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# Differences in the Impact of Digital Platform Use – Evidence from an Austrian Enterprise survey

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**Abstract**

In light of the widespread use of digital platforms, this paper addresses the question of whether and how firms derive benefit from their use and aims to estimate the contributing factors. Using data from a newly implemented enterprise survey in Austria, we evaluate both individual survey results and a combined measure of the effects on revenues, costs and selling prices. Logistic regressions reveal significant differences in the impact of digital platforms on firms depending on the firm characteristics and the business domains, like for sales, in which the platforms are used. Their application also has effects for the business partners of the firms. Empirical results find a predominantly positive impact of platform use on the firms' customers, consisting of firms (B2B) and consumers (B2C), with respect to quality and product variety.

**Keywords:** Digital platforms, enterprise survey, technological impact, network effects

**JEL Classification**: L20, L86, O33

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## 1. Introduction

According to the OECD, we define digital platforms as "[...] *a digital service that facilitates interactions between two or more distinct but interdependent sets of users (whether firms or individuals) who interact through the service via the Internet."* [33, p.20] As Gawer [22] argues, digital platforms are the dominant organizational forms in the digital age. They are widely used in business and society and are part of the ongoing digital transformation. In line with the broader digital process which *"*[...] *aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies*" [52, p.118], digital platforms have far-reaching implications and affect various aspects of economic and social interactions [44]. Their economic impact has been studied from a broad perspective, including economic growth, productivity, wealth distribution, development, consumption and labour [21,27,33,44,49]. Literature further investigates their implications for firms with respect to incumbent industries and services [38,42]. Digital platforms can help to grow businesses by providing customers access, marketing instruments, and payment and delivery methods [44] and act as channel for knowledge sharing, exchange and conversion [3,8]. Used for online learning and training, digital platforms can help to empower employees, enhance their skills and contribute to the organization's absorptive capacity [1].

Some digital platforms have become global and now dominate many sectors, with some of the highest valued companies in hospitality, transport, food delivery, communications, and entertainment [21]. They also have the potential to enhance companies' networking capabilities, ensuring both flexibility and continuity of sourcing processes [31]. Additionally, digital platforms facilitate the exchange between all actors, can allow firms, in particular smaller firms, to operate globally, and facilitate innovation [22].

Opposed to the digital platform's opportunities for value creation power asymmetries may arise with risks for entrepreneurs that stem from dependencies [16]. Drawing on power-dependency theory Cutolo & Kenny [16] argue that the power imbalances between a platform and its ecosystem members are intrinsic to digital platforms' economic logic and technological design. Digital platform firms have economic and governance power over their ecosystem members because rules are set up by private digital platform firms and are not governed through democratic processes [22]. Gawer [22] refers to network effects that can drive rapid growth but also produce customer lock-in and winner-take-all or -most outcomes, undermining competition; when multihoming is difficult or costly and switching is hindered by poor data portability or interoperability, strong network effects can entrench incumbents and push digital platform markets toward monopoly.

Notwithstanding, empirical literature refers to positive effects on firm performance of digital transformation and the adoption of new digital processes [20,48]. Digital platforms have positive effects on supply chain capability which mediates the relationship between digital platforms and operational performance [24]. Adopting digital platforms among SME startups significantly impacts also factors like startup attitude, subjective norms, entrepreneurial behavioral control, and sociocultural factors [32].

Additional case study evidence indicates that firms can provide new solutions, increase community participation and deliver services more cheaply even as quality and performance rise [40].

However, there are significant differences in adoption rates between manufacturing and service sectors, with tourism firms are among the heaviest users of digital platforms [35]. Firm size also matters because SMEs and large firms perceive the benefits of digital service differently

[31] and small firms tend to be more affected by the additional costs of using digital platforms than larger firms respectively [35]. For B2B, further relevant determinants on the adoption span the technological, organizational (including technological readiness) and environmental context (e.g. the degree of competition and government regulation) [43]. In more general, the firms organizational change capabilities are essential to effectively adapt to transformations as technological changes [2]. Digital maturity also plays a role, firms that rate themselves as more advanced in terms of digitalization report better terms of use and significantly higher satisfaction with their use of digital platforms, and moreover, platform competition is a crucial factor in their adoption and impact on user satisfaction [35].
The use of digital platforms has effects not only on firms using a digital platform but also on their business partners (B2B), and consumers (B2C). Digital platforms can affect prices, quality and variety of offered goods and services, with implications for consumer surplus. For example, in the Chinese book market, the number of products almost doubled from 2015 to 2019 using a digital platform [15]. Literature refers to the welfare effects of digital services like digital platforms and e-commerce from the consumer perspective [e.g. 12,14,17,18,25,26].
Contributing to the literature in three ways, we take a different angle and adopt a firm-side perspective to examine the effects of digital platforms on firms and consumers. First, drawing on an Austrian enterprise survey, we empirically investigate the impact of digital platform use on firms across digital platform types, application fields (business domains), and firm-specific characteristics. Estimating the contributing factors, our research follows the literature explaining heterogeneity in the performance outcome in the general digital transformation process [e.g. 10,19,30]. We apply logistic regressions and find that smaller firms (with respect to revenues) have a higher probability to benefit from the use. Moreover, firms using digital platforms for e-sales report a higher positive impact from the platform use. Secondly, in addition to the direct impact on the firms, we examine whether their partners (consumers and other business partners) benefit from the use of digital platforms in terms of higher quality, greater variety of goods and services, and lower prices. Third, we can identify the business domains where platforms are most likely to cause these effects. Assessing the firms directly allows us to gather information about the use of digital platforms in specific business domains and their impact, which otherwise cannot be directly observed by consumers and attributed to the platforms.

The remainder of this paper is structured as follows: Section 2 describes the enterprise survey and the data. Section 3 states the research questions and introduces the methodology by defining measures for beneficiaries from digital platforms. Section 4 gives the empirical results on the differences in the impact of digital platform use and section 5 concludes.

