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Facilitating Trade in Pharmaceuticals: A Response to the COVID-19 Pandemic

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Abstract: *This paper reviews trade in pharmaceutical products, focusing on ASEAN countries. Trade in this sector is of singular policy importance as a result of the COVID-19 pandemic. First, the paper shows that pharmaceuticals are traded within Global Value Chains, which in turn means that international linkages are complex. Second, the paper shows that policy reforms can help boost trade in the sector, which has important human development implications during the pandemic period.*

Keywords: COVID-19; Global value chains; Public health; Gravity model

JEL Classification: F15; O24

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1. Introduction

The coronavirus disease (COVID-19) pandemic has brought trade to the centre of policy debates in Asia and elsewhere. On the one hand, the pandemic's supply-side effects, combined with necessary public health restrictions on the demand side, have combined to provide a substantial negative shock to trade. This shock has been particularly felt in the services sector, which is in contrast to the trade impacts of the Global Financial Crisis, which fell relatively lightly on services compared to goods.

But the second set of trade implications is potentially more profound. Crucial public health goods now rely heavily on international trade. Early in the pandemic period, many countries learned that domestic manufacturing capacity for personal protective equipment was relatively limited, while large manufacturers were sometimes subject to trade restrictions designed to safeguard domestic supply. Relatively quickly, however, production networks increased manufacturing capacity of key products such as face masks and hand sanitiser, and moved large quantities from supplying countries to consuming countries, without sacrificing domestic availability. Nonetheless, the lag with which this occurred has led to serious discussions in some countries, in particular the United States, about the desirability of 're-shoring' production. In this context, that would mean moving Global Value Chain (GVC) production capacity closer to consuming markets.

As of writing (March 2021), the issue in this regard is more about vaccines, which are part of the pharmaceuticals sector. Production capacity is relatively concentrated globally, so manufacturers are under competing demands from local and international governments to ship vaccines quickly. Some countries are engaging in 'vaccine nationalism' by restricting exports formally or informally. But others are engaging in 'vaccine diplomacy', by using free or subsidised vaccine shipments to achieve broader foreign policy objectives.

Against this background, it is timely to review the ways in which trade policy affect pharmaceutical products, including vaccines. These products are subject to active trade policy measures in a number of countries. UNCTAD's TRAINS database shows that although the average rate of protection worldwide is low, under 2% on an effectively applied basis, the range is wide: from zero to 65%. The implications of interventionist trade policy in this sector is to increase the cost and decrease the availability of goods of first necessity from a health care perspective (Helble and Shepherd, 2017).

The present paper aims to use empirical analysis to answer two questions that naturally arise against this background, focusing on pharmaceutical products as a case study:

1. What measures did countries in East and Southeast Asia take, and what more could they have taken, to facilitate trade in pharmaceutical products by way of response to the COVID-19 pandemic?
2. What would have been the effect on trade in the region of removing policy restrictions affecting pharmaceutical products as a response to the COVID-19 pandemic?

The overall objective of the research is to highlight an important dimension of the policy response to the COVID-19 pandemic in the region, as well as to provide a first quantitative assessment of the likely effects of measures put in place.

The paper proceeds as follows. The next section describes the available data. Section 3 discusses methodology. Section 4 presents results. Finally, Section 5 concludes, discusses policy implications, and provides suggestions for future work.

2. Data Description

The main data source for this paper is the Global Trade Alert (GTA) database, which provides a comprehensive and up-to-date record of policy measures contemplated and actually implemented. The GTA team have previously used this dataset to look at policies designed to facilitate trade in health products, but without paying particular attention to the countries of East and Southeast Asia.[1]

[1] https://www.globaltradealert.org/reports/54.

Table 1 summarises the GTA data for Association of Southeast Asian Nations (ASEAN) countries included in the dataset in terms of the stock of restrictive and liberalising measures implemented between 2009, when data collection started, and end-2019. It therefore provides a policy baseline against which different alternative actions can be evaluated. As the table makes clear, some ASEAN countries did not impose any restrictive measures in the GTA sense during this time period: Brunei, Cambodia, Lao PDR, and Singapore. Only three countries stand out as having imposed a significant number of restrictive measures in the baseline: Thailand, Viet Nam, and particularly Indonesia. In fairness, those countries have also tabulated a substantial number of liberalising measures in the GTA sense, so the picture is a nuanced one rather than an unmitigated image of continuous policy restriction.

