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Mobility Restrictions and Macroeconomic Policymaking in the Great Covid-19 Recession

A Panel Study on the Effect of Fiscal and Monetary Policy Announcements on Economic Activity in the Euro Area

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Spring Term 2021

Master Essay 1 (NEKN01)

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Abstract

The Covid-19 pandemic is in multiple ways a new type of crisis. The virus outbreak has had a serious impact on global health and has caused an economic downturn that is heavily driven by the restrictions implemented to attenuate the health-crisis. Apart from affecting the mobility of individuals, these restrictions impose additional constraints that policy makers need to adhere to when conducting macroeconomic policy as means of mitigating the negative economic effects of the crisis. This thesis investigates what role the level of restrictions play in the extent to which fiscal and monetary policy announcements are able to stimulate economic activity. This is done by estimating several random effects models using a daily panel dataset consisting of 18 euro area countries from 2020-02-15 to 2021-02-25.

Interestingly, the results indicate a positive response in economic activity from fiscal policy announcements in the countries subject to the most stringent restrictions, and a negative response in the remaining countries. This suggests a reverse restriction-uncertainty relationship where uncertainty could be the driving force, which increases in surrounding countries as a response to more stringent restrictions in another. This could fuel a "wait and see"-behaviour which has a negative impact on economic activity. The effect of monetary policy is seen to differ across time, rather than across national levels of restrictions. This is suggested to occur due to the (brief) existence of positive animal spirit voiced in an initially positive response from expansionary monetary policy in all countries. This effect is later revised and turns negative, likely due to a Ricardian Equivalence-like response to the unconventional monetary policy interventions.

Key words: Covid-19, Restrictions, Macroeconomic Policy Announcements, Economic Activity, Uncertainty, Panel Data

Acknowledgments: We would like to thank our Supervisor, Anna Grodecka-Messi, for her guidance and encouragement throughout our writing process.

List of Abbreviations

CB	Central Banks
ECB	European Central Bank
FED	Federal Reserve
BOJ	Bank of Japan
JGB	Japanese Government Bond
GFC	Global Financial Crisis
GDP	Gross Domestic Product
CMP	Conventional Monetary Policy
UMP	Unconventional Monetary Policy
TFEU	Lisbon Treaty of the Functioning of the European Union
EMU	European Monetary Union
PEPP	Pandemic Emergency Purchase Programme
OxCGRT	Oxford COVID-19 Government Policy Tracker
FPI	Fiscal Policy Index
IMF	International Monetary Fund
SSR	Shadow Short Rate
HAC	Heteroscedasticity and Autocorrelation-consistent
SD	Standard Deviation

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1. Introduction

The 11th of March 2020, the Covid-19 virus outbreak was announced a pandemic. With more than 120 million worldwide cases and 2.7 million deaths related to Covid-19 as of March 2021 (WHO, 2021), the outbreak has disrupted the way of life for a majority of the global population. In addition to the health perspective, the global economy has also been severely damaged by the spread of the virus due to the disruption of global supply chains, the loss of jobs and the increasingly uncertain conditions under which the economy operates.

To hinder the spread of the virus, stringent movement restrictions such as lockdown policies and workplace closures have been enforced by governments, causing further economic disruptions. In mitigating the economic effects of the pandemic, governments and central banks (CB) have implemented various fiscal and monetary policies. Conventional as well as more unconventional policies have been introduced by major CBs, including the European Central Bank (ECB), the Federal Reserve (FED) and the Bank of Japan (BOJ). The rhetoric of these major CBs is very similar. The ECB announced that they will do "as much as necessary for as long as needed" and that their self-imposed restrictions to their policy are not to stop the ECB from fulfilling its mandate (ECB, 2020a). Across the Atlantic, the FED announced Open Market Transactions "in the amounts needed to secure the smooth functioning of markets" (FED, 2020). In Japan, the BOJ decided "to purchase a necessary amount of JGBs[1] without limit" (BOJ, 2021).

Though resorting to this type of whatever-it-takes-policy might cause issues in the future, it could be justified to offset an economic crisis fundamentally different from any other experienced in the past. It is first and foremost different in the way it originates from a health-crisis and has been intensified by various mobility restrictions. As mobility restrictions introduce economic constraints on policymakers and the public, and due to the increased risk of future pandemics (IPBES, 2020), this is an event likely to fundamentally reshape the way our economies operate.

Using a 377-day daily panel of 18 euro area countries, this thesis investigates whether monetary and fiscal policy announcements during the Covid-19 pandemic differ in their effect on economic activity based on the stringency of restrictions in the country in which the policy is

[1] Shorthand for Japanese Government Bonds, author´s translation.

undertaken. To accomplish this task, a random effects regression is run using data on the enforced levels of restrictions from the Oxford Covid-19 Government Response Tracker (OxCGRT) along with Fiscal and Monetary policy announcements on economic activity. The policy variables are measured as a self-constructed Fiscal Policy Index and Krippner's (2013, 2015) Shadow Short Rate (SSR) estimates. Main economic outcome variables such as GDP and unemployment are often reported with a lag and with low frequency which makes them unsuitable for this analysis. Therefore, high frequency Google Mobility Data is used as the measurement for economic activity in this thesis.

Apart from data availability,[2] the euro area is analysed in this thesis because it is appealing in the way its autonomous governments impose restrictions and fiscal stimulus to mitigate the country-specific negative effects of the Covid pandemic while being subject to frameworks, guidelines, and monetary policy common to all euro area members.

1.1. Background to the Great Covid-19 Recession

On the global scene, the economic effects of the ongoing pandemic are the largest in decades exceeding those of the Global Financial Crisis (GFC) of 2008. The pandemic has caused a downwards revision of growth in global Gross Domestic Product (GDP) from +2.9% to -3.4% for 2020. The countries in the euro area were more severely hit than the global average as the GDP growth rate for Spain, Italy, France, Portugal, and Greece all amounted to a decrease of more than -9% for 2020. Further, the crisis was seen to initially hit the European economies roughly equally with sharp, almost uniform downturns in most sectors. On the sector-level, a heterogeneous return is noticed with some sectors reverting to pre-Covid levels while others are affected more profoundly. For example, the global growth in goods trade volume bounced back to normal levels within a quarter and the global purchasing manager index made the same jump over the course of 6 months. Looking at other sectors such as the market capitalization of European banks or the revenues for the European tourism industry, the post-Covid estimates more resemble growth rates being pushed towards a lower, often negative, trajectory in the near-term (Statista, 2021a).

[2] Google Mobility Data is reported daily for all euro area countries except for Cyprus, which is why Cyprus is excluded from our sample.

As a means of battling the health-effects and containing the spread of the virus, local governments have implemented various social restrictions such as protocols for quarantine, regional lockdowns, and social distancing rules, all proven effective in slowing the spread of the virus (IMF, 2020a). Although being proven successful in combating the health effects, the restrictions have caused a wide range of economic implications where sectors strongly dependent on social interaction were severely affected. The International Monetary Fund (IMF) reports on the risk that workplace closures will disrupt supply chains leading to layoffs which imply less income, further adding to uncertainty, resulting in even less spending which triggers closures and work losses (IMF, 2020a). A realization of the described chain of events is for example seen in the gross household savings data for the euro area countries where the savings rate close to doubled in size from the fourth quarter 2019 (12.61%) to the second quarter of 2020 (25.01%) (Eurostat, 2021). In all, economic activity has been declining sharply as a result.

Taking this brief description of the effects of the Covid-pandemic into consideration, the main take-away is that this economic crisis, to some extent, is the consequence of the containment measures taken to resolve the health-crisis. This of course has policy implications, where the stimulation of economic activity is of most importance (World Bank, 2020, OECD, 2020). In normal crises, policy makers encourage economic activity by stimulating aggregate demand rapidly. Although, as the drop in aggregate demand is largely due to self-inflicted restriction policies, it makes stimulating activity subject to additional constraints, and thus more challenging (IMF, 2020a). Apart from having policy implications connected to the restrictions, demand deficiencies are shown to be a short-term driver of the price adjustment in markets (Balleer et al., 2020), emphasizing the extraordinary role demand plays in this crisis.

Based on the above, this article attempts to shed some light on this issue - what effect will macroeconomic policy announcements have in these peculiar times of Covid-19 whilst taking into consideration the economic and social implications of the restrictions? As the prominent 2000-th century economist Kenneth Galbraith said, “the enemy of the conventional wisdom is not ideas, but the march of events” (1958, p.21). This statement is highly relevant today, where restrictions have altered and affected lives of people across every level of society, resulting in unprecedented economic complications - a new situation in which the optimal policy decision is uncertain, and traditional economic wisdom possibly challenged.

1.2. Hypothesis and Structure of the Thesis

Since the restrictions imposed to contain the coronavirus will likely have a negative impact on the general ability to consume, alter the level of perceived uncertainty and in other ways weaken the various transmission mechanisms of economic policy, there are probably differences in policy effect conditional on the level of restrictions. This leads to the following hypothesis which the thesis aims at answering:

- *Monetary and fiscal policy announcements will have a different effect on economic activity depending on the level of restrictions in a country.*

This thesis is organized as follows: Section 2 provides a literature overview and the theoretical framework, including a review of macroeconomic policy approaches. In section 3, the methodology approach is outlined. This is followed by the presentation of the main results, together with a robustness test in section 4. Section 5 outlines the analysis, connecting the theoretical argument to the results. Finally, in section 6, the conclusion is presented together with suggestions of future research.

2. Literature Overview and Theoretical Framework

This chapter is dedicated to outlining theory and articles relevant to this study. First, we give a description of the structure and history of the euro area's economic policy along with an overview of the different policy approaches currently discussed in the literature. Second, we present a theoretical and literary framework describing why there would be a difference in the effectiveness of macroeconomic policy depending on the level of restrictions in a country.

2.1. Economic Policy and Crises in the Euro Area

2.1.1. Policy Purpose, Measurement, and Implementation

As stated in Andersson, the goal of economic policy throughout history can be summarized as having "a stable economy with full employment and low inflation" (2020, p.1). This is often translated into central banks and national governments stating their objectives in terms of a target GDP growth rate, level of unemployment, rate of inflation and budgetary surpluses over the business cycle. Additionally, the mandate and task of protecting the economy and the society from external shocks, or mitigating the effects of the like, has historically been assigned to the elected governments as well as the central banks.

In the euro area, monetary policy is centralized and independently conducted by the ECB with the ultimate goal of ensuring price stability (ECB, 2021). The national governments on the other hand are responsible for fiscal policy regarding budgets, general taxation, and regularisation of markets (European Commission, 2021a). Further, the responsibility of a well-functioning economy is shared by the ECB, with its monetary policy common to all members, and national governments who tailor the fiscal policies to the needs and wants of each individual member state. Therefore, the structure of the euro area adds to the complexity of conducting macroeconomic policy. For a further discussion of how these different tools are measured and used in this thesis, see section 3.2.3 and 3.2.4.

When regarding the active period of the ECB, in the absence of a crisis, monetary policy mainly operates to manage the liquidity in the money markets by setting a target for the overnight interest rate[3] and adjusting the monetary supply to meet this target (Smaghi, 2009). When the central bank steers the economy through the interest rate and the money supply, the situation is referred to as a Conventional Monetary Policy (CMP) environment. Whenever a crisis is present, as for example the GFC and the current great Covid-19 recession, these tools alone are often considered insufficient in reaching the Central Bank's goals. A period of economic distress is often categorized as an Unconventional Monetary Policy (UMP) environment. Here, more unconventional policy-tools are being used including Quantitative Easing,[4] Credit Easing,[5] Forward Guidance[6] as well as extensive government and corporate lending. One implication of the use of UMP-tools, however, is that the ECB interest rate becomes less informative in conveying the policy stance of the CB as the interest rate is only one of many tools at the disposal of the ECB, especially close to the zero-lower bound. This represents the foundation to why this thesis makes use of the shadow short rate (SSR) estimates as its measure of monetary policy, a measure discussed at length in section 3.2.4.

The way in which the ECB as well as the national governments are to implement policy to offset a crisis is a heavily debated topic. The origin of the European debate can be traced to the discussion of what the mandate and responsibility of the ECB truly is, a concept ambiguously defined in the founding principles of the Lisbon Treaty of the Functioning of the European Union (TFEU). On one hand, the TFEU (article 123.1) forbids the ECB to participate in the purchase of sovereign bonds or public debt instruments of European Monetary Union (EMU) countries, but on the other hand requires the ECB to contribute to the stability of the financial system (article 127.2) (Karakas, 2015).

