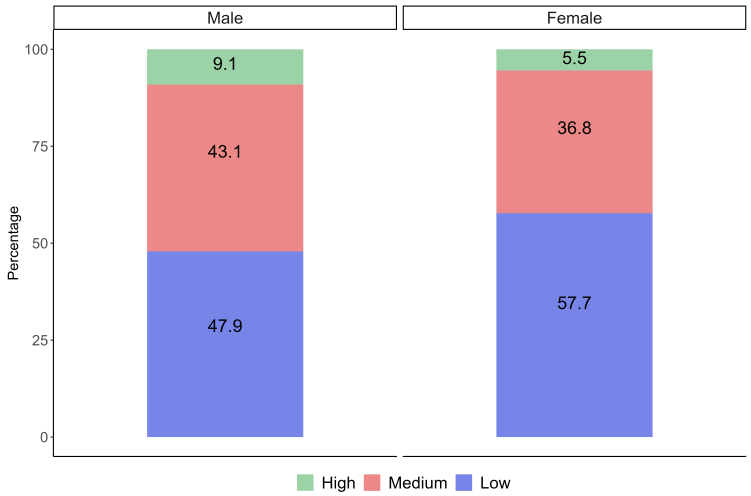
Notes: This figure presents the share of firm size (micro with one employee, micro with two or more employees, small, medium and large) by technology adopted. The technologies are as follows: 05 'Updated institutional website'; 06 'New or updated software', 07 'Creation of social media accounts', 08 'Investment in digital marketing', 09 'Use of e-commerce', 10 'Hardware renewal processes (computers servers)', 11 'Updating/upgrading of cloud systems', 12 'Training staff in technological issues', 13 'Hiring of a technician or professional in the technological area', 14 'Acquiring internet connection according to the company's needs', 15 'Development of interoperability between IT systems', 16 'Metrics analysis of digital channels (sales-products-customers, among others)', and 17 'None of the former'. The total number of firms in the sample is 1311. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

Figure C.2: Composition of firm size by type of software adopted



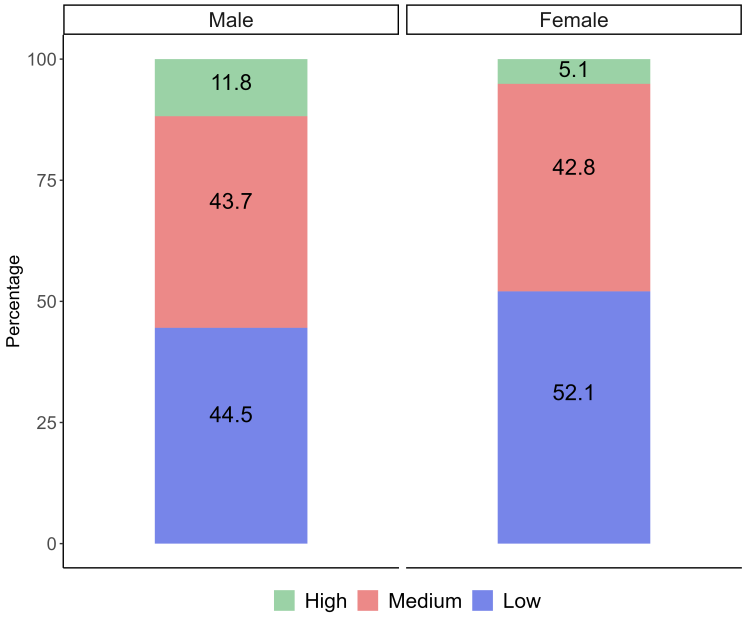
Notes: This figure presents the share of firm size (micro with one employee, micro with two or more employees, small, medium and large) by software program adopted. The kind of software are: Advanced technologies such as AI, machine learning, deep learning, among others (241); Processing and visualization of info. using MS Office (29); Communication (e.g. Zoom, Skype, Webex, etc) (30); To organize team tasks, such as Confluence, Asana, Slack, etc (31); For file synchronization in the cloud (e.g. Google Drive, One Drive, Dropbox) (32); Info. processing for accounting, (e.g. Sage Accounting, Odoo, Wave) (33); Info. processing for CRM (customer management, e.g. Bitrix24, HubSpot, Odoo, etc) (34); Security programs (e.g. Avast, Norton, McAfee, etc) (35); For digital marketing (e.g. Hubspot, Marketing Hub, Mailchimp) (36); For E-commerce (e.g. Shopify, Ecwid, GoDaddy eCommerce, etc) (37); For finance activities, supply chain, operations, commerce, HR (e.g. ERP systems, etc) (38); Optimize/improve goods or services (e.g. Idea Drop, Miro, Meister, etc) (39); Don't use any of these programs (40). The total number of firms in the sample is 1311. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

