# The Impact of Online Sales on Recovery from COVID-19

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*The massive spread of the COVID-19 outbreak has widely disrupted business activities around the world. In such a context, more manufacturing enterprises have to turn to online sales to restore sales and workforce. However, the actual effects of above relationships are still unknown. The aim of this study is to analyze whether and how online sales affect sales and workforce recovery from COVID-19. Meanwhile, we deeply explore the mediating effect of cash flow adequacy and the moderating effect of firm size. Drawing from a cross-country survey with 2714 manufacturing enterprises during the COVID-19 pandemic and controlling for self-selection bias, we find an inverted U-shaped effect of online sales on sales and workforce recovery. Online sales also exert an inverted U-shaped effect on cash flow adequacy, whereas this effect is weaker for small and medium enterprises (SMEs). Furthermore, cash flow adequacy positively facilitates sales and workforce recovery, indicating the role of cash flow adequacy in partially mediating the relationship between online sales and recovery. In addition, we confirm that firm size moderates the indirect effect of online sales on sales and workforce recovery through cash flow adequacy. This study not only expands e-commerce and emergency management research domain and enriches the results of related research, but also provides management implications for the recovery of manufacturing enterprises from the perspective of online sales during the COVID-19 pandemic.*

Keywords: *Online Sales; Recovery; Cash Flow Adequacy; Firm Size; Manufacturing Firms.*

## Introduction

The contemporary world has been challenged by the unprecedented outbreak of COVID-19, with significant negative effects on business activities. To slow down the speed of COVID-19 infection, governments have suspended offline business activities and favored lockdown to reduce interpersonal contact. As a result, the closure of retail stores hindered offline sales channels between manufacturers and consumers, leading to stagnant sales and reduced employment. In this situation, manufacturing enterprises, especially small and medium enterprises (SMEs), are struggling to restore sales channels to achieve sales and workforce recovery. Fortunately, with the development of e-commerce activities, online sales with non-contact advantages have gradually become the main sales channel for manufacturing enterprises to directly sell products to consumers during the COVID-19 pandemic. Thus, to facilitate sales and workforce recovery from COVID-19, some initiatives are now in place to encourage manufacturing enterprises to take part in online sales (Al-Omoush *et al.,* 2020). However, research on whether and how online sales affect sales and workforce recovery during the COVID-19 pandemic remains nascent.

In evaluating the role of online sales in influencing recovery from COVID-19, existing research related to the impact of e-commerce activities on sales growth and employment offers valuable guidance. However, the results are mixed. Concretely, as an extended sales channel with low

entry cost, e-commerce activities are conducive to increasing sales (Hernant & Rosengren, 2017), while the decline in offline sales may worsen total sales (Duch-Brown *et al.,* 2017). Concerning employment, e-commerce activities usually require professional technical personnel, thereby increasing the demand for corresponding positions (Terzi, 2011), while the transformation of e-commerce business to the traditional business may also reduce the demand for certain jobs (Biagi & Falk, 2017). That is, e-commerce activities may exert both positive and negative effects on sales growth, as well as employment. In this vein, as the main branch of e-commerce activities, online sales may act as a double-edged sword. That is, the impact of online sales on sales and workforce recovery may not be simply linear.

Traditionally, cash flow is considered a key factor in business recovery (Wiatt *et al.,* 2020). The view that cash flow is a key factor also emphasizes its importance in maintaining the normal operations of an organization in a challenging market environment (Georgeta *et al.,* 2011). Meanwhile, it is argued that cash flow is the key to improving the stability of each code along the supply chain (Tsai, 2011). In addition, as an important indicator to capture corporate reputation, cash flow is also essential for manufacturers to ensure timely delivery of products (Xiao & Zhang, 2018). This may be precisely what many manufacturing enterprises value most during COVID-19. Then, considering the possible sales disruptions caused by the COVID-19 pandemic, manufacturing enterprises should pay more attention to the

level of cash flow, such as cash flow adequacy. Therefore, combined with the positive impact of e-commerce activities on profitability (Cho *et al.,* 2019), cash flow adequacy may be a channel connecting online sales and recovery. However, no research pays attention to empirically investigating how online sales affect sales and workforce recovery through cash flow adequacy.

Furthermore, online sales may vary depending on firm size. For instance, it is argued that SMEs are still far behind large enterprises in developing e-commerce activities (Rahayu & Day, 2015). That is, compared with large enterprises, the e-commerce activities of SMEs may be relatively simple and require less investment. However, from the perspective of productivity gains, SMEs usually benefit more from the increase in online sales (Falk & Hagsten, 2015). This means that online sales may be a low investment and high returns for SMEs. In this vein, the impact of online sales on performance may be contingent upon firm size. Therefore, it is important to explore the role of firm size in the relationship between online sales and recovery. Unfortunately, existing literature provides little knowledge about this important issue.

To fill the above-mentioned gaps, this study contributes to the literature in the following ways. First, we intend to establish the non-linear impact of online sales on sales and workforce recovery, which can help enhance the understanding of the role of e-commerce activities in recovering from COVID-19. Second, we propose the mediating effect of cash flow adequacy on the relationship between online sales and recovery, thus establishing a mechanism explaining how online sales relate to sales and workforce recovery. Finally, we examine the moderating role of firm size on the online sales-cash flow adequacy relationship, which helps to investigate the difference in the impact of online sales on recovery between large enterprises and SMEs.

To this end, we develop and empirically test an overarching theoretical framework that integrates the online sales-recovery relationship through a survey study of 2714 manufacturing enterprises in 24 countries during the COVID-19 pandemic. Our theoretical base allows us to conceptually explain the inverted U-shaped online sales-recovery relationship, while our treatment effect analysis allows us to rigorously confirm the existence of this relationship by controlling self-selection bias. To investigate the indirect effect of online sales on recovery, we apply a three-step approach to test the role of cash flow adequacy in mediating the online sales-recovery relationship. Moreover, we added the interaction term between online sales and firm size into the mediation model to test the role of firm size in moderating the impact of online sales on recovery through cash flow adequacy.

The paper is organized as follows. In the next section, we present the background and hypotheses development, which is followed by a description of our methodology. Then, we provide the empirical findings as well as robustness checks. Finally, we discuss theoretical contributions and managerial implications, and suggest potential avenues for future research.

