A critique of quantitative easing by the Federal Reserve System and the European Central Bank

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Abstract: *The application of quantitative easing tools by certain central banks has been and continues to be the subject of professional debate. Therefore, this paper aims to assess an alternative scenario to the use of quantitative easing. We have used counterfactual analysis to estimate GDP growth in the US and in the Eurozone for the period during which quantitative easing was implemented, i.e., since 2009 in the US and since 2015 in the Eurozone. We used a vector autoregression (VAR) model for the analysis. We concluded that, in retrospect, the use of quantitative easing appears to be unwarranted. While there was slightly higher GDP growth in the Eurozone than there would have been without quantitative easing, there was no smoothing of the economic cycle. At the same time, returning to the inflation target took a relatively long time. In the US, quantitative easing prevented an initial slide into a deep recession and smoothed the economic cycle over the medium term. Overall, however, quantitative easing has mostly had a negative effect. One major negative is that when this instrument is used over a long time period, economic subjects gradually come to see it as a standard tool. Furthermore, inflation, central banks' main objective, did not rise rapidly over the period in question; on the contrary, over the long term, quantitative easing has become one of the factors behind today's higher inflation rates. An excessive monetary supply has created imbalances in the financial markets and has been a factor in price bubbles in the stock, bond, and property markets. Last but not least, it has increased moral hazard for governments, which have gone further into debt without difficulty. At the same time, central bank independence was violated, which has caused an abnormal increase in the central banks' balance sheets. We, therefore, recommend that this unconventional monetary policy instrument should only be used in the short term for emergency situations as a clear central bank response to stabilize the economy.*

Keywords: *Quantitative easing, the Federal Reserve System, the European Central Bank.*

JEL Classification*: E37, E58, E52.*

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Introduction

Quantitative easing became an important tool for many central banks during and after the financial crisis. Quantitative easing was intended to support economies' growth, avoid deflationary developments, and dampen negative shocks arising from financial market problems by increasing the money supply, supporting credit and investment, and influencing very low interest rates.

Before the outbreak of the economic crisis in September 2007, the federal funds rate was 5.25%. Concerns about an economic crisis that could turn into a depression caused the Federal Reserve System (FED) to lower the rate to 0.08% in December 2008 and subsequently to 0.05% in December 2009. However, this measure was not sufficient, given the seriousness of the situation. The FED feared that the United States of America would fall into a major economic crisis that would have the same or worse consequences as the depression of the 1930s. The interbank markets, which had been an effective means of distributing liquidity up to that point, stopped functioning.

For several years, the European Central Bank (ECB) resisted the American model of quantitative easing, primarily because applying quantitative easing would violate European restrictions on financing government debt through central banks. On 16 December 2008, interest rates in the US were close to zero. At the same time, the FED launched its first phase of quantitative easing by announcing its commitment to purchase approximately USD 1 trillion worth of securities. By contrast, the Eurozone's primary interest rate was 2.5% during the same period, and the ECB only lowered it to 1% over the next five months. After that, interest rates were decreased to zero and, after difficult political negotiations, quantitative easing was introduced in 2015, with the ECB announcing it on 22 January 2015. The ECB thus introduced this unconventional monetary policy tool more than six years after the FED introduced quantitative easing (Fatás, 2018).

Economies typically go through cyclical periods with pressures towards overheating or, conversely, pressures for these economies to fall into recession. Central banks attempt to minimize these fluctuations. Other external influences (e.g., natural disasters, wars, global influences, pandemics, etc.) that are not related to a country's monetary or fiscal policy also affect the economy. Nevertheless, it still remains central bankers' task to respond as effectively as possible to a given situation, both while actually exercising greater power and after this period has ended (Greenspan, 1996). Central banks have been successful in this, with economies quickly and rapidly returning to a growth phase.

The period of quantitative easing implementation is an interesting period when looked at in the context of how major central banks implement practical monetary policies in response to extraordinary economic or financial shocks. Major central banks began using an instrument that had not been previously needed for implementing monetary policies anywhere in the world. For this reason, the motivation for our research was to discover how economies would have evolved if central banks had not used the instrument of quantitative easing at all.

Based on the above, this paper aims to evaluate an alternative scenario to the use of quantitative easing, specifically by means of counterfactual analysis of GDP estimates in the US and the Eurozone.

This paper's main contributions include: i) a discussion of the theoretical and practical aspects of monetary policy implementation and what these approaches looked like after the financial crisis; ii) a backward-looking estimation of GDP's development without the use of quantitative easing by the FED and the ECB; and iii) recommendations to monetary policy makers regarding responses to other significant economic and non-economic shocks.

1. Theoretical background

One of the main economic indicators used to express an economy's performance is gross domestic product (GDP). This undergoes different cycles over time. The shortest fluctuations in real output are neither significantly relevant nor very indicative for central bankers. Modern central banks are primarily concerned with long-term stability. For this purpose, they use what are called conventional monetary policy instruments, the most important of which is setting monetary policy interest rates. They use these to influence market interest rates so that their values and changes help achieve price stability, central banks' primary objective. In doing so, the central banks specifically aim to smooth economic cycles – in other words, to achieve sustainable long-term economic growth.

Empirically, this has been a reliable way to influence interbank liquidity and the supply of money to economic entities in the financial market. It is intended to provide sufficient monetary stimulus to the economy during downturns, to limit inflationary pressures during economic growth, and to ensure that money markets function soundly (Smaghi, 2009).

In contrast, quantitative easing (QE) is defined as an unconventional form of monetary policy in which a central bank purchases long-term securities from the open market and from governments directly in order to boost economic growth and bring inflation down to its inflation target. This is done by increasing the money supply and lowering interest rates, which increases the availability of credit to economic entities. These, in turn, increase their consumption and investment, thereby supporting the economic growth.

Several central banks have resorted to unconventional forms of monetary policy in the past. This raises many questions about quantitative easing's objectives, benefits, effects, and real impacts on various aspects of a country's economy and, where appropriate, on other countries' economies. Specific examples of countries whose central banks resorted to quantitative easing in response to the financial crisis of 2007–2008 include the US, the UK, Japan, and the Eurozone countries as represented by the European Central Bank.

