Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.
Access to an educated workforce and the performance of private firms during the COVID-19 pandemic

Omar Farooq*, Mukhammadfoik Bakhadirov

ADA University, Baku AZ1008, Azerbaijan

Received 5 July 2022; revised 19 August 2022; accepted 20 August 2022
Available online 28 August 2022

Abstract

This paper uses data on private firms in 24 developing countries to show that, during the COVID-19 pandemic, firms with greater obstacles in accessing an educated workforce have lower performance than other firms. The findings are robust to the comprehensive inclusion of relevant control variables and to a number of sensitivity tests. For instance, the paper shows that the alternate measures of performance (capacity utilization, layoffs, cash flows, and ability to meet obligations) are also negatively affected by a firm's inability to access educated workforce. We argue that the impact of an educated workforce on performance is through higher productivity, lower costs, increased innovation, and efficient decision making. Our findings also show that firms with greater obstacles in accessing educated workforce did not use the government support programs efficiently during the COVID-19 pandemic.

Keywords: Employee skills; Performance; Pandemic; Developing countries

1. Introduction

The outbreak of COVID-19 pandemic severely affected the world economy and led to one of the worst global recessions since 1930 (Shen et al., 2020).1 In response to ensuing COVID-19 pandemic, governments imposed widespread restrictions, such as closing physical stores, curbing population mobility, and implementing lockdowns in an attempt to flatten the sudden peak in infection (Michie, 2020). Consequently, economic activity severely declined around the world. Because of the reduced or delayed demand for their products and services, most businesses faced a sharp decline in their revenue streams. In particular, businesses that require physical contact with customers experienced unrecoverable losses (Giritli & Olofsson, 2020). The restrictions imposed by governments also depressed production levels and led to severe job losses and bankruptcies (Bofinger et al., 2020; Carnap et al., 2020; Shen et al., 2020). In response to increased uncertainty, firms re-examined their operations and business models (Donthu & Gustafsson, 2020). The COVID-19 pandemic forced firms to change their mode of operations and introduce resilient business models to cope with the economic challenges (Ivanov, 2020). In this process, firms attempted to identify the optimal methods and key factors to ensure a rapid response to business disruptions and continuity of their operations.

This paper extends the prior literature by highlighting the impact of access to an educated workforce on the performance of small and medium sized enterprises (SMEs) in developing countries during the COVID-19 pandemic.2 We argue that the

---

1 The COVID-19 (SARS-CoV-2) is a contagious disease that may cause acute respiratory distress syndrome (ARDS). It spread when infected person is in proximity with people.

2 We focus on the SMEs because these firms have more financial constraints relative to large firms and may not have enough resources to cope with the challenging environment posed by the pandemic (Cao & Leung, 2020). Therefore, they are also more likely to experience the adverse impact of pandemic.
quality of a workforce has a significant impact on the performance of SMEs for several reasons. First, SMEs with access to a high quality workforce are more likely to have an ability not only to implement efficient strategies, but also to engage in effective decision-making (Mithas & Krishnan, 2008; Rehman, 2015). Second, these firms are more likely to encourage innovation and adopt new technology (Glaeser & Saiz, 2003; Staiger & Skinner, 2005). That is, a high quality workforce enjoys a comparative advantage with respect to learning and implementing new technologies. Third, SMEs with an educated workforce can better develop new ways of doing business because they are more capable of generating new ideas and introducing new business practices (Bartel & Lichtenberg, 1987). Consequently, access to a high quality workforce should lead to long-term sustainable performance by increasing productivity, lowering costs, and improving profitability (Healy et al., 2015; Mahy et al., 2015; Mertzanis & Said, 2019).

In this paper, we hypothesize that the importance of access to an educated workforce increases significantly during periods of uncertainty, such as the COVID-19 pandemic. Our hypothesis is based on the assumption that firms with access to an educated workforce find it easier to adopt new methods of running business operations, such as adopting internet-based solutions more rapidly to counteract the physical restrictions. Therefore, these firms should be less vulnerable to the adverse impacts of the COVID-19 pandemic. We argue that the COVID-19 pandemic exposed firms to an environment that was unique and new to them. They did not have enough historic evidence to prepare them for such a situation. Under such novel conditions, firms must turn to mechanisms that they have never used before. The transition from old to new ways of doing business results in job tasks and operating procedures that are not only different but, in the short run, less well-defined (Bartel & Lichtenberg, 1987). We argue that an educated workforce is more likely to succeed in executing this transition. Prior literature also argues that “education enhances one’s ability to receive, decode, and understand information” (Bartel & Lichtenberg, 1987; Nelson & Phelps, 1966; Welch, 1970). Therefore, firms with access to educated workforce can deliver better results under such conditions.

Consistent with these arguments, we document a significant impact of workforce quality on firm performance during the pandemic. We show that firms with access to a highly educated workforce did not experience as much decline in their sales during the pandemic as other firms that did not have access to an educated workforce. Our results hold across different sub-samples based on the gross domestic product (GDP) of countries, firm size, and types of industries. We also find a positive impact of having an educated workforce on alternative measures of performance, such as cash flow and capacity utilization. We show that firms that report having an inadequately educated workforce as a problem use their capacity less and experience bigger decline in cash flows. Furthermore, we document that firms with a better educated workforce report fewer temporary layoffs and are less likely to experience delays in meeting their obligations. Finally, our additional tests examine the moderating role of different forms of government support and suggest that access to adequately educated labor increases the successful utilization of these support measures. Our findings demonstrate the multifaceted role of human resources in attempts by firms to overcome the adverse impacts of the COVID-19 pandemic on their performance.

The remainder of the paper is structured as follows: Section 2 develops our hypothesis. Section 3 describes the data and the methodology. Section 4 assesses our arguments. Section 5 and Section 6 presents additional results. The paper concludes with Section 7.

2. Hypothesis development and literature review

The quality of the workforce is considered an important determinant of the success of firms (Barro, 1991; Hewitt & Wield, 1992; Doms et al., 2010; Mertzanis & Said, 2019). Firms that attract a higher quality workforce can adopt efficient strategies, which result in long-term sustainability in a competitive market (Staiger & Skinner, 2005; Healy et al., 2015; Mahy et al., 2015). Haskel et al. (2003) document that better performing firms employ workers with higher qualifications than other firms. Bassani, Scarpetta, and Hemmings (2001) also report similar findings by reporting a positive impact of an educated workforce on productivity. They estimate that a one-year increase in the average education level increases output per capita by 6 percent. In another related study, Lynch and Black (1995) document that an extra year of education increases productivity significantly. Their estimates show an increase in of 4.9–8.5 percent for manufacturing firms and 5.9 to 12.7 percent for service firms. These studies indicate that hiring and retaining an educated workforce is the key to the long-term sustainable performance of firms.

