ISSN 2071-789X

RECENT ISSUES IN ECONOMIC DEVELOPMENT

ECONOMICS & Sociology

Jabiyev, F., Mukhtarov, S., Gasim, N., & Gafarli, G. (2025). Assessing the macroeconomic impact of quantitative easing: Successes and shortfalls. *Economics and Sociology*, *18*(3), 137-159. doi:10.14254/2071-789X.2025/18-3/8

ASSESSING THE MACROECONOMIC IMPACT OF QUANTITATIVE EASING: SUCCESSES AND SHORTFALLS

Farid Jabiyev
Indiana University Bloomington, USA;
Karabakh University, Khankendi, Azerbaijan; Karabakh Economic Research Center, Azerbaijan State University of Economics (UNEC), Baku, Azerbaijan
E-mail: fjabiyev@iu.edu
ORCID 0000-0002-6675-0264

Shahriyar Mukhtarov*
Faculty of Business and International Relations, Vistula University, Warsaw, Poland;
Department of Economics, Korea University, Seoul, South Korea;
BEU-Scientific Research Center, Baku Engineering University, Baku, Azerbaijan;
UNEC Empirical Research Center, Azerbaijan State University of Economics (UNEC), Baku, Azerbaijan;
E-mail: s.mukhtarov@vistula.edu.pl
ORCID 0000-0001-6248-6120
**Corresponding author*

Nijat Gasim
Faculty of Medicine and Health Sciences, Karabakh University, Khankendi, Azerbaijan;
International Scientific Research Center, Baku State University, Baku, Azerbaijan
nijatgasim@bsu.edu.az
ORCID 0000-0002-3976-1283

ABSTRACT. After the 2008 Global financial crisis, the Federal Reserve (Fed) initiated Quantitative Easing (QE) programs in order to inject liquidity into markets in the form of purchases of mortgage and government bonds. The objective of these policies was primarily to reduce interest rates, encourage credit expansion, and spur economic recovery. In this context, this study assesses the macroeconomic effects of Quantitative Easing in the United States employing a Structural Vector Autoregression (SVAR) framework, using quarterly data spanning the period from 2003Q1 to 2025Q1. The findings of estimation indicate that QE shocks have a significant effect in reducing long-term treasury yields, weakening the U.S. currency against the Euro currency, and opening up credit channels in the short run. The impact on GDP is shown to be initially adverse, reflecting delay in absorption of liquidity in real sectors. The effect of inflation in response to QE is also shown to be limited in extent, implying that injected liquidity mostly remains in financial markets and not stimulating real demand. The rate of unemployment is shown to first increase in response to shocks in QE, reflecting the delay in transmission of monetary expansion into productive investment. These findings highlight the subtle and often delayed transmission processes of QE and call for complementarity of monetary policies in order to enhance real-sector recovery and employment generation.

Galib Gafarli
Department of World Economy, Baku State University, Baku, Azerbaijan;
Institute of Military Administration, National Defense University, Baku, Azerbaijan;
Department of Finance and Accounting, Azerbaijan State Agricultural University, Ganja, Azerbaijan
qalibqafarli@bsu.edu.az
ORCID 0000-0002-2292-2896

Received: September, 2024
1st Revision: July, 2025
Accepted: September, 2025

DOI: 10.14254/2071-789X.2025/18-3/8

***JEL Classification**:* C32, C51, E51, E52

Keywords: quantitative easing, monetary policy, macroeconomic effects, SVAR, USA.

Introduction

Unconventional monetary policies (UMPs) have grown to be a crucial component of central bank tactics over the last 20 years, especially during the 2008 financial crisis and the COVID-19 pandemic. When conventional monetary tools fail to stimulate economic activity - particularly in environments characterized by near-zero interest rates - unconventional measures, including Quantitative Easing (QE), negative interest rate policies, and large-scale asset purchases (LSAP), have been implemented. For instance, during the Global Financial Crisis and the COVID-19 pandemic, the Fed, the European Central Bank (ECB), the Bank of Japan (BOJ) and other leading central banks implemented a range of UMPs, adapting their strategies to the specific challenges of each time.

In response to the 2008 financial crisis and 2020 COVID-19 shock, the U.S. Federal Reserve initiated unprecedented quantitative easing (QE) programs. QE supported large quantities of asset purchases (mainly U.S. Treasury and mortgage-backed securities) after the federal funds rate has reached its zero lower bound (Burriel & Galesi, 2017; Zwolankowski, 2011). The response of the Federal Reserve was to restore financial system stability, promote economic recovery, and meet its dual mandate of maximum employment and price stability (Georgiadis, 2015). By growing its balance sheet from below $1 trillion in 2008 to around $4.5 trillion in 2015 through repeated runs of asset purchase programs, the Fed attempted to lower long-run interest rates and risk premiums. Decreasingly low yields on government securities and other securities would in theory trigger borrowing and investment, keep asset prices aloft, and ward off deflation and thus underpin aggregate demand in times of extreme stress. The principal objectives of these runs of QE programs were to restore economic balance, ward off deflationary spirals, push inflation upwards towards a 2% vigour, and lower unemployment in the wake of crisis-fueled spikes in unemployment. During the Great Recession for instance, core inflation risked falling below zero and unemployment in the USA was over 10%; QE was an essential instrument for countering these trends once conventional cuts in rates had been pushed to its limits (Hajek & Horvath, 2018).

Similarly, the Federal Reserve employed massive quantitative easing (QE) during the COVID-19 pandemic to stabilize markets and aid economic recovery. In March 2020, it committed to buy a minimum of $500 billion worth of Treasury securities and $200 billion worth of mortgage-backed securities. By late 2021, the balance sheet of the Fed had risen to near $8.8 trillion, its most rapid monetary expansion on record. The intervention facilitated a rapid rebound in GDP despite the initial contractions. Inflation pressures remained subdued in the beginning, while the reduction of long-term yields eased credit markets. The unemployment problem, plummeting as high as 14.7% as of April 2020, had weakened further by November 2021, to 4.2%. The effects of QE on the macroeconomy of the U.S. during the pandemic surfaced most notably in industrial production rebounds, as well as output growth (Liptáková et al., 2024).

Even though QEs have been studied extensively, not a great deal is understood about their macroeconomic effect in post-COVID times. More asset purchase programs, longer-term refinancing operations, and near-zero interest rates are some of the out-of-the-ordinary monetary interventions undertaken by central banks during the pandemic. The long-term impact of these measures on inflation, GDP per capita, and unemployment is still poorly understood. As major economies transition from pandemic-related stimulus measures to normalization, it is important to assess whether QEs have achieved their intended macroeconomic objectives.

QEs have been instrumental in reversing economic downturns and stabilizing confidence in markets. They are not, however, without issues of their own. One of their major issues is their potential side effects, including their potential to warp asset prices as well as create reliance on government involvement in markets via central banks. Studies suggest QE has helped to inflate equity markets and push yields on bonds down. While this appears to be favorable, it also sparks discussion about whether these measures inadvertently contributed to financial instability (Jordà et al., 2020; Rabhi & Parsons, 2025).

Furthermore, increasing evidence implies that extended durations of low or even negative interest rates have prompted financial institutions to assume more risk. This activity contributes to inefficient allocation of resources and systemic imbalances (Brunnermeier & Koby, 2018; Espinosa et al., 2023). While Quantitative Easing has served as an important instrument in delivering short-term stabilization, its long-term macroeconomic consequences remain insufficiently understood and therefore necessitate more rigorous empirical and theoretical scrutiny, particularly within the evolving dynamics of the post-pandemic global economy.

Another important debate concerns if QEs have actually fueled real economic growth or only affected financial markets. In Japan, for example, extended QE measures contained deflation but had a less-than-anticipated effect on raising overall demand and productivity (Hausman & Wieland, 2015). Similarly, in the Eurozone, early rounds of QE were more effective in spurring lending and consumption, while subsequent measures showed declining returns (Praet, 2017; Lyeonov et al., 2024). With all these inconsistent performances, this study examines whether QEs have impacted important macroeconomic indicators, both during the 2008-2009 crisis and during the COVID-19 pandemic.

Examining the effects of QEs on GDP per capita, inflation, unemployment, and economic activity in USA is the main goal of this study. Policymakers must comprehend these impacts in order to effectively deal with the difficulties of promoting economic expansion while preserving financial stability. Insights from this study can help central banks decide when and how to make policy changes as they contemplate normalising monetary policy in the post-pandemic era, preventing the unwinding of QEs from impeding economic recovery.

There have been recent studies analyzing how QE has worked in major economies including the USA (2008-2018), the Euro area (2008-2018), and Japan (2000-2018) based on macroeconomic aspects (Reichlin, 2021). The studies use a range of econometric techniques, including Granger causality and cross-correlations, in assessing QE efficacy while underlining implications of GDP, unemployment, and monetary aggregates. Existing studies have provided insight into central bank intervention in stabilizing economic conditions through consideration of seasonally adjusted quarterly and monthly data. Yet gaps remain in what we know about long-term impacts outside of crisis times for these programs.