Table 1: Summary of GTA Data for ASEAN Countries (stock of measures, 2009–2019)

Country	Liberalising Measures	Restrictive Measures
Brunei Darussalam	0	0
Cambodia	1	0
Indonesia	10	12
Lao PDR	0	0
Malaysia	1	2
Philippines	3	1
Singapore	0	0
Thailand	5	4
Viet Nam	6	5

GTA = Global Trade Alert, ASEAN = Association of Southeast Asian Nations.
Source: GTA.

As a counterpart to Table 1, Table 2 shows the liberalising and restricting measures taken in the course of 2020 to date. Given the salience of the COVID-19 pandemic, it is somewhat surprising that there has been very little policy activity in this sector in ASEAN at all. More countries have liberalised than have restricted, but the count of the total number of measures is identical. Given that policy restrictions can be expected to increase price and decrease availability of pharmaceuticals, a pandemic would seem to be an occasion to liberalise substantially so as to ensure maximum possible availability in the local market.

Table 2: Summary of GTA Data for ASEAN Countries (flow of measures, 2020 to date)

Country	Liberalising Measures	Restrictive Measures
Brunei Darussalam	0	0
Cambodia	0	0
Indonesia	3	2
Lao PDR	0	0
Malaysia	0	0
Philippines	2	1
Singapore	0	0
Thailand	0	1
Viet Nam	0	1

GTA = Global Trade Alert, ASEAN = Association of Southeast Asian Nations.
Source: GTA.

An important limitation of the GTA approach to data collection is that it counts measures but does not quantify their effects. So individual measures weigh equally in these summary measures whether they have large or small economic impacts. As discussed below, future work could concentrate on quantifying impacts of GTA data at a micro-level, but doing so is beyond the scope of the present study. Rather, the intention here is to provide some first evidence, based on basic analysis and subject to this caveat regarding the weighting of policy measures.

To analyse the net quantitative impact of these measures, the paper uses a standard structural gravity model. Trade data come from the Asian Development Bank's multi-region input–output table (MRIO). The reason for using this source is that it includes intra-national transactions in addition to international ones, and so is fully compatible with the data requirements of the current generation of gravity models. Data are available up to 2019, which is the year retained for the analysis. Data cover all ASEAN Member States except Myanmar.

The MRIO data do not identify pharmaceuticals as a separate sector. They are contained within a larger aggregate, namely 'chemicals and chemical products'. There is no alternative data source that combines recent data, necessary country coverage, and intra-national transactions in the way required for the analysis, so it is undertaken with the explicit caveat that the sectoral definition is not ideal. However, policies in the GTA are defined at the level of a 'pharmaceuticals' sector, so it could be argued that the model nonetheless captures the impact of such policies on the part of trade in chemicals that is most directly related to that sector.

Standard gravity control variables are sourced from the CEPII distance dataset.

3. Methodology

The analysis proceeds in two steps. First, there is a descriptive analysis of the MRIO data using current best practice for analysing GVC linkages at a disaggregated level. The purpose of this analysis is to provide background for the main discussion, and also to highlight the complex supply linkages that exist in the sector – a point that is typically lost in discussions over 're-shoring'.

Second, there is a gravity model that looks at the net impact of policy measures on trade in the region, using simple measures derived from the GTA data.

3.1. GVC Linkages in Pharmaceuticals

Current best practice for identifying GVC trade is Wang et al. (2013), which completely decomposes trade into its value added components at a disaggregated level.

The Wang et al. (2013) decomposition breaks down gross imports into three main aggregates from a value added perspective (Box 1). The first, domestic value added (DVA), refers to the portion of value added in gross exports that originates within the territory of the exporting country. The second, Foreign Value Added, refers to the portion of value added in gross exports that originates within the territory of other countries and is incorporated as intermediate inputs. The final element, Pure Double Counting, refers to movements of goods and services across international borders during production that are counted more than once.

