JOURNAL OF LAW AND ECONOMICS
ISSN 2709-8133
DEC. 2020 VOL. 1, NO. 1

Euro Depreciating Compared to Real GDP Rising: An Assessment of the Effectiveness of QE on the Euro Area Economy

Massimo Calugi
Business School, University of Aberdeen

ABSTRACT

The effectiveness of QE is difficult to assess thoroughly. Event studies, on the one hand, capture a snapshot around the introduction of new measures that omits the potential anticipation of the policy as well as delayed transmission to economic variables. Empirical studies over a longer horizon, on the other hand, face the restriction that the ECB programme is still evolving and that other factors, such as changes in commodity prices, or the developments in Emerging Markets, have affected the EA economy throughout the duration of QE. Against the background of these difficulties, we use a macroeconomic model to simulate the transmission of QE to financial markets and macroeconomic variables. The model extends previous theoretical work on QE by adopting an open-economy perspective that links the EA to the rest of the world (RoW) through trade and financial flows.

KEYWORDS

Quantitativeeasing; Portfolio adjustment; Asset prices;. Real sector.

1. Introduction

In March 2015 the ECB has joined the group of Western central banks that have implemented large-scale asset purchase programmes as unconventional policy measures. These asset purchases, also called Quantitative Easing (QE), have led to a strong expansion of the central banks' balance sheets. By end-July 2015 the amount of outright purchases on the balance sheet had reached 24% of GDP in the case of the US Federal Reserve, 64% of GDP in the case of the Bank of Japan, 21% of GDP in the case of the Bank of England, and 5% of GDP in the case of the ECB (Constâncio 2015). The ECB's expanded asset purchase programme announced in January 2015 (including purchases of securities issued by the public sector) foresaw buying €60 billion of assets a month from March 2015 to September 2016, which in sum corresponds to circa 10% of annualised euro area (EA) GDP. Modifications to the programme announced in December 2015 and March 2016 have extended the expected duration of the ECB asset purchases until March 2017 and, starting from April 2016, raised the amount of net monthly asset purchases to €80 billion. In late 2016, the expected duration was further extended until end-2017, while the monthly pace of net asset purchases was reduced back to €60 billion from April 2017.

Our dynamic general equilibrium model introduces QE as balance sheet operation of the central bank. The model includes different asset classes (short-term and long-term government bonds, productive capital, and foreign assets) that are imperfect substitutes. The purchase by the central bank of long-term government bonds leads to portfolio reallocation that affects the term premium, corporate financing costs, the exchange rate, and savings behaviour. The financial market implications, in turn, affect domestic demand, net exports, output, and inflation. The model is calibrated to reproduce term-premium effects of the order of magnitude observed after the start of ECB QE for the announced path of asset purchases. Beyond simulating the real impact of termpremia reductions that we associate with the programme as announced in January 2015, the model can be used to gauge the effect of its later extensions which have extended the duration and increased the volume of asset purchases.

2. Incorporating Qe in a Macroeconomic Model

QE can be understood as a monetary policy strategy that increases the size of the central bank's balance sheet. In particular, the central bank purchases longterm (government) bonds, with the aim of reducing the interest spread between short and long maturities, that is, it attempts to flatten the yield curve. The purchase of long-term bonds is financed by additional liquidity provision to the private sector. We introduce these channels of transmission of QE in a standard two-region (EA and RoW) version of the European Commission's QUEST macroeconomic model. Goods are tradable; capital is mobile internationally; labour is immobile across borders. A detailed description of the baseline QUEST model can be found in e.g. Ratto et al. (2009) and Vogel (2014). The following describes the introduction of QE in the model. A detailed account of the QE-related model equations and their derivation is provided in the model appendix and in Priftis and Vogel (2016). The latter paper focuses on the modelling of the portfolio balancing channel of QE and the robustness with respect to features such as cross-border asset holdings. The present paper builds on this model to investigate the impact of the ECB's initial PSPP announcement and the subsequent modifications (late 2015/early 2016, and late 2016) on the EA economy.

