INSTITUTE OF DEVELOPING ECONOMIES

IDE Discussion Papers are preliminary materials circulated
to stimulate discussions and critical comments

IDE DISCUSSION PAPER No. 945

The Wage Effect of the COVID-19 Pandemic by Company Size: Evidence from Thailand

Kazunobu Hayakawa*, Sasatra Sudsawasd

October 2024

Abstract: Large enterprises tend to perform better than small and medium-sized enterprises (SMEs) in normal times. However, this general principle may not hold true during periods of instability such as large-scale pandemics. While large companies may be able to implement a work-from-home system more flexibly, SMEs may require government support. Against this backdrop, we empirically investigate the effect of the COVID-19 pandemic on the labor market, especially wages, in Thailand. By using the individual-level quarterly data in Thailand from 2019 to 2022, we examine the differences in the wage impact of the COVID-19 pandemic according to company size. Our finding is that, as in other countries, workers in larger-sized companies had significantly higher wages. However, we also find that the COVID-19 pandemic contributed to reducing the wage gap across company sizes on average, especially in the manufacturing sector.

Keywords: Covid-19, wages, Thailand
JEL classification: I14, R11

* Bangkok Research Center, IDE-JETRO (Kazunobu_Hayakawa@ide.go.jp)

The Institute of Developing Economies (IDE) is a semigovernmental, nonpartisan, nonprofit research institute, founded in 1958. The Institute merged with the Japan External Trade Organization (JETRO) on July 1, 1998. The Institute conducts basic and comprehensive studies on economic and related affairs in all developing countries and regions, including Asia, the Middle East, Africa, Latin America, Oceania, and Eastern Europe.

INSTITUTE OF DEVELOPING ECONOMIES (IDE), JETRO
3-2-2, WAKABA, MIHAMA-KU, CHIBA-SHI
CHIBA 261-8545, JAPAN

The Wage Effect of the COVID-19 Pandemic by Company Size: Evidence from Thailand

Kazunobu HAYAKAWA[§#]
Bangkok Research Center, Institute of Developing Economies, Thailand

Sasatra SUDSAWASD
School of Development Economics, National Institute of Development Administration, Thailand

***Abstract*:** Large enterprises tend to perform better than small and medium-sized enterprises (SMEs) in normal times. However, this general principle may not hold true during periods of instability such as large-scale pandemics. While large companies may be able to implement a work-from-home system more flexibly, SMEs may require government support. Against this backdrop, we empirically investigate the effect of the COVID-19 pandemic on the labor market, especially wages, in Thailand. By using the individual-level quarterly data in Thailand from 2019 to 2022, we examine the differences in the wage impact of the COVID-19 pandemic according to company size. Our finding is that, as in other countries, workers in larger-sized companies had significantly higher wages. However, we also find that the COVID-19 pandemic contributed to reducing the wage gap across company sizes on average, especially in the manufacturing sector.

Keywords: COVID-19; wages; Thailand
JEL Classification: I14; R11

1. Introduction

The outbreak of coronavirus disease-2019 (COVID-19) began on December 1, 2019 in Wuhan, China and spread quickly to more than 200 countries worldwide. Subsequently, on March 11, 2020, the World Health Organization (WHO) declared the coronavirus outbreak a global pandemic. The spread of COVID-19 led to massive loss of human life. According to the WHO coronavirus dashboard, as of June 2, 2024, there have been a total of 776 million reported COVID-19 cases and 7 million deaths worldwide. To prevent the spread of COVID-19, most countries implemented various nonpharmaceutical interventions, especially those aimed at restricting people's movement. Stay-at-home orders led to reduced consumer

§ We would like to thank Fukunari Kimura, Miki Hamada, and the seminar participants at the Institute of Developing Economies for their helpful comments. This work was supported by JSPS KAKENHI Grant Number 22H00063. All remaining errors are ours.
# Corresponding author: Kazunobu Hayakawa; Address: JETRO Bangkok, 127 Gaysorn Tower, 29th Floor, Ratchadamri Road, Lumphini, Pathumwan, Bangkok 10330, Thailand; Tel: 66-2-253-6441; Fax: 66-2-254-1447; E-mail: kazunobu_hayakawa@ide-gsm.org.

demand, while work-from-home (WfH) schemes decreased production capacities in factories. The severity of COVID-19 damages led to decreased economic output.

This study empirically investigates the effect of the pandemic on the labor market, especially wages, in Thailand. On January 13, 2020, Thailand became the first country outside China to report a confirmed case of COVID-19. Like in most countries, the Thai government declared a state of emergency and responded to the pandemic by implementing several public health and containment measures to prevent and slow the spread of COVID-19. Despite these efforts, Thailand has recorded a total of 4.78 million confirmed COVID-19 cases and 34,653 deaths as of June 2, 2024. Figure 1 shows the number of daily confirmed new COVID-19 cases and deaths by day in Thailand, with a peak of 182,510 daily confirmed new cases on April 3, 2022. The COVID-19 pandemic has had a large impact on the Thai economy, which has affected the lives and well-being of many people, partially caused by disruption to business operations. According to the World Bank rapid phone survey in Thailand (World Bank, 2021), more than half of respondents reported job losses (42 percent), temporary work stoppages (49 percent), a reduced number of working hours (53 percent), and/or reduced pay (59 percent) between March 2020 and June 2021.

=== Figure 1 ===

More specifically, we shed light on the differences in the wage effect of the pandemic across company sizes. In general, large enterprises tend to perform better than small and medium-sized enterprises (SMEs) in normal times. However, this general principle may not hold true during periods of instability such as a large-scale pandemic. On the one hand, large companies may be able to implement work-from-home schemes more flexibly among a large number of workers to maintain a minimum operation (Fernández-Cerezo et al., 2022). On the other hand, to address financial challenges, governments may need to provide various kinds of financial and fiscal relief measures to assist businesses. Many of these measures, such as soft loans, are specifically aimed at SMEs. In addition, once the coronavirus has spread within a large company, the number of confirmed cases increases greatly, and the virus is likely to be transmitted to more people outside the company. Thus, governments tend to restrict the operation of large companies more severely.

In Thailand, for example, the cumulative confirmed cases and deaths were unevenly distributed across different regions of the country. Figure 2 presents the numbers of COVID-19 cases and deaths per thousand people by province. Samut Sakhon province was found to have the highest confirmed cases at 159 cases per thousand people. One of the reasons was the dense living conditions of the migrants and the lack of personal precautions to prevent the spread of the disease (Ministry of Public Health, 2021). Hence, population density, particularly in Thailand's industrial provinces, appears to have been a significant factor in the spread of COVID-19. This prompted the government to implement preventive measures, such as the "Factory Sandbox" program, targeting provinces with large

manufacturing sectors. By participating in this program, factories with a specified number of workers in specific provinces were required to establish a field hospital or an isolation facility to manage COVID-19 cases. All workers had to be vaccinated and tested for the coronavirus weekly to ensure that infected workers were isolated and received immediate treatment. These requirements may have led to significant costs for compliance. As a result, large companies may have experienced greater financial strain from the COVID-19 pandemic and may have been forced to reduce wages more compared with SMEs.