Through analyzing the post-pandemic impact of QEs in the US and establishing if they succeeded in stimulating GDP, stabilizing inflation rates, and allowing for economic recovery, this study aims to bridge this research gap. In this context, this paper makes substantial contributions to the literature on macroeconomic effects of Quantitative Easing (QE) in teh case of the US economy using a Structural Vector Autoregression (SVAR) model. Unlike earlier studies that tend to use standalone macroeconomic indicators or a single channel of transmission, this paper does a comparative analysis of the multi-dimensional effects of Quantitative Easing on treasury yields, exchange rates, bank credits, GDP, inflation, and unemployment simultaneously. Another important point of this paper is including dummy variables for the 2008 Global Financial Crisis, Quantitative Easing programs, and COVID-19 Pandemic within the SVAR model. Whereas various earlier studies accounted for only the 2008 crisis, this paper goes beyond by also accounting for economic shocks induced by COVID-19. This model improvement makes it feasible for structural breaks and global economic shocks to be identified, and an overall stronger picture of Quantitative Easing's performance during different economic conditions emerges. Also, by using impulse-response functions within SVAR, the paper is able to account for dynamic responses of such macroeconomic indicators to Quantitative Easing shocks over time. This methodology makes it feasible for better interpretation of how injection of liquidity spreads through various sectors of an economy, impacting financial markets and the real sector differently. The findings of this study provide critical insights into the limitations of QE in stimulating real economic growth and employment, while highlighting its pronounced effects on financial markets.

The paper is structured as follows: After the introduction, Section 2 presents an overview of the 2008-2025 Federal Reserve policy phases, Section 3 provides a comprehensive review of the relevant literature, Section 4 describes the dataset and methodological approach of the study, Section 5 reports findings from the empirical analysis, and the concluding section gives an overview of key results and policymaking recommendations.

1. Evolution of Federal Reserve’s Policy Phases (2008–2025)

Over the last two decades, the Federal Reserve’s policy with respect to QE has alternated between periods of aggressive balance sheet expansion followed by stabilization or reduction, as outlined in Table 1. There were successive rounds of asset purchases in the post-crisis years to address financial distress and recession. QE1 (2008–2010) consisted of massive MBS and Treasury purchases that quickly expanded the Fed balance sheet by more than $1.7 trillion, designed to stabilize market functioning and confidence. This followed on from QE2 in 2010-2011, where the Fed purchased another $600 billion of long-term Treasuries further to reduce long-term yields. In 2011-2012, the Fed employed Operation Twist, the unorthodox tactic of shifting its holdings toward longer-term Treasuries by selling off the shorter-term ones. Crucially, the goal of this operation was to flatten the yield curve by selling higher-yielding, shorter-term bonds with maturities as short as three years without expanding the size of the balance sheet. A further round, QE3 (2012-2014), was an open-ended program of purchasing some $85 billion per month (divided between MBS and Treasuries) that continued till improvements in labor markets made further action unwarranted; the Fed started tapering such purchases during 2013 before ending QE3 by late 2014. These early stages (2008-2014) increased the Fed's asset holdings and provided previously unprecedented monetary easing in an effort to revive the economy.

Table 1. Key QE Policy Programs and Key Actions of the U.S. Federal Reserve (2007–2025)

Period	Program	Key Actions
2007-2008	Liquidity Facilities (TAF, Swap Lines, etc.)	Introduced the Term Auction Facility (TAF) and swap lines; QE1 began with $600 billion in agency debt/MBS.
2009–2010	QE1 (LSAP Round 1)	Expanded LSAP to $1.7–1.75 trillion; major increase in Fed balance sheet.
2010–2011	QE2 (LSAP Round 2)	$600 billion in long-term Treasuries purchased over 8 months.
2011–2012	Operation Twist	Rebalanced portfolio from short- to long-term Treasuries without expanding balance sheet.
2012–2014	QE3 (Open-ended LSAP)	Monthly purchases of $85 billion (MBS and Treasuries); tapered in 2013 and ended in 2014.
2017–2019	Balance Sheet Normalization (QT)	Gradual reduction of reinvestment; shrinking balance sheet.
2020	QE4 (Pandemic Response)	Restarted QE with $120 billion monthly purchases amid COVID-19 crisis.
2021–2022	QE Taper and Second QT	Reduced and ended asset purchases; began second round of balance sheet reduction.
2023	QT Continues; BTFP Introduced	Balance sheet runoff continued; Bank Term Funding Program launched to support liquidity amid bank stress.
2024	QT Slows; BTFP Ends	Pace of QT reduced in June; BTFP ceased new loans in March; balance sheet declined to $6.8 trillion.
2025	QT Nears Completion	QT expected to conclude by mid-2025; balance sheet projected to stabilize at approximately 22% of GDP.

Source*: Prepared by the authors based on the Fed's annual reports.*

After several years of economic growth, the Fed began to turn towards reducing some of its stimulus. Between 2017 and 2019, it practiced quantitative tightening (QT) - balance sheet normalization - by merely letting maturing securities roll off, unaccompanied by reinvestment. This phase involved gradual reduction of the Fed’s holdings of assets, indicating a wish to rebuild traditional policy space. By 2019, the Fed had modestly reduced its balance sheet, though still well above pre-crisis levels. The break with such stabilization came with the COVID-19 shock: in March 2020, amid pandemic-driven banking panics and activity collapse, the Fed rapidly restarted asset purchases on a massive scale (“QE4”). The Fed, at its peak, purchased up to $120 billion of securities monthly in 2020, putting back much of the withdrawn liquidity as well as extra. The balance sheet ballooned rapidly to record-breaking levels to stabilize markets between 2020 and 2021 as the pandemic unfolded. When the economy recovered, the Fed phased out such purchases from late 2021 through ending QE4, shifting once more to QT from 2022. The Fed had resumed a consistent asset runoff by 2023-2025.

Interestingly, in 2023 it introduced the Bank Term Funding Program (BTFP) as an emergency lending facility, reflecting the central bank's facility for introducing new tools to provide stability for finances even as broad QE-driven liquidity was being unwound (Ihrig & Waller, 2024; Sova & Lukianenko 2022). The Fed's balance sheet, as of 2024, had fallen toward a target of $6.5-7 trillion and estimates had it that by mid-2025, the unwind of QE would reduce the balance sheet down to perhaps 22% of U.S. GDP - still well above its share prior to 2008, reflecting a lasting impact of post-crisis QE (Federal Reserve, 2024).

3. Literature review

Quantitative Easing (QE) has emerged as a key unconventional monetary policy instrument in the contemporary era, particularly during periods of economic turbulence. Various economic theories offer insights into the expected effects of QE. Mainstream monetarist theory postulates that money supply changes only target nominal values like prices but have no influence on actual economic activity. Keynesian theory, on the other hand, predicts that money growth will increase real output as well as employment over the short run by suppressing yields and inducing spending as well as investment (Bibow, 2021; Brycz, 2012). Hohberger et al. (2019) highlight that by pursuing large-scale purchases of assets, central banks aim to increase the monetary base and lower long-term yields to supply liquidity to financial markets as well as to stimulate aggregate macroeconomic conditions. The complex relationship between monetary policy and labor market outcomes is further evidenced by research showing that inflation and employment exhibit negative short-term relationships but positive long-term dynamics, with sectoral variations that affect policy transmission mechanisms (Angelov, 2023).

Initially applied by the Bank of Japan in 2001 as a response to deflation, QE was subsequently adopted on a much larger scale by systemic central banks following the 2008 financial crisis (Joyce et al., 2012; Leong et al., 2018). Bernanke (2012) explains the Federal Reserve's use of QE amid and following the 2008 crisis as a monetary policy turning point, triggered once conventional cuts to interest rates were limited by the zero lower bound. The Fed, ECB, and Bank of England have used QE occasionally to stabilize the economy and promote economic growth ever since. Neuenkirch (2020) points out the flexibility of QE was confirmed once again by central banks during the COVID-19 pandemic, resuming large-scale purchases to mitigate the economic damage.

One of the most evident impacts of QE has been a decline in long-term interest rates and overall loosening of credit conditions. By large-scale purchases of Treasury debt and mortgage-backed securities, the Federal Reserve's QE programs brought about the reduction of yields on these securities through the portfolio balance channel. Krishnamurthy and Vissing-Jorgensen (2011) and Gagnon et al. (2011) argue that the 10-year Treasury yield between the first QE round covering the years 2009 to 2010 came down by over 100 basis points, largely because of steep cuts in corporate and mortgage borrowing rates. The resulting lower long-term rates boosted interest-sensitive activity, especially housing market activity, where more reasonably priced mortgages facilitated home appreciation rates and volumes of sale, thus steadying the financial system as well as consumer confidence. Gambacorta et al. (2014) claim that cross-country evidence identifies QE announcements as accompanying significant decreases in long-term yields as well as more accommodative financial conditions across major nations.

The inflation effects of QE have been relatively weak and still continue to be controversial. By providing liquidity and reducing interest rates, QE was thought to drive inflation toward central banks' targets and actually prevented outright deflation following the 2008 crisis. Chung et al. (2012) and Engen et al. (2015) mention that U.S. inflation in 2015 was around 0.5 percentage points higher because of QE than it otherwise would have been, thereby enabling the economy to avoid a low-inflation - or even a low-level-of-prices - trap. Williams (2014), however, contends that efforts at reflating through QE largely failed to drive inflation significantly above the Federal Reserve's 2% target for much of the post-2008 era, reflecting QE's modest success at inducing sustained pressures on prices under weak economic conditions. Ryou et al. (2019) find that the effect of QE was stronger on asset prices rather than consumer prices, implying that the infused liquidity extended more to the financial system than into the broader economy. In similar fashion, Pichova et al. (2023) observe that any inflationary influence of QE faded over the course of time as residual economic slack following the crisis lasted on.

