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Impact of the COVID-19 Pandemic to Maritime Trade and Port Performance in the Philippines

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***Abstract*: The COVID-19 pandemic has caused unprecedented challenges in several international economic domains, having an impact on port operations and maritime trade globally. By doing a thorough analysis of ship movements, domestic container traffic, and their correlation with GDP fluctuations, this research explores the effects of the COVID-19 pandemic on the maritime trade of the Philippines. The study begins by looking at the changes in container movement in the Philippine ports as well as the changes in both trade and import activity. The research aims to identify statistical changes and trends by means of comparative analysis of the data before pandemic and after pandemic. Our research findings indicate a decline in the number of ships entering Philippine ports, attributed to a range of factors. Notably, health concerns and disruptions in the supply chain have played pivotal roles. The intricacies of delivering goods to the vessel for shipments are distinct from ensuring timely approval and processing crucial aspects such as onboarding and offboarding procedures. The estimation of parameters and the determination of model significance were carried out through the application of simple linear regression. This analytical approach involved utilizing statistical methods to ascertain the relationships between variables, allowing for the extraction of meaningful parameters and the assessment of model significance within the given context.**

***Keywords*: COVID-19, pandemic, container, shipcalls, gross domestic product, maritime.**

1. Introduction

The maritime industry in the Philippines has always been consistent in adding to the overall economic standing of the country. It has been a key factor in keeping the economy afloat because of the access that it provides citizens and businesses to continuously engage in commerce through sea channels for both local or international trade. However, due to the outbreak of the pandemic, the maritime industry took a hit and because of the constant lockdowns that limited the movement of the transportation of goods as a precautionary measure to the pandemic which could be seen as an emergency immediate shut down (Saeed et al., 2021).

Delivering a good from point A to point B has to go through a process of exchange where it incurs additional costs to move around, and a lot of that depends on efficient transportation systems that directly affects goods and consumers. The pandemic has caused a lot of disturbance to the entirety of the global supply chain and port performance because of the sudden shock in the system provided by the uncertainty and unpredictability of the situation. A study conducted by (Clark et al., 2004) on the port efficiency and transport costs in relation to bilateral trade, suggests from their study that sea port efficiency can actually reduce overall trade costs by at least or more than 12% and that inefficient sea ports may actually drive-up costs. But because of the crisis that went on, ports have become inefficient due to more demands for space and immediate transport of goods. As an example, because of the restrictions and lack of global mobility, there has been a lack of supplies coming in from large producers like China, the world's second largest economy, to be able to continue production of goods that will be provided to consumers, therefore, further increasing the already heavy demand on a constrained system (Kasinska & Jendryczka, 2022).

This study aims to provide relevant literature pertaining to the maritime industry in the country and to evaluate the presumed effects of the COVID-19 to sea trade and its effects on the economy. This study in particular was chosen because of the apparent lack of literature regarding sea trade in the region and in the country which also includes its supply chain process and ports. More so in special cases like what happened during the pandemic. The researchers aim to help provide relevant literature and fill in gaps that may be used in the future as reference regarding the situation of the maritime industry during the pandemic and its relation to the overall Philippine economy.

2. Review of Related Literature

A. The Maritime Industry During the Pandemic

The Maritime Industry (or also known as the shipping industry) is a key component to the ever-growing globalized trend seen all around the world. It plays a key part in ensuring that goods are safely delivered over water so that it may reach manufacturing sites that can further manufacture on the delivered raw materials or deliver to their designated destinations the already finished goods to the various types of consumers overseas. Since maritime shipping as an industry has been observed as being responsible for at least 90% of all the transported global goods trade (Yazir et al., 2020) the supply chains are constantly being disrupted by what appears to have been anticipated to happen to the industry during such times as the pandemic and is causing a perceived domino effect that

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affects each and every component vital to the overall process that trade has to go through in order to complete its transfer of goods. The trade restrictions have severely affected the maritime business because of the sudden slowdown of trade, where it is estimated that at least 80% of all the volume of the goods transported and at least 70% of all the value of goods being transported is being placed on ships and being distributed on various seaports all over the world (Millefiori et al, 2021). Various problems such as port disruptions, idle ships, and prioritization of essential goods are some of the complicated matters that the industry needed to take care of and where it eventually showed an apparent weakness in its overall process of efficiency and delivery seeing that the degree of interconnectedness in comparison with previous years had been down because of the complicated issues involving importing and exporting goods (Vidya & Prabheesh, 2020).

