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Unintended consequences of business digitalization among MSMEs during the COVID-19 pandemic: The case of Indonesia

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UNINTENDED CONSEQUENCES OF BUSINESS DIGITALIZATION AMONG MSMEs DURING THE COVID-19 PANDEMIC

THE CASE OF INDONESIA

Keita Oikawa, Fusanori Iwasaki, Yasuyuki Sawada, and Shigehiro Shinozaki

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ABSTRACT

The coronavirus disease (COVID-19) pandemic disrupted businesses, economies, and societies worldwide. This study employs unique data from Indonesia to investigate whether and how digitalization of micro, small, and medium-sized enterprises (MSMEs) helped them weather the adverse shocks from the pandemic and resulting lockdowns. The main empirical result is that, in the pandemic's early phases, digitalized MSMEs disproportionately encountered negative effects on their business outcomes. The seemingly harmful elements of digitalization disappeared during later stages. Moreover, COVID-19 restrictions initially had a "positive" impact on the business environment. This is counterintuitive. But when considering the panic buying at the onset of restrictions and large share held by the essential sector in our dataset, particularly the wholesale and retail sectors, the positive impact from the restrictions is not unreasonable. These findings suggest that the digital transformation had not yet been stably established among MSMEs by the start of the pandemic. Our findings provide critical implications for industrial and competition policies related to MSMEs during the COVID-19 recovery process.

Keywords: digitalization, digital financial services, access to finance, SME development, SME policy, Indonesia

JEL Codes: D22, G20, L20, L50

1. Introduction

The coronavirus disease (COVID-19) pandemic disrupted businesses, economies, and whole societies worldwide. Prolonged restrictions enhanced the risk of business downturns, failures, and bankruptcies, particularly for micro, small, and medium-sized enterprises (MSMEs). In developing Asia, MSMEs have been playing a major role in generating income, employment, and in promoting inclusive growth nationally. Business digitalization—computer and internet use for business and/or online product sales, other transactions or e-commerce—is considered key to accelerate MSME contributions to national economies (Asian Development Bank [ADB] 2020a). National mobility restrictions encouraged MSMEs to go digital, but only those dealing with essential products like food and healthcare products were likely to succeed (ADB 2021a). Supply chain disruptions limited business for internationalized MSMEs and likely contributed to their major losses in sales and revenue (ADB 2020b).

With this as background, a proper evaluation of the direct and indirect effects of the pandemic and related restrictions on MSMEs is needed to identify timely and effective policy interventions that could keep them a mainstay in Asian development. As mobility restrictions induced many MSMEs to switch from retail to online operations, digitalization would appear to be indispensable for them to survive during the pandemic.

Well before the pandemic, digitalization led to the rise of online platforms for goods like Amazon and Alibaba, and services like Airbnb, Grab, and Gojek. Yet, the importance of digital platforms became more evident when the pandemic struck. Use of digital platforms intensified for online shopping, Zoom meetings, digital payments, EdTech, and telehealth. This allowed society to maintain essential economic interactions without risking infection. According to ADB (2021b), if digital sectors expand 20% from the 2020 baseline by 2025, global output would rise by \$4.3 trillion annually, with Asia's output rising by \$1.7 trillion yearly.

However, digital platforms are also disruptive. They tend to ease out traditional businesses and employment, creating new business opportunities at reduced costs (Acemoglu and Restrepo, 2019). While emerging technologies such as robotics, three-dimensional printing, artificial intelligence, and the internet of things will help drive future prosperity, they have been leading to completely automated production in manufacturing, for example, in the apparel and footwear industries (ADB 2018). Similarly, it is becoming technically feasible to automate more complex service tasks such as customer support through business processing and outsourcing (BPO). Indeed, the extent to which digitalization helped MSMEs withstand the negative shocks of the pandemic and lockdowns was largely unknown—particularly in developing countries due to the lack of suitable microdata (Miguel and Mobarak 2022). Exceptions include (i) Elhan-Kayalar, et al. (2022), which use administrative records and merchant survey data (collected digitally) to investigate MSME business strategies and performance in Indonesia during the pandemic; (ii) Shinozaki (2021), which evaluates whether and how platforms provide potential benefits using unique microdata from selected Asian countries; (iii) Zhou, et al. (2024), which uses detailed administrative data from Alibaba Group's online on-demand food delivery platform (in the People's Republic of China) to find that the digital platform contributed to the food security, wellbeing, employment, and business sustainability of MSMEs both during and after the pandemic; and (iv) Todo et al. (2022), which uses a unique firm-level dataset from Asia to examine the potential determinants of the robustness and resilience of supply chain links against economic shocks due to the spread of COVID-19.

This study aims to bridging the remained evidence gap in the literature by adopting granular microdata collected by ADB through business surveys in Indonesia in 2020 and 2021 (ADB 2020b,

2021a).¹ The canonical difference-in-differences method is used to identify the arguably causal impacts of COVID-19 and the effectiveness of digitalization in mitigating the harmful effects of the pandemic. By doing so, critical implications can be derived for industrial and competition policies related to MSMEs during the ongoing COVID-19 recovery process.

One major unexpected empirical result emerged from the analysis. In the early phase of the pandemic, digitalized MSMEs disproportionately encountered losses in sales and employment. Yet, these seemingly negative aspects of digitalization disappeared in the later phase. These findings suggest that the digital transformation had not been stably established among MSMEs at the start, reaffirming the findings of Shinozaki (2021). While compressed demand and supply disruptions continuously affected MSME revenue and financial conditions throughout the first year of the pandemic, the effects of digitalization on MSME performance were mixed, possibly depending on their readiness. In other words, digitalization is not necessarily a sufficient condition for MSMEs to avoid the unforeseen negative contingencies arising from the pandemic.

The empirical findings reaffirm the importance of policy support on multiple fronts in unleashing the potential gains from the digital economy (ADB 2021b). While digitalization potentially offers a variety of opportunities for MSMEs to weather adverse shocks and move up the global supply chain network, digital capacity would have to be an indispensable component of digital dividends, given the lack of understanding on digitalization benefits (MSMEs tend to maintain the status quo in business; Shinozaki 2022). Governments play a critical role in building MSME digital capabilities—by investing in digital skills training and literacy, as well as supporting affordable access to mobile, broadband, and other information and communication technologies (ICT) and services. This can provide a stable system for safe and secure digital financial settlements and supply the resilient physical infrastructure needed for traditional goods trade and logistics. In addition to these broad industrial policies, competition policies must ensure that MSME owners can look beyond stability to become more growth-oriented. Governments should reduce entry barriers for digital platforms and promote fair market competition. These platforms are “double-edged” as they create unprecedented opportunities for MSMEs, but also create a few “winners” due to strong network effects and substantial scale economies.

The rest of this paper is organized as follows. Section 2 describes the broad situation and landscape of MSMEs in Indonesia. Section 3 explains the empirical method used, followed in section 4 by a description of the dataset. Section 5 details the estimation results. Section 6 provides concluding remarks along with policy implications.

2. MSME Landscape in Indonesia

MSMEs play a huge part in Indonesia’s economic growth.² As of the end of 2019, they accounted for 99.9% of total enterprises, employed 96.9% of the country’s workforce, and contributed to 60.5% of gross domestic product (ADB 2022b). In Indonesia, most MSMEs are dominated by wholesale and retail trade, focused on domestic markets.³ During the COVID-19 pandemic, there was a group that reported a better business environment than before the outbreak—typically those in essential goods or services and health care for households although these were a small fraction of 8.4%. Just a fraction trade internationally or participate in global supply chains. In 2019,

¹ The same surveys were conducted in the Lao People’s Democratic Republic (Lao PDR), the Philippines, and Thailand.