The argument underlying this strand of literature is that an educated workforce improves the performance of firms by increasing productivity, reducing costs, and improving efficiency of decision making. Mahy et al. (2015) argue that education increases skills and enhances the ability of individuals to learn. They show that this ability to learn improves the productivity of firms. Mithas and Krishnan (2008) contend that an educated workforce contributes to the performance of firms by providing superior managerial competencies. They show that superior managerial skills translate into productivity gains. Rehman (2015) comes to a similar conclusion when he documents the insufficient competencies of an inadequately educated workforce as a significant factor in underperformance by firms. Furthermore, the skills and competencies provided by an educated workforce enable firms to combine human, physical and technological resources and lead to the creation of novel outcomes and innovative solutions that are hard to replicate (Lippman & Rumelt, 1982; Mertzanis & Said, 2019). A significant amount of prior literature documents that access to an educated workforce encourages innovation (Cohen & Levinthal, 1990; Lin, 2009; Staiger & Skinner, 2005; Doms et al., 2010). Green et al. (2003), for instance, document that competent workforce leads to the creation of sophisticated products. Albaladejo and Romijn (2001) report higher levels of
innovation by firms that hire a workforce (managers as well as staff) with higher qualification levels. This strand of literature argues that an educated workforce implements new ideas and quickly adapts to new technologies and production techniques, which enables firms to increase their profitability.

This paper argues that the impact of an educated workforce on the performance of firms increases greatly during periods of extreme uncertainty. At such times, it becomes essential to adopt innovative and new ways of doing business. Having access to an educated workforce makes it relatively easy to implement new ideas and adopt new business practices (Bartel & Lichtenberg, 1987). Krueger and Kumar (2004) argue that education reduces the probability that workers will suffer a loss in productivity due to the introduction of new technology and business practices. An educated workforce is more productive because of its better capacity and adaptability when interacting with a changing environment. Furthermore, an educated workforce is also found to have a higher ability to interpret and analyze information (Wozniak, 2006). We argue that, in times of extreme uncertainty, such as the COVID-19 pandemic, it becomes essential for firms to forecast potential changes and evaluate how to respond to these changes. An inadequately educated workforce might not be competent enough to perform this task. Therefore, it will be difficult for these firms to devise strategies and implement them successfully if something unexpected happens. Our arguments also get support from prior literature that documents the superior performance of firms that introduce and adopt new changes in times of uncertainty. Makkonen et al. (2013), for instance, show that innovative firms perform better than non-innovative firms during a crisis. They attribute the competitive advantage from innovations for these firms’ superior performance. We believe that firms with an inadequately educated workforce will find it hard to innovate. A high quality workforce that can come up with innovative mechanisms that can dampen the impact of uncertainty. The view that firms with high quality workforce may outperform other firms is based on the assumption that these firms quickly adopt new technologies (Staiger & Skinner, 2005). The COVID-19 pandemic led to the rapid adoption of various software solutions to manage daily operations remotely along with the marketing of products via the internet. We argue that these tasks are performed more efficiently with a workforce that has adequate levels of skills. These firms are more likely to adopt newer technologies, which allow them to benefit from the first mover advantage in the transition process and reduce the negative impact of the pandemic on their performance (Glaeser & Saiz, 2003; Schultz, 1975). These arguments lead us to hypothesize that “a high quality workforce allows firms to reduce the adverse impact of COVID-19 pandemic on their performance”.

3. Data and methodology

3.1. Sample

This paper uses the World Bank’s COVID-19 Follow-up Enterprise Survey along with the Enterprise Survey conducted before COVID-19 to document the relationship between the performance of firms and access to an educated workforce.3

The data cover 24 countries and was collected after the outbreak of COVID-19. Our analyses include all firms for which data on the performance of firms and access to an educated workforce are available. Our sample excludes the publicly-listed firms, firms with a legal status of “Other”, and firms for which data on their legal status are missing (Enterprise Survey Code = b1).

3.2. Methodology and the definition of variables

To test our hypothesis, we estimate various versions of the following ordinary least squares (OLS) regression equation. The estimation is based on a robust regression to control for heteroskedasticity.

\[
\text{PERFORM} = \alpha + \beta_1(\text{WORKFORCE}) + \beta_2(\text{TRAINING}) + \beta_3(\text{CERTIFICATION}) + \beta_4(\text{LOCATION}) + \beta_5(\text{INNOVATION1}) + \beta_6(\text{INNOVATION2}) + \beta_7(\text{GENDER}) + \beta_8(\text{EXPERIENCE}) + \beta_9(\text{SUBSIDIARY}) + \beta_{10}(\text{TRANSPORT}) + \beta_{11}(\text{OWNERSHIP}) + \sum_{c=1}^{N} q_c(\text{CDUM}) + \epsilon
\]

(1)

In Eq. (1), the dependent variable (PERFORM) indicates the percentage change in a firm’s sales in comparison to the sales of a firm in the same month in 2019 (Enterprise Survey Code = COVb2a, COVb2b, COVb2c). Firms with better performance should have a higher percentage change in their sales. The main independent variable (WORKFORCE) is an ordinal variable that shows the degree to which firms consider access to an educated workforce as a major obstacle in their operations. It is the response to the question: “To what degree is inadequately educated workforce an obstacle to the current operations of this establishment?” (Enterprise Survey Code = i30b). The choices for the response were: (a) No Obstacle, (b) Minor Obstacle, (c) Moderate Obstacle, (d) Major Obstacle and (e) Very Severe Obstacle. The response “No Obstacle” takes a value of 0 and that of “Very Severe Obstacle” takes a value of 4. This variable can be treated as a proxy for the quality of a workforce (Deming & Kahn, 2018; Hershbein & Kahn, 2018; Jabbouri & Farooq, 2021).

In addition, Equation (1) includes the following characteristics as control variables.

- SIZE is defined as the natural log of the total number of employees of a firm (Enterprise Survey Code = 11). We argue that, because they have greater resources, larger firms may be in a better position to protect themselves against any unforeseen risks.