The central banks of these countries first responded with a range of traditional monetary policy tools, notably interest rate cuts and emergency liquidity programs. Given their lack of effectiveness, the banks further responded by significantly expanding their monetary base, i.e., quantitative easing. However, each central bank's quantitative easing program was different. The Bank of Japan and the European Central Bank proceeded to bank lending and later bond purchases, while the European Central Bank, the Federal Reserve, and the Bank of England focused mainly on bond purchases (Fawley & Neely, 2013).

It can be assumed that quantitative easing acts through certain transmission mechanisms, which allow quantitative easing to act on the economy via different channels.

One of these possible channels is the portfolio re-balancing channel, which is based on the assumption that money and financial assets are imperfect substitutes, where central bank asset purchases lead to asset price increases based on how households and investors respond to this portfolio change. This results in higher prices and lower returns (Bernanke et al., 2004; Christensen & Rudebusch, 2012; Joyce et al., 2011). Specifically, Krishnamurthy and Vissing-Jorgensen (2011) analyzed quantitative easing's impact on the US bond market. Their study suggests that quantitative easing has a significant and persistent effect on interest rates, with evidence of action through several different channels. The authors confirmed more pronounced effects in long-term bond markets. The effects of this mechanism can also be assumed when looking at the exchange rate, where the demand for both domestic and foreign assets increases along with exchange rate depreciation (Schenkelberg & Watzka, 2013).

The signaling channel is mainly associated with central bank communication and is primarily used because of time inconsistency in order to influence expectations about future economic developments, and it is conducted mainly through verbal interventions (Christensen & Rudebusch, 2012; Gern et al., 2015; Krishnamurthy & Vissing-Jorgensen, 2011). Again, a link to exchange rates can be found here, where prevailing low interest rates in a particular economy can lead investors to seek assets with higher yields in other economies, causing exchange rate depreciation (Delivorias, 2015). This has also been addressed by Kenourgios et al. (2015). Their results, based on high-frequency data from December 2009 to December 2012, suggest unconventional monetary policy actions by one central bank impact not only domestic currency but also the currencies of other countries, thus confirming the existence of a signaling channel in foreign exchange markets and highlighting the existence of potential profit opportunities related to changes in volatility between currencies. The potentially significant macroeconomic effects of asset purchases by the European Central Bank was also confirmed by Sahuc (2016). He stressed the importance of forward guidance as a signaling function and the approach of keeping rates low over the long term and explaining them to the public. He reported an effect on output growth and inflation of 0.2% and 0.1% in 2015 and 0.6% and 0.6% with the rate being maintained over the following year.

The liquidity channel represents quantitative easing's effect via an increase in bank

reserves and hence available liquidity. This allows banks in the economy to lend more or to invest in securities. It temporarily improves the bargaining power of sellers in the target securities market due to the presence of the central bank as a buyer, which leads to a reduction in the liquidity premium, especially for the duration of quantitative easing (Christensen & Gillan, 2022; Duffie et al., 2007; Joyce et al., 2011). The improvement in banking sector liquidity can also be expected to have a limited effect on funding new credit and, thus, on the economy (Hausken & Ncube, 2013).

Another example is the risk premium channel, which quantitative easing reduces. The assumption of such an effect is based on the fact that the amount of the risk premium depends on the amount of certain assets held by investors. The central bank's purchase of the assets in question reduces their volume, thereby reducing the risk premium (Krishnamurthy & Vissing-Jorgensen, 2011; Krugman et al., 2012).

As already mentioned, there is also the question of whether and how quantitative easing can affect other economies. The transmission of quantitative easing's effect from one market to another was addressed by Shogbuyi and Steeley (2017). Specifically, they examined quantitative easing's effect – as implemented by the Federal Reserve and the Bank of England – on the volatility of US and UK stock market returns within individual markets by using a multivariate GARCH model. The authors drew on portfolio equilibrium theory and used data from 2004 to 2014. Their results suggest a significant impact on stock markets, with quantitative easing operations calming the stock markets – and not only in the countries that implemented quantitative easing. The international effects of quantitative easing were discussed by Bluwstein and Canova (2016), who examine the use of unconventional monetary policy tools by the European Central Bank and their impact on nine European countries that have not adopted the euro. They point to differences in the countries studied concerning the international transmission of monetary policy decisions. Their results indicate that inflation was induced by unconventional monetary policy instruments, with output being primarily affected by conventional instruments. A significant international effect was also highlighted by Neely (2015), mainly due to an effect on expected real and nominal long-term US bond yields, long-term foreign dollar yields, and the value of the dollar.

An important question is the real impact quantitative easing has on a given economy, especially on its macroeconomic variables. Quantitative easing's real impact on macroeconomic variables has been discussed by Kapetanios et al. (2012). Using a VAR model, they examined the effects of the Bank of England's quantitative easing in 2009–2010. Their results suggest that without quantitative easing, there would have been a larger decline in real GDP (by 1.5%) and inflation (by 1.25%), thus confirming the effectiveness of QE during the financial crisis. Quantitative easing's macroeconomic effects have also been confirmed by the European Central Bank (2015–2017), which found 0.4% appreciation in the euro, 0.2% increase in real GDP, and 0.3% increase in prices (Priftis & Vogel, 2017). Furthermore, Gertler and Karadi (2013) quantified the impact large-scale asset purchases have had on the US economy. Using a macroeconomic model, they attempted to explain the effects that various quantitative easing programs undertaken by the Federal Reserve had on macroeconomic indicators. The authors examined the impact of purchases of different types of assets, namely government bonds and private securities. Their results suggest a positive effect on GDP and inflation, while pointing out that these depend on specific circumstances, including the existence of restrictions on arbitrage in private intermediation and interest rate setting.

Similarly, Chen et al. (2012) quantified the effect of large-scale asset purchases on the US economy. However, according to their model, the effects on GDP and inflation are modest, despite having a persistent impact on GDP growth. According to the results of their model, they do not predict an increase in GDP of more than 0.3%.

It is important to add that Fabo et al. (2021) find that central bank papers find quantitative easing to be more effective than academic papers do because they report larger effects of quantitative easing on output and inflation.

