

An Estimation of the Economic Impact of Three Covid-19 Stimulus Packages



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Abstract

This paper evaluates the effects of the economic reactions to the coronavirus crisis in Sweden, the United Kingdom and the United States of America. By using a structural vector autoregressive model we find the effect of a change in government spending, tax revenue and interest rates on GDP and unemployment. By calculating the effect found in historic data, we can estimate how the corona stimulus packages affect the economies of these three countries. Our results questions traditional theory, by indicating that increased government spending and tax cuts will have a negative effect on the economy. Meanwhile, stimulus in the form of cutting the interest rate will positively effect the economy.

Contents

1	Introduction	1
2	Literary Framework	3
3	Stimulus Packages	5
3.1	Sweden	5
3.2	The United Kingdom	6
3.3	The United States	7
3.4	Summary of Stimulus	8
4	The Structural VAR Model	10
5	Data	13
6	Result	14
6.1	Multipliers from the IRFs	14
6.2	Effect of Stimulus Packages	20
7	Conclusion	23
	References	24
8	Data Sources	28
8.1	Sweden	28
8.2	United Kingdom	29
8.3	USA	29
9	Appendix	30

1 Introduction

The coronavirus pandemic has caused untold economic damage through disruptions in supply chains, lockdowns, and social distancing policies meant to fight the virus. This economic crisis is something modern economies have yet to face and have been left scrambling for a response. Governments around the world are announcing some of the largest financial aid packages ever, aimed both at the private and public sectors, as well as rapidly lowering interest rates in order to encourage spending. The verdict of the effectiveness of these policies is not without controversy as there is an ongoing debate regarding the efficacy of the types of counter-cyclical policies being implemented.

Due to large sections of the economy being shut down across the world there is an immediate need for funds, with the policies reflecting this. The measures include massive amounts of government grants, tax breaks, and active labor market policies (IMF, 2020). These are designed to cushion the fallout from the crisis and keep businesses and people afloat during its duration. The stimulus packages are, therefore, not only unusual in their size and scope, but also in their purpose. The aim is not to simply stimulate the economy but to keep it "alive" as it were until normalcy can be achieved again and society and the economy can start back up. That being said, the basic form of most of the stimulus still follows traditional Keynesian theories of counter-cyclical policy.

These policies are popularly divided into fiscal and monetary policy, with fiscal policy being controlled by the executive branch of government and monetary policy by the central bank (Keynes, 1936). When demand drops in a recession, the government should step in and artificially increase the demand by debt-financed fiscal policy such as increased government spending and/or tax cuts, with Keynes favoring the former. This approach to counter-cyclical policy has ebbed and flowed in popularity with policy-makers ever since its introduction by Keynes in the 1930s. In conjunction with this stand the central bank (CB), in control of the monetary policy (Auerbach, 2012). The CB's most powerful counter-cyclical tool is the interest rate. The CB sets the interest rate through which they control the supply of money and thereby demand in the economy. Pursuing a stable inflation target, the central bank will decrease the interest rate in response to a negative demand shock in the economy to encourage lending and investment from the private sector and thereby increase output.

The current stimulus packages contain elements of every aspect of fiscal and monetary stimulus to varying degrees. There is, however, a noticeable lack of agreement in the literature about the "correct" shape and form of counter-cyclical policies with some arguing for the effectiveness of fiscal policy over monetary and others arguing the opposite (Lucas, 1976;

Barro, 1974; Guajardo et al., 2014). For a long time monetary policy was ascendant as the preferred tool for policymakers, following the experience of stagflation during the 1970s and the inability of classical Keynesian theories to predict or explain the phenomenon (Auerbach, 2012; Lagerwall, 2019). As a consequence of the Great Recession, and the interest rates of many countries reaching the zero lower bound, fiscal policy made a return in popularity in policy circles and have remained popular up until the time of writing. However, this popularity is not accompanied by any new consensus in academia as there still is an active debate on the ultimate effect of the effectiveness of active fiscal policy (Lucas, 1976; Barro, 1974; Guajardo et al., 2014). Of principal importance to this debate is the multiplier which measures the aggregate effect on the economy from a change in fiscal or monetary policy. A multiplier higher than unity would mean that the effect on output is larger than what is put in and a multiplier lower than unity meaning the opposite. Following the financial crisis a great deal of research was devoted to determining the size of the fiscal multiplier. Some evidence for a multiplier higher than unity was found but results have varied (Hall, 2009; Alesina and Ardagna, 2010; Auerbach and Gorodnichenko, 2012; Fisher and Peters, 2010; Ramey, 2011_a). Furthermore, Auerbach and Gorodnichenko (2012) found that the size and sign of the effect of fiscal policy vary over the business cycle, being more positive in recessions and less positive, even turning negative in times of booms. This counterintuitive phenomenon might be explained by the findings by Blanchard and Perotti (2002) and Wijnbergen and Kwaak (2017) who consistently found that private investment was crowded out by expansionary fiscal policy. With the positive effect of fiscal policy varying in size over time, coupled with the constant negative effect on private investment, it becomes easier to see how a negative multiplier might come about (Auerbach and Gorodnichenko, 2012).

Grounded in this debate, this paper will evaluate the ultimate effectiveness of the stimulus packages being implemented in Sweden, the UK and the US to counteract the economic consequences of the coronavirus crisis. The paper is constructed as follows; (1) introduction, (2) review of the literature on government spending, taxes, and monetary policy multipliers, (3) introducing the stimulus packages, (4) presentation of the vector autoregressive model which will be used to estimate the respective multipliers, (5) presentation of the data, (6) results, (7) conclusion.

2 Literary Framework

In the decades following the Great Depression, Keynesian economic theory about counter-cyclical policy held sway. The experience with high unemployment coupled with high inflation in the seventies and the inability of Keynesian theory to explain its occurrence laid the groundwork for authors like Barro (1974), Lucas (1976), Mundell (1963) and Fleming (1962). They challenge Keynes and argued for the limited to downright negative effects of active fiscal policy on output. The modern discussion of the size, and the sign, of the fiscal and monetary multipliers, arguably started here. These arguments were grounded in micro-economic thought of rational expectations and argued against the ad hoc nature of Keynesian theory. Prominent in the debate was the argument of Ricardian Equivalence, presented by Barro (1974). Barro argued that the rational and forward-looking consumer will, when the government increase debt-financed spending, internalize this as a future tax burden as the government would need to balance its budget at some point in the future. The consumer will start to save in preparation for this tax hike, thereby lower spending today and eliminate the positive effect on output the government spending would have resulted in. The net effect on output is thus zero.

The Ricardian Equivalence theorem faced criticism for its strong assumption of completely rational and forward-looking individuals as agents do seem to be susceptible to the effects of government spending to some degree (Buchanan, 1976; Hall, 2009). If expansionary policies worsen the deficit to such a degree that fiscal crises become more likely, the theorem shows more promise. As a result of debt-financed spending, the agents observe the deficit increase causing them to worry about a potentially painful economic readjustment in the future. In response the agent attributes a higher risk premium to consumption today, thereby leading to a slump in demand and subsequently output. As the debt to GDP ratio in all three countries of interest to this paper has routinely been high during the past 40 years, there is reason to believe that this might apply to them (Trading Economics, 2020b; Ekonomifakta, 2020; Trading Economics, 2020a). An increase in public spending, in this setting, might therefore not increase output but lower it by crowding out private spending (Alesina and Ardagna, 2010; Giavazzi and Pagano, 1990; Wijnbergen and Kwaak, 2017).

Coupled with these negative effects on the fiscal multiplier, Buchanan and Wagner (1977) argued that the nature of democratic governance would incentivize policymakers to spend money irresponsibly on their constituents and not where it was needed as prescribed by Keynes (1936). Both Keynesian theory and empirical findings suggest this will depress the positive multiplier effects (Christiano et al., 2011). It has been widely observed that fiscal

multipliers are smaller during booms and larger in busts. If during the spending frenzy that tends to accompany a government's response to an economic crisis, measures are not directed at the worst-hit areas of the economy, the effect would be smaller than intended while still bringing about the same costs from debt-financed spending and crowding-out effects discussed above.

The works of Mundell (1963) and Fleming (1962) also suggest that for small and open economies, and to some degree large open ones too, there will be little to no effect on output from expansionary fiscal policy. They argue that the effect of government stimulus will push up interest rates, attracting foreign investors. This will appreciate the exchange rate, making domestic goods less attractive and reducing net exports which will lower output by the same degree that the government stimulus raised it. This effect can be somewhat ignored for the US as it is a large economy but for countries like Sweden and, to a lesser extent, the UK it might very well curtail the effectiveness of fiscal policy on output.

