Exchange rate volatility and monetary policies

Introduction

Monitoring exchange rate volatility is one of the main targets of a central bank. This is due to the fact that economic growth is heavily linked to the price stability, which can be achieved only if the exchange rates do not vary too massively and quickly.

Our project is focused on the EUR/USD exchange. The aim of our work is to propose a model for its volatility taking into account many financial indeces, some of which represent monetary political choices of the EBC with respect to the USD, some others are quantities that can play a relevant role in the exchange market.

Literature review

*Exchange rate volatility*

The exchange rate is the one at which the currency of one country is converted to another currency from a different country. Its volatility is defined as being associated with exchange rate movements that are unexpected [1], and it has been a serious concern for those in the academia, policymakers, and participants in the financial market [2].

High fluctuation of the exchange rate in a short time horizon makes economic activity more risky as uncertainty rises. For example, Miyajima [3] observed that when the volatility in the rate of exchange spikes, it leads to an increase in core inflation. As it is not good for the economy, then there should be a systematic and measured policy to mitigate the foreign exchange fluctuations and to minimize the fluctuations, as well as to drive it to its fundamental value [4].

*Monetary policies*

Monetary policy is the way through which the monetary authority of any country (central bank) decides the amount of money supply for that given country. It has been the “fundamental instrument over the years in attaining macroeconomic stability and a prerequisite to attaining sustainable output growth” [5, 6]. It can be seen also as the regulating amount of the supply of money in a country’s economy in order to attain an optimal mix of output and inflation goal realization [7]. Exchange rates can thus serve as “automatic stabilizers” for the macroeconomy in any nation [8].

*Literature results*

Eze and Okotori [9] found that in the long run, monetary policy instruments tend to have a significant nexus with the volatility in the exchange rate, meaning that all the monetary policy variables have a significant long run correlation with the exchange rate; more specifically, they found that while money supply and the rate of exchange seem to have a significant short run impact on exchange rate volatility, other variables such as liquidity ratio or monetary policy rate did not show a significant short run relationship with it.

Adeoye and Saibu [10] analyzed this topic in the specific case of Nigeria, and observed that there is a causal link between the past values of monetary policy variables (e.g. interest rates) and the exchange rate, such that a change in the level of previous values of monetary policy variables causes exchange rate volatility; they concluded that “inflation rate, reserves, interest rate and money supply depreciate and cause volatility in nominal exchange rate which further reinforce other findings that monetary policy is crucial to exchange rate management in Nigeria”. They also found that “the short-run dynamics reveals that the changes in monetary policy instruments correlate to the variations in the rate of exchange via a process that is self-correcting, without the involvement of the CBN (the Central Bank of Nigeria)”.

Focusing on Indonesia and more generally all developing countries, it has been found [4] that “Indonesia as a small open economy tends to have a high and persistent exchange rate volatility, when this result holds in most open emerging countries”, and that an increase in real interest rate parity causes appreciation of the domestic currency. Furthermore, Foreign-exchange-Sale Interventions (a monetary policy strategy implemented by the Central Bank of Indonesia) make the return of the exchange rate decrease slightly, meaning that the monetary policies actually have got an effect on the evolution of the exchange rate volatility.

Hassan [11] suggested that a possible way to reduce exchange rate volatility could be to increase the foreign exchange reserve, like a lot of developing countries do. The findings of his research reveal that “there is still ample scope to accumulate reserves to absorb large inflows when the exchange rate is highly likely to be overvalued and to be contributing to a loss of competitiveness”, since “there is a very strong relationship between a country’s ratio of reserves to external financing requirement and the extent of the sell-off of its currency over this period”.

Adusei and Gyapong [12], focusing on the Ghanaian situation, observed that inflation rate, monetary policy rate, current account balance, money and quasi money supply per GDP, annual GDP growth rate and the total external debt are significant predictors of the cedi-dollar exchange rate in Ghana, supporting the already present evidences that monetary policy tools can generally help driving the exchange rate volatility in a desired way.

An and Sun [13] investigated the linkage between monetary policy, the monetary authority’s intrusion into the foreign exchange market, and the rate of exchange for Japan. Their results show that “the impact of intervention is not effective, possibly it has even a negative effect, and that normal monetary policy seems to exert a major impact on both the rate of exchange and interventions in foreign exchange”. They also observed that in response to contractionary monetary policy shocks, the exchange rate appreciates for a short while with the maximum effect coming within several months, and then depreciates over time to the original level in Japan.

