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The COVID-19 pandemic haunting the transmission of the quantitative easing to the exchange rate

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\textbf{ABSTRACT}

The sudden spread of the COVID-19 pandemic disturbed the entire macroeconomic system and overturned the expectations of financial market participants and decision-makers. Using a TVP-BVAR-SV model, I investigate the transmission of the quantitative easing (QE) to the exchange rate and the business credit in the Eurozone during the pre-and post-COVID-19 outbreak. I find that the responses of the exchange rate EUR/USD to monetary policy shocks vary over time. In particular, I show that the QE policy does not generate the expected effect on the exchange rate during the COVID-19 pandemic period. The results imply that the unforeseen COVID-19 crisis has disturbed and modified investors’ behavior.

1. Introduction

The exchange rate undergoes continuous variations due to several factors, namely: the supply and demand, the international trade balance, the economic growth, the interest rates, and the public debt. All these factors interfere to determine the exchange rate. Accordingly, the exchange market is sensitive to new economic or financial information (Frankel, 1992; Bacchetta and Van Wincoop, 2006). For instance, the exchange rate typically experiences extreme variations during crisis periods. Given the far-reaching economic consequences of the unforeseen and unprecedented COVID-19 pandemic, it is crucial to understand its effects on exchange rates. The COVID-19 crisis has upset all components of the economic environment and overturned all expectations (Goodell, 2020). It led to a collapse of the energy market, a stock market crash, and a global economic slowdown (Zhang et al., 2020). The COVID-19 pandemic has, also, affected the behavior of financial market participants and in turns the exchange market (Kinateder et al., 2021; Wei et al., 2020). For instance, Wei et al. (2020) show that the exchange rate of the “The Belt and Road” countries experienced major fluctuations during the COVID-19 outbreak. Kinateder et al. (2021) investigate the correlation within dominant asset classes during the COVID-19 event by comparing it to that of the 2008 global financial crisis. Their results reveal that the correlation between USD/EUR and USD/GBP has dropped significantly after 50 days of COVID-19. The pandemic continues to dominate the global economic sentiment and its economic and social consequences are still the subject of debate and speculation. With respect to the exchange market, despite a
year of COVID-19, the dynamic of the relation between the pandemic and exchange rates is not fully understood, and thus more research is needed in this regard.

In response to the COVID-19 crisis, the European Central Bank (ECB) decided to maintain the Asset Purchase Programmes, called also the “Quantitative Easing (QE)”. Through this unconventional monetary policy, the ECB seeks to fight deflation, boost economic activity, ease credit conditions and reduce the Euro exchange rate. To achieve these goals, the ECB aims to act on the market parity by lower magnitude to a QE shock during the COVID-19 period. This study is the first to document a change in the behavior of the exchange rate following the QE during the COVID-19 period. The remainder of this paper is structured as follows: Section 2 presents the methodology. Section 3 describes the data. Section 4 discusses the empirical results. Section 5 concludes.

2. Methodology

2.1. The model

I use a BVAR model with time-varying coefficients and stochastic volatility (TVB-BVAR-SV model) developed by Primiceri (2005) and Del Negro and Primiceri (2015). Recently, nonlinear estimation models have been employed in the context of exchange rates (e.g., Cao, 2012; Dybowski et al., 2018). The model is presented as follows:

\[ Y_t = c_t + b_{11}Y_{t-1} + \cdots + b_{1p}Y_{t-p} + \epsilon_t = 1, \ldots, T \] (1)

where \( Y_t \) is a vector of three endogenous variables, namely: the shadow rate, the exchange rate, and the business credit, \( p \) is the number of lags, \( c_t \) is an \( n \times 1 \) vector of constants, \( b_{1t} \) is an \( n \times n \) matrix of coefficients, and \( \epsilon_t \) is an \( n \times 1 \) vector of structural innovations which are normally distributed. The covariance-variance matrix of the innovations \( \epsilon_t \) is presented as follows:

\[ \Omega_t = A_t^{-1}H_t(A_t^{-1})' \] (2)

\[ H_t = \Sigma_{\epsilon} \Sigma_{\epsilon}' \] (3)

\[ \Sigma_{\epsilon} = \begin{bmatrix} \sigma_{11} & 0 & \cdots & 0 \\ 0 & \sigma_{22} & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & \cdots & 0 & \sigma_{nn} \end{bmatrix} \] (4)
The TVP-BVAR-SV model can be expressed as:

\[ y_t = X_t' \tilde{\mathbf{C}}_t + \mathbf{A}_t^{-1} \Sigma_t \epsilon_t \]  

