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THE IMPACT OF GOVERNMENT RESPONSES TO THE PANDEMIC COVID-19 ON VEGETABLE PRICES IN MALAYSIA

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Abstract: *The impact of Covid-19 to the Malaysian economy is critically affecting companies and businesses. Many businesses have been forced to cease operation due to the government's stringency such as the implementation of the Movement Control Order (MCO), the working from home, the banning of international and domestic travel and others in combatting the outbreak of Covid-19. Nevertheless, these restrictions are important to stop the spread of the virus as the World Health Organization (WHO) proved their effectiveness. The marketplace, where all the wet and dry food sources can be found, has become the main source of place for most people to buy their essential food items. Upon the announcement of the enforcement of lockdown, people started panic buying; hence, it gave a huge impact on the supply and price of groceries including vegetables. Therefore, the aim of this research is to determine the effects of the Covid-19 pandemic caused by the government stringency index which created a fluctuation on vegetable prices in the marketplace in Malaysia. To achieve this, the research framework recognises the factors that caused the fluctuation of the vegetable prices during the pandemic by using the time series data of 70 week-samples of the types of vegetables that were commonly bought by Malaysians. The selected types of vegetables used in this research include large onion, long beans and cucumber. The stringency index involves movement restrictions, assembly restrictions and international travel restrictions. The Covid cases selected are the new recorded cases and confirmed death cases. The total of the collected data are approximately 560, and this figure has already combined the three types of samples. Moreover, this research uses time series data and Autoregressive Distributed Lag (ARDL) method, and the results have shown that there is a relationship between vegetable prices and the stringency index caused by the increase of Covid-19 cases in Malaysia. The results of the analysis prove that when the cases of Covid-19 increased, the government tightened the stringency index which affected the prices of vegetables in the domestic market. In brief, an increase of the new cases and movement restrictions will increase the price of large onions and long beans.*

Keyword: *Stringency Index, Vegetables Price, MCO, Covid-19, Supply Shock, Demand Shock*

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Introduction

This research study impacts of Government Response Stringency Index and the Impact of Covid-19 on Vegetable Prices in Malaysia. This research focuses on the effects and consequences of Covid-19 on price fluctuations in the agricultural sector. This research investigates the economic impact on vegetable prices and how Covid-19 pandemic has posed a serious threat to every country around the globe. Therefore, this research is to examine what factors that will make Malaysian economy in the agricultural sector receive an impact in terms of vegetable price fluctuations that may be affected because of directives issued by the government to prevent the spread of Covid-19.

COVID-19 is a new disease caused by a viral infection known as Systemic Severe Acute Respiration Syndrome Coronavirus 2 (SARS-CoV-2). On December 31, 2019, the World Health Organization (WHO) issued a statement regarding the Wuhan Municipal Health Commission, China, reporting a group of cases of pneumonia in Wuhan, Hubei Province. The novel coronavirus was eventually identified. Starting with the first lockdown in China's Hubei province in January 2020 and nationwide in March, closures continued to be implemented in many countries throughout 2020 and 2021. On 18 March 2020 Malaysia start to implement the lockdown, during the MCO period, Malaysians should be at home and not make any movements such as crossing border set up by the police. In relation of the MCO's order, traders are also not allowed to open shops and any food stalls for a specified period of time. All employees who receive salaries including factories, companies and any business sector are granted two weeks' paid leave following the MCO order and paid salaries according to current salaries on the orders of the Malaysian government.

Although the agricultural industry is labelled by the federal government as critical during the MCO, the government still allows businesses to operate as usual, although limited supply of raw materials, labor and market access, along with logistical constraints, will affect the food supply system (Vaghefi, N., 2020). The lack of agricultural produce needed by the population has led to the upward trend in vegetable prices. For example, due to disruption to production and distribution due to the pandemic, the retail price of rice increased by about 10% – 20% between January to April 2020 in India, Laos, Mongolia, Pakistan, Sri Lanka and Thailand (Kim et al., 2020).