However, in the wake of the GFC, the ECB resorted to unconventional policy measures. The majority of which involved direct market transactions such as the *longer-term refinancing operations* that targeted banks and the *Securities Markets Programme* which was aimed at purchasing government bonds of EMU Member states (Draghi, 2019a, 2014). Further, a

[3] Throughout the thesis, by "interest rate" we consider the rate on Main Repurchase Operations (MRO).
[4] Quantitative Easing is a UMP-tool where the CB purchases government bonds or other financial assets in order to inject money into the economy (ECB, 2020).
[5] Credit Easing is an UMP-tool where the CB purchases non-treasury assets such as corporate bonds (Treanor, 2011).
[6] Forward Guidance refers to the communication of the CB regarding the state of the economy, its policy stance and future intentions (ECB, 2020b).

quantitative easing programme, *Public Sector Purchase Programme* was aimed at bonds and securities issued by national agencies and European institutions (Karakas, 2015). Today, the ECB seems to face the Covid-crisis by enforcing similar policies by the launch of the Pandemic Emergency Purchase Programme (PEPP) with an overall envelope of €1.850 billion as of December 2020. PEPP has a mandate to participate in similar market transactions as the GFC-related programs mentioned above (ECB, 2021b).

This interference and support to euro area governments represents a clear digression from the TFEU (article 123.1) where the independence of the ECB is no longer clear. Additionally, both the President and Vice-President of the ECB have stressed the importance of fiscal policy measures in combating the GFC, without which the downturn would have caused even more severe economic disruptions (Draghi, 2019b; Constâncio 2015).

By using the years prior to, and including, the GFC as a backdrop in addition to the current crisis, it seems the ECB conducts policy in line with the TFEU in times of economic harmony but violates the independence requirement in times of crises.

2.1.2. A Brief Academic Discussion of the European Central Bank's Policy Approach

The attitude to, and the effectiveness of, government and central bank response to a crisis is extensively discussed in academia. The main discussion revolves around whether primarily monetary or fiscal policy measures are more appropriate in the wake of an economic crisis.

Recent research has found evidence of monetary policy being more impactful in the acute phase of a crisis (Jannsen, Potjagailo and Wolters, 2019), and generally more effective in the euro area post the GFC relative to the period before (Collingro and Frenkel, 2020). Similar strong market responses to monetary policy measures are present in the US as well. As unconventional monetary policy has a historic record of efficiency, it should be used extensively to support the economy in the current pandemic (Bhar and Malliaris, 2021). Further, the spiralling public debt of the euro area governments and the following issues highlighted in the euro-debt crisis constitute an argument against the use of fiscal policies.

A theoretical argument favouring monetary policy is Ricardian Equivalence, where the critique of fiscal policy is founded in the expectations of households. The effect of Ricardian Equivalence is seen when households are forward looking and perceive that the money they get through expansionary fiscal policy will cause a government budget deficit which the

households will have to pay back with interest through future tax increases. As a response, households today will decrease their consumption and save to be able to repay the future tax that incurs with interest, which is why fiscal policy should have no effect (Fregert & Jonung, 2018). Note that the original theory imposes quite high assumptions on the rationality of individuals, leading to the actual response of households to be weaker than predicted by theory. However, the critique stands.

The promoters of a more balanced stance between monetary and fiscal policy argue that as we are approaching the zero-lower bound, monetary policy is not as powerful of a tool as it was before. By the heterogeneous nature of the Covid-crisis and the new lockdown policies imposed, Wei and Han (2021) find a weakened transmission mechanism of monetary policy, motivating the inclusion of fiscal policy to mitigate the effects of the crisis. Selim (2020) makes similar arguments, although bases them on the fact that the transmission channel of conventional central bank policy is through the commercial banks. These banks might not increase lending in response to lower interest rates because of an increased fear of loan losses. Therefore, monetary policy may not be an effective strategy. Also, with an interest rate of 0% since 2019 (ECB, 2021b), the phenomenon of a liquidity trap[7] is highly present, an issue monetary policy alone is insufficient in solving (Hommes, Massaro and Salle, 2019). Further, fiscal policy brings the flexibility of targeting specific sectors of the economy (IMF, 2020a, Fornaro and Wolf, 2020), making it a powerful tool in mitigating the crisis that adversely hit the economy.

The efficiency and issues of UMP are also discussed in academia. One risk with unconventional monetary policy is the associated inflation. Quantitative Easing for example, could result in an increase of the money supply and a higher inflation than desirable. The topic of Quantitative Easing and inflation is also present in this debate and research has however shown that the perceived inflation is higher than the actual inflation among individuals in the euro area (Schnabl, 2021). Also, much research on UMP is performed by the same central banks conducting it, naturally leading to questions regarding the true effect and efficiency of these policies (Fabo et.al, 2021). Therefore, by the structure and aim of this thesis, some light will be shed on this potential bias arising from the central bank's essentially assessing its own work.

[7] A liquidity trap is the situation where the nominal interest rate is or zero (Romer, 2019) or close to zero (Krugman, 1998). Once this happens, money and bonds become substitutes which implies that conventional central bank interventions are insufficient in steering the economy as any injected amount of monetary base will be hoarded by economic agents instead of invested. This often leads to a demand-driven recession (Korinek and Simsek, 2014).

Another area of discussion is how the trust for the ECB affects the efficiency of UMP. Since the GFC, the ECB has faced a barrage of criticism, especially regarding legitimacy of their actions and the way they communicate with the public. This has led to a deteriorating of thrust for the ECB among the public (Reuters, 2020). The recent measures taken by the ECB have been described as complex which often fuels suspicion. The new measures, and the mandate of the ECB, is therefore being increasingly questioned, especially regarding their effect on house prices and inequality. The falling trust for the ECB can also be a consequence of the ECB's inability to achieve its inflation target, several years counting (Schnabel, 2020a).

2.2. Restrictions and Uncertainty

In the previous section we discussed the different policy measures undertaken by authorities, their aim and implication as well as the academic debate regarding what policy to pursue in these challenging times. However, the announced and implemented policies, whatever the type, requires people to act on them for the policies to achieve the desired outcome. Put plainly, more money in the hands of people is of no use if the additional funds do not influence the *behaviour* of individuals. The same applies to the lending, financing, and investing behaviour of firms and businesses as favourable financing opportunities are of little help if these are not exhausted by the intended recipients. Both these examples touch upon the fact that individual and corporate decisions to a large extent are based on expectations about the future, highlighting the importance of altering these expectations in order to influence behaviour of people. Below, we will present the literary and theoretical framework necessary to understand why policy announcements will have different implications in countries with low relative high levels of restrictions.

2.2.1. The Pandemic and Uncertainty

The negative shock of the pandemic can, broadly speaking, be seen from two perspectives. First, as a shock that mainly disrupts supply, with spill over effects on demand or alternatively, as a shock in demand which later causes disruptions in supply (Fornaro & Wolf, 2020). As seen in section 1.2, the stimulation of economic activity in a crisis is of most importance, a feat usually conducted through the demand-side of the economy. Further, short-run evidence suggests that the demand side is driving the price adjustment on German markets (Balleer et al., 2020).

Taking this into consideration, the Covid-19 demand shock can be decomposed into two parts. First, the practical aspect of consumers simply being prevented from participating in market transactions due to restrictions, sickness or, by being unable to visit stores and marketplaces due to various alternative reasons. This results in some consumers (unwillingly) leaving the market, translating to a fall in demand. Secondly, there is a psychological aspect as firms and consumers tend to have a "wait and see"-attitude when faced with uncertainty. Especially in the current setting where the variability of government policy will lead to economic agents lacking quantifiable knowledge about the near future, a concept called Knightian uncertainty pioneered by Frank Knight (1921) and used by e. g Caballero and Krishnamurthy (2008) in discussing investor behaviour.

Looking at past periods of increased uncertainty such as the GFC, evidence reveals a tendency for firms and individuals to postpone consumption and delay investments (Baldwin & di Mauro, 2020). This is along the lines of Keynes classic discussion of animal spirits, in which investors are victims of sudden waves of optimism and pessimism, affecting GDP through fluctuations in demand for investments. This underpins the importance of expectations in the Keynesian model (Fregert & Jonung, 2018), a theoretical perspective where primarily demand drives economic growth.

The idea that expectations and sentiment is a driver of economic activity is being increasingly noted in academia, where for example Nowzohour and Stracca (2020) finds that most economic and financial variables are forward-looking, especially consumer confidence.

Consumer confidence has been described as a relevant proxy for perceived uncertainty (Nowzohour & Stracca, 2020; Daskalopoulou, 2014) but also for consumer spending, especially in times of crises (Desroches & Gosselin, 2002; Deés & Brinca, 2011). It can also be

used as a predictor for GNP growth, household investment and business cycle fluctuations (Daskalopoulou, 2014). Consumer confidence is in the euro area measured by the European Commission. The euro area average is depicted below, note the co-movement between confidence and Covid-19 deaths.

Figure 1: Consumer Confidence in the Euro Area

Notes: The graph was generated using data from the European Commission (2021)

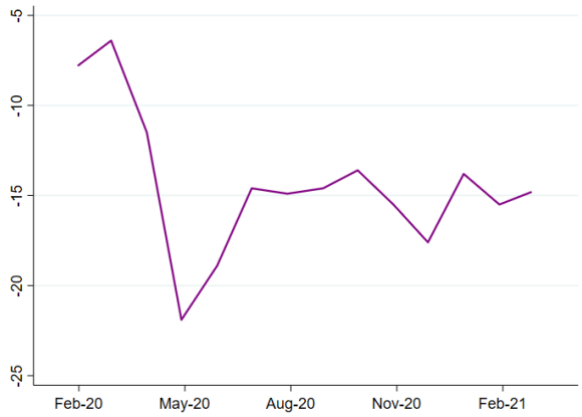


Figure 2: Covid-19 Deaths in Europe

Notes: The graph was generated using data from European Centre for Disease Prevention and Control (ECDC, 2021)

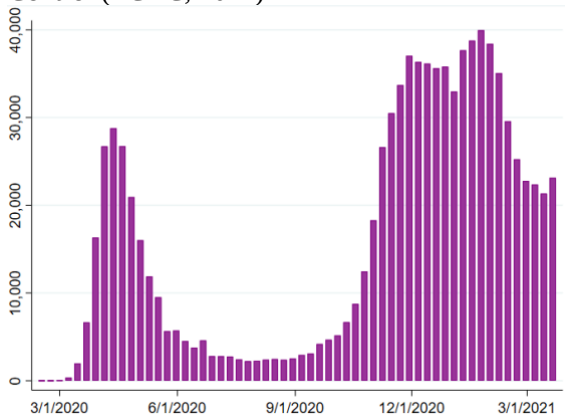


Figure 1 shows that consumer confidence plummeted as the first wave of Covid-19 hit Europe, rebounded over the summer to fall, rise, and fall again as the second wave struck. As consumer confidence can be used as a proxy for uncertainty, uncertainty appears to increase in times of high rates of infection and increasing death tolls, as in the first and second wave of the pandemic. The increased level of uncertainty is consistent with the "wait and see ''-argument presented above as the euro area savings rate, as a response, almost doubled in size from the fourth quarter of 2019 to the second quarter of 2020 (Statista, 2021a).

2.2.2. The Economic Implications of Uncertainty

A change in the level of perceived uncertainty can be transmitted to a change in behaviour through the concept of risk aversion (Perloff, 2017). Translated to economic agents, firms for example become more cautious about present and future investments as future profits are more difficult to estimate. Disinvestment is thus not an unreasonable outcome as firms hold off on this type of spending until uncertainty has decreased again (Bloom, Bond, and van Reenen, 2007; Perloff, 2017). This situation can be referred to as a supply-demand doom loop, described by Fornaro and Wolf (2020), where weak incentives to invest leads to financially constrained firms holding off on investments. As a consequence, productivity growth will drop, eventually

lowering the supply of firms which introduce further cuts in demand. Lower demand is translated into less revenue and thus less room for investments which again lowers productivity growth.

Regarding the households, individuals that are financially constrained and on the lower end of the income scale, consume a large proportion of their income. These people might find a rationale in consuming the additional income generated by e. g fiscal stimulus as a response to a negative income shock. Consumers less constrained might be reluctant to borrow or use a fiscal stimulus check in order to smooth consumption when income is temporarily low. The rationale being that borrowing will leave them vulnerable to future, or persistent, negative income shocks. Thus, instead of taking actions to withhold a base level of consumption, these consumers start accumulating a buffer (Obstfeld & Rogoff, 1996), possibly adding to the negative spiral described in Fornaro and Wolf (2020).