Cagliarini and Mckibbin [14] ascertained that in the US monetary policy tends to affect relative prices for up to four years, since “the effect of a temporary change in real interest rates varies across sectors. The effect depends on each sector’s relative capital intensity as well as on the change in the demand for the output of each sector as consumption and investment adjust”. Eventually the effect of monetary policy on relative prices dissipates.

Specifically regarding the EU, it has been found [15] that the ECB systematically responds to exchange rate movements, but quantitative effects are small, which is consistent with the hypothesis that the central banks do not target the fluctuations in the exchange rate but consider them only to the impact they have on the expected inflation and output path. It ha salso been observed [16] that “the most defining element of the ECB’s monetary policy framework, its characteristic definition of price stability with a hard 2% ceiling, functioned as a key shockabsorber in the relatively high-inflation years prior to the crisis, but offered a softer defence in the face of the disinflationary forces that hit the euro area in its aftermath. The imperative to halt persistent disinflation in the post-crisis era therefore called for a radical, unprecedented policy response, comprising negative policy rates, enhanced forms of forward guidance, a large asset purchase programme and targeted long-term loans to banks”.

Data and methodology

Our dataset consists of monthly observations from October 2004 up to March 2022 of the following quantities:

1. EUR/USD exchange rate;
2. Monetary aggregate (M3), namely the sum of currency in circulation, overnight deposits, deposits with an agreed maturity of up to two years, deposits redeemable at notice of up to three months, repurchase agreements, money market fund shares/units and debt securities with a maturity of up to two years;
3. HICP, i.e. the Harmonized Index of Consumer Prices, hence a measure of the inflation;
4. MRO (interest rate on main refinancing operations), meaning the interest rate the banks pay when they borrow money from the ECB for one week;
5. Yield curve spot rate of the government bonds (all issuers of all ratings included) with one year maturity (yieldEU\_1y);
6. Foreign currency reserves, so the quantity of reserves in dollars the ECB holds (ExtRes);
7. Refinancing operations, hence the total amount of money the central bank lends in one month measured in millions of euros (RefOp);
8. EUR/USD volatility. Since this is something not observable, we had to choose how to estimate it: specifically we took daily data of the exchange rate and performed the sample standard deviation on each month.

All the time series have been downloaded from the ECB statistical data warehouse.

Regarding our proposals, firstly our efforts were focused on a linear regression model in order to catch how each one of the above variables influence the exchange rate volatility. Inspired by [9], our first model takes as independent variable the EUR/USD volatility and as regressors M3 and the MRO rate, while the second one takes as regressors the 1 year yield curve and the foreign currency reserves; in both cases we then proceded to add to the regressors set the EUR/USD rate, the HICP inflation rate and the refinancing operations total amount. Besides we did a regression considering all the quantities in our dataset as dependent variables.

To improve the results we checked the stationarity of the time series that belong to our dataset, then we modified the ones that resulted to be not stationary by taking the difference between two consecutive observations in order to get all the regressors stationary. At this point we did a last trial under the cointegration framework to arrive to a more sophisticated and accurate model.

Results

In the first part of our work we implemented linear regression models. In particular we used all the variables in the dataset since our goal was understanding which ones are more statistically significant for explaining exchange rate volatility. Inspired by [9] we first proposed a regression only on M3 and MRO (actually in the paper M2 is used, but nowadays ECB uses the index M3 in order to monitor the same thing). In this case both regressors are very significant but the adjusted-R2is only about 0.15. According to the same publication we implemented as second model a regression with yieldEU\_1y and ExtRes: in this case the yield curves is slightly significant while the foreign currency reserve is not, thus we obtained a very low adjusted-R2of 0.06. We have then extended both these models by adding EUR/USD, HICP and RefOp: the first one does not improve, indeed M3 and MRO are quite significant but the adjusted-R2 is 0.14, whilst the second one improves since ExtRes, EUR/USD, RefOp are very significant and the adjusted-R2 rises up to 0.18. Lastly we used as regressors all the variables available in our dataset, obtaining good significance levels (except for HICP which is not significant at all) and an adjusted-R2 of 0.24. Even though this last model is a bit better it is still not good enough to describe the dependent variable. We tested multicollinearity in order to understand why linear regression is not sufficient to interpretate the problem with these variable and in fact, by computing the VIF of each variable, we saw that many variables are multicollinear, in particular MRO and yieldEU\_1y that have a VIF around 25.

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