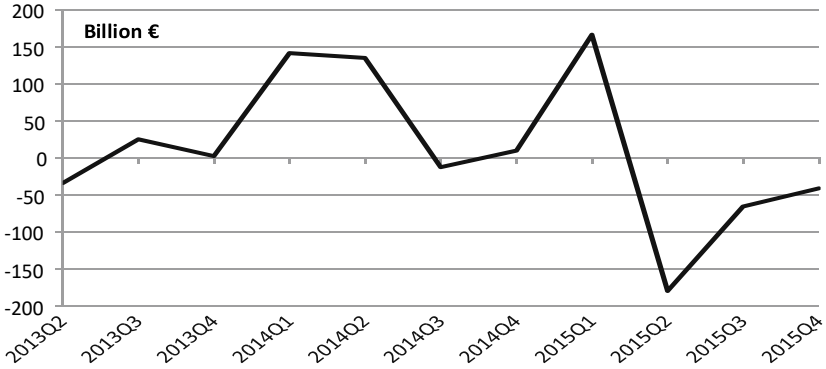

Figure 1. Change in EA government debt liabilities vis-à-vis non-EA world.

2.1. Pricing Long-Term Bonds

The model extension we use introduces long-term government bonds alongside shortterm government debt and an explicit central bank balance sheet. Long-term government debt is modelled through bonds for which the nominal coupon depreciates over time, following Woodford (2001), Chen et al. (2012), and Liu et al. (2017). The price of a long-term bond is thus equal to the discounted value of future payments. The depreciation rate on the coupon is set to 0.975, so that, on average, 1/40th of the longterm bonds mature in each quarter. The average long-term bond lasts for 10 years, which is consistent with the ECB's choice to consider government bonds maturing within 2 to 31 years (Valiante 2015).

2.2. Cross-Border Holdings of Government Bonds

Figure 1 provides evidence that non-EA residents have reduced theirs holdings of EA government debt after the start of ECB QE in 2015q1, suggesting that (part of) these bonds may have been purchased by the ECB as part of its QE operations. EA government debt liabilities vis-à-vis the RoW have been reduced by ca. €32 billion per month during 2015q2–4 according to the data in Fig. 1, which approximately corresponds to half of the amount purchased by the ECB over the same time horizon.

2.3. Imperfect Substitutability Between Short- and Long-Maturity Bonds

We model imperfect substitutability between short-term and long-term bonds through the introduction of quadratic portfolio adjustment costs. In particular, households have a preference for holding a mix of short-term and long-term bonds, and deviations from the target value for the ratio of long-term over short-term debt generate quadratic adjustment costs. The same formulation of portfolio preferences/adjustment costs has been used in other studies, such as Andrés et al. (2004), Falagiarda (2013), Harrison (2012), and Liu et al. (2017).

2.4. Household Decisions

Households receive labour income, returns on financial assets, income from lending capital to firms net of an (exogenous) risk/insurance premium given revenue uncertainty, and dividends from firm ownership. The government levies taxes on income from labour, on corporate income, and on consumption, affecting the intensive margins of consumption, investment and labour. The household's optimisation problem includes decisions on investment in shortterm bonds, long-term domestic bonds and foreign bonds, investment in physical capital, consumption, and labour supply, yielding respective optimality conditions.

2.5. Channels of Transmission

Central bank's purchases of long-term bonds affect asset prices in the model due to the imperfect substitutability between different financial assets. Given imperfect substitutability, reducing the amount of long-term domestic bonds held relative to short-term bonds in the household portfolio has similar effects on the long-term interest rate as a reduction of the short-term interest rate that also reduces long-term rates. Unconventional monetary policy can, hence, mimic the effects of short-term interest rate reductions on long-term yields. In particular, when the central bank intervenes by purchasing long-term bonds, private investors that aim at re-establishing the portfolio mix of shortterm and long-term assets can respond by holding more corporate equity and foreign bonds, and by lowering their savings. The first response means portfolio reallocation towards equity and foreign-currency assets that increases the prices of corporate equity (rising stock market) and foreign currency (euro depreciation).

2.6. Central Bank Balance Sheet

We conclude our narrative description of the modelling environment by specifying a balance sheet for the central bank. The operating profit of the central bank is equal to the sum of base money issuance and interest income minus the current expenditure on buying long-term bonds. Under the central bank's budget constraint, purchases of long-term government bonds can be financed either by money issuance, or by reducing the central bank's operating profit. We opt for the first option, enhanced liquidity provision, in line with the standard definition of QE and the ECB an budget-closure rule in the model ensures the stabilisation of government debt around its target level. In the simulations we assume that debt stabilisation operates through the adjustment of the labour tax rate.