Since the value of exports being brought in have since fallen behind from where it was prior to the pandemic shutdowns were enacted, we can also look at imports as a point of reference to gauge the health of the trade sector, in fact, according to the World Bank (2022) there was an decrease of about 29% in the total number of imports being brought into the country which was a result of the shutdowns imposed as a measure for safety against the disease and was subsequently followed by a months' worth more of declining import quantities due to stricter protocols. This seems very similar to a Philippine ASEAN neighbor, Singapore, where a significant decline in trade had been observed where it had affected its entire import and export metrics such as an incurred decline in trade for merchandised goods and even the ravaged oil and petroleum trade of Singapore that had been taking heavy declines from January 2020 to May 2020 (Fukunari & Zen 2022). Major ports from the biggest hubs in China to the most traded ports in the Atlantic, then having to go through the huge amount of backlogs for shipping vessels to pass through the busiest canals and ports in the world has contributed to a huge decline in productivity for the maritime industry (Armstrong, 2021).

The economy and consumers of a particular country is not the only victim of sudden trade shocks, in fact even ship owners are affected, due to the volatile nature of the shipping market and it being heavily dependent on a strong trade environment, shipowners and company operators would severely be affected by the lack of cash flow given the pandemic, thus forcing them to save costs and attempt to limit business and engagement in trade, in fact according to (Michail & Melas, 2020) there seems to be a strong relation to the number of coronavirus cases and the freight rates at the time. It is also important to note that there are real people behind these vessels such as the seafarers that make sure our goods make it to their desired destination. However, increased stress and uncertainty has affected their mental state within their ships (Sliskovic, 2020). Due to the circumstances of the pandemic, the maritime industry had to respond accordingly to survive and keep companies providing these services to survive by reducing the available ships in order to save resources which then affects the price and the priority of the goods being delivered by cargo ships, thus limiting access to other goods which might be essential for others (Xu et al., 2021).

It is also worth considering that it is such a huge loss for maritime trade and global economies to have goods sitting idle and not being converted to revenue because of restrictions on trade, where it just further emphasizes its grave importance to the international economy (United Nations Conference on Trade and Development., 2017). This is why according to the observations made by Barbero (2021) there have been calls for liberalization of imports in a number of countries, this is so that supplies can get in efficiently given that trade restrictions were still difficult to deal with given the logistical and demand circumstances and how it mostly affected seagoing transport vessels.

B. The Trade Situation of the Philippines during the COVID Pandemic

One of the most important economic areas in the Philippines is the maritime sector. It generates a sizable portion of the nation's exports, thousands of thousands of jobs, and a sizable portion of its GDP (Gross Domestic Product). However, the impact of the COVID-19 pandemic has exacerbated some of the pre-existing challenges, while also posing new challenges for the maritime industry (Shan, 2021). Major challenges that were faced included the closure of ports to prevent the further spread of the virus which halted entire operations and affected the shipment of both exports and imports that were expected to be processed from the ship to the ports at a much earlier date. Because of this trade and transactions has been put at a halt and its effect on the economy has been much worse than some previous economic crises, as stated by the World Bank the trade situation has been much worse than the previous Asian financial crisis that occured in 1998 which is more than two decades ago where it had been reported that the combined decline of trade (exports) had been at (-14.7%) as well as another monetary crisis that happened much more recently which is known as the global financial crisis of 2008 where the trade metrics showed that it fell off by around (-11.8%) for both goods and services for the two mentioned years (Arenas et al., 2022).