---

3 We merge the two datasets by using the unique identification number provided by the Enterprise Survey (Enterprise Survey Code = idstd). The data that support the findings of this study are openly available in [World Bank Enterprise Surveys] at [www.enterprisesurveys.org].
• TRAINING is a dummy variable that takes a value of 1 for firms that provide training to their employees and 0 otherwise (Enterprise Survey Code = 110).
• CERTIFICATION is a dummy variable that takes a value of 1 for firms that possess internationally recognized quality certification and 0 otherwise (Enterprise Survey Code = b8). We argue that clients of firms with high quality products are less likely to switch their purchases to similar competing products in uncertain times. Therefore, these firms are less likely to be affected by uncertain events than other firms.
• LOCATION is a dummy variable that takes a value of 1 for firms that are located in small towns (with population less than 50,000) and 0 otherwise (Enterprise Survey Code = a3). Assuming that lockdowns are enforced more strictly in larger cities, firms in small towns might experience smaller losses during the pandemic than other firms.
• INNOVATION1 is a dummy variable that takes a value of 1 for firms that have introduced a new product/service in the past three years and 0 otherwise (Enterprise Survey Code = h1). We expect innovative firms to perform better in uncertain times.
• INNOVATION2 is a dummy variable that takes a value of 1 for firms that have introduced a new process/significantly improved process in the past three years and 0 otherwise (Enterprise Survey Code = h5). We expect innovative firms to perform better in uncertain times.
• GENDER is a dummy variable that takes a value of 1 for firms whose top manager is a female and 0 otherwise (Enterprise Survey Code = b7a).
• EXPERIENCE is defined as the number of years of experience of a top manager in the sector in which a firm operates. We expect firms with more experienced management to perform better than other firms (Enterprise Survey Code = b7).
• SUBSIDIARY is a dummy variable that takes a value of 1 for firms that are in a business group and 0 for standalone firms (Enterprise Survey Code = a7). We expect subsidiaries to perform better than standalone firms during the pandemic.
• TRANSPORT is a categorical variable that indicates whether transportation is considered an obstacle to the operations of a firm (Enterprise Survey Code = d30a). This variable takes a value between 0 and 4, with 0 indicating “no obstacle” and 4 indicating a “very severe obstacle”. We argue that problems in transportation affect the supply chain of firms and negatively affect performance.
• OWNERSHIP measures the ownership of the largest shareholder (Enterprise Survey Code = b3).
• CDUM comprises a set of country dummies to control for country-specific effects on the performance of firms. It is possible that firms headquartered in some countries are hit harder by the pandemic than others.

4. Results

4.1. Summary statistics

Table 1 reports the average values of the main variables (WORKFORCE and PERFORM) for each country. The average values of PERFORM show a considerable variation across countries. For example, on one extreme are El Salvador, Guinea, Honduras, Moldova, Jordan, Niger and Zimbabwe where firms experienced a decrease in their sales of more than 50 percent decrease during the pandemic. The other extreme comprises Hungary, Slovenia, Poland, Croatia, and Belarus where firms have experienced considerable smaller sales decline (less than 20 percent). All the countries that have been less affected are in Europe. A similar level of divergence is also observed in the average values of WORKFORCE. For instance, in countries, such as Chad, Zimbabwe, Guinea, and Belarus, firms consider an inadequately educated workforce as almost less than a minor obstacle in their business. But, in other countries, such as Greece, Guatemala, and Honduras, firms consider an inadequately educated workforce as almost a moderate obstacle in their business.

Table 2 documents the descriptive statistics for control variables used in this study. The table reports very high ownership concentration among our sample firms. The average

| Country      | Performance (Sales Decline) | Access to an educated workforce | Observations |
|--------------|-----------------------------|---------------------------------|--------------|
| Albania      | −45.7561                    | 1.4228                          | 324          |
| Belarus      | −18.2540                    | 1.0588                          | 374          |
| Bulgaria     | −24.8817                    | 1.6339                          | 448          |
| Chad         | −41.1891                    | 0.8513                          | 74           |
| Croatia      | −17.4125                    | 1.1848                          | 303          |
| Cyprus       | −35.1172                    | 1.2654                          | 162          |
| El Salvador  | −55.6746                    | 1.5413                          | 375          |
| Georgia      | −47.1585                    | 1.5827                          | 429          |
| Greece       | −29.4913                    | 2.0192                          | 519          |
| Guatemala    | −49.7771                    | 2.1204                          | 166          |
| Guinea       | −55.5068                    | 0.9863                          | 73           |
| Honduras     | −54.6216                    | 1.8783                          | 148          |
| Hungary      | −12.8016                    | 1.4325                          | 615          |
| Jordan       | −53.4436                    | 1.1171                          | 444          |
| Moldova      | −54.1673                    | 1.7322                          | 239          |
| Mongolia     | −35.6157                    | 1.3595                          | 242          |
| Morocco      | −45.0602                    | 1.7789                          | 647          |
| Nicaragua    | −41.8535                    | 1.6433                          | 157          |
| Niger        | −53.0000                    | 1.5510                          | 49           |
| Poland       | −15.5675                    | 1.6869                          | 837          |
| Russia       | −24.8673                    | 1.2156                          | 1025         |
| Slovenia     | −14.8711                    | 1.3111                          | 225          |
| Togo         | −47.0370                    | 1.5555                          | 27           |
| Zimbabwe     | −50.3915                    | 0.8893                          | 452          |

Note: The table reports the average values of the main variables (firm performance and access to an educated workforce) along with the total number of firms in each country.
The shareholding of the largest shareholder is almost 79.52 percent. The table also shows that around a third of the firms (33.46 percent) provide their employees with some sort of training, around one-fifth of the firms (22.13 percent) have internationally recognized quality certifications, and around 27.10 percent are headquartered in small towns. The average

Table 2
Descriptive statistics.

| Variables   | 25th Percentile | Median | Mean | 75th Percentile | Standard deviation | Observations |
|-------------|-----------------|--------|------|-----------------|--------------------|--------------|
| SIZE        | 2.1972          | 2.9957 | 3.1819 | 4.0430          | 1.2797             | 8292         |
| TRAINING    | 0               | 0      | 0.3346 | 1               | 0.4718             | 8301         |
| CERTIFICATION | 0              | 0      | 0.2213 | 0               | 0.4152             | 8103         |
| LOCATION    | 0               | 0      | 0.2710 | 1               | 0.4445             | 8354         |
| INNOVATION1 | 0               | 0      | 0.2849 | 1               | 0.4514             | 8292         |
| INNOVATION2 | 0               | 0      | 0.1665 | 0               | 0.3725             | 8300         |
| GENDER      | 0               | 0      | 0.1678 | 0               | 0.3906             | 8342         |
| EXPERIENCE  | 10              | 19     | 19.2557 | 26             | 10.7855            | 8056         |
| SUBSIDIARY  | 0               | 0      | 0.1501 | 0               | 0.3572             | 8339         |
| TRANSPORT   | 0               | 1      | 1.0855 | 2               | 1.2022             | 8215         |
| OWNERSHIP   | 51              | 100    | 79.5255 | 100             | 26.1404            | 8092         |

Note: The table provides the descriptive statistics for all of the control variables used in this paper. All the variables are defined in Section 3.