## Background and Hypotheses Development

### Background

The outbreak of COVID-19 has severely affected business activities. Many manufacturing enterprises around the world might get into trouble altogether, since customers are confined to their residences, leading to halting in business activities. One constant during COVID-19 is that labor bears the brunt of the decline, manifested in the drop in the employment rate (Sobieralski, 2020). However, this drop in the post-outbreak month was largely driven by mass layoffs and not workers quitting their jobs (Dias *et al.,* 2020). As argued by Forsythe et al. (2020), nearly all industries and occupations saw a contraction in postings, resulting in a large number of unemployed workers. It is noted that the uncertainty shocks caused by the COVID-19 pandemic have forced enterprises to reduce workforce to save costs (Hodder, 2020). Meanwhile, another major impact of the COVID-19 pandemic is sales decline. On the one hand, in addition to protecting equipment and daily necessities, market demand has sharply decreased as a result of the lockdown associated with the spread of COVID-19 (Donthu & Gustafsson, 2020). On the other hand, manufacturing enterprises cannot achieve normal production during the COVID-19 crisis due to supply chain disruption (Shafi *et al.,* 2020), reduced solvency (Mirza *et al.,* 2020), or insufficient profits (Shen *et al.,* 2020). Obviously, the COVID-19 crisis has brought severe shocks to the employment and sales of manufacturing enterprises. In this regard, the recovery of the workforce and sales should be the important indicator of whether manufacturing enterprises can escape the crisis.

Taking into account that the infection of COVID-19 brought an abrupt halt to most offline business activities, online sales with non-contact advantages have become popular among manufacturing enterprises (Al-Omoush et al., 2020; Hartmann & Lussier, 2020). Most manufacturing enterprises have taken part in online sales to promote recovery from the COVID-19 crisis. However, evidence on the relationship between online sales and recovery remains scarce. Extant studies mainly focus on the impact of e-commerce activities on sales growth (Duch-Brown *et al.,* 2017; Hernant & Rosengren, 2017), profitability (Cho *et al.,* 2019; Hua *et al.,* 2015), transaction cost (Wang & Lee, 2017), customer service (Cao et al., 2018), innovation (Popa *et al.,* 2018), employment (Biagi & Falk, 2017), capacity utilization (Zhu *et al.,* 2021), and productivity (Liu *et al.,* 2013). Among them, most studies argue that e-commerce activities can act as a competitive advantage of an organization, emphasizing the positive impact of e-commerce activities on performance. In terms of sales and workforce recovery, studies on the impact of e-commerce activities on sales growth and employment are closely related, but the results are mixed. Concretely, it is argued that e-commerce activities can expand sales channels and increase complementarity with offline sales, thus increasing total sales (Hernant & Rosengren, 2017; Pauwels & Neslin, 2015). However, it is also argued that online sales can divert sales from traditional channels, thereby reducing total sales, which indicates a crowding-out effect of online sales on offline sales (Duch-Brown *et al.,* 2017). Additionally, the

impact of e-commerce activities on employment remains mixed. It is noted that e-commerce activities tend to be positively related to employment by increasing the demand for corresponding positions (Atasoy, 2013). However, research also argued that e-commerce activities can not only create jobs but also destroy jobs by reducing the demand for certain positions (Terzi, 2011). Similarly, Biagi and Falk (2016) noted that e-commerce activities appear to be rather neutral to employment, indicating that the substitution effects and compensation effects tend to cancel each other out. Therefore, e-commerce activities may exert both positive and negative effects on sales growth and employment. This provides useful guidance for studying the relationship between online sales and recovery during COVID-19.

### Linking Online Sales to Sales and Workforce Recovery

Online sales are identified as information and technology-intensive activities that require some certain-skilled workers and equipment to achieve. That is, online sales have a creating effect on new jobs related to information and technology management (Terzi, 2011). Meanwhile, online sales enable manufacturers to gain access to new sales channels at a low cost, thus improving their market competitiveness (Mkansi, 2021; Jiang *et al.,* 2015). As a result, enterprises with online sales can take advantage of product price competition to achieve superior revenue and enhance the ability to hire employees, especially during the COVID-19 pandemic. Additionally, since online customers can order at anytime from anywhere but cannot obtain products in time like offline stores, timely delivery of products is the key to improving customer satisfaction (Vasi *et al.,* 2019). This drives manufacturers to improve their ability to produce in time and deliver quickly. In fact, this is difficult to achieve for enterprises at the beginning of online sales. As a result, they usually have to hire more production and logistics workers. Thus, online sales can increase the employment demand, such as creating new jobs, enhancing hiring capacity, and expanding the employment demand of existing positions, thus contributing to workforce recovery.

However, over-reliance on online sales is not without cost pressure. In order to make more online customers recognize their products, manufacturers that rely excessively on online sales have to pay high marketing costs to increase the visibility of their products. Unlike manufacturing enterprises that use online sales as an auxiliary expansion sales channel, if manufacturers rely too much on online sales, or even regard online sales as the only sales channel, offline sales channels will be severely squeezed by the cost pressure (Wang & Goldfarb, 2017). As we all know, offline stores usually require a large number of employees to maintain normal operations. Then, the substitution effect of online sales may reduce employment demand (Biagi & Falk, 2017). That is, the reduced number of employees caused by the closure of offline stores due to over-reliance on online sales may far exceed the number of employees increased by the development of online sales. As a result, over-reliance on online sales may be harmful to workforce recovery. In addition, it is noted that online sales are changing the sales chains by altering the roles of various

links such as procurement, production, logistics, and after-sales service (Bloom *et al.,* 2012). As a result, online sales may reduce the demand for certain traditional positions, thus having a substitution effect on employment (Biagi & Falk, 2017). Taken together, there may be a trading-off between online sales and workforce recovery. That is, online sales should be positively related to workforce recovery initially. However, this relationship may be subject to diminishing or even negative returns beyond a certain point, indicating an inverted U-shaped relationship between online sales and workforce recovery. Therefore, we propose:

H1a: There is an inverted U-shaped relationship between online sales and workforce recovery.

Unlike offline sales that rely on physical stores, online sales with contact-less functions are favored by manufacturers and customers during the COVID-19 crisis. Meanwhile, due to low-cost entry barriers, online sales bring the price advantage (Pauwels & Neslin, 2015), and contribute to sales recovery through various promotional methods such as the issuance of coupons. Meanwhile, online sales can be utilized to create a unique organizational capability within an organization (Xia & Zhang, 2010). The ability to combine e-commerce resources with production and operation management resources to meet changing customer demand and address changing environments is the key to gaining a competitive advantage (Hua *et al.,* 2015). In this vein, online sales enable manufacturing enterprises to achieve sales growth by improving their competitive advantage. In addition, due to the space limitations of offline stores, customers cannot browse more products through offline sales. However, online sales can feature more product or service information and provide complementary after-sale services for offline sales (Hernant & Rosengren, 2017; Xia & Zhang, 2010). In this regard, online sales, as a booster for offline sales, play an important role in product marketing, which may promote sales recovery. Therefore, online sales should be positively related to sales recovery.