2. Research methodology

The above indicates that major central banks have been using quantitative easing to a large extent for several years. It is, therefore, appropriate to try to determine what real impact quantitative easing has on macroeconomic variables,

in this case using changes in GDP growth. It is clear that despite the delay, the effects of these central bank interventions have been felt in the economy. Is central bank monetary policy effective when it uses unconventional instruments? What can be determined from the data collected over the last few years is an estimate of quantitative easing's impact on the real economy by analyzing the data with an appropriate econometric model. A vector autoregression (VAR) model, which is an appropriate and flexible model for multivariate time series analysis, can be used for estimation. VAR models have proven to be particularly useful for describing the dynamic behavior of economic financial time series and for forecasting – providing better predictions than the results from univariate time series models and sophisticated simultaneous equation models. In addition to data description and forecasting, VAR models are also used for structural inference and policy analysis.

In structural analysis, certain assumptions are made about the causal structure of the data under study, and the resulting causal effects of unexpected shocks are summarized. These causal impacts are typically summarized using impulse response functions and forecast variance decomposition. Thus, vector autoregression captures the relationship between multiple variables, including how it changes over time, with each variable having its own equation. This equation includes the lagged values of the variable, the lagged values of the other variables in the model, and the error term.

The general form of the vector autoregressive (VAR) model:

$$y_t = \varphi_0 + \phi_1 y_{t-1} + ... + \phi_p y_{t-p} + \varepsilon_t \quad (1)$$

First-order vector autoregressive (VAR) model, VAR1 (with constant):

$$y_t = \varphi_0 + \phi y_{t-1} + \varepsilon_t \quad (2)$$

$$y_{1t} = \varphi_{10} + \varphi_{11} y_{1,t-1} + \varphi_{12} y_{2,t-1} + \varepsilon_{1t} \quad (3)$$

$$y_{2t} = \varphi_{20} + \varphi_{21} y_{1,t-1} + \varphi_{22} y_{2,t-1} + \varepsilon_{2t} \quad (4)$$

where: y – explained variable; j – explanatory variable; In the expanded matrix notation, the coefficients have only two indexes. The first one indicates the explained variable to which they refer, and the second index represents the explanatory variable to which they refer. Subsequent orders also have an indexing that defines the given or chosen lag.

Second-order vector autoregressive (VAR) model, VAR2 (with constant):

$$y_t = \varphi_0 + \phi_1 y_{t-1} + \phi_2 y_{t-2} + \varepsilon_t \quad (5)$$

$$y_{1t} = \varphi_{10} + \varphi_{111} y_{1,t-1} + \varphi_{121} y_{2,t-1} + \\ + \varphi_{112} y_{1,t-2} + \varphi_{122} y_{2,t-2} + \varepsilon_{1t} \quad (6)$$

$$y_{2t} = \varphi_{20} + \varphi_{211} y_{1,t-1} + \varphi_{221} y_{2,t-1} + \\ + \varphi_{212} y_{1,t-2} + \varphi_{222} y_{2,t-2} + \varepsilon_{2t} \quad (7)$$

The estimates were calculated using the Gretl program. In order to estimate the impact on GDP, the data obtained was used to make a so-called historical forecast, i.e., an alternative scenario without the use of quantitative easing. Among the explanatory variables, the following data were collected and sorted on a monthly basis over the time period of 2003 to 2021, mainly from the Federal Reserve database (Federal Reserve System, 2023), the Eurostat database (2023), and the The World Bank (2023) database. The data were chosen with regard to their suitability and availability.

When the historical forecasts, i.e., the alternative scenarios without the use of quantitative easing, were carried out for the United States in 2009 and for the Eurosystem from 2015 onward, a problem arose concerning the data for the above periods, indicating the data did not have sufficient length to produce a good historical forecast. For this reason, the model had to be adjusted or explanatory variables with available data with an earlier start had to be used as well in order to extend the time series (backwards). The following series fulfilled this criterion: GDP, HICP, and industrial production in the Eurosystem, the Eurozone long-term yield curve, the DAX stock market index, the unemployment rate in the Eurosystem, industrial production in the US, the market yield on US Treasury bonds, the S&P 500 stock market index, the US unemployment rate, and the FED funds rate. These time series started in 1998.

3. Research results

First, the time series of the individual macroeconomic variables were plotted on a common graph to check whether the model was meaningful and whether it was appropriate

to proceed with its construction. Plotting the joint time series graph in Gretl showed that the time series exhibited stochastic dependence, i.e., a model could be constructed that would allow the forecasts of each time series to be improved based on the values of the other time series. For the vector autoregressive model, we assumed that the selected variables were stationary, i.e., that they did not have unit roots, so that the results would not be biased. Subsequently, a cross-correlogram was constructed for the residuals (Fig. 1 and Fig. 2). The inter-correlation correlogram of the residuals corresponded to the required correlation coefficient values for the macroeconomic Eurozone variables being compared and had a negligible overlap with the values for the US. The model was tested in Gretl to meet the assumptions using the Doornik-Hansen residual normality test. The above explanatory variables were well-suited for use in the VAR2 model, and the constant remained in the model.

To identify the order of the VAR model, information criteria were used within the Gretl software solution, including the Bayesian/Schwarz criterion (BIC), the Akaike criterion (AIC), and Hannan-Quinn criterion (HQC). In general, it is not necessary to use large lags, but for most series, first-, second- or third-order vector autoregressive lags suffice. Based on the identification criteria, the model was run with second-order lags for the Eurozone and first-order lags for the US. An inverse roots unit circle was run on the data to diagnose whether the VAR model satisfied the conditions for stationarity. With respect to the unit circle, the inverse roots also fit, meaning they fell within the complex plane inside the unit circle. The model is suitable from the standpoint of the stationarity framework. An autocorrelation