Table 3
Correlation matrix.

| No. | Variables       | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    |
|-----|-----------------|------|------|------|------|------|------|------|------|------|------|------|
| 1   | SIZE            | 1.0000 |      |      |      |      |      |      |      |      |      |      |
| 2   | TRAINING        | 0.2391 | 1.0000 |      |      |      |      |      |      |      |      |      |
| 3   | CERTIFICATION  | 0.3091 | 0.1474 | 1.0000 |      |      |      |      |      |      |      |      |
| 4   | LOCATION        | 0.0239 | 0.0321 | 0.1592 | 1.0000 |      |      |      |      |      |      |      |
| 5   | INNOVATION1    | 0.0993 | 0.2169 | 0.0995 | 0.0293 | 1.0000 |      |      |      |      |      |      |
| 6   | INNOVATION2    | 0.1345 | 0.2210 | 0.1080 | 0.0468 | 0.3532 | 1.0000 |      |      |      |      |      |
| 7   | GENDER         | −0.0875 | −0.0255 | −0.0589 | 0.0356 | 0.0259 | 0.0050 | 1.0000 |      |      |      |      |
| 8   | EXPERIENCE     | 0.0781 | 0.0639 | 0.1446 | 0.0885 | 0.0835 | 0.0684 | −0.0616 | 1.0000 |      |      |      |
| 9   | SUBSIDIARY     | 0.1427 | 0.0953 | 0.1146 | −0.0214 | 0.0573 | 0.0597 | −0.0171 | 0.0524 | 1.0000 |      |      |
| 10  | TRANSPORT      | 0.0424 | 0.0308 | −0.0014 | −0.1079 | 0.0002 | 0.0281 | −0.0352 | −0.0413 | 0.0544 | 1.0000 |      |
| 11  | OWNERSHIP      | −0.1550 | −0.0657 | −0.1081 | 0.0245 | −0.0413 | −0.0266 | 0.0508 | −0.0829 | −0.1179 | −0.0455 | 1.0000 |

Note: The table reports the correlation between the control variables. All the variables are defined in Section 3.

shareholding of the largest shareholder is almost 79.52 percent. The table also shows that around a third of the firms (33.46 percent) provide their employees with some sort of training, around one-fifth of the firms (22.13 percent) have internationally recognized quality certifications, and around 27.10 percent are headquartered in small towns. The average

Table 4
Access to an educated workforce and firm performance during the COVID-19 pandemic.

| Variables   | Model (1) | Model (2) | Model (3) |
|-------------|-----------|-----------|-----------|
| WORKFORCE   | −0.2255   | (−0.81)   | −0.5796   | (−2.09)   | −1.0166   | (−3.28)   |
| SIZE        |           |           | 3.4776**  | (12.95)   | 2.3480**  | (7.23)    |
| TRAINING    |           |           |           |           |           |           |
| CERTIFICATION |        |           | 4.9437**  | (4.81)    |           |           |
| LOCATION    |           |           | 1.5112    | (1.64)    |           |           |
| INNOVATION1 |           |           | 0.0572    | (0.06)    |           |           |
| INNOVATION2 |           |           | 0.1505    | (0.14)    |           |           |
| GENDER      |           |           | −2.4289** | (−2.61)   |           |           |
| EXPERIENCE  |           |           | −0.0148   | (−0.41)   |           |           |
| SUBSIDIARY  |           |           | 2.5392**  | (2.20)    |           |           |
| TRANSPORT   |           |           | 0.8663**  | (2.61)    |           |           |
| OWNERSHIP   |           |           | −0.0407***| (−2.88)   |           |           |
| Country Dummies | Yes    | Yes       | Yes       |           |           |           |
| Observations | 8354     | 8292      | 7388      |           |           |           |
| F-Value     | 91.81     | 96.83     | 64.73     |           |           |           |
| R-Square    | 0.1897    | 0.2052    | 0.2149    |           |           |           |

Note: The table reports the baseline results. The t-values based on the heteroscedasticity-robust standard errors are presented in parentheses. The outcome variable is PERFORM (changes in sales) and the key independent variable is WORKFORCE (access to educated workforce). An OLS regression is used. The symbols *, **, *** correspond to p-value < 0.1, p-value < 0.05, p-value < 0.01, respectively. All the variables are defined in Section 3.
experience of the manager is around 19 years, and more than 16 percent of the top managers are female. The table also shows that almost 28.49 percent of the firms introduced new products/services in the recent past, and around 16.65 percent introduced new processes during the same period.

The correlation between the variables is presented in Table 3. The table shows that the correlation between variables is modest and multicollinearity does not appear to be an issue in our analysis.

4.2. Effect of an educated workforce on the performance of firms

Table 4 documents the main results of our analysis. The main variable of interest in this table is WORKFORCE. As expected, we report a significantly negative coefficient estimate of WORKFORCE. Model (3), the most comprehensive model, indicates that a one-point increase in the WORKFORCE variable decreases the sales growth by 1.0166 units (assuming that the other variables in the model are held constant). This indicates that the firms that consdered access to an educated workforce a bigger problem in their business experienced a larger decline in sales during the pandemic. These results are consistent with prior literature that documents a significantly positive impact of an educated workforce and firm performance (Bassani et al., 2001; Haskel et al., 2003; Lynch & Black, 1995). We argue that the impact of an educated workforce on performance is through an increase in productivity, motivation for dividing the sample into various sub-samples is also driven by Mertzanis (2019), who argues that doing so provides a robustness check to potential measurement error in the outcome variable. Our findings are reported in Table 5. We show that our findings hold in most of the sub-samples. The only exceptions are the sub-sample of large firms and manufacturing firms, both of which have an insignificant (but negative) coefficient estimate of WORKFORCE.

### Table 4

| Variables | Size | Type of sector | Manufacturing | Service | Firm size | Country GDP | Low | Medium | High |
|-----------|------|----------------|---------------|---------|-----------|-------------|-----|--------|------|
| WORKFORCE | 1.135*** (0.54) | Large | 1.793*** (0.25) | 2.679*** (0.42) | 1.349 (0.73) | 0.882 (1.45) | 1.882 (1.11) | 2.340 (1.84) | 2.679 (1.45) |
| SIZE | 0.193 (0.24) | Medium | 0.951 (1.11) | 0.951 (0.73) | 1.132 (1.84) | 1.620 (1.45) | 1.793 (1.11) | 2.340 (1.84) | 2.679 (1.45) |
| TRAINING | 0.524 (0.29) | Large | 0.594 (0.46) | 0.594 (0.73) | 0.872 (1.45) | 1.258 (1.45) | 1.882 (1.11) | 2.340 (1.84) | 2.679 (1.45) |
| CERTIFICATION | 0.343 (0.28) | Medium | 0.343 (0.28) | 0.343 (0.28) | 0.343 (0.28) | 0.343 (0.28) | 0.343 (0.28) | 0.343 (0.28) | 0.343 (0.28) |
| LOCATION | 0.434 (0.46) | High | 0.434 (0.46) | 0.434 (0.46) | 0.434 (0.46) | 0.434 (0.46) | 0.434 (0.46) | 0.434 (0.46) | 0.434 (0.46) |
| INNOVATION1 | 0.398 (0.46) | Low | 0.398 (0.46) | 0.398 (0.46) | 0.398 (0.46) | 0.398 (0.46) | 0.398 (0.46) | 0.398 (0.46) | 0.398 (0.46) |
| INNOVATION2 | 0.454 (0.46) | Medium | 0.454 (0.46) | 0.454 (0.46) | 0.454 (0.46) | 0.454 (0.46) | 0.454 (0.46) | 0.454 (0.46) | 0.454 (0.46) |
| SUBSIDIARY | 0.369 (0.46) | High | 0.369 (0.46) | 0.369 (0.46) | 0.369 (0.46) | 0.369 (0.46) | 0.369 (0.46) | 0.369 (0.46) | 0.369 (0.46) |
| TRANSPORT | 0.369 (0.21) | High | 0.369 (0.21) | 0.369 (0.21) | 0.369 (0.21) | 0.369 (0.21) | 0.369 (0.21) | 0.369 (0.21) | 0.369 (0.21) |
| PAY | 0.304 (0.21) | Medium | 0.304 (0.21) | 0.304 (0.21) | 0.304 (0.21) | 0.304 (0.21) | 0.304 (0.21) | 0.304 (0.21) | 0.304 (0.21) |
| EXPERIENCE | 0.073 (1.33) | Low | 0.073 (1.33) | 0.073 (1.33) | 0.073 (1.33) | 0.073 (1.33) | 0.073 (1.33) | 0.073 (1.33) | 0.073 (1.33) |
| OWNERSHIP | 0.0218 (0.46) | High | 0.0218 (0.46) | 0.0218 (0.46) | 0.0218 (0.46) | 0.0218 (0.46) | 0.0218 (0.46) | 0.0218 (0.46) | 0.0218 (0.46) |
| * | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| ** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| *** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