=== Figure 2 ===

In our empirical analysis, we use the individual-level quarterly data obtained from the Labour Force Surveys in Thailand. Our study period is from the first quarter of 2019 to the fourth quarter of 2022. With this dataset, we investigate the differences in the wage impact of the COVID-19 pandemic according to company size. We cannot panelize the data across individuals but will control for individual observable characteristics such as age, sex, marital status, company size, education level, occupation, and location (urban or not). Following the literature on the COVID-19 pandemic, we measure severity at the province level according to the number of confirmed cases or deaths. The company size is categorized as small (1–99 employees), medium-sized (100–199 employees), and large (>200 employees). As briefly mentioned above, the Thai government introduced various measures according to company size. We empirically examine how the wage effects of the COVID-19 pandemic differed by company size in Thailand.

Our findings can be summarized as follows. Our main finding is that the COVID-19 pandemic contributed to reducing the average wage gap of companies, regardless of size. To control for all possible confounding regional factors, we introduce province-time fixed effects. Therefore, our empirical framework cannot uncover the effect of this pandemic on absolute wages for each company size. It does, however, enable us to examine the effect on the relative wages across company sizes. Our results indicate that the pandemic decreased this difference, especially in the manufacturing sector. In contrast, we found an increase in the wage difference in the agricultural sector. We also examine the effect of the government preventive measure, specifically the Factory Sandbox program, which targets large companies in some industries and provinces. The results show significantly higher wages in those companies.

Our study belongs to the large literature on the economic impacts of the COVID-19 pandemic. In particular, two strands of literature are closely related to our study. One strand is the individual-level studies on the labor market. Almost all of these studies examine the impacts of the pandemic on employment (e.g., Casario and Lattanzio, 2022; Montenovo et al., 2022; Couch et al., 2020; Farre et al., 2022). Those studies reveal the heterogenous impacts across individuals' age, gender, religion, race, education level, location, work-from-home availability, and the existence or number of children. In contrast, the number of studies on

wages is rather limited. For example, Béland et al. (2023) examine the impacts of the pandemic on hourly wages (in addition to those on employment) in the US, finding an insignificant effect on wages. Similarly, Cajner et al. (2020) find that nearly 7 million continuously employed workers in the US received a nominal wage cut between March and June 2020. Although these studies do not exploit the heterogeneous effects across individual characteristics or company sizes, we closely investigate such heterogeneity in Thailand.[1]

The other strand is the firm-level studies on firm performance. Those studies mostly investigate the effect of the pandemic on the return on equity, return on assets, sales, or employment (e.g., Shen et al., 2020; Rababah et al., 2020). For example, Bartik et al. (2020) find that smaller firms with fewer than 20 employees in January 2020 were more likely to be closed. Firms with between 6 and 19 employees had the largest employment reductions. Bloom et al. (2021) also find that the smallest offline firms experienced sales drops of over 40% compared with less than 10% for the largest online firms. Only a limited number of studies examine the effect on wages. For example, Apedo-Amah et al. (2020) find that the likelihood of reducing wages did not significantly differ across company sizes (except relative to micro firms). This firm-level evidence is informative. However, Cajner et al. (2020) find that despite the rapid nominal wage growth for the average employed worker in the US, there was essentially no nominal wage growth for continuing workers during the first half of 2020. That is, it is crucial to control for individual characteristics in the evaluation of the wage effect of the pandemic.

The remainder of this study is organized as follows. Section 2 provides an overview of the COVID-19 pandemic and government policy measures in Thailand. After specifying our empirical framework in Section 3, we present our estimation results in Section 4. Section 5 concludes the paper.

2. Background

Thailand was the first country outside China to report a confirmed case of COVID-19 on January 13, 2020. Like many countries, the Thai government declared a state of emergency on March 26, 2020, and responded to the pandemic by implementing several public health and containment measures aimed at preventing and slowing down the spread of COVID-19. Some of the measures included closing its international borders to tourists, limiting movement between provinces, ordering lockdowns in major cities, and instituting curfews.

The government also imposed different levels of restrictions by province. The Center for COVID-19 Situation Administration announced the first such restriction on January 3,

[1] Chairassamee and Hean (2022) and Paweenawat and Liao (2024) also examine the labor market in Thailand during the COVID-19 pandemic; however, they do not explicitly identify the effect of the COVID-19 pandemic.

2021. Based on the level of infection and transmission risk, five COVID-19 zones were established in Thailand: the surveillance zone, the high surveillance zone, the controlled zone, the maximum-controlled zone, and the maximum- and strict-controlled zone. In each zone, specific COVID-19 control measures were implemented and updated over time. In general, each zone's measures were based on the situation on the ground, with stricter controls in high-risk zones and more relaxed measures in low-risk zones.

For example, according to the Center for COVID-19 Situation Administration announcement on October 15, 2021, gatherings of people were restricted as follows: no more than 50 in the maximum- and strict-controlled zone, no more than 100 in the maximum-controlled zone, no more than 200 in the controlled zone, no more than 300 in the high surveillance zone, and no more than 500 in the surveillance zone. These numbers changed over time depending on the situation on the ground. Additionally, in the maximum- and strict-controlled zone, a nighttime curfew was in effect from 11 p.m. to 3 a.m. Restaurants, department stores, community malls, cinemas, theatres, stadiums, convenience stores, and markets were allowed to remain open until 10 p.m.

To alleviate the impact of the pandemic, the Thai government implemented various financial and fiscal relief measures to help people and businesses, including land and building tax reductions, reduced social security contributions, and generous cash handouts, which led to 1.5 trillion Thai baht in government borrowing to finance these measures and other government stimulus programs. The government also provided direct assistance for SMEs, including debt resolution measures and liquidity support initiatives such as a 6-month broad-based loan-payment holiday for SMEs with a credit line not exceeding 100 million Thai baht, a 2-month loan-payment holiday for SMEs who were severely affected and unable to clearly assess cashflows, and special 5-year term loans (soft loans) with an interest rate not exceeding 5 percent per annum to SMEs with a credit line not exceeding 500 million Thai baht or with no prior credit line[2].

In addition, several preventive and control measures were adopted so that workers would be able to work normally and business operations would not be disrupted. For instance, the Thai government introduced the "bubble" and "seal" measures in August 2021 to prevent the spread of COVID-19 infections among factory workers. Depending on the situation, firms conducted irregular tests every 1 or 2 months, using test kits. Workers were separated into sub-groups (small and large bubbles) to reduce exposure and limit their movement and travel. In some cases, they stayed in factories with accommodation facilities or had travel restrictions if they lived outside the factories. If more than 100 employees or more than 10% of employees were infected (and the infection did not subside after 14 days of isolation measures), the workplace was required to take one of the following measures: provide isolation facilities for infected employees inside or outside the workplace, or secure a temporary hospital or affiliated hospital and prepare vehicles to transport infected

[2] For the overview of financial measures during the COVID-19 in Thailand, please see https://www.bot.or.th/en/our-roles/special-measures/covid-19.html, Retrieved July 31, 2024.

employees there. As a result, larger firms needed to make more adjustments and spend more money to comply with these measures.

At the same time, in August 2021, the Thai government launched the Factory Sandbox program, which aimed to build immunity for workers and confidence for both domestic and foreign investors as well as to maintain employment in the key export-driven manufacturing industries (e.g., cars, electronics, food, and medical equipment). It was a volunteer-based program designed to limit COVID-19-related disruptions. Factories were motivated to participate for several reasons, including protecting their employees from COVID-19, minimizing the risk of outbreaks within their workplaces, maintaining operational continuity, and enhancing their reputation by demonstrating a commitment to health and safety, which could attract business partners and customers.