Box 1: Wang et al. (2013) Decomposition of Gross Exports

The categories identified in the main text break down further as follows:

- DVA: domestic value added absorbed abroad through final goods and services exports, intermediate exports absorbed by the direct importer, and intermediates sent to a first importer and then re-exported to a third country, as well as Domestic Value Added first exported then returned home.
- Foreign Value Added: foreign value added contained in final exports, and foreign value added contained in intermediate exports.
- Pure Double Counting: Pure double counting from domestic sources, and pure double counting from foreign sources.

Source: Wang et al. (2013).

For policy purposes, Foreign Value Added as a proportion of gross exports can be understood as an indicator of Global Value Chain participation from a backward linkages perspective. If a country imports more foreign intermediates in order to produce its own exports, it has a higher ratio of Foreign Value Added to gross exports, which indicates a higher level of Global Value Chain participation. Similarly, Pure Double Counting as a proportion of gross exports can also be indicative of Global Value Chain integration, as a higher proportion suggests more movements of intermediate goods and services across borders during production, which is a characteristic of the Global Value Chain production model.

It can also be useful to look at the mirror image of these data, namely the forward linkages perspective. In the Wang et al. (2013) decomposition, DVA_INTRex captures forward linkages as the proportion of a country’s gross exports that are intermediates used in production of another country’s exports. In other words, this domestic value added is shipped abroad, where it is incorporated into other goods and services and re-exported. By the same reasoning as above, a higher proportion of forward linkages in gross exports is also indicative of greater Global Value Chain integration, as this kind of production sharing is again typical of the Global Value Chain model.

To see how the Wang et al. (2013) decomposition works, it is useful to consider notation using three countries, such that the elements of the decomposition can easily be generalised. The three countries are s, r, and t. The decomposition is consistent at the sectoral level, but subscripts are left out so as not to complicate notation. The example can therefore easily be interpreted either as aggregate trade, or a single sector.

The starting point is a standard multi-region input–output table:

$$X = AX + Y$$

where: X is gross output, A is a matrix of technical coefficients, and Y is final demand. This is the standard input output relationship that has been long studied in economics. Rearranging gives the Leontief inverse B, which summarises direct and indirect input requirements for an extra unit of output:

$$X = (1 - A)^{-1}Y \equiv BY$$

The matrices can be partitioned through appropriate notation to capture bilateral relationships. For example:

$$Y = \begin{bmatrix} Y^{ss} & Y^{sr} & Y^{st} \\ Y^{rs} & Y^{rr} & Y^{rt} \\ Y^{ts} & Y^{tr} & Y^{tt} \end{bmatrix}$$

So in this case, final demand separates, for example, final demand from s for s's output (Y^{ss}) from final demand for s's output from r (Y^{sr}), and so on. The same notational convention is applied to all other matrices as required.

Wang et al. (2013) used this kind of approach to distinguish the global Leontief inverse (B above) from submatrices indicated by superscripts:

$$B = \begin{bmatrix} B_{11}^{ss} & B_{12}^{ss} & B_{11}^{sr} & B_{12}^{sr} & B_{11}^{st} & B_{12}^{st} \\ B_{21}^{ss} & B_{22}^{ss} & B_{21}^{sr} & B_{22}^{sr} & B_{21}^{st} & B_{22}^{st} \\ B_{11}^{rs} & B_{12}^{rs} & B_{11}^{rr} & B_{12}^{rr} & B_{11}^{rt} & B_{12}^{rt} \\ B_{21}^{rs} & B_{22}^{rs} & B_{21}^{rr} & B_{22}^{rr} & B_{21}^{rt} & B_{22}^{rt} \\ B_{11}^{ts} & B_{12}^{ts} & B_{11}^{tr} & B_{12}^{tr} & B_{11}^{tt} & B_{12}^{tt} \\ B_{21}^{ts} & B_{22}^{ts} & B_{21}^{tr} & B_{22}^{tr} & B_{21}^{tt} & B_{22}^{tt} \end{bmatrix}$$

$$B^{sr} = \begin{bmatrix} B_{11}^{sr} & B_{12}^{sr} \\ B_{21}^{sr} & B_{22}^{sr} \end{bmatrix}$$

They also define L as a local Leontief matrix, drawn from B and defined as follows:

$$L = \begin{bmatrix} B_{11}^{ss} & B_{12}^{ss} & 0 & 0 & 0 & 0 \\ B_{21}^{ss} & B_{22}^{ss} & 0 & 0 & 0 & 0 \\ 0 & 0 & B_{11}^{rr} & B_{12}^{rr} & 0 & 0 \\ 0 & 0 & B_{21}^{rr} & B_{22}^{rr} & 0 & 0 \\ 0 & 0 & 0 & 0 & B_{11}^{tt} & B_{12}^{tt} \\ 0 & 0 & 0 & 0 & B_{21}^{tt} & B_{22}^{tt} \end{bmatrix}$$

Particular local Leontief matrices are defined as submatrices of L using superscripts.