These arguments based in theory, coupled with practical experience of negative fiscal multipliers led monetary policy to take the more prominent role as the counter-cyclical policy of choice for some time (Giavazzi and Pagano, 1990; Auerbach, 2012). As the Great Recession forced CBs around the world to lower their interest rates closer and closer to the zero lower bound, doubts about monetary policy's effectiveness to counteract downturns in the economy were raised and fiscal policy made a comeback in popularity. This shift in focus is supported by findings made in the wake of the crisis that indicates the expansionary fiscal policies have a net positive effect on the economy (Auerbach and Gorodnichenko, 2012; Hall, 2009; Ramey, 2011_a; Ramey, 2011_b). One thing to note is that the most positive multipliers were consistently found in military spending, a form of government spending that is missing from the stimulus packages being implemented currently.

Despite being one of the most well-researched areas in macroeconomics there is precious little consensus to be found about the ultimate effectiveness of expansionary policies in general and whether monetary or fiscal policy is to be preferred specifically. Recently there have been well-documented instances of positive effects of fiscal stimulus on output in the literature. But there are well-founded arguments, both in the literature and theory, suggesting that this is not a given phenomenon. The positive effects of fiscal policies are dependent on the economic situation in the country and the state of public finances as well as on the form the policies take, requiring the policies to be directed at correct sectors.

3 Stimulus Packages

The economic havoc caused by Covid-19 is unparalleled in modern times, and so are the stimulus packages being implemented to control the damage. The exact size of these packages are currently unknown, but they are sure to be massive by any standard. Precise predictions of take-up rates of the programs being offered do not exist and further measures may be implemented as the crisis continues. The estimates provided in this section about the size of the stimulus packages are, for these reasons, just that, estimates. However, they will be able to give a solid indication of the size of the stimulus and thus also an indication of its effect on output and unemployment. As mentioned earlier, expansionary policies are divided into three categories historically: interest rates, controlled by the CB, as well as taxes and government spending, controlled by the executive branch (Lagerwall, 2019). We will follow these distinctions and limit our analysis to these more traditional forms of fiscal and monetary stimulus.

3.1 Sweden

The Swedish handling of the coronavirus crisis has been less restrictive than many other countries, allowing larger parts of the economy to operate at as close to normal as possible (Savage, 2020). The economy has still been hit hard by the crisis and is expected to shrink by 4% in 2020 and unemployment to increase from 6,7% to 9% (Department of Finance, 2020). In response, the government and the Swedish CB, the Riksbank, have launched a multipronged stimulus package implementing both expansive fiscal and monetary measures to prop up the economy.

The share of fiscal stimulus classified as government spending is divided into two main parts with one directed at the private sector and one at the public. The measures directed at the private sector include: direct grants to businesses to cover fixed costs based on loss of business, temporary rent subsidies for select businesses, wage subsidies for short-term leaves, and paying of sick leave Swedish National Debt Office (2020); IMF (2020). Efforts directed at the public sector include: increased active labor market policies in the form of more generous terms for unemployment insurance, increased access to higher learning, government-supported short time furloughs, and grants to municipalities and regions as well as to culture and sports. All in all, the efforts are calculated to cost SEK 182 billion or roughly 3.6% of GDP.

A slew of temporary tax cuts, deferrals and rebates have also been announced: One-time

deferral for 2019 on general payroll tax, VAT and salaries tax deferrals for small companies judged to be serious and not in substantial tax debts, severely hit sole proprietors are eligible for a 100% tax cut for the taxable profits from 2019 up to SEK 1 million, contributions to social security schemes by employers will temporarily be reduced and shouldered by the government and temporary reduction in payroll tax and equivalent payments for the entire business sector. The final amount will depend on the degree of uptake and is therefore subject to a high degree of variance. The IMF estimate that the cost of the policy of payroll tax and VAT deferrals ranges from a lower bound of SEK 27 billion if uptake is similar to the Great Recession and an upper bound of SEK 315 billion if fully utilized by the entire business sector (IMF, 2020). It is very likely that the economic fallout from the coronavirus crisis is bigger than the Great Recession. As we lack any reliable way of predicting the take-up rate, we will assume it to be in the middle of the upper and lower bound given by the IMF. Total tax measures add up to SEK 224 billion or 4.5% of GDP.

On the monetary policy side the Swedish Riksbank has announced that the repo rate, the Riksbank's policy rate, will remain unchanged at 0% but the overnight lending rate has been reduced by 55 basis points to 0.2%, down from 0.75% (Swedish Riksbank, 2020). This will be used as a proxy for short term interest rates for Sweden, as it is widely used by many other CBs as the interest rate (IMF, 2020).

3.2 The United Kingdom

The economic situation in the United Kingdom amidst the crisis is serious with the Bank of England (the CB of the UK) predicting the economy heading into its worst slump in 300 years and upwards of a quarter of the workforce are currently furloughed or out of employment according to the Office of Budget Responsibility (OBR) (Milliken and Bruce, 2020; OBR, 2020)

As of mid-May the government has increased spending on a variety of measures. These include, but are not limited to: government refunds for paid sick leave, direct grants to the most exposed sectors, spending on the National Health Service and related charities, self-employed support scheme, grants to devolved governments, small business grant scheme and the Coronavirus job retention scheme (HM Treasury, 2020; IMF, 2020). This last policy brings with it a substantial amount of uncertainty to the size of the final bill. As things stand in mid-May, the program is set to run until the end of October at an estimated cost of £14 billion per month. However, the government has announced that come the end of July, employers will be expected to start contributing to the scheme more. No details for this have

been given but as things stand the OBR (2020) estimate that the cost of the scheme might reach £71 billion, bringing the total spending cost to £139.4 billion, or 6% of GDP (BBC, 2020b).

Tax cuts in the UK come in the form of a 100% reduction of business rates for small and medium businesses in exposed sectors as well as a deferral of all VAT payments for the second quarter of 2020 (£31 billion) (BBC, 2020a; IMF, 2020; OECD, 2020; HM Treasury, 2020_b).

On the monetary side, the interest has been cut by 65 basis points, down to 0.1% from 0.75%. To support this measure the Bank of England will expand its holding of government bonds and non-financial corporate bonds by £200 billion along with more monetary efforts to support the interest rate cut (BoE, 2020; IMF, 2020).

3.3 The United States

The United States has had the worst outbreak in the world of coronavirus so far with over a million confirmed cases and large sections of the country have been shut down in an effort to slow the spread of the virus. The economic impact has been substantial with millions becoming unemployed in a matter of weeks. The reaction to this, mainly the CARES act, is the largest recovery plan in American history and overshadows both the Recovery Act of 2009 as well as FDR's New Deal, which were the contestants of that claim beforehand (St. Louis Fed, 2017).

Legislatively, Congress has passed four bills as a reaction to corona allowing spending that adds up to the huge sum of \$3.6 trillion. The Trump administration has implemented actions which add short term support of approximately \$380 billion. Finally, the Federal Reserve has cut interest rates, created emergency loans to companies and bought assets from the treasury adding up to the colossal sum of \$5.8 trillion (CRFB, 2020). However, all of these actions are not within our framework. Parts of the stimulus package are just temporary tax deferrals rather than tax cuts, loans which might be forgiven or other action which only helps with short term liquidity.

Government spending has been increased to fund health care, research for a vaccine, expanded unemployment benefits, giving tax rebates, create forgivable loans (basically grants, as long as conditions are met) to name a few. By adding up all numbers that we have to date, it adds up to \$2451 billion (CRFB, 2020). Depending on how we define spending, this number can drastically change. Therefore this should be seen more like an approximation rather than a precise objective number.

There is a grey area regarding tax cuts. Should a reduction of taxes be categorized as a tax reduction even when it is practically a cash give away, done through their tax system infrastructure. The \$293 billion of "tax rebates" given to individuals, \$1200 per adult, is an example of this grey area. We follow the definition of CRFB (2020) and categorize \$290 billion as a tax reduction.

In March the Fed cut the Federal funds rate by 150 basis points, lowering it from the range 1.5 – 1.75 down to the range 0.00 – 0.25. They have also stated that they will keep the interest rate low in the future to affect speculations about the future (Brookings, 2020; Federal Reserve, 2020).

3.4 Summary of Stimulus

Table 1: Size of stimulus

Country	Tax cuts	Government spending increase	Interest rate cuts
Sweden	SEK 224 (36.4)	SEK 182 (29.8)	0.55%
United Kingdom	£31 (17.5)	£139 (66.6)	0.65%
United States	\$290 (20.0)	\$2451 (132.1)	1.5%

Percentage change since previous quarter in parentheses.

Numbers are in billions.