Figure C.3: Share of firms by intensity adoption and gender of the owner (in percentage)



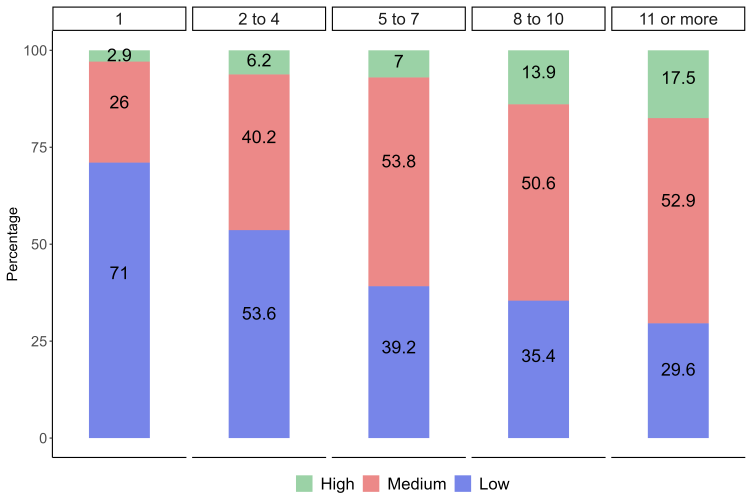
Notes: This figure shows the digital intensity composition (in percentage) by gender of the owner. Digital intensity adoption is defined as low if the firm has adopted between 0 and 3 technologies, medium when the range is between 4 to 7, and high when the number of technologies adopted is equal to or greater than 8. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

Figure C.4: Share of firms by intensity adoption and gender of the manager (in percentage)



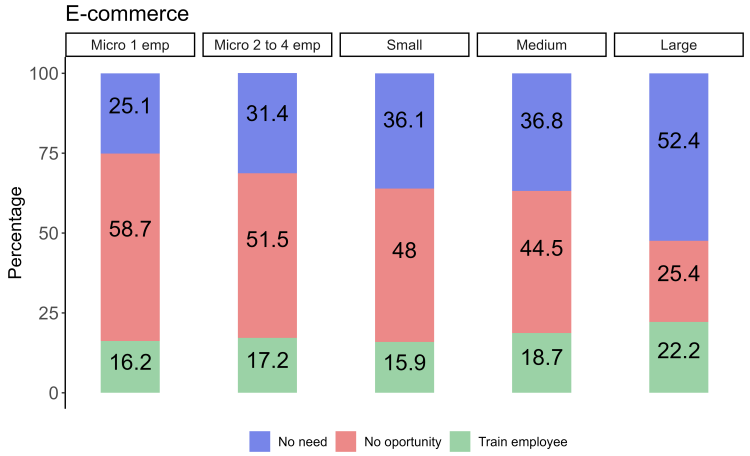
Notes: This figure shows the digital intensity composition (in percentage) by gender of the manager. Digital intensity adoption is defined as low if the firm has adopted between 0 and 3 technologies, medium when the range is between 4 to 7, and high when the number of technologies adopted is equal to or greater than 8. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

Figure C.5: Share of firms by intensity adoption and number of employees (in percentage)



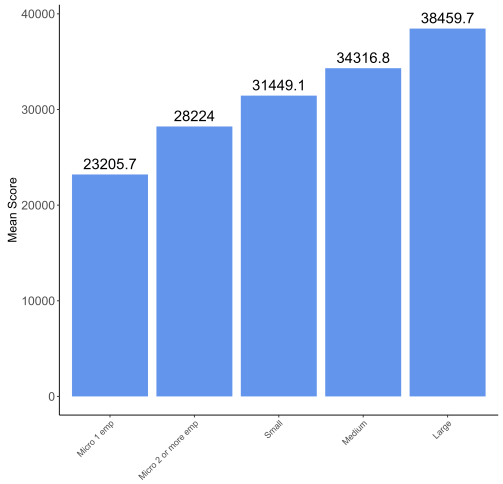
Notes: This figure shows the digital intensity composition (in percentage) by number of employees. Digital intensity adoption is defined as low if the firm has adopted between 0 and 3 technologies, medium when the range is between 4 to 7, and high when the number of technologies adopted is equal to or greater than 8. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

