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Effect of the Dutch government policies on the stock market in relation to each Covid-19 wave

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Abstract

This paper first examines the effect of the Dutch government policies on the stock market in relation to each Covid-19 wave. In the second part it will research whether an increase in the amount of policies has a positive or negative effect on the stock market. An ARMA-X (2,2) model is determined to be the best fit for the data. The main findings show that three of the four policy indices start with a significant positive effect during the first wave. This turns into a insignificant negative effect in the second wave and in the third wave goes towards zero. The second part of the thesis shows that an increase in restrictive policies has a significant positive effect and an increase in support and health policies has a insignificant negative effect.

Contents

1 Introduction

On the 27th of February 2020 the first covid-19 case was recorded in The Netherlands, and a few weeks later, on the 11th of March, it was officially declared to be a global pandemic by the World Health Organisation (WHO). This pandemic has had a devastating impact on the Dutch economy, healthcare and society. The Dutch government put multiple policies and restrictions in place to combat this pandemic and ensure an as low as possible infection and mortality rate while keeping economic en social interests in mind. It has been proven that a lockdown to prevent the spread of Corona does indeed work. The effect of a lockdown ensures a decrease in Covid-19 cases at least 20 days after the policy has been put in to place according to Alfano and Erculano (2020)

Nonetheless, Covid-19 and these policies still have had a major impact on the Dutch stock market. The Amsterdam Exchange Index (AEX) recorded a 13% weekly loss on the 28th of February 2020, the lowest since the 2008 economic crisis (Paul Le Clerq, 2020). According to Mr. Chadwick, Technical Officer for Influenza Preparedness and Response at the WHO it is a question when and not if the next pandemic comes (2021). As the government will have to respond to this again, it is very important to understand what the effect has been of these government policies on the stock market during this pandemic and learn from that. Not only can the government learn from this paper what the effect is of which policies it implements, but also from the amount of policies it implements. It is socially highly relevant as the stock market influences our everyday lives and impacts a lot of our jobs. It is also scientifically relevant as there has already been some research on the effect of government policies on the stock market, but this research was only on a very limited time span which gives a possible biased result. This paper looks at a time span from the first Covid case till the ending of the last government rule and thus gives a much more complete image of the effects on the stock market. It is important to understand how these government policies caused these low returns and how this changed during the pandemic. This paper will thus research the following research question:

How did the Dutch government policies affect the stock market in relation to each Covid-19 wave?

We will look at four different policy indices defined by the Oxford Covid-19 government response tracker and research what the effects for each of the three different Covid waves were and compare these effects with each other. These four indices are defined as: the overall

government response (GR), stringency (ST), containment and health (CH), and economic support (ES) indices. They are preferred over specific government policies such as face mask obligation as they comprise of an simple average of multiple pandemic and control policies and thus give a more concise and understandable image of the government policies. See figure 1 for a detailed overview of which policies each index comprises. The time span which is chosen for this paper is from the first Covid case in the Netherlands, 27$^{\text{th}}$ of February 2020, till the ending of the last government policy, the 23 $^{\text{rd}}$ of March 2022. In table 1 a short overview is shown of the expected effect in wave 1 and on the expected difference of effect for each index between each wave.

Table 1: Hypotheses testing

	CH	ST	GR	EC
Wave 1	POS	NEG	POS	POS
Wave 1 to 2	$\downarrow^*$	$\downarrow^*$	$\downarrow^*$	$\uparrow$
Wave 2 to 3	$\downarrow$	$\downarrow$	$\downarrow$	$\downarrow$

Note: * is significant change in coefficient at a 5% significance level.