In addition to these practical considerations, consumption is, in part, determined by future expectations. If the negative income shock is expected to be permanent, income, thus consumption, will naturally suffer more than in the case where the shock is considered more temporary. A shock resulting in job loss is often perceived as a more permanent income change (Gottfries, 2012). This implies heterogeneity in household response to economic policy with regards to what sectors they are occupied in as well as their position on the income scale.

The effect of a "wait and see" attitude mentioned in the previous section is depicted in the simple, yet comprehensive, scenario presented by Fregert and Jonung (2018) where an individual wishes to purchase shoes although finds out that the left shoe is unavailable at the market at this particular time. The consumer then waits until the left shoe is on the market to purchase both the shoes. As left and right shoes are complements rather than substitutes, consumers will wait until the entire basket of desired goods, both the left and right shoe, is available in the market. Regardless of it being due to the vulnerability to negative income shocks or to the "wait and see" attitude, this behaviour is seen in the data as an apparent increase in the savings rate, see section 1.2.

As Christine Lagarde (2020) said in a speech, this is a highly unusual recession. The people losing their jobs are most often at the bottom of the income scale, working in sectors not normally as severely affected by a recession. Further, as previously noted, with an interest rate at 0% since 2019, the policy space is limited which leads to expectations becoming a main

driver of the transmission of monetary policy. This naturally has policy implications, where the effect of unconventional macroeconomic policies like excessive corporate lending is likely weakened as the incentives for fully taking advantage of extraordinarily loose financial conditions are fewer. In these situations, macroeconomic policy cannot unfold its full potential (Schnabel, 2020b). Fornaro and Wolf (2020) further argues that restrictions, in addition to the uncertainty currently perceived, impose new constraints on people, likely weakening the effect of expansionary fiscal as well as monetary policy. However, the lockdowns and restrictions implemented are, notably, supported by a majority of people in many countries, for example in Italy, Ireland, Germany, and the Netherlands (Breakingnews.ie, 2021; Meier et.al., 2020).

2.3. Summary of Arguments

When restrictions increase in a country some firms are forced to close. These workplace closures do not affect each sector alike. As most people losing their jobs are at the bottom of the income scale or employed in sectors suffering from both the negative impact on demand caused by the recession as well as the lockdown policies enforced, uncertainty will increase substantially for these economic agents in particular. Although it will also affect the society in general. When restrictions increase, a larger proportion of the population will be affected both directly by closures but also indirectly through various spill over effects, including increased uncertainty. These spill over effects might not be restricted to national borders, as increased restrictions in another country in the euro area could affect how an individual perceives his or her own situation.

By the ideas, evidence and arguments presented above, uncertainty is expected to be higher in countries with more stringent restrictions. When uncertainty is higher, the effect of monetary and fiscal policy announcements is expected to be reduced. This assumption is founded in the transmission mechanisms of economic policy being affected in both the practical aspect of people being restrained to their homes, unable to participate in some market transactions, as well as the psychological effect of uncertainty. The latter transmission channel voices itself in, for example, a “wait and see”-attitude which will arguably be more prominent in countries where movement restrictions are more stringent. Individuals and firms are then likely to hold off on their investment and consumption plans until they have more information regarding a future easing of restrictions or a potential end to the pandemic.

3. Methodology

In this chapter, we present descriptive statistics followed by a section describing the main variables and how they are processed in the (main) analysis of this thesis. In section 3.3 we outline details of the methodology together with the specification of the main model.

3.1. Descriptive Statistics

Within the scope of this thesis, Google Mobility Data, a Restriction Index, Fiscal Policy announcements and a measure of monetary policy is used in determining the impact of restrictions on the effect of macroeconomic policy announcements. Google Mobility Data is used in constructing the dependent variable, *Economic Activity*, whilst the other variables are treated as independent variables, see section 3.2 for a more thorough review of the variables. Further, in testing the hypothesis of section 1.3, the main analysis is based on a panel regression of *Economic Activity* on the independent variables using a random effects model.

The data sample consists of a daily panel from the 15th of February 2020 to the 25th of February 2021 of 18 European countries. This time period is appropriate since the first Covid-related death in the euro area was reported in France the 15th of February 2020 (Statista, 2021a). The 25th of February marks the end date of the panel series mainly due to the availability of Monetary Policy data which is reported on with a greater lag than the other variables. The data forms a strongly balanced panel with no missing values. The main panel variables are summarized in Table 1.

Table 1: Summary Statistics

VARIABLES	N	mean	SD	min	p25	p50	p75	max	skewness	kurtosis
Economic Activity	6,786	-24.09	18.71	-92.50	-35.25	-21	-11.50	28	-0.733	3.444
Restriction	6,786	56.94	20.74	0	45.37	58.33	73.15	93.52	-0.639	3.032
Monetary Policy	6,786	-2.581	0.174	-2.970	-2.720	-2.559	-2.460	-2.127	0.126	2.521
Fiscal Policy	6,786	122.5	17.51	100	107.9	122.3	134.5	171.9	0.738	3.031

3.2. Data Description and Data Processing

3.2.1. Economic Activity

Economic Activity is measured using Google Mobility Data. Google Mobility Data captures, among other things, the shift in human behaviour as a result of the restrictions implemented by general governments as means of limiting the spread of Covid-19. This data is provided by Google and is reported with daily frequency along six dimensions: retail and recreation, grocery and pharmacy, parks, transit, workplace and residential. As suggested by Achyunda, Arini and Putra (2020), activity (or mobility in their case) is measured as the weighted change in people's mobility. By the argument of Faulkner (2020) we exclude parks and residential areas as they are not mainly used for economic activity. However, as working from home has soared as a result of movement restrictions, the behaviour of the population has changed. By including workplace in the activity variable, we capture an additional aspect of the change in economic activity as a reaction to fiscal and monetary policy announcements.

As this thesis takes aim at determining the impact of restrictions on the effect of macroeconomic policy announcements, the outcome variables of economic policy need to be considered. Laid out in section 2.1.1, GDP and unemployment are examples of such outcome variables traditionally used by policymakers and in academia. However, in times of crises where change is rapid, several problems arise when it comes to traditional economic variables – the main ones being that the variable of interest is only reported on a monthly or even quarterly basis and often with a serious lag. This makes it difficult to monitor the state of the economy in near time. As a result of this, and by the evolution of big data, several high frequency macroeconomic indicators have gained in use, the more popular being the Google and Apple Mobility Reports released by Google and Apple respectively, the Weekly Economic Index by Lewis, Mertens and Stock (2020), and the Daily News Sentiment Index by Buckman et al. (2020). Also, the last year has shown a shift in academia towards the usage of more unorthodox sources of data (van der Wielen and Barrios, 2020) where for example Achyunda, Arini and Putra (2020) uses night light from satellite data when studying pandemic effects on industrial production and Doerr and Gambacorta (2020) uses Google Trends in the study of how adversely Covid-19 has affected Europe.

Further, mobility data from Google and Apple is used in research to study the effects of the pandemic in a variety of fields, for example in bioinformatics and genomics, see Bryant and Elofsson (2020); in medicine, see Zhu et al. (2020); and in criminology, see Halford et al.

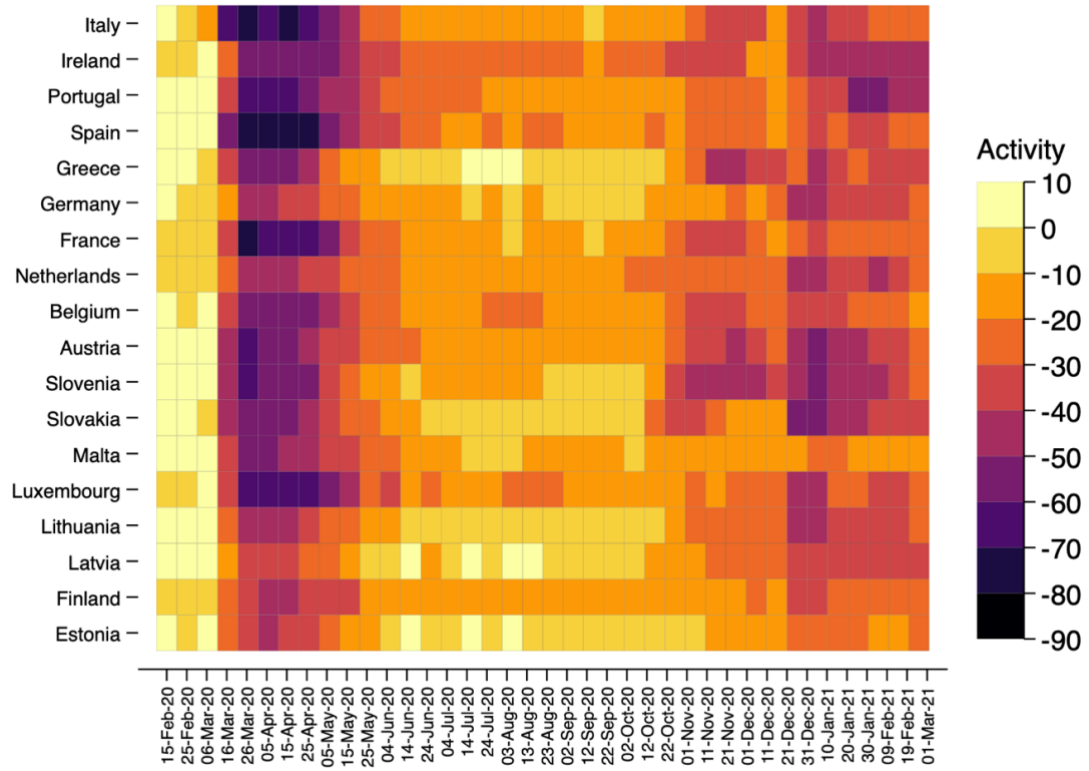
(2020). In economics, changes in mobility are shown to be a useful measure for economic activity which proxies growth of industrial production and GDP (Achyunda, Arini and Putra, 2020; Sampi Bravo and Jooste, 2020). As a result, mobility data could serve as a useful proxy for measuring the response in the main macroeconomic variables targeted by ECB and government policy. Therefore, the use of Google Mobility Data as the measure for Economic activity in this thesis naturally follows.

When daily data is used the problem of seasonality arises, for which guidelines and consensus on how to address the issue is yet to be formed (Nikolova and Elliott, 2019). Seasonality in the Economic Activity data can manifest itself as e.g., increased movement during weekends and holidays. To take this into consideration, and to reduce the potential bias in the analysis due to seasonality, two measures are taken. Firstly, a 7-day moving average of the Economic Activity Data is constructed, as suggested by Chetty et al. (2020). In producing the 7-day moving average, equal weight is given to each weekday. Secondly, two supplementary dummy variables are included in the analysis, for the Christmas and Easter holiday, respectively. The Easter-dummy is defined as the four days from Good Friday, on the 10th of April, until Easter Monday, the 13th of April. The dummy variable for Christmas covers the week from the 23rd of December to the 1st of January. Alternative ways of adjusting for seasonality exist,[8] although not applicable due to the high-frequency characteristics of the included data.

Economic Activity is presented below, countries are listed based on the average restriction level throughout the sample period, Italy being the strictest.

[8] The most frequently used method for official statistics is the "X-family" provided by the US Census Bureau, the newest being X-13 (the updated version of X-12 and X-11). This method is seen to be a powerful tool for seasonal adjustment, see Scott (1992), Wang and Wu (2012) and Sax and Eddelbuettel (2018). Another approach is to make comparisons with historical data to trace out the seasonal patterns, see for example Brownlee (2016). However, these methods require monthly or quarterly frequency of data (X-13/12/11) or the presence of "normal" periods for comparisons (for the method described in Abay et al. (2020)). As Google Mobility Data is reported with daily frequency starting February 15th, 2020, neither of these methods are applicable for this thesis.

Figure 3: Economic Activity in the Euro Area
Notes: The figure is generated using Google Mobility Data retrieved from Google Community Mobility Report (Google, 2021)



As seen in figure 3, a sharp downturn of Economic Activity occurs in mid-March as restrictions to movement are gradually introduced in Europe. When summer approaches, and the spread of Covid-19 is dropping and restrictions eased slightly, activity bounces back to almost pre-Covid levels only to revert back into negative territory as the second wave of Covid-19 and its subsequent lockdown-policies hits the countries, however to less extent than in the first wave.