## 2. Survey Design and Data

The data base for this research is a new and original enterprise survey[1] concerning the use of digital platforms by firms in Austria, conducted in 2021/22. Preceding this, expert interviews and a pretest were carried out to pilot the questionnaire and to assess the relevance of the survey's thematic focus [6]. The sampling frame was derived, following Arvanitis et al. [4], from Herold MD Online. This database contains information on 30,077 companies with at least 10

[1] On the basis of the dataset so far research was conducted regarding the extent of use of digital platforms as well es their motives and obstacles [6], their use for platform work [11], digital platforms used free of charge [9] and on the interplay of competition, satisfaction and willingness to pay with respect to digital platform use [35].

employees from the sectors of industry, construction and services[2]. From this, a sample of 9,032 companies was drawn in a two-stage procedure, considering firm size and economic sector [6]. The net sample size comprised 8,600 firms (adjusted for failures due to unavailability or non-deliverability), our stratified sample covers 1,380 firms, which corresponds to a response rate of 16 percent. The weighting of the data accounts for both the sampling design (design weighting) and differences in the distribution of firm characteristics between respondents and the firm population (adjustment weighting). The design weighting pertains only to firm size due to the fact that all companies with at least 100 employees were included in the sample, smaller companies were, following Arvenitis et al. [4], selected by random sampling [6]. This prioritisation of larger enterprises reflects their presumed greater economic importance, also for business use of digital platforms; at the same time, the larger number of small enterprises allows for a reliable random sampling [35]. The final weight of a firm is the product of the design weight and the adjustment weight [41][3]. If not mentioned separately in this paper all results refer to weighted data.

The survey provides, for the first time, empirical evidence on the firm use of digital platforms in Austria in five business domains (e-sales, procurement including gigwork and cloudwork, production and logistics, human resources, communication including information and advertising). Among other aspects, questions were raised about the use, motives, significance, obstacles, and effects of using digital platforms. Regarding firm characteristics, the survey gathered assessments of the degree of digitalization relative to competitors, the competitive situation, and export orientation; it also collected information on firm age, corporate group affiliation, headquarters location, firm size, revenues and employment development, as well as a recent assessment of demand trends in the main sales market. Apart from the usual plausibility checks self-reported data on firm size and revenues were cross checked with information from Herold MD Online. However, a common method bias in the regression analysis cannot be ruled out.

According to the survey 88.1% of the companies use at least in one of the five business domains one or more digital platforms [6]. With respect to e-sales it is possible to distinguish further between business-to-business (B2B), business-to-consumer (B2C) and business-to-government (B2G) sales. In the survey enterprises were asked to consider the effects of the use of digital platform with respect to revenues and costs, as well as their impact on selling prices, quality and variety of their products and services offered according to a 5-point *Likert scale* ranging from "*much higher – rather higher – neutral – rather lower – much lower*".

Table 1 shows the variables in detail together with basic descriptive statistics, whereby the results are ranked from 1 ("*much lower*") to 5 ("*much higher*"). From the results we can deduce in detail which operational activities are facilitated using digital platforms and whether firms in Austria are able to reduce their costs and or increase revenues by using digital platforms. Descriptive statistics suggest that the use of digital platforms for enterprises rather leads to an increase in total revenues and total costs than to a decline.

- Table 1 here

According to the survey 38.5% of respondents indicated that the use of digital platforms results in a rise in revenues, while only 2.3% reported a decrease in revenues due to their use. The

[2] Specifically, companies were selected from the NACE sectors 10 to 74 (excluding 12, 34, 48, 54, 57, 67), 77 to 82 and 95 and 96.

[3] For sample weights see Table 2 in Peneder et al. [35, p. 4].

others see no change. With regard to the effects on total costs, only 11.7% indicated a decrease, while for 29% the use of digital platforms leads to an increase in overall costs. Again, the rest are neutral. With a Spearman rank coefficient of 0.21 the correlation between the two variables is weak positive (Table 2).

Going more into detail and looking at different aspects of revenues and costs (Table 1), we also find a positive tendency in most answer categories, meaning the use of digital platforms tends to increase the number of customers, the revenues per customer, the number of business partners, the selling prices for products and services, the quality of products and services offered as well as the variety of products and services offered. On the cost side, also personnel costs, investment costs, costs for intermediate goods and services and distribution, administrative costs and information search costs tend to increase. Only in the case of recruitment costs results suggest rather a decline from the use of digital platforms. Table 1 shows the mean and the standard deviation of the variables and summarizes the survey results of the two higher (4 and 5) and the two lower response categories (1 and 2). The remaining respondents chose the middle answer category.

- Table 2 here

In addition to the positive correlation between the variables describing the impact on total costs and revenues, Table 2 also shows a positive significant coefficient for the impact results of quality and variety, quality and selling prices as well as variety and total revenues. The correlation between total costs and variety, quality and total revenues, variety and selling prices as well as selling prices and total revenues is also positive but weaker.

## 3. Theoretical Background and Research Methodology

According to theoretical work, digital platforms can have positive effects in various respects. Literature refers to their ability to create economic value by enabling connections, facilitating matching [22,29] and increasing the efficiency of trade through lower costs of searching, reproduction and verification [23]. In the tradition of Penrose [36], the **resource-based view** considers the firm to be a collection of productive resources. Participating in a digital platform therefore reflects a choice to increase the firm's productive opportunities and capture value from its specific competencies and **dynamic capabilities** [45,46]. By operating multi-sided markets, digital platforms enable companies to extend their reach and orchestrate resources in manyfold directions (e.g. to new suppliers, production networks, and customers) in response to changing competitive conditions. The positive outcomes using digital platforms are more likely to be accessed when firms have the necessary (digital) capabilities to use the information, visibility and connectivity that are provided by the platforms [24].

Digital platforms can also lower **transaction costs** (eg., for search, contracting or monitoring) by improving communication between trading partners, they reduce costs of logistics, payment processing costs, and by offering the opportunity to reach a wider range of targeted markets with tailored advertising they facilitate to connect supply and demand [33,49].

Implications of digital platform use are related to **network effects**, which create efficiencies through demand aggregation [50] and the utility from a good increase, with the number of users [28]. Literature refers to positive *direct network effects* of digital platforms, arising from a large number of users in the same user group, e.g. in social networks, and positive *indirect network effects* of digital platforms by bringing together different groups of users, like consumers and

suppliers. The impact of network effects depends on factors such as the degree of competition that affects the outcomes in platform markets [7]. Network effects can also influence the pricing behavior of firms allowing them to set the price in one market to zero if revenues are generated in another market [34].

Based on the value proposition of digital platforms above we address the following research questions:

**Research Question 1:**

Do firms benefit from the use of digital platforms with respect to higher revenues, lower costs and higher selling prices?