The following explanation is given for table 1: the expectation for the containment and health index is that it will start with a positive effect on the stock market, this effect will become significantly smaller after the first wave and insignificantly smaller after wave 2. This is because the containment and health index will initially give more trust in the stock market and thus positive returns, but after the first wave this trust will decline and thus become less positive. For the stringency index the expectation is that this will have a negative effect on the stock market as this is index in damaging for companies as well as for the trust in the future, after every wave the expectation is that this index will have a worse effect because the trust in the future will decline and thus the returns of the stock market. This paper expects that the effect of the overall government response will start positive as it is a summary of most policies and as the expectation is that most policies start positive, this index will also start positive. For the economic support index is expected to have a positive effect on the stock market which will only increase after the first wave as this will help companies and consumers to spend more money. However, after the second wave it is expected to decline as the fact that these economic support policies are still necessary will decrease the trust in the stock market.

The government does not implement all policies at the same time, there are times that there are more policies in place and times that there are fewer in place. The second part of this paper will research whether an increase in the amount of policies has a positive or nega-

tive effect on the stock market. For this investigation, two variables are created: Restrictive policies (RP) and Support & Health policies (SHP). Restrictive policies consist of policies which restrict movement and freedom and Support & Health policies which includes policies which help with economic consequences of Covid and help infected people. The expectation is that an increase in restrictive policies will have a negative effect on the stock market as these policies are economically harmful for most companies and thus the stock market. An increase in Support & Health policies should have a positive effect on the stock market as this ensures a more secure investing climate and a safer feeling for the population.

The remainder of the thesis is structured as follows. Section 2 describes the literature review where previous research on this subject and the theories that this study uses are reviewed. Section 3 discusses the data and any data adjustments. Section 4 explains the method which is selected to perform this research. Section 5 discusses the results of the used methodology. The last section, section 6, concludes the thesis and gives recommendations for future research.

2 Literature Review

This research focuses on the effects of government Covid-19 policies on the Covid-19 stock market in relation to each Covid-19 wave in The Netherlands. As Covid-19 has only recently cooled down in The Netherlands, it has not been possible to conduct a lot of research on it. There has been some research on what effect the government policies had on the stock market. For example what the effect of a lockdown or economic stimulus packages are (Narayan, Phan, and Liu, 2020). They show in their paper that lockdowns, travel bans, and economic stimulus packages all had a positive effect on the G7 stock markets. However, lockdowns were most effective in cushioning the effects of COVID-19. The drawback from this research is that it is a more general approach on the government policies as there are many other policies which were implemented and only covers the beginning of the pandemic.

There is a research that investigated the effect of COVID-19 and the stringency of government policy responses on stock market returns worldwide over the complete span of the pandemic (Saif-Alyousfi, 2022). The results from this paper are that both the daily growth in confirmed cases and deaths caused by COVID-19 have significant negative effects on stock returns across all markets. In addition to this it also shows that stock markets react more to the growth of confirmed cases than to the growth in the number of confirmed deaths. And finally it finds evidence that stringent policy responses lead to a significant increase in the stock market returns, both globally and across regions. This paper however, still only looks at the negative government policies en disregards all the other policies a government can instill.

In addition to the above mentioned paper there are multiple other papers that have shown that the amount of Covid-19 cases has a direct influence on a country's stock market. This is important to note because when modelling the regression one should also not forget to add control variables and this variable is one that should not be forgotten. (Ali, Alam, and Rizvi 2020; Haroon and Rizvi 2020; Zhang et al., 2020; Salisu and Sikiru 2020)

There has been one research on the effect of specific government policies on the global stock market performed by Chang, Feng and Zheng (2021). This paper has a results that indicate that the overall government response, containment and health, and stringency indices have a significantly positive effect on stock market returns. Specifically, the following government policies can increase stock market returns: shutting down workplaces, canceling public events, restricting public gatherings and international travel, providing income sup-

port, and implementing fiscal measures. Their evidence shows that the stock market does not react significantly to government interventions in the health system.

The shortcoming of this paper is that this paper researches the effects from January 2nd 2020 till July 21st 2020. Because the final government policy in the Netherlands had not been cancelled till the 23rd of March 2022, the time span from this research was only long enough to see what the initial effects entailed. This paper will not only look at a longer time span, but will also compare how the effect changes over this period.