² According to Law No.20/2008 on Micro, Small, and Medium-sized Enterprises, an MSME in Indonesia is defined as a productive entity owned by an individual or individual business unit with maximum net assets, excluding land and buildings, of Rp10 billion, or with maximum annual sales of Rp50 billion.

³ MSMEs engaged in wholesale and retail trade accounted for 63.5% of non-agricultural sectors in 2016 (ADB 2022b).

MSMEs contributed 15.7% of total export value. They typically export food, beverages, textiles, shoes, handicrafts, and furniture (ADB 2020a). Informal MSMEs are estimated to account for 18.9% of Indonesia's gross domestic product (Shinozaki 2022).

Since 2010, internet and mobile phone penetration has progressed rapidly in Indonesia. Internet use jumped from 11% of the population in 2010 to 62% in 2021 (World Development Indicators). Mobile cellular subscriptions increased from 87 per 100 people in 2010 to 134 in 2021. Improved digital access helped drive the growth of domestic e-commerce. A good example is Gojek—a mobile-based ride-hailing services company—that provides additional digital services like bill payments, e-ticketing, and e-commerce platforms by merging with the country's large online shop Tokopedia.

During the pandemic, given the limited personal contact for businesses, digitalization became critical for private companies (including MSMEs) to survive. It became more pronounced post-pandemic as the “new normal” encouraged firms to go digital. The Organisation for Economic Co-operation and Development (OECD 2021) highlights several benefits of digitizing, such as better access to needed business information, strengthened business networks, new market opportunities, reduced operating costs, diversified funding opportunities (such as access to digital financial services), and more business innovation. Global surveys found that up to 70% of small firms increased their use of digital technology due to the pandemic.

Shinozaki's (2022) empirical study on informal MSMEs in Indonesia that, while the COVID-19 crisis and mobility restrictions led many MSMEs to accelerate digitalization, those already operating digitally were not always successful during the pandemic. They fell into two clusters—contracting firms that suffered from the pandemic and those that benefited.⁴ An ADB report (ADB 2021a) suggested that comprehensive government assistance could promote digitalization and use of technology in businesses. This could include guidance on developing e-commerce, online administrative and cost management, and funding through digital financial services (such as mobile credit, digital insurance, peer-to-peer lending, and equity crowdfunding). It also stressed that strengthening competitiveness is critical for creating new demand for MSMEs to grow post-pandemic, through business development and advisory services, along with training for upgrading worker skills. These will help widen the base of quality jobs for domestic and internationalized MSMEs so they can better capture new demand.

3. Empirical Method

The study aims to empirically investigate whether business digitalization positively affects business performance under COVID restrictions. To do this, the canonical difference-in-differences (DID) method was used. The DID method is a popular causal inference method using outcome changes of two comparable groups—one, the treatment group, is exposed to the external intervention that a researcher is interested in; the other, the control group, is not. The DID method assumes that both the treatment and control groups share a common trend of interested outcomes (how an intervention affects something of interest). That way, the treatment group's potential counterfactual outcome after the intervention can be obtained assuming the intervention does not exist. The difference between the observed actual changes in the outcome of the treated group and the observed change of the control group is interpreted as the average treatment effect on the treated (ATET). In this study, business performance, such as sales growth, is the target outcome, and COVID restrictions on firms are the treatment of interest—under which

⁴ In this study, micro and small enterprises that declared their company type as “sole proprietorship” or “others (family-run business)” were extracted from the survey data as informal firms for analysis.

digitalization would generate heterogenous impacts. In this way, the effectiveness of business digitalization among MSMEs during the COVID-19 pandemic can be quantified.

To calculate the ATET, two comparable groups are needed—one is treated, the other is not. The DID method uses the differences in timings of interested intervention in the two groups. One group is exposed to the interested intervention earlier than the other group—then, the period when only one is exposed but the other not can be determined. The method set the first group as the treated group and the second as the control group. The study uses the difference in the timings when COVID restrictions were in effect across Indonesia's provinces. This section explains a specific empirical model to estimate ATET and the pairs of province groups used in the study.

Empirical Model

As explained below, there are two types of datasets—one surveyed in April 2020, right after COVID restrictions were imposed in Jakarta and some urban provinces; the other surveyed in April and May 2021, when some provinces, including Jakarta, already had COVID restrictions in place, while others had just started or restarted restrictions. First is the empirical model for the April 2020 dataset. This dataset includes two types of provinces: one with COVID restrictions and the other without. Those with is the treatment group; those without is the control group. We postulate the following DID model for firm i 's performance at time t , y_{it} :

$$y_{it} = \beta_0 + \beta_1 D_i + \beta_2 W_i + \beta_3 T_t + \beta_4 D_i W_i + \beta_5 D_i T_t + \beta_6 W_i T_t + \beta_7 D_i W_i T_t + \varepsilon_{it}, \quad (1)$$

where W_i is the treatment indicator variable that takes one if firm i is part of the treatment group under the COVID restrictions and zero otherwise. T_t is a dummy variable that takes one if time t is after the COVID restrictions are in effect and zero otherwise. To capture the potential role digitalization plays in weathering the adverse impacts of the pandemic, D_i is a dummy variable that takes one if the firm i uses the internet for sales and marketing and zero otherwise. ε_{it} is the error term. Taking a first difference of Equation (1) between the firm i 's performance before and after the COVID restrictions, we have:

$$\Delta y_{it} = \beta_3 + \beta_5 D_i + \beta_6 W_i + \beta_7 D_i W_i + \Delta \varepsilon_{it}, \quad (2)$$

where Δ is a first-difference operator. Equation (2) indicates that the estimated value of β_7 is the shock mitigation effect of using the internet for business on a firm's performance under the COVID restrictions (see Appendix). As for the other coefficients, β_3 represents the common time effect of post COVID restrictions on business performance for both treatment and control groups, β_5 is the effect of using the internet for business on the common time fixed effect of post COVID restrictions business performance for both treatment and control groups, and β_6 is the effect COVID restrictions have on the business performance of the treatment group.

When estimating Equation (2), it is crucial to address the endogeneity of D_i , because the use of the internet for sales and marketing may be positively correlated with missing variables influencing business performance in Equation (2), such as human capital and management practices (e.g., Bloom et al. 2012). To respond to the D_i endogeneity issue, inverse probability weighting (IPW) is used. In this context, IPW is a statistical method to average heterogeneity between the two groups being compared—firms using the internet and those that do not—by employing the inverse of the propensity score of a firm being selected as a firm using the internet for regression weight to estimate the unbiased effect of using the internet on business performance. To estimate the propensity score, we employ the logit model with regressors representing a firm's basic profile

and situation—including province, industry, size (the number of employees), female share of employees, firm age, net asset value, current operational status, current funding conditions, and primary business concerns.

Additionally, the DID method relies on the parallel trend assumption, where the treatment group shares the same trend in dependent variables before the intervention. Our April 2020 dataset records the changes in performance variables (sales, income, wage, and employment) from February to March 2020, a period before the PSBB intervention began. Using this information, we conducted a placebo test by regressing Equation (2) with these variables. The results indicate that there are almost no significant coefficients of regressors, suggesting no potential violation of the parallel trend assumption underlying the DID method.⁵

Next, we present the empirical model for the April and May 2021 datasets. These carry two limitations in terms of estimating the interested effects using the DID method. The first is that there are only two treatment groups, but a control group is not available. More specifically, these datasets comprise two distinct types—one imposed "before" March 2021 with the other imposed "during" March 2021. In other words, there are treatment groups exclusively concerning COVID restrictions, exhibiting heterogeneity in the timing of the restrictions. The former is referred to as the first treatment group; and the latter is the second treatment group. The second limitation is that the datasets do not allow use of the *absolute levels* of business performance. This is because the survey only inquired about *changes* compared with the previous month (e.g., sales growth from the previous month) and the pre-COVID period for the overall business environment (whether it is better, no change, or worse since the COVID-19 outbreak). Under the two limitations, we consider how to approach estimating the interested effects.