**Research Question 2:**

Do firms' business partners and consumers benefit from the use of digital platforms with respect to higher quality, more variety and lower prices?

Literature refers to heterogeneity in the impact on performance induced by the general digital transformation process [e.g. 10,19,30,48]. Based on this, we attempt to identify the influencing factors for the benefit of digital platform use, with special interest in sector, firm size and digital maturity.

**Research Question 3:**

What factors determine the perceived impact of digital platform use of firms on revenues and costs?

**Research Question 4:**

What factors determine the impact of firms' digital platform use for consumers?

In the following we introduce combined measures on the reported impact of the firms: The first measure is based on the effects on total revenues, total costs and selling prices in order to identify whether a firm is benefitting from using digital platforms. Based on their answers we categorise the firms into beneficiaries in a narrow sense $F_{gain}$, beneficiaries in a wider sense $F_{wgain}$, as well as non-beneficiaries $F_{ngain}$:

- $F_{gain}$ ... firms benefiting from the use of digital platforms by increases in total revenues (*Likert scale = 4 or 5*) together with falling or constant total costs (*Likert scale = 1, 2 or 3*) or
  decreases in total costs (*Likert scale = 1 or 2*) together with constant or increasing total revenues (*Likert scale = 3, 4 or 5*).
- $F_{wgain}$ ... $F_{gain}$ extended by strong increases in total revenues (*Likert scale = 5*) together with costs rather increasing (*Likert scale = 4*) or
  only rather decreasing total revenues (*Likert scale = 2*) together with strong decreasing costs (*Likert scale = 1*).
- $F_{ngain}$ ... firms that are not belonging to $F_{wgain}$.

The second measure investigates whether companies observe cost reductions that are not passed on to customers in the form of lower selling prices. In this sense, we are looking at the firms' response combinations regarding the effects on total costs and selling prices and again

categorise the firms into beneficiaries in a narrow sense $F_{price}$, beneficiaries in a wider sense $F_{wprice}$, as well as non-beneficiaries $F_{nprice}$:

- $F_{price}$ ... firms benefiting from the use of digital platforms by decreases in total costs (*Likert* scale = 1 or 2) together with at least constant selling prices (*Likert scale = 3, 4 or 5*) or
  increases in selling prices (*Likert scale = 4 or 5*) with no cost increases (*Likert scale = 1, 2 or 3*) at the same time.
- $F_{wprice}$ ... $F_{price}$ extended by rather decreasing prices (*Likert scale = 2*) together with strong decreasing costs (*Likert scale = 1*) or
  strong increases in prices (*Likert scale = 5*) together with costs only rather increasing (*Likert scale = 4*).
- $F_{nprice}$ ... firms that are not belonging to $F_{wprice}$.

The third measure mirrors the firms' responses regarding the impact of digital platform use on their selling prices as well as on the quality and variety of their goods and services to allow an assessment of the effects for other side of the market. We define $O_{gain}$ to consider the others, which are the firms' business partners and customers, including companies and consumers, that benefit from the firms' use of digital platforms. Additionally, we construct a proxy for consumer gain $C_{gain}$ by focusing on B2C e-sales only.

- $O_{gain}$ ... others benefiting from the use of digital platforms by better (*Likert scale = 4 or 5*) quality or variety or both, together with falling or stable prices (*Likert scale = 1, 2 or 3*) or
  price reductions (*Likert scale = 1 or 2*) together with at least constant (*Likert scale = 3, 4 or 5*) quality or variety or both.
- $C_{gain}$ ... restricting $O_{gain}$ to B2C e-sales.

## 4. Empirical Results

### *4.1 Beneficiaries from Digital Platforms*

According to the above definitions we construct binary dummy variables combining the respective answer categories. The empirical results suggest that a quarter of the firms benefit from the use of digital platforms, $F_{gain}$ = 25.6%. The share increases to 27.4% using the wider definition $F_{wgain}$. In contrast, 72.6% do not benefit from the use of digital platforms according to this definition. Looking at the positive effects regarding the cost-price combinations, we find only $F_{price}$ = 15.9% and $F_{wprice}$ = 16.6% of total enterprises belonging to the subsets of beneficiaries. In contrast, 83.4% do not benefit from the use of digital platforms according to this definition. Considering the effects of digital platform use for the firms' business partners $O_{gain}$, we find that 31.7% of the firms report positive effects for their partners with respect to quality, variety and prices. Having the focus on firms using digital platforms for B2C e-sales, empirical results suggest $C_{gain}$ = 33.9%, as the share of firms reporting positive effects for their customers with respect to prices, quality and variety. Table 3 summarizes the results.

- Table 3 here

### *4.2 Explanatory Variables*

Using logistic regressions, we identify differences in the impact of digital platform use on firms and consumers. The explanatory variables are taken from the enterprise survey, among them firm characteristics and aspects of the platform use (see Table 4), to explain differences in the impact on revenues and costs directly, and on combined measures of revenues and costs as well as of costs and price effects. The first two blocks of Table 4 refer to the sector of economic activity of the firm (industry, construction, tourism (accommodation and food service activities) and other services) and the business domain where the digital platform is used (e-sales, procurement including gigwork and cloudwork, production, human resources and communication including information and advertisement). While the sector is a uniquely assignable attribute, the answers regarding the digital platforms use cannot be assigned uniquely to a business domain as there are firms working with digital platforms in more than one business domain simultaneously.

- Table 4 here

According to Bärenthaler-Sieber et al. [6] digital platforms are used particularly often in the areas human resources and communication (including information and advertisement). In these business domains digital platforms are used by more than 70% of the firms in the survey. In order to identify differences between the use in these two activities and to distinguish it from other units, we restrict the attribution more narrowly and refer it to the use of either only human resources or only communication or the combination of these two. Doing that, these categories still amount almost half of the survey (Table 4). Beside the attributes of the business domains, we include a set of other firm characteristics in the analysis, as export orientation, the investment structure (indicated as expenses in percent of the firms' revenues, e.g. for gross fixed capital formation and for R&D) as well as the degree of digitalization. The structure variables obtain more missing observations than the other explanatory variables. Their inclusion in the regressions leads to a smaller sample size. Therefore, we construct two sets of estimations, one including the structure variables in smaller sample, and a lager sample, omitting them. The main results for the common variables show robust estimates. All variables are represented as binary dummy variables indicating the proportions of valid responses for the underlying characteristics. Moreover, in the regressions we use information regarding the number of business domains where digital platforms are used and their intensity, again measured with binary dummy variables. As control variables we consider a set of motives for the use of digital platforms selected by the firms in the survey, represented again as binary dummy variables (last block of Table 4).