In addition, this research focused on measurement data using Autoregressive Distributed Lag (ARDL) suggested by Pesaran, Shin and Smith (2001). Econometric methodology is used to calculate and analyze vegetable price in according with government responds stringency index. This research is to measure the level of government response regarding new cases of COVID, confirmed deaths, restrictions on movement, assembly restriction, ban from international travel on vegetable price fluctuations in Malaysia. This research specifically examines the economic impact faced by agricultural and plantation sector entrepreneurs and the selected vegetables is commonly used by Malaysians namely Large Onion, long bean, and lastly cucumber.

Figure 1 shows the fluctuations in vegetable prices for 2020 starting from the first week until the 53rd week. Vegetable prices before the start of the movement control order did not show much change but after the 13th week, vegetable prices were affected with a sharp declined on the price of cucumber and fluctuation of long beans.

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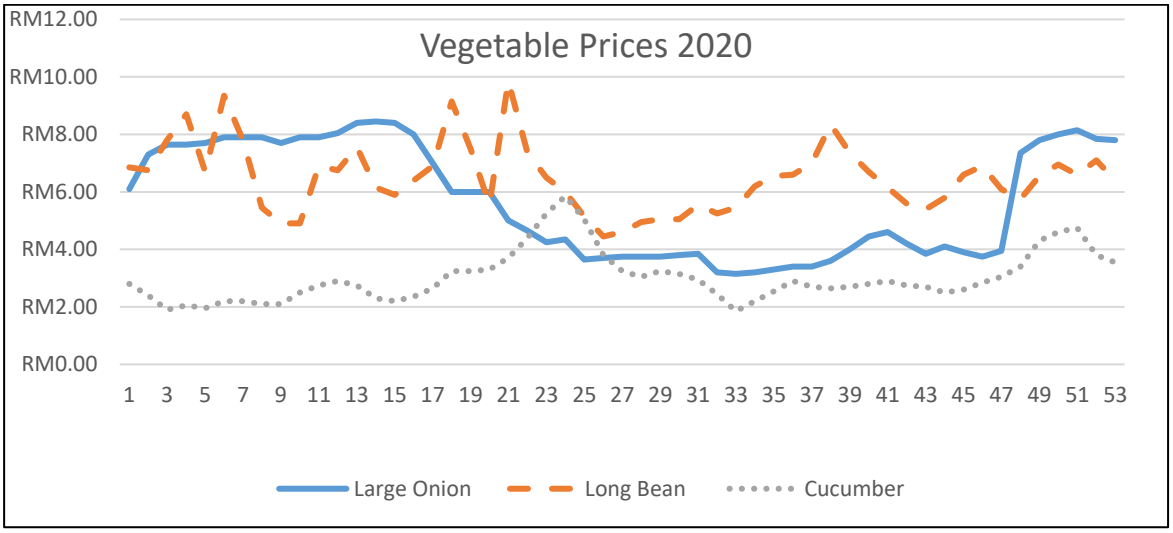

Figure 1: Vegetable Prices 2020

In figure 2, according to records released by The Federal Agricultural Marketing Authority (FAMA) on vegetable prices for 2021 in, price fluctuations were not very effective except in week 3 after the announcement of the start of MCO 3.0 and then vegetable prices became quite steep and did not show much significant change. After the 3rd week onwards, the government has issued a special statement regarding the extension of the MCO as well as other restrictions related to Covid-19.

The fluctuation of vegetable prices is more or less the same until the 13th week where the price of cucumbers rises until the 16th week and the price of cucumbers begins to fall until the 18th week. For the price of onions and long beans is the opposite where the price of the two vegetables decreased slightly until the 17th week and increased in the 18th week.