Equation (1) is modified by incorporating two treatment groups with two different timings of COVID restrictions. Three periods are considered: Time zero ($t = 0$), which is the period before COVID restrictions for both groups; Time one ($t = 1$), which is the time after COVID restrictions for the first treatment group but before COVID restrictions for the second treatment group; and Time two ($t = 2$), which is the period after COVID restrictions for both groups. We assume the following DID model for firm i 's performance at time t , y_{it} :

$$y_{it} = \beta_0 + \beta_1 D_i + \beta_2 W_{1i} + \beta_3 W_{2i} + \beta_4 T_{1t} + \beta_5 T_{2t} + \beta_6 D_i W_{1i} + \beta_7 D_i W_{2i} + \beta_8 D_i T_{1t} + \beta_9 D_i T_{2t} + \beta_{10} W_{1i} T_{1t} + \beta_{11} W_{1i} T_{2t} + \beta_{12} W_{2i} T_{2t} + \beta_{13} D_i W_{1i} T_{1t} + \beta_{14} D_i W_{1i} T_{2t} + \beta_{15} D_i W_{2i} T_{2t} + \varepsilon_{it}, \quad (3)$$

where T_{1t} is a dummy variable that takes one if time t is one and zero otherwise. T_{2t} is a dummy variable that takes one if time t is two and zero otherwise. W_{1i} is the first treatment group indicator variable that takes one if the firm i is part of the first treatment group and zero otherwise. W_{2i} is the second treatment group indicator variable that takes one if the firm i is part of the second treatment group and zero otherwise.

As explained below, there are only two types of changes in business performance for the April and May datasets as reference point: one is from time one to time two with the other from time zero to time two. Based on Equation (3), the former is written as

⁵ The results are available on a request basis.

$$\begin{aligned}\Delta y_{i2} \equiv (y_{i2} - y_{i1}) = & \beta_5 - \beta_4 + (\beta_9 - \beta_8)D_i \\ & + (\beta_{11} - \beta_{10})W_{1i} + (\beta_{14} - \beta_{13})W_{1i}D_i \\ & + \beta_{12}W_{2i} + \beta_{15}D_iW_{2i} + \Delta\varepsilon_{i2}.\end{aligned}\quad (4)$$

In the same way, the latter is written as

$$\Delta_2 y_{i2} \equiv (y_{i2} - y_{i0}) = \beta_5 + \beta_9 D_i + \beta_{11} W_{1i} + \beta_{14} W_{1i} D_i + \beta_{12} W_{2i} + \beta_{15} D_i W_{2i} + \Delta_2 \varepsilon_{it}. \quad (5)$$

Recall that the primary interest is to estimate the effect of using the internet for business on the effect of COVID restrictions on the treatment group's business performance. Due to the dataset limitations, we cannot directly estimate interested effects such as β_{14} , and β_{15} . However, we can approach those effects by estimating Equations (4) and (5) separately for the case of only using the first treatment group samples ($W_{1i} = 1, W_{2i} = 0$), only using the second treatment group samples ($W_{1i} = 0, W_{2i} = 1$), and using both treatment group samples with the restriction of $W_{1i} = 1 - W_{2i}$.

Focusing Equation (4) for the first treatment group, we have

$$\Delta y_{i2} = \beta_5 - \beta_4 + (\beta_{11} - \beta_{10}) + \{(\beta_9 - \beta_8) + (\beta_{14} - \beta_{13})\}D_i + \Delta\varepsilon_{i2}, \quad (6)$$

for the second treatment group, we have

$$\Delta y_{i2} = \beta_5 - \beta_4 + \beta_{12} + \{(\beta_9 - \beta_8) + \beta_{15}\}D_i + \Delta\varepsilon_{i2}, \quad (7)$$

and plugging $W_{1i} = 1 - W_{2i}$ into Equation (4), we have

$$\begin{aligned}\Delta y_{i2} = & (\beta_5 - \beta_4) + (\beta_{11} - \beta_{10}) + \{(\beta_9 - \beta_8) + (\beta_{14} - \beta_{13})\}D_i \\ & + \{\beta_{12} - (\beta_{11} - \beta_{10})\}W_{2i} + \{\beta_{15} - (\beta_{14} - \beta_{13})\}D_iW_{2i} + \Delta\varepsilon_{i2}.\end{aligned}\quad (8)$$

The estimated coefficients of D_i in Equation (6), denoted as b_1 , and in Equation (7), denoted as b_2 , and the estimated coefficient of D_iW_{2i} in Equation (8), denoted as b_3 , provide the linear combinations of the value of β_{15} , the second treatment group-specific effect of using the internet for business on the effect of COVID restrictions on business performance at time two; the value of $(\beta_{14} - \beta_{13})$, the difference in the first treatment group-specific effect of using the internet for business on the effect of COVID restrictions on business performance between time two and time one; and the value of $(\beta_9 - \beta_8)$, the difference in the group-common effect of using the internet on business performance between time two and time one.

Next, focusing on Equation (5) for the first treatment group, we have

$$\Delta_2 y_{i2} = \beta_5 + \beta_{11} + (\beta_9 + \beta_{14})D_i + \Delta_2 \varepsilon_{i2}, \quad (9)$$

For the second treatment group, we have

$$\Delta_2 y_{i2} = \beta_5 + \beta_{12} + (\beta_9 + \beta_{15})D_i + \Delta_2 \varepsilon_{i2}. \quad (10)$$

and plugging $W_{1i} = 1 - W_{2i}$ into Equations (5), we have

$$\Delta_2 y_{i2} = \beta_5 + \beta_{11} + (\beta_9 + \beta_{14})D_i + (\beta_{12} - \beta_{11})W_{2i} + (\beta_{15} - \beta_{14})D_iW_{2i} + \Delta_2 \varepsilon_{i2}. \quad (11)$$

As in Equations (6)-(8), the estimated coefficients of D_i in Equation (9), denoted as b'_1 , and in Equation (10), denoted as b'_2 , and the estimated coefficient of $D_i W_{2i}$ in Equation (11), denoted as b'_3 , provide the linear combinations of the value of β_{15} , the second treatment group-specific effect of using the internet for business on the effect of COVID restrictions on business performance at time two; the value of β_{14} , the first treatment group-specific effect of using the internet for business on the effect of COVID restrictions on business performance at time two; and the value of β_9 , the group-common effect of using the internet on business performance at time two.

We interpret the coefficient $b_1(b'_1)$ as the long-term impact of internet use for business under COVID restrictions, $b_2(b'_2)$ as the short-term impact of internet use under COVID restrictions, and $b_3(b'_3)$ as the very short-term impact of internet use under COVID restrictions. Let us consider Equations (9)-(10) for simplification. As the linear combination of $\beta_9 + \beta_{14}$ represents the sum of the 1-year-after group common impact since the COVID outbreak and the 3 (or 4) months after impact since the PPKM initiation for the first treatment group, we can say that it indicates more of a long-term impact of internet use under COVID restrictions. Next, β_{15} is the right-after impact of using the internet under PPKM for the second treatment group; thus, the linear combination of $\beta_9 + \beta_{15}$ is more of a short-term impact of internet use under COVID restrictions. Lastly, the linear combination of $\beta_{15} - \beta_{14}$ more clearly shows the right-after impact since the PPKM initiations because it is the difference between the right-after impact and the 3-months-after impact of internet use under COVID, not including the group-common 1-year after impact since the COVID outbreak.

