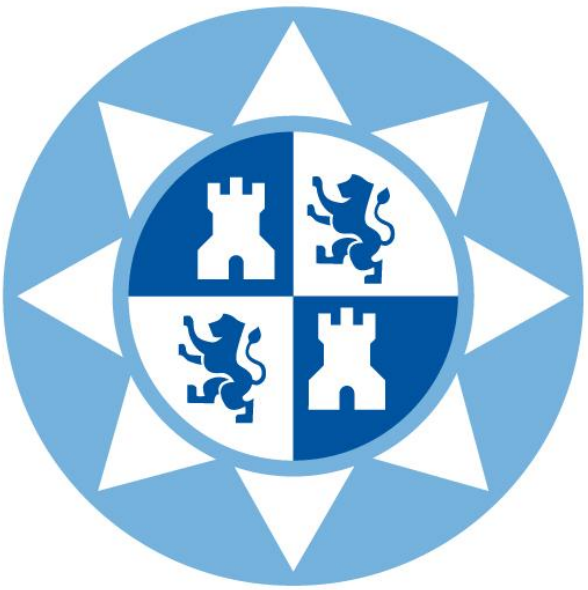
THE EFFECTS OF A MONETARY EXPANSION ON THE EURO ZONE ECONOMY

UNIVERSIDAD POLITECNICA DE CARTAGENA

FACULTAD DE CIENCIAS DE LA EMPRESA

GRADO EN ADMINISTRACIÓN Y DIRECCIÓN DE EMPRESAS.



Alma M Fernández Sota

13-10-2015

Director: Víctor López Pérez

INDEX

INTRODUCTION

Economic and Monetary Union is a big endeavor leading towards the integration of European Union economies. It involves the coordination of economic and fiscal policies, a common monetary policy and a common currency, the Euro. From the 28 member states of the European Union (EU hereinafter), 19 of them have reached a higher degree of integration and have adopted the euro.

The current economic crisis that started in 2007 has led the European Central Bank (ECB) to apply non-standard measures like quantitative easing (QE) to avoid deflation and increase output in the euro area. This work explains the non-standard measures that have been applied in the euro area until now. It also estimates an autoregressive vector (VAR) to quantify the expected effects of QE on production, prices, interest rates and exchange rates in the euro area.

MONETARY POLICY

Financial or monetary policies are types of economic policy. Monetary policy uses money as a tool to control prices and maintain economic stability. It includes all the decisions from monetary authorities that modify the amount of money or the interest rate in the money market. When the central bank increases (decreases) the amount of money, it is called expansionary (restrictive) monetary policy.

As Andrés R. et al. (2004) argue, before the single currency and after the treaty of Rome, the free movement of goods favored trade between European countries and did not damage the power of decision by each national government. The main policy weapons, fiscal policy and monetary policy, were in the hands of the ministers of national economies. Nowadays, the EU is growing up but is still composed of very heterogeneous countries. The differences between the countries during last years led to different effects from the adoption of a single currency and the abandonment of national monetary policies.

The general objective of monetary policy in the euro area is to achieve price stability. If price stability is not endangered, the ECB may aim to contribute to higher rates of economic growth, full employment and a stable exchange rate.

MONETARY-POLICY DECISIONS BY THE ECB IN NORMAL TIMES

The ECB's Governing Council sets the key policy interest rates in the euro area. The most important of them is the interest rate of the main refinancing operations (MROs hereinafter). The MROs are loans to the private sector, which thus also modify the amount of money supplied. These operations normally provide the bulk of liquidity to the banking system.

Another policy rate is the rate of the deposit facility. In this facility the ECB works as a bank for commercial banks, and its rate is the return that euro-area banks get for lending money to the ECB. After the start of the financial crisis, many banks mad extensive use of the deposit facility instead of lending money to the productive sectors of the economy. The ECB reacted by setting a negative deposit-facility rate, which means that it charges money for these deposits, in order to improve the flow of credit to households and firms.

Finally, the last key policy rate is the rate of the marginal lending facility. This facility acts as the last resort for banks which are unable to obtain funding at the interbank market. Thus, it provides financial institutions with access to funds in order to satisfy reserve requirements using the overnight lending market.[1]

[1]Information from ECB and investopedia.

Non-standard Measures

The ECB wants to keep prices stable, which means an inflation rate below, but close to, 2% over the medium term. But after the crisis it was difficult to achieve these goals using the standard tools only. As a consequence, the ECB decided to implement non-standard monetary-policy measures. The first of them was implemented between 2008 and 2009: the Eurosystem (the ECB and the national banks in the euro area) conducted liquidity-providing longer-term refinancing operations (LTROs hereinafter) with a maturity of 12 months and also purchase euro-denominated covered bonds issued in the euro area. Before the crisis in 2008, the longest LTRO maturity was three months (Cemal 2015).