Figure C.6: Training needs and opportunities in E-commerce by firm size



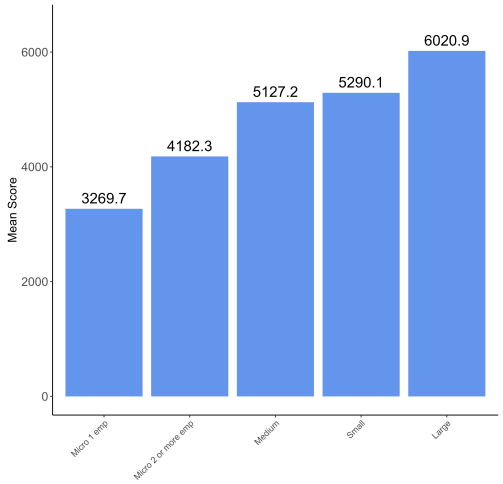
Notes: This Figure shows the results for whether firms have provided training to their workers in E-commerce. The question distinguishes between five categories, where it combines needs with frequency of training provided. The five options given in the answers have been grouped into three in the following way: no need for training (No need), there is need but no opportunity for it (No opportunity), and a training per year, a training per semester, or a training every quarter (Train employee). Firms are classified into micro, small, medium and large firms depending on the sales range that they declare (excluding VAT) in the corresponding question in the Check-up Tool. Micro firms are the ones with up to Uruguayan pesos (UY) 10,300,800, small between UY 10,300,801 and 51,504,000, medium UY 51,504,001 to 386,280,000, and large over UY 386,280,000. We split the micro firms into firms with one employee and firms with two or more employees since the former normally have very different behavior and logic in comparison to the latter. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

Figure C.7: Mean of general maturity score by firm size



Notes: This figure presents the average maturity score index by firm size. Firms are classified into micro, small, medium and large firms depending on the sales range that they declare (excluding VAT) in the corresponding question in the Check-up Tool. Micro firms are the ones with up to Uruguayan pesos (UY) 10,300,800, small between UY 10,300,801 and 51,504,000, medium UY 51,504,001 to 386,280,000, and large over UY 386,280,000. We split the micro firms into firms with one employee and firms with two or more since the former normally have very different behavior and logic in comparison to the latter. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

Figure C.8: Mean of technology score by firm size



Notes: This figure presents the average technology score index by firm size. Firms are classified into micro, small, medium and large firms depending on the sales range that they declare (excluding VAT) in the corresponding question in the Check-up Tool. Micro firms are the ones with up to Uruguayan pesos (UY) 10,300,800, small between UY 10,300,801 and 51,504,000, medium UY 51,504,001 to 386,280,000, and large over UY 386,280,000. We split the micro firms into firms with one employee and firms with two or more since the former normally have very different behavior and logic in comparison to the latter. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