Note: The table reports the results in different sub-samples. The symbols based on the heursically robust standard errors are presented in parentheses. The outcome variable is PERFORM (changes in sales) and the key independent variable is WORKFORCE (access to educated workforce). An OLS regression is used. The symbols * , **, *** correspond to p-value < 0.1, p-value < 0.05, p-value < 0.01, respectively. All the variables are defined in Section 3.
5. Sensitivity tests

5.1. Effect of an educated workforce on the performance of firms: different sample structures

In this section, we document the sensitivity of our results to different sample structures. For the purpose of this paper, we identify three alternate sample structures. The first alternate sample structure is based on publicly-listed firms. We re-estimate Eq. (1) for only the sample of publicly-listed firms. The findings, reported in Table 6, show that publicly-listed firms that considered access to an educated workforce as a bigger problem in their business experienced a greater decline in their sales during the pandemic. This result is consistent with the previous findings.

The second and third alternate sample structures are based on the sample size of the countries. Mertzanis (2019) argues that the data quality might be questionable for countries with a
Table 8
Access to an educated workforce and alternate indicators of performance during the COVID-19 pandemic.

| Variables          | Dependent variable = | Dependent variable = |
|--------------------|----------------------|----------------------|
|                    | increase/decrease in | capacity utilization  |
| WORKFORCE          | −0.0718*** (−2.25)   | −0.0570*** (−2.62)   |
| SIZE               | 0.1159*** (4.97)     | 3.0577*** (8.21)     |
| TRAINING           | 0.2212*** (3.58)     | 2.1184** (2.08)      |
| CERTIFICATION      | 0.2064*** (2.95)     | 1.3598 (1.18)        |
| LOCATION           | 0.1556** (2.43)      | 1.3800 (1.29)        |
| INNOVATION1        | 0.0384 (0.59)        | −1.9882* (−1.86)     |
| INNOVATION2        | −0.0809 (−1.02)      | 0.5231 (0.42)        |
| GENDER             | −0.0371 (−0.54)      | −2.1021* (−1.88)     |
| EXPERIENCE         | −0.0001 (−0.05)      | −0.0248 (−0.58)      |
| SUBSIDIARY         | 0.2564*** (3.16)     | −0.4452 (−0.33)      |
| TRANSPORT          | 0.0300 (1.27)        | 0.3417 (0.90)        |
| OWNERSHIP          | −0.0013 (−1.38)      | −0.0159 (−0.99)      |
| Country dummies    | Yes                  | Yes                  |
| Observations       | 7349                 | 3573                 |
| Wald Chi-square/F-value | 705.19              | 37.61                |
| Pseudo R-square/R-square | 0.0725             | 0.2650               |

Note: The table reports the results after replacing the dependent variable with alternate measures of performance. The z-values (in column 2) t-values (in columns 3) based on the heteroscedasticity-robust standard errors are presented in parentheses. The outcome variable is PERFORM (alternate measures of performance) and the key independent variable is WORKFORCE (access to educated workforce). An ordered logit regression (for column 2) and an OLS regression (for columns 3) are used. The symbols *, **, *** correspond to p-value < 0.1, p-value < 0.05, p-value < 0.01, respectively. All the variables are defined in Section 3.

Table 9
Access to an educated workforce and the layoffs during the COVID-19 pandemic.

| Variables          | Dependent variable = | Dependent variable = |
|--------------------|----------------------|----------------------|
|                    | permanent layoffs    | temporary layoffs    |
| WORKFORCE          | 0.0001 (0.01)        | 0.1144* (1.85)       |
| SIZE               | −0.0420*** (−5.20)   | −0.0692*** (−6.67)   |
| TRAINING           | −0.0450 (−1.08)      | 0.0109 (0.40)        |
| CERTIFICATION      | −0.0135 (−0.78)      | −0.0543** (−2.12)    |
| LOCATION           | 0.0535 (1.17)        | −0.0153 (−0.64)      |
| INNOVATION1        | 0.0552 (1.07)        | −0.0086 (−0.43)      |
| INNOVATION2        | −0.0358 (−0.83)      | −0.0202 (−1.04)      |
| GENDER             | −0.0066 (−0.15)      | 0.0112 (0.57)        |
| EXPERIENCE         | −0.0001 (−0.05)      | 0.0001 (0.02)        |
| SUBSIDIARY         | 0.0007 (0.03)        | 0.0889*** (2.20)     |
| TRANSPORT          | 0.0017 (0.13)        | −0.0091 (−1.01)      |
| OWNERSHIP          | 0.0003 (1.44)        | 0.0001 (0.17)        |
| Country dummies    | Yes                  | Yes                  |
| Observations       | 2763                 | 5339                 |
| F-value            | 6.53                 | 21.19                |
| R-square           | 0.0288               | 0.0837               |

Note: The table reports the results after replacing the dependent variable with alternate measures of performance. The t-values based on the heteroscedasticity-robust standard errors are presented in parentheses. The outcome variable is PERFORM (proportion of temporary and permanent layoffs) and the key independent variable is WORKFORCE (access to educated workforce). An OLS regression is used. The symbols *, **, *** correspond to p-value < 0.1, p-value < 0.05, p-value < 0.01, respectively. All the variables are defined in Section 3.

Table 7 documents the results of our analysis. As before, the coefficient of WORKFORCE for all estimations is significant negative.

6. Additional tests

6.1. Access to an educated workforce and alternate indicators of performance

If our arguments are true, they should also hold for alternate indicators of performance. For the purpose of this paper, we identify two alternate indicators of performance during the pandemic. These indicators are:

- The first indicator is a categorical variable that takes a value of 1 for firms that experienced a decrease in cash flows during the pandemic, 2 for firms that experienced no impact on their cash flows, and 3 for firms that experienced an increase in cash flows during the pandemic (Enterprise Survey Code = COVc1a).
- The second indicator measures capacity utilization. It indicates the output produced as a percentage of the maximum output possible if all the physical capital available is used (Enterprise Survey Code = COVe1a).