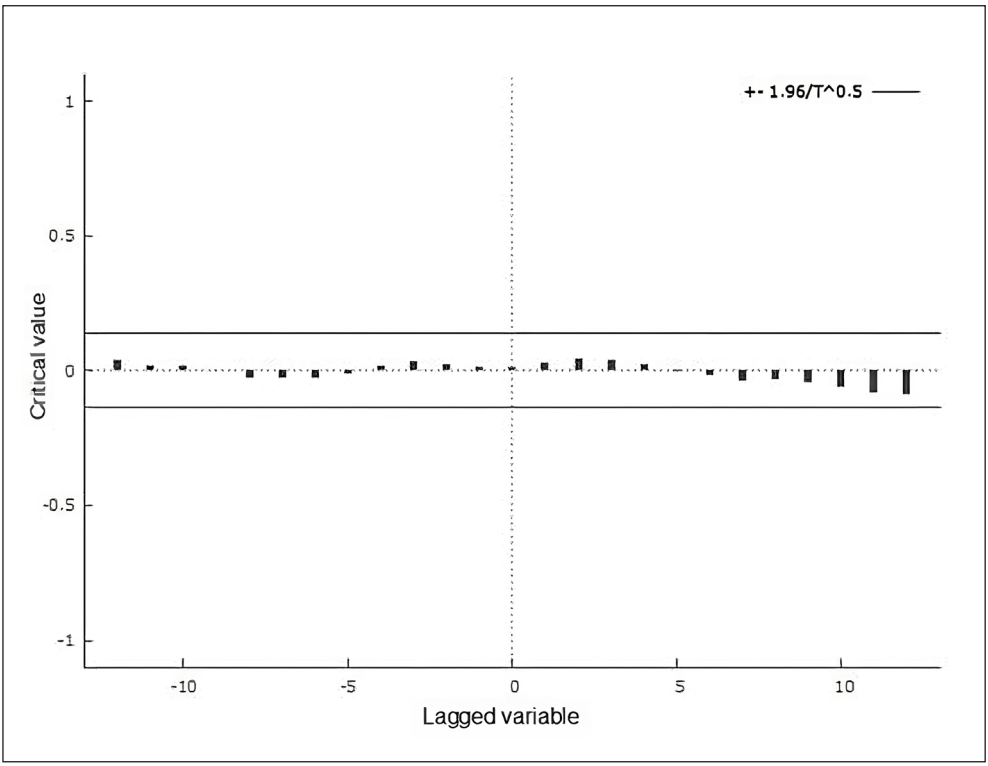

Fig. 1: Eurozones data residuals correlogram

Source: own

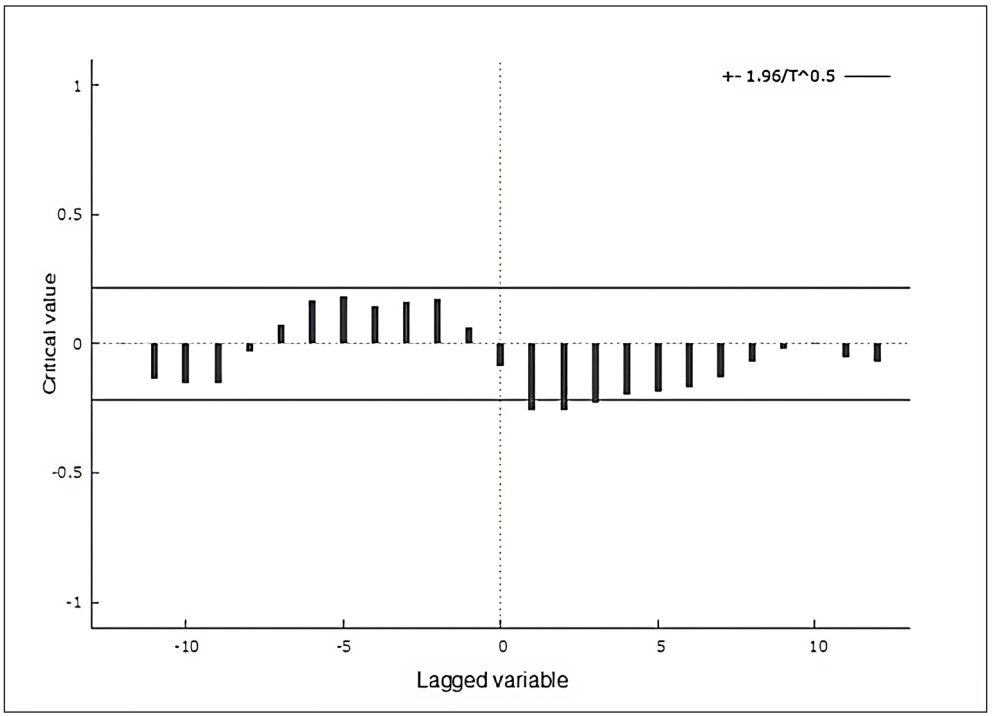

Fig. 2: US data residuals correlogram

Source: own

test was performed by fitting the residuals of each of the two equations in Gretl and then displaying the autocorrelation, where the non-simultaneous correlations (of orders different from zero) in these residuals were not statistically significant.

Fig. 3 shows the evolution of GDP in the Eurozone and the US. It also shows the individual periods when the FED and the ECB triggered each phase of quantitative easing.

In addition, a causality test was performed to address the relationships between the time series, because good causality between one series and another improves the prediction of the second series. The tests used were Granger causality tests, where terms in the model link the series being explained to a different series, i.e., with the first two indices being different. In examining the selected coefficients' statistical significance for both equations, it was clear that neither of them was statistically significant for either of the macroeconomic variables; therefore, we can conclude that according to Granger causality, these series are independent in this model. Since causality was not confirmed for the model, it was superfluous to examine the proof of the causal relationship. Therefore, the above variables were examined in a VAR model with a lag order of 1 and a lag order of 2, retaining a constant in both cases, since the constant was statistically significant in at least one of the equations for both the Eurozone and the US. The coefficient of determination was greater than 0.99 for both of the macroeconomic variables explained, i.e., GDP and HICP, in both equations.