### *4.3 Impact of Digital Platform Use on Firms*

#### *4.3.1 Revenues and Costs*

We investigate the influence of the explanatory variables $X_{kn}$ on the impact of digital platform use $I_n$ on revenues and costs for the firms $n = 1...N$:

$$I_n = \sum_{k=1}^{K} \beta_k X_{kn} + \epsilon_n.$$

The observed variable $I_n$ from the survey is ordinal 5-point Likert scaled and we estimate ordered logit models to attribute the differences in the results to firm specific characteristics $X_{kn}$,

as summarized in Table 4. The results are given in Table 5. The coefficients are shown in column (1) when all the explanatory variables are included, resulting in a smaller sample size. Column (2) refers to fewer variables, resulting in a larger sample size.

The results suggest that firms belonging to the tourism sector (accommodation and food service activities) have a higher probability of benefiting from the use of digital platforms in terms of higher revenues as opposed to firms belonging the industry, construction and other services. Regarding the business domain where the digital platforms are used, we found evidence that a use in e-sales is more likely to lead to an increase in total revenues. Further, both number and extend of digital platform use make a difference. While the use of digital platforms in at least two business domains has a rather positive impact, a low intensity of use has a significant negative one. Also firm-specific factors explain differences in the impact. The estimation results suggest that firms with lower revenues are more likely to profit from the use of digital platforms. Also firms whose expenditures are characterized by a rather low share of gross fixed capital formation and high R&D expenditures tend to have a higher positive impact from digital platform use in terms of total revenues. While export orientation does not show clearly positive effects, business growth (measured by the expansion of employees) and the degree of digitalization are rather positively associated. Among the motives the use growth opportunities and visibility for target groups were found to be significant and highly positive. Table 5 reports the odds ratios with respect to the impact on total revenues.

- Table 5 here

Similarly, we estimate differences in the impact on total costs (Table 6) with the large (1) and smaller set of variables (2). On the one hand we find that total costs tend to increase with the use of digital platforms if firms are belonging to the tourism sector compared to industry and construction. The number of business domains where digital platforms are used has a cost increasing impact, too. The use of more than two digital platforms is found to be a source of higher costs. On the other hand, the digital platform use leads to a cost decline for firms that are export oriented and whose spending structure is rather personal intensive. Also, firms, with revenues below 10 million euro rather face cost reductions. Firms that are in a position to reduce costs have also previously referred to this as a motive for the use. However, the business domain in which digital platforms are used does not have a significant impact on cost effects.

- Table 6 here

### *4.3.2 Beneficiaries*

After having analyzed effects on total revenues and total costs individually, we are considering the combined measure of total costs and revenues as well as total cost and prices. As expected, results of Table 5 and Table 6 are also reflected in the combined analyses. Having the beneficiaries $F_{wgain_n}$ as binary dependent variable (either being a beneficiary or not), we investigate the influence of the explanatory variables $X_{kn}$ for the firms $n = 1...N$:

$$F_{wgain_n} = \alpha + \sum_{k=1}^{K} \beta_k X_{kn} + \epsilon_n.$$

- Table 7 here

Logit regressions support the result that using digital platforms in e-sales tend to increase the probability that the firm benefits from its use. The same is true for firms with revenues below

10 million euro and firms with increasing employment (Table 7). But a low intensity of use reduces probability of the firms benefit. Among the motives the visibility for target groups and saving costs and time were found to be significantly positive. The firm sector and the number of business domains where platforms are used do not have a significant effect here. The firm size (measured by revenues) also plays a significant role in explaining differences in the impact, when considering the profiteers $F_{wprice_n}$ as dependent variable. These are firms that report favorable price-cost effects (Table 3). The estimation results are given in the Appendix (Table 11).

#### *4.3.3 Components of Total Effects*

To get more insights on the kind of effects that are observed by the firms we examine how they contribute to the overall effects measured above. With detailed information on the types of costs and other specific effects of using digital platforms, we can assess which ones have the greatest contribution on total revenue and total cost impact. On the revenue side, the results of an ordered logit model show that the items number of customers, revenue per customer, number of business partners and selling prices of products and services mainly determine the impact for firms (Column (1) in Table 8). Considering total costs, the effects are significantly driven by the impact of investment costs and administrative costs (Column (2) in Table 8).

- Table 8 here

Similarly, by using a logit model, we find that the variables mainly contributing to the probability firms are benefiting from the use of digital platforms (Column (3) in Table 8) are the number of customers and business partners as well as the selling prices are positively associated, while investment costs have a dampening effect. Likewise, running case studies in the USA and Germany, Veile et al. [51] state the formation of new key partners as important aspect of the value creation of digital platforms. Further, on the base of multiple-case study of four leading digital companies in Italy, France and the UK, Ronteau et al. [39] refer to the matchmaking mechanism as the essential driver of value creation in two-sided digital platforms, which is complemented by other factors and constituted by a specific value proposition on each side. More generally, this entails the potential of the key success of digital platforms: a value creation network in which each partner wins [37].

### *4.4 Impact of Digital Platform Use on Firms' Business Partners*

The dataset also allows us to examine how the use of digital platforms affects variety, quality and prices, which in turn has an impact for firms' business partners and customers (Table 9). Literature reports positive effects of online and platform sales on product variety [e.g. 14,15]. Looking at the effects on quality and variety which are also predominately positive in our survey, we find significant differences with respect to the business domains where the platforms are used. In both cases, the use of digital platforms in the business domains e-sales, procurement and production amounts to significant higher shares of firms reporting an increase compared to the whole sample. While 20.3% of firms indicating positive effects on quality, the restriction on firms using digital platforms for production increases the share to 35%. In the case of variety, results clearly suggest that the use of digital platforms for e-sales is associated with an amplified assessment of the positive effects (45.2% opposed to all firms 30.5%). Contrary, only 22.8% of firms using digital platforms for human resources and/or communication report an increase in variety.

