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# Impact of COVID-19 on Malaysia's Bilateral Export: Testing for Heterogeneous Effects in the Product Category

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This study analyzes the impact of COVID-19 on Malaysia's bilateral export in three categories of goods. The results show that higher numbers of COVID-19 cases among trading partners has led to higher levels of bilateral export for capital and consumption goods. Meanwhile, incremental increases in a trading partner's policy stringency index has lowered the level of bilateral export for capital goods. These negative impacts highlight the need for support policies to ensure the survival of domestic producers during the current pandemic.

## I. Introduction

The coronavirus (COVID-19) pandemic has nearly halted all global economic activities as countries have imposed various measures to curb outbreaks. According to Baldwin & Freedman (2020), the latest pandemic distorts international trade and supply chain, since global demand has dramatically decreased. This is shown for the second half of 2020, when demand and supply weakened, causing global trade to decrease by 3.5% (International Monetary Fund, 2020). Because of this situation, the world is about to face the worst economic and social crises in history. The pandemic outbreak has significantly reduced global trade interconnectedness, connectivity, and density among countries (Vidya & Prabheesh, 2020). As one of the world's top trading nations, Malaysia's export also faces huge challenges in the current scenario. In April 2020, Malaysia's exports registered a decline of 23.8% year on year, the worst performance since the global financial crisis in 2009 (Department of Statistics Malaysia, 2020). The reductions are also due to preventive measures taken by policymakers to slow down the spread of COVID-19.

The severity of the COVID-19 outbreak has led various researchers and policymakers to investigate its economic implications (Padhan & Prabheesh, 2021). Although most studies focus on the financial impact, several have established strong evidence on the adverse impact on trade performance (Barichello, 2020; Cao et al., 2020; Hayakawa & Mukunoki, 2021; Vidya & Prabheesh, 2020). Hayakawa & Mukunoki (2021) find that the number of COVID-19 cases affects global exports flows. Moreover, although the literature shows evidence of the negative implications of the stringency index on the stock market (Fernandez-Perez et al., 2021), studies investigating its impact on trade are lacking. The early appraisal of Büchel et al. (2020) highlights the importance of investigating trade impacts, since their correlation analysis found that the stringency index is related to trade performance.

Meier & Pinto (2020) find that the reduction in export is also due to distortion in the inflows of capital and intermediate goods. Unlike final goods, which are more consumer-centric, capital and intermediate goods, which are more production-centric, rely heavily on the global supply chain. This reliance highlights the heterogeneous impacts on different categories of goods and should be among the major concerns of countries deeply involved in global value chains, such as Malaysia. Most empirical studies analyze the trade impact of COVID-19 either at the country level, as aggregated sectors, or in specific sectors (Barichello, 2020; Vidya & Prabheesh, 2020; Zeshan, 2020). Hence, they could be subject to aggregation bias and thus unable to explain the varying product category impacts (Hyun, 2018).

The varying impacts on different categories of goods raise a key research question: does COVID-19 have a heterogeneous impact on Malaysia's bilateral exports for each category of goods? Hence, this study contributes to the literature in two aspects: first, in analyzing the heterogeneous impact of COVID-19 on Malaysia's bilateral export for three categories of goods, namely, capital goods, intermediate goods and consumption goods. Second, this study considers the implication of the stringency index on export performance, since empirical studies focusing on this matter are lacking.

This study is organized as follows. Section II presents the methodology and data. Section III report the findings. Section IV provides the conclusion of the study.

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## II. Methodology

This study utilizes panel data for 36 months starting in January 2018 through December 2020 for Malaysia's top 10 major export destination countries at the product level, following the Broad Economic Categories (BEC) classification. The ex post trade analysis uses the gravity model of trade. The gravity model is attributed to Tinbergen (1962) in analyzing the impact of free trade agreements on bilateral trade flows. The basic gravity model can be written as

$$X_{ij} = \frac{Y_i Y_j}{t_{ij}} \tag{1}$$

where $X_{ij}$ is the bilateral export from country $i$ to country $j$ ; $Y_i$ and $Y_j$ are the income for countries $i$ and $j$, respectively; and $t_{ij}$ is the cost of trade between two countries, such as the bilateral distance.