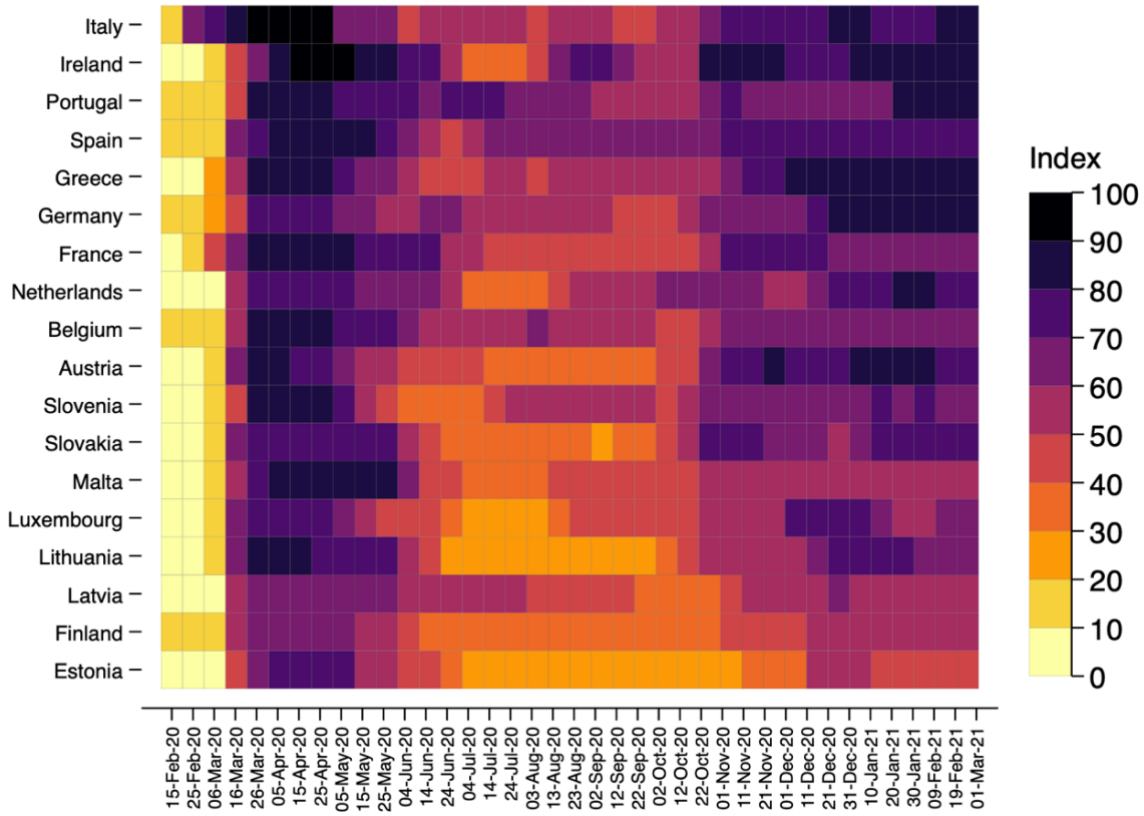
3.2.2. Restriction Index

To account for the different policies undertaken throughout Europe to contain the spread of Covid-19 this thesis uses the stringency index which is part of the Oxford COVID-19 Government Response Tracker (OxCGRT) produced by Hale et al. (2021). The OxCGRT presents four different indices capturing different aspects of the policies undertaken, the Stringency Index is here referred to as measuring "lockdown policies" (Hale et al., 2021). The Stringency Index consists of nine ordinal indicators including closure of schools and workplaces, stay-at-home recommendations and restrictions on international travel. Each indicator is given a score representing the level of strictness in that dimension, see appendix A1 for a more detailed description. As each of these indicators have different maximum values, subindices for each indicator are first calculated, after which the composite stringency index is

produced as the simple average of the included indicator variables. The index is reported at daily frequency from January 1st, 2020, and onwards, available on the website of Our World in Data.

Plotting the data, a clear tendency of co-movement of restrictions imposed between the countries is visible, although the extent of these containment measures differs substantially across countries, see figure 4 below.

Figure 4: Covid-19 Policy Stringency Index in the Euro Area
Notes: The figure is generated using data on restrictions from OxCGRT (Hale et al., 2021)



As a part of the analysis, the sample countries are allocated in four groups based on the percentiles of the average restriction level throughout the measurement period. This is done to further examine if the effect of macroeconomic policy depends on the level of restrictions. Group 1 consists of the 25th percentile, group 2 consists of countries in the 50th percentile, group 3 of countries with an average in the 75th percentile and the countries with the highest restriction averages are found in group 4. The groups are presented in table 2 where the group number indicates the hierarchy of strictness.

Table 2: Groups Based on the Quartiles of the Average Restriction Level

Notes: The figure is generated using data on restrictions from OxCGRT (Hale et al., 2021)

Group 1	Mean	Group 2	Mean	Group 3	Mean	Group 4	Mean
Estonia	38.552	Austria	57.141	Belgium	58.197	Ireland	67.317
Finland	43.812	Malta	51.948	France	61.664	Italy	67.829
Latvia	49.715	Slovakia	54.363	Germany	62.433	Portugal	65.251
Lithuania	51.101	Slovenia	56.271	Greece	63.827	Spain	64.897
Luxembourg	51.245			Netherlands	59.32		
Average	46.885	Average	54.93075	Average	61.0882	Average	66.3235

3.2.3. Fiscal Policy Index

To measure the fiscal support that national governments have implemented throughout the sample period with one single variable, the self-constructed Fiscal Policy Index (FPI) is used. The index is cumulative and captures the portion of the public spending over the sample period that is directed at Covid-19 related policy. This is done by first estimating government spending as was expected in the absence of the pandemic and then relating the various Covid-19 stimulus packages to that baseline level of public spending. A FPI score of 100 thus represents no additional spending while a score of 120 represents a government implementing Covid-19 stimulus such that their estimated public spending is exceeded by 20%. By the current rhetoric of whatever-it-takes-policy, the implicit assumption that the fiscal stimulus being additional spending, rather than cannibalising on the existing budgetary allocations, is viable.

Pre-Covid estimated government expenditures (for 2020 and 2021) are collected from the *IMF October 2019 Fiscal Monitor Report*, where the reported value is expressed as % of GDP. Further, we obtain the IMF estimated GDP for the sample countries for 2020 and 2021 from the *IMF October 2019 World Economic Outlook Database*. Based on these estimates we obtain the projected government spending in euros for all sample countries for 2020 and 2021. Since

these estimates are all based on the available data, predictions, and circumstances of 2019, they are free of all Covid-19-related fiscal spending, thus proxying a "normal year" without this external shock. This approach will capture the additional public spending that is actually due to Covid-19 by weighting the spending announced by the Euro countries, and approved by the European Commission, to this baseline level of expected spending. Data regarding the Covid-19 related fiscal spending is collected from the European Commission (2021b) as well as from the IMF Covid-19 Policy Tracker (2021). To include these two sources allows for cross-checking the fiscal policy announcements which enhances the accuracy and validity of the data used for constructing the FPI.

In specifying the FPI, inspiration is drawn from Hale et al. (2021) who uses a composite index when constructing their stringency index. In constructing their index, they first produce the individual indices of every indicator, all of which is later combined in a simple average to form the stringency index. As the FPI only includes excessive Covid-19 spending only one such indicator is present. Thus, the index is calculated as the cumulative additional spending by governments using the predicted 2020/2021 government spending as base value, the general formula is stated below. As expected government spending is reported annually, a subscript for years, *y*, is included to distinguish the years. The subscript *i* and *t* represents the individual and time-specific variables *Country* and *Date*, respectively. The FPI is depicted for all countries in figure 5-8 below.

$$FPI_{i,t} = 100 * \frac{\mathbb{E}\left[Government\ Expenditure_{i,y}\right] + \sum_{1}^{t} Fiscal\ Policy\ Announcements_{i}}{\mathbb{E}\left[Government\ Expenditure_{i,y}\right]}$$

Note that as time passes and 2021 is entered, the projected value for 2021 GDP and fiscal spending is now used in calculating the estimated government spending in euros. GDP in all countries was expected to grow, whereas government spending as a share of GDP was expected to fall in 14 of the 18 countries. Thus, in the absence of new announcements, the passing into 2021 is represented by a downwards shift in FPI. This effect in FPI clearly visible for Luxembourg in table figure 5 below.

Figure 5: Fiscal Policy Index Group 1
Notes: This graph is generated using the FPI described above

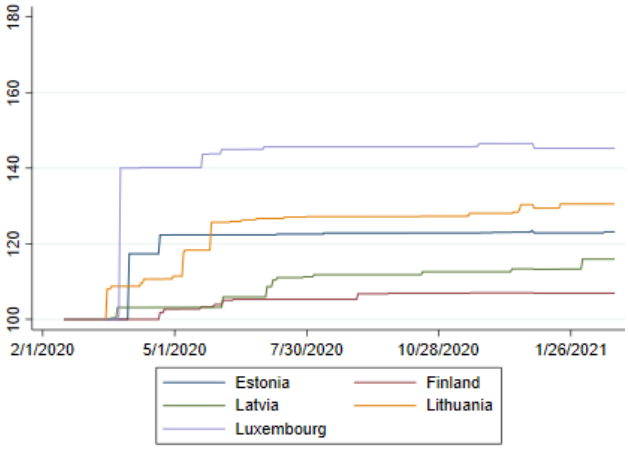


Figure 6: Fiscal Policy Index Group 2
Notes: This graph is generated using the FPI described above

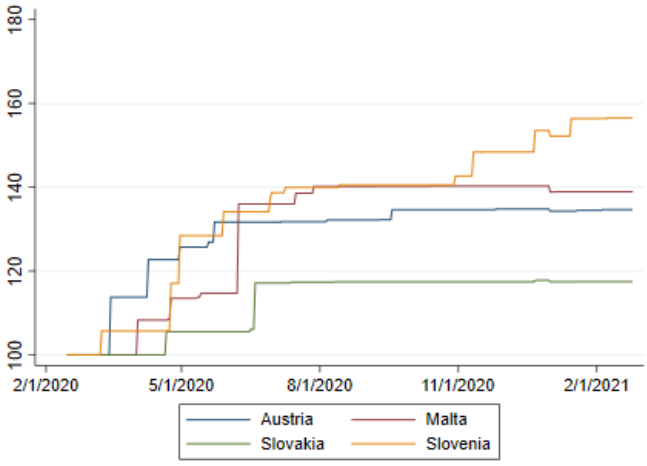


Figure 7: Fiscal Policy Index Group 3
Notes: This graph is generated using the FPI described above

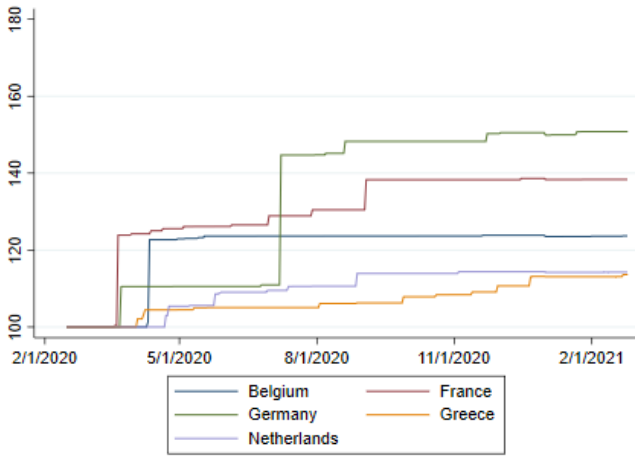
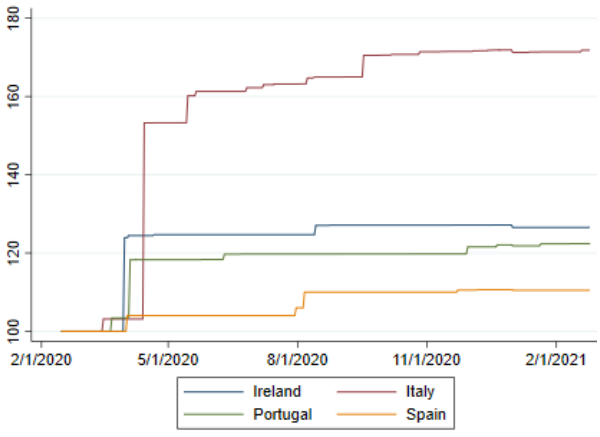


Figure 8: Fiscal Policy Index Group 4
Notes: This graph is generated using the FPI described above



To clarify the specification of the FPI, Luxembourg is used as an example. Expected GDP and government expenditure are found in the IMF October 2019 World Economic Outlook Database and Fiscal Monitor Report, respectively (IMF, 2019a; IMF, 2019b). These are used to calculate the expected government expenditure in Euros found in row three of table 3 below.

