

# The effect of Quantitative easing on the modern economy

A comparison on economic crisis management using historical data

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## Abstract:

In this paper, using historical data of 17 western economies, I compare the performance of GDP recovery after crisis years when countries are using Quantitative Easing and when they are not. With the local projection method, I estimate an Impulse Response of the GDP five years after the crisis. I make two models: the first without Quantitative easing and the second with Quantitative easing. The results show that the use of Quantitative Easing will make the economy recover slower in the first two years after the crisis but recover more quickly in the years afterwards.

## Introduction

The history of central banking is long and wide. For ages, policymakers have thought about the best way to steer the economy in the right direction; the selling of foreign assets, being the lender of last resort or increasing interest rates, just to name a few. With the 2008 financial crisis, a new approach has emerged on the economic stage: Quantitative easing (QE). The idea is that the central bank of a country buys up long term securities on the open market to free up the balance sheets of commercial banks which will in turn fuel the economy.

In the past 20 years, central banks have struggled with deflation, low growth and a slow economy. Policy makers came up with a new form of monetary expansion which included freeing up the restrictive balance sheets of banks and corporations with cash. This financial injection, which 2008 Treasury secretary Henry Paulson called the “Bazooka”, would be the cure for all our economic ailments. Simple as it sounds, this policy is not without controversy. The 2008 financial crisis led to an all-time low of popularity for the world of finance. They were portrayed as criminals and thieves (and in some cases, they were) who took tremendous risks to gain profits. While the financial crisis was wreaking havoc on the streets and in family homes, the government helped the big corporations and banks with quick cash to survive the storm. But this raises a question, were these hugely sums of money really needed to make the economy recover? In the past we have managed our economic crisis without handing out money to the big corporations. Now more than ten years later, we are in the perfect position to look back on whether this is true. The banking sector has survived another blow but how did the citizens benefit? This comes to my main research question: *Will the economy of a country recover better when Quantitative Easing is used?*

In the short term, the stock market reacts positively on Quantitative Easing as there will be more money to be spent on the economy. In the hour after the announcement of QE, the volatility of the stock market will increase substantially (Corbet, Dunne & Larkin, 2019). The long-term effects are not so obvious, but it turns out that quantitative easing is a viable policy to stabilize the economy (Kapetanios et. al, 2012). To fully understand this topic, I will make use of two sub questions in this paper:

1. What has the effect been of Quantitative Easing on the GDP per capita compared to historical data?

2. How has the economy, historically speaking, recovered in general?

To make an assessment about the economy, GDP is usually used as an indicator for macroeconomic events. A lot of critique has been given on the use of this indicator as it does not take any other aspects of wellbeing into account but for the research of QE it is quite useful. For this paper I will make use of GDP per capita in a country.

In this paper, I use the historical data from 17 (Western) economies. With this data I will make two models using the 'local projections method' from Oscar Jordà. The 'local projections method' is an alternative of the VAR method. One model will give an indication on how the recovery of the economies is in general. The other model will show how this recovery differs when there is Quantitative Easing used to assist this recovery. In my results I find that the recovery of GDP after a crisis is slower with QE in the first years but recovers faster in the long run.

## Literature review

The literature Quantitative easing is not as extensive as one might think of such a popular policy tool. One of the reasons is that it is relatively hard to come up with solid results as the effect of Quantitative easing reaches so many layers in an economy that it is almost impossible to make a sound conclusion from the data. The following papers still try to give an image on how the policy works.

Kapetanios, Mumtaz, Stevens and Theodoridis conducted research on the quantitative easing program of the Bank of England conducted in 2009. In their research they made use of three different Vector Autoregressive (VAR) models; a Bayesian VAR, a structural VAR and a time-varying parameter VAR. They found that, in the first round of QE, the real GDP increased with 1,50% points and the CPI with 1,25% points. The results of the Bayesian VAR model suggested that the GDP would have decreased even more if QE was not implemented. The structural VAR and the time-varying parameter both supported this finding.

Krishnamurthy and Vissing-Jorgensen (2011) looked at the effects of Quantitative easing on interest rates. They came to two conclusions. The first one being that because of the complexity of Quantitative easing and the multiple levels it reaches, it is insufficient to look only at the treasury rates when estimating the effect of QE. The second thing that they found is that some types of assets have a bigger effect on the outcome of QE than others. For instance, the mortgage-backed securities were essential for lowering corporate yields of these securities.