However, this positive effect may decline and even become negative if manufacturing enterprises rely too much on online sales. In order to improve online customer satisfaction, manufacturers need to complete the entire process of order receiving, manufacturing, and delivery in a short time, which places extremely high requirements on their flexibility. In fact, this is difficult to achieve for most manufacturing enterprises. To this end, manufacturers have to produce products in advance to achieve timely delivery, but this forces them to predict customer demand preferences as accurately as possible. Once it fails, mismatched preferences may lead to unpredictable demand fluctuations (Wan *et al.,* 2012), resulting in product backlogs and delays in sales recovery. Additionally, manufacturers may prefer to choose online sales as the core sales channel, which may cause a crowding-out effect on offline sales, leading to the reduction in cross-channel sales (Melis *et al.,* 2015; Hernant & Rosengren, 2017). Meanwhile, as indicated by Xia and Zhang (2010), the lack of prior examination of physical products before purchase is the key inhibitor of online sales. The reduction in offline stores may weaken customers' purchasing motivation, thus delaying sales recovery. Furthermore, product returns, not necessarily caused by product quality, play a vital role in hindering sales growth.

Here again, however, such product returns mainly occur in online sales, rather than offline sales (Xia & Zhang, 2010). For example, if a lower-priced purchase channel is discovered before receiving the product purchased through online sales, customers prefer to return the product, but this is rare for offline sales where customers may use the product immediately after payment. Therefore, there may be a trading-off between online sales and sales recovery. This points to an inverted U-shaped relationship in which the positive impact of online sales on sales recovery is available only up to a certain level of online sales, and becomes negative as online sales grow beyond this level. Collectively, we propose our hypothesis:

H1b: There is an inverted U-shaped relationship between online sales and sales recovery.

### The Mediating Role of Cash Flow Adequacy

As the name implies, cash flow adequacy refers to the adequacy of cash flow used to cover the ongoing expense. In our study, cash flow adequacy mainly captures the ability of manufacturers to meet their cash outflow requirements for remaining open. Given the contact spreading characteristics of the COVID-19 pandemic, traditional sales that rely on offline stores are severely affected, which may easily lead to sales stalls and product backlogs. In response to the challenges posed by COVID-19, manufacturing enterprises focus on contact-less online sales to alleviate sales difficulties. Therefore, online sales, through expanding new sales channels, contribute to reducing product backlogs and releasing cash flow, thus improving cash flow adequacy. Meanwhile, online sales provide a convenient payment, simple transaction process alternative to sales channel, in conditions where offline sales are difficult to operate normally during the COVID-19 pandemic. In other words, online sales allow manufacturing enterprises to obtain cash flow from selling products faster (Kalaignanam *et al.,* 2018). Moreover, online sales may enable manufacturing enterprises to improve profitability by reducing sales costs (for example, offline store rents, sales commissions from intermediary retailers), thereby increasing cash flow adequacy.

However, after reaching a given threshold, the positive effect of online sales on cash flow adequacy may diminish. On the one hand, relatively transparent product prices in online sales are the fuse of the price war. As argued by Ghose and Yao (2011), in situations where information about product price is easily available, competitors in the same market are more likely to adopt price reduction strategies to gain a competitive advantage. According to this line of reasoning, over-reliance on online sales may isolate manufacturing enterprises from offline sales systems and plunge them into price wars with online competitors, resulting in a decrease in the ability to supplement cash flow. On the other hand, product returns hurt the sales revenue, which in turn reduces cash flow adequacy. Given the convenience of returning products sold online, customers are more likely to return products for various reasons (for example, unsatisfactory price, unqualified quality, or even wrong purchase.) (Kim *et al.,* 2016), thus decreasing cash flow adequacy. Taken together, we argue that online sales have an inverted U-shaped relationship with cash flow adequacy.

Generally, adequate cash flow contributes to a stable production due to its positive impact on supply chain relationships (Tsai, 2011). In the context of COVID-19, manufacturers have focused their attention on strengthening their operational stability by using cash to purchase goods and services from upstream partners and even providing credit sales to downstream partners. Instead, the lack of cash flow forces manufacturing enterprises to reduce their production scale to maintain production, which serves as a stopgap measure to cope with the survival crisis that may occur over time. As such, adequate cash flow enables manufacturing enterprises to maintain sales and workforce through stable production. Moreover, adequate cash flow provides a guarantee for the smooth completion of the order, improves supply chain stability, and enhances competitive advantage in the market (Xiao & Zhang, 2018). As argued by Vasi et al. (2019), order fulfillment in terms of product quality, product price, and delivery services is an important determinant of customer satisfaction for manufacturers. Then, manufacturing enterprises with adequate cash flow are more likely to experience market expansion, thus resulting in better sales and workforce recovery. In sum, we posit that online sales have an inverted U-shaped impact on cash flow adequacy, while cash flow adequacy should be positively related to sales and workforce recovery. Therefore, we propose:

H2a: Cash flow adequacy mediates the relationship between online sales and workforce recovery.

H2b: Cash flow adequacy mediates the relationship between online sales and sales recovery.

### The Moderating Role of Firm Size

Firm size has been widely identified as a context factor in the field of business management. A long line of research articulates firm size as a standard to capture the abundance of enterprise resources (Cao & Zhang, 2011; Rahayu & Day, 2015). In the present context, we view firm size as a collection of production resources. For online sales to succeed, manufacturing enterprises should enjoy a comparative advantage in resource endowment regarding labor, capital, and even technology, which is difficult for SMEs. For instance, Lun and Quaddus (2011) find that large enterprises are more likely to adopt e-commerce activities at a higher level of sophistication. Falk and Hagsten (2015) also indicate that SMEs usually do not utilize advanced ICT systems despite having access to high-level infrastructure. According to this line of reasoning, large enterprises are better suited than SMEs to adopt online sales and to realize value from them. Thus, large enterprises can more fully exert the influence of online sales, such as the influence on sales growth that is closely related to cash flow adequacy. Meanwhile, taking into account the importance of prices in online sales, large enterprises are more capable of online discount sales, thus enjoying a greater impact of online sales on cash flow adequacy.