The factories participating in this program were required to have a field hospital or an isolation facility. All workers in the factories had to be vaccinated and tested for COVID-19 every week. Employees who tested positive had to be isolated, and cohorts[["contacts"?]] had to be inoculated and undergo subsequent tests every 7 days. The first phase of the program, launched in August 2021, targeted large factories with at least 500 workers in Nonthaburi, Pathum Thani, Samut Sakhon, and Chonburi provinces, expanding to Rayong, Prachin Buri, Phra Nakhon Si Ayutthaya, Lop Buri, Sara Buri, Chachoengsao, Samut Prakan, and Songkhla provinces in the second phase of the program, starting in November 2021. The size of the targeted factories was lowered to 100 employed workers.

3. Empirical Framework

This section explains our empirical framework to investigate the wage effect of the COVID-19 pandemic in Thailand. Our main source of data is the Labour Force Surveys from the first quarter of 2019 to the fourth quarter of 2022, collected by the National Statistical Office of Thailand. The population surveyed included all people aged 15 years or older who are classified as either in the labor force or not, according to the activity in which each person was engaged during the survey reference week.[3] Note that we cannot panelize the individuals across time. The weight for each sample unit is available to recover the population in the whole country.[4] We run our regressions using this weight. The data

[3] The survey was based on stratified two-stage sampling. Provinces constituted strata, with each stratum divided into two types of local administration, municipal areas and non-municipal areas. The primary and secondary sampling units were blocks for municipal areas and villages for non-municipal areas, and private households/persons in special households (which included persons living in a group), respectively. Data were collected through interviews.

[4] According to the report of the Labour Force Surveys, there were three steps for calculating a weight for each sample unit: 1) the calculation design weight or base weight and the inverse selection probabilities for each state of the selected sampling unit were calculated; 2) adjustments for non-response and base weights were made to compensate for non-response households; and 3) post-stratification calibration

include workers in all industries.

Our equation for individual i who works in industry s and lives in province p at time t is specified as follows.

$$\ln Wage_{ispt} = \mathbf{X}'\boldsymbol{\beta} + COVID_{pt} \times \mathbf{X}'\boldsymbol{\gamma} + FE_{pt} + FE_{st} + FE_{sp} + \epsilon_{ispt} \quad (1)$$

The dependent variable is the log of monthly wages. The vector $\mathbf{X}$ includes various individual attributes. The standard variables are (the log of) age, gender dummy, marital status dummy, education level dummy, occupation dummy, and location dummy. The marital status includes single, married (registered or unregistered), and widowed/divorced (including living separately). We categorize education level into two groups, university graduate or not. University graduates include those with post-secondary education, a bachelor's degree, a master's degree, or a doctoral degree. Based on the definition of the International Labor Organization, the occupation category was classified into three groups: high-skilled, middle-skilled, and low-skilled.[5] The location dummy indicates living in an urban or rural area.

These attributes will be related to the wage effect of the pandemic. For example, older persons are likely to exhibit more serious symptoms, and males are more likely to work in labor-intensive sectors with greater levels of physical contact. Thus, these persons may have had to reduce their working time. Also, married persons may have been better able to share the burden of the pandemic and maintain their normal performance. Educated workers may have been better able to adapt to different work conditions or WfH technologies, while WfH tasks may have been more feasible in skilled occupations. Last, because the possibility of infection was higher in urban areas due to population density, urban residents may have been reluctant to work outside and therefore reduced their working time.

The vector $\mathbf{X}$ also includes two more interesting variables in the context of the pandemic. One is *Teenagers*, which takes a value of 1 if a family includes kids under the age of 20 years. If an individual has kids in their family, they may have to take care of them and thus need to reduce their working time, or their performance may decline. The other variable is the feasibility of a WfH arrangement (*WfH Feasibility*), which is defined by occupation. Specifically, based on Holgersen et al. (2021), it takes a value of 1 if the occupation is manager, professional, or clerical support worker. With WfH jobs, workers can work remotely and may maintain their normal performance. Last, our main variable of individual attributes is the dummy variables on the size of the company where an

adjustment was performed. The base weight adjusted by non-response data was further adjusted using the projected population and classified by grouped age, sex, region, and administration.

[5] Specifically, high-skilled occupations include managers, professionals, and technicians. Middle-skilled occupation includes clerical support workers; service and sales workers; skilled agricultural, forestry, and fishery workers; craft and related trades workers; and plant and machine operators and assemblers. Elementary occupations are classified as low-skilled occupation.

individual works, which, as mentioned above, is grouped into small (1–100 employees), medium-sized (101–199 employees), and large (>200 employees).

To capture the heterogeneous effects of the COVID-19 pandemic, we introduce interaction terms of these individual characteristics with exposure to the pandemic ($COVID_{pt}$) defined at a province–time level. We use two indicators for this variable, that is, the number of confirmed cases and deaths per population by quarter. Their data are obtained from the Department of Disease Control under the Ministry of Public Health in Thailand. The figures for 2019 are set to 0. Note that many studies on COVID-19 also use the stringency index of lockdown-style policies to measure the extent of COVID-19 damages (e.g., Miguel and Malloy, 2021). As mentioned in Section 2, based on the level of infection and transmission risk, the Thai government also established COVID-19 zones to restrict economic and social activities. However, we do not use this information to measure the exposure to the pandemic because this policy started in 2021 despite the fact that the damages from the pandemic (e.g., the number of confirmed cases or deaths) were also large in 2020. In other words, we cannot measure the exposure to COVID-19 in 2020 from this zone information.

In our analysis, we prioritize controlling for a detailed level of fixed effects and thus do not take into account the selection mechanism of labor participation. We use the ordinary least square (OLS) method with various fixed effects to estimate our model rather than the Heckman method.[6] Specifically, we introduce three kinds of fixed effects. The first is province–time fixed effects (FE_{pt}), which control for minimum wages and other province-specific factors. In particular, the average effect of the above-mentioned zone policy, including restrictions on people's inter-provincial movement, is included in this type of fixed effects. The second is industry–year fixed effects (FE_{st}). In our analysis, we study all industries, including services industries. Industries are defined using the two-digit level of the International Standard Industrial Classification (ISIC). This type of fixed effect controls for the effects of industry-level trade barriers (e.g., tariffs for goods) and domestic institutional changes. The third is industry–province fixed effects (FE_{sp}), which control for the availability of primary factors. ϵ_{ispt} is a disturbance term.

There are three data issues. First, some data items such as company sizes were omitted in the third quarter of 2021 to reduce the burden on respondents. Thus, the dataset used for the empirical analyses does not include observations for the third quarter of 2021. Second, we restrict the study population to workers aged 25–60 years because, by definition, teenagers cannot be university graduates, and the official retirement age in Thailand is 60 years. We also exclude individuals with wages in the top or bottom 1% as outliers. Third,

[6] Employed persons in our dataset are defined as individuals who, during the survey week, worked for at least 1 h for wages/salary, profits, dividends or any other kind of remuneration or in-kind payment. Hence, our observations in the wage equation do not include individuals who did not work at all, worked less than 1 h, worked for at least 1 h without pay in business enterprises, or worked on farms owned or operated by household heads or members.

our wage variable is monthly wages, which is affected by the number of working days. For instance, because the minimum wage in Thailand is defined on a daily basis, workers receiving the minimum wage may have also experienced a monthly wage decline.[7] The basic statistics for our study observations are reported in the Appendix.