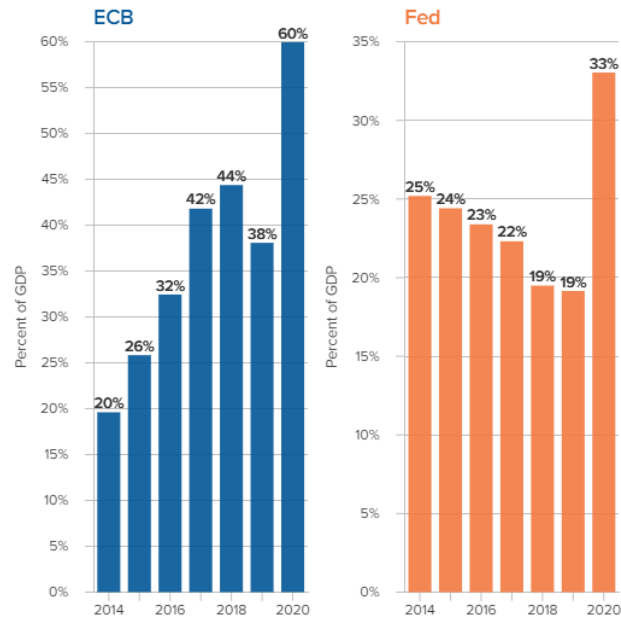
Ryou, Baak and Kim (2019) researched the effect of the Quantitative easing program of Japan on the economies of Japan and South Korea. The paper looks at whether the announcement of the program had a significant effect on the Japanese and Korean economy using a qualitative VAR model. They found that the Quantitative easing policy has worked well in increasing the CPI in the long run. But this policy also had the effect of depreciating the Yen.

Fratzscher, Duca and Roland (2013) investigated the effect that the QE program of the Federal Reserve had on other economies. They found that economies reacted differently on the set of QE rounds. The first round of QE had the result that neighboring economies were more in line with the economy of the US while this was the opposite with rounds 2 and 3 of QE. They explained this difference in responses by the fact that during a timeframe where “macroeconomic uncertainty is low and the US outlook is positive, QE announcements are

transmitted with stronger intensity to portfolio flows outside the US” (Fratzscher et al., 2013).

One thing that comes out of the literature is that there appears to be one consensus in how difficult it is to analyze the effects of the policy. To start off, the policy itself is only implemented in times of crisis so it cannot be compared to other periods where there was no QE program. Another issue is that the effect of QE is differs per circumstance that it is implemented. Martin and Milas (2012) confirmed that the governments bond rates go down with QE, but the magnitude of this effect is smaller when bond rates are already low and that the initial wave of QE has a much larger effect than the subsequent purchases. The effect of QE is therefore difficult to visualize by a graph or a change in percentages. Adding to this, the exact time when the QE has a significant effect is not entirely clear. The timing of QE depends on the circumstances in which it is implemented because QE influences multiple layers of the economy and whether these layers hand over their assets to the next layer. For example, if a commercial bank sells its bonds in an asset purchasing program, the bank may decide to wait a few months before investing this new capital. Because of this uncertainty, it is unclear how long it takes for QE to take effect or even at all.

The idea of Quantitative Easing is that the commercial banks should give more loans and the corporations should invest more. In times of crises these commercial banks and corporations tend to do the opposite. They “flee” to safe assets and try to wait out the storm and start investing again in better times. When the central bank implements Quantitative Easing, they buy in large amounts these safe governmental bonds and securities, increasing their balance sheets enormously as can be seen in graph 1. These banks do this on such a big scale that the price of these safe assets go up because of a decrease in supply. When the price is higher on those safe assets, it will be no longer profitable for these commercial banks to invest in them. The idea behind this is that the banks will no longer have the option to “stall” their capital in safe investments but must put their money at risk in the economy which will result in growth. The question here is, however, if this is indeed the case.



Graph 1: Because of the Corona Crisis, the ECB and the Federal Reserve have made drastic changes to their asset purchases. This is clearly visible in their balance sheets.