According to the Philippine Statistics Authority (PSA), Ocean based Industries which include Maritime Transportation and Storage as a category, contributed 4.7% to the total Gross Domestic Product (GDP) of the country during 2019 which had a value of 916.31 billion Pesos where Maritime Transportation and Storage contributed 14.6% to the total value. This is in comparison to the data of the year 2020 where the industry was only able to contribute 617.20 billion Pesos or 3.4% to the GDP which is a decline of about -32.6% compared to the year prior (Philippine Statistics Authority, 2021). Given that there has been such a seeming declining trade activity at the time, it is not surprising to see reports such as the one given by the Organisation for Economic Co-operation and Development (OECD) that reported that member states, including the Philippines, collectively have had a (-16.7%) decline in exports by way of services and had a (-8.2%) decrease on its goods exports throughout the year 2020 which emphasizes the health of international trade at a time where concerns about trade restrictions has been preventing people from trading and

making them more conservative in engaging in the market (OECD, 2022).

This affects consumer confidence where according to Sawadjaan et al (2022), there has been significant evidence of GDP and consumer confidence had been found to have some effect on each other, which implies the assumption that given what had transpired, the economy is at a concerning status. Furthermore, evidences show that despite bouncing back from the immediate effect of the nationwide shut down the Philippine Statistics Authority (PSA) was still able to report that merchandise exports for June 2020 has had a concerning rate of conversion at 17.8% or the amount of $28.4 billion for merchandise exports in comparison from the same type of data gathered and published at an amount of $34.6 billion during the previously recorded period. Data concerning the trade between countries including the exports and imports of similar goods, have found that during the first 6 months the trade metric for the transactions of the Philippines and foreign countries is at a decline of 24.7% in comparison to the data of the previous year where the rate was at $89.6 billion. To further emphasize the situation, just in June alone the external trade for the country was reduced to $11.9 billion or a 19.9% decrease.

C. The Port Activity in the Philippine Islands During COVID-19

Port activity is crucial to understanding how healthy in terms of production the maritime trade sector of the country has been through the use of container traffic as a measure of productivity. During the COVID-19 pandemic there have been concerns regarding the ability of our ports to handle all the backlog driven by a delay in the supply chain. One of the main factors that contributed to this is shipping time for goods because of port delays which have increased the travel time of goods by an additional average of 1.5 days by the end of the year 2021. Comparing this to previous years, this is actually a 25% increase on the average shipping time for goods on a global scale (Cerdeiro, D., Komaromi, A., & Liu, Y., 2022).

In relation to what was mentioned, there has actually been a noticeable difference between the number of ships entering the country in comparison to previous years where ship calls or also known as port of calls was seen to be in a decline. According to Jesudasan, Smita et al., (2022), the Philippines had the biggest downturn during the pandemic where it was observed that it was at a 21.80% decline and this led them to believe that the Philippines' port performance at the time was in a bad situation. In relation to this both the Manila International Container Terminal and Manila South Harbor were only able to operate at 68% and 56% utilization respectively, both of which covered at least 80% of all foreign volume of goods being transported in the entire country. Because of lapses due to delays and restrictions on foreign and local trade, the current situation has created gaps and doubt on the capability of ports to handle the volume of goods coming into the country (Philippine Ports Authority, 2020).

As for additional data to further emphasize the degree of decline for ports, according to Portcalls, (2022). The domestic cargo in the country had a significant decline where it experienced a drop of around 24% from 104.428 million MT just a year prior to going down to 79.24 million MT during the start of the global pandemic. The delivery of domestic containers was also an indication in the maritime industry based on how the ports were performing where it has been observed that the servicing of domestic containers went on a decline from 3.166 million TEUs to 2.745 million TEUs which is a 13.3% decline on domestic trade. While ship calls for domestic ships also experienced a drop of 36.9%.