These are massive packages representing 8.1%, 7.7%, and 13.3% of GDP for Sweden, the UK, and the US respectively. The countries have focused their counter-cyclical policies in slightly different ways. The Swedish fiscal stimulus is the most balanced of the three, with only a slight preference for tax cuts. It has also pursued the weakest monetary policy, by electing to only lower overnight rates by 55 basis points. The UK also leaned heavily into fiscal stimulus. However, unlike Sweden, their focus was not as uniform and their increase in government spending is much larger than their tax cuts. Finally, the US has the largest increase in government spending by percentage increase. This is unsurprising seeing as their public sector is the smallest of the three to begin with, meaning each percentage increase will equal a smaller share of GDP compared to that of Sweden and the UK. Their fiscal stimulus focus on increased spending rather than tax measures, while also pursuing the strongest monetary policy by cutting interest rates by 150 basis points. The different policies making up these stimuli will not be implemented all at once. More likely, the implementation stretch for a year and we will, therefore, adjust the size of the stimuli down to better fit with our

quarterly estimates.

Table 2: Size of stimulus, by quarter

Country	Tax cuts	Government spending increase	Interest rate cuts
Sweden	SEK 56 (9.1)	SEK 46 (7.5)	0.55%
United Kingdom	£8 (4.4)	£35 (16.7)	0.65%
United States	\$73 (5.0)	\$613 (33.0)	1.5%

Percentage change since previous quarter in parentheses.
Numbers are in billions.

In table 2 the estimates of tax cuts and government spending from table 1 have been divided by four. These are the numbers that will be used when evaluating the effectiveness of the three countries' stimulus packages in later sections.

4 The Structural VAR Model

In order to forecast what, if any, effect the stimulus packages in Sweden, the UK, and the USA will have on the economy, we will make use of a structural vector autoregression model or structural VAR model. Specifically, the impulse response function of the VAR model will be used to trace out what effect the stimulus packages will have on the wider economy. The use of VAR models in this setting has become popular within macroeconomics over the past few decades as a means to more accurately forecast economic trends over time compared to more traditional simultaneous equation methods (Litterman, 1979; Sims, 1980; Diebold, 1998).

The VAR-model is used to capture the linear interdependence among multiple stationary time series. This interdependence means that rather than relying on assumptions of exogeneity, the VAR-model treats all variables as endogenous to the model. Thus, the only a priori knowledge necessary to perform a VAR model is what variables are to be included, thereby allowing for a more parsimonious use of restrictions. The structural VAR model is able to relate the dynamic movements in a variable to a set of structural shocks. This will be used in order to forecast what effect shocks in fiscal and monetary policy will have on GDP and unemployment.

This paper aims to estimate what effect the stimulus packages in our three countries will have on output and unemployment. This will be done in two steps. Firstly three structural VAR models will be estimated, one for each country. These contain seven variables for Sweden and the UK and six for the US, consisting of the growth rates of the following: GDP(y_t), unemployment(u_t), government spending(G_t), taxes(T_t), short interest rate(i_t), CPI(π_t) and exchange rate to the dollar(e_t) (for Sweden and the UK). Secondly, these will be used as our baseline models which we transform into their respective impulse response functions. These impulse response functions (IRFs) will then be used to estimate the dynamic response of GDP and unemployment to a shock in government revenue, taxes, and short interest rate (Enders, 2014).

To estimate our model we require a structural model containing simultaneous effects between the variables. The model will be specified as follows:

$$A_0 Z_t = k + A_1 Z_{t-1} + A_2 Z_{t-2} + \dots + A_p Z_{t-p} + \varepsilon_t \quad (1)$$

where $Z_t = (y_t, u_t, \pi_t, e_t, i_t, T_t, G_t,)$, k is a constant and ε_t is a white noise k -dimensional vector of error terms or innovations. The model requires all variables to be stationary and

ergodic and there cannot be any perfect multicollinearity present. Augmented Dickey-Fuller tests were carried out on all variables to check for the presence of a unit root and the Akaike information criterion was used to determine appropriate lag-length, with four lags providing the best fit.

The coefficient matrix A_0 represents the simultaneous effects of the variables on each other. For us to be able to perform the IRFs we have to impose some restrictions on the coefficients in A_0 . Specifically we need to limit the amount of variables that are allowed to affect the others in time period t . We will use the popular method presented by (Sims, 1980), whereby we transform A_0 into a lower triangular matrix, using a Cholesky decomposition.

$$A_0 = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 & 0 \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & 1 \end{bmatrix} \quad (2)$$

GDP is ordered first and will thus be able to affect all variables contemporaneously while taxes, government spending, and interest are ordered last to only affect the other variables with a lagged effect. This is shown more clearly in (2) where the lower triangular form of A_0 is shown. This way of restricting the variables is supported by the observation that fiscal and monetary policies often experience a recognition and implementation lag when faced with unanticipated economic shocks and thus it is unlikely that they would have a significant contemporaneous effect on our slow-moving macro variables (Giordano et al., 2007; Ludvigson et al., 2001; Cecchetti and Rich, 2001). The ordering of monetary policy and fiscal policy is less clear cut but we have elected to follow the example of (Muscatelli et al., 2004) where fiscal policy is allowed to contemporaneously affect monetary policy but monetary policy does not contemporaneously affect fiscal policy.

Just as a standard autoregressive process can be turned into a moving average model provided the process is stable, the VAR model can be converted into a vector moving average model (VMA) by finding the solution for the process, that is solving for Z_t . For this we premultiply the model with A_0^{-1} , giving us the standard form of the model:

$$Z_t = \alpha + B_1 Z_{t-1} + B_2 Z_{t-2} + \dots + B_p Z_{t-p} + e_t \quad (3)$$

where $\alpha = A_0^{-1} * k$, $B_i = A_0^{-1} * A_i$ and $e_t = A_0^{-1} * \varepsilon_t$. Using lag operators and solving for

Z_t will result in the VMA model:

$$Z_t = \mu + \sum_{i=0}^{\infty} \beta^i e_{t-i} \quad (4)$$

where $\mu = (I - \beta(L))^{-1} * \alpha$ and $\sum_{i=0}^{\infty} \beta^i e_{t-i} = (I - \beta(L))^{-1} * e_t$. This is the impulse response function. In this setting Z_t has reached its steady state and we can thus easily trace out the effect that shocks in fiscal and monetary policy will have on output and unemployment. This is done by shocking one of the variables for one period, thus creating a one-time disturbance in that variables error term and then mapping out what subsequent effects are transferred to the variables in Z_t over time. Of critical importance in this model is our β coefficient and the economic implications it brings. It acts as the multiplier to the shock that will enter the model through the error term and will thus decide how large the effect on the variables of interest in Z_t will ultimately prove.

5 Data

We have 40 years of data at a quarterly frequency for Sweden, the UK, and the USA. This means our sample contains a total of 160 time periods. This is advantageous as it allows us to use 4 lags and still have enough degrees of freedom in our SVAR model, something a SVAR model might otherwise suffer from a lack of.

Table 3: Data sources

Country	Inflation	Exchange rate	GDP	Unemployment	Interest rate	Tax revenue	Government spending
Sweden	OECD	FRED'	OECD	FRED*	FRED'*	OECD†*	See footnote†*
United Kingdom	OECD	FRED'	OECD	Office for National Statistics	Bank of England	OECD†*	World Bank†*
United States	OECD	N/A	OECD	FRED	FRED'	Bureau of Economic Analysis	Bureau of Economic Analysis

Links to all of the sources can be found after our reference list.

' The FRED data for the exchange rate and interest rate is seasonally adjusted using STL decomposition.

† Linearly interpolated from yearly data.

* Missing a maximum of 3 years of data at either the start or the end of the time series.

Sweden's Government spending was a bit tricky. We only found spending for the whole time period as a % of GDP. Up until 2011 this data is taken from IMF, thereafter it is taken from OECD. We then multiplied this times series with Sweden's annual GDP, which is from the World Bank.

Since the USA is a large economy we do not include an exchange rate in their specification. All data is transformed to be the percentage change from the previous quarter. We divided the natural logarithm values with their previous period to get this, unless the data was already in percentages in which case we just subtracted the previous period.

6 Result

6.1 Multipliers from the IRFs

In this section the results from our IRFs are presented. Through them it is possible to observe how the variables of interest, GDP, and unemployment, are affected over time from a positive shock in government spending, taxes, and interest rate. By accumulating the marginal effect of the shocks each quarter we can observe both its direct effect upon impact and the accumulated, long-run outcome. The effects on GDP are presented for each country first and is then followed by the effects on unemployment. Keep in mind that the stimulus implemented for taxes and interest rate are a *decrease*, but results from the IRFs are presented as an *increase* since that is how the model works. Therefore, the effect of the stimulus package will be the inverse of the graphs for the variables "Taxes" and "Interest rate".