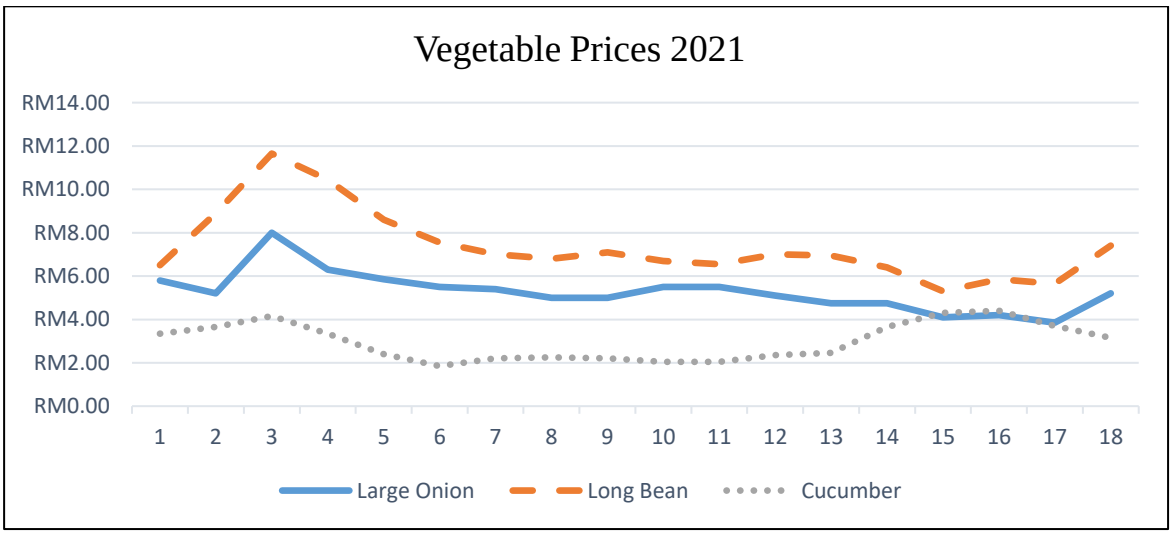

Figure 2: Vegetable Prices 2021

Literature Review

Every country has taken precautionary measures such as implementing lockdown to protect the safety and health of people due to the Covid-19 pandemic. As a result, the world logistics movement has been affected. Skawinska (2021) expressed that the introduction of new restrictions for movement across countries in Europe and around the world has created

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disruptions in logistical movements. Additional checks such as new and/or additional certificate requirements at the border require time-consuming processes and cause detrimental delays to perishable goods and cause losses. There have been countries that quarantine trucks and/or drivers which significantly reduces logistical travel using dirt roads, particularly in Europe. Due to the decline in international trade, disturbance in food supply chain and food production as well as food insecurity issues may emerge. FAO stated that small farmers and fishers may face difficulty in selling their products which in turn causes a decrease in their income and purchasing capacity. Food insecurity due to Covid-19 will highly affect the poorest and the most vulnerable segments of the population (FAO, 2020).

The impact of Covid-19 on food security can be observed on many fronts. Due to the travel restrictions experienced by many countries in the world, both food consumption and food supply have been affected. As for consumers who live in cities, the movement restrictions involved staying at home to limit the frequency of eating out and shopping in order to avoid the infectious contraction (Mohd Saudi et al., 2021). At the macro level, the closure of businesses and services, along with travel and movement controls has had a significant impact on private sectors and business investments. Its adverse effects on individuals and business lives are even worse. Individuals and businesses affected by temporary closures are at high risk of facing immediate cash flow constraints which greatly reduce their income. More importantly, these financial pressures are constantly felt by Small and Medium Enterprises (SMEs), and vulnerable groups such as low-income individuals, part-time workers and unemployed citizens. This can have detrimental effects on the entire Malaysian economy which include the reduction of business cost, the potential risk of bankruptcy, and the pressure of the financial system caused by non-performing loans (Cheng, C. 2020).