3 Data

3.1 Data source

The daily stock market return data comes from the Yahoo finance database. The data on the different government policies comes from the Oxford Government Covid-19 response tracker. This is a database which displays when each individual policy was in place in the Netherlands. The exact definition of each policy is displayed in Appendix A1. The time span from the data has been set from the first confirmed Covid-19 case in the Netherlands, 27$^{\text{th}}$ of February 2020, till the ending of the last government policy, the 23 $^{\text{rd}}$ of March 2022. According to the World Health Organisation (WHO), for one wave of a pandemic to end, "the virus has to be brought under control and cases have to fall substantially. Then for a second wave to start, you need a sustained rise in infections", thus the first wave is from 27-2-2020 till 8-2-2021, the second from 9-2-2021 till 26-6-2021 and the third wave is from 27-6-2021 till 23-3-2022.

3.2 Variable definition

We plan on using the following variables. The stock market returns (RET) have been calculated by taking the Adjusted Closing AEX price data using the following formula:

$$Stockmarketreturn_i = LN(\frac{AdjClose_t}{AdjClose_{t-1}}) \tag{1}$$

The stringency index(ST) records the strictness of 'lockdown style' policies that primarily restrict people's behaviour and refers to information on public information campaigns and testing policy. The economic support index (EC) refers to income support and debt/contract relief for households. The containment and health index (CH) combines 'lockdown' restrictions and closures of companies and shops with measures such as testing policy and contact tracing, short term investment in healthcare, as well investments in vaccines. The overall government response index (GR) considers all dimensions of government policy response, including containment and closure, economic response, and health systems. The exact composition of these indices is shown in Appendix A2 along with the formula used to calculate the indices.

As discussed in the literature review the variable New Covid-19 cases (NC) is proven to have a direct effect on the stock market and thus has been added to our data set.

The variables Restrictive policies and Support and Health policies are calculated by adding certain individual policies to each other, which are binary codes and are 1 when

the policy is in place and 0 if not, and dividing them by the amount of policies, as shown in the formulae below:

$$Restrictive = \frac{C1 + C2 + C3 + C4 + C5 + C6 + C7 + C8}{8} \tag{2}$$

$$SupportandHealth = \frac{E1 + E2 + H1 + H2 + H3 + H6 + H7 + H8}{8} \tag{3}$$

The restrictive variable contains policies which mostly restrict movement and is quite similar to the Stringency index however it does not contain the record presence of public info campaigns. As for the Support and Health variable, this consists of the economic support policies and combines them with the health policies. The exact definition of what each individual policy entails can be found in appendix 1. The research on the Restrictive policies and Support and Health policies will be done on the complete time span.

3.3 Descriptive statistics and correlation table

To get a first impression of our variables the descriptive statistics are shown in table 2.

Table 2: Descriptive statistics

Variable	Minimum	Mean	Maximum
Return	-0.114	0,000	0.086
New cases	0	10451.9	380399
Stringency	556	5752.028	8241
Government response	1146	5980.235	7292
Containment and Health	1310	5872,171	7619
Economic support	0	6736.372	8750
Restrictive policies	0	0.778	1
Support and Health policies	0	0.85	1

Note: Return is in percentages

Table 2 shows that the mean of the return is equal to 0, this means that overall our stock market data has had an average of 0 return, however, a minimum of -11.4%, and a maximum return of 8.6% indicate that there has been significant fluctuation on the stock market. The maximum amount of new cases is over 300,000 and after investigating the data set further

there are some large outliers which for example come due to a malfunction in the government system which has as a consequence that a couple of days will be added to each other. Because these new cases are such large numbers, to make the data better fitting for the model this paper has chosen to adjust for these large numbers and take the natural logarithm of 1 + New cases. This will ensure that these large outliers do not make the model biased.