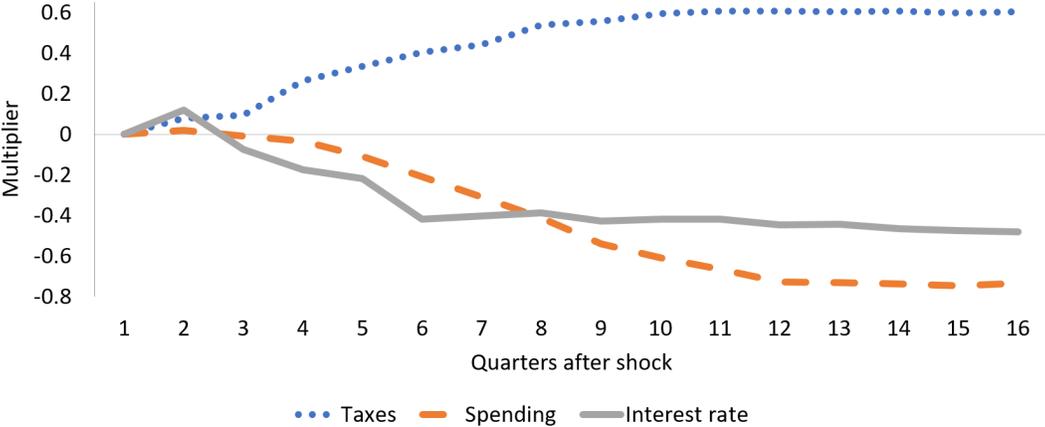


Figure 1: SWE accumulated GDP.

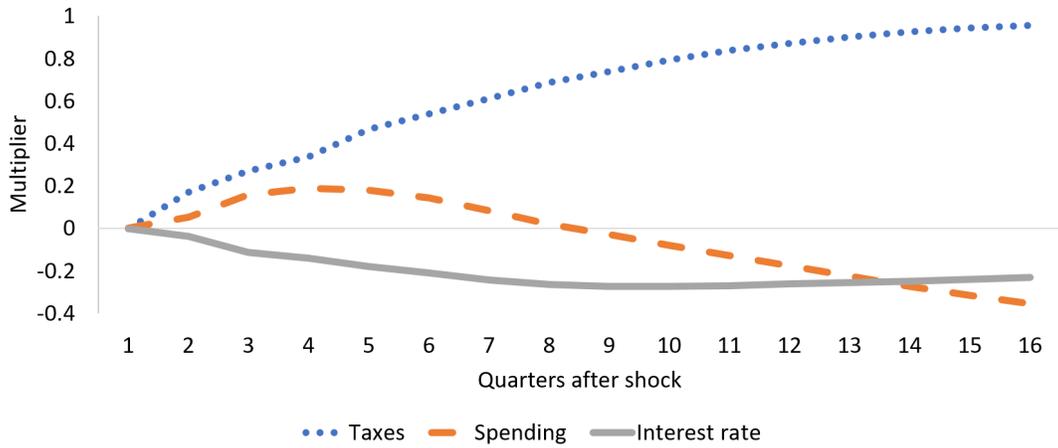


Figure 2: UK accumulated GDP.

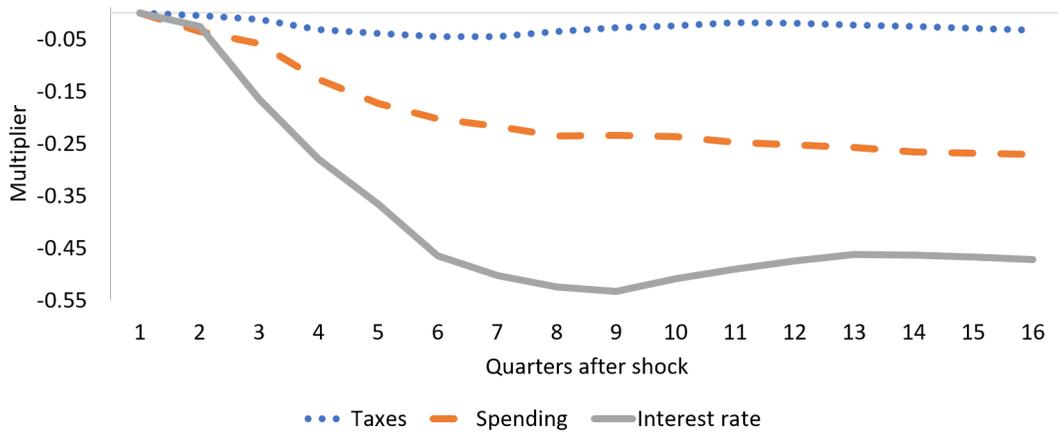


Figure 3: USA accumulated GDP.

Table 4: Accumulated multipliers for GDP after 4, 8, 12 and 16 quarters.

Year	<u>Sweden</u>			<u>United Kingdom</u>			<u>United States</u>		
	Taxes	Spending	Interest rate	Taxes	Spending	Interest rate	Taxes	Spending	Interest rate
1	0.262	-0.033	-0.174	0.337	0.190	-0.140	-0.032	-0.127	-0.280
2	0.539	-0.412	-0.388	0.688	0.019	-0.265	-0.036	-0.236	-0.525
3	0.606	-0.727	-0.446	0.872	-0.176	-0.262	-0.020	-0.253	-0.475
4	0.605	-0.736	-0.481	0.957	-0.356	-0.232	-0.033	-0.271	-0.472

The numbers shown above are the accumulated multipliers of a positive shock in the variables shown. Graphs of the multipliers standard deviation and the marginal quarterly effects can be found in the appendix.

In Figure 1-3 we see the accumulated effect of Swedish, UK, and US GDP to a single period, 1%, positive shock in one of our three stimulus variables. The dotted line represents taxes, the broken line spending, and the solid line interest rate. Due to the Cholesky decomposition all effects are zero in the first quarter. Table 4 summarizes the main results from the figures and is useful for more precise interpretations of the impulse responses. The results are quite striking. An increase in taxes for Sweden and the UK can be seen as having a positive effect on output and a negligibly small but negative effect in the US. The accumulated effect of an increase in spending is uniformly negative across all countries at the end of the time horizon. For the UK, spending is observed to have a positive effect on output for roughly two years, with a high of 0.19, before turning substantially negative. An increase in the interest rate affects GDP in all three countries negatively, with Sweden and the US having nearly identically strong multipliers while the UK's is roughly half as strong. These results imply that, contrary to traditional Keynesian theory, expansionary fiscal policy has a negative effect on output while monetary policy appears to have its intended, positive, effect. The economic realities in these countries along with the rebuttals to Keynesian theories provided by Barro (1974), Buchanan (1976), and Alesina and Ardagna (2010) provide some explanations for these findings.

The accumulated negative effects of an increase in government spending and the positive effects of an increase in taxes fit neatly with the Ricardian equivalence as presented by Barro (1974). As the expansionary fiscal policies are pursued, the private sector of the economy contract in anticipation of future austerity measures and wipe out and even reverse the positive effect the policies were intended to have. This reasoning is especially compelling in the case of Sweden as the multiplier for taxes and spending are roughly equal, meaning equivalence holds in both directions. It is less evident in the UK and US however.

The marginal effect of increased spending in the UK is positive during the first year, after which it turns negative. The accumulated effect stays positive until two years after a shock. According to the theory by Buchanan and Wagner (1977), supported by the findings of Giavazzi and Pagano (1990) and Alesina and Ardagna (2010), the ratio of debt to GDP is important in order to determine the effect on expansionary policies. A high ratio help to explain why, in some cases, the fiscal multiplier might turn negative. The debt to GDP has been historically lower in the UK than in Sweden and the US for the duration of our sample. This difference between the countries could explain why the UK responds more positively to an increase in government spending.

The negative impacts of fiscal policies are most muted in the US. Considering the debt

to GDP ratio is significantly higher in the US compared to the UK and Sweden this is not what one would expect, at least not if Buchanan and Wagner (1977) are to be believed. One possible explanation is that the impulse response is calculated as a percentage. Due to the US public sector being significantly smaller than both the Swedish and the UK governments, a percentage increase in government spending would result in a lower increase as a proportion to their total GDP.

The works of Mundell (1963) and Fleming (1962) might provide even better explanations however. A small and open economy, like Sweden, is far more susceptible to the appreciation in the exchange rate and subsequently depreciation in net trade that, according to Mundell and Fleming, expansive fiscal policies will bring. The US on the other hand, being a large open economy, would be less affected due to its sheer size. From this framework, the impulse response functions of our countries behave in precisely the way one would have assumed with Sweden being the most affected and the US the least from shocks to taxes and spending and interest rate being the only lever with which policymakers are able to affect the economy in a reliable way.