Inefficient ports would also drive up the initial estimated costs of delivering the goods because of delays due not only because of port performance or infrastructure but also in the adjustment of necessary regulations for the ports. In a study conducted by Clark, X et al., (2004) they found that improvement in such areas that would affect port efficiency in the long run would actually yield positive results as it would reduce shipping costs by about 12%. Based on what was observed by the Hong Kong Trade Development Council (HKTDC Research) the effect of the pandemic on the overall port situation was at a difficult position where the Manila International Container Terminal and both North and South Harbor all experienced increased difficulty as the major hubs of northern luzon where it bares 85% of the entirety of the trade volume in the entire Philippine archipelago HKTDC research. (2022).

There are those who would be quick to point out that the port situation in the Philippines was not merely because of the pandemic. One could also point to port infrastructure as a problem that has contributed to a lot of the experienced delays at the time. A better infrastructure would significantly have had a better effect in handling all of the problems within ports as it would have increased port performance which in turn would have been better for the economy as the goods are processed faster (Munim, Z. H., & Schramm, H.-J. 2018). In Manila, once things got a lot more stricter with regulation, there has been an observed heavier traffic on the ports themselves, where on an average year the utilization of containers for the port infrastructure would only be at around 60%, during the strict and heavily imposed lockdowns the utilization of the ports has risen to dangerous levels of 98% of all the available space in the Manila ports during the earlier parts of the pandemic (Elhan-Kayalar, Y. 2021).

3. Methodology of the Study

A. Hypothesis

H0: There is no significant correlation between the state of the maritime industry in terms of Container Traffic (Domestic) during the COVID-19 pandemic in relation to the overall PH GDP.

H0: There is no significant correlation between the state of the maritime industry in terms of its port productivity in relation to the Philippine GDP during the pandemic era.

H0: There is no significant correlation between the state of the maritime industry in terms of number of ship calls in relation to the PH GDP.

B. Synthesis

The study essentially explores the relationship between the dependent variable Gross Domestic Product (GDP) of the Philippines and the various independent variables and how it all relates together to properly give an insight into the Maritime Industry and how much of it has changed due to the pandemic and how important is it to the overall economy

C. Research Simulacrum

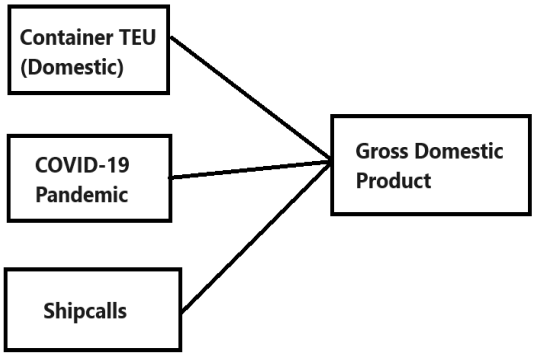

Fig. 1. Research simulacrum

D. Research Methodology

This study examined the effects of the Covid-19 pandemic to sea trade and effects on the economy of the Philippines by using a cross-sectional study. The needed data are acquired from (a) the Philippine Statistics Authority for Gross Domestic Product, (b) Philippine Ports Authority for Container TEU Domestic and Ship Calls taken quarterly from 2015 to 2nd Quarter of 2022.

The regression model below is the basis used to assess the impact of Covid 19 to the Maritime industry and economy of the Philippines.

$$GDPt = \beta 0 + \beta 1 CTDt + u$$
$$GDPt = \beta 0 + \beta 1 SCt + u$$

GDP = Gross Domestic Product
CTD = Container TEU Domestic
SC = Ship Calls
t = Time
u = Error Term

4. Results & Discussion

A set of 30 Quarterly observations in the Philippines (2015-2022) is used to measure the impacts of Covid 19 to the Maritime industry in relation to the economy of the Philippines. Our paper examines the relationship of Ship Calls and Container TEU Domestic with the Gross Domestic Product of the Philippines. To indicate the absence and presence of Covid 19 we added a dummy variable named COVID.

The table 1, descriptive statistics are computed using GRETL summary Statistics tool.