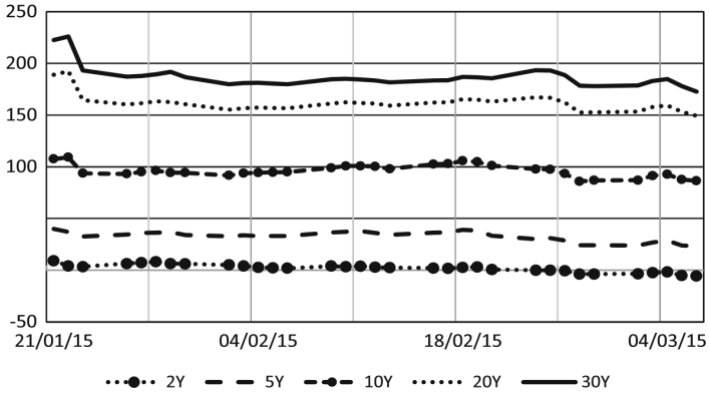

Figure 2. AAA bond yields 21 Jan - 6 March 2015

2.7. Calibration of Bond Market Segmentation and the Baseline

The size of portfolio adjustment costs determines the impact of QE on bond yields across the maturity spectrum in the model. The impact on bond yields is difficult to identify from data as it requires knowledge about the relevant time horizon, i.e. when did agents start anticipating the volume and time path of QE, and about other domestic and international factors, including the time path of (other) risk premia and the path of expected future short-term interest rates, that affect in particular long-term yields.

Figure 2 plots the development in the yield of EA AAA bonds of different maturity between 21 January and 6 March 2015. Figure 3 shows the changes in the yield of EA bonds of different maturity and quality over the same period, where a negative number indicates a decline in the yield between the two points in time. Both Figures suggest that EA long-term bond yields have fallen during this period, depending on the maturity structure and the rating, by between 4 basis points (1-year maturity AAA) and 50 basis points (30-year maturity all ratings).

3. Simulation Results

This section presents the quantitative details and simulation results for implementing the ECB's QE programme in our macroeconomic model. In a first step, we consider the January 2015 announcement of purchasing assets of €60 billion a month from March 2015 until September 2016, with a gradual exit thereafter; in particular, we assume a pace of exit such that half of the central bank balance sheet expansion is undone by mid-2018. In a second step, we look at the implications of subsequent modifications to the QE programme introduced in late-2015 and early-2016. The modifications include an extension of the expected programme duration and an increase of net monthly asset purchases to €80 billion until March 2017 in late 2015 and early 2016 as well as a further extension until end-2017 communicated in late 2016, with the monthly pace of net asset purchases reduced back to €60 billion from April 2017. In our simulations of the programme extensions, we keep the balance sheet expanded one year after the end of purchases before gradual exit (at the same pace as for the January 2015 programme) thereafter to capture non-immediate unwinding of the central bank's balance sheet position. The imposed path on exit is hypothetical. In particular, the unwinding of the balance sheet expansion may start later and proceed at much lower speed than assumed here. Applying uniform exit assumptions for simulations of the initial programme and its subsequent extensions should, however, still provide some information about the impact of the programme extensions compared to the original programme according to the model.

3.1. January 2015 Programme

Table 1 reports simulation results for implementing asset purchases as announced by the ECB in January 2015. The simulations assume a credible announcement, i.e. anticipation of the path of purchases once it had been announced; the zero bound on nominal short-term rates is binding during the duration of the programme (2015-16).

The resultsinTable1 showa positiveimpactonrealGDP growthofalmost0.1 pp. on average in 2015 and 2016. The positive GDP effect is driven by higher private consumption and investment, which is associated with lower savings and portfolio rebalancing towards riskier assets (physical capital/equity). The demand stimulus together with euro depreciation also implies an increase in inflation by about 0.1 pp. in the first two years. The government balance improves slightly and government debt to GDP declines due to stronger GDP growth and lower government financing costs. One should also note the strong improvement in the current account associated with the cross-border holding of long-term government debt. Purchases by the ECB of EA long term bonds reduce the interest income paid to non-EA residents, which leads to an improvement in the current account.