The Gretl model resulted in a comparison of GDP's actual development in the Eurozone and the US with a so-called backcast, i.e., an estimation with a 95% confidence interval focused on GDP development without quantitative easing by central banks, which was determined using the model described above. In the graphs (Fig. 4 and Fig. 5), it is possible

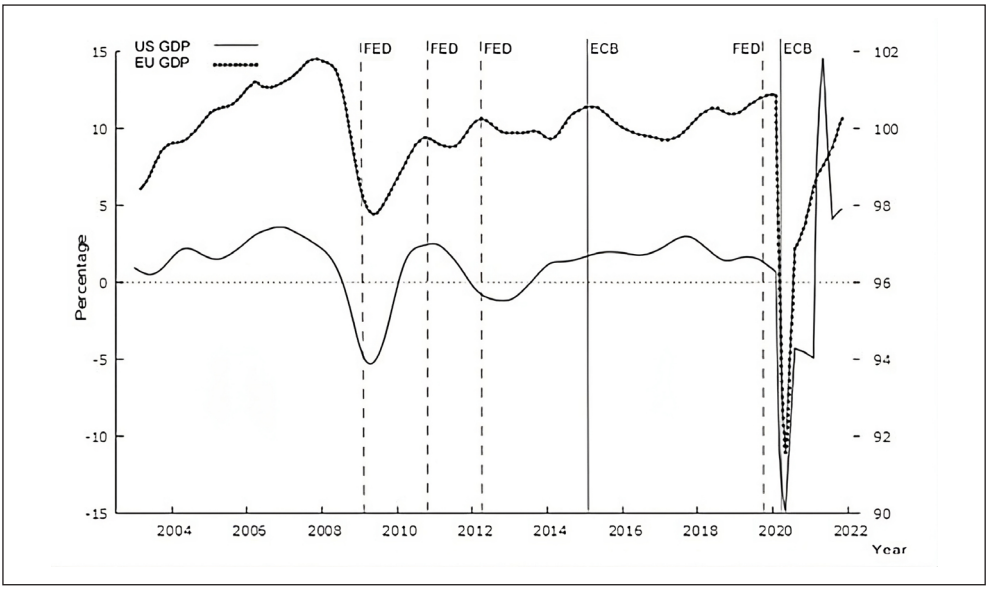

Fig. 3: **GDP growth in the Eurozone and the US from 2003 to 2021**

Source: own

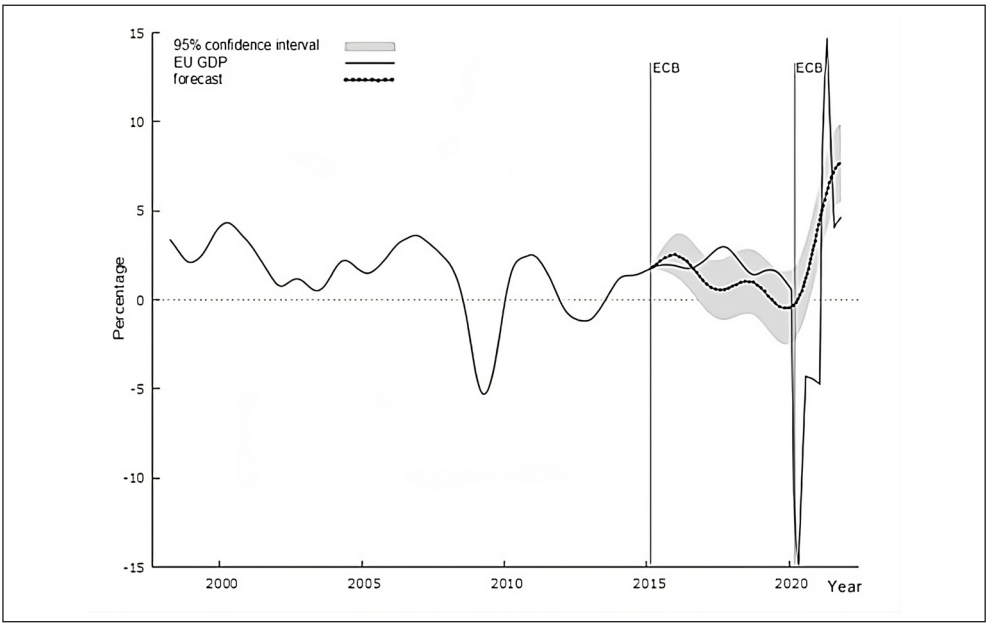

Fig. 4: **GDP forecasts for the Eurozone without quantitative easing**

Source: own

to see the results of our model, i.e., GDP's alternate evolution if quantitative easing had not been used. Furthermore, the individual periods when the FED and the ECB triggered the different phases of quantitative easing are defined.

Fig. 4 shows that quantitative easing had an impact on GDP growth in the Eurozone, with the calculated forecast showing a difference of up to 2% between the actual situation and the model without quantitative easing in 2016. It is important to note that the short-term effect following the launch of the first wave of quantitative easing was net positive. Actual GDP grew faster compared to the backcast, in which GDP growth would have been positive, but would have steadily declined until 2020. In contrast, in the case of the COVID-19 crisis, the path of estimated GDP without quantitative easing appears to be flatter, but here we are unsure about using econometric prediction for a major non-economic shock such as the significant economic contraction brought about by COVID-19.

The results of the model shown in Fig. 5 show the differences between US GDP's actual development and its backward-looking estimate. In this case, the differences are more substantial. Initially, quantitative easing helped to significantly dampen the decline in GDP in the short term, with the difference between actual and backcast GDP being more than 3%. However, the backcast predicted higher GDP growth after the second and third waves of QE. Over the long term, it can be seen that quantitative easing has helped smooth the business cycle, as GDP growth before the fourth phase of QE would have been stronger than actual growth with the contribution of quantitative easing. Again, we found the response to COVID-19, which indicates