Regarding the effect on prices, over all business domains, 8.6% of the firms indicate the use of digital platforms leads to lower prices for their business partners. The share increases to 11.4% when firms are using digital platforms among others for e-sales, and to almost 13% if firms using digital platforms among others for production. On the other hand, using digital platforms in the business domain human resources and/or communication leads only in 5.2% of the answers to a decline in price. But there are also differences in price increases. While 19.5% of firms using digital platforms for procurement report a price increase, only 7.6% of firms using digital platforms in the business domain human resources and/or communication report a price increase.

Combining the effects on prices, quality and variety in the combined measure $O_{gain}$, again we find significant differences between the business domains, with higher shares of firms reporting positive effects if digital platforms are used in production (41.3%), e-sales (41.1%) and procurement (34%) compared to the whole sample (31.7%). When digital platforms are used in human resources and/or communication the share declines to 26.2%.

- Table 9 here

With respect to e-sales, the enterprise survey also provides information about the target group. Due to the design of the survey, there is no exclusive allocation as firms can sell to either businesses, consumers, the government, to all of them or to a combination. The results of the survey suggest that 78.7% of companies using digital platforms for e-sales target consumers (B2C), while 51.6% target businesses (B2B). The public sector (B2G) was given less importance 15.8%.

On the basis of this data, we examine whether there are differences in the impact of digital platform use for e-sales according to the target customer group, B2C, B2B and B2G. With respect to the impact on quality and variety, we find that the positive effects are significantly lower when the target group is B2C as compared to the e-sales in general. While 23.2% (Column 2 in Table 9) of the firms using digital platforms for e-sales refer to a higher quality, this is the case only for 20.9% when the firms are using digital platforms for B2C e-sales (Column 1 in Table 10). For B2B e-sales results suggest a share of 25.6% (Column 2 in Table 10). Higher variety as impact of digital platform use in e-sales is reported by 45.2% (Column 2 in Table IX), among them only 40.3% for B2C and 52.8% for B2B e-sales (Column 2 and 3 in Table 10). With regard to the impact on prices, we find that price increases are more often recorded as an outcome in B2C e-sales than in e-sales in general. Price declines as effects were reported to a similar extent (approximately 11% in e-sales, e-sales B2C and e-sales B2B). Due to the low number of observations in B2G e-sales, no significant differences were found.

Combining the effects on price, quality and variety in the measure $O_{gain}$ and $C_{gain}$ for B2B and B2C respectively, the results confirm that the effects are less likely to be seen as positive in B2C e-sales (33.9%, compared to e-sales in general 41.1% and compared to B2B 47.5%).

- Table 10 here

## 5. Conclusions

The study supports the value proposition of digital platforms with a quarter of the firms indicating to benefit from their use. This is determined by a combination of lower costs and higher revenues; latter are triggered by a higher number of customers. Positive network effects may

also contribute to this outcome. But digital platforms do not have an independent positive impact on firm performance [24] and effects are not the same over all kind of firms. A high degree of digital competence contributes positive to the effects on revenues. This is in line with the literature on digital transformation and the role of digital organizational culture or digital orientation for firm performance [5,13,30]. Moreover, the business domain, in particular digital platform use for e-sales, as well the firms size (measured by the revenues) are the main factors determining the likelihood of whether firms benefit from the use of digital platforms. Besides firms, also consumers are affected, as the use of digital platforms increases the quality and variety of goods and services offered. When digital platforms are used for e-sales and production, over 40% of the responses indicate this outcome.

The newly implemented Austrian enterprise survey does not only examine the effects of digital platform use and identifies its key determinants but also offers some practical insights for managers. The use of digital platforms is significantly associated with an increase in total revenues, in particular in the tourism sector and for firms using digital platforms for e-sales. But managers should also be aware that the use of digital platforms tends to increase a range of costs for firms. Results show that the probability is higher particularly for companies in the tourism sector than for those in industry and construction. Even though the study does not offer direct suggestions for managerial actions and policies makers, it provides them additional insights and perspectives when addressing their particular decision problems, e.g. with regard to pricing, platform design or compliance with regulation.

The willingness to engage with digital platforms hinges not only on firm- and market-specific characteristics, but also on the quality of the digital infrastructure and the regulatory framework governing their operation and use. Public policy can affect both through many channels. The empirical evidence presented in this paper on the impacts of their use supports the call for policy to promote a dynamic digital ecosystem. The call for a business environment that is conducive to private and/or public investments is rather universal and hardly contested, given the general purpose of many digital technologies and platform business models. In contrast, rapidly changing technologies and markets make regulating markets extremely demanding, particularly with regard to preserving intense rivalry and high levels of innovation. A dynamic approach to competition policy is needed that preserves firms' ability to earn a reasonable return on invested resources while preventing the accumulation of insurmountable barriers to entry for new competitors [47].

There are certain limitations in our research: First, although the results of an enterprise survey can indirectly reveal some information with regard to benefits for consumers, the survey data are not representative for consumer behavior. Second, most data are self-reported, which could lead to a common method bias. While the professional design of the survey by a specialized team was instrumental to mitigate related problems, the results must always be interpreted in terms of the subjective perception of the respondents. Third, focusing on Austria, as a small open economy, may limit the generalizability of the results to larger countries. However, this limitation is mitigated by the fact that Austria is well integrated into the much larger EU single market with common regulations for digital matters such as data protection, AI, abuse of dominant market positions, etc. Under these common framework conditions, Austria is also well comparable to the EU average in terms of progress in digital transformation and the matchmaking mechanism as one of the key value propositions of digital platforms is an internationally observed result as shown in the literature. Furthermore, the positive effect on product variety

was observed beyond Austria. Moreover, the business use of digital platforms is clearly relevant to business strategy and economic policy beyond national borders. In particularly, the focus on Austrian firms provides detailed data that are relevant for companies in other small open economies operating within the legal and institutional framework of the European Union. Fourth, the reliance on just one wave of survey data is a further limitation which prevents the use of more complex models that would allow for causal inferences. Therefore, there is scope for further research to capture the dynamic of platform adoption by running another wave of the survey. This would make it possible to map developments and trends in a longer perspective, that also includes possible changes induced during the COVID-19 pandemic which might have become permanent features of the business landscape.

## Disclosure statement

No potential conflict of interest was reported by the authors.

## Data availability statement

Data are not publicly available due to legal restrictions.