One of the channels of QE transmission is through financial markets. Chen et al. (2016) describe how Federal Reserve purchases of safe assets like government debt pushed investors to shift their portfolios to riskier assets, increasing stock, corporate bond, and housing prices. Asset price inflation was an explicit aspect of QE, intended to increase household wealth and confidence - the so-called wealth effect - which fed through into higher consumption spending and aggregate economic growth. Fratzscher et al. (2013) and Joyce et al. (2011) provide evidence that large QE announcements caused immediate equity market jumps and housing price jumps, driven by portfolio rebalancing forces. By raising wealth and relaxing credit constraints (by increasing the value of collateral), QE indirectly supported both private consumption and investment. But the benefits to the appreciated value of assets came with a cost: the distributional effect. Gains to QE-related stock rises largely went to higher-income households with higher financial assets, potentially exacerbating wealth inequality. Domanski et al. (2016) caution that protracted high asset prices can lead to financial imbalances because extended QE may encourage over-risk-taking and overvalued market pricing, requiring more macroprudential oversight.

Beyond financial markets, the macroeconomic consequences of QE on inflation and output have been widely tested using different econometric methods. Baumeister and Benati (2012), applying a structural VAR approach, find that QE policies within the U.S. context generated positive but relatively modest impulses to real GDP as well as inflation. According to their analysis, quantitative easing (QE) helped the economy recover, but the extent of the impact was limited by structural weaknesses and ongoing uncertainty in the economy. Within the U.K., Joyce et al. (2011) suggest that the QE actions by the Bank of England provided significant support to aggregate demand by reducing borrowing rates and inducing spending by both firms and private consumers. Their results highlight the importance of QE as a preventive of deflationary spirals when there is intense financial distress. Vector autoregression models have been extensively used to analyze causal relationships between key macroeconomic variables, demonstrating that interest rates, inflation, and exchange rates exhibit complex dynamic interactions that can be effectively captured through VAR methodology (Aji et al., 2021).

The spillovers of QE have extended beyond the country of origin; U.S. monetary policy easing has transmitted internationally through both trade connections and financial intermediaries. Tillmann (2016) and Meszaros and Olson (2020) observed that whenever the Fed undertakes QE, it puts downward pressure on U.S. interest rates and the dollar, thus influencing other economies' capital flows and exchange rates. Empirical evidence indicated that U.S. monetary policy shocks create spillovers internationally, even though the intensity is influenced by economic interlinkages and domestic policy regimes. Feldkircher and Huber (2016) note that nations with fixed dollar pegs or tight fiscal and financial linkages to the U.S. are subject to particularly significant spillovers from QE. In emerging nations, Hajek and Horvath (2018) and Jabiyev et al. (2022) report that massive Fed purchases of assets habitually caused large increases in inflows of capital, appreciation of currency, and higher asset price variability, making it harder to manage macroeconomics in those countries. Chen et al. (2016) highlight that both output levels and financial markets of emerging nations tend to react highly to U.S. QE announcements, given their openness to world liquidity patterns. By comparison, Bluwstein and Canova (2016) argue that nations with more flexible exchange rate systems or weak financial integration are subject to weaker spillovers, given that monetary independence and capital controls can mitigate external shocks.

An increasing body of evidence similarly highlights the salience of the expectations channel for understanding QE's broader influence. Woodford (2012) contends that QE works by influencing both the supply-demand balance of securities markets, as conventional accounts emphasize, but more importantly by influencing market expectations regarding the future evolution of monetary policy and macroeconomic conditions. In shaping views about the extent to which interest rates will remain low, as well as communicating the central bank's long-run commitment to accommodative policy, QE has the ability to influence behavior throughout financial markets and the real economy. Combined with forward guidance, as Woodford underscores, QE is far more active, because both tools are able to work in concert to influence expectations and reinforce the credibility of the central bank's long-run policy position. That interaction multiplies QE's transmission mechanism, making it an even more effective tool for stabilizing output and inflation with economic slack.

A lesson of the QE era is that monetary and fiscal policy can interact to influence economic outcomes. Evidence indicates that QE works best with accompanying support from fiscal policy. In the US, the comparison between the post-2008 and post-2020 recoveries show this to be the case. In the 2010s, the Fed's QE programs did most of the work of the work, as fiscal policy was relatively tight after the initial 2009 stimulus. Horvath and Rusnak (2009) and Mukhtarov et al. (2020) suggest that the absence of fiscal-monetary cooperation reduced QE’s aggregate demand stimulus, as government spending reductions or fiscal austerity counteracted some of the stimulus to be provided by the low interest rates. By way of stark contrast, the COVID-19 pandemic crisis involved record levels of fiscal expansion - together with direct household payments, extended unemployment benefits, and large-scale assistance to businesses - taken at the same point as bold QE steps. The coordination of these policies created an overriding transmission effect, leading to an unusually rapid rebounding of GDP and employment relative to 2008. Empirical analysis documents that QE’s output effect was materially boosted by the availability of expansive fiscal programs throughout the pandemic. Liptáková et al. (2024) prove that US GDP reacted approximately twice as vigorously to QE under the 2020–2021 fiscal stimulus circumstances as compared with the comparatively fiscal-constrained framework of the early 2010s. In the same vein, Ganelli and Tawk (2019) propose that positive investor expectations and confidence effects from QE are stronger when governments at the same time adopt accommodative fiscal measures.

Conversely, as fiscal policy tightens, it can offset the effects of QE. When governments raise taxes or cut spending to balance budgets - as was common after the global financial crisis - aggregate demand could be muted even after central bank easing. In such a scenario, QE has it harder to spur economic activity, as decreasing interest rates cannot offset the pullback from tightening going on with fiscal policy. Reichlin (2021) supports this argument noting that QE is effective “depending on fiscal coordination” and yields substantially larger gains with higher growth when monetary policy and fiscal policy are both expansive. Considerations of these dynamics have led policymakers and institutions to increasingly recognize the potential for harmony. Bowman (2024) points out that both the Federal Reserve and the International Monetary Fund made this argument in their recent historical review, reaching a conclusion that the combined force of both fiscal and monetary responses was key to the pandemic recession’s record recovery. In the future, the central bank balance sheet policy interplay with government budgets is again likely to have a key role, as efficient demand management through deep downturns is best brought about by synchronization of both policy arms.

A comparison of the QE experience under the 2008–2009 Global Financial Crisis and the 2020 COVID-19 crisis outlines the power of context to drive monetary policy effectiveness. In response to the 2008 crisis, the Federal Reserve initiated successive rounds of QE (QE1 to QE3) over three years. Chung et al. (2012) emphasize that these interventions are largely credited with halting a more severe collapse of output and stopping deflationary pressure - getting credit markets functioning again and steadying the shrinking economy. The recovery from the Great Recession following these interventions was, nonetheless, sluggish and drawn out. Unemployment came off only gradually over years, as inflation consistently lived below the Fed's 2% target over the course of the 2010s even after the extraordinary degree of monetary support. The lack of powerful price pressures during that time confirmed that QE's stimulus had gone mainly to closing an output gap, as would be expected in terms of insufficient demand. It also made it possible for the Fed to unwind its emergency measures very slowly.

In contrast, the 2020 recession due to COVID-19 pandemic was unprecedented in both its rapidity and the magnitude and promptness of the policy response. According to Adrian et al. (2024), the Fed's QE response (QE4) was reportedly implemented almost overnight in March 2020 and resulted in a balance sheet expansion that, within months, exceeded the initial QE1 stimulus of 2008–2009. The swift recovery of the economy is fueled by powerful interactions of large-scale government stimulus and an intense monetary policy response. U.S. GDP was back to pre-pandemic levels by mid-2021, while unemployment rates plummeted from an apex at 14.8% in April 2020 to slightly over 6% within one year. The quick recovery was quite different from the prolonged one following 2008. The World Bank (2023) reports that inflation in the U.S. accelerated to a level higher than it has seen for forty years by late 2021 and early 2022, with annual rates rising to as much as 9%. Large-scale QE and broad fiscal measures significantly increased aggregate demand, which contributed to economic overheating; yet, high oil prices and ongoing supply constraints to manufacturing chains continued to be the principal causes of inflation. As a result, the authorities had to immediately change course. The Fed abruptly stopped QE from an emergency position, reversed course on asset purchases, and hiked rates significantly beginning in 2022. The change was quite different from after 2008, where low inflation permitted the authorities to withdraw support gradually.

4. Model specification and data

In the analysis of macroeconomic time series, vector autoregressive (VAR) models are frequently preferred for revealing the dynamic relationships between variables (Greene, 1993; Mukhtarov et al., 2019). However, the neglect of structural causality links in standard VAR models leads to interpreting the effects of policy shocks only through statistical correlations (Sims, 1980). In contrast, the effects of monetary policy shocks, especially the expansion processes occurring in central bank balance sheets, on macroeconomic variables in the financial and real sectors are mostly shaped within a specific theoretical framework. Therefore, structural VAR (SVAR) models are needed to distinguish these effects within a cause-and-effect relationship (Mukhtarov et al. 2021).

In this study, the effects of shocks in the Total Assets (TA) variable, which reflects the size of the central bank's balance sheet, on the 10-Year U.S. Treasury Yield (Treasury Rate - BR), exchange rate (Exchange Rate - EXR), total credit (Credit - CRD), real GDP per capita (GDP per capita - GDP), consumer price index (CPI), and unemployment rate (UR) are analyzed. It is expected that expansionary monetary policies realized through total assets would affect these indicators at different periods and levels, either directly or indirectly. To accurately disentangle these relationships, a SVAR model with short- and long-term constraints based on economic theories has been preferred (Blanchard & Quah, 1988; Hamilton, 2020).