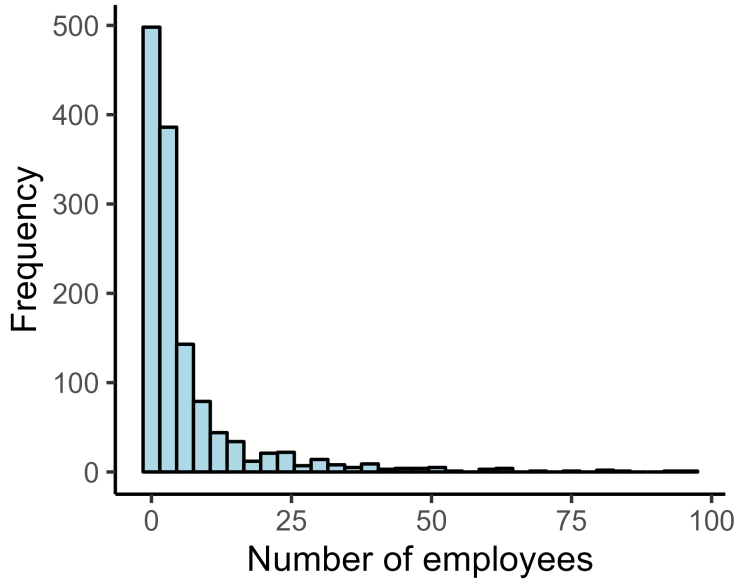
C.2 Descriptive statistics

Table C.1: Summary statistics of number of employees

Mean	SD	First quartile	Median	Third quartile	P90	Min	Max
8.8	26.7	1	2	7	20	1	475

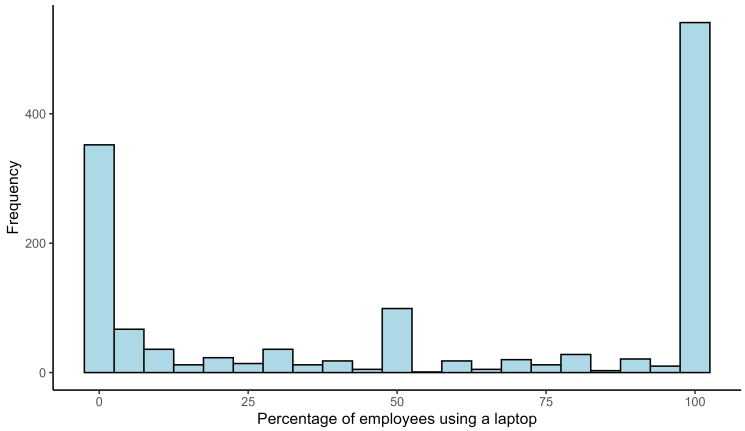
Notes: This table shows the descriptive statistics for the variable employees. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

Figure C.9: Distribution of the number of employees



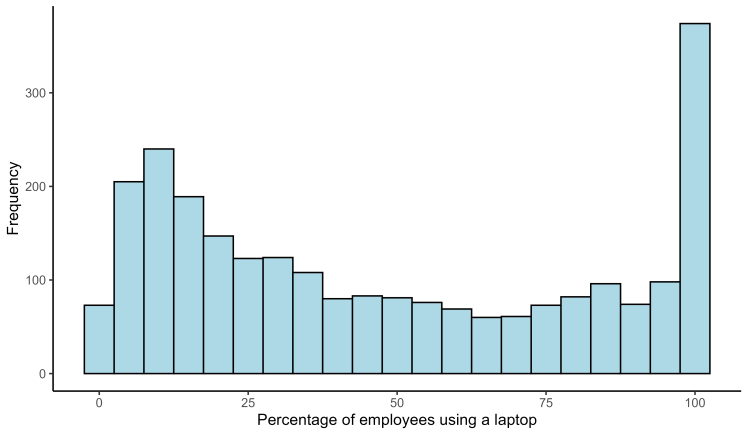
Notes: This figure shows the distribution of the number of employees. We have restricted the sample to firms with 1 to 100 employees. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

Figure C.10: Distribution of share of employees using laptops. Check-up Tool



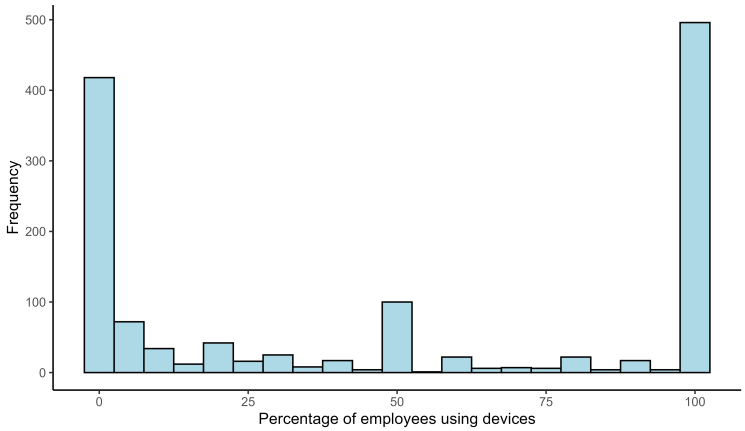
Notes: This figure shows the distribution of the variable percentage of employees using laptop. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