In 2010 the ECB's Governing Council decided to conduct interventions in the euro area public- and private-debt securities markets (Securities Markets Programme), to ensure depth and liquidity in those market segments which were identified as dysfunctional.

Between 2011 and 2012 as part of the agreed package of measures, two new LTROs with a maturity of three years were announced to support the supply of credit to the euro area economy. The first operation was conducted in December 2011 and the second was conducted in February 2012.

Quantitative Easing or Expansionary Policy

It is the most famous non-standard monetary-policy measure announced by the ECB. In this policy, national central banks increase the money supply by buying bonds from euro-area governments. The goal of this policy is to stabilize or raise prices and reduce long-term interest rates. This measure is often used when the most common methods of controlling the money supply have not worked; or when the discount interest rates or interbank interest rate is close to zero.

The ECB decided to buy public bonds every month with a value of 60 billion euros from March 2015 to September 2016.

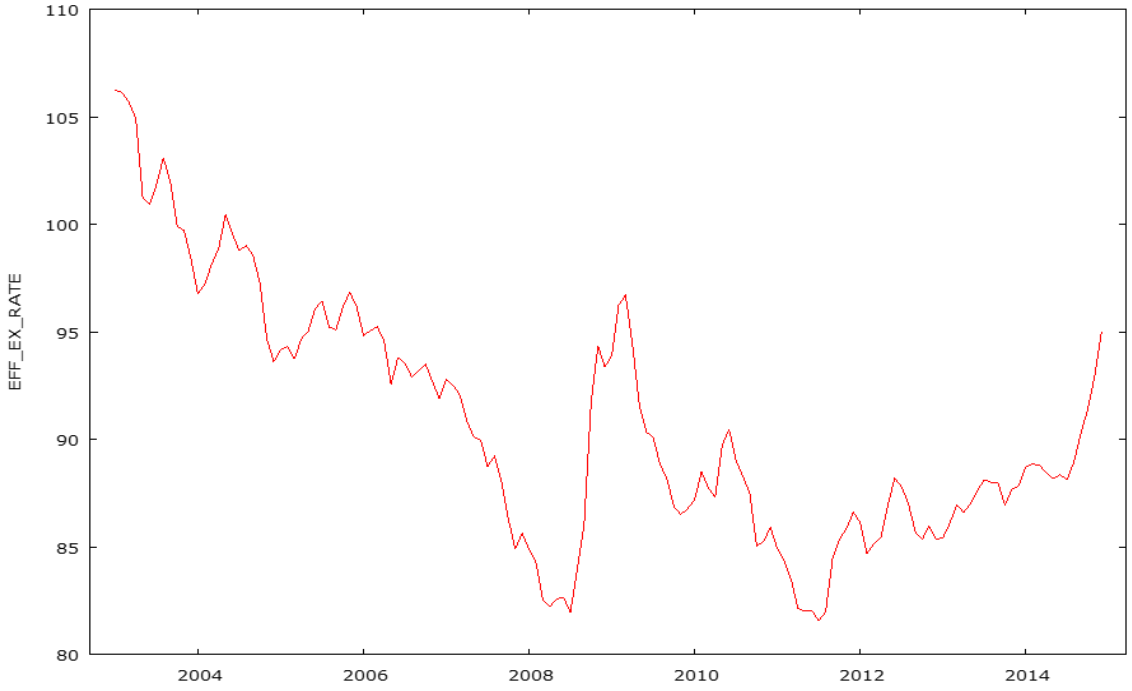
DATA

The remainder of this paper estimates a VAR model to quantify the expected effects of QE on several macroeconomic variables of the euro area. The variables that we use in the VAR are the nominal effective exchange rate, the short-term and the longer-term interest rates, industrial production, prices and money. The next paragraphs detail each of the variables used and the next Section presents the model we estimate.

All the data has been collected from Eurostat or the ECB's Statistical Data Warehouse. All the data is monthly and refer to the euro area, in changing composition, from January 2003 to December 2014.

NOMINAL EFFECTIVE EXCHANGE RATE

The international currency market is the market where participants from around the world are able to buy, sell, exchange and speculate on different currencies. Participants in this market are banks, commercial companies, central banks, investment management firms, hedge funds, retail forex brokers and investors.



