**Background**

COVID-19 has profoundly transformed global daily life through the enforcement of mandatory or recommended isolation measures. As nations adopt varied policies and strategies to combat the virus's spread, numerous studies have explored how political, cultural, and economic factors shape the stringency of COVID-19 policy responses (Frey et al., 2020; Tang et al., 2022). Amid the pandemic, administrators must balance the need for workplace closures to control infection rates with the potential impact on economic development. Our research specifically focuses on the influence of economic factors on closure policy responses, examining how economic considerations guide decisions in the midst of health crises.

**Rationale and Questions**

Countries with a significant portion of their GDP derived from industry may experience more severe economic repercussions from workplace closures. This can lead to a more cautious approach to imposing such restrictions, balancing health risks against economic stability. Is the effect of infectious rate on closure moderated by the industrial sector's share of GDP? We hypothesize that, for countries with a lower industry sector’s share of GDP, a higher infectious rate predicts a higher closure policy; for countries with a higher industry sector’s share of GDP, the effect of infectious rate on closure is less significant.

Jobs in industry possess unique characteristics different from jobs in agriculture and services. For example, compared to agriculture and the service sector, the industrial sector requires more and denser on-site work. These characteristics can generate differences in moderation effect in the relationship between closure policy and infectious rate. To further validate the moderation effect for industry, economic sectors other than industry can be tested. Is the effect of infectious rate on closure moderated by other economic sectors’ share of GDP in a way different from industry? We hypothesize that the agricultural and service sectors do not demonstrate a similar attenuating influence on the correlation between infection rates and the implementation of workplace closures.

Different economic factors can interact with each other. For instance, manufactured products can be put into international trade. International trade inherently involves a level of human contact, so it can play a role in guiding decisions in making workplace closure policies. One indicator of involvement in international trade is export volume. We investigated whether the industrial sector's share of GDP interacts with export volume to have effects on policy-making regarding workplace closure. We hypothesize that

**Data**

We used 5 datasets: international trade, GDP composition, population, cumulative case of COVID-19 infection and workplace closure.

The data *Exports\_and\_Imports\_by\_Areas\_and\_Co.xlsx* comes from the International Monetary Fund (IMF). It includes export and import volumes by country from 2014 to 2022 in each month. Each row in the raw dataset represents a country’s export volume in sheet 1 and import volume for sheet 2 across 2014-2022. (source from:<https://data.imf.org/regular.aspx?key=61013712>) We sum the export value for each country in 2020.

The data *gdp\_composition\_2020.csv* comes from The World Bank. It includes GDP composition by agriculture, industry and service by country in the year 2020. (source from: [https://wdi.worldbank.org/table/4.2#](https://wdi.worldbank.org/table/4.2%23))

The data *population.csv* comes from Worldometer website. The raw data includes variables such as population, urban percentage and land area by country. (source from: [https://www.worldometers.info/world-population/population-by-country/#google\_vignette](https://www.worldometers.info/world-population/population-by-country/%23google_vignette))

The data *WHO-COVID-19-global-data.csv* comes from the World Health Organization (WHO). It includes cumulative cases of infection from 2019 to 2023 by each day. (source from: <https://covid19.who.int/data>) We used the cumulative cases in 2020-12-31, which is the cumulative cases for 2020 in each country. The infectious rate is calculated by (cumulative cases / population) for each country.

The data *workplace-closures-covid.csv* is from the Our World in Data website. It includes workplace closure levels during the pandemic by country. Each row in the raw dataset represents a country’s response level of strictness. (source from: <https://ourworldindata.org/covid-school-workplace-closures>) The data is shown by day. There are 4 levels: “no workplace closure” labelled “0”, “recommended workplace closure” labelled “1”, “required for some workplace closure” labelled as “2,” and “required for all but key workers” labelled as “3”. We sum all the values for the days in 2020. So, a higher value after summation means a higher level of workplace closure in 2020 overall.

The 5 datasets all aim to include all countries in the world. However, due to various reasons, some countries are shown in some of the 5 datasets but not the others. The countries we used in the analysis are the shared countries in the 5 datasets. The countries used include countries from all continents except Antarctica. The countries include high-income, middle-income and low-income countries.