Table 3: Expected GDP and Expected Government Expenditure for Luxembourg
Notes: The data used to construct the table is retrieved from the International Monetary Fund (IMF, 2019)

	2020	**2021**
Expected GDP	€ 51.871 Billion	€ 53.25 Billion
Expected Government Expenditure (as % of GDP)	43.825%	43.875%
Expected Government Expenditure (in €)	€ 22.733 Billion	€ 24.464 Billion

Thus, € 22.733 B and € 24.464 B are the baseline expected fiscal spending for Luxembourg in 2020 and 2021. In the absence of any Covid-19 related fiscal spending, this level of expenditure yields an FPI-value of 100. Luxembourg announced the first Covid-19 support and stabilization packages on the 24th and the 25 of March, amounting to € 300M and € 8.8B, respectively. Note that as the dataset starts on the 15th of February 2020, these dates are number 39 and 40 in the data series. The FPI-score is calculated as the following:

$$FPI_{Luxembourg,39} = 100 \times \frac{22.733 + \sum_{1}^{39} Fiscal\ Policy\ Announcements_{Luxembourg}}{22.733} = 100 \times \frac{22.733 + 0.3}{22.733} = 101.319$$

$$FPI_{Luxembourg,40} = 100 \times \frac{22.733 + \sum_{1}^{40} Fiscal\ Policy\ Announcements_{Luxembourg}}{22.733} = 100 \times \frac{22.733 + 8.8 + 0.3}{22.733} = 140.03$$

To illustrate the effect of time passing and entering 2021, in which GDP is expected to grow, Luxembourg is kept as an example. The last fiscal policy announcement of 2020 in Luxembourg was on the 18th of December, resulting in the accumulated additional fiscal spending for 2020 amounting to € 10.573 Billion. Compared to the 2020 expected level of spending, this means an FPI-score of 146.515. As of January 1st, 2021, this additional € 10.573 Billion is related to the larger expected spending of 2021 as seen in table 3, thus resulting in a FPI-score of 145.259.

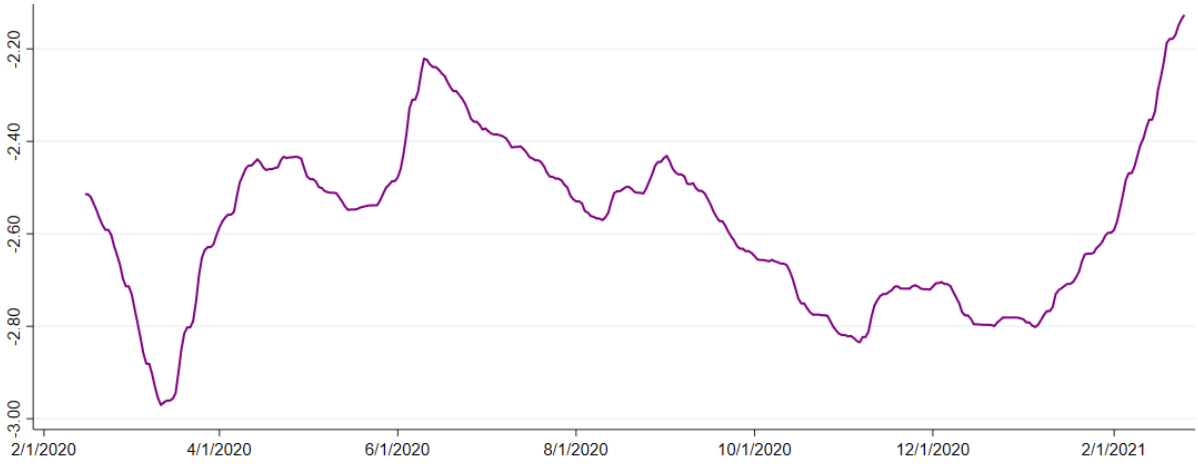
Alternative, similar, measures are being proposed in the literature, see Elgin, Basbug and Yalaman (2020) who capture the combined economic policy measures into one single metric reported once for each sample country. As this thesis separates fiscal from monetary measures, and focuses on the effect of announcements, the constructed FPI is used as the measurement for fiscal policy as the thesis proceeds.

3.2.4. Monetary Policy

To fully capture all aspects of the ECB monetary policy, Krippner's (2013, 2015) measure of the shadow rate (SSR) is employed. As discussed in section 2.1.1, monetary policy measured solely as the interest rate is not particularly informative in the current UMP environment where efforts such as quantitative easing, credit easing, extensive government and corporate lending and forward guidance are being implemented. To summarize the policy stance of a central bank in a CMP as well as an UMP environment, Krippner (2013, 2015) introduced his SSR estimate. The shadow rate is calculated using securities of different maturity and takes into account the existence of bonds, options, and other financial instruments. The yield curve of the particular securities is decomposed using options to visualize a shadow yield curve which represents the actual rates of return for the different securities. The short-term interest rate of this shadow yield curve is the SSR. The SSR is however reported for weekdays only and to have a balanced panel, we simply let the missing values (weekends) be represented by the average of the two closest values (Friday and Monday).

Visual representation in figure 9 below of the SSR reveals the expansionary monetary policy implemented to combat the first wave of Covid-19, characterised by the initial drop in the rate. Note that expansionary monetary policy is captured by a fall in the interest rate. The ECB further acts proactively with expansionary policy after the first wave until late December. Although the rise in the SSR visible in the far right of the series, suggest a contractionary policy, an SSR of -2.2% is to be considered as very expansionary.

Figure 9: Visual Representation of the Shadow Rate
Notes: This graph is generated using data of the Shadow Rate retrieved from Krippner (2013,2015)



The idea of one measure to cover "all" of the monetary policy conducted has gradually gained attention in recent research. In addition to the Krippner SSR, Wu and Xia (2016) estimate similar rates, both based on the ideas first presented by Black (1995). These estimates are used extensively by central bankers, for example in Damjanovic and Masten (2016), Andreasen and Meldrum (2018), Draghi (2019b) and Ajevskis (2020), but also in academia, see Ouerk, Boucher and Lubochinsky (2020) and Morin and Shang (2020). Krippner (2020a) recently adjusted his estimation technique to e.g., accommodate for the possibility of a negative central bank interest rate setting. By this, and as the period of interest in this thesis is the Covid-19 pandemic where monetary policy is largely relying on the more unconventional tools, the Krippner SSR is chosen as the measure of monetary policy throughout the analysis.

3.3. Model Specification

In panel, or longitudinal, regressions, fixed or the random effects models are common specifications. To decide on the appropriate specification, a Hausman test is conducted. The null hypothesis for this test is that the random effects estimator is more appropriate. In all specifications throughout this thesis, the Hausman test fail to reject the null hypothesis, why the random effects model is used.

The purpose of the fixed and random effects estimators is to model treatment effects in the face of unobserved individual specific effects. In the random effect model, the individual specific effect is a random variable that is assumed to be uncorrelated with the explanatory variables of all pasts, current and future time periods of the same individual. In this specification, individual specific effects are captured by a composite error term ($\alpha_i + \varepsilon_{i,t}$) which assumes that individual

intercepts are drawn from a random distribution of possible intercepts. Alfa (α_i) represents this individual intercept, and the remainder component, epsilon ($\varepsilon_{i,t}$), is an error term consisting of white noise (Bogard, 2018; Verbeek, 2004).

In the regressions, when applicable, clustered standard errors are used, which is a type of heteroskedasticity- and autocorrelation-consistent (HAC) standard errors. Using clustered standard errors allows the regression errors to have an arbitrary correlation within a cluster, or grouping, but assume that the regression errors are uncorrelated across clusters (Stock & Watson, 2018). By means of this discussion, the cluster variable is *Country*. For regressions based on the different groups presented in 3.2.2, the cluster standard error option is not available, leading to the inclusion of traditional Robust (White-)Standard Errors.

The aim of this paper is to determine how the level of restrictions affect the impact of macroeconomic policy announcements on economic activity. As a first step in accomplishing this task, the two following linear models are estimated, equation (1) and (2), where $Economic\ Activity_{i,t}$ represents the activity in *country* i at *time* t.

$$\begin{aligned} &Economic\ Activity_{it} \\ &\quad = \beta_1 Restrictions_{i,t} + \beta_2 Fiscal\ Policy_{i,t-1} + \beta_3 Monetary\ Policy_{t-1} \\ &\quad + \beta_4 Restrictions_{i,t} * Fiscal\ Policy_{i,t-1} + \beta_5 Restrictions_{i,t} \\ &\quad * Monetary\ Policy_{\,i,t-1} + \beta_6 Christmas + \beta_7 Easter\ + \lambda_t + \alpha_i + \varepsilon_{i,t} \end{aligned} \tag{1}$$

$$\begin{aligned} &Economic\ Activity_{it} \\ &\quad = \beta_1 Restrictions_{i,t} + \beta_2 Fiscal\ Policy_{i,t-7} + \beta_3 Monetary\ Policy_{t-7} \\ &\quad + \beta_4 Restrictions_{i,t} * Fiscal\ Policy_{i,t-7} + \beta_5 Restrictions_{i,t} \\ &\quad * Monetary\ Policy_{\,i,t-7} + \beta_6 Christmas + \beta_7 Easter\ + \lambda_t + \alpha_i + \varepsilon_{i,t} \end{aligned} \tag{2}$$

As a second step, to get a wider picture of the relationship studied, the following models are estimated where the group-variables from section 3.2.2 are included both as dummy variables but also as an interaction with the variables for economic policy. The full name of the policy variables is suppressed here to reduce the length of the equations and ease interpretation. *Fiscal Policy* from (1) and (2) is the same variable as *Fiscal* in (3) and (4), the same applies for *Monetary Policy.* Note that the fourth group, as a dummy and interaction, is omitted as inclusion would have caused perfect multicollinearity.

$$Economic\ Activity_{i,t} = \beta_1 Group\ 1_i + \beta_2 Group\ 2_i + \beta_3 Group\ 3_i + \beta_4 Fical_{i,t-1} + \beta_5 Group\ 1_i * Fiscal_{i,t-1} + \beta_6 Group\ 2_i * Fiscal_{i,t-1} + \beta_7 Group\ 3_i * Fiscal_{i,t-1} + \beta_8 Monetary_{t-1} + \beta_9 Group\ 1_i * Monetary_{t-1} + \beta_{10} Group\ 2_i * Monetary_{t-1} + \beta_{11} Group\ 3_i * Monetary_{t-1} + \beta_{12} Christmas + \beta_{13} Easter + \lambda_t + \alpha_i + \varepsilon_{i,t} \quad (3)$$

$$Economic\ Activity_{i,t} = \beta_1 Group\ 1_i + \beta_2 Group\ 2_i + \beta_3 Group\ 3_i + \beta_4 Fical_{i,t-7} + \beta_5 Group\ 1_i * Fiscal_{i,t-7} + \beta_6 Group\ 2_i * Fiscal_{i,t-7} + \beta_7 Group\ 3_i * Fiscal_{i,t-7} + \beta_8 Monetary_{t-7} + \beta_9 Group\ 1_i * Monetary_{t-7} + \beta_{10} Group\ 2_i * Monetary_{t-7} + \beta_{11} Group\ 3_i * Monetary_{t-7} + \beta_{12} Christmas + \beta_{13} Easter + \lambda_t + \alpha_i + \varepsilon_{i,t} \quad (4)$$

Third, equation (5) and (6) are specifications that are estimated in four separate regressions where only countries in each of the four different groups are included. The reason for including this third analysis is to be able to better examine the marginal effect of the policy variables for each of the four groups separately.

$$Economic\ Activity_{i,t} = \beta_1 Fiscal\ Policy_{i,t-1} + \beta_2 Monetary\ Policy_{t-1} + \beta_3 Christmas + \beta_4 Easter + \lambda_t + \alpha_i + \varepsilon_{i,t} \quad (5)$$

$$Economic\ Activity_{i,t} = \beta_1 Fiscal\ Policy_{i,t-7} + \beta_2 Monetary\ Policy_{t-7} + \beta_3 Christmas + \beta_4 Easter + \lambda_t + \alpha_i + \varepsilon_{i,t} \quad (6)$$

In all specifications, *Fiscal Policy* and *Monetary Policy* are lagged 1 and 7 days, respectively. This is done as individuals do not instantaneously act on information. Reasonably, they need time to receive, interpret and change their behaviour according to the information contained in policy announcements.