Using E to indicate exports (with two country superscripts indicating a bilateral relationship, while a star indicates total exports of the listed country) and V to indicate value added shares, with the * operator indicating elementwise multiplication of matrices, the full Wang et al. (2013) decomposition, following the notation in the 2018 version of the paper, is as follows:

$$E^{sr} = DVA + FVA + PDC$$

$$DVA = (V^s B^{ss})' * Y^{sr} + (V^s L^{ss})' * (A^{sr} B^{rr} Y^{rr})$$

$$+(V^s L^{ss})' * \left[A^{sr} \sum_{t \neq s,r}^{G} B^{rt} Y^{tt} + A^{sr} B^{rr} \sum_{t \neq s,r}^{G} Y^{rt} + A^{sr} \sum_{t \neq s,r}^{G} B^{rt} \sum_{u \neq s,t}^{G} Y^{tu} \right]$$

$$+(V^s L^{ss})' * \left[A^{sr} B^{rr} Y^{rs} + A^{sr} \sum_{t \neq s,r}^{G} B^{rt} Y^{ts} + A^{sr} B^{rs} Y^{ss}\right]$$

$$FVA = (V^r B^{rs})' * Y^{sr} + \left[\left(\sum_{t \neq s,r}^{G} V^t B^{ts}\right)' * Y^{sr}\right]$$

$$+(V^r B^{rs})' * (A^{sr} L^{rr} Y^{rr}) + \left(\sum_{t \neq s,r}^{G} V^t B^{ts}\right)' * (A^{sr} L^{rr} Y^{rr})$$

$$PDC = (V^s L^{ss})' * \left(A^{sr} B^{rs} \sum_{t \neq s,r}^{G} Y^{st}\right) + \left(V^s L^{ss} \sum_{t \neq s,r}^{G} A^{st} B^{ts}\right)' * (A^{sr} X^r)$$

$$+(V^r B^{rs})' * (A^{sr} L^{rr} E^{r*}) + \left(\sum_{t \neq s,r}^{G} V^t B^{ts}\right)' * (A^{sr} L^{rr} E^{r*})$$

The above decomposition keeps the three country notation, but it is clear that repeating the sums over appropriate country groups makes it straightforward to generalise. ADB has calculated the Wang et al. (2013) decomposition in full for all countries in its MRIO. The analysis below focuses on 2019 only, as the most recent year for which data are available.

3.2. Structural Gravity Model

The standard single sector structural gravity model takes the following form:

$$(1)\ X_{ij} = d_i d_j \tau_{ij}^{-\theta} e_{ij}$$

where X signifies exports from country i to country j, τ is trade costs on the bilateral route between countries i and j, the d terms are fixed effects by exporter and importer, and e is an error term satisfying standard assumptions. The parameter θ is the trade elasticity, and captures the sensitivity of trade flows with respect to changes in trade costs. A structural gravity model in the form of equation (1) is consistent with a range of standard trade theories, including the Armington model of Anderson and Van Wincoop (2003), the Ricardian model of Eaton and Kortum (2002), and the heterogeneous firms model of Chaney (2008). Its properties are fully described in standard sources such as Yotov et al. (2016).

Before taking equation (1) to the data, it is necessary to specify trade costs in terms of observables, as follows:

$$(2) \log \tau_{ij} = b_1 GTA_j * intl_{ij} + \sum_{k=2}^{N} b_k control_{ij}^{k}$$

The variable of interest is a measure of trade policies from GTA. As noted above, the GTA data do not quantify policy effects, but rather provide simple counts of measures. To include these data in the gravity model, I take counts of the restricting and liberalising measures, as catalogued by the GTA team. I use those two counts separately in some specifications, then in others I use a net count based on the difference between the two. The idea of setting up the model in this way is to capture, in a broad sense, the impacts of liberalising and restricting measures in the ASEAN region, as captured in the GTA data.