Next we study the effect of a shock in the same variables as before but the responding variable is changed from GDP to unemployment. This is done in part as a robustness check, considering the level of unemployment should be roughly inversely related to changes in GDP and in part due to large sections of the stimulus packages being devoted to job-saving measures. It is therefore of great relevance to measure the results to unemployment levels from these policies.

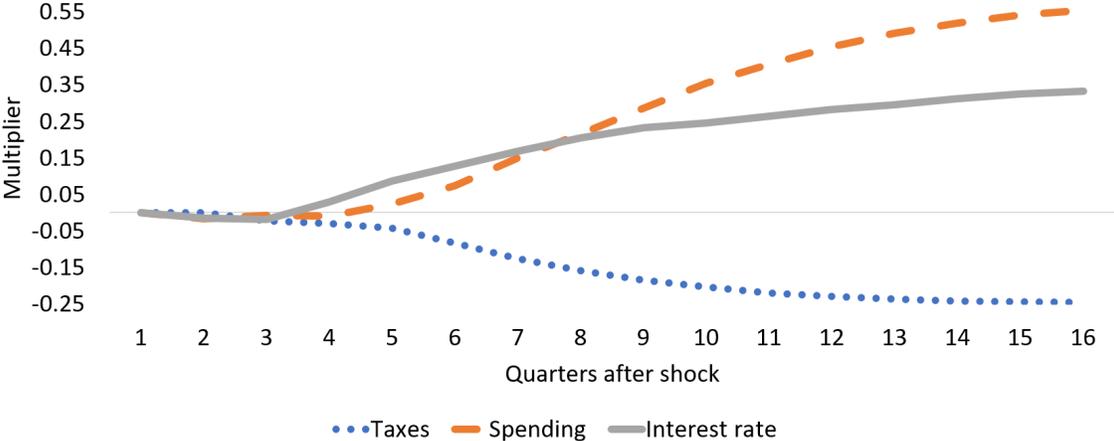


Figure 4: SWE accumulated unemployment.

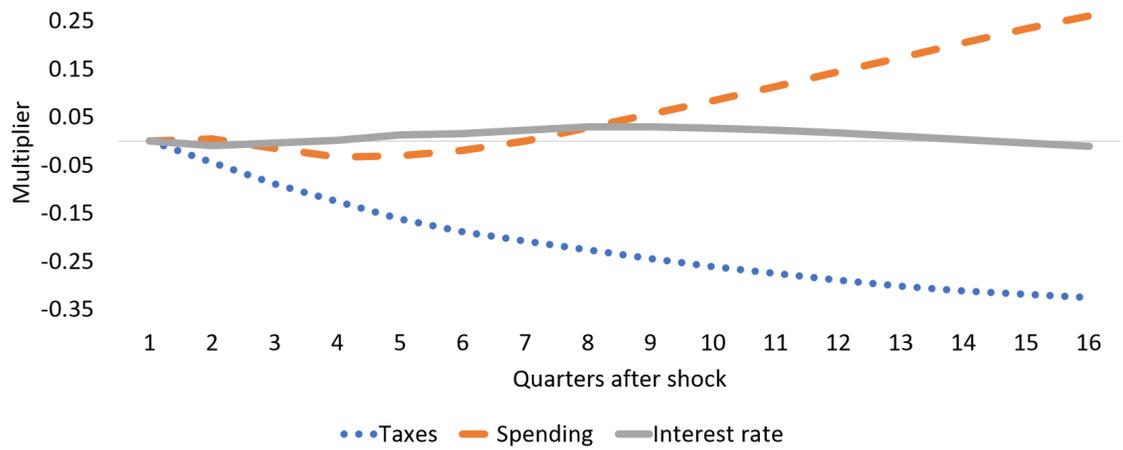


Figure 5: UK accumulated unemployment.

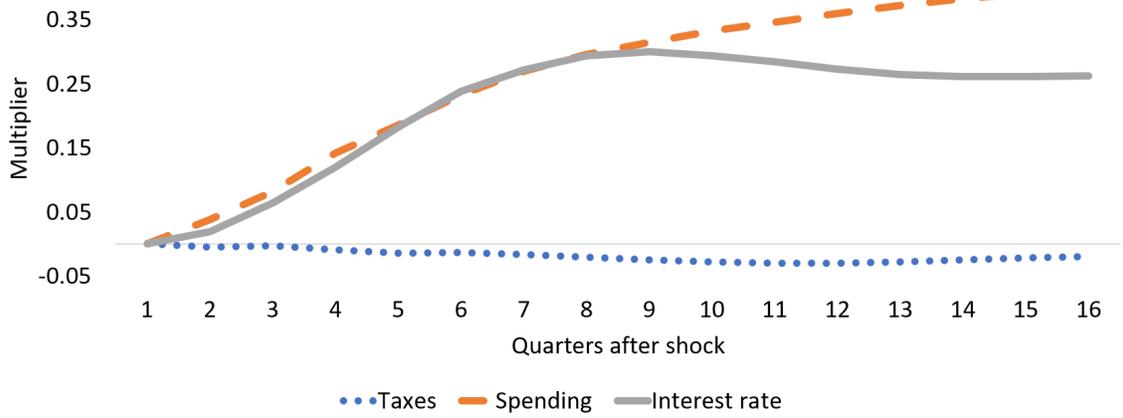


Figure 6: USA accumulated unemployment.

Table 5: Accumulated multipliers for unemployment after 4, 8, 12 and 16 quarters.

Year	<u>Sweden</u>			<u>United Kingdom</u>			<u>United States</u>		
	Taxes	Spending	Interest rate	Taxes	Spending	Interest rate	Taxes	Spending	Interest rate
1	-0.030	-0.009	0.029	-0.126	-0.034	0.002	-0.010	0.112	0.111
2	-0.160	0.217	0.205	-0.227	0.028	0.029	-0.020	0.296	0.294
3	-0.229	0.454	0.283	-0.290	0.144	0.017	-0.030	0.360	0.273
4	-0.245	0.554	0.333	-0.325	0.260	-0.010	-0.020	0.399	0.262

The numbers shown above are the accumulated multipliers of a positive shock in the variables shown. Graphs of the multipliers standard deviation and the marginal quarterly effects can be found in the appendix.

Figure 4-7 represents the accumulated impulse responses in unemployment from a shock in spending, taxes, and interest rate and table 5 provides a more in-depth reading of the accumulated multiplier. As with GDP, the dotted line represent taxes, the broken line spending, and the solid line interest rate. Unsurprisingly the results, largely, mirror those found when looking at GDP. The effect of taxes in the US are still very weak. Sweden's fiscal multipliers are the strongest of any country and the UK still experiences some positive effects of an increase in spending in the short term but that is wiped out in the medium term as the marginal effect turns negative after roughly a year.

However, some changes can be observed. The results are all consistently muted, when compared to the results in GDP, and in Sweden it takes up to a year for the shocks to show any effect in unemployment rates. This is likely due to a combination of sticky wages and prices not adjusting as quickly or strongly as output. The delayed effect in Sweden might be due to the exceptionally strong unions and employment protections present in the country. Noticeably the effect of taxes switches signs in Sweden and the UK, as the responding variable is changed to unemployment. Meanwhile the US multiplier for taxes remains largely unchanged, meaning a reduction in taxes would affect both output and unemployment positively in the US. This would imply that the inverse relationship between output and unemployment does not hold for the US during the time period 1980-2019, though the weakness of the effect urge caution when drawing inference from it as it is not a significant result.

In the main the results from the IRFs on unemployment confirm the negative multipliers for fiscal policy and positive multiplier for monetary policy. One should however note that these negative effects might be overstated in the model for a few reasons. Auerbach and

Gorodnichenko (2012) find that in times of expansion the positive effects of the multipliers will be lower than in times of recession. The economies of all three countries in this paper have, during a majority of the years in the sample, been booming, thereby likely affecting the multipliers negatively. Furthermore, the variation found in the literature about the precise estimates of multipliers shows how different time periods and specifications affect the size and direction of the multiplier (Ramey, 2011_b). Since the current economic retraction is unusual, and the size of the stimulus is so vast, the multipliers presented should be taken as an indication of direction rather than as an exact measure of effect.

6.2 Effect of Stimulus Packages

In this section the estimated effect on GDP and unemployment from the crisis packages discussed in section 3 are presented.