This study augments the basic model by including several proven essential control variables in the gravity model (Tham et al., 2018). Moreover, to address heterogeneities between countries, panel data are utilized. Hence, the basic model is augmented by including these variables and converted into a panel dimension in logarithmic form, as follows:

$$\begin{aligned} lnExport_{ijt} = {} & \beta_0 + \beta_1 lnGDP_{it} + \beta_2 lnGDP_{jt} \\ & + \beta_3 lnDist_{ij} + \beta_4 lnEXR_{ijt} \\ & + \beta_5 CL_{ij} + \varepsilon_{ijt} \end{aligned} \tag{2}$$

where $Export_{ijt}$ is the bilateral export from country $i$ to country $j$ at time $t$; $GDP_{it}$ and $GDP_{jt}$ are the income for countries $i$ and $j$ at time $t$, respectively; $Dist_{ij}$ is the bilateral distance from country $i$ to country $j$; $EXR_{ijt}$ is the bilateral exchange rate between country $i$ and country $j$ at time $t$; $CL_{ij}$ is the dummy variable that equals one if countries $i$ and $j$ share a common language, and zero otherwise; and $\varepsilon_{ijt}$ is the error term.

This research further expands the model to include product dimension, to avoid aggregation bias. Past research has shown that crisis affects export flows (Abafita & Tadesse, 2021). Therefore, following Hayakawa & Mukunoki (2021), this study captures the impact of the current pandemic by including the number of monthly COVID-19 cases. The study also includes a stringency index for government policy, to measure the impact of government action in curbing the outbreak, since past empirical studies have shown that government policies affect trade flows (Büchel et al., 2020; Zainuddin et al., 2020). Given the issues of zero trade and heteroscedasticity in the trade analysis (Sun & Reed, 2010), this study employs a Poisson pseudo-maximum likelihood (PPML) regression. Hence, following and Silva & Tenreyro (2006), the equation is transformed into exponent form, as follows:

$$\begin{aligned} Export_{ijnt} = {} & \exp(\alpha_0 + \beta x_{it} + \alpha_1 lnCOV_{it} \\ & + \alpha_2 lnCOV_{jt} + \alpha_3 POL_{it} \\ & + \alpha_4 POL_{jt}) \varepsilon_{ijnt} \end{aligned} \tag{3}$$

where $Export_{ijnt}$ is the bilateral export from country $i$ to country $j$ for product $n$ at time $t$; $x_{it}$ is a vector of independent variables according to equation (2); $COV_{it}$ and $COV_{jt}$ denote the number of monthly COVID-19 cases in countries $i$ and $j$, respectively; $POL_{it}$ and $POL_{jt}$ are the stringency index of government policy in countries $i$ and $j$, respectively; and $\varepsilon_{ijnt}$ is the error term.

The stringency index values are obtained from the Oxford COVID-19 Government Response Tracker, based on nine response indicators, including school closures, workplace closures, and travel bans, rescaled to a value from zero to 100, where higher values indicate greater stringency. Following Sun & Reed (2010), time and country fixed effects are included in the estimation to control for endogeneity bias. This study estimates aggregate exports, as well as by group, for three basic classes of goods under the BEC classification. Table 1 presents the variable descriptions.

## III. Results

Prior to reporting the estimation results, the results of the descriptive statistics for each variable used in Table 2 are discussed. Briefly, most variables in the model have low standard deviation values, indicating that the data in the model are dispersed and have normal distributions. The mean values for common language show that three of the 10 countries in this study share a language with Malaysia. For the focus variables, the mean of $lnCOV_{it}$ is lower than that of $lnCOV_{jt}$, showing that, on average, Malaysia has lower numbers of monthly cases compared to its trading partners. The mean for $POL_{it}$ being higher than the mean of $POL_{jt}$ implies that, on average, the Malaysian government has more stringent policy measures compared to its trading partners.