As shown in table 2 the indices are numbers between 0 and 10,000. As the stock market returns are percentages between minus one and one, all indices are divided by 10,000 in order to be able to make a model with coefficients that can easier be interpreted. As these variables are indices, it does not matter if we divide them by 10,000. It is important to note that most policy indices do not have a minimum of zero. This is because there were already some basic policies in place before the first Covid case in the Netherlands occurred for example basic health care for influenza or default pandemic contingency plans. The only one that starts at zero is the Economic support index which is logical as the economic support policies from the government did not start until Covid influences the Dutch economic market.

The restrictive policies variable has a mean of 0.778 which shows that on average there 75% of these policies were in place. On the other hand the Support and Health policies variable has a mean of 0.85 which shows that, on average, there were 10 percentage points more Support and Health policies in place than there were Restrictive policies in place.

To look at a first possible connection between these variables the following correlation table is given:

Table 3: Correlation results

	RET	NC	ST	GR	CH	EC	RP	SHP
RET	1.000							
NC	0.027	1.000						
ST	0.110	0.111	1.000					
GR	0.133	0.386	0.876	1.000				
CH	0.108	0.488	0.823	0.974	1.000			
EC	0.144	-0.290	0.478	0.401	0.188	1.000		
RP	0.118	0.028	0.957	0.848	0.761	0.603	1.000	
SHP	0.057	0.595	0.228	0.500	0.513	0.102	0.267	1.000

As can be seen in table 3 there is a surprisingly small correlation between NC and RET but for all of the policy indices there is a correlation of more than 0.1. It is also surprising

that the correlation between NC and RET is not negative. This can be explained by the fact that this paper uses a long time span so that in the beginning of Covid-19 it would have had a negative correlation but after a while will have evened out.

4 Methodology

As the data set for this research consists of time series data, the best method model this data would be to perform an Autoregressive integrated moving average (ARIMA) model. The Box Jenkins method will be used to determine the correct ARIMA model. The identification of the model will be done by using the complete time span and using that model for each individual wave.

4.1 Stationary test

The first step to determine the correct ARIMA model is to whether the Return variable is stationary. This is done by performing two tests, a Dicky Fuller test and a Phillips Perron test. These tests are performed on not only the entire data set but also on each individual wave as we model both the individual waves as well as the entire time span. The results were for all waves and for both tests that all the data is stationary. This means that there is no need for differencing of the data and we thus have a ARMA model.

4.2 Identifying the model

The next step is to use Autocorrelation Functions (ACF) and Partial Autocorrelation Functions (PACF) to determine what possible ARMA models could be a good fit for the data. It is important to note that the full base model includes the variables RET and NC. The reason for adding the NC variable to the base model is because it has been shown before in this paper that the amount of new Covid-19 cases definitely has a direct influence on a country's stock market and thus should also definitely be in our base model. This means that we will have an ARMA-X model. There were three possible models that could fit the data, being an ARMA-X (2,2), ARMA-X (3,2) and a ARMA-X (3,5). The next step to determine which model fits best is to perform a maximum likelihood test on the full base model. The following two maximum likelihood tests will be performed, the minimum Aikaike Information Criterion (AIC) and the minimum Bayesian Information Criterion (BIC) are used. The AIC indicates how well the model fits the data without overfitting the data (Aikaike, 1974). Both the AIC and BIC use a penalty term for adding parameters. The BIC has a bigger penalty for using too many parameters (Schwarz, 1978). The AIC does not directly depend on the sample size whereas the BIC does. The AIC and BIC scores are shown in table 4.

Table 4: AIC and BIC results

Model	AIC	BIC
ARMA-X (2,2)	-2390.636	-2366.351
ARMA-X (3,2)	-2387.023	-2358.691
ARMA-X (3,5)	-2389.169	-2352.743

The best model is the model with the lowest AIC and BIC scores. Thus for this data set the ARMA-X (2,2) model is the best fit. This means that this study will use the model shown in equation 4.

$$RET_t = \alpha + \beta_1 RET_{t-1} + \beta_2 RET_{t-2} + \beta_3 NC_{t-1} + \beta_4 X_{t-1} + \beta_5 \epsilon_{t-1} + \beta_6 \epsilon_{t-2} + \epsilon_t \quad (4)$$