Our results indicate that the GDP of Sweden, the UK, and the US are predicted to fall by roughly 10.7%, 10%, and 8.1% respectively over the coming four years in response to the economic stimulus currently being implemented. Unemployment is expected to increase by 6.2 percentage points in Sweden, 5.7 in the UK, and 12.9 in the US. As with most things regarding the coronavirus crisis, these numbers are huge and unprecedented. So huge in fact that they should be taken with a healthy degree of caution. The multipliers are calculated as the response in GDP and unemployment to a relatively small shock in the stimuli variables. In a given quarter from 1980 to 2019, these variables were unlikely to change more than one or two percent, with an exception for the Great Recession. The negative effects observed at these levels of change might not transfer fully over to the, comparatively, massive changes in taxes, and government spending associated with the coronavirus stimulus packages. This is not to say that we suggest the results of this paper be disregarded. The predicted impact of the three stimulus packages by our model estimates should, as previously stated, be interpreted as a possible indication of the direction the stimulus packages will take the economy in the years to come rather than as a precise road map.

Unequivocally the most positive effect on GDP as well as unemployment is predicted to stem from the cuts in interest rates done by the CB's of all three countries, with the strongest effect seen in the US. This is due to a combination of a strong multiplier for interest rates and the Fed maintaining a relatively high-interest rate before the crisis. This has allowed the Fed to lower its rates substantially more than the CB's of Sweden and the UK have been able to. This would serve as an indictment against, especially, the Swedish CB's decision to abandon traditional counter-cyclical monetary policy during the decade after the Great

Recession, pursuing low and even negative interest rates before the crisis and limiting its ability to respond effectively now. The interest rate cuts reported for Sweden are from the overnight rates and not the main repo rate, used by the Swedish CB, Riksbanken. Therefore, the Swedish effect from its interest rate cuts might be lower than what has been calculated in this paper. The decision to keep the repo rate at its current level of zero, and not lower it below zero as it did in 2015, is questionable based on our results. Negative interest rates are however a relatively new and controversial phenomenon and its effects might be harder to calculate than by a traditional multiplier method so some caution by the Riksbank might be warranted.

The fiscal part of the US stimulus package is heavily favored towards increased government spending rather than a reduction of taxes. The weak, but still negative, results from the tax multiplier, and the stronger negative multiplier for government spending suggests that this is the wrong strategy. The current government spending measures might be necessary actions, despite their future costs, considering they are required to keep the economy going through lockdown measures and social distancing rules. But, not capitalizing on the positive effect of tax cuts on output and unemployment looks to be an unforced error. While the effect might be estimated as negligibly small in the model, the fact that this multiplier is based on a period of predominantly booming economic periods would suggest that the effect would be stronger in times of recessions. Not focusing more heavily on expansive fiscal policies through the tax channel is therefore likely a missed opportunity, potentially fueled by political incentives as Buchanan and Wagner (1977) suggests is liable to happen in a re-election focused democracy. It is also possible that the poor design of the stimulus package is a result of the time constraint the policymakers are working under during this crisis. The economy is in dire straits and immediate action has been necessary. In this setting it is easy to see how the policies implemented might be less than optimal without them being motivated any political self-interest.

The design of the fiscal side of the UK stimulus package appear in a better light. While it is predicted to have a greater negative impact on the economy, compared to the American, the UK appears to be leaning into the strengths of their economy rather than the weaknesses. The accumulative multiplier for government spending is significantly less negative than that of taxes and will even increase output and reduce unemployment in the short term. The UK stimulus package is likely therefore much more focused on increased government spending, with roughly 80% of fiscal stimulus stemming from increases in it. The estimated effect is still predicted to be negative in the medium turn, but as stated, these are necessary evils in

order to keep the economy going through the lockdown. Focusing on the measures that are likely to do the least harm is thus a sound strategy.

7 Conclusion

This paper has attempted to evaluate what effects the Swedish, the UK, and American stimulus packages will have on their respective economies. Our findings suggest that the effect will be negative as output will decrease and unemployment will increase, as a result of their implementation. The results suggest that monetary policy, rather than fiscal policy is better suited for counter-cyclical stimulation of the economy, especially in small open economies, like Sweden. We do acknowledge the extraordinary size our model predicts the effects will have, and allow for the possibility that they are overstated. We also recognize the urgent need for many of the job and business saving policies being supported through the fiscal stimulus, and do not suggest they be disbanded. The findings of this paper simply urge caution and thoughtful implementation of any further debt-financed stimulus, as it might carry with it a distinct cost in the future.

References

- Alesina, Alberto F. and Silvia Ardagna (2010). “LARGE CHANGES IN FISCAL POLICY: TAXES VERSUS SPENDING”. In: *Tax Policy and the Economy* 24, pp. 35–68. ISSN: 0735-0015. URL: <https://doi.org/10.1086/649828>.
- Auerbach, Alan J. (2012). “The Fall and Rise of Keynesian Fiscal Policy”. In: *Asian Economic Policy Review* 7, pp. 157–175.
- Auerbach, Alan J. and Yuriy Gorodnichenko (2012). “Measuring the Output Responses to Fiscal Policy”. In: *AMERICAN ECONOMIC JOURNAL* 4.2, pp. 1–27. ISSN: 0735-0015.
- Barro, Robert J. (1974). “Are Government Bonds Net Wealth?” In: *Journal of Political Economy* 82.6, pp. 1095–1117. URL: <http://nrs.harvard.edu/urn-3:HUL.InstRepos:3451399>.
- BBC (Mar. 2020a). *Budget 2020: Business rates suspended for shops and cafes*. URL: <https://www.bbc.com/news/business-51836256>.
- (May 2020b). *UK furlough scheme extended by four months*. URL: <https://www.bbc.com/news/business-52634759>.
- Blanchard, Olivier and Roberto Perotti (2002). “An Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes on Output”. In: *The Quarterly Journal of Economics* 117.4, pp. 1329–1368. URL: www.jstor.org/stable/4132480.
- BoE (May 2020). *Interest rates and Bank Rate*. URL: <https://www.bankofengland.co.uk/monetary-policy/the-interest-rate-bank-rate>.
- Brookings (May 2020). *What’s the Fed doing in response to the COVID-19 crisis? What more could it do?* URL: <https://www.brookings.edu/research/fed-response-to-covid19/>.
- Buchanan, James M. (1976). “Barro on the Ricardian Equivalence Theorem”. In: *Journal of Political Economy* 84.2, pp. 337–342. URL: <https://www.jstor.org/stable/1831905>.
- Buchanan, James M. and Richard E. Wagner (1977). *Democracy in Deficit: The Political Legacy of Lord Keynes*. New York: Academic Press.

- Cecchetti, Stephen G and Robert W Rich (2001). “Structural Estimates of the U.S. Sacrifice Ratio”. In: *Journal of Business Economic Statistics* 19.4, pp. 416–427. ISSN: 0735-0015. URL: <https://doi.org/10.1198/07350010152596664>.
- Christiano, Lawrence, Martin Eichenbaum, and Sergio Rebelo (2011). “When Is the Government Spending Multiplier Large?” In: *Journal of Political Economy* 119.1. URL: <https://doi.org/10.1086/659312>.
- CRFB (Apr. 2020). *COVID Money Tracker: Policies Enacted To Date*. Committee for a Responsible Federal Budget. URL: <http://www.crfb.org/blogs/covid-money-tracker-policies-enacted-to-date>.
- Department of Finance (Mar. 2020). *Mycket allvarligt läge i världsekonomin och svensk ekonomi*. URL: <https://www.regeringen.se/pressmeddelanden/2020/03/mycket-allvarligt-lage-i-varldsekonomin-och-svensk-ekonomi/>.
- Diebold, Francis X. (1998). “The Past, Present, and Future of Macroeconomic Forecasting”. In: *JOURNAL OF ECONOMIC PERSPECTIVES* 12.2, pp. 175–192.
- Ekonomifakta (2020). *Statsskulden*. Accessed on 21 May 2020. URL: <https://www.ekonomifakta.se/fakta/offentlig-ekonomi/statsbudget/statsskulden/>.
- Enders, Walter (2014). *Applied Econometric Time Series*. 4th ed. Wiley.
- Federal Reserve (Mar. 2020). *Federal Reserve issues FOMC statement*. URL: <https://www.federalreserve.gov/newsevents/pressreleases/monetary20200315a.htm>.
- Fisher, Jonas D.M. and Ryan Peters (2010). “Using Stock Returns to Identify Government Spending Shocks”. In: *The Economic Journal* 120, pp. 414–436.
- Fleming, J. Marcus (1962). “Domestic Financial Policies Under Fixed and Under Floating Exchange Rates”. In: *IMF Econ Rev* 9, pp. 369–380. URL: <https://doi.org/10.2307/3866091>.
- Giavazzi, Francesco and Marco Pagano (1990). “Can Severe Fiscal Contractions Be Expansionary? Tales of Two Small European Countries”. In: *NBER Macroeconomics Annual* 5, pp. 75–111. URL: <https://doi.org/10.1086/654131>.