3.2. Modifications to the Programme

The ECB has modified its QE programme with announcements in December 2015 and March 2016 to extend the expected duration of the purchase programme until (at least) March 2017 and to increase the amount of net asset purchases to €80 billion per month between March 2016 and March 2017. In late 2016, the expected programme duration was further extended until end-2017. We implement these modifications in the model, assuming that the announcements are considered credible, but have not been anticipated (i.e. no effect prior to the actual time of announcement). The announcement to keep the balancesheet expandedafter the termination ofnet asset purchases isimplemented in the simulation by keeping the stock of central bank holdings of EA government debt at its end-2017 level in 2018 and start gradual unwinding of the asset position only in 2019.

The results in Table 2 show a significantly stronger response of real GDP in 2016 and following years under the modified programme. Real GDP growth increases by almost 0.2 pp. in 2016 and 0.1 pp. in 2017 compared to 0.1 pp. and 0.0 pp. in Table 1, and the euro depreciates more strongly. The increase in economic activity is again driven by stronger consumption and investment growth. Consequently, the inflation effect is also stronger, i.e. 0.2 pp. in 2016 and almost 0.3 pp. in 2017 in Table 2 instead of 0.1 pp. in both years in Table 1.

Table 1. EA results for January 2015 programme

	2015A	2016A	2017A	2018A	2019A
GDPR_PCER	0.11	0.17	0.15	0.12	0.10
EMPLOYMENT_PCER	0.07	0.14	0.13	0.11	0.08
DOM.DEMAND_PCER	0.09	0.17	0.16	0.12	0.10
CONSUMPTION_PCER	0.17	0.23	0.19	0.14	0.12
.CLC_PCER	0.06	0.15	0.19	0.20	0.19
.CNLC_PCER	0.22	0.27	0.19	0.12	0.08
INVESTMENT_PCER	0.16	0.25	0.22	0.17	0.12
EXPORTS_PCER	0.05	0.10	0.12	0.13	0.12
IMPORTS_PCER	0.09	0.16	0.14	0.11	0.08
REAL.WAGES_PCER	−0.01	−0.02	−0.01	−0.00	0.00
PGDP.LEVEL_PCER	0.08	0.19	0.25	0.28	0.31

CPI.LEVEL_PCER	0.09	0.20	0.26	0.29	0.31
EXR_PCER	0.45	0.43	0.38	0.37	0.37
	2015A	2016A	2017A	2018A	2019A

Table 2. EA results for programme with 2015-16 modifications

	2016A	2016A	2017A	2018A	2019A
GDPR _PCER	0.11	0.28	0.38	0.36	0.30
EMPLOYMENT_PCER	0.07	0.22	0.38	0.43	0.32
DOM.DEMAND_PCER	0.09	0.28	0.45	0.51	0.34
CONSUMPTION_PCER	0.17	0.40	0.52	0.47	0.36
.CLC_PCER	0.06	0.22	0.43	0.58	0.57
.CNLC_PCER	0.22	0.49	0.57	0.41	0.25
INVESTMENT_PCER	0.16	0.41	0.55	0.49	0.37
EXPORTS_PCER	0.05	0.15	0.26	0.32	0.33
IMPORTS_PCER	0.09	0.25	0.38	0.37	0.27
REAL.WAGES_PCER	−0.01	-0.04	-0.06	−0.05	−0.01
PGDP.LEVEL_PCER	0.08	0.29	0.55	0.74	0.79
CPI.LEVEL_PCER	0.09	0.30	0.55	0.74	0.80
EXR_PCER	0.45	0.90	1.14	1.04	0.96
	2015A	2016A	2017A	2018A	2019A

4. Conclusions

The paper has analysed the impact of the ECB asset purchase programme (QE) on the euro area economy in a dynamic general-equilibrium model, which includes assets of different types and maturities as well as a distinction between long-term government bonds held domestically versus abroad. We have extended the European Commission's QUEST model and have explicitly incorporated asset purchases of long-term bonds by the central bank and their impact on the central bank's balance sheet. In particular, QE is captured by central bank purchases of long-term government bonds financed by increased liquidity provision to the private sector. With imperfect substitutability between short-term and long-term assets, QE affects private-sector portfolio allocation and saving decisions and, by consequence, term premia, stock prices, the exchange rate and private demand. We also incorporate cross-border portfolio holdings, so that nonEA residents are among the counter-parties of ECB bond purchases.