\footnote{\textsuperscript{5} For the purpose of this analysis, we define industry by ISIC (International Standard Industrial Classification) classification.}

\footnote{\textsuperscript{6} In an unreported result, we confirm that our instrument is valid instrument. For instance, while estimating Model (3), the coefficient of the instrument is 0.9072 in the first stage. It is significant at p-value < 0.01 (t-value = 25.28). The corresponding F-value for the first stage regression is 71.23.}

\footnote{\textsuperscript{7} We inverted the coding of the variable for the sake of uniformity.}
The key independent variable is WORKFORCE (access to educated workforce). A logit regression is used. The symbols heteroscedasticity-robust standard errors are presented in parentheses. The outcome variable is PERFORM (measures indicating delays in meeting obligations) and

```
| Variables          | Dependent variable = default expectations | Dependent variable = obligations to financial institutions | Dependent variable = obligations to suppliers | Dependent variable = obligations to tax authorities |
|--------------------|-------------------------------------------|----------------------------------------------------------|-----------------------------------------------|---------------------------------------------------|
| WORKFORCE          | 0.0971*** (4.08)                           | 0.0713** (2.35)                                           | 0.0494** (2.20)                               | 0.0436 (1.50)                                    |
| SIZE               | −0.1417*** (−5.45)                         | −0.0473 (−1.51)                                           | −0.0206 (−0.87)                               | −0.0157 (−0.52)                                 |
| TRAINING           | 0.0037 (0.06)                              | 0.0258 (0.31)                                             | −0.0381 (−0.62)                               | 0.0025 (0.03)                                   |
| CERTIFICATION      | −0.1538* (−1.90)                           | −0.1970* (−1.79)                                          | −0.1844*** (−2.38)                            | −0.319*** (−3.05)                               |
| LOCATION           | −0.0935 (−1.22)                            | −0.0789 (−0.78)                                           | −0.0340 (−0.47)                               | −0.2907*** (−3.04)                              |
| INNOVATION1        | 0.0277 (0.40)                              | −0.0048 (−0.06)                                           | 0.1132* (1.77)                                | 0.0862 (1.03)                                   |
| INNOVATION2        | −0.0420 (−0.49)                            | 0.2179*** (2.14)                                          | 0.1307* (1.68)                                | 0.1765* (1.76)                                  |
| GENDER             | 0.1270* (1.71)                             | 0.1459 (1.58)                                             | 0.1325** (1.97)                               | 0.1379 (1.62)                                   |
| EXPERIENCE         | −0.0015 (−0.58)                            | −0.0056 (−1.59)                                           | −0.0027 (−1.08)                               | −0.0057* (−1.75)                                |
| SUBSIDIARY         | −0.3707*** (−4.25)                         | −0.2619** (−2.30)                                         | −0.1768** (−2.17)                             | −0.2827*** (−2.74)                              |
| TRANSPORT          | −0.0090 (−0.35)                            | −0.0001 (−0.01)                                           | 0.0110 (0.47)                                 | −0.0123 (−0.42)                                 |
| OWNERSHIP          | 0.0016 (1.43)                              | 0.0019 (1.40)                                             | −0.0004 (−0.42)                               | 0.0003 (0.28)                                   |
| Country dummies    | Yes                                       | Yes                                                      | Yes                                           | Yes                                              |
| Observations       | 7349                                      | 6797                                                     | 7334                                          | 7333                                             |
| Wald Chi-square    | 705.19                                    | 431.02                                                   | 65.3                                          | 652.60                                           |
| Pseudo R-square    | 0.0725                                    | 0.0866                                                   | 0.0288                                        | 0.1105                                           |
```

Note: The table reports the results after replacing the dependent variable with measures indicating delays in meeting obligations. The z-values based on the heteroscedasticity-robust standard errors are presented in parentheses. The outcome variable is PERFORM (measures indicating delays in meeting obligations) and the key independent variable is WORKFORCE (access to educated workforce). A logit regression is used. The symbols *, **, *** correspond to p-value < 0.1, p-value < 0.05, p-value < 0.01, respectively. All the variables are defined in Section 3.

We re-estimate Eq. (1) after replacing the dependent variable with the alternate indicators of performance and report the findings in Table 8. We report a significantly negative coefficient of WORKFORCE for both indicators of performance. Our findings indicate that firms that report an inadequately educated workforce as a problem experience a decline in cash flows and have less capacity utilization.

6.2. Access to an educated workforce and layoffs

Our arguments also suggest that firms with an inadequately educated workforce should lay off more employees during the pandemic than other firms. It is intuitive to believe that poor performers are more likely to lay off their employees than good performers are. In order to test this conjecture, we re-estimate Eq. (1) by replacing the dependent variable either with the percentage of total employees who are permanently laid off or with the percentage of total employees who are temporarily laid off (Enterprise Survey Code = COVd8 and COVd6). The results of our analysis are reported in Table 9. Our findings show a significantly negative coefficient of WORKFORCE for the estimation when the dependent variable is the percentage of total employees who are temporarily laid off. In the event of permanent layoffs, we report no relationship between WORKFORCE and the percentage of permanent layoffs.

We re-estimate Eq. (1) after replacing the dependent variable with the indicators that represent delays in meeting obligations. Our findings, reported in Table 10, show that firms that report an inadequately educated workforce as a problem are more likely to experience delays in meeting their obligations. For instance, we show that higher obstacles in accessing an educated workforce significantly increase the likelihood that a firm will default in the future. It is significantly associated with

6.3. Access to an educated workforce and delays in meeting obligations

A corollary of the arguments that suggest the adverse impact of an inadequately educated workforce on the performance of firms is that it would also reduce the ability of firms to meet their obligations. In this section, we test the relationship between access to an educated workforce and delays in meeting obligations. We identify four indicators for meeting the obligations.

- The first indicator measures the expectation that a firm will default on its outstanding liabilities in the next six months (Enterprise Survey Code = COVg1).
- The second indicator measures whether the firm is already overdue on its obligations to financial institutions (Enterprise Survey Code = COVe4).
- The third indicator measures whether the firm has delayed its payments to its suppliers for more than one week (Enterprise Survey Code = COVe3a).
- The fourth indicator measures whether the firm has delayed its payments to tax authorities for more than one week (Enterprise Survey Code = COVe3c).

---

* We divide the number of employees laid off by the total number of employees to get the proportion of employees laid off.
firms that already have overdue obligations to financial institutions and suppliers.