Similar to estimating Equation (2) for the large-scale social restrictions (Pembatasan Sosial Berskala Besar, PSBB) case, IPW is used to estimate Equations (6)-(11) to address the endogeneity D_i issue. The regressors for estimating propensity scores for being a part of samples using the internet are almost the same as the PSBB case: Additional dummy variables are included that indicate whether respondents received the government assistance available for businesses under COVID-19 or not, in addition to the existing regressors. Government assistance programs are discussed in the data section.

Two Cases of Comparable Groups: PSBB and PPKM

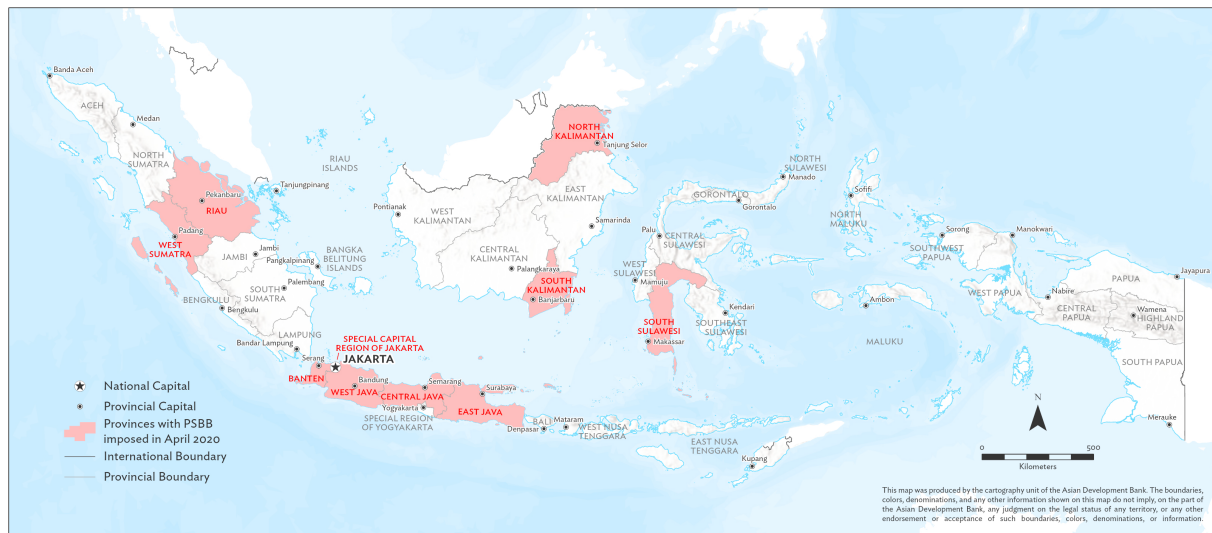
From the beginning of the COVID-19 outbreak to May 2021, which the ADB dataset covers, Indonesian provinces went through two phases of social restrictions. The first was the large-scale PSBB restrictions, which began 10 April 2020 in Jakarta and then expanded to other regions. PSBB imposed a partial lockdown, including school and office closures, except for essential activities. Whether PSBB was imposed was decided by the regional leader, even if they needed to submit a request to the Minister of Health that was accepted. PSBB continued until the beginning of 2021 in Jakarta with some restriction modifications (e.g., changes in office closure levels), but not all regions decided to apply PSBB. Also, there were regions that decided to stop PSBB due to the enormous economic impact.

The second phase were restrictions on community activities (Pemberlakuan Pembatasan Kegiatan Masyarakat, PPKM). In contrast to PSBB, PPKM depended on the Minister of Home Affairs based on recommendations of the committee for handling COVID-19 and national economic recovery (Komite Penanganan Covid-19 dan Pemulihan Ekonomi Nasional, KPC-PEN). While PSBB was a bottom-up approach, PPKM was top-down. PPKM restrictions were similar to PSBB such as school closures and work-from-home requirements except for essential activities. PPKM started 11 January 2021 in most of Java and Bali, afterwards expanding to other regions.

The ADB MSME survey data allow an assessment of PSBB and PPKM. The 2020 ADB data was collected by MSME surveys on changes in business performance from February to April 2020. The effects of COVID restrictions under April 2020 PSBB can thus be estimated. Similarly, the survey data covering April and May 2021 can be used to quantify the PPKM impact. It is important whether the geographic unit where PSBB and PPKM were imposed was at the city or district level. However, the datasets identify the respondent's location at the provincial level. For estimation purposes, if PSBB or PPKM was implemented at the city level, it is treated as if PSBB or PPKM was implemented at the corresponding provincial level.

First, the detailed estimation procedure begins with PSBB, which started in Jakarta 10 April 2020, followed by Jawa Barat (West Java) on 15 April. Afterwards, the provinces of Riau, Banten, Sumatera Barat (West Sumatra), Jawa Tengah (Central Java), Kalimantan Selatan (South Kalimantan), and Sulawesi Selatan (South Sulawesi) were covered, with PSBB in effect in Kalimantan Utara (North Kalimantan) on 26 April and in Jawa Timur (East Java) on 28 April (Figure 1). The DID method uses samples based in those provinces for the treatment group and samples based in the other provinces for the control group.

Figure 1: Provinces under PSBB in April 2020



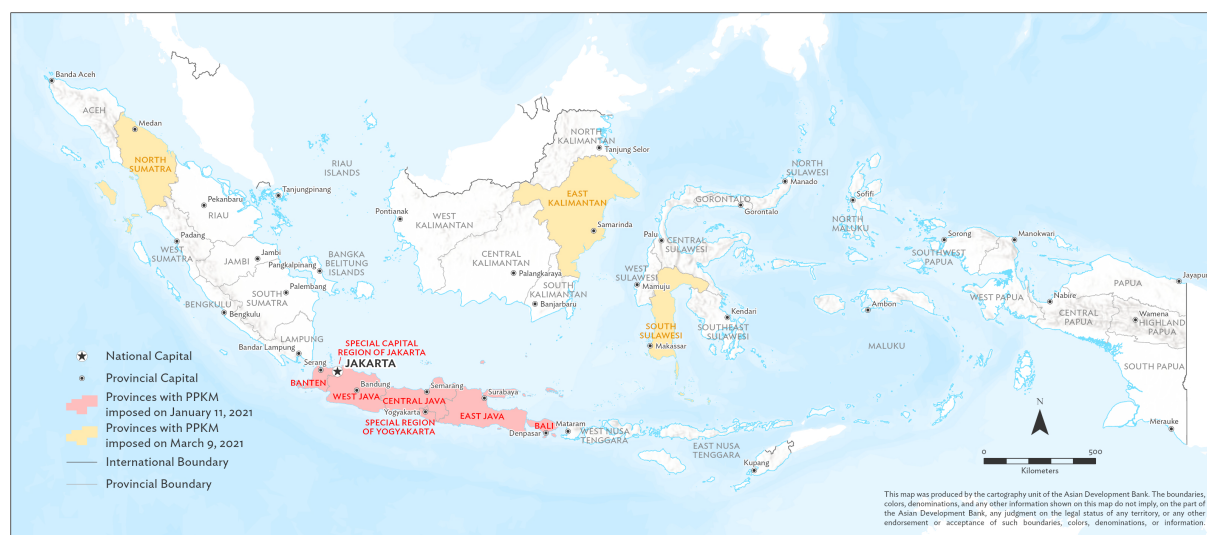
PSBB = Pembatasan Sosial Berskala Besar (large-scale social restrictions).