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## Appendix

- Table 11 here

## Tables

Table 1 Descriptive statistics

| Effects of the use of digital platforms on | Mean ordinal variable 1-5 | SD | Share in % 1-2 | 4-5 | N |
|---|---|---|---|---|---|
| Total revenues | 3.40 | 0.65 | 2.34 | 38.53 | 1011 |
| Total costs | 3.18 | 0.65 | 11.71 | 29.03 | 964 |
| Number of customers | 3.63 | 0.68 | 0.61 | 53.45 | 942 |
| Revenues per customer | 3.17 | 0.54 | 3.45 | 18.49 | 930 |
| Number of business partners | 3.36 | 0.62 | 1.77 | 34.32 | 912 |
| Selling prices for products, services | 3.05 | 0.54 | 8.56 | 12.24 | 903 |
| Quality of products/services offered | 3.19 | 0.56 | 3.50 | 20.26 | 903 |
| Variety of products/services offered | 3.35 | 0.64 | 1.89 | 30.47 | 901 |
| Personnel costs | 3.05 | 0.63 | 12.53 | 17.46 | 916 |
| Investment costs | 3.22 | 0.66 | 7.42 | 26.90 | 905 |
| Costs for intermediates/distribution | 3.11 | 0.71 | 13.84 | 23.98 | 884 |
| Administrative costs | 3.29 | 0.82 | 14.71 | 41.22 | 907 |
| Information search costs | 3.10 | 0.75 | 16.39 | 25.06 | 887 |
| Recruitment costs | 2.89 | 0.81 | 30.45 | 19.65 | 922 |

Note: The underlying question in the survey was: “How does the use of digital platforms affect the following domains of your organization?” with the response options: 1...much lower, 2...rather lower, 3...neutral, 4...rather higher, 5... much higher.

Table 2 Spearman rank correlation

| Correlation between the effects of the use of digital platforms on | total costs | total revenues | selling prices | quality |
|---|---|---|---|---|
| Total revenues | 0.213*** | | | |
| | N=958 | | | |
| Selling prices | 0.028 | 0.150*** | | |
| | N= 855 | N=895 | | |
| Quality | 0.051 | 0.191*** | 0.217*** | |
| | N=856 | N=893 | N=888 | |
| Variety | 0.093*** | 0.282*** | 0.102*** | 0.412*** |
| | N=855 | N=891 | N=884 | N=891 |

Note: Results refer to unweighted data.*** p < 0.01, ** p < 0.05, * p < 0.1."

Table 3 Categorization of firms and consumers using digital platforms

| Variable | Definition based on ordinal scaled answers | Share in % | N |
|---|---|---|---|
| $F_{gain}$ ... | revenues=*Likert* 4 or 5 and costs=*Likert* 1, 2 or 3 or costs=*Likert* 1 or 2 and revenues=*Likert* 3, 4 or 5. | 25.6 | 958 |
| $F_{wgain}$ ... | $F_{gain}$ extended by revenues=*Likert* 5 and costs=*Likert* 4 or revenues=*Likert* 2 and costs=*Likert* 1 | 27.4 | 958 |
| $F_{ngain}$ ... | firms that are not belonging to $F_{wgain}$. | 72.6 | 958 |
| $F_{price}$ ... | prices=*Likert* 4 or 5 and costs=*Likert* 1, 2 or 3 or costs=*Likert* 1 or 2 and prices=3, 4 or 5. | 15.9 | 855 |
| $F_{wprice}$ ... | $F_{gprice}$ extended by prices=*Likert* 5 and costs=*Likert* 4 or prices=*Likert* 2 and costs=*Likert* 1. | 16.6 | 855 |
| $F_{nprice}$ ... | firms that are not belonging to $F_{wprice}$. | 83.4 | 855 |
| $O_{gain}$ ... | quality or variety=*Likert* 4 or 5 and prices=*Likert* 1, 2 or 3 or prices=*Likert* 1 or 2 and quality or variety=*Likert* 3, 4 or 5. | 31.7 | 884 |
| $C_{gain}$ ... | quality or variety=*Likert* 4 or 5 and prices=*Likert* 1, 2 or 3 or prices=(1 or 2 and quality or variety=*Likert* 3, 4 or 5). | 33.9 | 189 |

Note: F... Firms, O... Others (Firms and Consumers), C... Consumers. 1...much lower, 2...rather lower, 3...neutral, 4...rather higher, 5... much higher.

Table 4 Explanatory variables

| Variable | Description | Share in % | N |
|---|---|---|---|
| — Sectors | | | |
| Industry | NACE sections C, D, E | 17.7 | 1380 |
| Construction | NACE section F | 17.4 | 1380 |
| Tourism | NACE section I | 11.4 | 1380 |
| Services | NACE sections G, H, J, K, L, MN, S | 53.4 | 1380 |
| — Business domain[a] | | | |
| E-sales | E-sales | 21.7 | 1360 |
| Procurement | Procurement | 21.9 | 1336 |
| Production | Production | 15.2 | 1320 |
| HR/Communication | Human resources and/or communication | 46.7 | 1308 |
| — Other firm characteristics | | | |
| Revenues low | Revenues < 10 million euro (year 2020) | 77.6 | 1371 |
| Export | Export of goods and services | 35.6 | 1103 |
| Employment increase | Increasing employment (year 2019) | 35.1 | 1380 |
| Investment low | Gross fixed capital formation< 5 % of revenues | 37.3 | 599 |
| R&D expenditures high | R&D expenditures > 10 % of revenues | 21.2 | 536 |
| Personal intensive | Personnel expenses > purchases of goods/services and personnel expenses > GFCF (in percent of revenues) | 46.8 | 653 |
| Highly digitalized | Higher level of digitalization compared to competitors | 24.8 | 1359 |
| Competition low | ≤ 5 competitors in main sales market (year 2020) | 31.4 | 1142 |
| — Digital platform use | | | |
| Domains with DP use | Use of digital platforms in ≥ 2 business domains | 68.3 | 1349 |
| Low intensity of DP use | Proportionate use < 10% in the relevant activity | 41.2 | 1097 |
| — Motives | | | |
| Enable new business models | Introducing/enabling new business models | 24.8 | 1230 |
| Use of growth opportunities | Use of growth opportunities | 55.7 | 1230 |
| Visibility for target groups | Greater visibility/better reachability of target groups | 75.5 | 1230 |
| Saving costs, time | Time saving/costs saving (increased efficiency) | 69.3 | 1230 |

[a]Among others e-sales, procurement, production; Only HR and/or communication.