- Giordano, Raffaella et al. (2007). “The effects of fiscal policy in Italy: Evidence from a VAR model”. In: *European Journal of Political Economy* 23.3, pp. 707–733.
- Guajardo, Jaime, Daniel Leigh, and Andrea Pescatori (2014). “Expansionary Austerity? International Evidence”. In: *Journal of the European Economic Association* 12.4, pp. 949–968. URL: <https://doi.org/10.1111/jeea.12083>.
- Hall, Robert E. (2009). “By How Much Does GDP Rise if the Government Buys More Output?” In: *Brookings Papers on Economic Activity* 40.2, pp. 183–249. URL: <https://www.nber.org/papers/w15496>.
- HM Treasury (Apr. 2020_b). *Chancellor provides over £14 billion for our NHS and vital public services*. URL: <https://www.gov.uk/government/news/chancellor-provides-over-14-billion-for-our-nhs-and-vital-public-services>.
- (Mar. 2020). *Chancellor announces additional support to protect businesses*. URL: <https://www.gov.uk/government/news/chancellor-announces-additional-support-to-protect-businesses>.
- IMF (May 2020). *Policy Responses to Covid-19*. URL: <https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19?fbclid=IwAR16bWoviXt0AiAl9k4s748nG6KMvMAQ3hIkjezrMVpj8UhATw7uNES5dQwU>.
- Keynes, John Maynard (1936). *The General Theory of Employment, Interest, and Money*. New York:Harcourt: Macmillan.
- Lagerwall, Björn (May 2019). *Fiscal policy in a monetary policy perspective*. URL: <https://www.riksbank.se/globalassets/media/rapporter/ekonomiska-kommentarer/engelska/2019/fiscal-policy-in-a-monetary-policy-perspective.pdf>.
- Litterman, Robert B. (1979). “Techniques of forecasting using vector autoregressions”. In: *Federal Reserve Bank of Minneapolis Working paper.115*.
- Lucas, Robert E (1976). “ECONOMETRIC POLICY EVALUATION: A CRITIQUE”. In: *Carnegie-Rochester Conference Series on Public Policy* 1, pp. 19–46. URL: [https://doi.org/10.1016/S0167-2231\(76\)80003-6](https://doi.org/10.1016/S0167-2231(76)80003-6).

- Ludvigson, Sydney, Charles Steindel, and Martin Lettau (2001). “Monetary Policy Transmission Through the Consumption-Wealth Channel”. In: *Federal Reserve Bank of New York*, pp. 1–13.
- Milliken, David and Andy Bruce (May 2020). *Bank of England sees worst slump in 300 years as coronavirus bites*. URL: https://www.reuters.com/article/us-health-coronavirus-brita-in-boe/bank-of-england-sees-worst-slump-in-300-years-as-coronavirus-bites-idUSKBN22I3BV?feedType=RSS&feedName=topNews&utm_source=FeedyNews&utm_medium=Link&utm_campaign=Noticia.
- Mundell, Robert (1963). “Capital Mobility and Stabilisation Policy Under Fixed and Flexible Exchange Rat”. In: *Canadian Journal of Economics and Political* 29.4, pp. 475–485. URL: <https://www.jstor.org/stable/139336>.
- Muscatelli, Anton V., Patrizio Tirelli, and Carmine Trecroci (2004). “Monetary and fiscal policy interactions over the cycle: some empirical evidence”. In: *Monetary Policy, Fiscal Policies and Labour Markets*. Ed. by Roel Beetsma et al. Cambridge: Cambridge University Press. Chap. 10, pp. 256–264.
- OBR (Apr. 2020). *Coronavirus analysis*. URL: <https://obr.uk/coronavirus-analysis/>.
- OECD (Apr. 2020). *SME policy responses*. URL: https://read.oecd-ilibrary.org/view/?ref=119_119680-di6h3qgi4x&title=Covid-19_SME_Policy_Responses.
- Ramey, Valerie A. (2011_a). “Identifying Government Spending Shocks: It’s all in the Timing”. In: *The Quarterly Journal of Economics* 126.1, pp. 1–50. URL: <https://doi.org/10.1093/qje/qjq008>.
- (2011_b). “Can Government Purchases Stimulate the Economy?” In: *Journal of Economic Literature* 49.3, pp. 673–685. URL: <https://www.aeaweb.org/articles?id=10.1257/jel.49.3.673>.
- Savage, Maddy (Apr. 2020). *Coronavirus: Has Sweden got its science right?* URL: <https://www.bbc.com/news/world-europe-52395866>.
- Sims, Christopher A. (1980). “Macroeconomics and Reality”. In: *Econometrica* 48.1, pp. 1–48. URL: <https://www.jstor.org/stable/1912017>.

St. Louis Fed (2017). *The Recovery Act of 2009 vs. FDR's New Deal: Which Was Bigger?*
URL: https://www.stlouisfed.org/publications/regional-economist/first_quarter_2017/the-recovery-act-of-2009-vs-fdrs-new-deal-which-was-bigger.

Swedish National Debt Office (May 2020). *Företagsakuten – garantiprogram för företag*. URL: <https://www.riksgalden.se/sv/var-verksamhet/garantier-och-lan/foretagsakuten-garantiprogram-for-foretag/>.

Swedish Riksbank (May 2020). *Reporänta, in- och utlåningsränta*. URL: https://www.riksbank.se/sv/statistik/sok-rantor--valutakurser/reporanta-in--och-utlaningsranta/?fbclid=IwAR3rvuamTEt0NSKgFdHY6PfKyBxNFTaWXnhL7pO5Z5SrUUPjaYk3_oLQGxI.

Trading Economics (2020a). *United Kingdom Public Sector Net Debt to GDP*. Accessed on 21 May 2020. URL: <https://tradingeconomics.com/united-kingdom/government-debt-to-gdp>.

— (2020b). *United States Gross Federal Debt to GDP*. Accessed on 21 May 2020. URL: <https://tradingeconomics.com/united-states/government-debt-to-gdp>.

Wijnbergen, Sweder van and Christiaan van der Kwaak (2017). “Financial Fragility and the Fiscal Multiplier”. In: *Tinberg Institute Discussion Paper*. URL: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2375129.

8 Data Sources

The following links are gathered on 2020-05-14.

8.1 Sweden

Inflation: <https://stats.oecd.org/>

GDP: <https://stats.oecd.org/>

Tax revenue: <https://stats.oecd.org/>

Exchange rate: <https://fred.stlouisfed.org/series/CCUSMA02SEQ618N>

Unemployment: <https://fred.stlouisfed.org/series/LRHUTTTTSEQ156S>

Interest rate: <https://fred.stlouisfed.org/series/IR3TIB01SEQ156N>

Government spending: <https://stats.oecd.org/>,
<https://www.imf.org/external/datamapper/exp@FPP/SWE> and
<https://data.worldbank.org/country/sweden>

8.2 United Kingdom

Inflation: <https://stats.oecd.org/>
GDP: <https://stats.oecd.org/>
Tax revenue: <https://stats.oecd.org/>
Exchange rate: <https://fred.stlouisfed.org/series/USUKFXUKQ>
Unemployment: <https://www.ons.gov.uk/employmentandlabourmarket/peoplenotinwork/unemployment/timeseries/mgsx/lms>
Interest rate: <https://www.bankofengland.co.uk/boeapps/database/fromshowcolumns.asp?Travel=NIxAZxSUx&FromSeries=1&ToSeries=50&DAT=RNG&FD=1&FM=Jan&FY=2010&TD=11&TM=May&TY=2025&FNY=Y&CSVF=TT&html.x=66&html.y=26&SeriesCodes=IUQABEDR&UsingCodes=Y&Filter=N&title=IUQABEDR&VPD=Y>
Government spending: https://tcddata360.worldbank.org/indicators/govt.exp?country=GBR&indicator=354&viz=line_chart&years=1980,2024

8.3 USA

Inflation: <https://stats.oecd.org/>
GDP: <https://stats.oecd.org/>
Exchange rate: Not used as USA is a large economy.
Unemployment: <https://fred.stlouisfed.org/series/LRUN64TTUSQ156S>
Interest rate: <https://fred.stlouisfed.org/series/IR3TIB01USQ156N>
Tax revenue: <https://apps.bea.gov/iTable/iTable.cfm?reqid=19&step=3&isuri=1&1921=survey&1903=86>
Government spending: <https://apps.bea.gov/iTable/iTable.cfm?reqid=19&step=3&isuri=1&1921=survey&1903=86>