The short-term constraints used in the model are designed by considering the capacity of financial markets to react instantly and the delays in decision-making and price adjustment processes in the real economy. In this context, it is assumed that TA shocks can affect financial variables such as treasury rate (BR), exchange rate (EXR), and total credit (CRD) in the short run, while their effects on real output (GDP), price level (CPI), and unemployment rate (UR) are expected to be delayed. Long-term constraints are based on the hypothesis of monetary neutrality, which posits that monetary expansion shocks cannot create permanent effects on real growth and employment in the long run but can have lasting level effects on nominal variables (prices and exchange rates) (Uhlig, 2005; Christiano et al., 1999).

The short-run impulse-response functions presented below are derived from the structural restrictions imposed on the contemporaneous relationships among the variables, as specified in the short-run SVAR matrix.

$$A = \begin{bmatrix} a_{11} & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & a_{22} & 0 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & a_{33} & 0 & 0 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & a_{44} & 0 & 0 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & a_{55} & 0 & 0 \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & a_{66} & 0 \\ a_{71} & a_{72} & a_{73} & a_{74} & a_{75} & a_{76} & a_{77} \end{bmatrix} * \begin{bmatrix} LTA \\ LBR \\ LEXR \\ LCRDD \\ LGDP \\ LCPI \\ LUR \end{bmatrix} = \begin{bmatrix} u_{LTA} \\ u_{BR} \\ u_{LEXR} \\ u_{CRD} \\ u_{GDP} \\ u_{LCPI} \\ u_{UR} \end{bmatrix}$$

This matrix captures the assumed causal ordering and contemporaneous interactions among the macroeconomic indicators, in line with economic theory and empirical evidence. Based on this identification structure, the dynamic responses of key macroeconomic variables to a one-standard-deviation shock in total assets are estimated and visualized in the impulse-response graphs.

Before estimating the model, the stationarity degrees of the series were evaluated with the Augmented Dickey-Fuller (ADF,1981), Kapetanios, Shin, and Shell (KSS, 2003), and Fourier based unit root tests-Fourier Kruse (Güriş, 2019), and they were stabilized with appropriate differencing processes. Subsequently, according to the information criteria (AIC, BIC, HQIC), the lag length was determined as VAR (3), and autoregressive LM tests and White heteroskedasticity tests on the residuals indicated no autocorrelation or heteroskedasticity in the model. Moreover, the inverse roots of the VAR model being inside the unit circle showed that the model is stationary.

Consequently, this study analyzes the effects of monetary expansion shocks occurring in the central bank's balance sheet on financial and real macroeconomic indicators within a causality-based structure using the SVAR model. Thanks to the theoretically justified constraint structure applied in the model, the short- and long-term effects of policy shocks on the economic system were empirically tested by disentangling them. Thus, the findings of the study are evaluated not only statistically but also in alignment with economic theories.

Nevertheless, it should be acknowledged that the SVAR identification strategy adopted here relies on theoretical restrictions, and alternative identification schemes could potentially yield different dynamic responses. In addition, although Fourier-based unit root tests partially account for structural breaks, extreme shocks such as the COVID-19 pandemic may not be fully captured. These methodological considerations indicate that the empirical results should be interpreted with awareness of such limitations.

The dataset used in this study consists of quarterly macroeconomic time series covering the period from the first quarter of 2003 to the first quarter of 2025. The variables included in the model are comprised of seven main indicators: Total Assets (TA), representing the size of the central bank's balance sheet; Bond Rate (BR), representing the long-term government bond interest rate; Consumer Price Index (CPI), measuring the general level of consumer prices; Credit (CRD), indicating credit volume; Exchange Rate (EXR), measured through the Euro/USD parity; Gross Domestic Product per capita (GDP), representing real income per capita; and Unemployment Rate (UR), representing the labor market.

Some of the variables are expressed in percentages (BR, UR), some are defined in index form (CPI), and others are measured in U.S. dollars (TA, CRD, GDP). The exchange rate variable (EXR) is defined as the Euro/USD parity. All data are sourced from the Federal Reserve Bank of St. Louis's Federal Reserve Economic Data (FRED) database and are seasonally adjusted. This data structure enables a holistic analysis of the financial and real sector dynamics, providing a foundation for a multi-dimensional examination of the transmission mechanisms of monetary policy shocks within the structural VAR model framework.

Table 2. Variable definition

Symbol	Definition	Unit	Period	Source
BR	The 10-Year U.S. Treasury Yield	%	2003Q1-2025Q1	Federal Reserve Bank of St. Louis (2025)
CPI	Consumer Price Index	Index	2003Q1-2025Q1	Federal Reserve Bank of St. Louis (2025)
CRD	Bank Credit, All Commercial Banks	Millions of U.S. Dollars	2003Q1-2025Q1	Federal Reserve Bank of St. Louis (2025)
EXR	Excahange Rate	Euro/USD	2003Q1-2025Q1	Federal Reserve Bank of St. Louis (2025)
TA	Total Assets of the Federal Reserve	Millions of U.S. Dollars	2003Q1-2025Q1	Federal Reserve Bank of St. Louis (2025)
GDP	Gross Domestic Product per capita	Chained 2017 U.S. Dollars	2003Q1-2025Q1	Federal Reserve Bank of St. Louis (2025)
UR	Unemployment Rate	%	2003Q1-2025Q1	Federal Reserve Bank of St. Louis (2025)

Before proceeding with the estimation, descriptive statistics are presented to reveal the fundamental characteristics of the variables used in the model. In this section, measures of central tendency and dispersion for each variable are evaluated to obtain preliminary information about the structure of the series. Descriptive statistics are particularly important for enhancing the comparability of the series and identifying potential imbalances or outliers. This information plays a supportive role in justifying the econometric methods to be applied in the subsequent sections.

As seen in Table 3, the majority of the series deviate from the normal distribution assumption, and this should be taken into account in the structural VAR modeling. Since the non-normal distribution structure may lead to increased estimation errors, especially under small sample conditions, it is recommended to use transformation methods (such as log transformation or differencing) or robustification techniques during the modeling process.

Furthermore, the skewness and kurtosis properties of the variables emphasize the importance of analyses that consider both policy effects and structural breaks.

Table 3. Descriptive statistics

	BR	CPI	CRD	EXR	TA	GDP	UR
Mean	3.04	10047.7	11123.8	1.2237	3826906.3	18612.04	5.7876
Median	2.93	9930	9925.2	1.2045	3881489	18016.10	5.1000
Maximum	5.07	13480	18026.8	1.5625	8934916	23542.30	13.000
Minimum	0.65	7724	5502.3	1.0066	723346	14614.10	3.5000
Std. Dev.	1.13	1509.1	3668.4	0.1273	258366.1	2449.062	2.0319
Skewness	-0.08	0.610	0.4518	0.4811	0.5207	0.429418	1.0674
Kurtosis	1.93	2.69	2.0788	2.4012	2.1642	2.053926	3.5939
Jarque-Bera	4.26	5.857	6.1748	4.7630	6.6129	6.054426	18.095
Probability	0.12	0.05	0.0456	0.0924	0.0366	0.048450	0.0002
Observations	89	89	89	89	89	89	89

To visually analyze the long-term trends and significant cyclical fluctuations of the variables included in the study, time series graphs were utilized. These graphs reflect the trajectory of the variables throughout the 2003Q1–2025Q1 period and make it possible to visualize the impact of structural breaks, such as the global financial crisis, QE programs, and COVID-19. In the graphs, the QE1, QE2, QE3, and COVID-19 periods are highlighted with red bands, and the relationship between the timing of shocks and the responses of the variables is evaluated within this framework (See Figure 1).

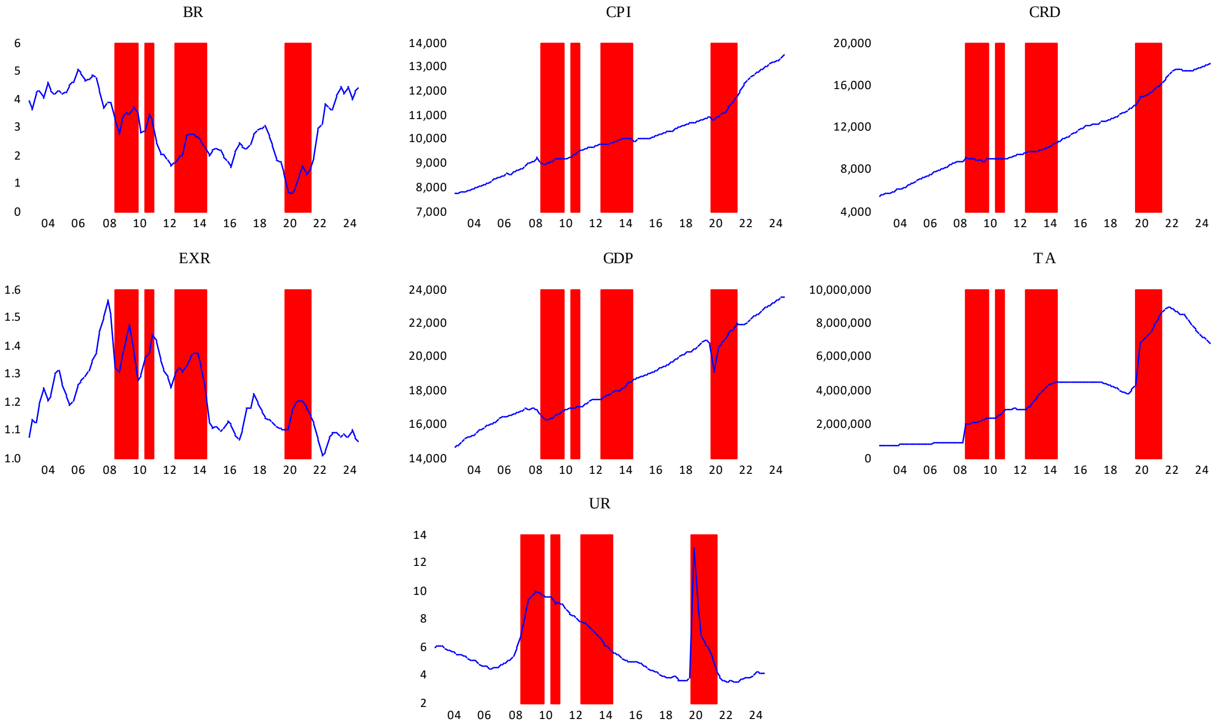


Figure 1. Macroeconomic Trends and Policy Episodes: QE1–QE3 Highlighted
Source: *Federal Reserve Bank of St. Louis (2025)*