To fuel the economy, there are a few things you can do, but the main idea is that the wheels of production and consumption keep on turning. Giving out money to everyone in society is a handy and quick way to solve consumption issues but this may lead to a higher inflation rate. Another idea is to buy foreign currency which will decrease the value of our own currency, resulting in higher exports and therefore a higher production. However, this works counterproductive for your neighboring countries which could lead them to protest this type of monetary policy. Which was exactly the case when Switzerland raised its foreign currency and was labeled a currency manipulator by the USA (Jordan, 2012). So, there should be another way that is more smoothly than the previous instruments. After the burst of the Japanese real estate market, the economy was in great peril and needed a push in the right direction. At the start of 2001, the Bank of Japan (BoJ) came up with a new solution to their deflation problem (Voutsinas and Werner, 2011). Under the name program name 量的金融緩和, *ryōteki kin'yū kanwa*, the BoJ began buying assets from corporations and commercial banks. The reasoning behind this is as follows. When an economy is not growing enough, a way of creating a new source of liquidity is increasing the supply of money. Central banks do this by buying bonds and securities from commercial banks or larger corporations. On the balance sheet of commercial banks and corporations are numerous assets. Some of these assets are more liquid than others. The idea behind Quantitative Easing is that these banks

and corporations are stuck with safe assets like governmental bonds that are due in roughly 10 years. In order to increase the liquidity of the economy, the central bank buys these assets from the commercial banks and corporations. This way the balance sheet of these banks and corporations has less illiquid assets and more liquid cash. The commercial banks are then able to give out more loans at a lower interest rate than before, fueling the economy.

There are numerous ways to assess these macroeconomic events. But since the publication of Christopher Sims' (1980) enormously influential paper *Macroeconomics and Reality*, the Vector Autoregressive model (VAR) has been the go-to tool for analyzing macroeconomic effects in the past 40 years. Studying macroeconomics can become quickly complex due to the large number of (unknown) factors that are influencing the outcome. In the VAR model, each variable that is used is a linear function of lags of itself. It is a useful tool to use if two time series influence each other. The variables of the VAR model are bi-directional. This is because all the variables influence each other. In 2005, there was a new method proposed by Oscar Jordà named the 'local projection estimator'. In the literature, VAR and local projections are numerously compared and the main consensus is that the VAR is less biased for larger datasets and the local projections approach for smaller datasets (Brugnolini, 2018). Because the dataset that I will be using in this paper is relatively small, I will opt for the local projection approach. Even though both models give a relatively good representation of the effects of QE, one of the critiques on QE research is that almost all studies use these two methods, making the scope of different views on the topic quite limited.

## The Data

The dataset that I will be using for this paper is the Macroeconomic History database of Oscar Jordà, Moritz Schularick and Alan Taylor. The dataset contains numerous financial historical data from a group of certain western countries and is a panel dataset. The following countries are present in the dataset: USA, UK, Belgium, Denmark, France, Germany, Italy, Netherlands, Norway, Finland, Ireland, Portugal, Spain, Sweden, Switzerland, Canada, Japan and Australia. The historical data starts from 1870 to 2017. The data is in years. Even though this dataset is quite extensive, there are still some missing values. For instance, for most countries the GDP is missing during 1940-1945 due to the second world war. Also, the financial information before 1900 can have some gaps.

The variables of interest for my research are the real GDP per capita, CPI, whether there is a crisis and the governmental bond rate. Most of them are straight forward but the crisis variable needs some special attention as it is dubious what a crisis is. In their database, Jordà Schularick and Taylor have conducted extensive research on whether a country was hit by a crisis or not in a particular year. Usually, these crisis years are coinciding with a great economic downturn.

Lastly, we have the Quantitative Easing (QE) variable. This variable states whether a country was undergoing an asset purchasing program at the time. In table 1 you can see the years in which the countries of the dataset were doing QE.

Country	Years of Quantitative Easing
Australia	2020
Belgium	2014 – 2018
Canada	2020
Finland	2014 – 2018
France	2014 – 2018
Germany	2014 – 2018
Ireland	2014 – 2018
Italy	2014 – 2018
Japan	2001 -2004 & 2014 – Now
Netherlands	2014 – 2018
Norway	2014 – 2018
Portugal	2014 – 2018
Sweden	2015 – 2021
Switzerland	Did not use QE



UK	2009 – 2016 & 2020
USA	1932 & 2008 – 2014

Table 1.

There are a few things to note on the data on this table. The first is that at first glance it seems that most countries had the same period of QE, but these countries are part of the EU which is under jurisdiction by the ECB. So, they all have the same monetary program. Another thing to note is that even though I have included the years in which the countries have conducted QE, the macro historical dataset only goes till the year 2017. So, in this case, Canada and Australia did not make use of QE in the dataset. Also, Switzerland does not make use of QE as the country is not big enough for QE to have a significant effect according to the Swiss National bank. The US officially used QE for the first time in 2008 to combat the financial crisis. But in the aftermath of the stock market crash of 1929, the fed bought huge sums of governmental bonds from private and public investors. Even though this is not named as QE, in hindsight this could be classified as such (Bordo & Sinha, 2016).