Note: Dark colored provinces include DKI Jakarta, Jawa Barat (West Java), Riau, Banten, Sumatera Barat (West Sumatra), Jawa Tengah (Central Java), Kalimantan Selatan (South Kalimantan), Sulawesi Selatan (south Sulawesi), Kalimantan Utara (North Kalimantan), and Jawa Timur (East Java).

Source: Authors.

Second is PPKM, which began 11 January 2021 in seven provinces (the first group): Bali, Banten, DI Yogyakarta, DKI Jakarta, Jawa Barat, Jawa Tengah, and Jawa Timur. It began 9 March 2021 in three provinces (the second group): Kalimantan Timur, Sulawesi Selatan, and Sumatera Utara (North Sumatra). The initial set of provinces includes PPKM A group samples, used for the first treatment group in estimating equations (6), (8), (9), and (11). Conversely, the second set of provinces includes PPKM B group samples, used for the second treatment group in estimating equations (7), (8), (10), and (11). All PPKM A provinces—the first treatment group for DID modeling—are on Java and Bali and all highly populated or urbanized (Figure 2).

Figure 2: Provinces under PPKM on 11 January 2021 and 9 March 2021



PPKM = Pemberlakuan Pembatasan Kegiatan Masyarakat (restrictions on community activities).

Note: Dark-gray provinces include Bali, Banten, DI Yogyakarta, DKI Jakarta, Jawa Barat (West Java), Jawa Tengah (Central Java), and Jawa Timur (East Java). Light gray provinces are Kalimantan Timur (East Kalimantan), Sulawesi Selatan (South Sulawesi), and Sumatera Utara (North Sumatra).

Source: Authors.

4. Data

In 2020 and 2021, ADB conducted a series of surveys to examine the impact of the COVID-19 pandemic on MSMEs in Indonesia. The results showed that the business climate for MSMEs improved considerably between years, with firms reopening in 2021 even though domestic demand for their goods and services had not entirely recovered. The COVID-19 crisis divided MSMEs into two groups: those most severely affected by the epidemic and social restrictions, and a tiny subset that profited (Shinozaki 2021). Those who reported a more favorable business climate were mostly involved with everyday necessities, such as food and healthcare supplies. Those most severely affected often produced non-essential products or services. The two groups reported significantly differing incomes, as the pandemic exacerbated inequality among MSMEs.

To evaluate the effect on MSMEs a year into the pandemic, structured questionnaires were distributed at four data points via surveys: April 2020, September 2020, April 2021, and May 2021. Determining how MSMEs were dealing with the pandemic amid the various restrictions—and to assist in developing the most suitable regulations—online questionnaires were used.

Samples were obtained using networks of survey partners that monitor MSMEs nationwide—the Indonesian Chamber of Commerce and Industry and Indonesia’s Ministry of Finance. In addition, the online surveys were distributed through ADB’s Indonesia Facebook pages. For the April and May 2021 surveys, enumerators from a local survey agency conducted field visits to complement the online survey.

To examine the extent of the bias for data distribution in ADB (2020), survey data were compared with the Badan Pusat Statistik (BPS; or central statistics bureau) 2016 Economic Census sampling frame; enterprise database. By firm size, BPS uses two categories: (i) micro and small firms and (ii) medium-sized and large firms. Following these categories, ADB survey data showed a 1.6%

underrepresentation from the BPS distribution for micro and small firms and a 1.6% overrepresentation for medium-sized and large firms. By industry, the difference in each sector's share of total respondents between the ADB and BPS distribution was four percentage points or less, except for manufacturing (9.7% underrepresentation from the BPS statistics). By region, the difference of each region's share to total respondents between both was less than five percentage points, except for Yogyakarta (5.5% overrepresentation from the BPS statistics).

The April 2020 survey was used for the PSBB restrictions and the April and May 2021 surveys for the PPKM. The first dataset includes information on changes in business performance from March to April 2020. More specifically, the survey asked about sales growth and changes in total employment during the period.⁶ The survey also asked whether the overall business environment in April was better, no change, or worse compared to the pre-COVID period. This information was also used for changes in business performance using ordered logit modeling. The survey in April 2020 also asked whether respondents used the internet in their daily business. In terms of what the internet was used for, the survey offered options such as selling products and/or services, buying materials from suppliers, and transferring money for business.

The 2021 datasets also contain information about changes in business performance for two periods: from March to April and from April to May 2021.⁷ Changes in business performance collected included sales growth rates and salary paid, as well as the changes in permanent and part-time employment. These were used in estimating Equations (6)-(8). The April and May 2021 datasets also asked respondents about the overall business environment similar to the earlier dataset. These were used to estimate Equations (9)-(11) using ordered logit modeling. The surveys further inquired about respondents use of e-commerce. It is important to note that the April and May 2021 surveys assessed internet usage only in terms of selling products or services and purchasing materials.

In contrast to the April 2020 dataset, the April and May 2021 datasets also provided information on whether firms received government assistance or not. Government assistance includes (i) *Subsidi bunga*, interest rate subsidy for loans; (ii) *Penempatan dana*, fund placement for credit restructuring; (iii) *Penjaminan kredit UMKM*, credit guarantees for MSMEs; (iv) *PPh final UMKM*, final income tax break facility for MSMEs; (v) *Pembiayaan Investasi LPDP*, investment financing for cooperatives and MSMEs; and (vi) *Bantuan Presiden usaha mikro*, presidential assistance for microenterprises. To consider the effects these government programs had on the affordability of internet use for business, the dummy variables representing whether a respondent received each type of government assistance or not are included in regressors to estimate propensity scores for Equations (6)-(11).

Next, the fundamental attributes of the samples used to estimate ATET for PSBB and PPKM are examined. An overview of the characteristics of the treatment group (subject to COVID restrictions) and the control group (not subject to restrictions) for PSBB is presented (Table 1). About 80% of

⁶ The survey also asked about business performance from February to March 2020. As PSBB started only in April, the March-April changes were used to estimate ATET. The original survey plan was to see the changes in business performance from February to March, but in Indonesia, COVID restrictions were not in place during March. Thus, the ADB survey team decided to ask respondents about their business performance for both periods.

⁷ In contrast to the April 2020 survey, the April 2021 survey asked respondents only about changes since the previous month. While the survey was from March to April 2021, some respondents answered in March while others answered in April. The original survey window was for March 2021. However, by the end of March there were too few respondents, so the ADB survey team decided to extend the deadline to the end of April. Consequently, the dataset consists of respondents who reported changes in their business performance from February to March 2021, as well as those reporting changes from March to April 2021. The small number of samples collected during March 2021 were not used in the dataset.

firms use the internet for business in both treatment and control groups. No significant differences in firm attributes are detected between the treated and control groups and between respondents using the internet or not. Notably, both groups are predominantly microenterprises (those with 1-4 employees), which cover approximately 80% of the sample. In addition, the essential sector accounts for around 70% of the sample, with young firms—those established within the last 0-5 years—representing approximately half of the total sample.⁸ Firms with female employees at just 0%-10% of the total are prevalent in both groups. As for business performance, the average sales growth rate is about minus 80%, with around 60% of firms reporting a decline in employment. Furthermore, more than 80% of respondents felt the overall business environment was worse than before the pandemic, no matter which group, or whether they used the internet for business or not.