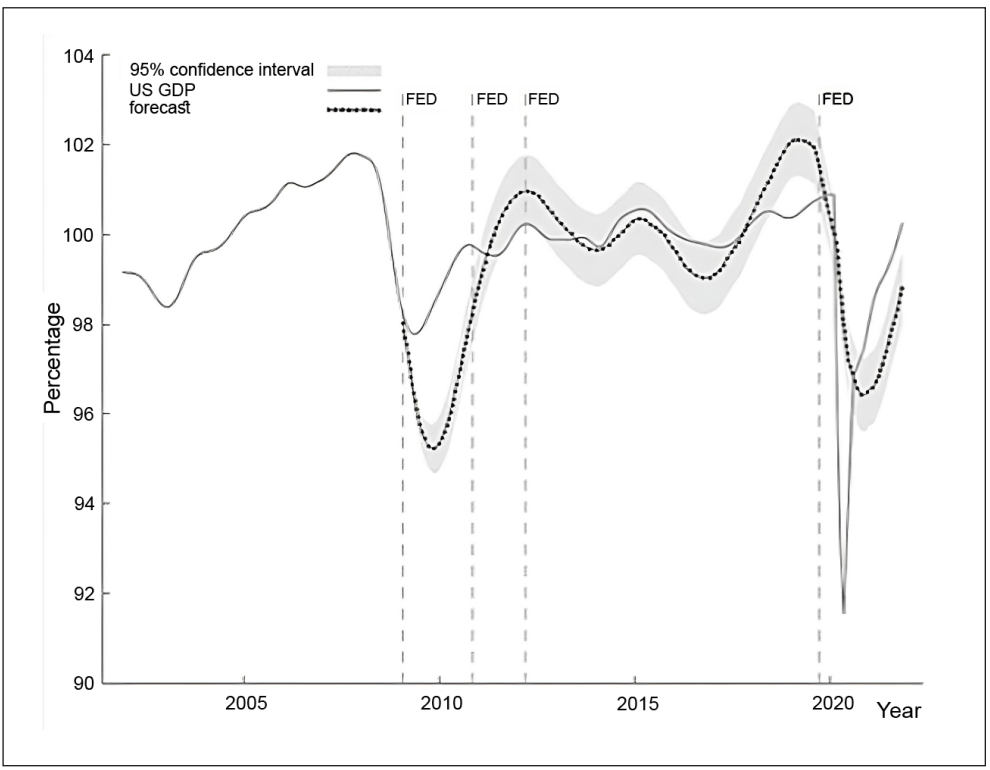

Fig. 5: US GDP forecasts without quantitative easing

Source: own

that GDP would not have fallen as significantly under the backcast, not very telling because it is hard to predict the effects of such a large, unexpected non-economic shock.

4. Discussion

Many of the studies cited above focus on the different channels through which QE is reflected – not only in the economy but also in different markets via changes in prices and revenues. Given our focus on predicting GDP without QE, we find that our models' conclusions are consistent with those of Hausken and Ncube (2013), Kapetanios et al. (2012), Priftis and Vogel, (2017), Fawley and Neely (2013), and Chen et al. (2012). All of these studies determined slightly greater GDP growth compared to the alternative scenario without QE during the period under analysis, i.e., that QE had a positive effect on the evolution of the economy. Indeed, in our models, the alternative GDP growth figures were mostly lower than the actual ones, except for some phases of significant GDP growth following phases of significant contraction in the US. However, taking into account the differences between the alternative and actual values and the effects of this significant monetary expansion on business cycle re-balancing, we have to separate our conclusions according to the economic areas where QE was used.

In the case of the Eurozone, it is interesting to note that without QE, GDP would have grown faster for the first year and a half before slowing down and showing less growth when compared to reality. A very mild recession would have occurred only in early 2019. Actual GDP growth relative to the alternative without QE was greater; in some periods, it was up to 2% higher. From this perspective, QE would seem efficient and meaningful.

As regards business cycle smoothing – which, in addition to ensuring price stability, is a focus for monetary policy – we can conclude that there was no smoothing. In both cases, two waves of moderate growth were evident, with the alternate scenario showing only slightly lower levels.

We consider our model's prediction regarding the economic shutdown caused by the coronavirus crisis to be inadequate, because no model can predict this type of shock and its effects, nor can it assess it retrospectively.

To summarize the above comments, QE appears to us to be unwarranted here in terms of its impact on economic developments. Both market and mixed economies work according to the principle of alternating phases of growth and recovery with phases of decline, which over the long term, should eventually result in human and financial resources shifting towards more profitable activities.

In the case of the US, the situation is different. The first wave of QE prevented a significant drop in GDP, with the difference between actual developments and the backcast alternative without QE being more than 3%. On the other hand, the impact of the second and third waves of QE was significantly smaller. In these periods, by contrast, the economy would have grown faster without QE nearly until the end of 2013. The ratio again tipped in favor of the alternative scenario without QE at the end of 2017. From this perspective, QE appears to us to have been effective, because it prevented a fairly significant initial drop in US GDP and then kept GDP growth higher than it would have been without QE over a longer period of around four years.

We also judge QE to be positive in the US in terms of smoothing the business cycle, where the effects of QE were clearly evident. The alternative scenario indicated two significant growth peaks and three fairly significant economic downturns, a situation that is not in line with any economic policy goals. In contrast, when QE was used, there was only one dip into recession immediately after the outbreak of the financial crisis. Thereafter, GDP evolved fairly steadily.

As in the case of the Eurozone, we cannot presume to evaluate alternative scenarios for the COVID-19 crisis using our model.

To summarize the above comments, in the case of the US, QE appeared to be highly effective in terms of its effect on GDP.

However, within the overall context of implementing QE, it is necessary to reflect on its positive and negative effects. In terms of positive benefits, our model shows it had a moderately positive effect on GDP growth. Nevertheless, we still think that this unconventional monetary policy instrument should only be used during exceptional periods, i.e., only as a rapid response to a major financial crisis. Regarding policy, it should be seen as an important signal in the sense that a central bank indicates that it has begun to react to a significant economic or non-economic shock and wants to cushion any negative effects. This may reassure the professional community. However, once the initial

effects of the shock have passed, central banks should refocus on using standard monetary policy tools, including increased communication and transparency with regards to their actions. The problem is that the use of unconventional tools has continued even during phases of economic growth, and sometimes these instruments are being perceived as a standard monetary policy tool.

The negative effects of QE are far more numerous and are described below. While we have not primarily examined the QE's effect on the inflation rate in this paper, it is clear from the known data that an inflation rate does not move from slightly positive values to its target very quickly. In the period in question, however, it did not rise significantly or in a way that would support natural economic growth. The question is whether QE – and the resulting enormous amount of newly issued money – was worth it. It turns out that deflation would probably not have lasted long and certainly would not have been extensive, i.e., in the order of tens of percent.