6.4. Effect of an educated workforce on the performance of firms: role of government support

Around the world, governments responded to the COVID-19 pandemic by enforcing curbs on economic activities. Given that SMEs have greater financial vulnerability than large corporations, these curbs were assumed to affect SMEs disproportionately. As a result, governments used various measures to support these financially vulnerable firms. In view of the backdrop, we also explore whether access to an inadequately educated workforce limits the success of government support measures. In order to test this conjecture, we modify Eq. (1) by introducing the following variables. In the following regression equation, GOV indicates whether the firm has received any national or local government support in response to the pandemic (Enterprise Survey Code = COVf1). In addition, we also redo the analysis by replacing the GOV variable with various types of government supports. More specifically, we replace the GOV variable with the following indicators of government support.

- Cash support indicates whether the firm received cash transfer from the government in response to the pandemic (Enterprise Survey Code = COVf2a).
- Wage subsidies indicate whether the firm received wage subsidies from the government in response to the pandemic (Enterprise Survey Code = COVf23).
- Fiscal exemptions indicate whether the firm has received some form of fiscal exemption from the government in response to the pandemic (Enterprise Survey Code = COVf2d).
- Deferral of Credit Payments: It indicates whether the firm received a deferral of credit payments from the government in response to the pandemic (Enterprise Survey Code = COVf2b).

The modified equation takes the following form.

\[
\text{PERFORM} = \alpha + \beta_1(\text{WORKFORCE}) + \beta_2(\text{GOV}) + \beta_3(\text{WORKFORCE}*\text{GOV}) + \beta_4(\text{TRAINING}) + \beta_5(\text{CERTIFICATION}) + \beta_6(\text{LOCATION}) + \beta_7(\text{INNOVATION1}) + \beta_8(\text{INNOVATION2}) + \beta_9(\text{GENDER}) + \beta_{10}(\text{EXPERIENCE}) + \beta_{11}(\text{SUBSIDIARY}) + \beta_{12}(\text{TRANSPORT}) + \beta_{13}(\text{OWNERSHIP}) + \sum_{C=1}^{N} q_{C}(\text{CDUM}_C) + \epsilon
\]

(2)

The results of our analysis are reported in Table 11. The main variable of interest in this table is WORKFORCE*GOV. Our findings indicate a significantly negative coefficient of WORKFORCE*GOV when government support is used as a measure of GOV. It indicates that the relationship between access to an educated workforce and firm performance becomes more pronounced (negative) for firms that received some type of government support in response to the pandemic. This might indicate that firms cannot efficiently channel government support to sustain their business. We also show that, of four types of supports available, wage subsidies and deferral

Table 11

Access to an educated workforce and firm performance during the COVID-19 pandemic: Role of government support.

| Variables | GOV = Government support | GOV = Cash support | GOV = Wage subsidies | GOV = Fiscal exemptions | GOV = Deferral of credit payments |
|-----------|--------------------------|--------------------|----------------------|------------------------|----------------------------------|
| WORKFORCE | -0.5811 (-1.53)          | -0.8182** (-2.50) | -0.9425** (-2.64)   | -0.7707** (-2.35)     | -0.9119** (-2.81)               |
| GOV       | -8.8059*** (-7.04)       | -3.8274* (-1.87)  | -12.1622*** (-9.09) | -5.2626*** (-2.85)    | -10.0338*** (-5.17)             |
| WORKFORCE*GOV | -1.0892* (-1.87) | -1.7757** (-2.02) | -0.0116 (-0.02)     | -1.6462** (-1.99)     | -0.4686 (-0.53)                 |
| SIZE      | 2.4438*** (7.60)         | 2.2802*** (6.96)  | 2.4519*** (7.65)    | 2.2509*** (6.92)      | 2.3510*** (7.17)                |
| TRAINING  | 1.1642 (1.34)            | 1.9027 (1.14)     | 1.0624 (1.23)       | 1.2999 (1.49)         | 1.2959 (1.48)                   |
| CERTIFICATION | 4.7501*** (4.68)      | 4.7495*** (4.56)  | 4.6412*** (4.56)    | 4.9145*** (4.77)      | 4.7429*** (4.62)                |
| LOCATION  | 1.6368* (1.80)           | 1.6294* (1.76)    | 1.6464* (1.82)      | 1.6063* (1.74)        | 1.4094 (1.53)                   |
| INNOVATION1 | 0.3299 (0.37)            | -0.0783 (-0.09)   | 0.2413 (0.27)       | 0.0965 (0.11)         | 0.0810 (0.09)                   |
| INNOVATION2 | 0.3044 (0.28)            | 0.1425 (0.13)     | 0.2903 (0.27)       | 0.3737 (0.34)         | 0.1378 (0.13)                   |
| GENDER    | -2.3559*** (-2.56)       | -2.1707** (-2.32) | -2.0324** (-2.21)   | -2.1604** (-2.33)     | -2.1508** (-2.32)               |
| EXPERIENCE | -0.0138 (-0.39)          | -0.0170 (-0.47)   | -0.0167 (-0.47)     | -0.0092 (-0.26)       | -0.0229 (-0.64)                 |
| SUBSIDIARY | 2.2853** (2.00)          | 2.1291* (1.85)    | 2.4425** (2.15)     | 2.4760** (2.15)       | 2.4338** (2.11)                 |
| TRANSPORT | 0.8297** (2.52)          | 0.9980** (2.98)   | 0.8390** (2.53)     | 0.8710** (2.62)       | 0.8743** (2.64)                 |
| OWNERSHIP | -0.0471*** (-3.37)       | -0.0398*** (-2.79) | -0.0455*** (-3.25)  | -0.0438*** (-3.11)    | -0.0434*** (-3.08)              |
| Country dummies | Yes | Yes | Yes | Yes | Yes |
| Observations | 7344 | 7211 | 7316 | 7333 | 7315 |
| F-value    | 66.96 | 61.73 | 68.21 | 652.60 | 64.62 |
| R-square   | 0.2312 | 0.2207 | 0.2325 | 0.1105 | 0.2244 |

Note: The table reports the impact of government subsidies on the relationship between access to educated workforce and performance. The t-values based on the heteroscedasticity-robust standard errors are presented in parentheses. The outcome variable is PERFORM (changes in sales) and the key independent variable is WORKFORCE (access to educated workforce) and WORKFORCE*GOV. The GOV indicates the type of government support provided to the firms. An OLS regression is used. The symbols *, **, *** correspond to p-value < 0.1, p-value < 0.05, p-value < 0.01, respectively. All the variables are defined in Section 3.
of credit payments do not affect the relationship between access to an educated workforce and firm performance. The cash transfer and fiscal exemptions make the relationship more pronounced.