Table 3 shows the estimation results for the PPML regression. In brief, the high $R^2$ values signify that the estimation model fits the observed data. The importer's and exporter's gross domestic product, distance, and common language variables have signs that are consistent with gravity theory. Although the exchange rate has a positive relation with the export of capital goods, the relation can be justified with J-curve theory. In the short run, exchange rate appreciation (inverse J-curve) can lead to higher export levels, due to existing contracts between firms, thus necessitating time for adjustment (Bahmani-Oskooee et al., 2021; Zainuddin & Zaidi, 2020).

For the focus variables, this study finds that the number of COVID-19 cases and the policy stringency index in Malaysia have no significant impact on the bilateral exports for all category of goods. On the contrary, higher numbers of a trading partner's COVID-19 cases positively impact the export of capital goods and consumption goods. This means that higher numbers of COVID-19 cases in trading partners distort their domestic production and thus lead to greater dependence on import (i.e., more exports for Malaysia). Meanwhile, the high policy stringency index for trading partners has a negative impact on the export of capital goods. Stringent measures imposed by trading partners' policymakers distort their production and thus lower their demand for input (i.e., lowering demand for Malaysia's capital goods).

## IV. Conclusion

The COVID-19 pandemic has distorted global supply chains as the demand side and supply side are heavily affected. This study employs PPML regression in gravity models to analyze the impact of COVID-19 on Malaysia's bi-

**Table 1. Variable description**

| Variables | Description | Sources | Expected Sign |
|---|---|---|---|
| $Export_{ijnt}$ | Bilateral export values from Malaysia to trading partners | Department of Statistics Malaysia (DOSM) | |
| $GDP_{it}$ | Monthly GDP for Malaysia obtained from average quarterly GDP | International Monetary Fund (IMF) | + |
| $GDP_{jt}$ | Monthly GDP for trading partners obtained from average quarterly GDP | Organisation for Economic Co-Operation and Development (OECD), International Monetary Fund (IMF) | + |
| $Dist_{ij}$ | Bilateral distance between Malaysia and trading partners | Centre d'Etudes Prospectives et d'Inform'tions Internationales (CEPII) | - |
| $EXR_{ijt}$ | Bilateral exchange rates for foreign currency per Ringgit Malaysia | Federal Reserve Bank of St. Louis | - |
| $CL_{ij}$ | Dummy for common language if Malaysia and the trading partner share a common language | Our World in Data | + |
| $COV_{it}$ | Number of COVID-19 cases in Malaysia | Our World in Data | - |
| $COV_{jt}$ | Number of COVID-19 cases in trading partner countries | Our World in Data | + |
| $POL_{it}$ | Malaysia's policy stringency index | Oxford COVID-19 Government Response Tracker | - |
| $POL_{jt}$ | Trading partner's policy stringency index | Oxford COVID-19 Government Response Tracker | + |

This tables gives a description to each variable, identifies its source and the expected sign. Selected trading partners consist of China, Hong Kong, Indonesia, Japan, Korea, Singapore, Thailand, Australia, the United States and India.