Table 1: Summary Statistics of April 2020 Samples

	PSBB		No PSBB	
	Internet	No internet	Internet	No internet
Size (employees)				
1-4	0.84	0.87	0.66	0.90
5-19	0.13	0.13	0.27	0.10
20-99	0.02	0.00	0.07	0.00
100+	0.00	0.00	0.00	0.00
Sector				
Essential sector	0.73	0.78	0.68	0.76
Nonessential sector	0.27	0.22	0.32	0.24
Age (years)				
0-5	0.53	0.42	0.53	0.43
6-10	0.27	0.33	0.29	0.33
11-15	0.15	0.13	0.10	0.10
16-30	0.05	0.08	0.07	0.10
31+	0.01	0.04	0.01	0.04
Female employees share				
0-10%	0.67	0.65	0.55	0.71
11-30%	0.10	0.10	0.10	0.08
31-50%	0.08	0.10	0.12	0.08
51-80%	0.07	0.00	0.07	0.04
81-100%	0.09	0.14	0.16	0.08
Business performance				
Sales	-0.78	-0.76	-0.77	-0.78
Employment decrease	0.61	0.62	0.60	0.54
Business environment				
Better	0.13	0.17	0.11	0.12
No change	0.04	0.03	0.02	0.00
Worse	0.83	0.81	0.87	0.88
Observations	211	78	164	72

PSBB = Pembatasan Sosial Berskala Besar (large-scale social restrictions).

Note: The essential sector consists of electricity, gas, steam and air conditioning supply, water supply, sewerage, waste management and remediation activities, construction, wholesale and retail trade, transportation and storage, accommodation and food service, information and communications, financial and insurance activities, public administration defense, compulsory social security, and human health and social work activities. The nonessential sector consists of the remaining industries.

Source: Authors.

⁸ Following the DKI Jakarta Governor Regulation No. 88 of 2020, dated 11 September 2020, the essential sector consists of electricity, gas, steam and air conditioning supply, water supply, sewerage, waste management and remediation activities, construction, wholesale and retail trade, transportation and storage, accommodation and food services, information and communications, financial and insurance activities, public administration defense, compulsory social security, and human health and social work activities.

Overviews of the summary statistics of sample attributes for PPKM are presented (Tables 2, 3). Again, PPKM datasets comprise two distinct time periods. As to the four key attributes of size, sector, age, and female employee representation, there are no significant differences either across different time periods or between firms using e-commerce or not. The majority of the subsamples consist of microenterprises, while the essential sector holds the largest share of the sample. Most firms had been established for less than 5 years, with the majority reporting that less than 10% of employees were female. As for business performance, the average sales growth rate showed a decrease of approximately 30%, and roughly 10% of firms report reduced permanent and part-time employment—a higher percentage reduced employment in permanent positions than part-time jobs. There is a notable disparity in perceptions of the business environment between PPKM A and PPKM B. About 70% of PPKM A samples said the business environment was "worse" than before the pandemic. In contrast, for PPKM B samples, only around 30%-40% of respondents chose the "worse" response. On government assistance, approximately 10%-20% of respondents received some form of assistance.

Table 2: Summary Statistics of April 2021 Samples

	PPKM A		PPKM B	
	E-com	No E-com	E-com	No E-com
Size (employees)				
1-4	0.85	0.87	0.92	0.98
5-19	0.12	0.11	0.05	0.01
20-99	0.03	0.02	0.02	0.00
100+	0.00	0.00	0.00	0.00
Sector				
Essential sector	0.72	0.83	0.67	0.83
Nonessential sector	0.28	0.17	0.33	0.17
Age (years)				
0-5	0.58	0.38	0.68	0.53
6-10	0.22	0.26	0.22	0.25
11-15	0.10	0.14	0.05	0.09
16-30	0.07	0.18	0.03	0.10
31+	0.02	0.04	0.01	0.03
Female employees share				
0-10%	0.40	0.44	0.54	0.61
11-30%	0.07	0.05	0.02	0.01
31-50%	0.13	0.18	0.07	0.09
51-80%	0.07	0.04	0.09	0.05
81-100%	0.33	0.29	0.28	0.25
Business performance				
Sales	-0.28	-0.25	-0.34	-0.25
Salary paid	-0.30	-0.22	-0.35	-0.34
Employment (permanent) decrease	0.09	0.05	0.14	0.05
Employment (part-time) decrease	0.05	0.02	0.07	0.03
Business environment				
Better	0.16	0.15	0.40	0.45
No change	0.14	0.11	0.12	0.17
Worse	0.70	0.74	0.48	0.37
Government assistance				
Interest subsidy	0.18	0.14	0.18	0.08
Credit restructuring	0.16	0.09	0.11	0.05
Credit guarantees	0.15	0.09	0.16	0.14
Tax break	0.12	0.09	0.13	0.06

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	PPKM A		PPKM B	
	E-com	No E-com	E-com	No E-com
Investment financing	0.06	0.04	0.11	0.02
Productive assistance	0.25	0.19	0.23	0.13
Observations	422	1287	92	398

E-com = e-commerce, PPKM = Pemberlakuan Pembatasan Kegiatan Masyarakat (restrictions on community activities).

Note: The essential sector consists of electricity, gas, steam and air conditioning supply, water supply, sewerage, waste management and remediation, construction, wholesale and retail trade, transportation and storage, accommodation and food service, information and communications, financial and insurance activities, public administration defense, compulsory social security, and human health and social work activities. The nonessential sector consists of the remaining industries.

Source: Authors.

Table 3: Summary Statistics of May 2021 Samples

	PPKM A		PPKM B	
	E-com	No E-com	E-com	No E-com
Size (employees)				
1-4	0.85	0.88	0.95	0.98
5-19	0.13	0.10	0.04	0.02
20-99	0.02	0.02	0.01	0.00
100+	0.00	0.00	0.00	0.00
Sector				
Essential sector	0.75	0.84	0.73	0.88
Nonessential sector	0.25	0.16	0.27	0.12
Age (years)				
0-5	0.61	0.40	0.76	0.53
6-10	0.22	0.24	0.16	0.25
11-15	0.09	0.14	0.04	0.11
16-30	0.07	0.17	0.04	0.08
31+	0.02	0.04	0.01	0.04
Female employees share				
0-10%	0.38	0.41	0.59	0.58
11-30%	0.06	0.06	0.01	0.01
31-50%	0.14	0.19	0.04	0.06
51-80%	0.08	0.05	0.07	0.07
81-100%	0.34	0.29	0.29	0.28
Business performance				
Sales	-0.22	-0.16	-0.35	-0.16
Salary paid	-0.27	-0.17	-0.33	-0.35
Employment (permanent) decrease	0.08	0.04	0.18	0.06
Employment (part-time) decrease	0.07	0.02	0.10	0.05
Business environment				
Better	0.24	0.15	0.49	0.53
No change	0.11	0.10	0.17	0.11
Worse	0.66	0.75	0.34	0.35
Government assistance				
Interest subsidy	0.23	0.14	0.12	0.15
Credit restructuring	0.14	0.06	0.20	0.09
Credit guarantees	0.16	0.08	0.20	0.16
Tax break	0.11	0.08	0.09	0.04
Investment financing	0.06	0.03	0.10	0.03
Productive assistance	0.24	0.17	0.17	0.13
Observations	395	1297	82	424

E-com = e-commerce, PPKM = Pemberlakuan Pembatasan Kegiatan Masyarakat (restrictions on community activities).

Note: The essential sector consists of electricity, gas, steam and air conditioning supply, water supply, sewerage, waste management

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and remediation, construction, wholesale and retail trade, transportation and storage, accommodation and food service, information and communications, financial and insurance activities, public administration defense, compulsory social security, and human health and social work activities. The nonessential sector consists of the remaining industries.
Source: Authors.