Table 5 Ordered logit, $I_n$ on total revenues

| | (1) | | (2) | |
|---|---|---|---|---|
| | Odds Ratio | S.E. | Odds Ratio | S.E. |
| — Sectors (ref. Tourism) | | | | |
| Service | 0.602 | 0.354 | 0.519* | 0.194 |
| Industry | 0.309* | 0.216 | 0.431* | 0.196 |
| Construction | 0.172** | 0.125 | 0.469* | 0.208 |
| — Business domain[a] | | | | |
| E-sales | 4.279*** | 1.959 | 3.931*** | 1.218 |
| Procurement | 0.816 | 0.380 | 1.346 | 0.393 |
| Production | 1.001 | 0.430 | 1.243 | 0.348 |
| HR/Communication | 1.129 | 0.612 | 1.145 | 0.384 |
| — Other firm characteristics | | | | |
| Revenues low | 1.422 | 0.525 | 1.111 | 0.216 |
| Export | 0.986 | 0.381 | 1.146 | 0.234 |
| Employment increase | 1.204 | 0.430 | 1.614** | 0.320 |
| Investment expenditures low | 1.823* | 0.628 | | |
| R&D expenditures high | 1.462 | 0.580 | | |
| Personal intensive | 0.556 | 0.211 | | |
| Highly digitalized | 1.005 | 0.355 | 1.670** | 0.374 |
| — Digital platform use | | | | |
| Domains with DP use | 3.497 | 4.552 | 1.505 | 0.679 |
| Low intensity of DP use | 0.379** | 0.170 | 0.503*** | 0.119 |
| — Motives | | | | |
| Enable new business models | 1.679 | 0.557 | 1.300 | 0.279 |
| Use of growth opportunities | 2.630** | 1.048 | 1.543* | 0.362 |
| Visibility for target groups | 2.209 | 1.247 | 2.404*** | 0.708 |
| — N | 331 | | 772 | |
| — Overall p-value (F-test) | 0.000 | | 0.000 | |

[a]Among others e-sales, procurement, production; Only HR and/or communication.
Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 6 Ordered logit, $I_n$ on total costs

| | (1) | | (2) | |
|---|---|---|---|---|
| | Odds Ratio | S.E. | Odds Ratio | S.E. |
| — Sectors (ref. Tourism) | | | | |
| Service | 0.440 | 0.294 | 0.834 | 0.304 |
| Industry | 0.223* | 0.191 | 0.722 | 0.335 |
| Construction | 0.175** | 0.149 | 0.674 | 0.301 |
| — Business domain[a] | | | | |
| E-sales | 0.827 | 0.356 | 1.248 | 0.407 |
| Procurement | 1.101 | 0.440 | 1.076 | 0.330 |
| Production | 1.163 | 0.543 | 1.169 | 0.427 |
| HR/Communication | 0.872 | 0.479 | 1.133 | 0.429 |
| — Other firm characteristics | | | | |
| Revenues low | 0.621 | 0.182 | 0.967 | 0.187 |
| Export | 0.528** | 0.153 | 0.783 | 0.138 |
| Employment increase | 0.944 | 0.280 | 0.949 | 0.176 |
| Investment expenditures low | 0.965 | 0.287 | | |
| R&D expenditures high | 0.815 | 0.309 | | |
| Personal intensive | 0.568* | 0.180 | | |
| Highly digitalized | 0.790 | 0.256 | 1.230 | 0.277 |
| — Digital platform use | | | | |
| Domains with DP use | 2.764** | 1.227 | 2.018** | 0.617 |
| Low intensity of DP use | 0.682 | 0.224 | 0.918 | 0.187 |
| — Motives | | | | |
| Saving costs, time | 0.551 | 0.222 | 0.711* | 0.140 |
| — N | 312 | | 731 | |
| — Overall p-value (F-test) | 0.101 | | 0.274 | |

[a]Among others e-sales, procurement, production; Only HR and/or communication.
Note: *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 7 Logit on beneficiaries $F_{wgain_n}$

| | (1) | | (2) | |
|---|---|---|---|---|
| | Odds Ratio | S.E. | Odds Ratio | S.E. |
| — Sectors (ref. Tourism) | | | | |
| Service | 1.084 | 0.781 | 0.731 | 0.274 |
| Industry | 1.379 | 1.168 | 0.892 | 0.446 |
| Construction | 0.695 | 0.630 | 0.781 | 0.419 |
| — Business domain[a] | | | | |
| E-sales | 2.600* | 1.318 | 1.872* | 0.619 |
| Procurement | 0.994 | 0.457 | 1.135 | 0.335 |
| Production | 0.645 | 0.299 | 0.711 | 0.230 |
| HR/Communication | 0.679 | 0.425 | 0.599 | 0.226 |
| — Other firm characteristics | | | | |
| Revenues low | 2.441** | 0.916 | 1.235 | 0.278 |
| Export | 1.244 | 0.454 | 1.177 | 0.266 |
| Employment increase | 1.455 | 0.487 | 1.515* | 0.329 |
| Investment expenditures low | 1.386 | 0.483 | | |
| R&D expenditures high | 1.170 | 0.443 | | |
| Personal intensive | 0.850 | 0.306 | | |
| Highly digitalized | 0.819 | 0.272 | 1.097 | 0.255 |
| — Digital platform use | | | | |
| Domains with DP use | 0.575 | 0.426 | 0.626 | 0.317 |
| Low intensity of DP use | 0.724 | 0.297 | 0.553** | 0.139 |
| — Motives | | | | |
| Enable new business models | 1.037 | 0.371 | 1.117 | 0.271 |
| Use of growth opportunities | 1.514 | 0.655 | 1.184 | 0.308 |
| Visibility for target groups | 3.481** | 2.178 | 1.795* | 0.624 |
| Saving costs, time | 1.496 | 0.784 | 2.120** | 0.673 |
| — N | 311 | | 728 | |
| — Overall p-value (F-test) | 0.242 | | 0.000 | |