7. Conclusion

Access to an educated workforce is important for the survival and the performance of any firm. Firms that attract a high quality workforce can create sustainable advantage for themselves. Failure to do so jeopardizes the ability of firms to remain competitive. In this paper, we document the impact of access to an educated workforce on the performance of firms during the COVID-19 pandemic. Using data from the World Bank’s COVID-19 Follow-up Enterprise Survey, we show that access to educated workforce had a significant impact on the performance of firms during the pandemic. We find that firms with greater obstacles in accessing an educated workforce had significantly lower performance, as measured by changes in sales, during the pandemic. The findings remain qualitatively the same after comprehensive inclusion of relevant controls and to addressing endogeneity concerns. In this paper, we also show that alternate measures of performance, such as capacity utilization, layoffs, cash flows, the ability to meet obligations, are also negatively affected by a firm’s inability to access an educated workforce. More important, we also show the impact of government support programs on the relationship between access to an educated workforce and the performance of firms. We show that firms with greater obstacles in accessing an educated workforce cannot use government support programs efficiently.

Declaration of competing interest

There is no conflict of interest.

References

Albaladejo, M., & Romijn, H. (2001). Determinants of innovation capability in small UK firms. ECIS Working Paper # 00.13. Netherlands: Eindhoven Centre for Innovation Studies.
Burro, R. J. (1991). Economic growth in a cross section of countries. Quarterly Journal of Economics, 106(2), 407–443.
Bartel, A., & Lichtenberg, F. (1987). The comparative advantage of educated workers in implementing new technology: Some empirical evidence. The Review of Economics and Statistics, 69(1), 1–11.
Bassani, A., Scarpetta, S., & Hennings, P. (2001). Economic growth: The role of policies and institutions. Panel data evidence from OECD countries. OECD economics department working papers # 283. Paris, France: OECD Publishing.
Bofinger, P., Dullien, S., Felbermayr, G., Fuest, C., Huther, M., Suedekum, J., & Weder du Mauro, B. (2020). Economic implications of the corona crisis and economic policy measures. Wirtschaftsdienst, 100(4), 259–265.
Cao, S., & Leung, D. (2020). Credit constraints and productivity of SMEs: Evidence from Canada. Economic Modelling, 88, 163–180.
Carnap, T. V., Almas, I., Bold, T., Ghisolfi, S., & Sandefur, J. (2020). The macroeconomics of pandemics in developing countries: An application to Uganda. Working Paper #555. Washington DC, USA: Center for Global Development.
Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. Administrative Science Quarterly, 35(1), 128–152.
Deming, D., & Kahn, L. B. (2018). Skill requirements across firms and labor markets: Evidence from job postings for professionals. Journal of Labor Economics, 36(S1), S337–S369.
Doms, M., Lewis, E., & Robb, A. (2010). Local labor force education, new business characteristics, and firm performance. Journal of Urban Economics, 67(January), 61–77.
Donthu, N., & Gustafsson, A. (2020). Effects of COVID-19 on business and research. Journal of Business Research, 117(September), 284–289.
Giritli, N. K., & Olofsson, A. (2020). Managing the covid-19 pandemic through individual responsibility: The consequences of a world risk society and enhanced ethopolitics. Journal of Risk Research, 23(7–8), 1031–1035.
Glaeser, E., & Saiz, A. (2003). The rise of the skilled city. NBER Working Paper #10191. USA: National Bureau of Economic Research.
Green, F., Mayhew, K., & Molloy, E. (2003). Employer perspectives Survey. DIWES.
Haskel, J., Hawkes, D., & Pereira, S. (2003). How much of the productivity spread is explained by skills? UK evidence using matched establishment/workforce Survey data. CeRBA Mimeo.
Healy, J., Mavromaras, K., & Sloane, P. J. (2015). Adjusting to skill shortages in Australian SMEs. Applied Economics, 47(24), 2470–2487.
Herrhein, B., & Kahn, L. B. (2018). Do recessions accelerate routine-biased technological change? Evidence from vacancy postings. The American Economic Review, 108(7), 1737–1772.
Hewitt, T., & Wield, D. (1992). Technology and industrialization. In T. Hewitt, H. Johnson, & D. Wield (Eds.), Industrialization and development. Oxford University Press.
Ivanov, D. (2020). Predicting the impacts of epidemic outbreaks on global supply chains: A simulation-based analysis on the coronavirus outbreak (COVID-19/SARS-CoV-2) case. Transportation Research Part E: Logistics and Transportation Review, 136(April), Article 101922.
Jabbouri, I., & Farooq, O. (2021). Inadequately educated workforce and financing obstacles: International evidence from SMEs in developing countries. International Journal of Managerial Finance, 17(1), 118–137.
Knueger, D., & Kumar, K. (2004). Skill-specific rather than general education: A reason for US-europe growth differences? Journal of Economic Growth, 9, 167–207.
Lin, J. (2009). Technological adaptation, cities, and new work. Federal Reserve Bank of Philadelphia Mimeo.
Lippman, S. A., & Rumelt, R. P. (1982). Uncertain imitability: An analysis of firm differences in efficiency under competition. The Bell Journal of Economics, 13(2), 418–438.
Lynch, L., & Black, S. (1995). Beyond the incidence of training: Evidence from a national employers’ Survey. NBER Working Paper #5231,. USA: National Bureau of Economic Research.
Mayh, B., Ryx, F., & Vermeylen, G. (2015). Educational mismatch and firm productivity: Do skills, technology and uncertainty matter? De Economist, 163(3), 233–262.
Makkonen, H., Pohjola, M., Ollkonen, R., & Koponen, A. (2013). Dynamic capabilities and firm performance in a financial crisis. Journal of Business Research, 67(1), 2707–2719.
Mertzanis, C. (2019). Family ties, institutions and financing constraints in developing countries. Journal of Banking & Finance, 108(November), Article 105650.
Mertzanis, C., & Said, M. (2019). Access to skilled labor, institutions and firm performance in developing countries. International Journal of Manpower, 40(2), 328–355.
Michie, J. (2020). The covid-19 crisis – and the future of the economy and economics. International Review of Applied Economics, 34(3), 301–303.
Mithas, S., & Krishnan, M. S. (2008). Human capital and institutional effects in the compensation of information technology professionals in the United States. *Management Science, 54*(3), 415–428.

Nelson, R., & Phelps, E. (1966). Investment in humans, technological diffusion, and economic growth. *The American Economic Review, 56*(1/2), 69–75.

Rehman, N. U. (2015). Drivers of firms’ growth: A case study of software firms in islamabad/rawalpindi regions. *The Journal of Management Development, 34*(8), 901–921.

Schultz, T. W. (1975). The value of the ability to deal with disequilibria. *Journal of Economic Literature, 13*(3), 827–846.

Shen, H., Fu, M., Pan, H., Yu, Z., & Chen, Y. (2020). The impact of the COVID-19 pandemic on firm performance. *Emerging Markets Finance and Trade, 56*(10), 2213–2230.

Staiger, D., & Skinner, J. (2005). Technology adoption from hybrid corn to beta blockers. NBER Working Paper #11251. USA: National Bureau of Economic Research.

Welch, F. (1970). Education in production. *Journal of Political Economy, 78*(1), 35–59.

Wozniak, A. (2006). *Why are college graduates more responsive to distant labor market opportunities*. University of Notre Dame Mimeo.