The nominal effective exchange rate is the price of the currency of a country in terms of the currencies of its trading partners. It is measured by a weighted average of the bilateral nominal exchange rates. The next graph show us the value of this variable during our sample 2003-2015. Note that this variable is an index, which takes a value of 100 at the beginning of 2004. An increase (decrease) in the chart means a depreciation (appreciation) of the euro.

We can see the big effect that the start of crisis had on the external value of the euro in 2008. After this depreciation, the euro recovered much of its value before 2012 but the start of the sovereign debt crisis in 2011 and the announcement of QE in January 2015 had eroded significantly the value of the euro in the currency market.

INTEREST RATES

Market interest rates are an indicator of the transmission of monetary-policy decisions to bank loans. Higher interest rates makes investment projects more expensive and less attractive, and increase the return on savings.

Commercial banks charge an interest on loans to make a profit, to offset the risk of the operation (a kind of insurance premium) and because lending money has an opportunity costs (they cannot use it for other investment opportunities which also be lucrative) operations. As a result, bank-loan rates are higher than the MRO rates.

We have chosen two interest rates in the euro area: the rates charged on loans with maturities up to 1 year and over 1 year. Both variables have been measured in percentage points. This

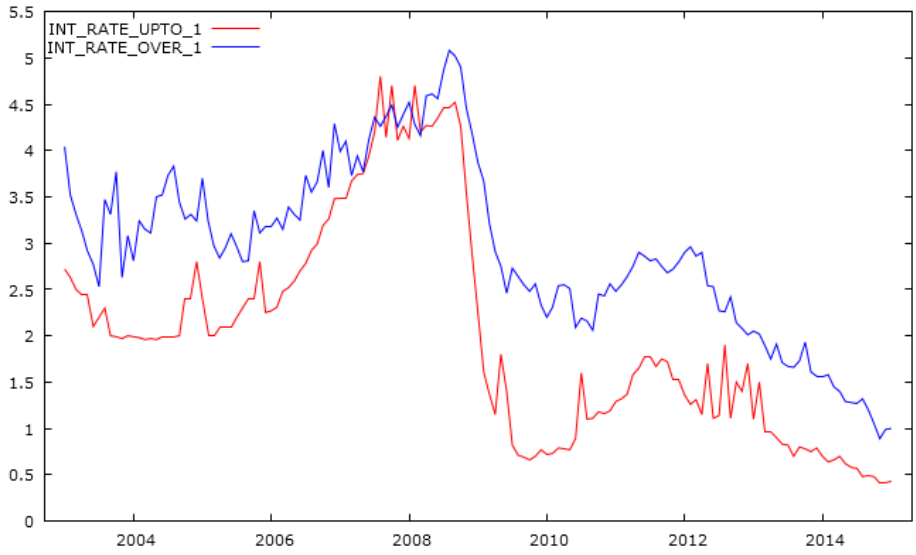


chart shows how these rates have changed over the sample period. The red line is the rate charged on loans with maturity up to 1 year and the blue line is the rate charged on loans with maturity over one year. After the outbreak of the crisis, obviously both rates fell significantly. From 2010 to 2012, the commercial banks increased the margins applied to new loans to reflect their higher risk perception. These higher interest rates hurt borrowers.