The GTA data are interacted with a dummy identifying trade between different countries (intl) following the identification approach of Heid et al. (forthcoming). RTA is a dummy for country pairs in the same regional trade agreement, sourced from Mario Larch's RTA dataset (based on Egger and Larch, 2008). Finally, I follow the recent literature such as Larch et al. (2019) by including directional country-pair fixed effects to account for a wide range of observable and unobservable trade costs, with the time trend interaction providing added flexibility to the specification.

I estimate the gravity model defined by equations (1) and (2) by Poisson Pseudo-Maximum Likelihood (PPML), following Santos Silva and Tenreyro (2006). PPML estimation ensures that coefficients are not biased due to heteroskedasticity, as is the case with ordinary least squares (OLS) under log-linearisation, and that zeros are naturally included in the estimation sample. The PPML estimator is consistent under the weak assumption that the conditional mean is correctly specified, and does not require that the dependent variable follow any particular distribution.

Arkolakis et al. (2012) showed that a broad family of quantitative trade models that produce structural gravity formulations in fact exhibit the same relationship between changes in trade costs and changes in trade flows or real GDP, irrespective of their different microeconomic foundations. Under their assumptions, I can therefore solve the general equilibrium gravity system in a fully-theory consistent way, and extract information on the implied change in country-level price indices associated with observed policy changes between 2008 and 2015. The gravity system takes the following form, which is identical for the full class of models Arkolakis et al. (2012) considered, as listed above:

$$(3)\ \widehat{X_{ij}} = \frac{\left(\widehat{\tau_{ij}}\widehat{w_i}\right)^{-\theta}\widehat{w_j}}{\sum_{i=1}^{C}\lambda_{ij}\left(\widehat{\tau_{ij}}\widehat{w_i}\right)^{-\theta}}$$

$$(4)\ \widehat{w_i} = \frac{\sum_{j=1}^{C}\gamma_{ij}\left(\widehat{\tau_{ij}}\widehat{w_i}\right)^{-\theta}\widehat{w_j}}{\sum_{i=1}^{C}\lambda_{ij}\left(\widehat{\tau_{ij}}\widehat{w_i}\right)^{-\theta}}$$

$$(5)\ \widehat{P_j} = \left(\sum_{i=1}^{C}\lambda_{ij}\left(\widehat{\tau_{ij}}\widehat{w_i}\right)^{-\theta}\right)^{\frac{1}{-\theta}}$$

where: X and tau are defined as above; w is the wage; P is the price index; and $\lambda_{ij} = \frac{X_{ij}}{E_j}$ is the import share, and $\gamma_{ij} = \frac{X_{ij}}{w_i L_i}$ is the export share. Following Dekle et al. (2007), a hat over a variable indicates a proportional change. The system consists of three sets of equations in three sets of unknowns (X, w, and P), with one structural parameter (the trade elasticity), and export and import shares calculated from observed data. I solve the system using the approach of Baier et al. (2019).

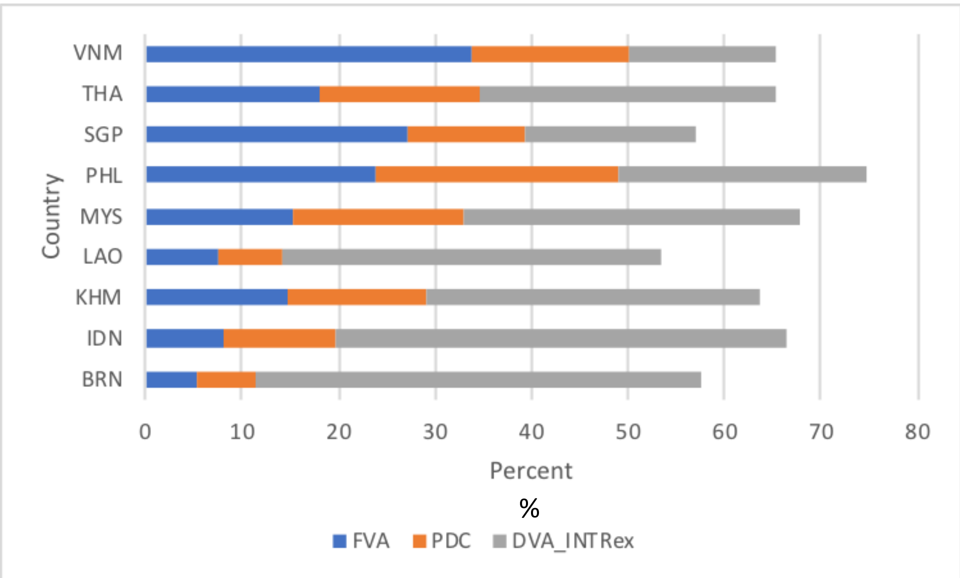
To solve the gravity system in equations (3) through (5), I need information on the trade elasticity. I source it from Egger et al. (2018), who estimate it directly from a structural gravity model using information in a multi-regional input–output table. Their value for chemicals and chemical products is 4.60, which I use without modification.