The trajectory of treasury interest rates over time demonstrates a notable downward trend, especially after the 2008 global financial crisis. A significant decline in these rates was observed during the QE1 and QE2 implementations, highlighting the effectiveness of the bond purchase programs conducted by central banks to suppress long-term interest rates. The CPI series generally exhibits an upward trend, indicating structurally ongoing price increases and inflationary pressures. Particularly during the QE periods, changes in the speed of CPI growth remained limited, suggesting that the short-term capacity of monetary policy to generate inflation may be low. The graph shows that the general price level increased steadily outside major crisis periods.

The time series for credit volume reveals a marked upward trend coinciding with the QE periods. Especially during the QE2 and QE3 periods, the acceleration of credit expansion is evident. This increase demonstrates that the banking sector boosted credit supply thanks to liquidity abundance, indicating that monetary expansion policies reached the real sector through the credit channel (Bernanke & Blinder, 1988).

The exchange rate data, especially in the post-2008 crisis period, showed significant fluctuations. Following the QE1 implementation, the depreciation of the dollar and the subsequent recovery highlighted the sensitivity of capital flows to monetary policy decisions. The Euro/USD parity approached the 1.6 level at times but entered a downward trend again in the post-COVID-19 period.

The GDP data shows a stable upward trend in the long term. However, noticeable breaks in this trend were observed during the 2008 crisis and the COVID-19 period. Particularly, the decline in 2020 reflects the period when economic activities came to a near standstill. This graph also reveals that the contribution of expansionary policies to growth reflects positively over time.

The Total Assets series shows remarkable jumps parallel to the QE periods. These jumps mark the periods when the central bank's balance sheet expanded and reveal the direct impacts of monetary policy on asset markets. Especially during the QE3 period, the increase in assets was quite sharp, allowing for the observation of the systemic effects of policy shocks.

In the unemployment rate data, significant increases were observed, particularly during the 2008 crisis and the COVID-19 period. Although a gradual decline followed QE1, it is understood that this decrease occurred with a certain lag. This finding is consistent with theoretical approaches suggesting that the effects of monetary policy on employment are indirect and lagged.

After presenting the descriptive statistics and time series graphs, a correlation matrix was constructed to examine the linear relationships between the variables. Correlation analysis is crucial for identifying multicollinearity risks that could affect the predictive accuracy of the model. Especially before moving on to the structural VAR model, determining whether there is a high correlation between dependent and independent variables serves as a guide for the reliability of economic interpretations and the stability of estimation results. Below, the Pearson correlation coefficients among the seven main macroeconomic variables included in the analysis and the statistical significance levels of these coefficients are visualized (See Figure 2).

As understood from Figure 2, there are quite high and statistically significant correlations between CPI, CRD, GDP, and TA. For instance, there is a positive correlation of 0.99 between CRD and GDP, significant at the 1% level. This finding confirms that credit expansion strongly co-moves with economic growth and supports the view that the credit channel promotes growth. Similarly, the correlations of the TA variable with both CPI, CRD and GDP are also high and significant (0.93, 0.95 and 0.92 respectively). This indicates that expansionary monetary policies can be transmitted to the real economy through the financial system. At the same time, the significant correlation of -0.43 between TA and BR supports the idea that bond purchases (asset expansion) have a lowering effect on interest rates.

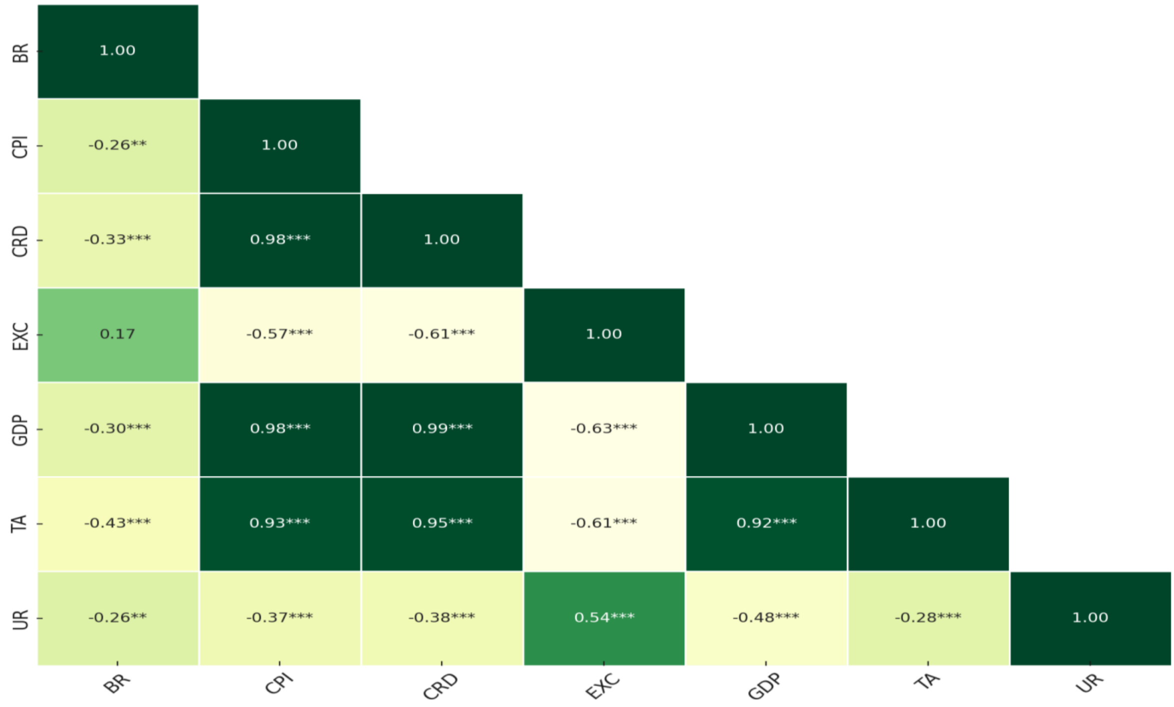


Figure 2. Correlation matrix
Source: *own calculation*

5. Empirical results and discussions

In order to more accurately determine the deterministic structures of the time series used in this study, trend analysis was performed. This step is critically important for the application of unit root tests, as not only the level of stationarity of the series but also the inclusion of constant and/or trend terms in the equation directly affects the validity of the test results. Accordingly, graphical examinations and statistical trend analyses helped to select the appropriate test specification (whether only constant or constant and trend) for each variable. Thus, the stationarity tests in the subsequent steps were theoretically grounded on a more solid basis.

Table 4. Trend analysis results

Trend Analysis Results by Variable		
Variables	**C**	**Trend**
BR	3.9060***	-0.0198***
LCPI	4.3545***	0.0056***
LCRD	8.7021***	0.0127***
LEXR	0.3037***	-0.0024***
LTA	13.505***	0.0309***
LGDP	9.6061***	0.0049***
UR	6.9473***	-0.0264***

Source: *own calculation*

The results of the trend analysis provide important information regarding whether the time series contain deterministic components. As seen in Table 3, the coefficients for the constant term (C) and the time trend for all variables were found to be statistically significant at the 1% level (***). This clearly indicates that each series not only fluctuates around its mean but also exhibits a distinct trend over time. Consequently, this trend analysis explicitly shows that constant and trend terms need to be included in the model during the stationarity testing phase. In this context, using the trend-included versions of the ADF (1981), KSS (2003), and F-Kruse (Güriş, 2019) tests in the following steps will enhance the reliability of the obtained results.

Following the trend analysis, unit root tests were applied to determine the stationarity properties of the variables included in the model. This is crucial because econometric analyses conducted with non-stationary (I(1)) time series may lead to spurious regression issues (Granger & Newbold, 1974). Therefore, it was evaluated whether the variables are stationary at their levels or after differencing through the ADF (Dickey & Fuller, 1979), KSS (Kapetanios, Shin & Snell, 2003), and the Fourier-based F-Kruse (Güriş, 2019) tests. The obtained results are presented in Table 5.