It is essential to note that the DID method assumes that both treatment and control groups share common objectives on the outcomes desired. Although the current dataset does not allow for examining outcomes before PSBB and PPKM implementation, the treatment and control groups share most of the basic firm attributes.

5. Estimation Results

PSBB Results (April 2020 Samples)

The PSBB results of the regression analysis on Equation (2) use business performance indicators in April 2020 to estimate the ATET 1 month or in the immediate aftermath of the COVID restrictions (Table 4). For changes in business performance from March to April 2020, there was no discernible impact of internet usage for firms on either sales growth, income (revenue) growth or employment variations (a dummy variable that takes one if a respondent decreased employment).

Table 4: Regression Results of Effects of Using the Internet on Business Performance Based on April 2020 Samples

	Sales	Income	Employment (negative)	Business environment
Internet	0.035 (0.040)	0.030 (0.044)	-0.032 (0.076)	0.677 (0.499)
COVID	0.051 (0.053)	0.009 (0.046)	0.001 (0.089)	1.369** (0.535)
Internet x COVID	-0.068 (0.062)	-0.034 (0.060)	-0.030 (0.104)	-1.269** (0.641)
N	525	525	525	525

Note: Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The models in the first to the third columns are estimated using the maximum likelihood method with inverse probability weighting. The model in the fourth column is estimated using the ordered logit method with inverse probability weighting.
Source: Authors.

For changes in the business environment and overall evaluation of the firm at the time surveyed, the coefficient of the treatment group dummy ("COVID") is positively significant, and the coefficient of the interaction term of the internet use dummy and treatment group dummy ("Internet X COVID") are negatively significant. The "positive" impact of COVID restrictions is counterintuitive. However, considering the panic buying at the beginning of COVID restrictions (e.g., Kompas.com 2022) and the large share in the dataset of the essential sector, in particular wholesale and retail trade, the positive impact of the treatment group is not unreasonable.

In addition, using the internet for business has an unfavorable impact on the business environment under PSBB, which is intriguing. One possible reason is logistics. According to Pusparisa (2020), right after PSBB implementation, delivery to Jakarta and its surrounding areas (Bogor, Depok, Tangerang, and Bekasi) took 2-3 days, while it took only 1-2 days before. While PSBB did not mandate local governments to restrict traffic across regional borders, local governments were permitted to impose traffic restrictions within smaller areas for quarantine measures (Azmi and Kusumasari 2021). Border controls might negatively affect the delivery

capacity of PSBB regions. The negative effects of using the internet for business under COVID restrictions are discussed below.

PPKM Results (April and May 2021 Samples)

The results of the regression analysis on the impact of e-commerce use on sales growth rates, total salary paid, permanent employment, part-time employment, and business environment for the April and May 2021 samples are intriguing (Tables 5, 6). Business performance from the first to fourth variables are values changed since the previous month. The fifth variable is an ordered factor variable indicating a change in a respondent's subjective evaluation of the business environment: better, no change, or worse compared to before the outbreak.

Table 5: Regression Results of Effects of Using the Internet on Business Performance Based on the Samples from the April 2021 Dataset

	Sales	Wage	Employment (permanent)	Employment (part-time)	Business environment
PPKM A only					
E-commerce	0.022 (0.023)	-0.005 (0.024)	0.002 (0.013)	0.014 (0.010)	0.143 (0.143)
N	1709	1709	1709	1709	1709
PPKM B Only					
E-commerce	0.054 (0.057)	0.087 (0.066)	-0.146** (0.071)	-0.044 (0.034)	-0.808** (0.369)
N	490	490	490	490	490
PPKM A&B					
E-commerce	0.033 (0.023)	-0.001 (0.024)	-0.002 (0.013)	0.009 (0.010)	0.205 (0.149)
COVID	0.001 (0.020)	-0.133*** (0.026)	0.011 (0.017)	0.029* (0.015)	1.493*** (0.123)
E-com x COVID	-0.089* (0.047)	0.064 (0.057)	0.008 (0.030)	-0.033 (0.020)	-0.585* (0.302)
N	2199	2199	2199	2199	2199

PPKM = Pemberlakuan Pembatasan Kegiatan Masyarakat (restrictions on community activities).

Note: Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The models in the first to the fourth columns are estimated using the maximum likelihood method with inverse probability weighting. The model in the fifth column is estimated using the ordered logit method with inverse probability weighting.

Source: Authors.

Table 6: Regression Results of Effects of Using the Internet on Business Performances Based on the Samples from the May 2021 Dataset

	Sales	Wage	Employment (permanent)	Employment (part-time)	Business environment
PPKM A only					
E-commerce	-0.013 (0.025)	-0.026 (0.031)	0.029* (0.017)	0.029** (0.013)	0.389** (0.152)
N	1692	1692	1692	1692	1692
PPKM B only					
E-commerce	-0.032 (0.081)	0.080 (0.075)	0.054 (0.051)	-0.019 (0.019)	0.090 (0.351)
N	506	506	506	506	506
PPKM A&B					
E-commerce	-0.015 (0.025)	-0.024 (0.027)	0.029 (0.018)	0.033** (0.014)	0.392*** (0.146)
COVID	0.004 (0.019)	-0.152*** (0.025)	0.037** (0.016)	0.042*** (0.015)	1.682*** (0.118)
E-com x COVID	-0.095 (0.060)	0.105* (0.062)	0.027 (0.051)	-0.055** (0.023)	-0.318 (0.314)
N	2198	2198	2198	2198	2198

PPKM = Pemberlakuan Pembatasan Kegiatan Masyarakat (restrictions on community activities).

Note: Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The models in the first to the fourth columns are estimated using the maximum likelihood method with inverse probability weighting. The model in the fifth column is estimated using the ordered logit method with inverse probability weighting.

Source: Authors.

First, the impact of using e-commerce under PPKM is likely negative on sales and the overall business environment for firms facing new or reimposed COVID restrictions. On sales, the coefficient of the interaction term of the e-commerce use dummy and PPKM B group dummy in the bottom panel of Table 5 is estimated as -0.089, significantly negative at the 10% level for both tails. According to Equation (8), this coefficient represents the difference in the e-commerce effect under PPKM between the PPKM B group and the PPKM A group. Assuming no improvement in the effect of e-commerce under PPKM for Group A ($\beta_{14} - \beta_{13} = 0$), the coefficient of the interaction term becomes identical to the PPKM B group-specific e-commerce effect under PPKM (β_{15}). Thus, the results suggest a negative impact of e-commerce on sales at the beginning of COVID-19 restrictions.

In terms of business environment, the coefficient of the interaction term in the bottom panel of Table 5 is -0.585, also significantly negative. Equation (11) interprets this coefficient as the difference between the e-commerce effect under PPKM between PPKM B and PPKM A ($\beta_{15} - \beta_{14}$). Considering the coefficient of e-commerce in the middle panel (-0.808) is also significantly negative, which is equivalent to the sum of the group-common e-commerce effect and the PPKM B-specific e-commerce effect under PPKM ($\beta_9 + \beta_{15}$), it is reasonable to expect a negative impact of e-commerce on the business environment at the start of COVID restrictions.

Second, the long-term effect of using e-commerce is likely positive. As to the business environment, the coefficients of e-commerce in the top panel of Table 6 are estimated as 0.389, statistically significant at the 5% level for both tails. The coefficient is interpreted as the sum of the group-common and PPKM A group-specific effects of e-commerce on the business environment based on Equation (11). Even though we cannot distinguish between these two effects, considering that PPKM was imposed on the PPKM A group earlier than the PPKM B group, we can infer that the long-term effect of e-commerce is positive because both effects are positively correlated over time.