**Table 2. Descriptive statistics**

| Variables | Mean | SD | Min. | Max. |
|---|---|---|---|---|
| $lnExport_{ijnt}$ (aggregate goods) | 17.604 | 2.827 | 0.000 | 22.895 |
| $ln\ Export_{ijnt}$ (capital goods) | 17.643 | 3.257 | 0.000 | 21.923 |
| $ln\ Export_{ijnt}$ (intermediate goods) | 18.089 | 2.959 | 0.000 | 22.895 |
| $lnExport_{ijnt}$ (consumption goods) | 16.962 | 2.335 | 0.000 | 21.318 |
| $ln\ GDP_{it}$ | 13.956 | 2.780 | 9.460 | 18.912 |
| $lnGDP_{jt}$ | 11.705 | 0.065 | 11.519 | 11.790 |
| $lnDist_{ij}$ | 7.981 | 1.039 | 5.754 | 9.624 |
| $lnEXR_{ijt}$ | 1.948 | 2.970 | -1.470 | 8.245 |
| $CL_{ij}$ | 0.300 | 0.458 | 0.000 | 1.000 |
| $lnCOV_{it}$ | 2.380 | 3.680 | 0.000 | 10.765 |
| $lnCOV_{jt}$ | 2.474 | 4.276 | 0.000 | 15.676 |
| $POL_{it}$ | 18.246 | 28.133 | 0.000 | 78.516 |
| $POL_{jt}$ | 17.730 | 27.993 | 0.000 | 98.643 |

This table reports selected descriptive statistics (mean, standard deviation (SD), minimum (Min.) and maximum (Max.)) for exports, GDP, distance, exchange rate, common language dummy, the number of COVID-19 cases, and the policy stringency index.

lateral export, by product category. Overall, the estimation results follow standard gravity theory. The findings of this study show that an incremental increase in the number of COVID-19 cases in trading partners leads to higher exports of capital goods and consumption goods. Meanwhile, an increase in the trading partner's stringency index distorts the exports of capital goods. Therefore, policymakers need to ensure that adequate support policies are targeted at the negatively affected capital goods sector to ensure the survival of relevant industries post-outbreak.

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**Table 3. PPML estimation results**

| Variables | Aggregate Exports | Capital Goods | Intermediate Goods | Consumption Goods |
|---|---|---|---|---|
| $ln\ GDP_{it}$ | 1.027*** | 0.669** | 1.083*** | 1.075*** |
| | (0.264) | (0.300) | (0.252) | (0.324) |
| $lnGDP_{jt}$ | 0.201 | 0.378 | 0.028 | 1.393*** |
| | (0.348) | (0.404) | (0.358) | (0.467) |
| $lnDist_{ij}$ | -2.200*** | -3.397*** | -2.010*** | -2.342*** |
| | (0.590) | (1.167) | (0.569) | (0.692) |
| $lnEXR_{ijt}$ | 0.365 | 3.218** | -0.033 | -0.192 |
| | (0.616) | (1.432) | (0.643) | (0.745) |
| $CL_{ij}$ | 6.357** | -12.120*** | 4.512 | 3.376 |
| | (3.102) | (4.263) | (3.210) | (3.693) |
| $lnCOV_{it}$ | 0.020 | 0.026 | 0.021 | -0.007 |
| | (0.023) | (0.035) | (0.023) | (0.035) |
| $lnCOV_{jt}$ | 0.003 | 0.026*** | -0.008 | 0.031*** |
| | (0.009) | (0.007) | (0.009) | (0.011) |
| $POL_{it}$ | -0.003 | -0.003 | -0.004 | 0.001 |
| | (0.003) | (0.004) | (0.003) | (0.005) |
| $POL_{jt}$ | 0.001 | -0.003** | 0.002 | 0.000 |
| | (0.002) | (0.001) | (0.002) | (0.002) |
| *Constant* | 7.997** | 41.267*** | 15.275*** | -3.166 |
| | (3.839) | (12.736) | (3.950) | (5.356) |
| Observations | 5,760 | 663 | 2,880 | 2,160 |
| $R^2$ | 0.821 | 0.924 | 0.875 | 0.763 |

This table shows the PPML estimation results. The time and country fixed effects are included in the regression, but the coefficients are omitted for brevity. Robust standard errors are in parentheses. Lastly *, **, and *** represent the significance levels at the 10%, 5%, and 1%, respectively.

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