Table 5. Unit root tests results

Variables	**ADF C&T**	**KSS C&T**	**F-Kruse C&T**			**Results**
	Test.stat	**Test.stat**	**Test.stat**	**k**	**F**	
BR	-0.8138	-1.1121	4.4181	1	59.021	I(1)
ΔBR	-7.9238***	-	-	-	-	
LCPI	-0.8564	-0.4547	10.476	1	165.73	I(1)
ΔLCPI	-6.1338***	-	-	-	-	
LCRD	-2.0593	-1.9332	5.6043	2	34.213	I(1)
ΔLCRD	-6.5611***	-	-	-	-	
LEXR	-3.6064**	-3.5141**	7.4614	1	42.150	I(0)
LGDP	-2.7166	-6.3326***	39.046***	1	31.296	I(0)
ΔLGDP	-11.096***	-	-	-	-	
LTA	-1.2627	-2.3507	15.677	1	30.046	I(1)
ΔLTA	-8.5492***	-	-	-	-	
UR	-2.9130	-4.4948***	25.064***	2	28.376***	I(0)
ΔUR	-10.989***	-	-	-	-	

Source: *own calculation*

In time series analysis, the stationarity level of variables is a critical prerequisite for both the structural consistency and predictive power of the modeling process. In this context, to evaluate the stationarity levels of the variables included in this study, three different unit root tests were employed: ADF (1981), KSS (2003), and the Fourier Kruse test (Güriş, 2019). These tests allowed for a more robust assessment of stationarity by taking into account both linear and nonlinear structural breaks.

According to the results obtained, if the test statistics for the level value of a variable rejected stationarity, and a test was performed for the differenced series, the respective series was considered I(1). Otherwise, if the test results for the level value directly favored stationarity, the variable was accepted as I(0).

Based on the unit root test results, BR, CPI, TA, and CRD were found to be I(1), while only LEXR, LGDP, and UR were found to be I(0), meaning they are stationary at their levels. This situation lays the groundwork for the VAR and SVAR modeling in the study to be of a mixed structure, including both level and differenced series. Additionally, considering the nonlinear breaks provided by the Fourier-based stationarity tests, it can be stated that the data structure has been analyzed in a more realistic manner. This meticulous testing approach indicates that the model is built according to advanced econometric standards.

So as to apply the VAR procedure, the optimal lag number should first be defined. The results of tests presented in Panle A, Table 6. Although the findings related to the information

ISSN 2071-789X

RECENT ISSUES IN ECONOMIC DEVELOPMENT

criteria suggested different lag lengths, the model selection process was not limited solely to information criteria; the diagnostic reliability of the model was also considered. In this context, the VAR(2) model, which does not contain autocorrelation or heteroskedasticity at an acceptable level and whose inverse roots are all within the unit circle, was selected as the primary model for the analysis. The choice of this model was influenced not only by statistical consistency but also by its strong capacity for economic interpretation. Therefore, the VAR(2) model, estimated in alignment with both theoretical expectations and empirical validity, serves as the foundation for the subsequent structural analyses.

Table 6. The VAR residual diagnostics and Lag interval tests

Panel A: Information Criteria

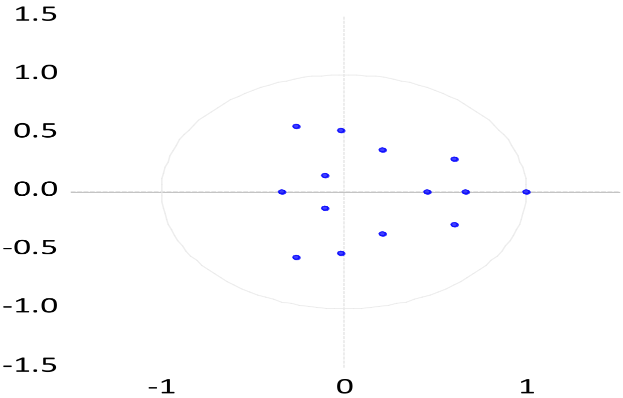
Lag	LR	FPE	AIC	SC	HQ
0	NA	3.14e-17	-18.139	-16.316	-17.406
1	536.2487	3.90e-20	-24.858	-21.617*	-23.555*
2	83.19427*	3.43e-20*	-25.055	-20.396	-23.182
3	60.27873	4.10e-20	-25.005	-18.928	-22.562
4	59.51531	4.64e-20	-25.105*	-17.610	-22.092

Panel B: Diagnostic Test

Autocorrelation: LM test (P)	Heteroskedasticity: White test (P)
48.803 (0.4859)	1098.5 (0.0243)

Panel C: Stablility test results

Inverse Roots of AR Characteristic Polynomial



Modulus
0.9973
0.6597
0.6597
0.6186
0.6186
0.5286
0.5286
0.4529
0.4107
0.4107
0.3442
0.1786
0.1786

Source: *own calculation*

After ensuring the statistical validity and stationarity of the VAR(2) model, impulse-response functions (IRF) were calculated to enable a deeper examination of the structural dynamic relationships presented by the model. In this context, a structural impulse-response analysis was applied to reveal the short-term effects of a one-standard-deviation structural shock in the Total Assets (TA) variable on other macroeconomic variables. This analysis serves as a critical tool for evaluating the propagation patterns and response times of policy shocks over time.

The TA variable responds strongly and positively to a shock in total assets during the first period. Although the effect of the initial shock weakens in a short time, a significant positive impact is observed in the first three periods. This indicates that central bank interventions have an immediate and noticeable impact on the balance sheet, with the effect gradually fading over time. This finding is consistent with expectations that the balance sheet size will temporarily increase during periods of monetary expansion.

The TA shock creates a negative but significant effect on treasury rates. This effect is statistically significant during the first 2–3 periods and gradually diminishes over time. This finding is aligned with the theory that expansionary monetary policies tend to reduce long-term interest rates (e.g., the portfolio balance approach and Bernanke & Mihov, 1998). The abundance of liquidity and increased bond purchases raise bond prices and push yields downward (Gagnon et al., 2011). This finding is also confirmed in the study by Gagnon et al. (2011), which shows that QE reduced long-term bond interest rates by approximately 1%.

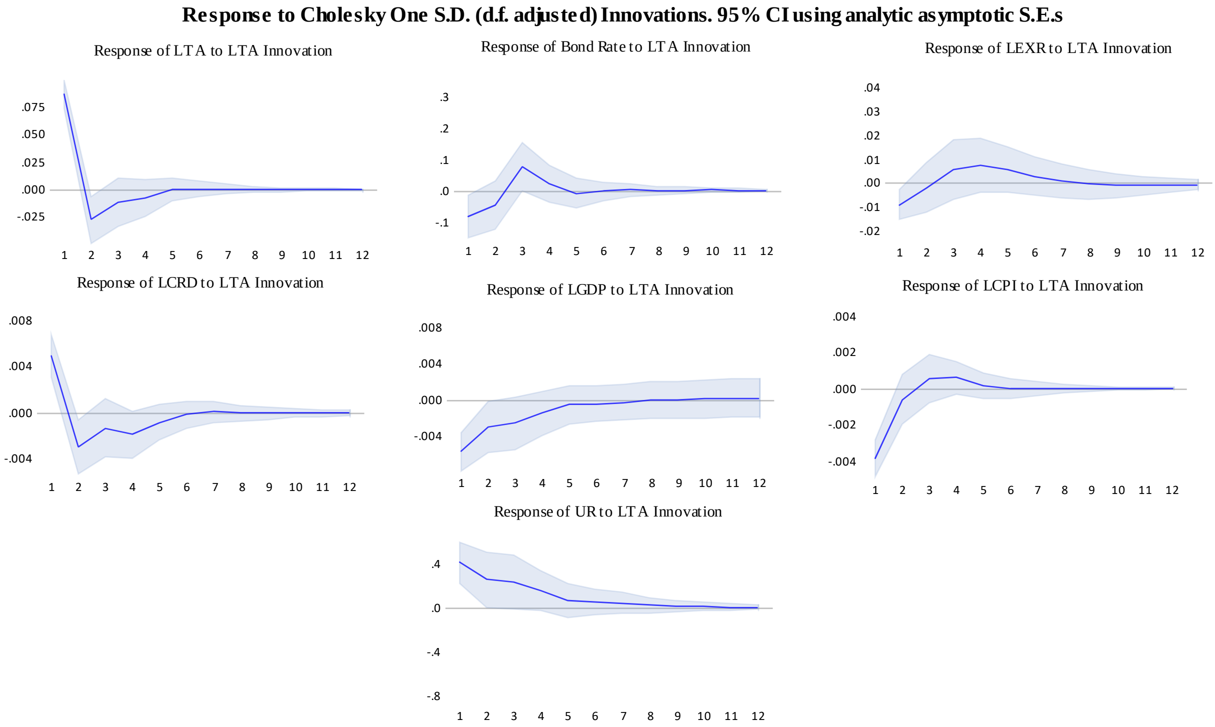


Figure 3. Short-run impulse response functions
Source: *own calculation*

The exchange rate (Euro/USD) initially shows a negative response but follows a positive and statistically significant upward trend in subsequent periods. This indicates that with expansionary monetary policy, the exchange rate tends to depreciate (i.e., the dollar weakens) and that it takes time for capital flows to rebalance. This result is consistent with the portfolio balance approach and the international interest rate parity hypothesis. Neely (2015) points out that expansionary monetary policy causes significant international effects in foreign exchange markets, while Chen et al. (2016) reveal that the unconventional monetary policies of the United States, particularly during crisis periods, have significant and lagged effects on the exchange rate.

The TA shock positively and statistically significantly affects total credit (CRD). This effect, observed in the first 2–4 periods, can be interpreted as a short-term increase in credit volume due to the TA shock. This indicates that expansionary monetary policy strengthens bank balance sheets and promotes credit distribution. Joyce et al. (2011) explain this as QE increasing the lending capacities of banks and making financial markets more liquid. Moreover, this finding supports the credit channel-based monetary policy transmission mechanism model proposed by Bernanke and Blinder (1988). At the same time, Lown and Morgan (2006), who highlight the strong relationship between the credit cycle and the business cycle, emphasize that expansionary policies support economic recovery by increasing credit supply. Therefore, the impact of the TA shock on credit volume is evaluated within a framework that is both theoretically anticipated and empirically validated.