*Restrictions*Fiscal Policy* and *Restrictions*Monetary Policy* are two interaction terms between the restriction index and variables for macroeconomic policy. These interaction terms are included to let the relationship between macroeconomic policy and activity depend on the level of restrictions. In the second specification of the model, *Group*Fiscal* and *Group*Monetary*, are the interactions between policy variables and the four different groups.

Christmas and *Easter* are two dummy variables included to account for the effects of seasonality in these periods. Lambda, (λ_t), in equations 1-6, denotes monthly fixed effects. These are included to control for characteristics that differ over time yet are constant across

countries. Examples of these characteristics would be the policies conducted by other large open economies such as the U.S and Japan, as well as the development and roll-out of vaccines.

A common issue that arises when including interaction terms is a high degree of multicollinearity as the new variable consists of combinations of already included variables. As a result, multicollinearity can induce misleading results and reduce statistical significance. To counter this problem, all the variables in the analysis have been standardized. The standardized variables are calculated as:

$$z_x = \frac{1}{s_x}(x - \bar{x})$$

Where z_x is the standardized version of the variable x, s_x is the SD of x and $\bar{x}$ is the mean of x. Since the standardized variable has mean of 0 and standard deviation (SD) of 1, the regression coefficient is interpreted as "expected standard deviation change in the dependent variable associated with a one standard deviation change in the independent variable" (Allen, 1997). Further, standardization of variables makes interpretation of the coefficients slightly more difficult. To ease interpretation, note that the standardized coefficient is the unstandardized coefficient normalized by the ratio of the standard deviation of the variables:

$$b_x^* = b_x\left(\frac{s_x}{s_y}\right)$$

Where b_x^* and b_x are the standardized and unstandardized coefficient of the independent variable x, and s_x and s_y are the SD of unstandardized x and y, respectively (Allen, 1997). By this relationship we can calculate the unstandardized coefficients by multiplying standardized coefficients with the inverse of the ratio of standard deviations.

To put this into context, assume that the regression output of the effect of monetary policy on economic activity is -0.5, thus $b_{Monetary}$*= -0.5. From table 1, $s_{Monetary}$=0.174 and $s_{Economic\ Activity}$ = 18.71. Using the described relationship between the standardized and unstandardized coefficients, the (unstandardized) marginal effect of Monetary Policy on Economic Activity is calculated as:

$$b_{Monetary} = b^*_{Monetary}\left(\frac{s_{Economic\ Activity}}{s_{Monetary}}\right) = -0.5 \times \left(\frac{18.71}{0.174}\right) = -53.76$$

As $b_{Monetary}$ is interpreted as the change in Economic Activity due to an increase of one unit (percentage point) in Monetary Policy, rather than the standard deviation change in Economic Activity due to a one standard deviation increase in Monetary policy, the unstandardized coefficient is easier to interpret. Note that expansionary Monetary Policy is represented by a *decrease* in the shadow rate, not an increase. Therefore, expansionary policy amounting to a 1 percentage point decrease in the interest rate is expected to result in a 53.76 unit increase in activity. As this method does not translate to the case of interaction terms, several which are included, the standardized coefficients will be reported in the results section in chapter 4. For relevant unstandardized coefficients, see table A2-A5 in the appendix.

4. Empirical Results

In this section we present our main results. The effects of *fiscal* and *monetary policy announcements* on *Economic Activity* are estimated in three separate regressions using a random effects model. Following the main results, a robustness analysis is conducted using *Consumer Confidence* as the dependent variable.

4.1. Main Results

In our main model, a random effects model of the vector of independent variables, *Restrictions, Monetary Policy* and *Fiscal Policy,* is run on the vector of the dependent variable *Economic Activity,* as described by equation 1 and 2 in section 3.3 above. The interaction terms *Fiscal Policy*Restrictions* and *Monetary Policy*Restrictions* are included to allow for the effect of macroeconomic policy to depend on the level of restrictions in a country. The results are presented in table 4 below.

Table 4: Main Model 1, Regression Results

VARIABLES	1-day lag	7-day lag
Fiscal Policy	-0.153*	-0.123
	(0.0811)	(0.0855)
Restrictions	-0.614***	-0.589***
	(0.0437)	(0.0471)
Fiscal Policy*Restrictions	0.0807*	0.0873**
	(0.0428)	(0.0410)
Monetary Policy	-0.0300	0.135***
	(0.0275)	(0.0329)
Monetary Policy*Restrictions	0.119***	0.145***
	(0.0258)	(0.0318)
Constant	-0.0638	-0.151*
	(0.0963)	(0.0885)
R-sq. (overall)	0.7759	0.7808
Time Fixed Effects	Months	Months
Holiday Fixed Effects	Christmas, Easter	Christmas, Easter
Standard Errors	Clustered	Clustered
Observations	6,678	6,606
Number of Countries	18	18

*** p<0.01, ** p<0.05, * p<0.1

Table 4 above shows that both interaction terms are significant across the specifications, which means that the level of restrictions influences the marginal effect of both types of macroeconomic policy announcements. Further, in the 1-day specification, *Fiscal Policy* is negative while *Monetary Policy* is insignificant. The opposite is true for the 7-day specification where the coefficient for *Monetary Policy* is positive while *Fiscal Policy* is insignificant. This implies that, in the case of significance, an increase in *Fiscal Policy* and *Monetary Policy* leads to a decrease of *Economic Activity*. Recall that expansionary monetary policy is coherent with a decrease in the shadow rate, implying that expansionary monetary policy amounting to a 1 standard deviation decrease is associated with an expected decrease in *Economic Activity* with 0.135 standard deviations.

The results presented in table 4 are unanticipated, which motivates further investigation of the relationship between restrictions, policy, and activity. This is done by including a set of group-variables as described in equation 3 and 4, for more information regarding these variables, see section 3.2.2. The results of these regressions are found in table 5 below.

Table 5: Main Model 2, Regression Results

VARIABLES	1-day lag	7-day lag
Fiscal Policy	0.145*	0.185***
	(0.0777)	(0.0706)
Group1	0.618***	0.655***
	(0.142)	(0.154)
Group2	0.397***	0.401***
	(0.113)	(0.124)
Group3	0.374***	0.399***
	(0.126)	(0.133)
Group1*Fiscal Policy	-0.399***	-0.332**
	(0.137)	(0.143)
Group2*Fiscal Policy	-0.310**	-0.300**
	(0.134)	(0.122)
Group3*Fiscal Policy	-0.361***	-0.334***
	(0.0962)	(0.103)
Monetary Policy	-0.267***	0.331***
	(0.0693)	(0.0654)
Group1*Monetary Policy	0.211**	0.169*
	(0.0848)	(0.0902)
Group2*Monetary Policy	0.302***	0.307**
	(0.112)	(0.122)
Group3*Monetary Policy	0.208***	0.206***
	(0.0767)	(0.0780)
Constant	-0.647***	-1.004***
	(0.141)	(0.139)
R-sq. (overall)	0.6257	0.6494
Time Fixed Effects	Months	Months
Holiday Fixed Effects	Christmas, Easter	Christmas, Easter
Standard Errors	Clustered	Clustered
Observations	6,678	6,606
Number of Countries	18	18

*** p<0.01, ** p<0.05, * p<0.1

The interaction between the categorical variable and the variables for macroeconomic policy are all significant for both specifications. Additionally, by including the Group-variables, thus taking into account the differences in national restriction policies, we find fiscal policy behaving as expected with positive marginal effects on activity. Monetary policy is negative, as expected, in the 1-day-lag-specification but positive on the 7-day-lag-version.

To better interpret these results, margin plots are used to visualize the marginal effects of policy as the level of restrictions vary. This makes the difference between groups apparent.

Figure 10: Marginal Effects of Fiscal Policy Announcements on Economic Activity, 1-day Lag.

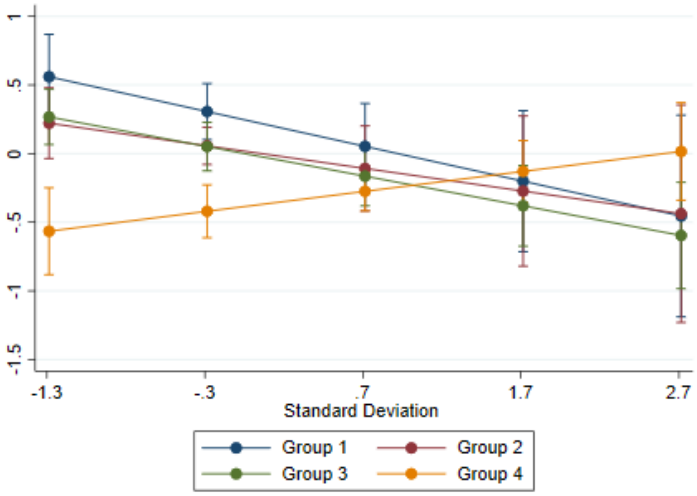


Figure 11: Marginal Effects of Monetary Policy Announcements on Economic Activity, 1-day Lag.

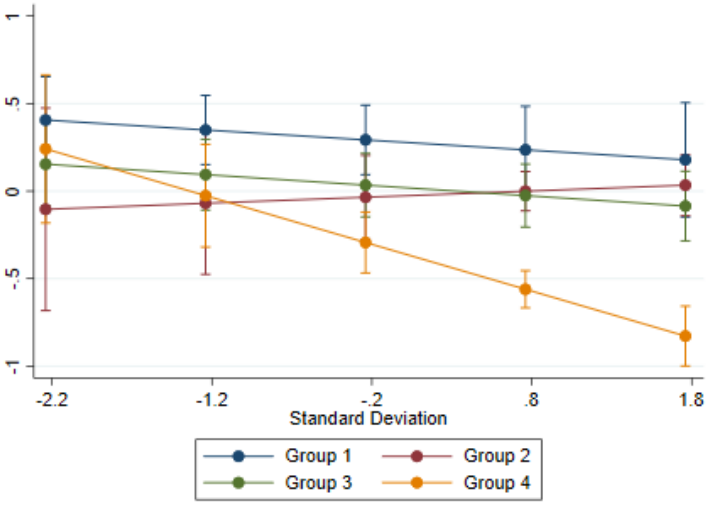


Figure 12: Marginal Effects of Fiscal Policy Announcements on Economic Activity, 7-day Lag.

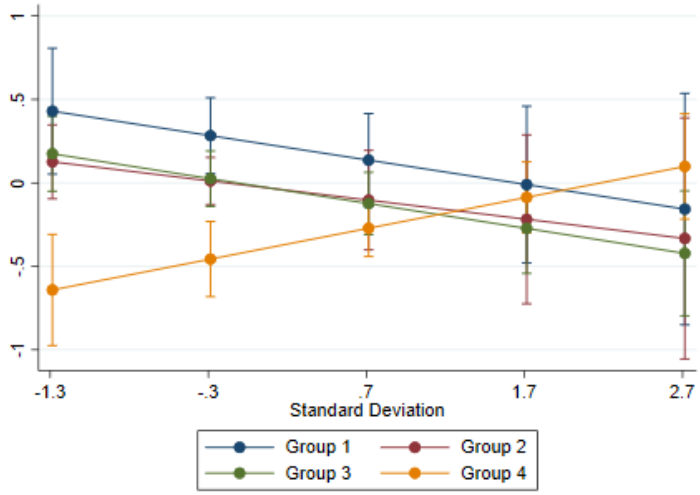
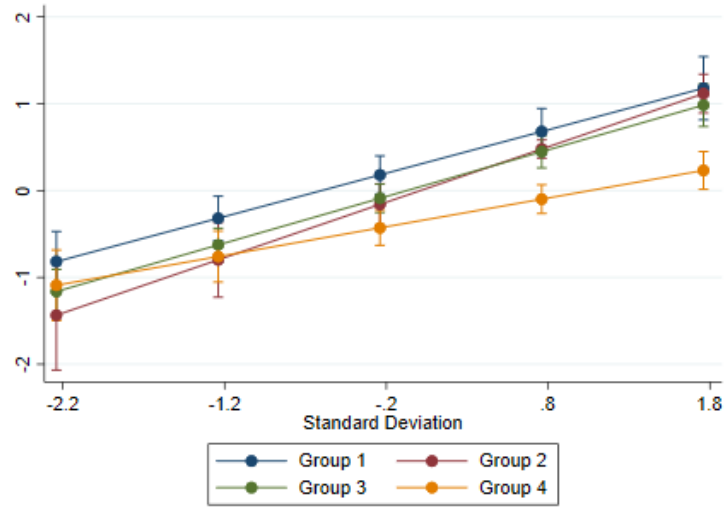


Figure 13: Marginal Effects of Monetary Policy Announcements on Economic Activity, 7-day Lag.