In this model RET_{t-1} and RET_{t-2} are the AR(2) part of the ARMA-X model, ϵ_{t-1} and ϵ_{t-2} are the MA(2) part of the ARMA-X model. NC_{t-1} is the lagged variable of the New Covid-19 cases in The Netherlands. The reason that the first lag of NC is added is because the stock market of today reacts on the new Covid-19 cases of yesterday. X_{t-1} is the lagged variable of ST, GR, CH, EC, RP or SHP. This variable is also lagged because the stock market of today reacts on the policies that were implemented yesterday.

4.3 Testing of coefficients

To test whether there is a difference in coefficients between waves, a two-sided Z-test of equation 5 will be used.

$$Z = \frac{\beta_{Wave_t} - \beta_{Wave_{t+1}}}{\sqrt{(SE\beta_{Wave_t})^2 + (SE\beta_{Wave_{t+1}})^2}} \quad (5)$$

Where β_{Wave_t} is the coefficient of wave t and $\beta_{Wave_{t+1}}$ of wave t+1. $\text{SE}\beta_{Wave_t}$ is the Standard error of β_{Wave_t}. For this test a 5% significance level will be used.

5 Results

In this section the empirical results from the ARMA-X (2,2) are discussed. The ARMA-X (2,2) model has been used to investigate the effect of different Covid-19 government policies during each Covid-19 wave on the Dutch stock market. After this, the difference of effects between each wave will be shown and finally the effect of implementing more or less policies will be discussed.

5.1 Coefficient results

After performing the ARMA-X (2,2) on each wave the results that are produced are shown in table 5, 6 and 7 which match Covid wave 1, 2, and 3 respectively.

Table 5: ARMA-X (2,2) results wave 1: 27-2-2020 till 8-2-2021

Variable	Return	Return	Return	Return
l.EC	0.015*** (0.003)			
l.ST		0.025*** (0.001)		
l.GR			0.029*** (0.006)	
l.CH				0.041*** (0.012)
l.RET	-0.845 (0.093)	-1.152*** (0.031)	0.496 (0.572)	-1.524*** (0.031)
ll.RET	0.851*** (0.094)	-0.903*** (0.028)	0.4 (0.518)	-0.902*** (0.028)
l.ϵ	0.062 (33.999)	1.541*** (0.016)	-0.634 (.)	1.541*** (0.016)
ll.ϵ	-0.938 (31.894)	0.999 (.)	-0.364 (0.803)	1 (.)
l.NC	0.001 (0.001)	-0.0003 (0.001)	-0.0004 (0.0003)	-0.001 (0.001)
Cons	-0.015***(0.003)	-0.013*** (0.004)	-0.014*** (0.003)	-0.018*** (0.004)
N	262	262	262	262

Note: Significance level is indicated with * P$\leq$ 0.1 and ** P $\leq$ 0.05 and *** P $\leq$ 0.01. Standard Error is in parentheses. EC = Economic Support, ST = Stringency, GR = Government Response, CH = Containment and Health

Table 6: ARMA-X (2,2) results wave 2: 9-2-2021 till 26-6-2021

Variable	Return	Return	Return	Return
l.EC	0			
l.ST		-0.011 (0.017)		
l.GR			-0.023 (0.034)	
l.CH				-0.02 (0.03)
l.RET	0.447 (0.932)	0.444 (0.965)	0.444 (0.907)	0.444 (0.908)
ll.RET	0.448 (0.773)	-0.442 (0.778)	0.444 (0.772)	0.444 (0.773)
l.ϵ	-0.72 (1203.748)	-0.729 (4306.107)	-0.727 (.)	-0.727 (.)
ll.ϵ	-0.28 (337.403)	-0.271 (116.677)	-0.273 (1.12)	-0.273 (1.196)
l.NC	0.0001 (0.001)	-0.001 (0.001)	0.0004 (0.001)	0.0004 (0.001)
Cons	0.0001 (0.01)	-0.005 (0.014)	0.013 (0.023)	0.011 (0.02)
N	77	77	77	77