According to Department of Statistics Malaysia (DOSM), more than 40% of the household reported a reduction in income during the MCO period. For businesses, the main challenges faced were a decrease in payroll (77%), lack of customers (66%), premises rental (61%), and cash flow problems (36%). In the technology sector, job rigs are seeing the number of job applicants increasing but job ads are decreasing. In addition, every four out of ten jobs depend on the tourism industry, but this industry is badly affected by Covid-19. However, the agriculture sector in Malaysia contributes about 7% of the total GDP in 2019. Recognizing that the global demand for food is expected to increase rapidly with a growing population and rising affluence, Malaysia has every reason to improve its food security. Given the scenarios of an affluent Malaysian society in the coming years, it is expected that the demand for food and meat consumption will be high in the future (Mohd Saudi et al., 2021). Clearly, the agriculture sector in Malaysia must play an important role in securing food to feed the growing and affluent population in the future decades. Recognizing that the global demand for food is expected to increase rapidly with growing population and rising affluence, Malaysia has every reason to step up its food security. Under the Economic Transformation Programme (ETP), the agriculture sector has been identified as one of the eleven sectors where growth will be given priority and focused. Under the programme, the Agriculture National Key Economic Area (NKEA) aims to double the agriculture sector's Gross National Income (GNI) contribution to RM49.1 billion by 2020 through 16 Entry Point Projects (EPP) and business opportunities. The targeted agriculture produce includes paddy, papaya, pineapples, vegetables, herbal products, livestock, aquaculture and bird's nests. Nevertheless, these achievements will involve capturing a higher value for Malaysia's produce and increasing productivity. Under the NKEA, the programme aims to increase the average yields for paddy farming, seaweed farming and temperate vegetable farming by 60%, 46% and 40% respectively (Habibullah, 2019).

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Harris et al., (2020) found that most farmers in one of the states in India reported negative impacts on production, sales, prices and income. On the other hand, research on the impact of Covid-19 on food prices in China showed that the pandemic has a considerable effect on the price increase of cabbage and pork (Yu et al., 2020). Some research estimates that five out of every six urban families in India typically spend 70% of their income on food, while in Kuala Lumpur, about 45-50% of total household spending goes to food (Zezza & Tasciotti, 2010). While the price of food is high in the city center due to the high demand, other factors such as the additional cost incurred in transportation and maintenance (freezing) are also contributing to the high price. The growing urban population growth and high food demand have exposed the lack of traditional/rural farming methods to adequately supply urban center food needs (Argañaraz & Gleiser,2017). A significant increase in demand during the MCO tends to have an inflationary effect, where the prices of healthy food may rise, and eventually change consumers' dietary patterns (Vaghefi, N., 2020). In relation to these, the Movement Control Order are possibly affecting the vegetable prices at all levels.

Methodology

This research employed an econometric technique of Autoregressive Distributed Lag (ARDL). Analysis is based on secondary data on weekly time series data. 70 weekly data was taken to investigate the correlation of each selected variable. This research measured variables of the government stringency index namely travel restrictions, assembly restrictions and international travel restrictions. The covid-19 cases variables were used as a controlled variable which includes confirmed Covid-19 cases, confirmed deaths and while dependent variable are vegetable prices of large onions, long beans and cucumbers. Hence this research tested Government Response Stringency Index, Covid-19 cases and selected vegetables prices in Malaysia.

$$\text{vegetableprice}_{jt} = \alpha_0 + \beta_k \text{lockdown}_{kt} + \alpha_1 \text{covid}_t + \varepsilon_{jkt} \quad (1)$$

Where $\text{vegetable price}_{jt}$ is the price of vegetables, lockdown_{kt} is preventive measures and k are an index of the firmness of government response and covid_t measures the total number of Covid-19 cases as a controlled variable. The error term for ε_{jkt} is considered to have a mean of zero and persistent variance. It is estimated in advance that $\alpha_1, \beta_k > 0$ or $\alpha_1, \beta_k < 0$ depends on whether the source of impact is from a supply disruption or a reduction in demand respectively (Yu et al., 2020).

Theoretical Framework

The underlying theoretical framework for this research is demand and supply shock that oversees the impact of the government's response stringency index to the changes in demand and supply. These changes were observed due to the extension of MCO and the fluctuation of vegetable prices in Malaysia. During the implementation of MCO in Malaysia, panic buying occurred, and customers bought goods in large numbers at once which increased the aggregate purchase. This situation caused logistic problems to the suppliers. When the logistics of the goods from the supplier to the delivered merchant became slow, some perishable goods were damaged. As a result, the suppliers incurred losses because the goods sold were damaged during delivery and thus affected the traders and buyers in the short term. It can be concluded that the supply and demand theory is fundamentally related to the MCO, government response stringency index as well as the Covid-19 cases in Malaysia.