[a]Among others e-sales, procurement, production; Only HR and/or communication. Note: *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 8 Components of total effects

| | (1) | | (2) | | (3) | |
|---|---|---|---|---|---|---|
| Variables | Odds Ratio | S.E. | Odds Ratio | S.E. | Odds Ratio | S.E. |
| Number of customers | 6.815*** | 1.655 | | | 4.673*** | 1.339 |
| Revenue per customer | 3.273*** | 0.883 | | | 0.917 | 0.284 |
| Number of business partners | 2.066** | 0.452 | | | 2.644*** | 0.661 |
| Selling prices | 2.734** | 0.813 | | | 2.663*** | 0.937 |
| Quality of products/services | 0.779 | 0.210 | | | 0.833 | 0.253 |
| Variety of products/services | 1.764** | 0.391 | | | 1.685* | 0.465 |
| Personnel costs | | | 1.332 | 0.432 | 1.035 | 0.390 |
| Investment costs | | | 2.401*** | 0.634 | 0.535* | 0.174 |
| Costs for intermediates/distribution | | | 1.508 | 0.429 | 0.885 | 0.306 |
| Administrative costs | | | 1.770** | 0.414 | 0.660 | 0.183 |
| Information search costs | | | 1.127 | 0.304 | 0.784 | 0.259 |
| Recruitment costs | | | 1.450 | 0.407 | 0.819 | 0.289 |
| — N | 853 | | 794 | | 767 | |
| — Overall p-value (F-test) | 0.000 | | 0.000 | | 0.000 | |

Note: (1) Ordered logit regression, dependent variable: $I_n$ total revenues. (2) Ordered logit regression, dependent variable $I_n$ total costs. (3) Logit regression, dependent variable $F_{wgain_n}$. *** p < 0.01, ** p < 0.05, *p < 0.1.

Table 9 Impact of digital platform use on firms and consumers

| | | Share in % | | | |
|---|---|---|---|---|---|
| | All DP | E-sales including | Procurement including | Production including | HR/Comm. only |
| Higher prices | 12.25 | 17.49*** | 19.46** | 16.32* | 7.61*** |
| Lower prices | 8.56 | 11.44 | 9.75 | 12.91** | 5.20*** |
| — N | 903 | 258 | 251 | 194 | 388 |
| Higher quality | 20.26 | 23.22** | 23.40* | 35.01*** | 16.97*** |
| Lower quality | 3.50 | 2.71 | 4.24 | 5.70** | 2.91 |
| — N | 903 | 259 | 252 | 194 | 386 |
| Higher variety | 30.47 | 45.15*** | 36.58** | 42.02*** | 22.85*** |
| Lower variety | 1.89 | 0.23 | 1.41 | 3.25 | 1.33 |
| — N | 901 | 255 | 252 | 193 | 388 |
| Beneficiaries $O_{gain}$ | 31.70 | 41.07*** | 33.96* | 41.27*** | 26.18*** |
| — N | 884 | 253 | 246 | 190 | 378 |

Note: Higher refers to much and rather higher; lower refers to much and rather lower. *** p < 0.01, ** p < 0.05, * p < 0.1 Wilcoxon test for difference from all digital platforms' use (unweighted data).

Table 10 Impact of digital platform use (e-sales) on firms and consumers

| | Share in % | | |
|---|---|---|---|
| | E-sales B2C including | E-sales B2B including | E-sales B2G including |
| Higher prices | 20.38** | 18.33 | 14.06 |
| Lower prices | 10.74 | 11.05 | 14.06 |
| — N | 191 | 148 | 46 |
| Higher quality | 20.85*** | 25.63 | 23.56 |
| Lower quality | 2.98 | 1.26 | 0.70 |
| — N | 191 | 148 | 45 |
| Higher variety | 40.31** | 52.76* | 42.11 |
| Lower variety | 0.30 | 0.47 | 0.95 |
| — N | 190 | 147 | 44 |
| Beneficiaries $O_{gain}/C_{gain}$ | 33.86*** | 47.52** | 39.73 |
| — N | 189 | 145 | 44 |

Note: Higher refers to much and rather higher; lower refers to much and rather lower.
*** p < 0.01, ** p < 0.05, * p < 0.1 Wilcoxon test for difference from all digital platforms' use (unweighted data).

Table 11 Logit on beneficiaries $F_{wprice_n}$

| | (1) | | (2) | |
|---|---|---|---|---|
| | Odds Ratio | S.E. | Odds Ratio | S.E. |
| — Sectors (ref. Tourism) | | | | |
| Service | 1.321 | 1.274 | 0.599 | 0.280 |
| Industry | 3.870 | 4.121 | 1.573 | 0.924 |
| Construction | 4.003 | 4.821 | 1.226 | 0.780 |
| — Business domain[a] | | | | |
| E-sales | 1.599 | 0.978 | 1.608 | 0.650 |
| Procurement | 1.172 | 0.703 | 1.072 | 0.354 |
| Production | 0.586 | 0.328 | 0.659 | 0.253 |
| HR/Communication | 0.837 | 0.676 | 0.484 | 0.231 |
| — Other firm characteristics | | | | |
| Revenues low | 2.974** | 1.395 | 2.164** | 0.685 |
| Export | 1.505 | 0.637 | 1.641* | 0.471 |
| Employment increase | 1.035 | 0.418 | 1.388 | 0.389 |
| Investment expenditures low | 0.964 | 0.392 | | |
| R&D expenditures high | 1.431 | 0.683 | | |
| Personal intensive | 1.573 | 0.680 | | |
| Highly digitalized | 1.221 | 0.470 | 0.987 | 0.294 |
| Competition low | 1.277 | 0.531 | 1.104 | 0.337 |
| — Digital platform use | | | | |
| Domains with DP use | 0.294 | 0.229 | 0.197** | 0.125 |
| Low intensity of DP use | 1.647 | 0.726 | 1.007 | 0.300 |
| — Motives | | | | |
| Enable new business models | 1.150 | 0.518 | 1.049 | 0.333 |
| Use of growth opportunities | 1.674 | 0.922 | 1.449 | 0.494 |
| Visibility for target groups | 1.921 | 1.223 | 1.486 | 0.641 |
| Saving costs, time | 1.845 | 1.134 | 5.038*** | 2.675 |
| — N | 294 | | 650 | |
| — Overall p-value (F-test) | 0.607 | | 0.002 | |

[a] Note: Among others e-sales, procurement, production; Only HR and/or communication. Note: *** p < 0.01, ** p < 0.05, * p < 0.1.