(6)

where,

\[ X_t' = I \otimes \begin{bmatrix} 1, \ y_{t-1}', \ldots, \ y_{t-p}' \end{bmatrix} \]  

(7)

\[ \tilde{\mathbf{C}}_t = \text{vec} \left[ \mathbf{c}_t, \ k_{1,t}, \ldots, k_{p,t} \right] \]  

(8)

and

\[ \text{VAR} \ (\epsilon_t) = I_n \]  

(9)

The coefficients \( \tilde{\mathbf{C}}_t \), \( \mathbf{A}_t \) and \( \Sigma_t \) are varying over time. These assumptions are crucial to detect non-linearity and to capture potential changes in the exchange rate behavior following monetary policy shocks.

2.2. Estimation

The estimation of the model is based on the approach of Primiceri (2005) and Del Negro and Primiceri (2015). Let \( \mathbf{C}_t \) be the vector of the coefficients \( \mathbf{C}_t = (\mathbf{c}_t, k_{1,t}, \ldots, k_{p,t})' \), \( k_t \) be the non-null and non-unitary elements of the matrix \( \mathbf{A}_t \), \( k_t = (a_{21,t}, \ldots, a_{m,1,t}, \ldots, a_{m-1,m-1,t})' \) and \( h_t \) be the vector of the standard deviations \( h_t = (\sigma_{1,t}, \sigma_{2,t}, \ldots, \sigma_{m,t})' \). The coefficients and the non-null and non-unitary elements of \( \mathbf{A}_t \) evolve as random walks:

\[ \mathbf{C}_t = \mathbf{C}_{t-1} + \omega_t \]  

(10)

\[ k_t = k_{t-1} + \phi_t \]  

(11)

Whereas, the stochastic volatility evolve as geometric random walks:

\[ h_t = \ln(\sigma_t) = \ln(\sigma_{t-1}) + \mu_t \]  

(12)

\[ h_t = h_{t-1} + \mu_t \]  

(13)

The residual vectors are normally distributed:

\[ \begin{bmatrix} \epsilon_t \\ \omega_t \\ \phi_t \\ \mu_t \end{bmatrix} \sim N(0, \mathbf{V}) \]  

(14)

\[ \mathbf{V} = \begin{bmatrix} \mathbf{I}_n & 0 & 0 & 0 \\ 0 & \mathbf{Q} & 0 & 0 \\ 0 & 0 & \mathbf{S} & 0 \\ 0 & 0 & 0 & \mathbf{W} \end{bmatrix} \]  

(15)

\( \mathbf{Q}, \mathbf{S} \) and \( \mathbf{W} \) are the hyper-parameters. According to Del Negro and Primiceri (2015), the most appropriate method to estimate the parameters and hyper-parameters is the Gibbs sampler with different blocking using the Markov Chain Monte Carlo algorithm (MCMC).

2.3. Priors

I employ the Primiceri (2005) and Del Negro and Primiceri (2015) method to establish the prior hypotheses. The first 42 months constitute the sub-sample used to draw prior calibration. The time-varying coefficients, the standard deviations as well as the matrix \( \mathbf{A}_t \) are normally distributed. The averages are estimated by the ordinary least squares method (OLS).

\[ \mathbf{C}_0 \sim N(\hat{\mathbf{C}}_{\text{OLS}}, 4.\mathbf{V}(\hat{\mathbf{C}}_{\text{OLS}})) \]  

(16)

\[ \ln(\sigma_0) \sim N(\ln(\hat{\sigma}_{\text{OLS}}), \mathbf{I}_n) \]  

(17)
\[ A_0 \sim N \left( \hat{A}_{OLS}, 4. V(\hat{A}_{OLS}) \right) \]  
(18)