Various descriptive statistics that are calculated from the sample are displayed in the above table. The mean and median for GDP are correspondingly 4.3701 and 4.4001, with a standard deviation of 6.4658 meaning that 50% or less of the observations lie at 4.3701. For the predictors, CTD shows a mean of 7.0073 and a median of 7.2883, with a standard deviation of 78946 while SC has a mean of 1.0606 and a median of 1.091 with a standard deviation of 17610.

A. Multicollinearity Test

Belsley-Kuh-Welsch collinearity diagnostics:
Count of condition indices >= 30: 1
Variance proportions >= 0.5 associated with cond >= 30:
GDPPesos~ Container~
0.721 0.922
Count of condition indices >= 10:3
Variance proportions >= 0.5 associated with cond >= 10:

const	GDPPesos~	COVID	Container~	Ship Calls
0.999	1.000	0.659	1.000	0.998

The table 2 demonstrates that the multicollinearity assumption has not been broken by the model. This indicates that the Container TEU Domestic and Ship Calls are two distinct things.

B. Time Series of Philippines

Figure 2 displays a trend that fluctuates, signifying erratic movements in the data points over the period under observation. Because The trend line lacks a steady trajectory, it is difficult to identify a regular pattern or direction of the GDP's growth. The highest peak was during the 4th Quarter of 2019 with

Table 1
Summary statistics of all variables

	GDP Trillions (Pesos)	COVID	Container Traffic	Ship calls
Mean	4.3701	0.36667	7.0773	1.0606
Median	4.4001	0	7.2883	1.091
Standard Deviation	6.4658	0.49013	78946	17610
Kurtosis	-0.65828	-1.6938	-0.32435	1.4264
Skewness	0.11652	0.55337	-0.73773	-1.0715
Minimum	3.2043	0	5.1462	52274
Maximum	5.6645	1	8.2133	1.3526
IQR	9.0815	1	1.2283	22440

Table 2
Variance proportions

lambda	Cond	const	GDP Pesos~	COVID	Container~	Ship calls
4.403	1.000	0.001	0.000	0.006	0.000	0.001
0.577	2.761	0.001	0.000	0.336	0.000	0.001
0.011	20.431	0.654	0.007	0.045	0.000	0.424
0.007	25.801	0.237	0.271	0.431	0.078	0.558
0.002	43.278	0.107	0.721	0.183	0.922	0.016

5,499,920,000,000 and the lowest peak was during 1st Quarter of 2015 with 3,204,277,000,000.

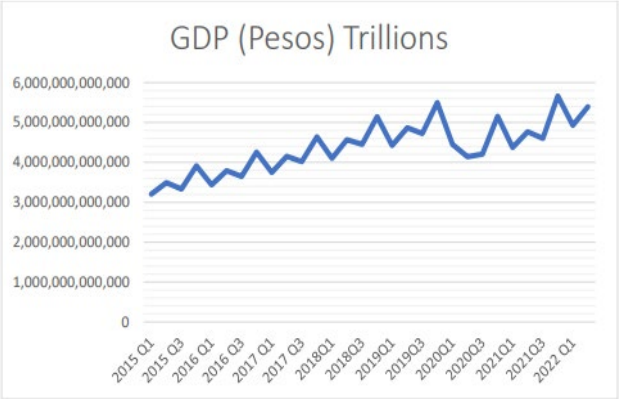

Fig. 2. GDP (Pesos) trillions

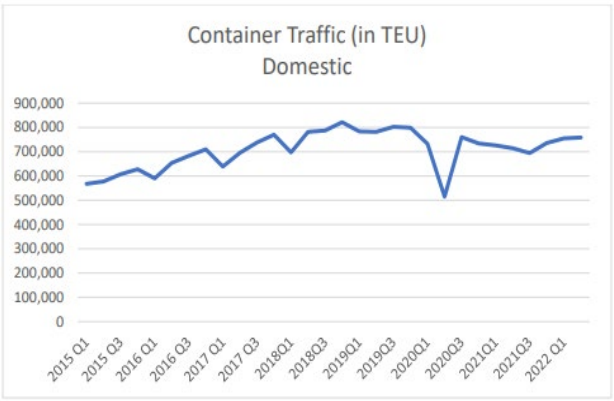

Fig. 3. Container traffic (in TEU) domestic

Figure 3 the data shows an upward trajectory during 1st Quarter of 2015 – 1st Quarter of 2020. However, the trend takes an unexpected turn with a sudden decline during 2nd Quarter of 2020 it may be potentially attributable to the commencement of the pandemic. The highest point was during the 4th Quarter of 2018 and the lowest peak was during the 2nd Quarter of 2020.