The impact of the TA shock on growth (GDP) is statistically weak but negative in the initial periods. This suggests that in the short term, monetary expansion does not create a significant increase in output but may have a marginal effect. This finding supports the argument that monetary policy's effect on aggregate demand may be limited in economic environments where the IS curve is relatively flat. That is, the immediate reflection of expansionary monetary policy on the real sector is limited. Krishnamurthy and Vissing-Jorgensen (2011) suggest that uncertainties during the transformation of liquidity into investments weaken this effect. Christiano et al. (2005) reveal that the impact of monetary shocks on real activity may be delayed and limited, while Romer C. and Romer D. (2004) also emphasize that the impact of monetary policy shocks on growth is not particularly evident in the short term and generally operates through indirect channels. The results obtained in this context are consistent with empirical observations in the literature.

Following an expansionary shock in total assets, the CPI initially shows a negative response but gradually converges toward zero. In other words, monetary expansion initially creates a suppressive effect on the general price level, but this effect weakens and disappears over time. The impact on inflation remains limited due to the slower-than-expected creation of demand by expansionary monetary policy. This can be explained by the concentration of liquidity in financial assets rather than the real sector. Especially during the initial QE waves after the 2008 Financial Crisis, monetary expansion did not create the expected impact on prices because consumer spending failed to recover. Furthermore, while bond purchases increased liquidity, banks' willingness to lend remained limited. This failed to create upward pressure on prices. Boivin et al. (2010) reveal that the effects of monetary policy shocks on prices are both delayed and weak, and in some cases, contrary to expectations, which can explain the observed reaction.

The impulse–response analysis indicates that the TA shock initially generates a positive response in the unemployment rate. This outcome can be explained by the delayed reflection of monetary expansion on the real sector, as liquidity growth in financial markets does not immediately translate into productive investment. Although expansionary monetary policy improves bank balance sheets and increases credit volume, firms may require time to regain confidence and initiate new investments. Hence, the short-term increase in unemployment reflects a temporary adjustment process. According to Bernanke (2012), the job-creation capacity of expansionary monetary policies tends to materialize gradually rather than instantaneously. Consequently, these findings suggest that the effects of monetary policy on the labor market are indirect and become evident only over time.

Furthermore, the structural shock in total assets is found to influence the financial system primarily through the interest rate, exchange rate, and credit channels, while its effects on growth, prices, and unemployment remain weak and delayed in the short term. This evidence aligns with both classical and new Keynesian perspectives, which emphasize the existence of time lags in the transmission of monetary policy shocks to the real sector (Christiano et al., 2005; Woodford, 2003). Empirical research further supports that these policy shocks operate via liquidity and portfolio channels (Gagnon et al., 2011; Neely, 2015). Particularly during crisis periods, quantitative easing policies transmitted through bond yields, exchange rates, and credit expansion exert immediate effects on financial markets, while their impact on the real economy unfolds more gradually over time.

Conclusion and policy Implications

This study examines the short- and long-term effects of expansionary shocks in total assets (TA) on financial and real macroeconomic variables within the framework of a structural

VAR model. The findings indicate that expansionary monetary policy shocks create significant effects, particularly in the short term, on credit volume, exchange rates, and bond interest rates. In contrast, the effects on inflation, growth, and unemployment remain more limited and do not reach statistical significance. Therefore, it shows that the Quantitative Easing (QE) policies implemented in the United States have noticeable effects on financial markets, but their reflections on the real economy take time.

The short- and long-term constraints applied in the model are consistent with monetary policy theories; especially, empirical counterparts of theoretical structures such as the monetary neutrality hypothesis, the portfolio balance approach, and the credit channel have been found. The use of Fourier-based approaches in unit root analyses has been a strong methodological choice in terms of considering the nature of structural breaks in the series.

As a result, this study reveals that the effects of QE policies extend beyond financial markets, being transmitted to the real sector through specific channels, albeit in an indirect and lagged manner. The findings provide important implications for both academics and practitioners in terms of monetary policy design. Based on the findings, the following policy recommendations are presented: (i) Credit expansion should be encouraged to be directed towards more productive sectors. Credits provided to high-growth-potential sectors such as SMEs and technology-focused startups can increase employment capacity. (ii) To balance the increase in unemployment rates during monetary expansion periods, labor training programs and employment incentives for the private sector should be implemented. Employment opportunities can be created especially in the digitalization and clean energy sectors. (iii) The results of the study emphasize that QE policies are effective in ensuring financial stability, but complementary fiscal policies are necessary to stimulate the real economy. To ensure a faster reflection of QE policies on the real sector, increasing public expenditures such as infrastructure investments, green energy projects, and employment incentives are important. Such direct investments can accelerate the transition of provided liquidity to the real economy. (iv) To prevent financial instability due to the depreciation of the dollar against the euro, Central Bank reserve policies should be reviewed, and foreign exchange interventions may be carried out if necessary.

Therefore, QE needs to be accompanied by macroprudential policy to check excessive credit growth or asset bubbles, and central banks need to coordinate internationally and communicate clearly about exit to contain spillover risks across borders. If used during times of slack and reversed as conditions normalize, an appropriately calibrated QE policy can meet growth and labor market objectives without compromising price or financial stability, as long as policymakers are careful to respond to transmission lags and risks to the financial system.

Despite these contributions, several methodological limitations should be acknowledged. First, the SVAR framework depends on identification restrictions, and alternative specifications could alter the magnitude or timing of responses. Second, the dataset spans 2003–2025 and captures major shocks such as the Global Financial Crisis and the COVID-19 pandemic, but its temporal scope is still limited and may not reflect longer historical dynamics. Third, while Fourier-based unit root tests allow for certain structural breaks, the model may not fully accommodate unprecedented shocks or nonlinear adjustments. Finally, the analysis is confined to the U.S. economy, and the findings may not be directly generalizable to other contexts with different institutional structures. These limitations suggest that future research could extend the analysis with nonlinear SVAR models, higher-frequency data, or cross-country comparisons to provide a more comprehensive understanding of the macroeconomic effects of QE.

References

Adrian, T., Erceg, C., Kolasa, M., Lindé, J., & Zabczyk, P. (2024). *New Perspectives on Quantitative Easing and Central Bank Capital Policies.* International Monetary Fund.

Aji, T. S., Prabowo, P. S., & Canggih, C. (2021). Causality relationship among interest rate, inflation, exchange rate using vector autoregression. *Economics, Management and Sustainability*, *6*(1), 49–60. https://doi.org/10.14254/jems.2021.6-1.4

Angelov, I. (2023). Inflation and employment: Exploring the dynamic relationship in the labor markets. *Economics, Management and Sustainability*, *8*(1), 53–57. https://doi.org/10.14254/jems.2023.8-1.5

Baumeister, C., & Benati, L. (2012). *Unconventional monetary policy and the great recession: Estimating the macroeconomic effects of a spread compression at the zero lower bound (No. 2012-21).* Bank of Canada.

Bernanke, B. S. (2012). The effects of the great recession on central bank doctrine and practice. *The BE Journal of Macroeconomics,* 12(3).

Bernanke, B. S., & Blinder, A. S. (1988). Credit, money, and aggregate demand. NBER *Working Paper Series*. #2534

Bernanke, B. S., & Mihov, I. (1998). Measuring monetary policy. *The quarterly journal of economics*, 113(3), 869-902.

Bernanke, B. S., & Mihov, I. (1998, December). The liquidity effect and long-run neutrality. *In Carnegie-Rochester conference series on public policy* (Vol. 49, pp. 149-194). North-Holland.

Bibow, J. (2021). Evolving international monetary and financial architecture and the development challenge: A liquidity preference theoretical perspective. *In Emerging Economies and the Global Financial System* (pp. 101-115). Routledge.

Blanchard, O. J., & Quah, D. (1988). The dynamic effects of aggregate demand and supply disturbances. *NBER Working Paper* #2737

Bluwstein, K. and Canova, F. (2016) Beggar-Thy-Neighbor? The International Effects of ECB Unconventional Monetary Policy Measures. *International Journal of Central Banking*, 12, 2352–2364.

Boivin, J., Kiley, M. T., & Mishkin, F. S. (2010). How has the monetary transmission mechanism evolved over time?. *In Handbook of monetary economics* (Vol. 3, pp. 369-422). Elsevier.

Bowman, M. W. (2024). The Federal Reserve's Balance Sheet as a Monetary Policy Tool: Past Lessons and Future Considerations: A speech at the 2024 BOJ-IMES Conference, hosted by the Institute for Monetary and Economic Studies, Bank of Japan, Tokyo, Japan., May 28, 2024 (No. 98296).

Brunnermeier, M. K., & Koby, Y. (2018). The reversal interest rate. *NBER Working Paper* No. 25406.

Brycz, M. (2012). Keynesian and monetary approach to the liquidity trap-looking for cointegration evidence from 2008-crisis in the United States. *Journal of International Studies,* 5(2), 18-29.

Burriel, P., & Galesi, A. (2017). Uncovering the heterogeneous effects of ECB unconventional monetary policies across euro area countries. *European Economic Review*, 101, 210–229.

Chen, Q., Filardo, A., He, D., & Zhu, F. (2016). Financial crisis, US unconventional monetary policy and international spillovers. *Journal of International Money and Finance,* 67, 62–81.

Christiano, L. J., Eichenbaum, M., & Evans, C. L. (1999). Monetary policy shocks: What have we learned and to what end?. *Handbook of macroeconomics*, 1, 65-148.