Q, S and W follow the Inverse Wishart distribution:

\[ Q \sim IW \left( k_0^2, 42 \cdot V(\hat{C}_{OLS}), 42 \right) \]  
(19)

\[ W \sim IW \left( k_0^2, 4 \cdot I_n, 4 \right) \]  
(20)

\[ S_1 \sim IW \left( k_0^2, 2 \cdot V(\hat{A}_1_{OLS}), 2 \right) \]  
(21)

\[ S_2 \sim IW \left( k_0^2, 3 \cdot V(\hat{A}_2_{OLS}), 3 \right) \]  
(22)

where,

\[ k_0^2 = 0, 01, \quad k_0^2 = 0, 01, \quad \text{and} \quad k_0^2 = 0, 1 \]  
(23)

\[ S_1 \text{ and } S_2 \text{ are two blocks that constitute } S \text{ and } A_1, A_2 \text{ two blocks of } A. \]

3. Data

As stated above, the goal of this paper is to examine the transmission of the ECB’s monetary policy to the exchange rate and the business credit volume in the Eurozone and to compare the responses of the pre-and post-COVID-19 pandemic. To do so, I use monthly data from January 2004 to November 2020. The data on the exchange rate and the business credit volume are gathered from the EuroStat database of the ECB’s website. I compute the logarithm of the business credit volume. Because of the zero lower bound context, I opt for the European shadow rate\(^1\) constructed by Wu and Xia (2016) to measure the monetary intervention. I consider three shadow rate shocks on three different dates, namely (i) in October 2012, which is featured by the implementation of Outright Monetary Transactions (OMT) during the sovereign debt crisis, (ii) in March 2016, which is characterized by the application of the QE policy, and (iii) in April 2020, which is characterized by the maintaining of the QE policy in the context of the COVID-19 pandemic.

4. Results

4.1. Stochastic volatility

Fig. 1 illustrates the stochastic volatility of the EUR/USD exchange rate and the business credit volume in the Eurozone from July 2007 to November 2020. The EUR/USD volatility reached its highest peak in history at the beginning of 2009. In fact, the subprime crisis has serious adverse effects on the global financial system. It led to a banking system disturbance, a stock market collapse, and a major economic recession. Furthermore, this volatility spike is owed to the high uncertainty and lack of confidence. The second main period is recorded between 2011 and 2013. Over that period, I notice a strong instability, which is probably related to the sovereign debt crisis and the application of new monetary policy tools. The third period of volatility is linked to the announcement of the QE in 2015-2016. The variation of the EUR/USD gradually declined and remained at a low level for about three years from 2017 to 2019. This may suggest that the QE was effective in reducing the volatility of the EUR/USD and rebuilding investors’ confidence during non-crisis periods. In 2020, however, I document an uptrend volatility owed to the spread of the COVID-19 pandemic. This instability can discourage international trade and Carry-Trade activity.

Likewise, the business credit recorded a substantial volatility during the global financial crisis in 2008-2009. Subsequently, I observe considerable fluctuations over the entire period of 2011-2017. This can be explained as follows: Following the sovereign debt crisis, the ECB introduced three successive unconventional monetary measures: The Outright Monetary Transactions (OMT), introduced in 2012, the Long-Term Refinancing Operation programmes (LTRO), adopted in 2014, and the QE launched in 2015. Because monetary policy directly affects interest rates and investment decisions, there is a high volatility of the business credit volume during these three key dates. The last peak in volatility is recorded in early 2020 with the onset of the COVID-19 pandemic. The oscillations of the exchange rate and the business credit in 2020 remain moderate compared to that of the subprime crisis.

4.2. Impulse responses

Fig. 2 presents the impulse responses of the exchange rate and the business credit volume to shadow rate shocks on three different dates, namely: 2012-10, 2016-03, and 2020-04. The dark shaded areas correspond to 68% confidence intervals. Figs. 3 and 4 display the pairwise differences between impulse responses in three different dates. At first, it appears that the shape of the response curves to

\(^1\) Shadow rates data for the Euro area can be downloaded from Cynthia Wu’s website: https://sites.google.com/view/jingcynthiawu/shadow-rates
monetary policy shocks is changing from one period to another, which suggests the variation of the link between the ECB’s monetary policy and the EUR/USD. This implies a nonlinear relation between the two variables.