4. Results

4.1. GVC Integration

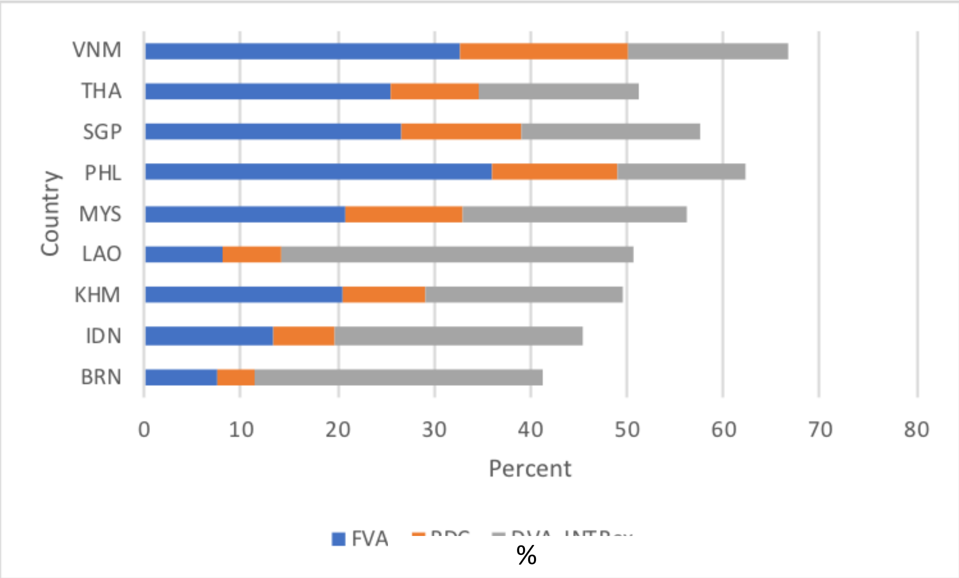
Figures 1 and 2 show the degree of GVC integration in ASEAN's chemicals and chemical products sector. It is immediately obvious that this kind of trade is very substantial, accounting for more than 70% of gross exports in some cases. The type of GVC involvement varies somewhat from country to country, although forward linkages tend to predominate. Comparing the two figures shows that intra-regional GVC integration tends to be higher than integration with non-ASEAN partners.

Figure 1: GVC Integration, Intra-ASEAN Trade, 2019 (%)



GVC = Global Value Chains, ASEAN = Association of Southeast Asian Nations.
Source: ADB MRIO.

Figure 2: GVC Integration, ASEAN Exports to Non-ASEAN Partners, 2019 (%)



GVC = Global Value Chains, ASEAN = Association of Southeast Asian Nations.
Source: ADB MRIO.

The key takeaway from the two figures is that production of pharmaceuticals is highly internationalised and relies heavily on the GVC model. Intuitively, such a conclusion should be clear from a basic understanding of the sector. For instance, research services are typically supplied in high income countries, but manufacturing often takes place in middle income countries, with India as the leading example. A second example is that transport and storage of vaccines and other pharmaceuticals often requires strictly controlled conditions of temperature and moisture (Helble and Shepherd, 2017). As such, traded goods in this sector can require extensive inputs from the transport and logistics sector, which would often show up as backward linkages in the Wang et al (2013) decomposition. Finally, given that the sectoral definition is broader than pharmaceuticals, it is likely that the forward linkages component comes from the chemicals used in production of these products: they are produced in one location, then shipped as intermediate inputs to another. Based on considerations like these, it is clear that the analysis above accords with common understanding of how the sector works, and should not be surprising given the way businesses there are organised.