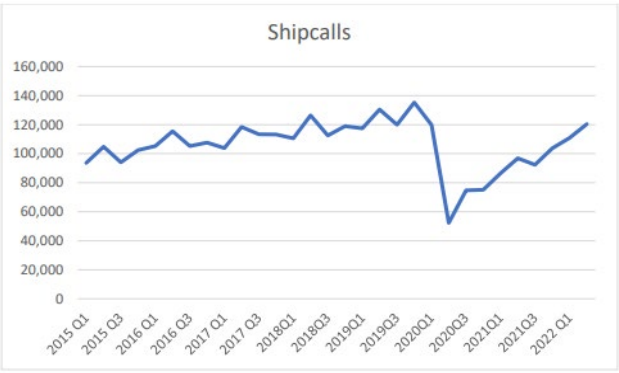

Fig. 4. Shipcalls

Figure 4 shows erratic fluctuations and shifts from the established trend after the initial uptrend. Unpredictable variations characterize this phase, suggesting that the observed values are not stable. The line then undergoes an abrupt and sharp decline, resulting in an apparent shift in the pattern; possibly the variable emerged from the initial phases of the pandemic. The highest was during 4th Quarter of 2019 and the lowest was during the 2nd Quarter of 2020.

C. Regression Model

Table 3
Model 1: OLS, using observations 2015:1-2022:2 (T = 30)
Dependent variable: GDP Pesos Trillions

	coefficient	std. error	t-ratio	p-value	
const	1.01497e+011	7.45531e+011	0.1361	0.8927	
Container Traffic~	6.03136e+06	1.04713e+06	5.760	3.50e-06	***

Mean dependent var	4.37e+12	S.D. dependent var	6.47e+11
Sum squared resid	5.55e+24	S.E. of regression	4.45e+11
R-squared	0.542308	Adjusted R-squared	0.525962
F(1, 28)	33.17657	P-value(F)	3.50e-06
Log-likelihood	−846.1851	Akaike criterion	1696.370
Schwarz criterion	1699.173	Hannan-Quinn	1697.267
rho	0.093799	Durbin-Watson	1.716960

The test above shows a calculated p-value of 3.50e-06, which is less than 0.05 level of significance. Thus We/The researchers reject the null hypothesis. This shows that CTD has a significant correlation to the Philippine GDP The computed r-squared for the model is 0.5423 which means that 54.23% of the variability in GDP is explained by the predictor.

Table 4
Model 2: OLS, using observations 2015:1-2022:2 (T = 30)
Dependent variable: GDP Pesos Trillions

	coefficient	std. error	t-ratio	p-value	
const	1.73138e+012	5.54244e+011	3.124	0.0042	***
COVID	1.03663e+012	1.76161e+011	5.885	2.87e-06	***
Shipcalls	2.12966e+07	4.90301e+06	4.344	0.0002	***

Mean dependent var	4.37e+12	S.D. dependent var	6.47e+11
Sum squared resid	4.93e+24	S.E. of regression	4.27e+11
R-squared	0.593711	Adjusted R-squared	0.563616
F(2, 27)	19.72758	P-value(F)	5.24e-06
Log-likelihood	−844.3982	Akaike criterion	1694.796
Schwarz criterion	1699.000	Hannan-Quinn	1696.141
rho	0.129339	Durbin-Watson	1.685384

The test above shows a calculated p-value of 0.0002, which is less than 0.05 level of significance. Thus We/The researchers reject the null hypothesis. This shows that Ship Calls have a significant correlation to the Philippine GDP The computed r-squared for the model is 0.5937 which means that 59.37% of the variability in GDP is explained by the predictor.