The EUR/USD exhibits a negative short-term response to shadow rate shocks only in 2012 and 2016. In 2012, the negative effect is temporary. The shadow rate shock produces a significant drop in the EUR/USD, which lasted for only two months, then the shock was quickly absorbed and dampened over time. There are two possible reasons for this temporary effect. The first reason relates to the external value of the U.S. dollar. In 2012, the dollar was suffering from the aftermaths of the subprime crisis. Moreover, the Federal Reserve (FED) adopted three rounds of QE: QE1 in 2009, QE2 in 2010, and QE3 in 2012. These measures caused a marked depreciation of the U.S. dollar. The second reason relates to the ECB’s monetary policy. In fact, the ECB adopted sterilized unconventional monetary policies, namely: The Security Market Programmes (SMP) in 2009 and the OMT in 2012. These two monetary measures aim to trigger an increase in sovereign debt prices without increasing the money supply by absorbing the created liquidity. On the other hand, the EUR/USD response, in March 2016, shows a significant decline in both short and medium-term. In fact, the depreciation of the EUR/USD is continuing despite the end of the QE programs and the OMT. This can be explained by the uncertainty related to the future path of interest rates in the U.S. and the potential for further tightening by the FED.

Fig. 1. Standard deviation of the residuals.
USD is maintained over a 20-month horizon. This finding implies that the ECB’s QE, implemented in 2015, was effective in weakening the Euro’s exchange rate with a lingering effect. This result is consistent with the objectives of the decision-makers to boost exports.

In 2020, which is characterized by the COVID-19 pandemic, the results indicate that a shadow rate shock leads to an increase in the EUR/USD during the two first months instead of falling. This result can be explained by three main factors, namely: (i) the great and sudden economic recession, and (ii) the considerable uncertainty haunting the global financial market. Such a risky environment contributes to (iii) investors’ reluctance and a decline in Carry-Trade operations. This investment reluctance is confirmed in Fig. 4, which indicates that the response of business loans in 2020 to a shadow rate shock is weaker compared to previous periods. In fact, the monetary shock generates an increase in the business credit volume on the three dates. However, the level reached is getting low over time. This can be explained by the fact that the pandemic has forced governments to apply containment measures to help stop the spread of the virus. Those measures led to a sharp decline in economic activity and a high financial instability. In addition, the COVID-19 outbreak continues to cause significant economic and social disruptions and massive uncertainty. It is, thus, difficult for the ECB to
Using a time-varying BVAR, this paper examines the behavior of the exchange rate and the business credit volume in the Euro area following the ECB’s monetary measures. The stochastic volatility analysis indicates that major events, such as the 2008 global financial crisis, the ECB’s decisions and the COVID-19 pandemic, contribute to the instability of the EUR/USD. In fact, the exchange rate is often sensitive to the market participants’ expectations and speculators’ behavior. My results, also, reveal that the responses of the EUR/USD during the first two sub-periods are in line with the ECB’s intentions to bring down the exchange rate. This effect is more pronounced and lasting over the medium term with the application of the QE in 2016. However, I find that the exchange rate has increased in the short-term in the face of a QE shock during the COVID-19 period. This suggests a major disruption of the behavior of investors who have been influenced by the unprecedented circumstance resulted from COVID-19. Furthermore, I show that, in 2020, the business credit reacts by lower magnitude to the QE shock. The financial market, including the credit market, was dramatically affected by the
containment measures, the industrial sector disruption and the stock market crash. Such factors led to a disturbance in the expectations of market participants. Therefore, a monetary policy that attempts to drive and control investors’ behavior through financial markets and exchange rate risks losing its effectiveness in the future. Thus, decision-makers should revisit their economic policies in the face of changing investors’ behavior and increasing uncertainty.

CRediT authorship contribution statement

Donia Aloui: Conceptualization, Methodology, Software, Data curation, Visualization, Investigation, Writing – review & editing.

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