Christiano, L. J., Eichenbaum, M., & Evans, C. L. (2005). Nominal rigidities and the dynamic effects of a shock to monetary policy. *Journal of political Economy*, 113(1), 1-45.

Chung, H., Laforte, J. P., Reifschneider, D., & Williams, J. C. (2012). Have we underestimated the likelihood and severity of zero lower bound events? *Journal of Money, Credit and Banking*, 44(s1), 47–82.

Cohen, J. (2013). *Statistical power analysis for the behavioral sciences*. New York, Routledge. doi.org/10.4324/9780203771587

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American statistical association*, 74(366a), 427-431.

Dickey, D. A., & Fuller, W. A. (1981). Likelihood ratio statistics for autoregressive time series with a unit root. *Econometrica: journal of the Econometric Society*, 1057-1072.

Domanski, D., Scatigna, M., & Zabai, A. (2016). Wealth inequality and monetary policy. *BIS Quarterly Review*, March, 45–64.

Engen, E. M., Laubach, T., & Reifschneider, D. (2015). *The macroeconomic effects of the Federal Reserve's unconventional monetary policies.* Washington, DC: Federal Reserve Board.

Espinosa, V.I., Alonso-Neira, M.A., & Huerta de Soto, J. (2023). The central banking system paradox. *Economics and Sociology*, 16(4), 56-72.

Federal Reserve Bank of St. Louis, (2025). Federal Reserve Economic Data (FRED), https://fred.stlouisfed.org, 15.01.2025

Federal Reserve. (2024). Federal Reserve Balance Sheet Developments. Board of Governors of the Federal Reserve System, May 2024.

Feldkircher, M., & Huber, F. (2016). The international transmission of US shocks—Evidence from Bayesian global vector autoregressions. *European Economic Review*, 81, 167–188.

Fratzscher, M., Lo Duca, M., & Straub, R. (2013). On the international spillovers of US quantitative easing. *ECB Working Paper No*. 1557.

Gagnon, J., Raskin, M., Remache, J., & Sack, B. P. (2011). Large-scale asset purchases by the Federal Reserve: did they work?. *Economic Policy Review*, 17(1), 41.

Gambacorta, L., Hofmann, B., & Peersman, G. (2014). The effectiveness of unconventional monetary policy at the zero lower bound: A cross-country analysis. *Journal of Money, Credit and Banking*, 46(4), 615–642.

Ganelli, G., & Tawk, N. (2019). Spillovers from Japan's unconventional monetary policy: A global VAR approach. *Economic Modelling*, 77, 147-163.

Georgiadis, G. (2015). Examining asymmetries in the transmission of monetary policy in the euro area: Evidence from a mixed cross-section global VAR model. *European Economic Review*, 75, 195-215.

Granger, C. W., & Newbold, P. (1974). Spurious regressions in econometrics. *Journal of Econometrics*, 2(2), 111-120.

Greene, W. H. (1993). *Econometric Analysis* (2nd ed.). New Jersey: Prentice-Hall.

Güriş, B. (2019). A new nonlinear unit root test with Fourier function. *Communications in Statistics-Simulation and Computation*, 48(10), 3056-3062.

Hajek, J., & Horvath, R. (2018). International spillovers of (un) conventional monetary policy: The effect of the ECB and the US Fed on non-euro EU countries. *Economic Systems*, 42(1), 91-105.

Hamilton, J. D. (2020). *Time series analysis*. Princeton university press.

Hausman, J. K., & Wieland, J. F. (2015). Overcoming the Lost Decades?: Abenomics after Three Years. *Brookings Papers on Economic Activity*, 2015(2), 385-431.

Hohberger, S., Priftis, R., & Vogel, L. (2019). The macroeconomic effects of quantitative easing in the euro area: Evidence from an estimated DSGE model. *Journal of Economic Dynamics and Control*, 108, 103756.

Horvath, R., & Rusnak, M. (2009). How important are foreign shocks in a small open economy? The case of Slovakia. *Global Economy Journal,* 9(1), 1850155.

Ihrig, J., & Waller, C. (2024). The Federal Reserve's responses to the post-Covid period of high inflation, *FEDS Notes*, February 14, 2024.

Jabiyev, F., Asgarov, A., & Heydarli, T. (2022). The relationship between public debt and economic growth: The case of Azerbaijan. *Journal of International Studies*, (2071-8330), 15(4), 213-225.

Jordà, Ò., Singh, S. R., & Taylor, A. M. (2022). Longer-run economic consequences of pandemics. *Review of Economics and Statistics,* 104(1), 166-175.

Joyce, M., Lasaosa, A., Stevens, I., & Tong, M. (2011). The financial market impact of quantitative easing. *International Journal of Central Banking*, 7(3), 113-161.

Joyce, M., Miles, D., Scott, A., & Vayanos, D. (2012). Quantitative easing and unconventional monetary policy–an introduction. *The Economic Journal,* 122(564), F271-F288.

Kapetanios, G., Shin, Y., & Snell, A. (2003). Testing for a unit root in the nonlinear STAR framework. *Journal of Econometrics*, 112(2), 359-379.

Krishnamurthy, A., & Vissing-Jorgensen, A. (2011). The effects of quantitative easing on interest rates: channels and implications for policy (No. w17555). *National Bureau of Economic Research.*

Leong, C. M., Puah, C. H., & Liew, V. K. S. (2018). The impact of Divisia money on monetary model of exchange rate in Indonesia. *Economics & Sociology*, 11(2), 52-63.

Liptáková, M., Šuliková, V., Siničáková, M., & Budová, J. (2024). Synchronisation of Quantitative Easing and Fiscal Expansion: Macroeconomic Effects in Times of Crises. Scientific *Papers of the University of Pardubice, Series D: Faculty of Economics and Administration 2024*, 32(1), 1992

Lown, C., & Morgan, D. P. (2006). The credit cycle and the business cycle: new findings using the loan officer opinion survey. *Journal of Money, Credit and Banking*, 1575-1597.

Lyeonov, S., Draskovic, V., Kubaščikova, Z., & Fenyves, V. (2024). Artificial intelligence and machine learning in combating illegal financial operations: Bibliometric analysis. *Human Technology,* 20(2), 325-360.

Meszaros, J., & Olson, E. (2020). The effects of US quantitative easing on South Africa. *Review of Financial Economics,* 38(2), 321-331.

Mukhtarov, S., Alalawneh, M. M., Azizov, M., & Jabiyev, F. (2020). The Impact of Monetary Policy and Tax Revenues on Foreign Direct Investment Inflows: An Empirical Study on Jordan. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, 68(6).

Mukhtarov, S., Humbatova, S., Mammadli, M., & Hajiyev, N. G. (2021). The Impact of Oil Price Shocks on National Income: Evidence from Azerbaijan. *Energies*, *14*(6), 1695. https://doi.org/10.3390/en14061695

Mukhtarov, S., Yüksel, S., Ibadov, E., & Hamidov, H. (2019). The effectiveness of exchange rate channel in Azerbaijan: an empirical analysis. *Banks and Bank Systems, 14*(1), 111-121. doi:10.21511/bbs.14(1).2019.10

Neely, C. J. (2015). Unconventional monetary policy had large international effects. *Journal of Banking & Finance,* 52, 101-111.

Neuenkirch, M. (2020). An unconventional approach to evaluate the Bank of England's asset purchase program. *Open Economies Review,* 31(1), 79-94.

Pichova, Cernohorsky, J., Kacerova, M., & Zila, J. (2023). *A critique of quantitative easing by the Federal Reserve System and the European Central Bank.*

Praet, P. (2017). *The ECB's monetary policy: past and present*. Speech at the Febelfin.

Rabhi, A., & Parsons, B. (2025). Monetary policy, inflation, and income inequality in developing countries. *Economics & Sociology,* 18(2), 11-22.

Reichlin, L. (2021). Non-standard monetary policy instruments: effectiveness and risks. *Event held online*, 283.

Romer, C. D., & Romer, D. H. (2004). A new measure of monetary shocks: Derivation and implications. *American economic review*, 94(4), 1055-1084.

Ryou, J. W., Baak, S. J., & Kim, W. J. (2019). Effects of Japanese quantitative easing policy on the economies of Japan and Korea. *The North American Journal of Economics and Finance,* 48, 241-252.

Sims, C. A. (1980). Macroeconomics and reality. Econometrica: *Journal of the Econometric Society*, 1-48.

Sova, Y., & Lukianenko, I. (2022). Empirical evaluation of monetary policy transmission to stock markets and further transfer of macroeconomic shocks to the real sector. *Journal of International Studies*, 15(1), 117-132.

Tillmann, P. (2016). Unconventional monetary policy and the spillovers to emerging markets. *Journal of International Money and Finance*, 66, 136–156.

Uhlig, H. (2005). What are the effects of monetary policy on output? Results from an agnostic identification procedure. *Journal of Monetary Economics*, 52(2), 381-419.

Williams, J. C. (2014). Monetary policy at the zero lower bound: Putting theory into practice. *Hutchins Center Working Papers*.

Woodford, M. (2012). Inflation targeting and financial stability (No. w17967). *National Bureau of Economic Research.*

Woodford, M., & Walsh, C. E. (2005). Interest and prices: Foundations of a theory of monetary policy. *Macroeconomic Dynamics,* 9(3), 462-468.

World Bank. 2023. Global Economic Prospects, January 2023. Washington, DC: World Bank

Zwolankowski, M. (2011). The financial crisis, financial system instability and monetary transmission mechanism. *Journal of International Studies,* 4(1), 26-32.