Moreover, given the complementary relationship between online sales and offline stores, large enterprises usually enjoy more offline stores that serve product sales, which can bring customers a full product experience and satisfactory after-sales service (Eid & El-Gohary, 2013). This will result in lower product returns, thus improving cash flow

adequacy. Conversely, due to the lack of prior examination of physical products before purchase, if there are not enough offline stores, it is difficult for SMEs to dispel customers' distrust of online sales (Lun & Quaddus, 2011; Li *et al.,* 2020). To make matters worse, since customers cannot get a satisfactory product experience from online sales, this will burden SMEs with costs of product returns. In addition, for customers choosing their manufacturers, they value the reputation of the manufacturer and the ability to deliver orders, especially for customers who lack sufficient trust in online sales (Xia & Zhang, 2010). In this regard, large enterprises not only enjoy a higher corporate reputation but also can get more online orders by virtue of production and delivery advantage, thereby improving cash flow adequacy. As a result, for large enterprises, the online sales-cash flow adequacy relationship will be stronger. Therefore, we propose that firm size moderates the relationship between online sales and cash flow adequacy. Combined with the role of cash flow adequacy in mediating the relationship between online sales and sales and workforce recovery (H2a and b), we thus state hypotheses that:

H3a: The indirect effect of online sales on workforce recovery, through cash flow adequacy, is moderated by firm size, such that the indirect effect is stronger for large enterprises than for SMEs.

H3b: The indirect effect of online sales on sales recovery, through cash flow adequacy, is moderated by firm size, such that the indirect effect is stronger for large enterprises than for SMEs.

In summary, we propose that online sales influence sales and workforce recovery (see Figure 1). Specifically, we examine the relationships among online sales, cash flow adequacy, firm size, workforce recovery, and sales recovery in the context of COVID-19. To better understand the impact of online sales on recovery, we propose a non-linear relationship between online sales and recovery. Subsequently, we hypothesize a mediating role of cash flow adequacy in linking online sales to recovery. Finally, we propose a moderating role of firm size on the direct impact of online sales on sales and workforce recovery through cash flow adequacy.
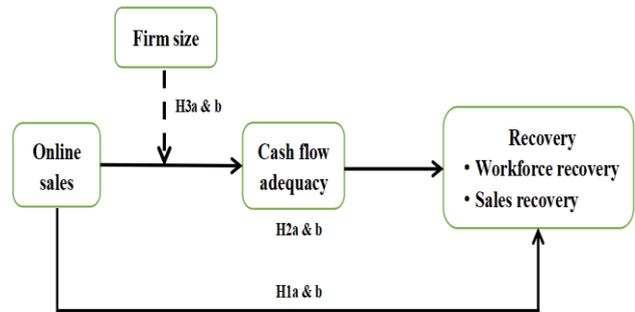


**Figure 1.** Conceptual Framework

**Research Methodology**

*Data Resource*

The data used in this study comes from the 2020 Enterprises Surveys database maintained by the World Bank Group, which involves the impact of the COVID-19

Table 1

**Survey Question Description of the Variables**

| Variable | Survey question description |
|---|---|
| Workforce recovery | In how many months is it expected that the size of this establishment's workforce will get back to normal? |
| Sales recovery | In how many months is it expected that this establishment's sales will get back to normal? |
| Online sales | Current what is the share of this establishment's online sales out of total sales? |
| Cash flow adequacy | Keeping the cost structure as it is now, how many weeks would this establishment be able to remain open if its sales stopped as of today? |
| Firm size | How many permanent, full-time employees did this establishment have? |
| Domestic sales | What percentage of this establishment's national sales were? |
| Production adjustment | Has this establishment adjusted or converted, partially or fully, its production or the services it offers in response to the COVID-19 outbreak? |
| Government support | Has this establishment received any national or local government support in response to the COVID-19 crisis? |

Table 2

**Descriptive Statistics and Correlations**

| | Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Workforce recovery | 1.000 | | | | | | | |
| 2 | Sales recovery | 0.366* | 1.000 | | | | | | |
| 3 | Online sales | 0.010 | 0.006 | 1.000 | | | | | |
| 4 | Cash flow adequacy | 0.104* | 0.077* | 0.058* | 1.000 | | | | |
| 5 | Firm size | 0.092* | 0.177* | 0.052* | 0.171* | 1.000 | | | |
| 6 | Domestic sales | 0.034 | -0.025 | 0.023 | -0.122* | -0.315* | 1.000 | | |
| 7 | Production adjustment | -0.026 | -0.037 | 0.244* | 0.057* | 0.052* | 0.025 | 1.000 | |
| 8 | Government support | 0.003 | -0.121* | 0.003 | 0.095* | 0.028 | -0.083* | 0.044 | 1.000 |
| Mean | | -0.451 | -1.321 | 0.966 | 1.831 | 3.549 | 83.752 | 0.363 | 0.225 |
| Standard Deviation | | 0.809 | 0.902 | 1.471 | 0.781 | 1.419 | 29.006 | 0.481 | 0.418 |

*[Sample size=2714. * p<0.01]*

### *Correcting For Self-Selection Bias*

It is important to consider that manufacturing enterprises may self-select whether to adopt online sales. Therefore, ignoring this self-selection issue may bias estimations in investigating the impact of online sales on recovery. That is, manufacturing enterprises with online sales may have enjoyed some underlying resources or capabilities, which can better recover from COVID-19. In such a case, examining the effect of online sales versus non-online sales choice in a single-equation context may introduce the self-selection bias into our estimation.

To this end, we employed treatment effect analysis to test the impact of online sales on recovery following the methodology in Ding (2015). Concretely, in the first step, we coded the observations with online sales in our sample as 1 and those observations with no online sales as 0. We estimated a Probit model by regressing the dummy variable of online sales choice on the sales change rate and country dummy variables (Hartmann & Lussier, 2020; Sila, 2013). Based on the Probit model, we estimated the probability of each sample observation, named inverse-Mill's ratio. In the second step, we used the inverse-Mill's ratio as an additional control variable in our models to correct for self-selection bias.

### Analyses and Results

### *Testing Direct Effects and Mediating Effects*

A series of regression analyses (see Table 3) were performed to investigate the proposed relationships among online sales, cash flow adequacy, and recovery. Concretely, multiple regression analysis was used to examine the direct effect of online sales on workforce recovery (Model 1) and sales recovery (Model 2). As shown in Model 1 (Table 3), online sales have a positive effect on workforce recovery ($\beta$=0.416, p<0.01), while the effect of the quadratic term of online sales is negative and significant ($\beta$=-0.073, p<0.01), indicating an inverted U-shaped relationship between online

sales and workforce recovery. Thus, Hypothesis 1a was supported. For Hypothesis 1b, we posit a curvilinear effect of online sales on sales recovery. As we show with Model 2, online sales relate positively to sales recovery ($\beta$=1.179, p<0.01), while the quadratic term of online sales negatively affects sales recovery ($\beta$=-0.200, p<0.01). That is, an inverted U-shaped relationship exists between online sales and sales recovery, in support of Hypothesis 1b.