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Demand Shocks Theory

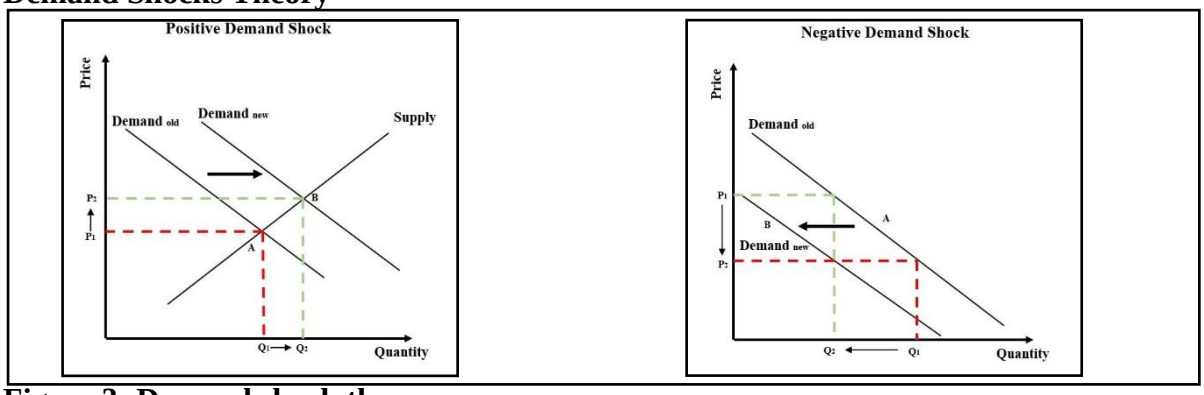

Figure 3: Demand shock theory

Figure 3 shows a business cycle model driven by surprises to retailer expectations of aggregate productivity. Suppliers and retailers are plagued by random and diverse productivity shocks; suppliers are observing their own productivity and seeing elevated and increased public signals about aggregate productivity. Public signals provoke "Demand Shock," which has the hallmarks of aggregate demand shocks: suppliers will increase output, jobs, and inflation in the short term and have impact in the long run.

The theory of demand shock is closely related to this research when the Covid-19 outbreak started in Malaysia. Starting on 18 March 2020, panic buying emerged in the country. Consumers may seek to reduce the risk of their exposure to the Covid-19 pandemic and reduce demand for products and services that involve close contact with others. At the beginning of the pandemic, stockpiling behavior also led to an increase in direct demand in the business sector (Baker et al., 2020). The shock of positive demand occurred when the MCO started. The demand for essential goods increased which has caused prices for some vegetables also increase. Based on the results of this research, the prices of large onions, long beans, and cucumbers were affected by the government's stringency responses index such as restrictions on movement and assembly restrictions.

Supply Shock Theory

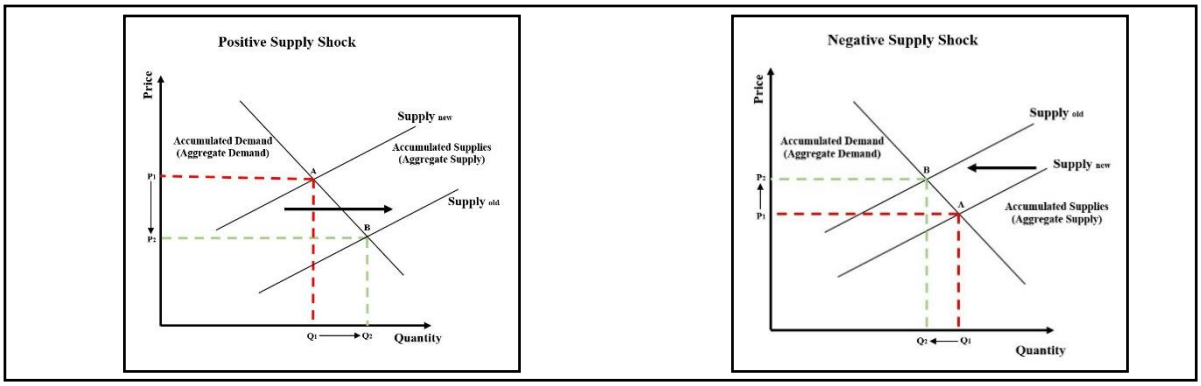

Figure 4: Supply shock theory

Figure 4 shows the supply shock theory model. According to the contemporary economic theory, supply shocks create a material shift in the aggregate supply curve and force prices to mix towards a new equilibrium level. The effect of supply shocks is unique to each particular event although consumers are usually the most affected. Not all supply shocks are negative;