4.2. Trade Impacts of Policy Changes

I estimate the gravity model using three measures of policy from the GTA: number of liberalising measures, number of restrictive measures, and the net balance of liberalising versus restrictive measures (measure one less measure two).

Table 3 shows results from the PPML estimation. Inclusion of liberalising and restricting measures separately does not give meaningful results. But the regression in column 2, which uses the net policy measures, produces a negative and statistically significant coefficient of interest: it implies that an increase in the number of restrictive measures reduces trade, while an increase in the number of liberalising measures promotes trade. This finding is in line with expectations. Signs and significance of gravity model control variables are also generally in accordance with expectations, and a high pseudo-R2 indicates that the model fits the data well.

With parameter estimates from column 2 above, I conduct a counterfactual simulation that asks the following question: how would 2019 trade have looked different if countries had adopted the liberalising and restricting measures they in fact adopted in 2020, but all other factors remained the same? The counterfactual is run using equations (3) through (5) above, and the solution technique due to Baier et al. (2019).

Table 3: Structural Gravity Model Regression Results

	(1)	(2)
Restricting*Intl	–0.018	
	(0.017)	
Liberalising*Intl	0.006	
	(0.024)	
(Restricting – Liberalising)*Intl		–0.038 ***
		(0.011)
RTA	–0.125	–0.131
	(0.217)	(0.217)
Log(Distance)	–0.507 ***	–0.500 ***
	(0.099)	(0.100)
Common Border	0.011	0.003
	(0.384)	(0.380)
Colonial Relationship	–0.347	–0.311
	(0.283)	(0.291)
Common Language	0.764 **	0.830 **
	(0.354)	(0.359)
Intl	–1.841 ***	–1.941 ***
	(0.437)	(0.434)
Constant	15.586 ***	15.541 ***
	(0.621)	(0.625)
Obs.	3721	3721
Pseudo-R2	0.921	0.921

Note: Dependent variable is exports of chemicals and chemical products. Estimation is by PPML with fixed effects by exporter and by importer. Robust standard errors corrected for two-way clustering by exporter and importer are in parentheses below the parameter estimates. Statistical significance is indicated as follows: * (10%), ** (5%), and *** (1%).
Source: Author's calculations.

Table 4 presents results in terms of percentage changes over baseline. There are relatively small increases in both exports and imports in all ASEAN Member States for which data are available. However, given the magnitude of the COVID-19 pandemic shock, it is surprising that countries have not done more to stimulate trade in this sector. The data show that there is considerably more scope to facilitate trade by taking more liberalising measures, or removing restrictive ones.

Table 4: Counterfactual Percentage Changes in Exports and Imports, ASEAN Member States

Country	Exports	Imports
Brunei Darussalam	0.369	0.000
Cambodia	3.234	0.342
Indonesia	2.490	2.169
Lao PDR	1.592	0.252
Malaysia	0.527	0.312
Philippines	1.844	2.340
Singapore	1.229	2.585
Thailand	2.163	3.989
Viet Nam	1.212	0.030

ASEAN = Association of Southeast Asian Nations.
Source: Author's calculations.

5. Conclusions, Policy Implications, and Future Research

Pharmaceuticals are widely traded within ASEAN, as in other world regions. That trade has come into the spotlight during the COVID-19 pandemic, along with that of other public health products, in particular personal protective equipment and hand sanitiser. This paper presents some of the first quantitative evidence on the types of trade links that are involved in pharmaceuticals trade in the region, as well as of the impacts of policies captured by the GTA.

The data suggest that GVCs play an important role in structuring trade in the pharmaceuticals sector. While the degree of integration varies across countries, there is generally a substantial level of both backward and forward GVC integration in pharmaceuticals. From a policy perspective, this is an important finding, because it highlights that it is important to maintain liberal policy settings not only in terms of policies that directly affect pharmaceuticals, but also in upstream and downstream sectors. The complexity of linkages across sectors and countries means that trade costs in one part of the value chain can cumulate in complex ways, to potentially have large welfare implications, or even perverse outcomes relative to policymakers' objectives.