Next, mirroring Zhu et al. (2020), we further test the mediating effect of cash flow adequacy by the following rules. Based on the significant impact of online sales on workforce recovery (Model 1) and sales recovery (Model 2), two conditions for mediation are necessary (Edwards & Lambert, 2007). The first condition for mediation is that the independent variable should directly affect the mediating variable. The second condition is that the mediator must affect the dependent variable. Then, we firstly regressed the online sales against the mediator, cash flow adequacy in Model 3. The results indicate that the effect of the quadratic term of online sales is significantly negative ($\beta$=-0.073, p<0.01). This suggests an inverted U-shaped relationship between online sales and cash flow adequacy. Second, we regressed both online sales and cash flow adequacy against workforce recovery (Model 4) and sales recovery (Model 5). Results suggest that the positive effect of cash flow adequacy both significantly exist ($\beta$=0.109, p<0.01; $\beta$=0.106, p<0.01). Meanwhile, the effect of the quadratic term of online sales remains significant and negative ($\beta$=-0.065, p<0.01; $\beta$=-0.192, p<0.01). By contrast, the magnitude (in absolute value) of the effect for the quadratic term of online sales in Model 1 (-0.073) is larger than that in Model 4 (-0.065), indicating a partial mediating effect of cash flow adequacy on the inverted U-shaped relationship between online sales and workforce recovery. Similarly, the magnitude in absolute value also becomes smaller. That is, cash flow adequacy partially mediates the relationship between online sales and sales recovery. Therefore, Hypothesis 2a and Hypothesis 2b were supported.

Table 3

**Results of Mediation Analysis**

| Variables | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 |
|---|---|---|---|---|---|
| | Workforce recovery | Sales recovery | Cash flow adequacy | Workforce recovery | Sales recovery |
| *Controls* | | | | | |
| Domestic sales | 0.001 | -0.001** | -0.003*** | 0.001* | -0.001* |
| | (1.368) | (-2.202) | (-5.107) | (1.900) | (-1.745) |
| Production adjustment | -0.054* | -0.090** | 0.074** | -0.062* | -0.097*** |
| | (-1.662) | (-2.442) | (2.386) | (-1.918) | (-2.662) |
| Government support | -0.084** | -0.367*** | -0.003 | -0.084** | -0.366*** |
| | (-2.117) | (-8.185) | (-0.087) | (-2.119) | (-8.208) |
| Inverse mill's ratio | -0.375*** | -0.972*** | -0.332*** | -0.339*** | -0.937*** |
| | (-4.201) | (-9.647) | (-3.910) | (-3.804) | (-9.308) |
| *Direct effect* | | | | | |
| Online sales$^2$ (OS$^2$) | -0.073*** | -0.200*** | -0.073*** | -0.065*** | -0.192*** |
| | (-3.524) | (-8.541) | (-3.713) | (-3.147) | (-8.221) |
| Online sales (OS) | 0.416*** | 1.179*** | 0.451*** | 0.367*** | 1.131*** |
| | (3.647) | (9.150) | (4.154) | (3.222) | (8.785) |
| *Mediator* | | | | | |
| Cash flow adequacy | | | | 0.109*** | 0.106*** |

| Variables | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 |
|---|---|---|---|---|---|
| | Workforce recovery | Sales recovery | Cash flow adequacy | Workforce recovery | Sales recovery |
| | | | | (5.408) | (4.629) |
| Constants | -0.660*** | -1.644*** | 1.801*** | -0.856*** | -1.834*** |
| | (-9.044) | (-19.944) | (25.929) | (-10.550) | (-19.974) |
| Country fixed effects | Yes | Yes | Yes | Yes | Yes |
| $R^2$ | 0.149 | 0.126 | 0.171 | 0.158 | 0.133 |

*[\*\*\*p<0.01, \*\*p<0.05, \*p<0.1. t statistics in parentheses]*

### Testing Moderated Mediating Effects

Regarding Hypotheses 3a and 3b, we predicted that firm size negatively moderates the indirect effect of online sales on sales and workforce recovery through cash flow adequacy, such that the indirect effect on large enterprises is stronger than that on SMEs. To test the hypothesized moderated mediation model, we employed a three-step regression and examined the interaction effect between online sales and firm size. Table 4 summarizes the regression results. Concretely, the results in Model 8 indicate that the second-order interaction between online sales and firm size is negative and significant ($\beta$=-0.027, p<0.01), whereas the effect of the cash flow adequacy in Model 7 is positive and significant ($\beta$=0.108, p<0.01). Meanwhile, the effect of the quadratic term of online sales in Model 6 is significantly negative ($\beta$=-0.090, p<0.01). However, the second-order interaction between online sales

and firm size in Model 6 is positive, but not significant ($\beta$=0.006, p>0.1). According to the methodology in Kollmann, Stöckmann, & Linstaedt (2019), these results indicate that firm size only moderates the effect of online sales on cash flow adequacy. Combined with the role of cash flow adequacy in mediating the relationship between online sales and workforce recovery, we conclude that firm size moderates the mediating effect of cash flow adequacy on the relationship between online sales and workforce recovery. Thus, we find support for Hypothesis 3a. Similarly, the results in Model 10 indicated that cash flow adequacy can positively impact sales recovery ($\beta$=0.118, p<0.01), whereas the second-order interaction between online sales and firm size is also not significant ($\beta$=-0.007, p>0.1). That is, firm size moderates the indirect effect of online sales on sales recovery through cash flow adequacy. Thus, Hypotheses 3b was supported.