Irrespective of the lag-length of the variables for economic policy, we see a clear separation between group 4 (with the strictest restriction policies) and the three other groups regarding the effect of both Fiscal and Monetary Policy. The strictest group, where Ireland, Italy, Portugal, and Spain belong, seem to be the one most responsive to the announced measures. One interesting feature that is illuminated in these plots is the time-effect of Monetary Policy. In the 1-day lag case we see, as expected, a negative effect whereas the opposite is the case for the

longer lag length, suggesting an initial positive response in activity from expansionary monetary policy, which is later reversed. To further demonstrate the difference between the four groups, a regression is run on each of the 4 groups separately, as described in equation 5 and 6. The results are found in table 6 and 7 below.

Table 6: Main Model 3, Regression Results

1-day lag	(1)	(2)	(3)	(4)
	Group 1	Group 2	Group 3	Group 4
VARIABLES				
Fiscal Policy	-0.329**	-0.125	-0.246**	0.155*
	(0.160)	(0.172)	(0.121)	(0.0813)
Monetary Policy	-0.0727**	0.0174	-0.0991**	-0.176**
	(0.0297)	(0.0815)	(0.0497)	(0.0771)
Constant	-0.0818	-0.289	-0.254	-0.589**
	(0.197)	(0.332)	(0.212)	(0.287)
R-sq. (overall)	0.6375	0.6079	0.5924	0.6526
Time Fixed Effects	Months	Months	Months	Months
Holiday Fixed Effects	Christmas, Easter	Christmas, Easter	Christmas, Easter	Christmas, Easter
Standard Errors	Robust	Robust	Robust	Robust
Observations	1,855	1,484	1,855	1,484
Number of Countries	5	4	5	4

*** p<0.01, ** p<0.05, * p<0.1

Table 7: Main Model 4, Regression Results

7-day lag	(1)	(2)	(3)	(4)
	Group 1	Group 2	Group 3	Group 4
VARIABLES				
Fiscal Policy	-0.109	-0.116	-0.173**	0.136
	(0.0893)	(0.125)	(0.0819)	(0.0866)
Monetary Policy	0.392***	0.647***	0.504***	0.501***
	(0.0675)	(0.0584)	(0.0529)	(0.0653)
Constant	-0.358**	-0.567*	-0.609***	-0.991***
	(0.178)	(0.293)	(0.163)	(0.293)
R-sq. (overall)	0.6350	0.6557	0.6253	0.6758
Time Fixed Effects	Months	Months	Months	Months
Holiday Fixed Effects	Christmas, Easter	Christmas, Easter	Christmas, Easter	Christmas, Easter
Standard Errors	Robust	Robust	Robust	Robust
Observations	1,835	1,468	1,835	1,468
Number of Countries	5	4	5	4

*** p<0.01, ** p<0.05, * p<0.1

In the 1-day lag specification, it is again clear that the fourth group significantly differs from the other three groups. In countries with the highest restrictions, the effect of more fiscal stimulus is positive, compared to the marginal negative effect in the other groups with less stringent restrictions. This effect is however only present in the short-term, the 1-day lag version of the model, as the difference is no longer significant in the longer-term version of the model.

Regarding Monetary Policy, for the 1-day lag model, the effect is increasingly positive as restrictions increase. In the 7-day model this effect is completely reversed which, by recalling the inverse interpretation of the variable, indicates an announcement effect similar to the case of fiscal policy, although this initial response turns negative over the course of a week. Here, group 4 faces the most negative marginal effect of more expansionary monetary policy.

4.2. Robustness Test

The presented results critically depend on the choice of dependent variable. As motivated in section 3.2.1, due to the high correlation between Google Mobility Data and more traditionally used measures of economic activity such as GDP, confidence is bestowed in using Google Mobility Data as the main measure of economic activity. Despite this, in order to test the robustness of the results presented above, another proxy for economic activity is considered, namely *Consumer Confidence*. As explained in section 2.2.1, this variable is also proven to be a useful predictor for GNP growth, household investment and business cycle fluctuations in times of crisis.

The data used for modelling *Consumer Confidence* is the Consumer Confidence Index (CCI) published by the European Commission. The CCI is part of the European Commission's Business and Consumer Surveys. The data is published monthly and is derived from surveys conducted by national institutes in the Member States. The questions asked are organized around 4 topics: the households' financial situation, the general economic situation, savings, and intentions with regards to major purchases. The CCI is the arithmetic average of the balances (in percentage points) of the answers to these questions (European Commission, 2021a).

As the CCI is available on a monthly frequency, linear interpolation is used to approximate the values between the observations available. A critique of this approach is that it lacks precision and presents the variance of the variable in an oversimplified manner. Although, as the CCI is used as an additional analysis in this thesis, the pros of having a balanced panel and a large number of observations outweigh the cons. The results of this model, specified in the same way as table 4 and 5 in our main analysis portrayed in the previous section, is presented below.

Table 8: Model 1, Robustness Test

VARIABLES	(1) 1-day lag	(2) 7-day lag
Fiscal Policy	0.0844***	0.0897***
	(0.0132)	(0.0128)
Monetary Policy	0.00823	0.0317**
	(0.0142)	(0.0144)
Fiscal Policy*Restrictions	0.0375***	0.0382***
	(0.00722)	(0.00716)
Restrictions	-0.206***	-0.196***
	(0.00993)	(0.00990)
Monetary Policy *Restrictions	0.0173**	0.0183**
	(0.00789)	(0.00793)
Constant	0.208	0.213
	(0.222)	(0.222)
R-sq. (overall)	0.1602	0.1581
Time Fixed Effects	Months	Months
Holiday Fixed Effects	Christmas, Easter	Christmas, Easter
Standard Errors	Clustered	Clustered
Observations	6,084	6,084
Number of Countries	18	18

*** p<0.01, ** p<0.05, * p<0.1

Table 9: Model 2, Robustness Test

VARIABLES	(1) 1-day lag	(2) 7-day lag
Fiscal Policy	0.151***	0.150***
	(0.0180)	(0.0169)
Monetary Policy	-0.115***	0.0849***
	(0.0181)	(0.0171)
Group 1	1.181*	1.183*
	(0.615)	(0.614)
Group 2	0.382	0.376
	(0.648)	(0.647)
Group 3	0.527	0.524
	(0.615)	(0.614)
Group 1*Fiscal Policy	-0.0314	-0.00650
	(0.0290)	(0.0268)
Group 2*Fiscal Policy	-0.104***	-0.0918***
	(0.0226)	(0.0213)
Group 3* Fiscal Policy	0.00161	0.0127
	(0.0226)	(0.0214)
Group 1*Monetary Policy	0.115***	0.109***
	(0.0155)	(0.0153)
Group 2*Monetary Policy	0.125***	0.125***
	(0.0163)	(0.0160)
Group 3*Monetary Policy	0.109***	0.0726***
	(0.0155)	(0.0153)
Constant	-0.471	-0.413
	(0.468)	(0.467)
R-sq. (overall)	0.2535	0.2587
Time Fixed Effects	Months	Months
Holiday Fixed Effects	Christmas, Easter	Christmas, Easter
Standard Errors	Clustered	Clustered
Observations	6,084	6,084
Number of Countries	18	18

*** p<0.01, ** p<0.05, * p<0.1

The results presented in table 8 do differ, although not remarkably from the results presented in table 4 in the main analysis. In table 8 *Fiscal Policy* is positive, the expected sign, which is opposite to the case of the main specification. When including the interaction of each group-dummy in table 9, the results become more similar to the results presented in the main analysis in table 5. More specifically, in table 9, we see the same sign before the coefficients of *Fiscal Policy* and *Monetary Policy* as in the main model. *Fiscal Policy* is positive with both lag lengths and the initially positive effect of more expansionary *Monetary Policy* fades away and turns negative over the course of 7 days. In contrast to the main model, some significance of the fiscal policy interactions is lost. One of these interaction terms is however significant, indicating a different effect of *Fiscal* policy over the groups.

As *Consumer Confidence* is measured in a different way and captures different aspects of the forward-looking components that drive main macroeconomic variables, these partly different results were expected. The result to highlight here is the fact that the level of restrictions cause differences in the way fiscal policy affects a variable known to be driving main macroeconomic variables, here measured as *Consumer Confidence*. This robustness test produces similar results as the results presented in the main analysis with *Economic Activity* as dependent variable, especially when it comes to the effect of monetary policy where the effect is more or less identical through the different specifications.

These results speak for the robustness of the method employed and described in chapter 3. The effect of restrictions on the efficiency of policy implementation is stable across the two ways of measuring the outcome variable presented in this thesis.

5. Analysis and Discussion

Presented in 1.3, the main hypothesis of this thesis is restated here for easy reference:

- Monetary and fiscal policy announcements will have a different effect on economic activity depending on the level of restrictions in a country.

To answer this question, we bring the reader's attention to the results presented in table 5, and figures 10-13. Regarding fiscal policy announcements we see a significant difference between group 4 and the rest of the groups. Group 4 is the group consisting of countries with the highest restrictions. When examining the effect of monetary policy, the differences between groups are not as prominent as for the fiscal policy. Although, there is a significant difference between the groups, implying that our main hypothesis cannot be dismissed.

In the end of chapter 2, after outlining the theoretical frameworks along with ideas and evidence from academia we made the argument that uncertainty would increase with the restrictions, with a postponement of consumption and investment as the logical outcome. This implied that a policy announcement, regardless of it being of monetary or fiscal nature, would be less impactful in stimulating activity in the countries where restrictions were higher relative to the less stringent countries. Here, the effect differs with the type of policy announcement you consider.

Regarding fiscal policy announcements, the effect is similar regardless of considering the regression with a 1 or 7-day lag. Figure 10 and 12 shows that the effect of fiscal policy is positive in group 4 whilst negative in the remaining three groups. As discussed above, we base our theoretical argument in the notion that uncertainty increases as the restrictions in a country increase. Looking at the results, a rethinking of this notion is warranted. Uncertainty in the presence of a pandemic and its resulting restrictions have a somewhat reversed effect compared to what we found evidence for in the theoretical foundations and literature.

One part in explaining this potential contradiction to theory is to note that when a country is facing stringent lockdown policies, the spread of the infection as well as the death toll declines. Also, when facing a complete lockdown, individuals can have a perception of ‘this is as bad as it gets’. This would in a sense imply that when restrictions are severe, uncertainty decreases.

When facing the most stringent restrictions, individuals are of course heavily constrained, but the fear of further lockdown policies is likely less tangible compared to individuals living in countries with less stringent restrictions. This might lead to people in the strictest group having a more positive attitude regarding the future, as they are currently in the worst state they perceive possible.

Taking the perspective of the countries in the three least stringent groups, an increase of restrictions in the fourth group might fuel the uncertainty since that emphasizes the room for even stricter restrictions in the home-country. This scenario is similar to the situation introduced in section 2.2.2 where an individual wants to buy a left and a right shoe on a market.

To provide a more intuitive representation of the results, the counter poles Finland and Spain, members of group 1 and 4 respectively, are used in the shoe example referenced above. Although the shoe-example might feel too unrealistic, it is illustrative and in line with the classic rhetoric of Keynes. For a more realistic context one could think of the consumption bundle as being a flight-ticket and a pair of shorts, or a new pair of running shoes and a ticket for the Berlin Marathon. However, the case of left and right shoes is kept for clarity.

Before the pandemic, no restrictions were in place in either country, a situation which can be represented by both shoes being available on the market. Here, the state of the world is known, and some sort of equilibrium is formed. Alternatively, the state where both countries enforce similar, though loose, restrictions can illustrate the availability of both shoes, which similarly leads to a known state of the world and the formation of an equilibrium.