Finally, we have the case of the UK. In all the countries from the dataset, when QE is announced by the central bank, they increase their purchases of governmental bonds and other securities substantially in the first three months while gradually increasing it in the following years. This however is not the case with the UK as they had only a few moments of purchasing, namely: 2009, 2012, 2016, March/June/November of 2020.



Graph 2: The bond purchases of the Federal Reserve in millions of Dollars

Let's take a look at the USA for example, you can see a big increase in bond purchases in 2008, 2011 and 2013, while the programme was diminishing its purchases after 2014.

Because most countries have conducted their QE programmes in this fashion, I will use the QE variable as the length of the purchasing programme. The UK would then be an outlier with only 2009, 2012 and 2016 with QE. To tackle this problem, I have chosen to look at these years as an extended QE programme, so the QE variable for the UK will be from 2009 till 2016.

## Methods

In this paper, I will make use of the local projections approach by Oscar Jorda which is a certain method to estimate an Impulse Response Function (IRF). First, I will briefly summarize how local projections work and then I will elaborate on how I will use this in the paper. The goal of IRFs are to estimate the multiplier of  $Y_{t+H}$  with respect in change in  $X_t$ . The autoregressive coefficients are estimated at each 'H' step ahead. The dependent variable is then regressed on itself from the previous equation. When computing the confidence interval, the SEs of the coefficients are used. All time periods after shock  $t$  have a regression function of their own.

$$\left\{ \begin{array}{l} y_{t+1} = B_1^1 y_t + B_2^1 y_{t-1} + \dots + B_p^1 y_{t-p} + e_{t+1}, \quad e_{t+1} \sim MA(1) \\ y_{t+2} = B_1^2 y_t + B_2^2 y_{t-1} + \dots + B_p^2 y_{t-p} + e_{t+2}, \quad e_{t+2} \sim MA(2) \\ \vdots \\ y_{t+H} = B_1^H y_t + B_2^H y_{t-1} + \dots + B_p^H y_{t-p} + e_{t+H}, \quad e_{t+H} \sim MA(H) \end{array} \right.$$

Brugnolini (2018)

For this paper, I will make use of two models. The first model is a simple regression using the year of crisis for a country as the shock variable.

$$Y_t = \alpha_{t-1} + \beta_{t-1} * Real\ GDP + \gamma_{t-1} * CPI + \delta_{t-1} * CrisisJST + \varepsilon_t$$

Real GDP is the real GDP per capita in each country, CPI is the Consumer Price Index, CrisisJST is a dummy variable containing whether a country was in crisis in that year and  $a$  is a constant. The results of this model will give an image on how the countries in the data set have coped with crises in general.

For the second model, I simply add the variable QE in the equation. The formula would then look something like this:

$$Y_t = \alpha_{t-1} + \beta_{t-1} * Real\ GDP + \gamma_{t-1} * CPI + \delta_{t-1} * CrisisJST + \eta_{t-1} * QE + \zeta_{t-1} * QE \\ * CrisisJST + \varepsilon_t$$

This model has another dummy variable named QE which contains whether a country was implementing Quantitative Easing in that particular year. So in this model, QE is controlled for.

***The results***

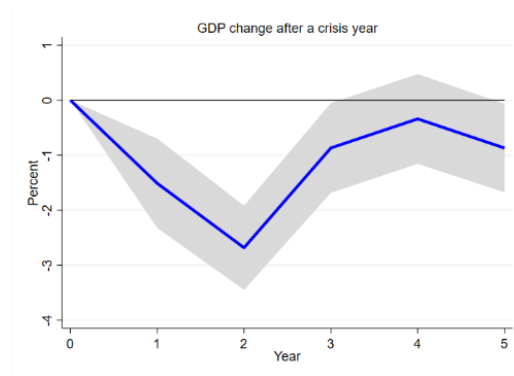
*The first model*

First off, we are going to look at the GDP. To be more specific, the variable of interest is the GDP per capita (GDPpc) after a crisis year. Normally when there is a crisis you would expect that the GDPpc would drop and recover slightly afterwards when the years go by and the economy recovers. This is also what I have found in my results. The tables that I show in my results are the coefficients of every variable of the regressions. So looking at table 2, we can see that at first the GDPpc decreased with 1,511 percentage points on average after a crisis year in the first lag. Furthermore, it keeps on decreasing to its lowest point after two years at 2,682 percentage points lower in GDPpc than before a crisis year. The p-value of Year 1 is lower than 0.01 and the p-value for Year two is lower than 0.001. The p-value of the other years is higher than 0.05.