Table 4

**Results of Moderated Mediation Analysis**

| Variables | Model 6 | Model 7 | Model 8 | Model 9 | Model 10 |
|---|---|---|---|---|---|
| | Workforce recovery | Workforce recovery | Cash flow adequacy | Sales recovery | Sales recovery |
| *Controls* | | | | | |
| Domestic sales | 0.001** | 0.002*** | -0.002*** | 0.001 | 0.001 |
| | (2.359) | (2.643) | (-2.850) | (0.390) | (0.554) |
| Production adjustment | -0.056* | -0.064** | 0.070** | -0.095*** | -0.101*** |
| | (-1.736) | (-1.967) | (2.276) | (-2.624) | (-2.790) |
| Policy support | -0.086** | -0.086** | -0.002 | -0.369*** | -0.368*** |
| | (-2.184) | (-2.187) | (-0.051) | (-8.328) | (-8.326) |
| Inverse mill's ratio | -0.356*** | -0.323*** | -0.322*** | -0.929*** | -0.903*** |
| | (-3.967) | (-3.599) | (-3.807) | (-9.240) | (-8.981) |
| *Direct effect* | | | | | |
| Online sales$^2$ (OS$^2$) | -0.090*** | -0.093*** | 0.036 | -0.152*** | -0.155*** |
| | (-2.743) | (-2.867) | (1.164) | (-4.166) | (-4.234) |
| Online sales (OS) | 0.515*** | 0.510*** | 0.046 | 1.002*** | 0.994*** |
| | (3.511) | (3.490) | (0.332) | (6.103) | (6.064) |
| *Mediator* | | | | | |
| Cash flow adequacy | | 0.108** | | | 0.118** |
| (CFA) | | (2.235) | | | (2.178) |
| *Moderator* | | | | | |
| Firm size (SIZE) | 0.050*** | 0.045* | 0.066*** | 0.103*** | 0.117*** |
| | (3.717) | (1.725) | (5.201) | (6.871) | (4.018) |
| *Interaction* | | | | | |
| OS$^2$×SIZE | 0.006 | 0.009 | -0.027*** | -0.007 | -0.006 |
| | (0.814) | (1.184) | (-3.788) | (-0.879) | (-0.653) |
| OS×SIZE | -0.035 | -0.045* | 0.097*** | 0.022 | 0.016 |
| | (-1.289) | (-1.655) | (3.772) | (0.717) | (0.512) |
| CFA×SIZE | | -0.001 | | | -0.011 |

| Variables | Model 6 | Model 7 | Model 8 | Model 9 | Model 10 |
|---|---|---|---|---|---|
| | Workforce recovery | Workforce recovery | Cash flow adequacy | Sales recovery | Sales recovery |
| | | (-0.085) | | | (-0.777) |
| Constants | -0.872*** | -1.033*** | 1.487*** | -2.108*** | -2.293*** |
| | (-9.403) | (-8.372) | (17.018) | (-20.328) | (-16.567) |
| Country fixed effects | YES | YES | YES | YES | YES |
| $R^2$ | 0.153 | 0.161 | 0.193 | 0.147 | 0.151 |

*[\*\*\*p<0.01, \*\*p<0.05, \*p<0.1. t statistics in parentheses]*

To gain more insight into the role of firm size in moderating the relationship between online sales and cash flow adequacy, we plotted simple slopes (Figure 2) at one standard deviation above and below the mean for the firm size. As shown in Figure 2, the cash flow adequacy gains from online sales increase more rapidly at high levels of firm size. That is, online sales have a stronger inverted U-shaped effect on cash flow adequacy for large enterprises.
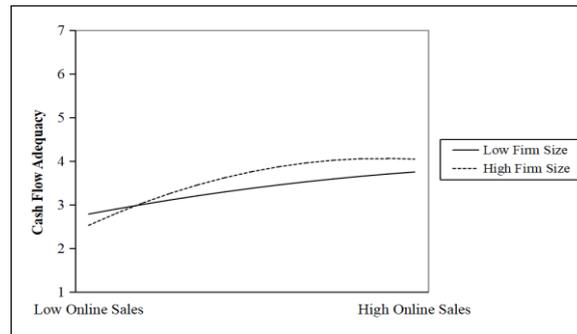


**Figure 2.** The Moderating Effect of Firm Size on Online Sales-Cash Flow Adequacy Links

### *Robustness Checks*

To strengthen and support our hypotheses, we vetted three separate checks to ensure the robustness of the results. We repeat the mediation models (Model 1 to 5) and moderated mediation models (Model 6 to 10) of our regression analysis. The corresponding results support our previous findings and are presented in Tables 5 to 7.

First, we examine whether our results are affected by countries with smaller sample sizes. It is argued that a certain type of sample that is too small may affect the validity of the fixed effect estimation results (Kezdi, 2004). To alleviate this concern, we check the robustness of our results by removing countries with a sample size of less than 50. Results in Table 5 suggest that the signs and statistical significance of main variables and interactions remain unchanged.

The purpose of the second robustness check is to minimize concerns that our results are susceptible to estimation bias caused by outliers. We further winsorized all variables at 2.5th and 97.5th percentile, which is a widely used approach to deal with outliers in empirical management research. Results of mediation and moderated mediation analysis are reported in Table 6. Concluding, the results increase our confidence in the robustness of our results.

Finally, we further conduct an additional robustness test to rule out problems caused by different periods of the questionnaire survey. In our study, the survey period lasted from May to September. Taking into account that differences in survey months may affect the estimation results, we added the month fixed effects to the estimation model to alleviate this problem. Results in Table 7 show that the signs and statistical significance of the main variables remain unchanged.

Table 5

**Robustness Check Results of Alternative Country Samples**

| Variables | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 | Model 8 | Model 9 | Model 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| | WR | SR | CFA | WR | SR | WR | WR | CFA | SR | SR |
| *Direct effect* | | | | | | | | | | |
| Online sales$^2$ (OS$^2$) | -0.054** | -0.166*** | -0.070*** | -0.047** | -0.158*** | -0.069** | -0.072** | 0.034 | -0.123*** | -0.125*** |
| | (-2.565) | (-6.809) | (-3.387) | (-2.228) | (-6.510) | (-2.090) | (-2.200) | (1.075) | (-3.290) | (-3.347) |
| Online sales (OS) | 0.313*** | 0.969*** | 0.427*** | 0.268** | 0.923*** | 0.409*** | 0.405*** | 0.038 | 0.808*** | 0.800*** |
| | (2.680) | (7.223) | (3.762) | (2.304) | (6.887) | (2.741) | (2.723) | (0.266) | (4.764) | (4.724) |
| *Mediator* | | | | | | | | | | |
| Cash flow adequacy | | | | 0.104*** | 0.109*** | | 0.102** | | | 0.129** |
| (CFA) | | | | (5.178) | (4.680) | | (2.090) | | | (2.323) |
| *Moderator* | | | | | | | | | | |
| Firm size (SIZE) | | | | | | 0.049*** | 0.044* | 0.067*** | 0.104*** | 0.123*** |

| Variables | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 | Model 8 | Model 9 | Model 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| | WR | SR | CFA | WR | SR | WR | WR | CFA | SR | SR |
| | | | | | | (3.619) | (1.662) | (5.176) | (6.762) | (4.101) |
| *Interaction* | | | | | | | | | | |
| OS²×SIZE | | | | | | 0.005 | 0.008 | -0.025*** | -0.006 | -0.004 |
| | | | | | | (0.688) | (1.022) | (-3.514) | (-0.715) | (-0.514) |
| OS×SIZE | | | | | | -0.032 | -0.041 | 0.093*** | 0.019 | 0.014 |
| | | | | | | (-1.170) | (-1.503) | (3.544) | (0.612) | (0.432) |
| CFA×SIZE | | | | | | | -0.001 | | | -0.013 |
| | | | | | | | (-0.056) | | | (-0.933) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Country fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| $R^2$ | 0.137 | 0.118 | 0.169 | 0.146 | 0.125 | 0.141 | 0.149 | 0.190 | 0.140 | 0.144 |