The model has been used to assess the impact of the ECB's QE programme in its initial form of January 2015, i.e. the announced purchase of €60 billion long-term bonds per month between March 2015 and September 2016. The results are then contrasted with the subsequent modifications of the QE programme, which include an increase in the volume of purchases and the expected duration of the programme.The simulations for the euro area suggest effective euro depreciation of 0.4%, an increase in real GDP by almost 0.2%, and an increase in price levels by 0.3% by 2017 under the programme as announced in January-2015. The later modifications have strengthened the cumulative impact on economic activity, inflation and the effective exchange rate, with real GDP rising by almost 0.4%, prices by almost 0.6%, and the euro depreciating by 1.1% by 2017. In both cases, the expansion of economic activity is driven by stronger consumption (lesssavings) and investment demand (portfolio reallocation towardsphysicalcapital/equity).

References

Andrés J, López-Salido D, Nelson E (2004) Tobin's imperfect asset substitution in optimizing general equilibrium. J Money Credit Bank 36:665–690

Caglar E, Chadha J, Meaning J, Warren J, Waters A (2012) Non-conventional monetary policies: QE and the DSGE literature. In: Chadha J, Holly S (eds) Interest rates, prices and liquidity: lessons from the financial crisis. Cambridge University Press, Cambridge, 240–273

Chen H, Cúrdia V, Ferrero A (2012) The macroeconomic effects of large-scale asset purchase programmes. Econ J 122:289–315

Claeys G, Leandro A, Mandra A (2015) European Central Bank quantitative easing: The detailed manual. Bruegel Policy Contribution 2015/02, Bruegel, Brussels

Constâncio V (2015) Assessing the new phase of unconventional monetary policy at the ECB. Panel remarks at the Annual Congress of the European Economic Association, Mannheim, 25 August 2015

Draghi M (2015) Introductory statement to the press conference. European Central Bank, 22 January 2015

Falagiarda M (2013) Evaluating quantitative easing: a DSGE approach. MPRA Paper 49457, University Library of Munich, Munich

Gros D, Alcidi C, De Groen W (2015) Lessons from quantitative easing: Much ado about so little? CEPS Policy Brief 330, Center for European Policy Studies, Brussels

Harrison R (2012) Asset purchase policy at the effective lower bound for interest rates. Working Paper 444, Bank of England, London

Hartwig Lojsch D, Rodríguez-Vives M, Slavík M (2011) The size and composition of government debt in the euro area. ECB Occasional Paper 132, European Central Bank, Frankfurt/M

Krishnamurthy A, Vissing-Jorgensen A (2011) The effects of Quantitative Easing on interest rates: Channels and implications for policy. Brook Pap Econ Act 43:215–287

Liu P, Mumtaz H, Theodoridis K, Zanetti F (2017) Changing macroeconomic dynamics at the zero lower bound. University of Oxford Department of Economics Discussion Paper 824, Department of Economics, University of Oxford, Oxford

Petersen A (2016) One year of QE: A controversial experiment. Allianz Global Investors QE Monitor, March 2016

Praet P (2015) The ECB's asset purchase programme: The impact so far. Speech at the Eurofi conference, Luxembourg, 09 September 2015

Priftis R, Vogel L (2016) The portfolio balancing mechanism and QE in the euro area. Manch Sch 84:84–105

Ratto M, Roeger W, in 't Veld J (2009) QUEST III: An estimated open-economy DSGE model of the euro area with fiscal and monetary policy. Econ Model 26:222–233

Schmitt-Grohé S, Uribe M (2003) Closing small open economy models. J Int Econ 61:163–185

Valiante D (2015) The 'visible hand' of the ECB's quantitative easing. CEPS Working Document 407, Center for European Policy Studies, Brussels

Vogel L (2014) Structural reforms at the zero bound. European Economy Economic Papers 537, European Commission, Brussels

Woodford M (2001) Fiscal requirements for price stability. J Money Credit Bank 33:669–728

Copyrights