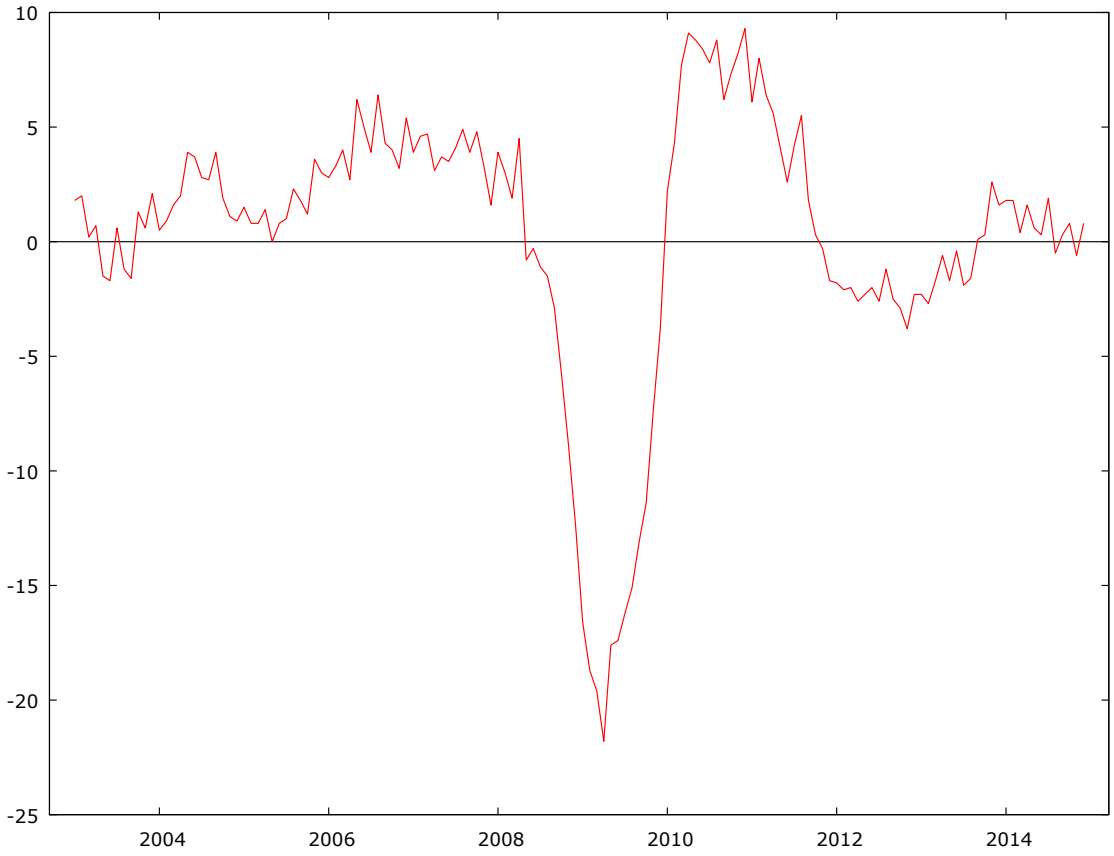
HARMONIZED INDEX OF PRODUCTION.

The harmonixed index of industrial production represents the added value of resident companies over factor costs at constant prices, excluding the construction sector. The harmonized index for the whole euro area is calculated from the series provide by each member countries. Eurostat then calculates the final index.[2]

Despite its name this industrial-production index is not intended to measure production but reflects the development of value added in the industry. This means that the inputs obtained by one branch from another must be deducted from its gross output. In this way double counting of production is prevented and the degree of vertical integration of branches should not influence the results of the indicator.

The graph below shows the rate of change of the harmonized index of industrial production in the euro area (changing composition), in percentage points. As expected, the effect of the crisis is evident, with a big decline in the index in 2009. The index recovers from there and starts to growth as a result of the measures that ECB has taken in the previous years.

[2]Data from Eurostat http://ec.europa.eu/eurostat/statistics-explained/index.php/Industrial_production_(volume)_index_overview



HARMONIZED INDEX OF CONSUMER PRICES IN EURO AREA.

The Harmonized Index of Consumer Prices (HICP) is compiled by Eurostat and the national statistical institutes in accordance with harmonized statistical methods. The HICP is also used in assessing whether a country is ready to join the euro area.

During 1995 this index was developed. The Council Regulation 2494/95 of October 1995 clearly defines the two phases of the process. The first phase took place in 1996 and established the calculation of Transitory Indices of Consumer Prices (CPIT), based on the CPI for each of the member countries of the European Union. The second phase involved the construction of the HICP index, standardizing it to make it comparable across countries.

The items that are part of the index are: food and non-alcoholic beverages, alcoholic beverages and snuff, clothing and footwear, housing, household, medical, transport, communications, recreation and culture, education, hotels, cafes and restaurants, other goods and services.

The HIPC represents the value of the cost of living, as it is an index that reflects the monthly change of the prices of goods and services consumed by European households. Thus, if a set of products or services price increases, the same amount of money will not be enough to buy them. That is what is called the loss of purchasing power of money due to inflation.

Another effect of keeping inflation rates higher than those of major trading partners is the loss of competitiveness of a country in the international market. As the price of output in the country increases, it becomes more difficult to sell it abroad.