Third, the effect of using e-commerce under PPKM is possibly negative on the probability of decreasing permanent employment—however, the effect likely becomes positive in the long term. The estimated coefficient of e-commerce in the middle panel of Table 5 (-0.146) suggests the PPKM B group-specific e-commerce effect on the probability of decreasing permanent employment. In contrast, the estimated coefficients for permanent and part-time employment indicate that the PPKM A group-specific e-commerce effect under PPKM or group-common e-commerce effect is positive on the probability of decreasing both permanent and part-time employment.

Finally, COVID restrictions at their start are likely to increase the probability of decreasing both permanent and part-time employment and decrease total salary paid. The estimated coefficients of the PPKM B dummy are significantly negative for the salary paid (wage) model and significantly positive for the permanent and part-time employment models. Based on Equation (8), these values represent the differences in these effects between the PPKM B group and the PPKM A group. The results imply that the effect of COVID restrictions is expected to be negative on salary and workers, at least in the short term.

Discussion

These findings show that internet or e-commerce use has some negative impact on business performance in the short term while becoming positive over time.⁹ This suggests several possibilities. The first involves bettering the business environment for MSMEs, especially in logistics—as mentioned, COVID restrictions initially affected delivery capacity. The second is that MSMEs need a level of maturity to effectively leverage digital tools to benefit. These empirical findings reinforce the critical role policy support plays on multiple fronts in realizing potential gains from the digital economy (ADB 2021b). While digitalization offered a range of opportunities for MSMEs to withstand the adverse shocks from the pandemic, developing digital capacity is mandatory for the digital dividends to be fully realized. MSME's perception gap on the benefits of digitalization must narrow. To enhance the digital capabilities of MSMEs, the government must invest in digital skills training and digital literacy. It needs to ensure affordable access to mobile, broadband, other ICT and services. It should establish a secure, stable system for digital financial settlements and provide robust physical infrastructure for traditional goods trade.

Aside from these industrial policies, competition policies must ensure MSMEs can look beyond stability and become more growth-oriented. The government should reduce entry barriers and promote fair competition between digital platforms—they have a "double-edged" effect, providing access to unprecedented opportunities for MSMEs while also creating a few "winners" due to strong network effects and substantial scale economies.

6. Conclusion

In this paper, we examined whether and how Indonesian MSMEs could have weathered adverse pandemic shocks through digitalization. The unique data allows analyses for two lockdowns—

⁹ We also conducted similar regression exercises using only the essential sector samples and utilizing whether firms participate in global supply chains (GSC) or not for heterogeneity instead of internet usage. The former results closely align with the results that include both essential and non-essential sectors. The latter results suggest a positive impact of GSC participation for the PSBB case. However, the latter results are not entirely reliable due to the limited number of samples participating in GSC: 29 firms in the PSBB April 2020 dataset, 25 in the PPKM April 2021 dataset, and 26 in the PPKM May 2021 dataset. These results are available upon request.

PSBB in 2020 and PPKM in 2021. Unexpectedly, for both, digitalization led to negative sales and reduced employment during the early lockdown stage. They eased later on. This suggests that digital readiness is critical to unleash digitalization's potential benefits. While digitalization offered a variety of opportunities for MSMEs to weather the negative shocks from the pandemic, digital and business capacity are indispensable in reaping the digital dividend.

By its very nature, digitalization is “double-edged”. It provides access to unprecedented opportunities for MSMEs, yet creates just a few major “winners” due to strong network effects and substantial scale economies. Thus, affordable and quality ICT infrastructure, seamless digital connectivity, digital skills and literacy, secure online payment systems, financial access for innovative startups, efficient e-government, and effective legal and regulatory frameworks for fair competition must be established to avoid disruptive aspects of the digital transformation (ADB 2021). Thus, in promoting the COVID-19 recovery process for MSMEs, the government should design and adopt appropriate industrial and competition policies. First, the government must help build MSMEs' digital capabilities by investing in digital skills training and digital literacy. It must support affordable access to mobile, broadband, and other ICT services. To facilitate the seamless transformation from offline to online business transactions, it needs to provide hard and soft infrastructure—the resilient physical infrastructure for traditional goods trade and logistics, as well as effective digital infrastructure, such as a stable and robust system for safe and secure digital financial settlements. To build an inclusive digital market structure, the government should ease entry barriers and promote fair market competition on digital platforms.

Appendix: The Difference-in-Differences Method

Based on Equation (1), we can show eight situations of a firm's expected performance depending on whether it adopts a digital platform or not:

$$\begin{aligned}
 E(y|D_i = 1, W_i = 1, T_t = 0) &= \beta_0 + \beta_1 + \beta_2 + \beta_4, \\
 E(y|D_i = 1, W_i = 1, T_t = 1) &= \beta_0 + \beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 + \beta_7, \\
 E(y|D_i = 1, W_i = 0, T_t = 0) &= \beta_0 + \beta_1, \\
 E(y|D_i = 1, W_i = 0, T_t = 1) &= \beta_0 + \beta_1 + \beta_3 + \beta_5, \\
 E(y|D_i = 0, W_i = 1, T_t = 0) &= \beta_0 + \beta_2, \\
 E(y|D_i = 0, W_i = 1, T_t = 1) &= \beta_0 + \beta_2 + \beta_3 + \beta_6, \\
 E(y|D_i = 0, W_i = 0, T_t = 0) &= \beta_0, \\
 E(y|D_i = 0, W_i = 0, T_t = 1) &= \beta_0 + \beta_3.
 \end{aligned}$$

Note that $E(y|D_i = 1, W_i = 1, T_t = 0)$ represents the expected value of performance of a company that uses e-commerce or the internet and belongs to the COVID-restriction treatment group at the period of pre-COVID-restriction. We refrain from enumerating the other patterns to circumvent redundancy. We are interested in quantifying the effect of the COVID restrictions on the performance of the firms that use the internet in comparison with the effect of COVID restrictions on the performance of firms that do not use the internet. The former effect can be captured by:

$$\begin{aligned}
 &[E(y|D_i = 1, W_i = 1, T_t = 1) - E(y|D_i = 1, W_i = 1, T_t = 0)] \\
 &\quad - [E(y|D_i = 1, W_i = 0, T_t = 1) - E(y|D_i = 1, W_i = 0, T_t = 0)] \\
 &\quad = \beta_6 + \beta_7.
 \end{aligned}$$

The latter effect is:

$$\begin{aligned}
 &[E(y|D_i = 0, W_i = 1, T_t = 1) - E(y|D_i = 0, W_i = 1, T_t = 0)] \\
 &\quad - [E(y|D_i = 0, W_i = 0, T_t = 1) - E(y|D_i = 0, W_i = 0, T_t = 0)] \\
 &\quad = \beta_6.
 \end{aligned}$$

Hence, the expected effect of using the internet on a firm's performance under COVID restrictions is simply captured by the value of β_7 in Equations (1) and (2).

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Unintended Consequences of Business Digitalization among MSMEs during the COVID-19 Pandemic

The Case of Indonesia

This study employs unique data from Indonesia to investigate whether and how digitalization of micro, small, and medium-sized enterprises (MSMEs) helped them weather the adverse shocks from the pandemic and resulting lockdowns. The main empirical result is that, in the pandemic's early phases, digitalized MSMEs disproportionately encountered negative effects on their business outcomes. The seemingly harmful elements of digitalization disappeared during later stages. The findings provide critical implications for industrial and competition policies related to MSMEs during the COVID-19 recovery process.

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