Figure C.11: Distribution of share of employees using laptops. EAAE



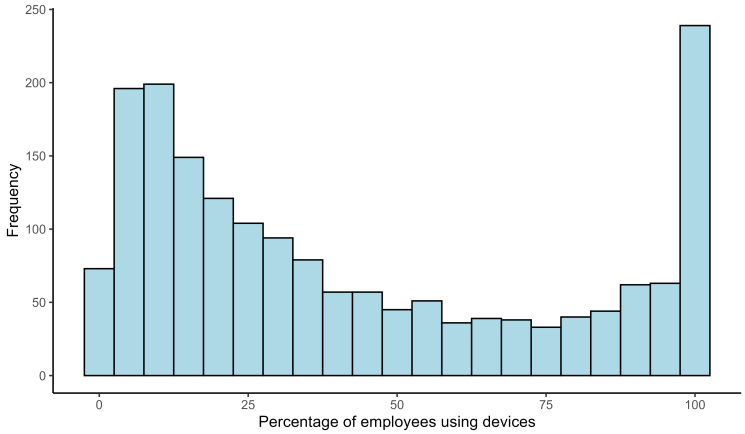
Notes: This figure shows the distribution of the variable percentage of employees using laptops. Source: Own elaboration based on EAAE 2020.

Figure C.12: Distribution of share of employees using devices. Check-up Tool.



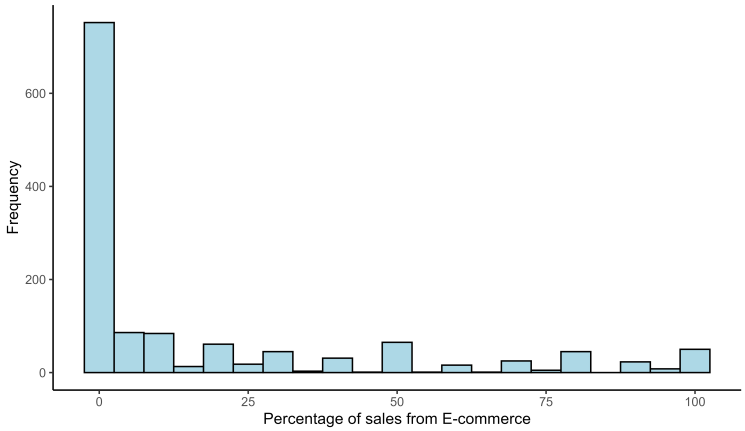
Notes: This figure shows distribution of the share of employees using devices. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

Figure C.13: Distribution of share of employees using devices. EAAE.



Notes: This figure shows the distribution of the share of employees using devices. Source: Own elaboration based on EAAE 2020.

Figure C.14: Histogram of share of sales coming from E-commerce. Check-up Tool.



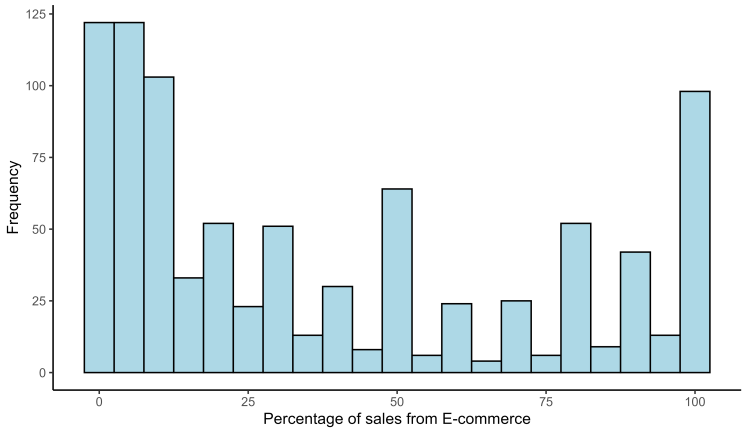
Notes: This figure shows the distribution of the share of e-commerce sales that the firms participating in the Check-up Tool have declared. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

Table C.2: Summary statistics of E-commerce by firm size (in percentage)

Size	Mean	SD	Median	Min	Max
Micro	20.0	30.7	0	0	100
Small	14.1	26.6	0	0	100
Medium	15.1	25.8	0	0	100
Large	11.8	25.9	0	0	100
Total firms	17.9	29.3	0	0	100

Notes: This table shows the summary statistics of the share of E-commerce sales for the total firms and by firm size. Firms are classified into micro, small, medium and large firms depending on the sales range that they declare (excluding VAT) in the corresponding question in the Check-up Tool. Micro firms are the ones with up to Uruguayan pesos (UY) 10,300,800, small between UY 10,300,801 and 51,504,000, medium UY 51,504,001 to 386,280,000, and large over UY 386,280,000. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

Figure C.15: Histogram of share of sales coming from E-commerce. EAAE.