Year	1	2	3	4	5
Lag GDP	0	1	2	3	4
crisisJST	-1,511**	-2,682***	-0,868	-0,339	-0,869
Standard error	(-0,494)	(-0,465)	(-0,496)	(-0,496)	(-0,489)
N	2540	2522	2504	2486	2468

Table 2.

Looking at graph 3, we can see table 2 visualized. The GDP starts at 0 (on-impact effect) and drops to -1,511 in the first year. When looking in the years after the crisis we can see a clear free fall in the first two years and a short recovery in the years from 3 to 4 years after the crisis. In the 4th year the economy has even fully recovered and is back where it started before the year of the crisis. After the 8th year, the economy falls back again. As we can see in graph 3, the economy is slowly and steadily recovering after a crisis year. In the end, the economy still goes down, but this could maybe be the case of a falling business cycle.



Graph 3.

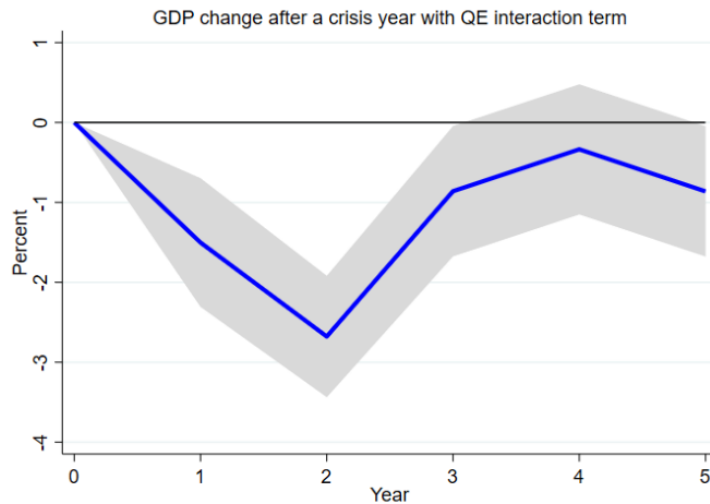
*The second model*

Now we will look at another model, but this time I add an interaction term of the dummy variable QE and the year of crisis variable. The results are displayed in table 3. In the first year after the crisis and starting at 0, the GDPpc drops with 1,511 percentage points and lowers to its minimum at -2,689 percentage points in year 2. After year 2, there is a recovery to -0,358 percentage points above the initial year after the crisis in the 4th year. After the 4th year, the GDPpc lowers again just as in the first model. The values of the first two years are the same as in the first model but the values of year 3 to 5 are different. The P-value of the first year is lower than 0.01 and the P-value for the second year is lower than 0.001. The P-value of the third year is lower than 0.05 while the P-value of the other years is higher than 0.05.

Year	1	2	3	4	5
Lag GDP	0	1	2	3	4
crisisJST	-1,511** (-0,494)	-2,689*** (-0,466)	-0,877 (-0,495)	-0,358 (-0,505)	-0,885 (-0,490)
N	2540	2522	2504	2486	2468

Table 3.

Graph 4 the second model is graphically displayed. Here we can see that the economy entered a free fall in the years after the crisis. Just like in the first model, the GDPpc recovers fast in the third year and then slowly progresses to its peak in the 4th year where it declines again.



Graph 4.

In table 4 the interaction term of Quantitative Easing and CrisisJST is displayed. Here we can see the coefficients of the interaction term of all the 5 lags. All the coefficients have a P-value higher than 0.05.

Year	1	2	3	4	5
Lag GDP	0	1	2	3	4
QE_crisisJ~m	-0,815 (-0,796)	-0,213 (-0,649)	-0,352 (-0,593)	0,660 (-0,462)	0,341 (-1,149)
N	2540	2522	2504	2486	2468

Table 4.

### *The differences in the models*

The first two models give us an image on how the GDP differs over the years after a crisis. Let us now take a look at the effect of QE on the crisis. In order to estimate the effect of Quantitative Easing on the economy, I will add the coefficients of the interaction term and that of the CrisisJST variable. In table 5 the results are shown.