4. Empirical Results

This section reports our estimation results. Before examining the wage effects, we begin by examining the effect of COVID-19 on employment, as previous studies have done. Specifically, we use the following simple equation based on the OLS method for an individual *i* who lives in province *r* in time *t*.

$$Employment_{ipt} = \mathbf{X}'\boldsymbol{\beta} + COVID_{pt} \times \mathbf{X}'\boldsymbol{\gamma} + FE_{pt} + \epsilon_{ipt} \quad (2)$$

The dependent variable is a dummy variable taking a value of 1 if an individual has been employed in the past week. Note that the information on occupation, company sizes, and working sectors is available only for employed persons. Thus, in this estimation, we do not include those variables.

The OLS results are presented in Table 1. We report the results using the number of cases or deaths separately. The results of non-interacted variables indicate that younger, male, non-single individuals or those without teenagers or with university degrees are more likely to have jobs in Thailand. These findings are generally consistent with Paweenawat and Liao (2024), which showed that married individuals and those without children are more likely to be employed in Thailand, although they found higher unemployment in female or older individuals.

=== Table 1 ===

The results using the number of confirmed cases show that the severe damages caused by COVID-19 decreased jobs for older, male, or married persons, urban residents, persons with teenagers, or educated persons[8]. Similar to a study in Mexico by Juarez and Villaseñor (2022), having children negatively impacts employment, likely due to time constraints and increased childcare needs caused by school and daycare closures, which reduce workers' labor supply. The higher chance of employment in younger or unmarried persons during the pandemic may indicate that they have been better able to adapt to changes in working conditions. Meanwhile, rural residents are likely to maintain employment because of the

[7] Although our data include workers in the informal sector, it is not possible to identify them in the data.
[8] Chairassamee and Hean (2022) also found that Thai female workers were less likely to lose their jobs during the pandemic.

less strict restrictions. The higher probability of unemployment in university graduates may indicate a smaller labor demand for high-skilled jobs during the pandemic. Some of these results are insignificant when using the number of deaths.

Next, we estimate equation (1) to examine the wage effects of the COVID-19 pandemic. The results are presented in Table 2. The results of non-interacted variables show that wages are higher in older, male, or married persons, urban residents, persons with teenagers, WfH-feasible occupations, educated or skilled persons, or persons working in larger companies. Overall, the results are mostly consistent with previous studies on wages in Thailand (e.g., Thaiprasert et al., 2020; Korwatanasakul, 2021), which find that age, a proxy for work experience, has a positive relationship with wages. Female workers earn less than their male counterparts, and workers with a university degree earn more than those without one. On average, workers living in urban areas earn more than those residing in rural areas. Having children is found to have a positive impact on wages. This may be due to the increased costs associated with raising children, which can incentivize workers to work harder to earn more money. In column "Case," the severe damages caused by COVID-19 expanded the wage gap based on skills but reduced the wage gap by company size.[9] The results using the number of deaths also show an increased wage gap between skilled and unskilled occupations as well as a decrease in the wage gap between large companies and others and between highly educated and less-educated workers.

=== Table 2 ===

In Table 3, we estimate equation (1) for some selected industries separately, using the number of confirmed cases. There are some noteworthy differences. Unlike the results for all industries shown in Table 2, COVID-19 damages expanded the wage gap in agriculture according to company size. Given that agricultural workers tend to work outside and not close together, normal production may have been more likely even during the pandemic because of the lower possibility of infection. As a result, larger agricultural companies may have hired more workers and expanded their business to meet the growing global demand for food, thereby raising workers' wages. The decrease in the wage gap by company size can be observed in the manufacturing and retail industries. The relative wages in medium-sized companies decreased in the construction industry and increased in the transport industry. No different effects by company sizes are detected in the hotel industry. The results using the number of deaths are shown in Table 4. Some of the above-mentioned results become insignificant. Nevertheless, we again find that COVID-19 damages decreased the wage gap by company size in the manufacturing and retail industries. This decrease in these industries is likely due to either the government's support for smaller firms or the higher costs of complying with restrictions in larger firms or both.

[9] The composition of each company size does not change much during our study period, though we can see a slight decrease in large companies since 2021. See Figure A1 in the Appendix.

=== Tables 3 & 4 ===

Last, we examine one specific policy, the Factory Sandbox program.[10] As explained in Section 2, this program imposes some costs for large companies in some industries in designated provinces. Specifically, we create a dummy variable (*Sandbox*) taking a value of 1 for large companies (i.e., those with over 200 employees) in some designated manufacturing industries (automotive, electronics, food, and medical equipment) in some designated provinces (Nonthaburi, Pathum Thani, Samut Sakhon, and Chonburi) from the fourth quarter of 2021. Although this phase-1 program, which started in August 2021, targets factories with 500 or more employees, our dataset cannot differentiate sizes for factories with more than 200 employees. Thus, the dummy is designed to take a value of 1 for companies with more than 200 persons. This dummy also takes a value of 1 for medium-sized companies (101–199 employees) and some additional provinces (Rayong, Prachin Buri, Phra Nakhon SiAyutthaya, Lopburi, Sara Buri, Chachoendsao, Samut Prakan, and Songkhla) in 2022. This dummy variable varies at a province–industry–time level.

The results are presented in Table 5. We focus on workers in the manufacturing sector because the sandbox program was applied to manufacturing companies. The coefficient for the *Sandbox* dummy is estimated to be significantly positive in both columns. The positive coefficient is opposite to our expectation, which is that large companies need to incur some costs in the sandbox program and thus lower their wages. The positive result may indicate that this program contributed to reducing uncertainty in business feasibility. As long as they follow the regulations, factories can maintain their production activities, thereby maintaining or increasing their profits. However, note that our estimate here does not show the causal effect of this program. In particular, although we control for province–industry fixed effects, we cannot rule out the selection mechanism, that is, that the participating companies had higher wages. Last, the results again show that COVID-19 damages decreased the wage gap by company size in the manufacturing sector.

=== Table 5 ===

5. Concluding Remarks

In this paper, we empirically investigated the effect of the COVID-19 pandemic on the labor market, especially wages, in Thailand. By using the individual-level quarterly data in Thailand from 2019 to 2022, we examined the differences in the wage impact of the COVID-19 pandemic according to company size. Our finding is that, as in other countries, workers

[10] We do not explicitly introduce the variable on the "bubble and seal" measure because it is applied to all establishments.

in larger companies had significantly higher wages. However, we found that the COVID-19 pandemic contributed to reducing this wage gap across company sizes on average, especially in the manufacturing sector. This result may be due to various kinds of policy support provided to SMEs. Although it remains unclear whether this wage gap reduction will benefit the country in the long run, our results at least suggest the success of supporting SMEs.

We also examined the effects of the Factory Sandbox program, a voluntary initiative aimed at export-driven manufacturing industries, on wages. The finding indicates that the program had a positive impact on wages. This program helped to prevent and reduce the spread of COVID-19 in workplaces, allowing businesses to maintain operational continuity without major disruptions. Consequently, the benefits of participating in such a program are likely to outweigh the costs. Therefore, the results provide valuable insights and important lessons for policymakers in the event of future pandemics.

References

Apedo-Amah, Marie Christine, Besart Avdiu, Xavier Cirera, Marcio Cruz, Elwyn Davies, Arti Grover, Leonardo Iacovone, Umut Kilinc, Denis Medvedev, Franklin Okechukwu Maduko, Stavros Poupakis, Jesica Torres, and Trang Thu Tran, 2020, Unmasking the Impact of COVID-19 on Businesses: Firm Level Evidence from Across the World, Policy Research Working Paper Series 9434, The World Bank.