Notwithstanding this degree of complexity, the policy analysis here has focused on those measures that directly affect the sector, as recorded by the GTA. Policy is an important determinant of trade, after controlling for other factors. A counterfactual simulation based on a 2019 baseline shows that the balance of liberalising and restricting measures adopted in 2020 would only have increased trade by a relatively small amount. As such, the primary conclusion is that there is much more ASEAN Member States can do to stimulate trade in this sector as part of a comprehensive response to the COVID-19 pandemic. This need for additional action is all the more evident in the current environment, where the primary objective in terms of managing the pandemic and its effects relates to vaccine distribution, which comes within the umbrella of pharmaceuticals in terms of a sectoral classification.

This paper has provided some first evidence on the extent of GVC integration in the pharmaceuticals sector in ASEAN, as well as a simple quantitative simulation of the potential of policy to facilitate trade. There is much for future research to do. A first priority, as already noted, is to work with the GTA data on a much more micro-level, to identify policy effects quantitatively at a disaggregated level. Given that many policies are less transparent than standard tariffs, this question is not an easy one to answer. A possible way forward is to first categorise measures in terms of the economic mechanisms underlying them, and to take one category at a time with a view to quantifying effects. It may well be that particular measures are much more restrictive or liberalising than others in terms of economic outcomes, and that would allow for more detailed simulation evidence on the effects of policy reforms than the starting point presented here.

A second priority is to work with alternative data sources to understand GVC linkages in pharmaceuticals specifically, as opposed to the broader chemicals aggregate. To date, the only global input–output database that identifies pharmaceuticals as a separate sector is GTAP. But the latest version of that database uses 2014 as its base year, and so is five years older than the ADB data used here. In addition, the database is not in free access like the ADB MRIO, or most other MRIOs, such as WIOD and TiVA. From an analytical perspective, the COVID-19 pandemic has highlighted the interest in attempting to isolate sectors at greater level of disaggregation in MRIOs. Pharmaceuticals is one obvious candidate. Medical devices and equipment would be another. Better understanding trade and policy effects in these areas is crucial to a nuanced understanding of policy response to the pandemic. However, further disaggregating MRIO data is not straightforward, given that most countries have relatively aggregated approaches to their national accounts. But it is a high priority going forward, in particular in light of the fact that most quantitative trade models – including structural gravity – now require data on domestic as well as international trade in order to provide consistent estimates.

A final priority is to better understand the potential for upstream and downstream policies to affect trade in pharmaceutical products. Research in this area is in its infancy, as it requires an analysis of the ways in which trade costs cumulate through the multiple stages of production implied by the GVC model. Some initial steps have been taken in this direction, but much more needs to be done to develop simple and consistent measures that can be deployed at scale. Informing policymakers as to the indirect effects of their policy choices is an important priority in light of the trade tensions the pandemic has brought to the fore.

In policy terms, all of the above research feeds into ongoing discussions on 're-shoring' in the United States and elsewhere. While the private sector has already taken steps to reassess the risks of networked production and just in time management in light of the stresses of the early pandemic period, the consensus is that the response is likely to be increased redundancies in supplier networks, and perhaps some limited shortening of GVCs. The private sector seems to have little appetite for systematically moving production closer to consumption, as 're-shoring' implies. Better understanding the economic costs associated with 're-shoring' will be important in ensuring that policymakers do not respond to public pressure in a way that undermines broader growth and development objectives. Moreover, there is little evidence that national production is less subject to disruption than networked production: in the case of idiosyncratic shocks across countries, portfolio diversification suggests that risk is best managed by not relying on production in a single location, whether close to consumption or distant from it.

The COVID-19 pandemic was in many ways a unique shock to the global economy, in the sense that it had both supply and demand side aspects, but more importantly, it affected all countries in similar ways at essentially the same time. While responses have been very different in quality and quantity – and Asia has generally performed well in this regard – it would be dangerous to make policy decisions on the basis of an extremely unusual shock. To help facilitate productive international linkages, including through trade and investment, it will be important to provide additional research inputs both highlighting the nature and extent of GVC production in health-related sectors, as well as providing a detailed analysis of policy effects that fully accounts for upstream and downstream cumulation of policies.

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