*[***$p<0.01$, **$p<0.05$, *$p<0.1$. t statistics in parentheses. WR denotes workforce recovery; SR denotes sales recovery; CFA denotes cash flow adequacy. Due to space limitations, the control variables (Controls) are not listed one by one]*

Table 6

**Robustness Check Results of Winsorizing Outliers**

| Variables | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 | Model 8 | Model 9 | Model 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| | WR | SR | CFA | WR | SR | WR | WR | CFA | SR | SR |
| *Direct effect* | | | | | | | | | | |
| Online sales² (OS²) | -0.095*** | -0.253*** | -0.053** | -0.089*** | -0.247*** | -0.105** | -0.111*** | 0.057 | -0.209*** | -0.213*** |
| | (-3.695) | (-8.808) | (-2.387) | (-3.474) | (-8.631) | (-2.509) | (-2.662) | (1.561) | (-4.482) | (-4.574) |
| Online sales (OS) | 0.500*** | 1.383*** | 0.327*** | 0.464*** | 1.349*** | 0.589*** | 0.595*** | -0.057 | 1.223*** | 1.222*** |
| | (3.776) | (9.321) | (2.831) | (3.510) | (9.104) | (3.392) | (3.441) | (-0.378) | (6.348) | (6.354) |
| *Mediator* | | | | | | | | | | |
| Cash flow adequacy | | | | 0.112*** | 0.105*** | | 0.101* | | | 0.160*** |
| (CFA) | | | | (4.981) | (4.142) | | (1.829) | | | (2.611) |
| *Moderator* | | | | | | | | | | |
| Firm size (SIZE) | | | | | | 0.051*** | 0.042 | 0.062*** | 0.102*** | 0.139*** |
| | | | | | | (3.736) | (1.443) | (5.243) | (6.800) | (4.345) |
| *Interaction* | | | | | | | | | | |
| OS²×SIZE | | | | | | 0.004 | 0.007 | -0.026*** | -0.006 | -0.004 |
| | | | | | | (0.457) | (0.757) | (-3.233) | (-0.567) | (-0.401) |
| OS×SIZE | | | | | | -0.032 | -0.041 | 0.089*** | 0.015 | 0.010 |
| | | | | | | (-0.993) | (-1.292) | (3.187) | (0.415) | (0.289) |
| CFA×SIZE | | | | | | | 0.002 | | | -0.024 |
| | | | | | | | (0.104) | | | (-1.468) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Country fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| $R^2$ | 0.155 | 0.130 | 0.155 | 0.163 | 0.136 | 0.159 | 0.167 | 0.175 | 0.151 | 0.155 |

*[***$p<0.01$, **$p<0.05$, *$p<0.1$. t statistics in parentheses. WR denotes workforce recovery; SR denotes sales recovery; CFA denotes cash flow adequacy. Due to space limitations, the control variables (Controls) are not listed one by one]*

Table 7

**Robustness Check Results of Adding Month Fixed Effects**

| Variables | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 | Model 8 | Model 9 | Model 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| | WR | SR | CFA | WR | SR | WR | WR | CFA | SR | SR |
| *Direct effect* | | | | | | | | | | |
| Online sales² (OS²) | -0.070*** | -0.200*** | -0.069*** | -0.063*** | -0.193*** | -0.086*** | -0.090*** | 0.041 | -0.153*** | -0.156*** |
| | (-3.372) | (-8.543) | (-3.502) | (-3.034) | (-8.240) | (-2.641) | (-2.772) | (1.318) | (-4.189) | (-4.270) |
| Online sales (OS) | 0.397*** | 1.182*** | 0.425*** | 0.353*** | 1.136*** | 0.496*** | 0.494*** | 0.018 | 1.008*** | 1.003*** |
| | (3.479) | (9.152) | (3.920) | (3.098) | (8.807) | (3.379) | (3.374) | (0.130) | (6.129) | (6.104) |
| *Mediator* | | | | | | | | | | |
| Cash flow adequacy | | | | 0.104*** | 0.108*** | | 0.105** | | | 0.120** |
| (CFA) | | | | (5.129) | (4.693) | | (2.176) | | | (2.203) |
| *Moderator* | | | | | | | | | | |
| Firm size (SIZE) | | | | | | 0.047*** | 0.044* | 0.063*** | 0.104*** | 0.117*** |

| Variables | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 | Model 8 | Model 9 | Model 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| | WR | SR | CFA | WR | SR | WR | WR | CFA | SR | SR |
| | | | | | | (3.518) | (1.683) | (4.964) | (6.883) | (4.014) |
| *Interaction* | | | | | | | | | | |
| OS²×SIZE | | | | | | 0.006 | 0.009 | -0.027*** | -0.007 | -0.005 |
| | | | | | | (0.780) | (1.136) | (-3.843) | (-0.871) | (-0.633) |
| OS×SIZE | | | | | | -0.034 | -0.044 | 0.099*** | 0.022 | 0.015 |
| | | | | | | (-1.251) | (-1.602) | (3.844) | (0.704) | (0.485) |
| CFA×SIZE | | | | | | | -0.002 | | | -0.010 |
| | | | | | | | (-0.125) | | | (-0.754) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Country fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| R² | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| | 0.155 | 0.130 | 0.155 | 0.163 | 0.136 | 0.159 | 0.167 | 0.175 | 0.151 | 0.155 |

*[\*\*\*p<0.01, \*\*p<0.05, \*p<0.1. t statistics in parentheses. WR denotes workforce recovery; SR denotes sales recovery; CFA denotes cash flow adequacy. Due to space limitations, the control variables (Controls) are not listed one by one]*

### Discussion and Conclusions

This study empirically explores how online sales affect sales and workforce recovery during the COVID-19 pandemic. Based on a survey of manufacturing enterprises in 24 countries, the mediating effect of cash flow adequacy and the moderating effect of firm size on the relationship between online sales and recovery are proposed and demonstrated. In this section, we discuss the theoretical contribution and managerial implications of these findings.