D. Discussions

The core of the paper addresses whether or not there have been significant effects of the pandemic pertaining to the productivity of the economy using the variables of Ship Calls and Container Traffic (Domestic) as metrics for measurement of port and shipping activity to gain an insight on how productive the country has been during the period of the COVID-19 global pandemic. Given the results that we have achieved using the data gathered from government agencies such as the Philippine Ports Authority (PPA) and the Philippine Statistics Authority we have been able to determine there is a positive relationship between the shipping industry and the pandemic.

In Cerdeiro, D., Komaromi, A., & Liu, Y., (2022) They were able to determine that both shipping and the capabilities of ports

have contributed to the delays and inefficiencies to the overall supply chain process. This hampers the ability of the economy to quickly recover since there would be a lot of backlogs and the deals taking place would also experience a slow down. Our findings suggest that there is a substantial amount of data evidence that implies that the maritime trade industry and the economy has a significant connection and that the productivity of one affects the other. This is backed up by our regression model for both variables where for Ship Calls the R-squared came out at 0.593711 or 59.37% and 0.542308 or 54.23% for the Container Traffic which signifies that the variables are somehow affecting the variable GDP because of the slow efficiency and disruptions brought about by the pandemic, it is directly affecting the overall output of the economy. This is also backed up by the results of our Durbin-Watson tests that suggest the relations of our data sets. Clark et al., (2004) suggested in their study that port efficiency brings down the costs incurred in the trade of goods. During the pandemic costs were driven high to a point where it has placed a constraint in the economy where people have a lot of demand but because costs were adding up and prices provided by the uncertainty of the situation in various ports and delays in the shipment of freight, it has reached a point where ordinary people and industry leaders are unable to keep up with the demand and costs to effectively supply the needs of the people within the time frame of the beginning of the crisis up until the recently ended pandemic.

E. Limitations

A number of difficulties were faced by our research when attempting to obtain accurate data for the GDP percentage of the Philippines for the designated year. Our analysis was not as accurate or thorough because specific and current information was not available through traditional search channels. We were unable to include import and export data, which has been accepted for providing a clearer overview of economic activity and what we feel like is a better representation of the maritime industry. We also refrained from using data for Container (International) because of uncertainty about the available literature to justify using the variable for our research that is why we only came up with the data for Container Traffic TEU (Domestic). We were unable to expand our research to include years beyond the scope of the 2nd Quarter of 2022 due to a lack of necessary data for certain variables in the study.

5. Conclusion and Policy Recommendation

A. Conclusion

The goal of this paper is to answer the effects of the pandemic on the maritime industry including its port performance during the COVID-19 pandemic & going back to the study of Cerdeiro, D., Komaromi, A., & Liu, Y. (2022), where they determined that port delays had significantly added additional strain to the time frame of the completion of delivering goods. Puts emphasis on the difficulty the country has experienced because of the complications of an inefficient system which is further put down because of an uncontrollable phenomena to which the major ports such as Manila International Container Terminal, North Harbor and South Harbor, and Batangas Port has reached their maximum capacities just to accommodate the inflow of essential goods. Based on the research that we have done, the number of ships going into the ports in the Philippines has declined because of numerous factors. One of them being health concerns and the other is delays in the supply chain process. This goes the same with the number of container traffic for domestic transactions but for a different reason, such as the ships not being able to dock and offload freight because ports are at maximum capacity and that there is not more storage in ports to accommodate other goods as processing has stalled, therefore affecting the flow of the economy in the process.

B. Policy Recommendation

Our policy recommendation would be centered around the further advancement of the ports in the Philippines such as improving supply chain processes through digitization and reduction of red tape. As well as acquiring more space for the eventuality of use for maximum capacity and capability of ports to handle all the goods that might pass through with or without a global crisis.

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