Notes: This figure shows the distribution of the share of E-commerce sales that firms participating in EAAE declare. Source: Own elaboration based on EAAE 2020.

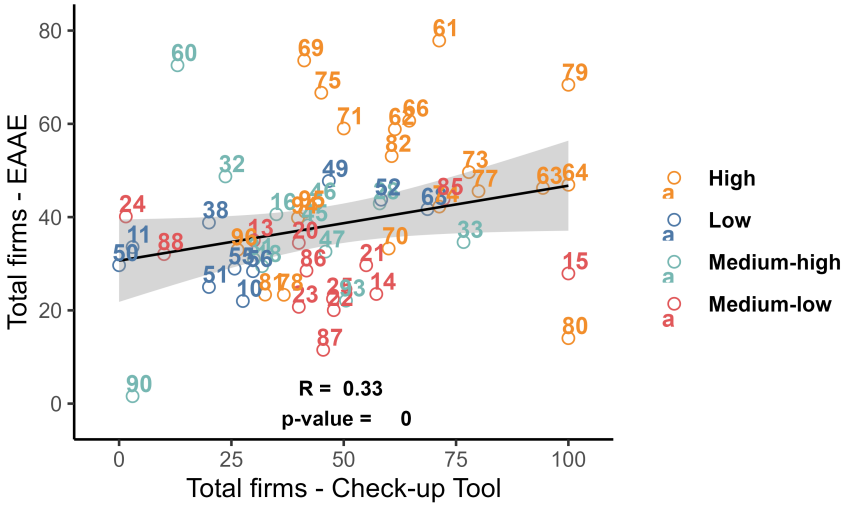
Table C.3: Summary statistics of age of the firm

Age range	Mean	SD	Median	Min	Max
New	1.0	0.7	1	0	2
Starters	3.7	1.0	4	2	5
Young	8.3	1.7	9	5	10
Mature	17.3	4.6	20	10	21

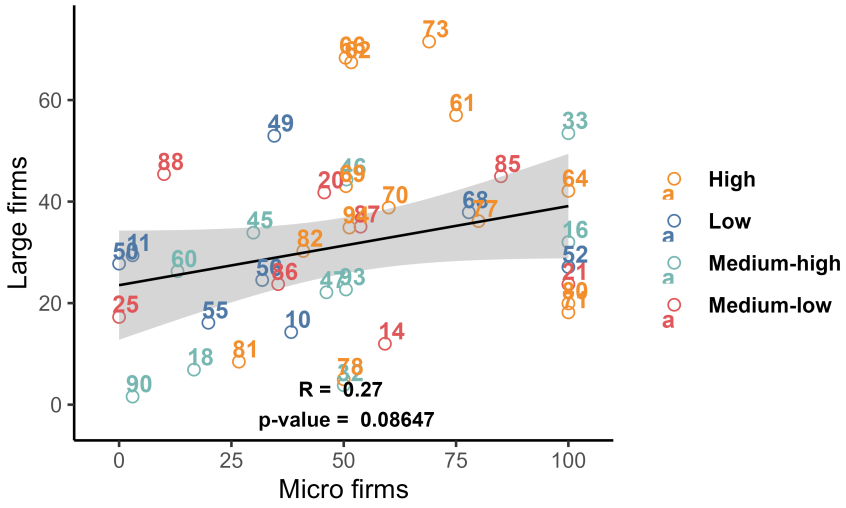
Notes: This table shows the descriptive statistics for the age of the firm by the age range. The age of the firm is constructed by subtracting the year of creation of the firm from the year in which the firm answered the questionnaire. Next, the age range is constructed by splitting the variable age into quartiles. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB).