**Results**

In order to test the first hypothesis, we estimated a regression model in which we regressed closure on industry, square root of infectious rate and their interaction. As predicted, there was a statistically significant interaction, F(1, 144) = 8.19, p = 0.005, eta\_squared = 0.05. For every one unit increase in square root infectious rate, the simple effect of industry decreases by 103.7 units on closure score. Our hypothesis is confirmed. Countries that rely heavily on industrial output for a large part of their economic activity might face greater economic challenges due to the closure of workplaces. To preserve their economic stability, these countries might be more hesitant to shut down workplaces.

To test the second hypothesis, we regress closure on agriculture, service and manufacturing. As predicted, there was a statistically significant interaction between infectious rate and manufacturing share in GDP, F(1, 144) = 12.36, p < 0.001, eta\_squared =0.08. For every one unit increase in square root infectious rate, the simple effect of manufacturing decreases by 183.7 units on closure score, it shows a convergent validity with model prediction for industry. There was no statistically significant interaction between infectious rate and service share in GDP, F(1, 144) = 0.281, p = 0.597, eta\_squared < 0.001. There was a statistically significant interaction between infectious rate and agriculture share in GDP, F(1, 144) =19.84, p < 0.001, eta\_squared = 0.12, the pattern of interaction is totally different from that of the manufacturing model and industry model, for every one unit increase in square root infectious rate, the simple effect of agriculture increases by 294.68 unit on closure score.

In order to test the third hypothesis, we estimated a regression model in which we regressed closure on industry, log(Export Volume +1) and their interaction. There was no statistically significant interaction between closure and export volume in GDP, F(1, 144) = 1.774, p = 0.185, eta\_squared = 0.001. There is a positive relationship between export volume and workplace closure, F(1, 144) = 7.706, p = 0.01, eta\_squared = 0.02.

**Discussion**

Countries that rely heavily on industrial output for a large part of their economic activity might face greater economic challenges due to the closure of workplaces. To preserve their economic stability, these countries might be more hesitant to shut down workplaces. Agriculture and services may not be as severely influenced by workplace closure as industry. Service-based economies might have greater flexibility to adapt to closures, as more jobs in this sector can transition to remote work. Besides, some services, such as tourism, are impacted by the pandemic anyway no matter whether workplaces are closed. This can influence the extent and stringency of workplace closure policies. A higher portion of agriculture in GDP may correlate with lower involvement in the global market. Apart from that, the operation of agriculture varies greatly from country to country. In some countries, agriculture is based on small-scale family units, while in others, it is dominated by mechanized farming. This is influenced by a variety of factors, including geography, economy, culture, and technology. Therefore, when agriculture is analyzed as a whole, the reference value may not be significant. The positive relationship between export volume and workplace closure may be as a result of the relationship between export volume and infectious rate, as international trade inherently involves a level of human contact. The more the export volume, the more the country is involved in international trade, thus higher potential for infection.

There are several limitations of this study. First, potential confounds can influence the moderation effect. For example, political and cultural factors, such as individualism, as mentioned in Frey et al. (2020), can affect policymaking. Second, we merged 5 datasets to conduct the analysis. Some countries do not have values in all datasets, which may introduce potential variance to the statistical models. Third, the implementation intensity of the policy may not match the originally envisaged policy intensity. For example, some organizations may have higher autonomy and will not close the workplace as required by the policy. Forth, the export and import data adapted from IMF does not include the data for May and June 2020 because of the pandemic.

In our exploration of various models, we observed that Health Policy is likely influenced by the intricate interplay of economic, political, and cultural factors. Future research could benefit from incorporating cultural and political elements, either as focal predictors or as covariates, to yield more precise and comprehensive results. Also, longitudinal studies can be conducted to investigate the factors influencing health policy-making over time.

**Reference**

Frey, C. B., Chen, C., & Presidente, G. (2020). Democracy, culture, and contagion: Political regimes and countries responsiveness to Covid-19. *Covid Economics*, (18).

Tang, J. W., Caniza, M. A., Dinn, M., Dwyer, D. E., Heraud, J. M., Jennings, L. C., ... & Zaidi, S. K. (2022). An exploration of the political, social, economic and cultural factors affecting how different global regions initially reacted to the COVID-19 pandemic. *Interface Focus*, *12*(2), 20210079.