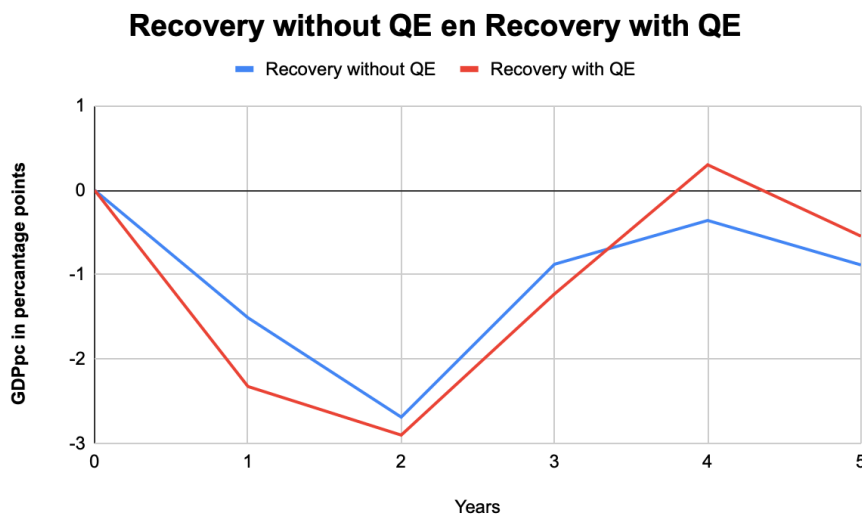
	CrisisJST	QE*CrisisJST	CrisisJST + QE*CrisisJST
Year 1	-1,511	-0,815	-2,326
Year 2	-2,689	-0,213	-2,902
Year 3	-0,877	-0,352	-1,229
Year 4	-0,358	0,660	0,302
Year 5	-0,885	0,341	-0,544

Table 5.

As can be seen in table 5, the addition of CrisisJST and the interaction term  $QE \cdot \text{CrisisJST}$  is presented on the right. In the first year after the crisis, the GDPpc would decrease with 2,326 percentage points compared to the year of crisis. In the second year it would decrease further down to -2,902 percentage points. From the second year on, the economy would steadily recover and in the 4<sup>th</sup> year, the GDP would be positive at 0,302 percentage points. Finally, in the 5<sup>th</sup> year it would drop down again to -0,544 percentage points compared to the crisis year.

At first glance, when the Quantitative Easing program is implemented to combat a crisis, the GDP tends to decrease more in the short term but recovers better in the long run. As can be seen in graph 5 where the results are visualized.

To sum up, the first three years the economy recovers slower and is worse off when QE is implemented. The GDPpc in the first year is 0,815 percentage points lower when the asset purchasing programme is active. But this difference in performance changes over the years. Eventually the GPDpc will be 0,660 percentage points higher in the fourth year and 0,341 percentage points higher in the fifth year because of the use of QE.



Graph 5.

### ***Conclusion and Discussion.***

In this paper, I have gone over the literature of Quantitative Easing and briefly explained the methods that could be used in macroeconomic research. In the first model, it becomes clear that the economy slowly recovers after taking a hit in the crisis year. The second model in which the interaction term is added gives the same image. When looking at the coefficients however, a different outcome emerges. The years where QE is implemented seemed to recover slightly slower in the first years than when there was no QE program active. The reason for this outcome could come from different scenarios. For example, the crises of the past 20 years could be more severe than the crises that happened before.

However, there seems to be a point of interest where the macroeconomic policies of the past may perform better than QE. The arguments for QE during the financial crisis in 2008 seemed to be to save commercial banks and private companies from bankruptcy. So maybe the stakes are higher now than they were before. The loss in recovery in the short term could be seen as collateral damage, needed to save the economy as a whole. Just simply going back to the instruments that were used earlier may have a better effect on the economy, but this does not include the fact that major institutions could go bankrupt.

Another explanation for the outcome could also be explained by some caveats in this paper. The first one, being that the dataset is limited to years only. It would be better if the data was in quarterly data in order to match the timing of the Asset purchasing programs of the central banks. The second caveat is that the QE variable has some serious issues. The timing of QE is hard to pin down as the effect could be felt during the time of the announcement of the program or many years later. So, the dummy variable of having only one year under influence of QE is problematic. Lastly, the present time could be vastly different economically speaking than the past. The reason that the central banks are not as effective in achieving growth with their monetary instruments as previously may have underlying reasons. For instance, it could be even the case that the economy would have done it even worse if QE was not implemented and that QE has dampened the fall rather well. This notion could be worked on in further research.

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