Note: Significance level is indicated with * P$\leq$ 0.1 and ** P $\leq$ 0.05 and *** P $\leq$ 0.01. Standard Error is in parentheses. EC = Economic Support, ST = Stringency, GR = Government Response, CH = Containment and Health

Table 7: ARMA-X (2,2) results wave 3: 27-6-2021 till 23-3-2022

Variable	Return	Return	Return	Return
l.EC	0.002 (0.009)			
l.ST		-0.006 (0.004)		
l.GR			-0.001 (0.007)	
l.CH				-0.008 (0.005)
l.RET	0.068 (0.457)	0.09 (0.475)	0.095 (0.485)	0.088 (0.481)
ll.RET	0.71* (0.392)	0.699* (0.41)	0.692 (0.43)	0.695* (0.413)
l.ϵ	-0.223 (.)	-0.243 (.)	-0.25 (797.248)	-0.244 (.)
ll.ϵ	-0.777 (0.853)	-0.757 (0.385)	-0.75 (597.6592)	-0.756 (0.881)
l.NC	-0.001*** (0.0001)	-0.001*** (0.0002)	-0.0007** (0.0003)	-0.001** (0.0003)
Cons	0.008 (0.005)	0.01*** (0.002)	0.012*** (0.003)	-0.011*** (0.002)
N	191	191	191	191

Note: Significance level is indicated with * P$\leq$ 0.1 and ** P $\leq$ 0.05 and *** P $\leq$ 0.01. Standard Error is in parentheses. EC = Economic Support, ST = Stringency, GR = Government Response, CH = Containment and Health

There are two things that are important to note for tables 5,6 and 7. The first one is that during the entire second wave, the Economic support variable has remained constant which means that there was no effect to be found. The second is that for some Standard Errors there is the following output: (.). This indicates that there is near collinearity for this variable.

On a first glance one can see that for all policy indices the significance changes completely after the first wave. For wave one all policy indices are statistically significant at a 1% level, for waves two and three this changes to not even 10% significance. Table 8 will show the results on the Z-Test on whether the coefficients significantly change in comparison to each wave.

Table 8: Z-test results

	CH	ST	GR	EC
Wave 1	POS	POS	POS	POS
Wave 1 to 2	$\downarrow^*$	$\downarrow^*$	$\downarrow^*$	$\downarrow$
Wave 2 to 3	$\uparrow^*$	$\uparrow^*$	$\uparrow^*$	$\uparrow$

Note: * is significant change in coefficient at a 5% significance level.

Table 5 shows that, in contradiction to the hypothesis, all government policy indices have a positive effect on the stock market returns in the first wave. This was expected for all of the policies except for the stringency policy, this could be caused by the fact that the fear for Covid-19 in the firs wave was substantial enough that the positive effects of safety thanks to the stringency policies outweighed the negative effect of the closing of shops and quarantine rules.

The hypotheses for the first to the second wave is correct apart from the economic support index, the reason that the hypothesis for the economic support index was wrong could be caused by the fact that it remained constant in the second wave and thus has a coefficient of zero. What is interesting to see however, is that all coefficients for the indices become negative after being positive in the first wave. These coefficients however, can not be interpreted as they are not significant. Whereas during the first wave all coefficients of the indices were significant at a 1% significance level, during the second wave the significance has dropped to not even 10%. On the other hand the second wave is of a short time span the insignificance of the coefficients could also be caused due to the low number of observations.

For the second to third wave there is a significant upward change for each coefficient

except for EC which is insignificant but still has an upward change. Even though all indices, except for EC, remain negative it is clear that the coefficients become closer to zero which can be explained by the fact that this is already the third wave of Covid-19 and the stock market will have gotten used to the government policies, all coefficients also remain insignificant.