Bartik, Alexander W., Marianne Bertrand, Zoe Cullen, Edward Glaeser, Michael Luca, and Christopher T. Stanton, 2020, The Impact of COVID-19 on Small Business Outcomes and Expectations, *Proceedings of the Natural Academy of Sciences*, 117(30): 17656–17666.

Béland, Louis-Philippe, Abel Brodeur, and Taylor Wright, 2023, The Short-Term Economic Consequences of COVID-19: Exposure to Disease, Remote Work and Government Response, *PLOS ONE*, 18(3): e0270341.

Bloom, Nicholas, Robert S. Fletcher, and Ethan Yeh, 2021, The Impact of COVID-19 on US Firms, *NBER Working Papers 28314*, National Bureau of Economic Research, Inc.

Cajner, Tomaz, Leland D. Crane, Ryan A. Decker, John Grigsby, Adrian Hamins-Puertolas, Erik Hurst, Christopher Kurz, and Ahu Yildirmaz, 2020, The U.S. Labor Market During the Beginning of the Pandemic Recession, *Brookings Papers on Economic Activity*, Summer: 3–33.

Casarico, Alessandra and Salvatore Lattanzio, 2022, The Heterogeneous Effects of COVID-19 on Labor Market Flows: Evidence from Administrative Data, *Journal of Economic Inequality*, 20(3): 537-558.

Chairassamee, Nattanicha, and Oudom Hean, 2022, Effects of the COVID-19 Pandemic on the Labour Market in Thailand, *Journal of Southeast Asian Economies*, 39(3): 330–41.

Couch, Kenneth A., Robert W. Fairlie, and Huanan Xu, 2020, Early Evidence of the Impacts of COVID-19 on Minority Unemployment, *Journal of Public Economics*, 192: 104287.

Farré, Lídia, Yarine Fawaz, Libertad González, and Jennifer Graves, 2022, Gender Inequality in Paid and Unpaid Work During Covid-19 Times, *Review of Income and Wealth*, 68(2): 323-347.

Fernández-Cerezo Alejandro, Beatriz Gonzalez, Izquierdo Peinado Mario, Enrique Moral-Benito, 2022, Firm-level Heterogeneity in the Impact of the COVID-19 Pandemic, *Applied Economics*, 55(42): 4946–4974.

Holgersen, Henning, Zhiyang Jia, and Simen Svenkerud, 2021, Who and How Many Can Work from Home? Evidence from Task Descriptions, *Journal for Labour Market Research*, 55(1): 4.

Juarez, Laura, and Paula Villaseñor, 2024, Effects of the COVID-19 Pandemic on the Labor Market Outcomes of Women with Children in Mexico, *Economía LACEA Journal*, 23(1): 30–49.

Korwatanasakul, Upalat, 2021, Determinants, Wage Inequality, and Occupational Risk Exposure of Informal Workers: A Comprehensive Analysis with the Case Study of Thailand, PIER Discussion Paper No. 160, Puey Ungphakorn Institute for Economic Research

Miguel, Cardoso and Brandon Malloy, 2021, Impact of the First Wave of the COVID-19 Pandemic on Trade between Canada and the United States, *Canadian Public Policy*, 47(4): 554-572.

Ministry of Public Health, 2021, Strategy: Managing the new wave of the Covid-19 Epidemic. Retrieved August 7, 2023, from https://ddc.moph.go.th/viralpneumonia/eng/index.php

Montenovo, Laura, Xuan Jiang, Felipe Lozano Rojas, Ian M. Schmutte, Kosali I. Simon, Bruce A. Weinberg, and Coady Wing, 2022, Determinants of Disparities in Early COVID-19 Job Losses, *Demography*, 59(3): 827-855.

Paweenawat, Sasiwimon Warunsiri and Lusi Liao, 2024, Who Suffers the Most During the COVID-19 Pandemic? Evidence From Thailand, *The Developing Economies*, 62(3): 238-268.

Rababah, Abedalqader, Lara Al-Haddad, Muhammad Safdar Sial, Zheng Chunmei, and Jacob Cherian, 2020, Analyzing the Effects of COVID-19 Pandemic on the Financial Performance of Chinese Listed Companies, *Journal of Public Affairs*, 20(4): e2440.

Shen, Huayu, Mengyao Fu, Hongyu Pan, Zhongfu Yu, and Yongquan Chen, 2020, The Impact of the COVID-19 Pandemic on Firm Performance, *Emerging Markets Finance and Trade*, 56(10): 2213–2230.

Thaiprasert, Nalitra, Supanika Leurcharusmee, Peerapat Jatukannyaprateep, and Jirakom Sirisrisakulchai, 2020, Determinants of Labor Force Participation and Wages in Thailand: What is the Role of the Informal Sector?, *Asian Economic Journal*, 34(3): 301-326.

World Bank, 2021, Impact of COVID-19 on Thailand's Households: Insights from a Rapid Phone Survey (English). Washington, D.C.: World Bank Group.

Table 1. Ordinary Least Square Results on the Employment Impacts

	Case	Death
Non-interacted variables		
ln Age	-0.101***	-0.103***
Male	0.152***	0.151***
Marital status: Single (Base)		
Married	0.055***	0.053***
Widowed/Divorced	0.043***	0.041***
Urban	-0.004	-0.005*
Teenagers	-0.030***	-0.031***
University graduates	0.071***	0.069***
Interaction of COVID-19 variables		
ln Age	-0.013***	-0.959
Male	-0.007**	-0.537*
Marital status: Single (Base)		
Married	-0.012***	-1.070***
Widowed/Divorced	-0.003	0.023
Urban	-0.004**	-0.270
Teenagers	-0.003**	-0.212
University graduates	-0.008***	-0.352
Province-time FE	X	X
Number of observations	1,641,234	1,641,234
Adjusted R-squared	0.064	0.064

Notes: Estimation results were obtained using the ordinary least square method. The dependent variable is a dummy variable taking a value of 1 if an individual was employed in the past week. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. The standard errors are clustered by provinces and are omitted to save space.

Table 2. Ordinary Least Square Results on the Wage Impacts: All Industries

	Case	Death
Non-interacted variables		
ln Age	0.143***	0.143***
Male	0.092***	0.091***
Marital status: Single (Base)		
Married	0.037***	0.038***
Widowed/Divorced	0.001	0.000
Urban	0.021***	0.022***
Teenagers	0.012***	0.012***
WfH Feasibility	0.166***	0.164***
University graduates	0.249***	0.253***
Occupation: Unskilled (Base)		
Middle skilled	0.124***	0.124***
High skilled	0.466***	0.466***
Company size: Small (Base)		
Medium	0.072***	0.073***
Large	0.093***	0.094***
Interaction of COVID-19 cases / population with		
ln Age	0.015	3.069
Male	-0.002	-0.122
Marital status: Single (Base)		
Married	-0.002	-0.97
Widowed/Divorced	-0.001	0.272
Urban	-0.007	-1.663
Teenagers	0.000	-0.249
WfH Feasibility	-0.012*	-1.147
University graduates	-0.003	-2.528**
Occupation: Unskilled (Base)		
Middle skilled	0.012**	2.470***
High skilled	0.026***	5.230***
Company size: Small (Base)		
Medium	-0.006	-2.488**
Large	-0.012***	-2.873***
Industry-time FE	X	X
Province-time FE	X	X
Industry-province FE	X	X
Number of observations	453,713	453,713
Adjusted R-squared	0.677	0.677

Notes: Estimation results were obtained using the ordinary least square method. The dependent variable is a log of monthly wages. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. The standard errors are clustered by provinces and are omitted to save space.