When the first cases of Covid-19 struck Europe, both countries responded with restrictions of similar stringency, see figure 4, here the equilibrium discussed is still intact. As the first wave arrived, both countries increased their restrictions. The Spanish government, however, responded more forcefully by enforcing more stringent restrictions compared to their Finnish counterpart. This represents the situation where the left shoe is not available on the market in either country, which raises several questions in this stylized example. Some of which could be, “is this situation temporary?”, “for how long will it last?” and “will the right shoe also disappear?”. As the withdrawal of the left shoe is likely to give rise to similar questions in both Spain and Finland, the origin of these questions is probably different. As for the people living in Finland, increased uncertainty is likely influenced by the strictness of the Spanish restrictions

as it emphasises the discrepancies between their government's strategies, thus the room for more stringent restrictions in Finland. As a result, the individuals of Finland would rather postpone consumption of goods and investments because of the increased (Knightian) uncertainty about future mobility constraints, fuelling the "wait and see"-attitude discussed earlier. Another rationale for postponement of consumption could be connected to the fear of a persistent negative income shock or threats to employment, which amplifies the "wait and see"-attitude by motivating savings.

In Spain however, the mobility restrictions create some sort of "this is as bad as it gets"-attitude, which can lead Spanish consumers to envision a more promising future as their situation reasonably cannot get any worse. The Spanish consumer, though still heavily affected by the restrictions in mobility, would have a better sentiment, perceiving a more promising future with an easing of restrictions. This would therefore make the Spanish consumers more likely to purchase the right shoe, which is still on the market, compared to the Finnish citizens.

Using this simplified example, increased levels of restrictions will in a sense decrease the level of uncertainty, strengthening the transmission mechanisms of relevant policy. This is seen in table 6, where the response from expansionary fiscal policy is positive in Spain but negative in Finland. The reverse restriction-uncertainty relationship can also be explained by remembering that the lockdown policies have public support in the countries subject to the most stringent restrictions. This support in government restriction policy, thus trust in authorities, can possibly be translated to a positive effect of fiscal policy.

Let us now discuss the effect of monetary policy announcements on economic activity as these findings paint a quite different picture compared to the case with fiscal policy announcements. Within each of the two lag specifications, the effect does not differ between groups to the extent that fiscal policy announcements did. Rather, the dimension accountable for the difference in monetary policy efficiency is time. The initial response of expansionary policy, captured by the 1-day lag model, is positive, an effect which turns negative over the course of a week. This result is surprising although it can be explained by discussing the existence of animal-spirits, the possibility of constraints on adapting one's behaviour or information lags.

The initial positive reaction of economic agents can be explained by monetary announcements invoking the sense of authorities acting responsibly and forcefully to combat the crisis. The

current rhetoric of a “whatever it takes”-policy in combination with the sheer authority of central banks might fuel some sort of optimism in market participants' animal-spirits, creating a response-bias. Driven by the high pace information-flow, the response of market participants, alternatively the visualization of the animal-spirits, is captured in the 1-day lag model. Although, as time passes and more effort is directed at understanding the announcements, the complexity of the unconventional measures is illuminated which might reverse the effect, as seen in the 7-day model. This chain of events is what is implied with information-lags explaining the results, since understanding the ECB efforts is time consuming, the initial animal-spirits effect is reversed as more is learnt regarding the monetary measures. Another reason for the peculiar results is of practical nature as adapting the behaviour accordingly might be subject to legal constraints connected to various contracts but also, naturally, constraints on mobility. Regarding the legal constraints of corporations however, the majority of these contracts are reasonably longer than a week, giving more strength to the animal-spirits and mobility arguments.

Further, this behaviour can be viewed as a consequence of Ricardian Equivalence (RE), although applied to monetary policy. As it is well established that a change in government spending affects the consumption, thus the saving, decision of individuals, the size and complexity of UMP, in combination with the decreasing trust of the ECB, seems to fuel some sort of RE-like response in economic activity. The rationale to this behaviour is that a portion of the monetary policy measures taken, collected under PEPP, is as previously mentioned directed at either national governments or corporations in the form of bonds of different maturity. By this structure, the liquidity added through this channel will have to be reversed back to the ECB, implying that the recipients will have to repay the money. Governments, unless reducing the public spending, would therefore, ceteris paribus, need to increase the future tax incidence. Corporations, when repaying the monetary support, would face higher costs in the coming years, which translates to higher prices, less investment, less profit, or a combination thereof. All in all, the European households would face increased costs in the future that are related to the UMP-measures currently undertaken by the ECB, thus motivating the drop in current consumption.

6. Conclusion and Suggestions for Further Research

The aim of this thesis was to determine if there is a difference in the effect of macroeconomic policy on economic activity depending on the level of restrictions in a country. By means of this goal, we gather data on mobility, restrictions, fiscal and monetary policy announcements and estimate a random effects model, taking into account time and holiday fixed effects.

By presenting and analysing literature and theory relevant to answering this hypothesis we proposed that restrictions would likely have a negative effect on various transmission mechanisms of economic policy (section 2.3). This implies that fiscal and monetary policy would have less of an impact on activity in countries with relatively more stringent restrictions. However, the results presented in Chapter 4 led to a contradiction of this proposition. Expansionary fiscal policy was successful in stimulating activity in the most stringent countries while it led to the opposite outcome in the remaining countries. The effect of monetary policy did not differ substantially between groups[9] it was rather time that constituted the parameter responsible for the differences. An initially positive response from expansionary monetary policy turned negative over the course of a week for the entire sample.

These peculiar results regarding fiscal policy leads to the conclusion of a reverse relationship between uncertainty and restrictions, in the presence of mobility restrictions in the euro area. As described in the introduction, the Covid-19 economic crisis is heavily driven by the actions taken to resolve the health-crisis, which includes protocols for quarantine, regional lockdowns, and social distancing rules. Apart from restricting mobility, these actions are seen to drive uncertainty which influences behaviour through cross-border spill over effects. Given the situation in which Spain introduces more stringent measures than Finland, the discrepancy of restriction policies emphasizes the room for even stricter policies in Finland, thus increasing the level of uncertainty there, which negatively impacts economic activity. In Spain, the mobility is naturally heavily constrained, although the uncertainty would arguably be lower as the enforced lockdown policies likely creates some sort of "this is as bad as it gets" attitude. This example illustrates the reverse restriction-uncertainty relationship.

[9] Four groups were constructed based on the average restriction level in the countries over the sample period.

Regarding monetary policy, the response of expansionary policy that is highlighted in model 3 is pointing towards the existence of animal spirits, the presence of Ricardian Equivalence, and constraints on adapting behaviour in accordance with the new policy. In all countries, the initially positive response fades away and turns negative over the course of a week, leading us to conclude that the sheer authority of the ECB fuels some sort of positive response-bias on the unconventional tools employed, collected under PEPP. Although, as time passes and resources are allocated in understanding the measures taken, market participants seem to understand that parts of the UMP policies are in the forms of government and corporate bonds which imply that the money added through this channel will have to be repaid by the recipients. Assuming relatively constant levels of inflation, government spending and corporate climate, this implies, broadly speaking, two things. First, governments will in the future need to increase the tax incidence. Second, corporations will face higher costs leading to higher prices, less revenue and less investment or a combination thereof. Ultimately, a portion, if not all, of the costs related to the UMP measures will be transferred to the private sector. Economic agents, as seen from the different effects of monetary policy in the 1-day lag and 7-day lag models, foresee this and act in accordance with the Ricardian Equivalence by reducing their consumption.

In conclusion, the level of restrictions in a country does influence the impact of macroeconomic policy, however not in the way first anticipated. Further, a behaviour in line with Ricardian Equivalence is seen as a response to expansionary monetary policy, reducing its impact on economic activity. Trust in governments and the ECB is also seen to be a factor of importance.

Our results contribute to further understanding the immediate impact of expansionary macroeconomic policy announcements. Since the Covid-19 pandemic and its associated lockdown policies is likely not the only global shock that will affect our increasingly intertwined societies in the near to medium term, research on macroeconomic policy in the face of various restrictions is highly relevant and encouraged. With a background in the spiralling government debt levels throughout the world, which is connected to the trustworthiness of policy, one concrete way of doing this would be to account for the level of government debt in researching the impact of macroeconomic policy in the face of restrictions.

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Appendix

Table A1: Details of The Stringency Index

Indicator	Value 0	Value 1	Value 2	Value 3	Value 4
School Closing	No measures	Recommend closing	Required closing some levels	Required closing all levels	N/A
Workspace Closing	No measures	Recommend closing	Require closing some levels	Require closing all levels	N/A
Cancel Public Events	No measures	Recommend cancelling	Require cancelling	N/A	N/A
Restrictions on Gathering Size	No restrictions	Restrictions on more than 1000 people	Restrictions on 100-1000 people	Restrictions on 10-100 people	Restrictions on less than 10 people
Close Public Transport	No measures	Recommend closing	Require closing	N/A	N/A
Stay at-home Requirements	No measures	Recommend not leaving house	Recommend not leaving house except for essential trips	Recommend not leaving house with minimal exceptions	N/A
Restrictions on Internal Travel	No measures	Recommend movement restriction	Restrict movement	N/A	N/A
Restrictions on International Travel	No measures	Screening	Quarantine arrivals from high-risk regions	Ban on high-risk regions	Total border closure
Public Information Campaign	No campaign	Public officials urging caution	Coordinated public information campaign	N/A	N/A

Table A2: Main Model 1, Unstandardized Coefficients

VARIABLES	1-day lag	7-day lag
Fiscal Policy	-0.145*	-0.121
	(0.0811)	(0.0855)
Restrictions	-0.508***	-0.487***
	(0.0437)	(0.0471)
Monetary Policy	-2.982	13.985***
	(0.0275)	(0.0329)
R-sq. (overall)	0.7759	0.7808
Time Fixed Effects	Months	Months
Holiday Fixed Effects	Christmas, Easter	Christmas, Easter
Standard Errors	Clustered	Clustered
Observations	6,678	6,606
Number of Countries	18	18

*** p<0.01, ** p<0.05, * p<0.1

Table A3: Main Model 2, Unstandardized Coefficients

VARIABLES	1-day lag	7-day lag
Fiscal Policy	0.142*	0.182***
	(0.0777)	(0.0706)
Group1	0.618***	0.655***
	(0.142)	(0.154)
Group2	0.397***	0.401***
	(0.113)	(0.124)
Group3	0.374***	0.399***
	(0.126)	(0.133)
Monetary Policy	-26.539***	32.216***
	(0.0693)	(0.0654)
R-sq. (overall)	0.6257	0.6494
Time Fixed Effects	Months	Months
Holiday Fixed Effects	Christmas, Easter	Christmas, Easter
Standard Errors	Clustered	Clustered
Observations	6,678	6,606
Number of Countries	18	18

*** p<0.01, ** p<0.05, * p<0.1

Table A4: Main Model 3, Unstandardized Coefficients

1-day lag	(1)	(2)	(3)	(4)
	Group 1	Group 2	Group 3	Group 4
VARIABLES				
Fiscal Policy	-0.322**	-0.123	-0.241**	0.152*
	(0.160)	(0.172)	(0.121)	(0.0813)
Monetary Policy	-7.226**	1.730	-9.850**	-17.494**
	(0.0297)	(0.0815)	(0.0497)	(0.0771)
R-sq. (overall)	0.6375	0.6079	0.5924	0.6526
Time Fixed Effects	Months	Months	Months	Months
Holiday Fixed Effects	Christmas, Easter	Christmas, Easter	Christmas, Easter	Christmas, Easter
Standard Errors	Robust	Robust	Robust	Robust
Observations	1,855	1,484	1,855	1,484
Number of Countries	5	4	5	4

*** p<0.01, ** p<0.05, * p<0.1

Table A5: Main Model 4, Unstandardized Coefficients

7-day lag	(1)	(2)	(3)	(4)
	Group 1	Group 2	Group 3	Group 4
VARIABLES				
Fiscal Policy	-0.107	-0.114	-0.170**	0.133
	(0.0893)	(0.125)	(0.0819)	(0.0866)
Monetary Policy	40.607***	67.022***	52.209***	51.898***
	(0.0675)	(0.0584)	(0.0529)	(0.0653)
R-sq. (overall)	0.6350	0.6557	0.6253	0.6758
Time Fixed Effects	Months	Months	Months	Months
Holiday Fixed Effects	Christmas, Easter	Christmas, Easter	Christmas, Easter	Christmas, Easter
Standard Errors	Robust	Robust	Robust	Robust
Observations	1,835	1,468	1,835	1,468
Number of Countries	5	4	5	4

*** p<0.01, ** p<0.05, * p<0.1