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there are shocks that lead to supply booms that cause prices to fall and improve overall living standards. Positive supply shocks can be created with new technological manufacturing techniques. New technology manufacturing techniques can also result from technological advances or the discovery of new source inputs.

The supply shock theory can be used during the MCO when the goods in the supply (warehouse) exceed the current demand. For example, when the production of vegetables is more than the demand of buyers, the prices of vegetables change according to the current market price situation. If the supply of vegetables exceeds the current demand, the price of vegetables will decrease because the time period for the goods to break down is faster, and the trader will have to finish the sales of the vegetables in a short period of time. This can also occur if suppliers have new ways that can make the supply of vegetables soars. For example, vegetable suppliers find a more effective and efficient method of growing vegetables that can double the output compared to previous supplies.

Results and Discussions

The first part of this section presents econometric output based on the research objective. For the analysis, all the value of the data will be transforming into logarithm before run using Eviews. The first analysis begins with a summary of descriptive statistics for selected vegetable price models in Malaysia. Next, unit root tests such as ADF, PP, and KPSS examined models for each type of vegetables such as onions, long beans and cucumbers. The ARDL test based on cointegration using F-statistics further confirmed the existence of short-term as well as long-term cointegration between variables. Then the Bound Test is conducted to see the results of all types of vegetables whether the analysis is at a significant level of 10%, 5% or 1%. Next, diagnostic tests such as serial correlation as well as heteroscedasticity are performed to ensure that the tested model produces a reliable estimated output. Finally, the long-term and short-term elasticity results explain the relationship between the independent variable and the dependent variable.

Short-Run Elasticity and Error Correction Terms for Vegetable Price Models in Malaysia

Table 1: Short-Run Elasticity and Error Correction Terms

Dependent Variables	Large Onions Coefficient	Long Beans Coefficient	Cucumber Coefficient	
ΔLNDV	0.046238	0.115705	0.420969***	
ΔLNNC	-0.161464	-0.074962	-0.101006	0.
$\Delta LNNC_{(-1)}$	0.010616	-0.100931	-0.060080	
ΔLNCD	0.015115	-0.019762	0.008547	
$\Delta LNCD_{(-1)}$	-0.000214	0.025374	0.026564	
ΔLNRM	-0.018642	0.098230	-0.041446	
$\Delta LNRM_{(-1)}$	0.067539	0.064448	-0.092940	
ΔLNIT	-0.042361	-0.247332**	0.019778	
$\Delta LNIT_{(-1)}$	-0.009671	0.341339***	0.066776	
ΔLNRG	-0.038749	0.251247	0.096192	
$\Delta LNRG_{(-1)}$	-0.279479	-0.229421	-0.077424	
$ECT_{(-1)}$	**-0.331718*** **	**-0.568886*** **	**-0.313111*** **	

Note: Δ is referring to the first difference. The dependent variable is LNDV. (*), (**), (***) showed significant levels of 10%,5% and 1%.

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Table 1 above describes the results of short-term elasticity and Error Correction Term (ECT). The description of short-term elasticity is based only on zero lag. In the short term, LNDV has a significant and positive relationship with the vegetable prices in Malaysia.

A practical implication of the existence of cointegration is that any one variable can be targeted as a policy variable to bring about the desired change in other variables in the system. Empirically, cointegration means that the change in the dependent variable is a function of the change in other independent variables in the system. This means that the change in the dependent variable is also a function of the degree of imbalance in the cointegration relationship, which can be identified by the ECT. The Error Correction Term (ECT) in the ARDL regression for all vegetable types shows negative and statistically significant results, which is a necessary feature for model stability. More importantly, the statistics-t on the ECM are significant which once again reinforce the finding that the variables introduced in the model are cointegrated.