Table 3. Ordinary Least Square Results on the Wage Impacts by Industry: Confirmed Cases

Sector	Agricul	Manufa	Constru	Retail	Hotel	Transp
Non-interacted variables						
ln Age	-0.075***	0.241***	0.061***	0.157***	0.069***	0.198***
Male	0.095***	0.107***	0.105***	0.077***	0.073***	0.056***
Marital status: Single (Base)						
Married	0.079***	0.019***	0.073***	0.038***	0.033***	0.054***
Widowed/Divorced	0.071***	-0.015*	0.015	-0.001	-0.006	-0.008
Urban	0.013	0.010	0.016**	0.030***	0.040***	0.004
Teenagers	-0.006	0.021***	0.008	-0.001	0.000	-0.011
WfH Feasibility	0.243***	0.174***	0.239***	0.133***	0.120***	0.095***
University graduates	0.148***	0.265***	0.288***	0.200***	0.200***	0.244***
Occupation: Unskilled (Base)						
Middle skilled	0.062**	0.098***	0.136***	0.178***	0.083***	0.224***
High skilled	0.497***	0.454***	0.542***	0.518***	0.410***	0.522***
Company size: Small (Base)						
Medium	0.179***	0.066***	0.105***	0.097***	0.088***	0.048***
Large	0.212***	0.095***	0.097***	0.115***	0.146***	0.073***
Interaction of COVID-19 cases / population with						
ln Age	-0.005	0.02	0.031**	0.01	-0.004	-0.01
Male	0.007	-0.001	-0.004	-0.010**	0.002	0.001
Marital status: Single (Base)						
Married	-0.001	-0.004	0.00	-0.005	0.012**	0.005
Widowed/Divorced	-0.026	-0.011	0.020	-0.004	0.019	-0.019
Urban	0.003	-0.009	-0.006	-0.001	-0.011	0.005
Teenagers	-0.009	-0.001	0.001	0.007	0.004	0.005
WfH Feasibility	-0.031	-0.010	-0.027**	-0.014*	-0.018	-0.023**
University graduates	0.021	0.001	0.005	0.009	-0.008	-0.048**
Occupation: Unskilled (Base)						
Middle skilled	0.022	0.008	0.013*	0.006	0.032	-0.004
High skilled	0.108	0.024	0.012	0.009	0.062**	0.026
Company size: Small (Base)						
Medium	-0.002	-0.015*	-0.058***	-0.003	0.006	0.033**
Large	0.069**	-0.023***	0.031	-0.012**	0.002	-0.002
Industry-time FE	X	X	X	X	X	X
Province-time FE	X	X	X	X	X	X
Industry-province FE	X	X	X	X	X	X
Number of observations	50,674	132,994	57,480	90,258	32,601	18,486
Adjusted R-squared	0.442	0.635	0.624	0.597	0.51	0.49

Notes: Estimation results were obtained using the ordinary least square method. The dependent variable is a log of monthly wages. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. The standard errors are clustered by provinces and are omitted to save space.

Table 4. Ordinary Least Square Results on the Wage Impacts by Industry: Deaths

Sector	Agricul	Manufa	Constru	Retail	Hotel	Transp
Non-interacted variables						
ln Age	-0.078***	0.236***	0.064***	0.158***	0.067***	0.193***
Male	0.096***	0.107***	0.102***	0.076***	0.076***	0.065***
Marital status: Single (Base)						
Married	0.081***	0.019***	0.072***	0.037***	0.036***	0.055***
Widowed/Divorced	0.070***	-0.017*	0.016	-0.004	-0.002	-0.004
Urban	0.012	0.013**	0.015**	0.031***	0.038***	0.003
Teenagers	-0.008	0.023***	0.009	-0.001	0.000	-0.010
WfH Feasibility	0.250***	0.171***	0.238***	0.130***	0.118***	0.090***
University graduates	0.156***	0.269***	0.292***	0.203***	0.199***	0.248***
Occupation: Unskilled (Base)						
Middle skilled	0.063**	0.098***	0.139***	0.179***	0.084***	0.220***
High skilled	0.518***	0.455***	0.538***	0.522***	0.416***	0.512***
Company size: Small (Base)						
Medium	0.177***	0.070***	0.104***	0.100***	0.084***	0.050***
Large	0.212***	0.097***	0.092**	0.118***	0.140***	0.070***
Interaction of COVID-19 deaths / population with						
ln Age	0.73	7.203**	3.293	1.348	-0.023	2.012
Male	0.677	-0.325	1.582	-0.995	-1.187	-5.664
Marital status: Single (Base)						
Married	-1.78	-0.928	0.456	-0.39	0.462	0.612
Widowed/Divorced	-3.55	-1.147	3.014	1.701	1.34	-5.521
Urban	0.897	-3.602**	-0.114	-1.260	-0.699	1.748
Teenagers	0.067	-1.533*	-0.893	1.154	1.028	-0.154
WfH Feasibility	-12.729	0.262	-5.202*	-0.755	-2.562	-1.511
University graduates	-1.073	-2.470	-1.572	-0.001	-0.587	-11.910**
Occupation: Unskilled (Base)						
Middle skilled	2.711	1.713	0.854	0.752	6.103**	1.222
High skilled	6.715	4.372	5.186	-0.321	7.806**	10.601*
Company size: Small (Base)						
Medium	1.961	-5.445***	-13.718***	-4.139	4.455	4.066
Large	8.065	-5.717***	8.46	-3.878**	4.203	1.107
Industry-time FE	X	X	X	X	X	X
Province-time FE	X	X	X	X	X	X
Industry-province FE	X	X	X	X	X	X
Number of observations	50,674	132,994	57,480	90,258	32,601	18,486
Adjusted R-squared	0.442	0.635	0.624	0.597	0.51	0.49

Notes: Estimation results were obtained using the ordinary least square method. The dependent variable is a log of monthly wages. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. The standard errors are clustered by provinces and are omitted to save space.

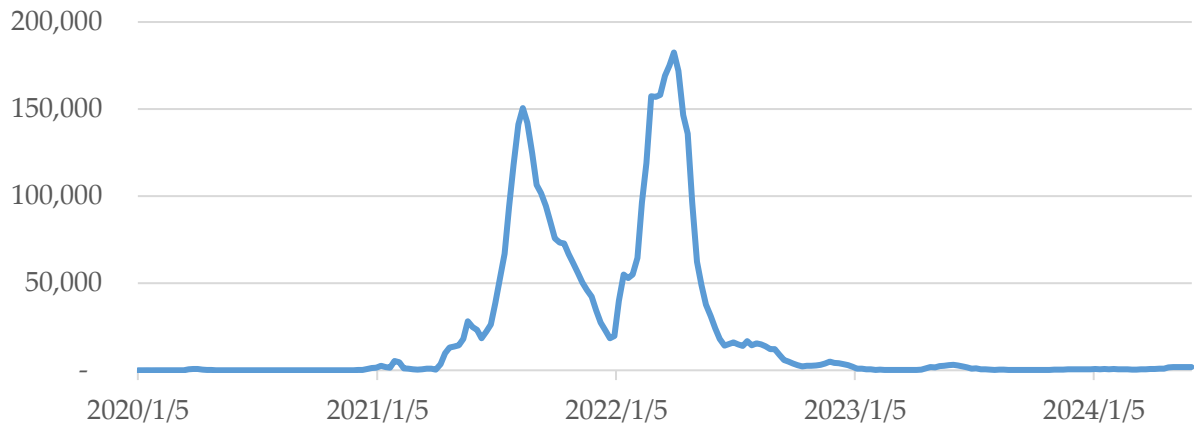
Table 5. Ordinary Least Square Results on the Wage Impacts in Manufacturing Industries: Sandbox Strategy