### *Theoretical Contributions*

This research makes several major contributions to the existing literature. First, drawing on the literature of e-commerce-performance relationship, we propose and empirically examine the effects of online sales on recovery from COVID-19, thus providing a new perspective on recovery as complementary to the existing literature. We provide evidence to show that online sales exert an inverted U-shaped impact on sales and workforce recovery. That is, online sales have a positive effect on recovery; however, after reaching a threshold, this effect declines. This finding partially agrees with the argument that e-commerce activities contribute to sales growth (Hernant & Rosengren, 2017; Pauwels & Neslin, 2015) and job creation (Terzi, 2011). However, over-reliance on online sales can be counterproductive. The negative impact of online sales on recovery provides evidence for the crowding-out effecting of e-commerce on sales (Duch-Brown *et al.,* 2017) and the substitution effect on employment (Biagi & Falk, 2017). That is, the impact of e-commerce on performance may gradually decrease. Therefore, this study may provide a plausible explanation for the mixed results of the e-commerce-performance relationship. In addition, the inverted U-shaped impact may also provide evidence for the view that online sales and offline sales are complementary (Xia & Zhang, 2010). This explains why companies that initially only relied on online sales chose to increase brick-and-mortar retail, such as Dell.

Second, we indicate that cash flow adequacy mediates the impact of online sales on both workforce recovery and sales recovery. This is a significant contribution in that it helps explain how online sales impact sales and workforce recovery and thus contribute to theory development. Concretely, previous studies mainly focus on the positive impact of e-commerce on financial performance (Hua et al., 2015). This study extends the literature by demonstrating the inverted U-shaped relationship between online sales and cash flow adequacy. That is, increasing online sales can improve cash flow adequacy. However, the increased online sales may not always be positively related to cash flow adequacy. There may be a trading-off between online sales and cash flow adequacy. This once again provides evidence for the diminishing impact of e-commerce on performance. Meanwhile, cash flow adequacy was found to partially mediate the online sales-recovery relationship. In other words, when manufacturing enterprises take part in online sales during COVID-19, improvements in workforce recovery and sales recovery can be achieved, both independently of, and indirectly through, cash flow adequacy. This study is consistent with Wiatt et al. (2020), who found that cash flow is critical to business recovery. Further, this also echoes the view that cash flow is king during challenging market environments (Georgeta *et al.,* 2011).

Finally, our evaluation of the moderating effect of firm size shows that the relationship between online sales and cash flow adequacy is strengthened with an increase in firm size. This result suggests that firm size acts as a boundary condition for cash flow adequacy mediating the impact of online sales on sales and workforce recovery. These findings indicate that large enterprises can experience greater marginal benefits from online sales, but after a certain threshold, they may suffer the negative impact of online sales. However, SMEs can always enjoy positive benefits from online sales, providing guidance to manufacturing enterprises of different sizes on how to develop online sales. One possible explanation is that large enterprises tend to adopt e-commerce at a high level of sophistication (Lun & Quaddus, 2011), while the adoption of e-commerce by SMEs is far behind adoption by large enterprises (Rahayu & Day, 2015). Interestingly, our results do not support the view that online sales bring in a higher level of performance achievements to SMEs than large enterprises (Falk & Hagsten, 2015). The possible explanation is that under the impact of COVID-19, manufacturing enterprises are more concerned with cash flow adequacy than productivity gains.

### Managerial Implications

Three managerially relevant implications seem important to note. First, we have demonstrated that an inverted U-shaped relationship between online sales and recovery would enable manufacturing enterprises to improve sales and workforce recovery by increasing online sales before a certain threshold. According to the direct effects of online sales on sales and workforce recovery, we find that more than 82 percent of the samples are on the left side of the threshold (82.2 percent for workforce recovery and 82.3 percent for sales recovery). These results indicate that the impact of online sales on recovery is still dominated by positive effects, indicating that for most manufacturing enterprises, managers can boldly increase online sales to promote recovery from COVID-19. However, managers should also pay attention to the combination of online and offline sales channels and not rely too much on a single sales channel.

Second, empirical results indicate that cash flow adequacy partially mediates the relationship between online sales and recovery. Managers should be aware of increasing cash flow adequacy as an important way to improve sales and workforce recovery. Moreover, this study provides empirical evidence on the inverted U-shaped relationship between online sales and cash flow adequacy. That is, managers can improve cash flow adequacy by increasing online sales. However, managers should avoid two pitfalls. The first is pursuing overly high online sales. Results suggest that over-reliance on online sales does not necessarily result in more cash flow adequacy than a mediocre one. The second pitfall is to overemphasize the role of cash flow adequacy in improving recovery, while ignoring the potential impact of other factors. As we all know that cash flow is scarce during the COVID-19 pandemic. Thus, while trying to promote recovery by increasing cash flow adequacy, managers should also pay attention to online sales.

Finally, our findings show to managers that the firm size influences how much online sales affect recovery through cash flow adequacy. State differently, managers should recognize how the importance of online sales changes with firm size. That is, although large enterprises benefit more from online sales before a certain threshold, SMEs can always enjoy positive benefits from online sales. In this case, this would seem prudent for managers of large enterprises to recognize that online sales can help recover from COVID-19, while over-reliance on online sales may undermine the recovery. Then, managers of large enterprises should take part in online sales appropriately. However, as a low-cost sales channel, managers of SMEs should actively develop online sales in order to quickly recover from COVID-19.

### Limitations and Future Research

The findings above should be considered in light of inherent limitations associated with any single study. Such limitations also provide interesting avenues for future research. First, this study only examined the mediating effect of cash flow adequacy on the online sales-recovery relationship. Other mechanisms, such as productivity and supply chain relationships, were not incorporated into our model. Future studies may consider these mediators to develop a more comprehensive framework in the online sales-recovery relationship. Second, this research only considers firm size as the moderator for investigation. Future research may identify other moderators relevant to the studied context, like environmental uncertainty or ownership structure, and examine their moderating effects on the relationship among online sales, cash flow adequacy, and recovery. Finally, this analysis derives results from its cross-sectional, survey based perceptual data. Since the respondents' perceptions of the cash flow adequacy and recovery are likely conditioned by their expectations which may vary over time, the accuracy of responses might be affected. Additionally, longitudinal data can help unearth causal inter-relationships better. Exploring these issues longitudinally would correct inaccurate expectations and provide additional insights into the underlying model proposed. Future research can explore how online sales affect recovery over time based on panel data.

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