Higher coefficient values represent higher adjustment speeds for convergent variables in the long run. Based on the ECT values in the Table above, the highest adjustment speed which is also known as ECT is obtained by long beans (-0.57), followed by large onions (-0.33) and cucumbers (-0.31). For example, more than 57%, 33% and 31% of adjustments are completed in a year for vegetable prices due to short-term adjustments, which are considered obvious.

Long -Run Elasticity for Vegetable Price Models in Malaysia

Table 2: Long-Run Elasticity

Dependent Variables	**Large Onions LNLO**		**Long Beans LNLB**		**Cucumber LNC**	
IV	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
LNNC	-0.445***	0.0001	-0.144**	0.0485	-0.216**	0.0283
LNCD	0.124***	0.0011	0.012	0.6537	-0.057*	0.0932
LNRM	-0.048	0.7225	0.190*	0.0526	0.151	0.3214
LNIT	-0.090	0.6133	-0.381***	0.0095	0.092	0.5793
LNRG	1.159**	0.0223	0.604*	0.0908	1.228***	0.0069
C	2.196	0.0000	2.329	0.0000	1.048	0.0000

Note: Δ is referring to the first difference. The dependent variable is LNDV. (*), (**), (***) showed significant levels of 10%,5% and 1%.

Table 2 shows the results for the long-term elasticity of variables. There are significant and positive signs detected between vegetable prices against covid cases and the government's stringency index in Malaysia. Coefficient for all dependent variables are significant and show signs of increase. The highest increase coefficient are long beans (LNLB) by 2.329, 2.275, Large Onions (LNLO) by 2.196 and cucumber (LNC) by 1.048.

The long-run elasticity results of the large onion model indicate that the new case variable (LNNC) and assembly restriction (LNRG) have positive influence of 0.124 for LNNC and 1.159 for LNRG and are significant at 1% and 5% levels for the large onion price. Looking at the value of the coefficient for LNRG is higher than LNNC, it proves that assembly restrictions contribute more to the effect of price increase for such vegetables than in the new case. With each increase of 1%, it will make LNNC and LNRG increase by 0.12% and 1.16%. This is in line with the current market situation in which when the assembly restrictions are tightened by

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the government, it will have a significant impact on Malaysians in buying essential goods. For instance, when supermarkets and wet markets restrict the entry of customers, it causes the increase in the price of vegetables. Confirmed deaths (LNCD) show a negative and significant value at 1% which indicates that the price of large onions will decrease and give an effect of 0.46% for every 1% increase.

The model for long beans shows a positive and significant coefficient value of 10% for assembly restriction (LNRG) as well as movement restriction (LNRM). With an increase of 1%, it will have an effect of 0.19% and 0.6%. The coefficient values for LNRG show a higher value than LNRM and prove that assembly restrictions have more effect on long bean prices than movement restrictions. This can be demonstrated by the demand shock theory as stated by Nicole (2020) when several protective measures have been taken by countries around the world to curb the spread of viruses such as quarantine, closure of shopping malls, schools, restaurants, hotels and movement restrictions. This will have an impact on perishable items such as meat and vegetables. Furthermore, the wet market has taken an extra step by closing floor sales which has affected the ability to exchange commodities. With each increase of 1%, the LNNC and LNIT show a negative and significant influence of 0.14% and also 0.39%. This gives a signal that when LNNC and LNIT occur, it will affect the decline of the prices of long beans in Malaysia.

For cucumbers, there is only one coefficient which shows a positive and significant sign that is the restriction of assembly (LNRG). With each increase of 1%, LNRG increases by 1.23% and is significant at the level of 1%. Restrictions on assembly have a lot of impact on vegetable prices, and cucumbers are no exception which gives an indicator that when LNRG gets tighter it will make cucumber prices higher. Confirmed deaths (LNCD) as well as new cases (LNNC) show negative and significant influence. The value of LNNC coefficient is higher than LNCD where LNNC is 0.22% and LNCD is 0.06%. This proves that when LNNC and LNCD increase, the price of cucumber will decrease in the Malaysian market.