	Case	Death
Non-interacted variables		
Sandbox	0.024**	0.022**
ln Age	0.241***	0.236***
Male	0.107***	0.107***
Marital status: Single (Base)		
Married	0.019***	0.020***
Widowed/Divorced	-0.015*	-0.017*
Urban	0.010	0.013**
Teenagers	0.021***	0.023***
WfH Feasibility	0.174***	0.171***
University graduates	0.265***	0.269***
Occupation: Unskilled (Base)		
Middle skilled	0.098***	0.098***
High skilled	0.454***	0.455***
Company size: Micro (Base)		
Medium	0.066***	0.069***
Large	0.094***	0.096***
Interaction of COVID-19 cases / population with		
ln Age	0.02	7.213**
Male	-0.001	-0.320
Marital status: Single (Base)		
Married	-0.004	-0.936
Widowed/Divorced	-0.011	-1.157
Urban	-0.009	-3.604**
Teenagers	-0.001	-1.514*
WfH Feasibility	-0.010	0.252
University graduates	0.001	-2.435
Occupation: Unskilled (Base)		
Middle skilled	0.007	1.639
High skilled	0.023	4.325
Company size: Small (Base)		
Medium	-0.015**	-5.522***
Large	-0.024***	-5.931***
Industry-time FE	X	X
Province-time FE	X	X
Industry-province FE	X	X
Number of observations	132,994	132,994
Adjusted R-squared	0.635	0.635

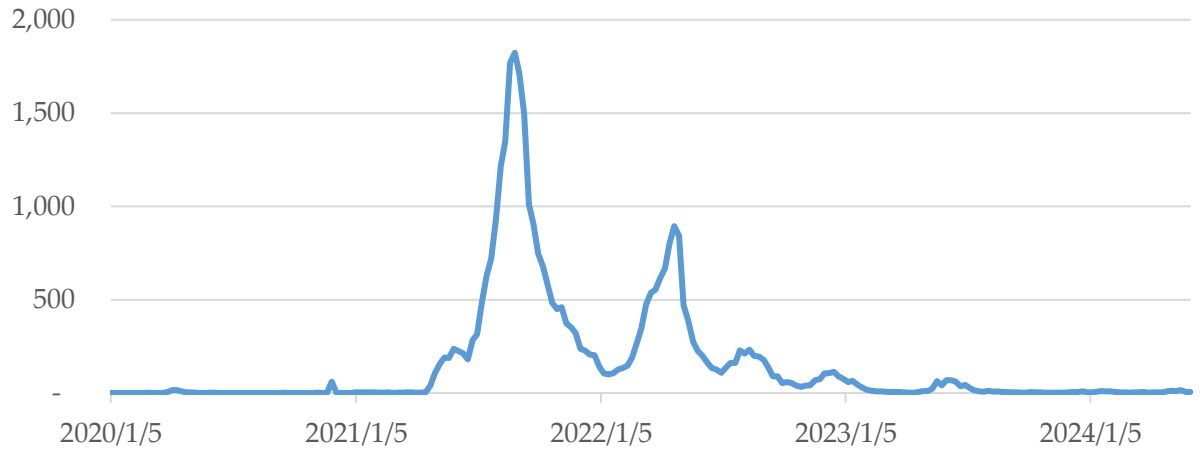
Notes: Estimation results were obtained using the ordinary least square method. The dependent variable is a log of monthly wages. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. The standard errors are clustered by provinces and are omitted to save space.

Figure 1. Daily New COVID-19 Cases and Deaths in Thailand

(a) Cases



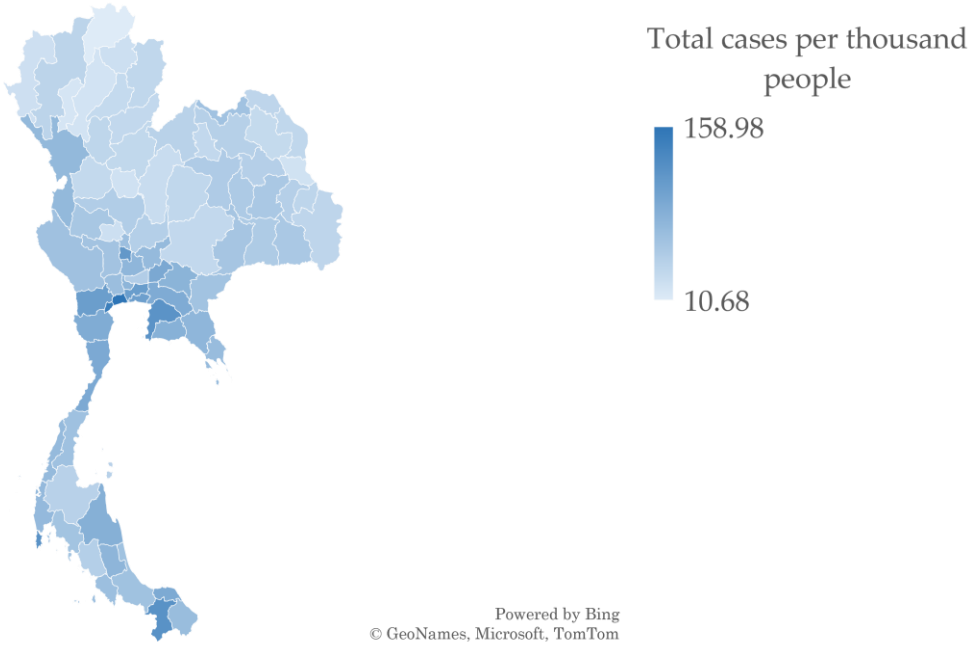
(b) Deaths



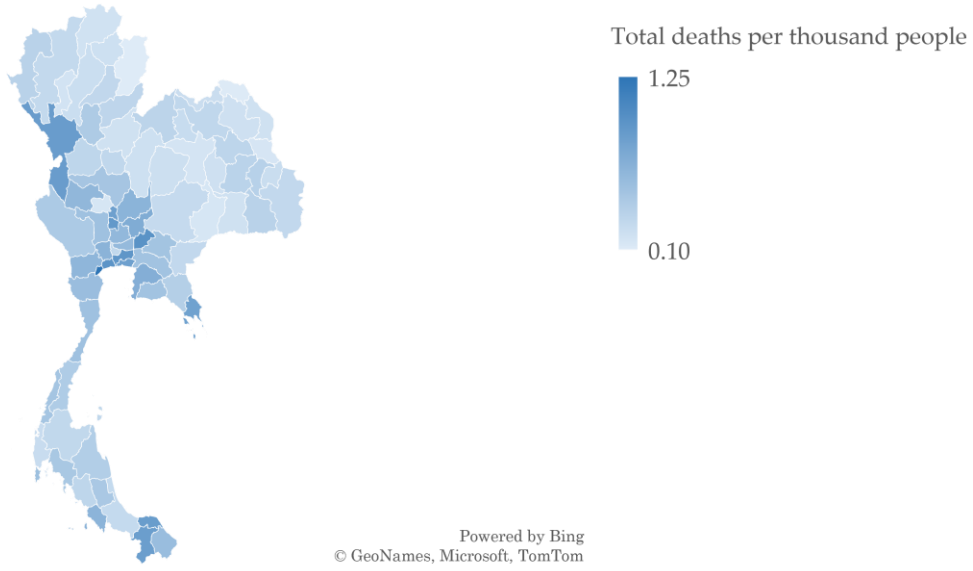
Source: The WHO coronavirus (COVID-19) dashboard. Retrieved June 18, 2024 from https://data.who.int/dashboards/covid19/data