One of QE's side effects was to put further pressures on very low interest rates in the economy. Not only do such values contradict financial theory, whereby reasonably set interest is paid by the lending of capital, but also financial reality, where some central banks' interest rates have even gone into negative territory. Market interest rates have thus been at very low levels for an unreasonably long period of time, which does not correspond to market economy requirements and the cost of capital. Economic entities have already begun to regard these instruments as standard. Among other things, this has made long-term low interest rates one of the factors behind the today's higher inflation rates in developed economies.

In addition, QE has had a significant impact on other parts of the financial market, such as the stock and bond markets, as well as on the property market. In these markets, the availability of free and cheap money has resulted in a significant increase in asset prices and the creation of price bubbles.

Last but not least, there is moral hazard on the part of the countries issuing bonds. Countries have found themselves in a situation where they have had no shortage of creditors to buy their bonds, because these were being purchased by their central banks. We consider this situation to be a distortion of the market environment. Under standard conditions, investors would both choose which bonds to buy and, more importantly, demand higher returns in the form of higher interest rates, which would correspond to the level of credit risk of the country in question. Thus, countries would have no reason to reduce their budget deficits, either by saving on the expenditure side or by raising revenues to balance their budgets over the long term.

The financial aspect of central bank independence has been violated. In fact, the central banks purchased bonds issued directly by governments. We are thus returning to a situation in which the state pays for increasing its expenditure by "printing" new money. The result is our current situation, where this excessive interbank liquidity transferred to the financial market is one cause of higher inflation rates now that the main effects of the coronary crisis have subsided and economies have restarted.

The problem may lie in the significant increase in central bank balance sheets and the associated riskiness. Central banks have become some of the largest lenders in the world, which is surely not their purpose. Furthermore, because they have been buying virtually any bonds from a given country or currency area, the risk of future defaults has been increasing for some of these banks.

We are of course aware of the limits of our models. First, we have focused on only one aspect of QE's effectiveness, namely the effect on GDP growth. We are aware that QE has also acted on economies through other channels and has had many other effects on macroeconomic and financial variables. However, in our view, the indicator of GDP is crucial for assessing QE's effectiveness, because it incorporates economic performance, confidence in the economy, financial markets' efficiency, the evolution of employment and thus the growth in living standards.

We know that the main objective of central banks in market economies, including the two analyzed here, is to achieve price stability. This means that the primary reason for using QE was to prevent economies from falling into deflation. However, in the case of the US, the FED's other main objective was to promote economic growth (through the full employment target). In the case of the ECB, the main objective was just price stability, but the ECB has added that price stability is something that is

essential for economic growth and job creation. The ECB itself cites promoting economic growth as the first reason it gives when explaining how QE operates.

Furthermore, it is clear that any form of counterfactual analysis is to some extent uncertain. In our case, this is compounded by QE's uniqueness, the lack of previous experience with QE, and the occurrence of a rather significant, unexpected financial shock.

Thus, based on our results, we recommend that central banks use this unconventional monetary policy tool only in exceptional situations. On one hand, it should be used as short-term shock therapy, responding quickly and significantly to the occurrence of an economic or non-economic shock in order to calm markets. Long-term use of this instrument, especially in times of economic growth, carries with it a number of negative effects, as mentioned above. Central bank monetary policy should not react ad hoc but should be consistent over the long term.

Furthermore, we recommend that governments not use the option of having their central banks buy back bonds they have issued. Governments should not succumb to the tempting option of easily financing their debt by issuing bonds for purchase by their central banks. This will mitigate moral hazard, which is not healthy for any economy.

At the same time, our research has opened up other questions for future investigation. It can be seen that QE's effect on GDP was different in the Eurozone and the US. Therefore, it is certainly recommended that an analysis be conducted of the monetary policy of all the central banks that have implemented QE. Furthermore, one could compare QE's effectiveness with that of other non-conventional monetary policy instruments, such as exchange rate commitment or negative interest rates, again using counterfactual analysis. One could also examine effects according to different types of shocks – economic or financial, as in the case of the financial crisis, and non-economic, such as the partial economic shutdown in response to the COVID-19 pandemic or the sharp rise in energy prices caused by a combination of factors, primarily the war in Ukraine. All of this could be examined using a sufficiently long time series.

Conclusions

In this paper, we have estimated a backward-looking VAR model for GDP using an econometric vector autoregression model under an alternative scenario without the use of quantitative easing by the FED and the ECB. Based on this backcast, it was found that applying quantitative easing resulted in faster GDP growth in the US, especially during its immediate response to the 2009 GDP slump. Similarly, within the Eurozone, not applying quantitative easing in 2015 would have led to a decline in GDP growth between 2016 and 2020.

As regards the immediate impact on economic performance, quantitative easing shows clear positive consequences. However, when focusing on smoothing the business cycle over the medium term, its effectiveness varies. While there was business cycle smoothing in the US, there was not any in the Eurozone – in the alternative scenario, we saw only lower growth rates when compared to reality. Thus, the effectiveness of using the unconventional monetary policy tool of quantitative easing varies by currency area. In the US, its use appears appropriate, but not in the Eurozone.

However, despite this positive assessment of QE's impact on GDP, we do not recommend continued use of this monetary policy tool. However, exceptionally, one use of this uncommon instrument could be in the event of an extraordinary economic or non-economic shock, but only for a very short period of time. Similarly, we recommend that governments not be tempted to finance their debt with relative ease and instead focus on repairing their public finances. These recommendations stem from the fact that using quantitative easing has a number of negative consequences. In particular, we are referring to excessively long periods of low interest rates, which are in conflict with financial theory and the reality of the knowledge of the cost of capital. Furthermore, quantitative easing appears to us to be too robust an instrument to allow for a very slight actual rise in inflation rates. Moreover, over the longer term, a significantly increased amount of cheap and available money in circulation translates into significant inflationary pressure. Another problem is the creation of price bubbles in the stock, bond, and property markets. At the same time, moral hazard increases for countries whose mounting debts are financed by their own central banks. Last but not least, central banks watch as their balance sheets grow significantly and are likely to increase their credit risk by holding government bonds that they would not normally buy.

At the same time, the research we conducted has raised new questions about the use of unconventional tools, namely research on the monetary policies of all the central banks that have used quantitative easing, a comparison of the effectiveness of different unconventional monetary policy tools, the effectiveness of unconventional tools on different types of shocks.