ARDL Test for Co-integration for Vegetable Price Model in Malaysia

Table 3: ARDL Test for Co-integration

Model	AIC (Lag order)	F Statistic
Large Onions	(2,2,2,2,2,2,2)	3.543*
Long Beans	(2,2,2,2,2,2,2)	4.176**
Cucumber	(2,2,2,2,2,2,2)	4.111**
Critical Value F-statistics#	Lower Bound, I (0)	Upper Bound, I (1)
k = 1%	3.41	4.68
k = 5%	2.62	3.79
k = 10%	2.26	3.35

Note: # Critical values are obtained automatically under Eviews 9, k is some variable (IV), critical value for border test: case III: unlimited shortcut and no flow. *, **, and *** represent 10%, 5% and 1% significant levels respectively.

Table 3 shows the ARDL cointegration approach using F-test to confirm the existence of cointegration between variables in the model. The optimal lag for annual data is usually low in 1 or 2. With quarterly data, 1 to 8 lags is appropriate. For monthly data, the optimal lag is 6, 12 or up to 24 for sufficient data collected. The optimum lags are chosen in the Eviews 9 system,

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and it is based on AIC. The critical values of the F-statistics in this test are available in Pesaran (1997) and Pesaran, Shin and Smith (2001).

The F-statistic needs to be compared with the critical value provided by Narayan (2004). The cointegration results show that the F-statistic obtained from the optimal lag for each vegetable type is greater than the upper bound critical value.

For example, the F statistic for Long Beans (4.176) and Cucumbers (4.111) is greater than the upper bound value at a significant level of 5%. However, the F statistics for Large Onion at the value of (3.543) are larger at a significant of 10% upper bound, I (1). Thus, it is confirmed that there is a long run relationship between the variables for each vegetable price in Malaysia.

Diagnostic Tests for Vegetable Price Models in Malaysia

Table 4: Diagnostic Tests

Model	A. Serial correlation χ^2 (1) [p-value]	B. Heteroscedasticity χ^2 (1) [p-value]
Large Onions	0.013706	0.290915
	[0.9864]	[0.9964]
Long Beans	1.321245	0.406423
	[0.2763]	[0.9777]
Cucumber	0.497791	0.503055
	[0.6110]	[0.9393]

Note: The probability value of diagnostic test is presented in square brackets. A. Lagrange multiplier test for serial correlation; B. Based on the regression of the value of squared.

The diagnostic statistics in Table 4 indicate that the model is well specified. None of the statistics (probability values) shown in the table are significant at the 10%, 5% or 1% levels. Based on the critical values of the null hypothesis, no first-order serial correlation and the null hypothesis of no heteroskedasticity is accepted in all selected vegetable types. The null hypothesis of no error specification in the form of a function is accepted for all cases.

Conclusions and Recommendations

Covid-19 pandemics have severely affected the business operation at many layers of sectors in the economy. Many businesses have been forced to cease operation due to the government's stringency such as the implementation of the Movement Control Order (MCO), the working from home, the banning of international and domestic travel and others in combatting the outbreak of Covid-19. The aim of the research is to study the impacts of Government Response Stringency Index and the Impact of Covid-19 on Vegetable Prices in Malaysia. This research focuses on the effects and consequences of Covid-19 on price fluctuations in the agricultural sector. The findings of this research indicated that price of large onions and long beans were the most affected with the Government Stringency Index namely restrictions on the assembly. The restriction to go out for the people especially to a confined place namely wet market, groceries shops and night market and shopping mall resulted very less demand of vegetables from the household that lead to oversupply of vegetables. These two-scenario lead to demand-shock and Supply-shock within the MCO period. The result from this research is in line with the supply and demand theory where when the quantity of a product becomes scarce, it will

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give a positive impact on the price, thus making it increases in value. However, when the quantity of the product becomes excessive, it will make the price value dropped significantly. The outcomes of the study provide an indication to the government to choose the best mechanism during MCO to minimize the economic impact. In the event of a recurrence of disease outbreak such as Covid-19 the government may have a better preventive measures to prevent infections and minimize the impacts.

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