Figure 2. Total COVID-19 Cases and Deaths per Thousand People by Province in Thailand, as of December 31, 2022

(a) Cases



(b) Deaths



Source: The Department of Disease Control, Ministry of Public Health, Thailand. Retrieved July 30, 2024 from https://covid19.ddc.moph.go.th/

Appendix. Other Tables and Figures

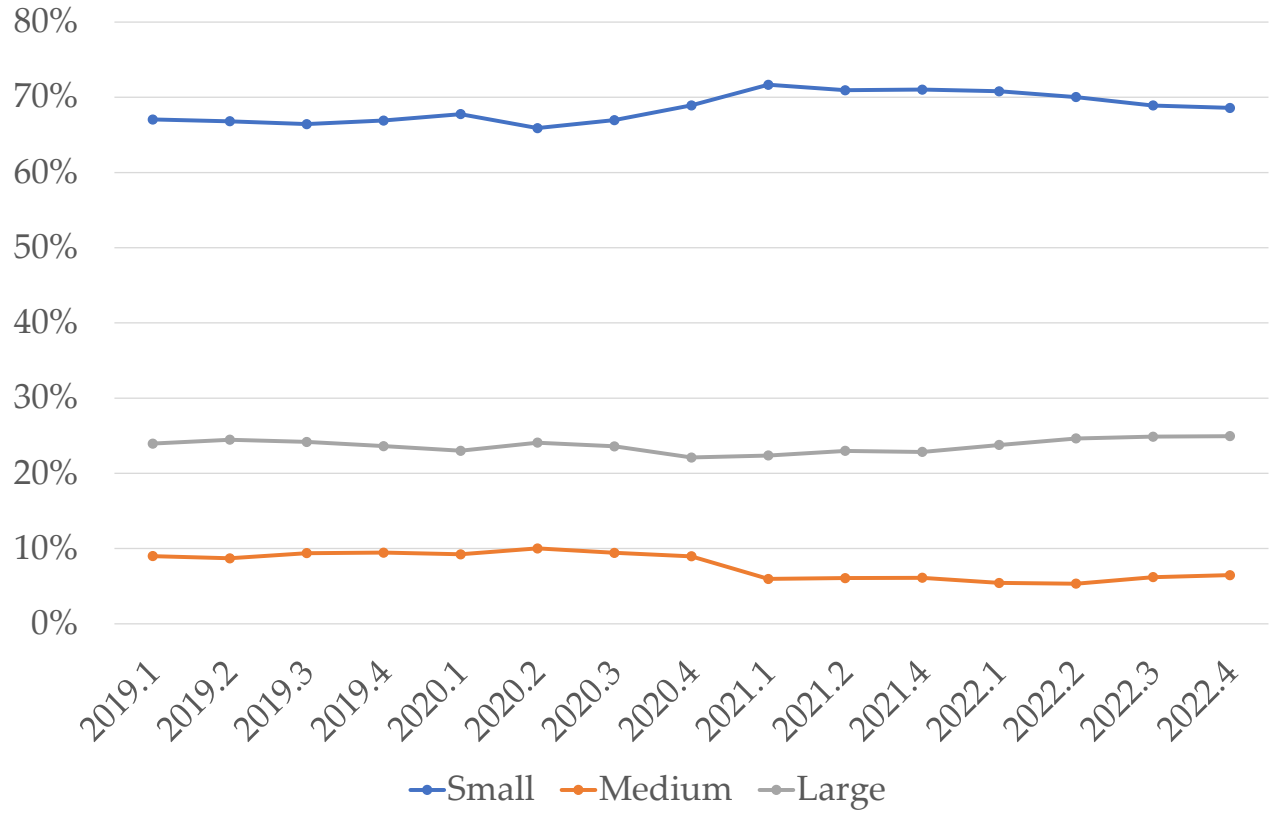
Table A1. Basic Statistics

	Obs	Mean	Std. Dev.	Min	Max
Employment	1,536,044	0.823	0.381	0	1
ln Wages	453,713	9.207	0.505	7.783	10.968
Non-interacted variables					
Sandbox	132,994	0.040	0.195	0	1
ln Age	453,713	3.616	0.317	2.708	4.522
Male	453,713	0.554	0.497	0	1
Marital status: Single (Base)					
Married	453,713	0.638	0.481	0	1
Widowed/Divorced	453,713	0.074	0.262	0	1
Urban	453,713	0.587	0.492	0	1
Teenagers	453,713	0.475	0.499	0	1
WfH Feasibility	453,713	0.129	0.335	0	1
University graduates	453,713	0.222	0.415	0	1
Occupation: Unskilled (Base)					
Middle skilled	453,713	0.641	0.480	0	1
High skilled	453,713	0.130	0.336	0	1
Company size: Small (Base)					
Medium	453,713	0.064	0.245	0	1
Large	453,713	0.209	0.407	0	1
Interaction of COVID-19 cases / population with					
ln Age	453,713	0.959	2.183	0	25.051
Male	453,713	0.145	0.461	0	5.916
Marital status: Single (Base)					
Married	453,713	0.162	0.487	0	5.916
Widowed/Divorced	453,713	0.019	0.174	0	5.916
Urban	453,713	0.155	0.467	0	5.916
Teenagers	453,713	0.113	0.413	0	5.916
WfH Feasibility	453,713	0.036	0.240	0	5.916
University graduates	453,713	0.063	0.320	0	5.916
Occupation: Unskilled (Base)					
Middle skilled	453,713	0.165	0.492	0	5.916
High skilled	453,713	0.037	0.246	0	5.916
Company size: Small (Base)					
Medium	453,713	0.014	0.152	0	5.916
Large	453,713	0.058	0.303	0	5.916

	Obs	Mean	Std. Dev.	Min	Max
Interaction of COVID-19 deaths / population with					
ln Age	453,713	0.006	0.011	0	0.113
Male	453,713	0.001	0.002	0	0.026
Marital status: Single (Base)					
Married	453,713	0.001	0.002	0	0.026
Widowed/Divorce	453,713	0.000	0.001	0	0.026
Urban	453,713	0.001	0.002	0	0.026
Teenagers	453,713	0.001	0.002	0	0.026
WfH Feasibility	453,713	0.000	0.001	0	0.026
University graduates	453,713	0.000	0.002	0	0.026
Occupation: Unskilled (Base)					
Middle skilled	453,713	0.001	0.002	0	0.026
High skilled	453,713	0.000	0.001	0	0.026
Company size: Small (Base)					
Medium	453,713	0.000	0.001	0	0.026
Large	453,713	0.000	0.001	0	0.026

Source: Authors' compilation.

Figure A1. Sample Compositions of Each Company Size



Source: Authors' compilation.

Note: To recover the population, we used weights in the computation.