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References

Bernanke, B. S., Reinhart, V. R., & Sack, B. P. (2004). Monetary policy alternatives at the zero bound: An empirical assessment. *Brookings Papers on Economic Activity*, *2*, 1–78.

Bluwstein, K., & Canova, F. (2016). Beggar-thy-neighbor? The international effects of ECB unconventional monetary policy measures. *International Journal of Central Banking*, *12*(3), 69–120.

Chen, H., Cúrdia, V., & Ferrero, A. (2012). The macroeconomic effects of large-scale asset purchase programmes. *The Economic Journal*, *122*(564), 289–315. https://doi.org/10.1111/j.1468-0297.2012.02549.x

Christensen, J. H. E., & Gillan, J. M. (2022). Does quantitative easing affect market liquidity? *Journal of Banking & Finance*, *134*, 106349. https://doi.org/10.1016/j.jbankfin.2021.106349

Christensen, J. H. E., & Rudebusch, G. D. (2012). The response of interest rates to US and UK quantitative easing. *The Economic Journal*, *122*(564), 385–414. https://doi.org/10.1111/j.1468-0297.2012.02554.x

Delivorias, A. (2015). *The ECB's Expanded Asset Purchase Programm*. European Parliamentary Research Service. Retrieved March 1, 2023 from https://www.europarl.europa.eu/EPRS/EPRS-Briefing-548976-The-ECBs-EAPP-FINAL.pdf

Duffie, D., Gârleanu, N., & Pedersen, L. H. (2007). Valuation in over-the-counter markets. *Review of Financial Studies*, *20*(6), 1865–1900. https://doi.org/10.1093/rfs/hhm037

Eurostat. (2023). *Database – Eurostat*. Eurostat – European Commission. https://ec.europa.eu/eurostat/data/database

Fabo, B., Jančoková, M., Kempf, E., & Pástor, Ľ. (2021). Fifty shades of QE: Comparing findings of central bankers and academics. *Journal of Monetary Economics*, *120*, 1–20.

Fatás, A. (2018). What has the eurozone learned from the financial crisis? *Harvard Business Review*. Retrieved March 1, 2023 from https://hbr.org/2018/09/what-has-the-eurozone-learned-from-the-financial-crisis

Fawley, B. W., & Neely, C. J. (2013). Four stories of quantitative easing. *Federal Reserve Bank of St. Louis*, *95*(1), 51–88. https://doi.org/10.20955/r.95.51-88

Federal Reserve System. (2023). *Federal Reserve Board – Data*. Board of Governors of the Federal Reserve System. Retrieved March 1, 2023 from https://www.federalreserve.gov/data.htm

Gern, K.-J., Jannsen, N., Kooths, S., & Wolters, M. (2015). Quantitative easing in the euro area: Transmission channels and risks. *Intereconomics*, *50*(4), 206–212. https://doi.org/10.1007/s10272-015-0543-1

Gertler, M., Karadi, P. (2013). QE 1 vs. 2 vs. 3. . .: A framework for analyzing large-scale asset purchases as a monetary policy tool. *International Journal of Central Banking*, *9*(1), 5–53.

Greenspan, A. (1996). *The challenge of central banking in a democratic society*. Federal Reserve Board. Retrieved March 1, 2023 from https://www.federalreserve.gov/BOARDDOCS/SPEECHES/19961205.htm

Hausken, K., & Ncube, M. (2013). Quantitative easing and its impact in the US, Japan, the UK and Europe. In *SpringerBriefs in Economics*. Springer New York. https://doi.org/10.1007/978-1-4614-9646-5

Joyce, M., Tong, M., & Woods, R. (2011). The United Kingdom's quantitative easing policy: Design, operation and impact. *Bank of England Quarterly Bulletin*, *2011*, 200–212.

Kapetanios, G., Mumtaz, H., Stevens, I., & Theodoridis, K. (2012). Assessing the economy-wide effects of quantitative easing. *The Economic Journal*, *122*(564), 316–347. https://doi.org/10.1111/j.1468-0297.2012.02555.x

Kenourgios, D., Papadamou, S., & Dimitriou, D. (2015). On quantitative easing and high frequency exchange rate dynamics. *Research in International Business and Finance*, *34*, 110–125. https://doi.org/10.1016/j.ribaf.2015.01.003

Krishnamurthy, A., & Vissing-Jorgensen, A. (2011). *The effects of quantitative easing on interest rates: Channels and implications for policy*. National Bureau of Economic Research. https://doi.org/10.3386/w17555

Krugman, P. R., Obstfeld, M., & Melitz, M. J. (2012). *International Economics: Theory & policy*. Pearson Addison-Wesley.

Neely, C. J. (2015). Unconventional monetary policy had large international effects. *Journal of Banking & Finance*, *52*, 101–111. https://doi.org/10.1016/j.jbankfin.2014.11.019

Priftis, R., & Vogel, L. (2017). The macroeconomic effects of the ECB's evolving QE programme: A model-based analysis. *Open Economies Review*, *28*(5), 823–845. https://doi.org/10.1007/s11079-017-9460-1

Sahuc, J.-G. (2016). The ECB's Asset Purchase Programme: A model-based evaluation. *Economics Letters*, *145*, 136–140. https://doi.org/10.1016/j.econlet.2016.06.009

Schenkelberg, H., & Watzka, S. (2013). Real effects of quantitative easing at the zero lower bound: Structural VAR-based evidence from Japan. *Journal of International Money and Finance*, *33*, 327–357. https://doi.org/10.1016/j.jimonfin.2012.11.020

Shogbuyi, A., & Steeley, J. M. (2017). The effect of quantitative easing on the variance and covariance of the UK and US equity markets. *International Review of Financial Analysis*, *52*, 281–291. https://doi.org/10.1016/j.irfa.2017.07.009

Smaghi, L. B. (2009). *Conventional and unconventional monetary policy* [Keynote lecture]. International Center for Monetary and Banking Studies. Retrieved March 1, 2023 from https://www.bis.org/review/r090429e.pdf

The World Bank. (2023). *World Bank open data*. The World Bank. https://data.worldbank.org