D Comparing firms from EAAE & Check-up Tool

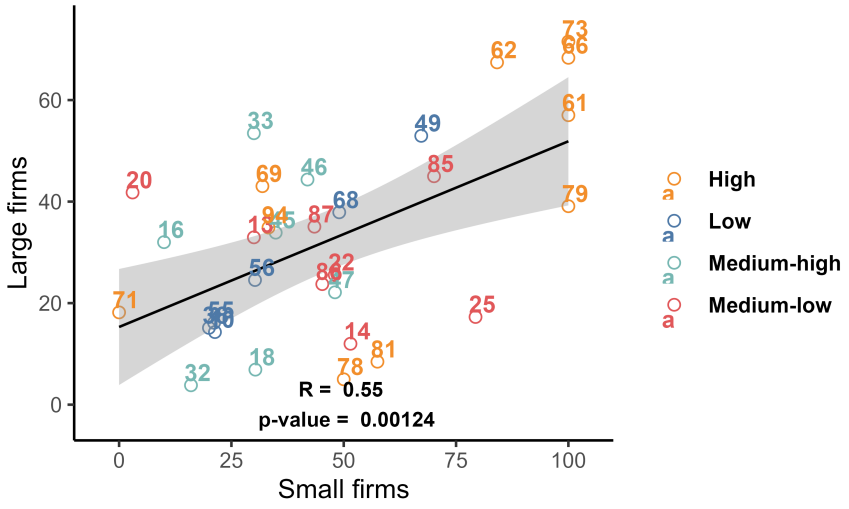
Figure D.1: Sectoral correlation of the share of employees that use a device



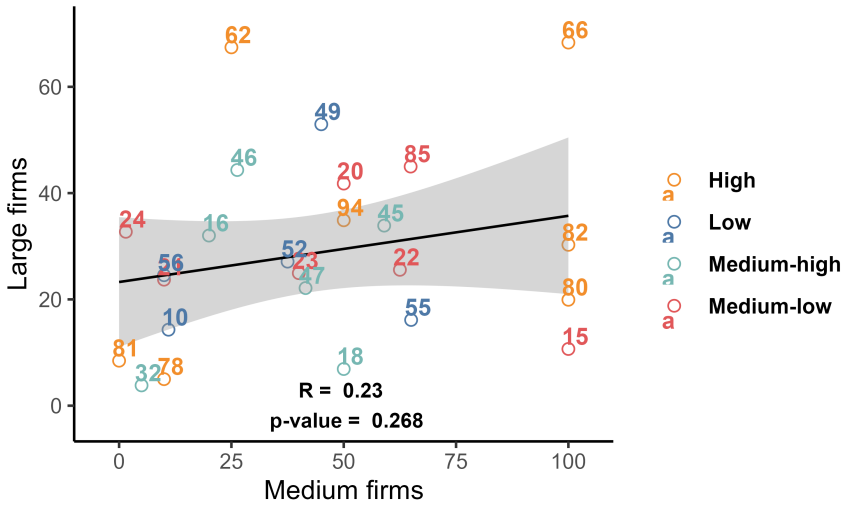
(a) Total firms in both data sources



(b) Large EAAE vs Micro Check-up Tool



(c) Large EAAE vs Small Check-up Tool



(d) Large EAAE vs Medium Check-up Tool

Notes: This Figure presents the correlation between the share of employees using a device by first comparing the total firms from EAAE (y-axis) and the total firms from the Check-up Tool (x-axis) and then by comparing large firms (y-axis) against micro, small, and medium firms (x-axis) separately in figures b, c and d, respectively. The results for large firms are sourced from EAAE and are weighted using the weights provided in the survey. The results for micro, small and medium firms come from the Check-up Tool and the sample excludes firms with one employee. The indicator is the average share of employees using a device in each sector (at ISIC 2-digit levels). The classification of firms into micro, small and medium categories is derived from the MSMEs Directory (see section 3). We are restricting the sample to the firms that match with the MSMEs Directory 2020 to avoid sectoral misclassification in the Check-up Tool. Therefore, these shares have been computed over a sample of 858 firms. We use the taxonomy elaborated by Calvino et al. (2018) to classify sectors into high, medium-high, medium-low, and low digital-intensive sectors. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB) and the EAAE 2020.

Table D.1 presents the share of firms that use their website for product description and for online sales for the total sample of firms. While 71% of the firms use the website for describing products in the firms included in the EAAE, around 45% of the firms that are included in the Check-up Tool do the same. When looking at the column with the share of firms that provide the possibility of ordering online, only 11.4% of the firms in the Check-up Tool do so, while the percentage is 23.3% in EAAE.

Table D.1: Share of firms by use of own website - total firms (in percentage)

Firm type	Product description	Order online
Check-up Tool	44.6	11.4
EAAE	71.0	23.3

Notes: This table shows the share of firms that use their own website for product description and for online sales (E-commerce) from the Check-up Tool and EAAE. The results from the EAAE are weighted with the sampling weights provided in the survey. The sample from the Check-up Tool is restricted to firms with two or more employees. Source: Own elaboration based on Digital Check-up tool Uruguay from the Interamerican Development Bank (IDB) and the EAAE 2020.