As stated before, the second wave has a low number of observations and this could also be a cause to the insignificance of the coefficients. To investigate this further, the second and the third wave will be added to each other in the data set and the results to this regression are shown in table 9.

Table 9: ARMA-X (2,2) results wave 2 + 3: 9-2-2021 till 23-3-2022

Variable	Return	Return	Return	Return
l.EC	-0.001 (0.007)			
l.ST		-0.003 (0.005)		
l.GR			-0.01 (0.008)	
l.CH				-0.01 (0.008)
l.RET	0.367*** (0.128)	0.368*** (0.127)	0.363*** (0.126)	0.359*** (0.127)
ll.RET	-0.552*** (0.165)	-0.552*** (0.163)	-0.554*** (0.161)	-0.555*** (0.161)
l.ϵ	-0.66 (12.492)	-0.664 (108.739)	-0.664 (51.377)	-0.66 (491.559)
ll.ϵ	0.999 (37.622)	1 (327.633)	0.999 (154.593)	-
l.NC	-0.0001 (0.0004)	-0.0001 (0.0005)	-0.0001 (0.0004)	-0.0002 (0.0005)
Cons	0.002 (0.007)	0.004 (0.006)	0.007 (0.007)	0.007 (0.007)
N	230	230	230	230

Note: Significance level is indicated with * P$\leq$ 0.1 and ** P $\leq$ 0.05 and *** P $\leq$ 0.01. Standard Error is in parentheses. EC = Economic Support, ST = Stringency, GR = Government Response, CH = Containment and Health

Table 9 shows that when wave 2 and 3 are added to each other, the coefficients are all negative and close to zero but most importantly remain insignificant. This is a good indication us that despite the short time span of the second wave the coefficients shown in table 6 are not insignificant due to the lack of observations. This in turn suggests that after the first wave the policies have had an insignificant effect on the stock market which is important to know for future pandemics.

5.2 Intensity of policies

The second part of this thesis investigated whether an increase in the number certain policies also caused an effect on the Dutch stock market returns. The results for this research are shown in table 10.

Table 10: ARMA-X (2,2) results additional policies

Variable	Return	Return	Return
l.RP	0.007*** (0.002)		0.007*** (0.002)
l.SHP		0.001 (0.006)	-0.002 (0.005)
l.RET	0.255 (0.293)	-1.967*** (0.006)	0.252 (0.306)
ll.RET	0.613** (0.277)	-0.989*** (0.008)	0.614** (0.278)
l.ϵ	-0.403 (246.434)	1.984*** (0.002)	-0.4 (29.735)
ll.ϵ	-0.597 (147.32)	1 (.)	-0.599 (17.918)
l.NC	-0.0003 (0.0002)	0.0004 (0.0004)	0.0004 (0.0004)
Cons	-0.007*** (0.002)	-0.004 (0.003)	-0.007** (0.003)
N	423	423	423

Note: Significance level is indicated with * P$\leq$ 0.1 and ** P $\leq$ 0.05 and *** P $\leq$ 0.01.
Standard Error is in parentheses. RP = Restrictive policies,
SHP = Support and Health policies

In the first two columns the effect of the amount these policies is shown when they are individually in place, in the third column when they are both in place. In contradiction to the hypothesis set, an increase in the intensity of policies causes a significant positive effect on the stock market. An increase in the amount support and health policies also causes a positive effect however this coefficient is not significant. Column 3 of table 10 shows that, when all policies are in place, an increase in the amount of restrictive policies still has a positive significant effect on the returns of the stock market while an increase in the amount of support and health policies becomes negative. The coefficient for support and health policies does remain insignificant however it is surprising that this becomes negative.

6 Conclusion

The first aim of this paper is to find an answer to the following research question: *What is the difference in effect of the Dutch government policies on the stock market in relation to each Covid-19 wave?* and in the second part the effect of an increase in the amount of government policies on the stock market during Covid-19. The government policy data is provided by the Oxford Covid-19 government policy and the stock market return data is from the Yahoo finance database. First a stationary test is done on the data after which, with the help of ACF's and PACF's three possible ARMA-X models are selected. After calculating the AIC and BIC scores for each model, the ARMA-X (2,2) is selected for being the best fit. To test whether there is a significant difference in coefficients in relation to each wave a two sided Z-test is performed.