9 Appendix

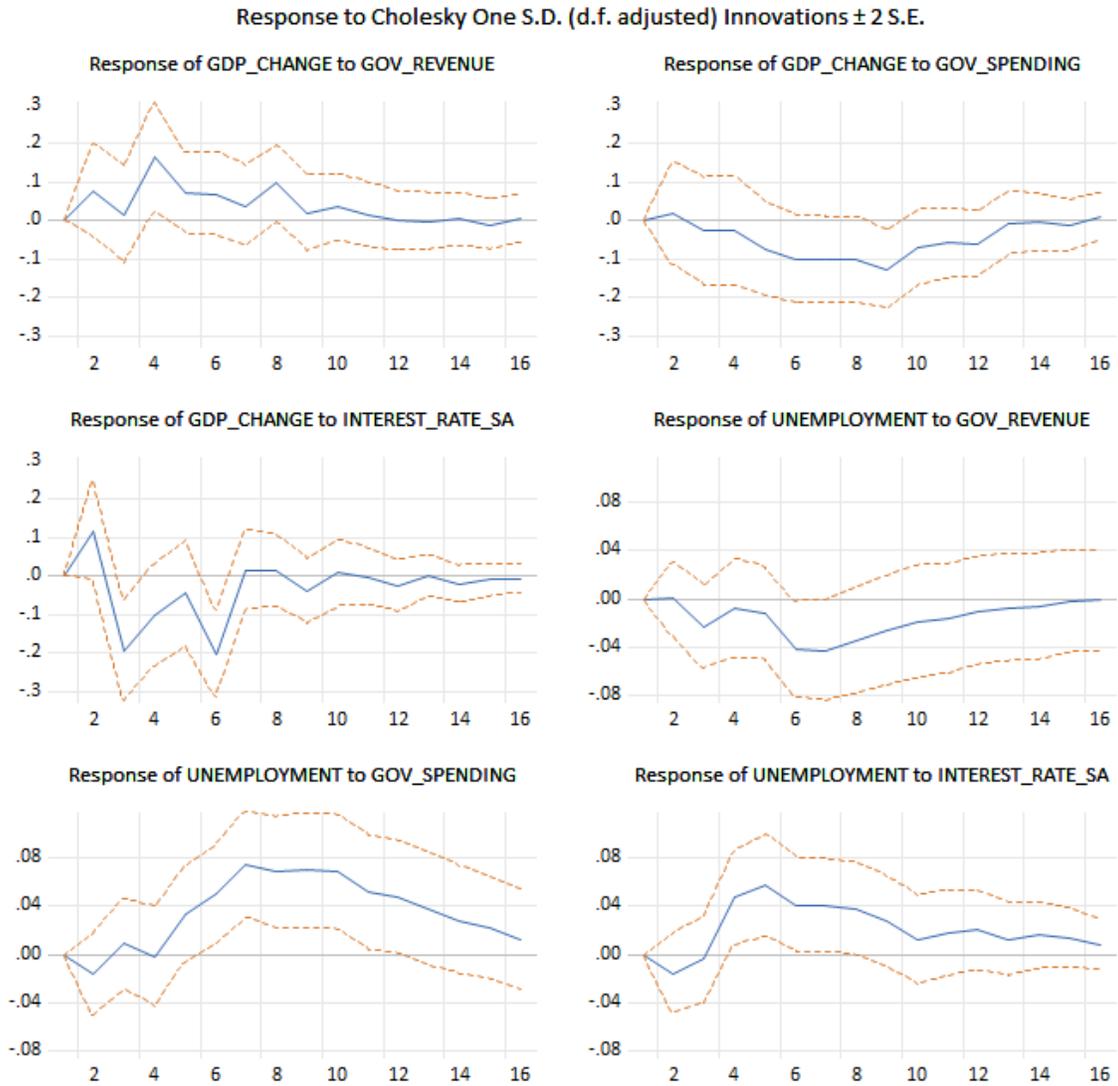


Figure 7: Additional information regarding the multipliers for Sweden:

The standard deviations are large, as expected, since we are measuring slow macro effects on a high-frequent, quarterly, basis. Intuitively, if the effect of something takes place over several years and we measure which effect it has on a timespan which is a fraction of that, the deviation from the effect is expected to be quite large. Furthermore, the standard deviation from this kind of model is generally high. This is why it is not a part of our result, which is in accordance with previous research.

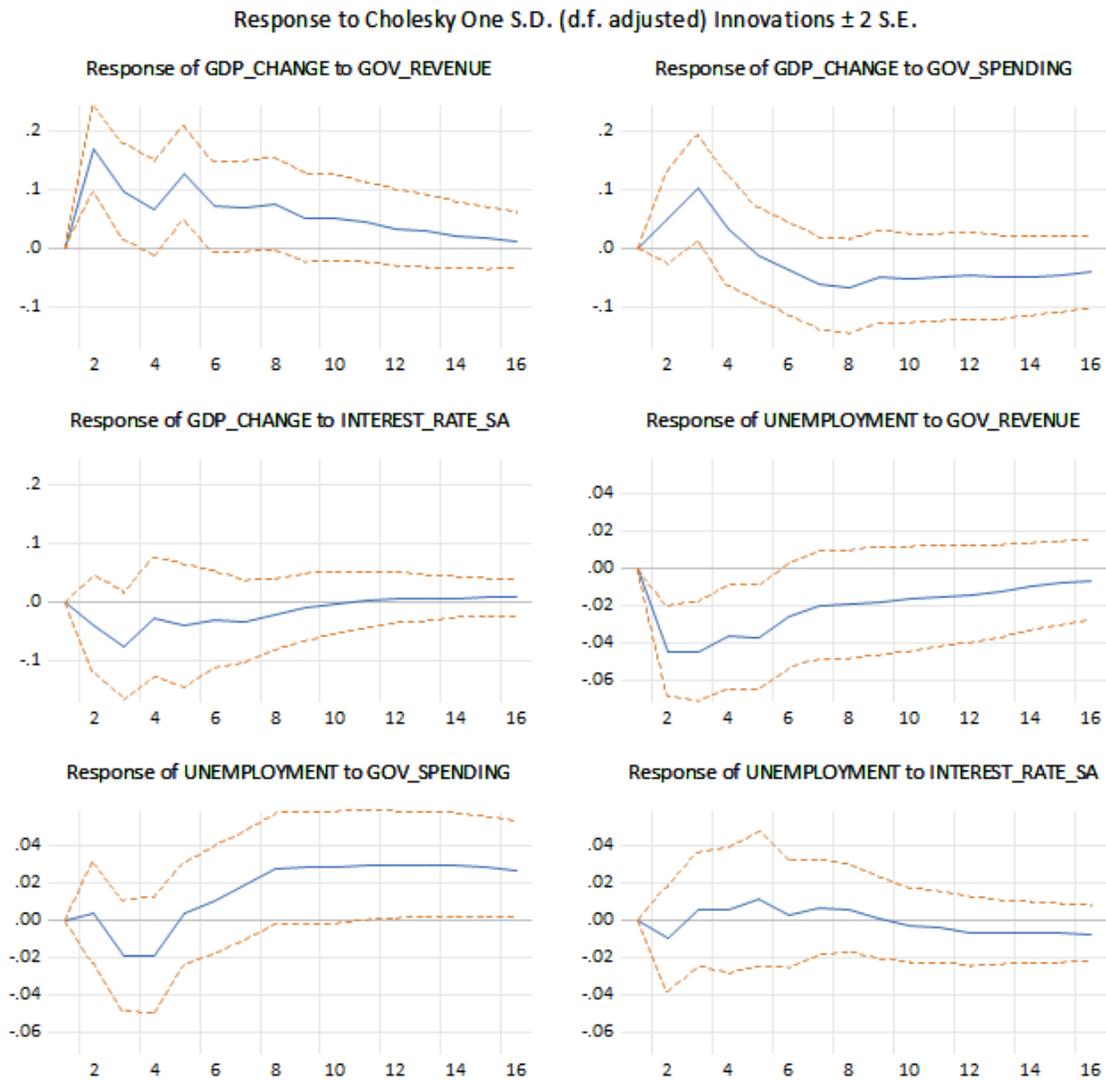


Figure 8: Additional information regarding the multipliers for the UK:

The standard deviations are large, as expected, since we are measuring slow macro effects on a high-frequency, quarterly, basis. Intuitively, if the effect of something takes place over several years and we measure which effect it has on a timespan which is a fraction of that, the deviation from the effect is expected to be quite large. Furthermore, the standard deviation from this kind of model is generally high. This is why it is not a part of our result, which is in accordance with previous research.



Figure 9: Additional information regarding the multipliers for the USA:

The standard deviations are large, as expected, since we are measuring slow macro effects on a high-frequency, quarterly, basis. Intuitively, if the effect of something takes place over several years and we measure which effect it has on a timespan which is a fraction of that, the deviation from the effect is expected to be quite large. Furthermore, the standard deviation from this kind of model is generally high. This is why it is not a part of our result, which is in accordance with previous research.