The results show that for all policies have a positive effect on the stock market in the first wave. From the first to the second wave all coefficients, except for the EC coefficient which remained constant in the second wave, become negative and are significantly different from the first wave. From the second to the third wave all coefficients, except for EC, increase significantly and become closer to zero. What is important to note is that during the first wave all coefficients of the government policies are significant at a 1% significance level while during the second and third wave none of them remain significant even at a 10% significance level. Besides this the coefficients also come closer to zero after each wave. This could indicate that, when a new pandemic hits, the government policies to combat this pandemic will only significantly effect the stock market during the first wave.

For the second part of this thesis, the results show that an increase in Restrictive policies has a significant positive effect on the stock market and Support and health policy an insignificant effect on the stock market. This are the results when looked at individually, when one looks at them at the same time the Restrictive coefficient remains the same and the Support and health coefficient becomes negative but remains insignificant.

6.1 Suggestions and shortcomings

One of the shortcomings of this study was that the Economic support variable remained constant for the entire second wave which made it difficult to compare between waves. For the second part of this paper it also is not taken into account which policies cause the biggest effect. The composition of the Support and Health variable and Restrictive variable can differ a lot through time. As each individual variable can have a different effect on the

stock market, the addition of each individual variable will also have a different effect on the stock market and thus the results can be biased. This paper only looks at the Dutch stock market. A recommendation for future research is to look at different countries and compare this paper's results with that. Another recommendation would be to look at past pandemics, for example the Spanish flu, and see whether that research produces the same results.

A Appendices

A.1 Policy definitions

Table 11: policy definitions

ID	Description
C1	Record of closing of schools and universities
C2	Record of closing of workplaces
C3	Record of cancelling public events
C4	Record of restrictions on gatherings
C5	Record closing of public transport
C6	Record orders to shelter in place and otherwise confine to the home
C7	Record restrictions on internal movement between regions
C8	Record restrictions on international travel
E1	Record if the government is providing direct cash payments to people who lose their jobs or cannot work
E2	Record if the government is freezing financial obligations for households
E3	Announced economic stimulus spending
E4	Announced offers of Covid-19 related aid spending to other countries
H1	Record presence of public info campaigns
H2	Record government policy who has access to testing
H3	Record government policy on contact tracing after a positive diagnosis
H4	Announced short term spending on healthcare system
H5	Announced public spending on Covid-19 vaccine development
H6	Record policies on the use of faical coverings outside the home
H7	Record policies for vaccine delivery for different groups
H8	Record policies for protecting elderly people
V1	Record the ranked position for different groups within a countries prioritisation plan
V2	Record which categories of people who are currently receiving vaccines
V3	Record how vaccines are funded for each category of people identified in V2 as currently receiving vaccines
V4	Reports of existence of a requirement to be vaccinated
M1	Record policy announcements that do not fit anywhere else

A.2 Policy indices

All of our indices are simple averages of the individual component indicators. This is described in equation 6 where k is the number of component indicators in an index and the sub-index score for an individual indicator is I_j.

$$Index = \frac{1}{k} \sum_{j=1}^{k} I_j \tag{6}$$

Index	k	C 1	C 2	C 3	C 4	C 5	C 6	C 7	C 8	E1	E2	E3	E4	H1	H2	H3	H4	H5	H6	H7	H8	M 1	V1	V2	V3	V4
Government response index	16	x	x	x	x	x	x	x	x	x	x			x	x	x			x	x	x					
Containment and health index	14	x	x	x	x	x	x	x	x					x	x	x			x	x	x					
Stringency index	9	x	x	x	x	x	x	x	x					x												
Economic support index	2									x	x															

Figure 1: Composition of policy indices

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