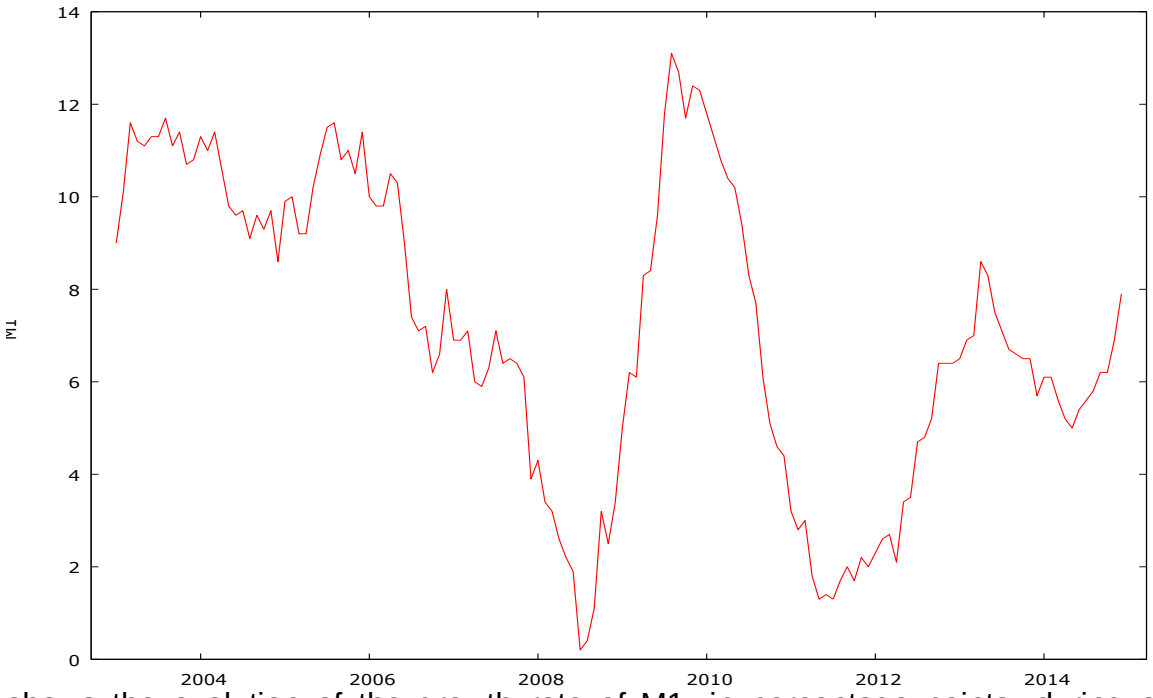
The following graph shows the year-on-year percentage change of the HIPC since 2003. The increase in inflation during 2007 and 2008 was caused by higher oil and energy prices. Specifically, inflation hit the highest value in the sample in July 2008 (4%). Thereafter, inflation started to decline, falling down to -0.3% in

September 2009. The non-standard policy measures mentioned above managed to stop the decline in prices until very recently, when the euro area was back to deflation (-0.2%).

MONETARY AGGREGATES

There are different measures of money supply. From the narrowest to the broadest, we have M0, M1, M2, M3 and M4. M0 is defined as the amount of bank notes and coins in the hands of citizens, plus the money banks have in their safe boxes and deposited at the central bank. M1 is equal to M0 plus the amount of notes and coins that the central bank has retained, plus overnight deposits by citizens at commercial banks, i.e. the money that citizens can access easily to finance spending. M2 includes M1 plus short-term deposits (up to one year) that citizens have in the financial system. M3 is M2 plus all deposits, including long-term deposits. M4 includes M3 plus other deposits, such as foreign deposits.

As M1 is the closest to what is meant by money supply in textbook analysis, we choose M1 as the monetary aggregate to include in our study. The graph below



shows the evolution of the growth rate of M1, in percentage points, during our sample. At the start of the financial crisis, M1 growth reaches its minimum at 0.1%.

Methodology and Process

The main objective of this paper is to analyze what happens to all the variables described in the previous section when M1 increases as a result of the ECB's QE policy. The model we use is a VAR (autoregressive vector). It offers the possibility of analyzing existing dynamic interrelationships among a set of variables, which gives greater possibilities to analyze and contrast theoretical models.

The VAR model makes the current value of a variable to depend on its past values and on past values of the rest of the variables in the model. The model can be formulated as:

$$y_t = \phi_1 y_{t-1} + \phi_2 y_{t-2} + \ldots + \phi_p y_{t-p} + c + \varepsilon_t$$

where y_t is the 6x1 vector containing the values at time *t* of all the variables in the VAR. y_{t-x} is the 6x1 vector containing the values at time *t-x* of all the variables. ϕ_1 ϕ_2 ... ϕ_p are 1x6 vectors containing the parameters of the VAR model. c is a 1x6 vector of constants and ε_t is a 6x1 vector of random perturbations.(Alvarez-de-Toledo et al.).

Before estimating the model, the seasonal component is removed from each variable. Then, the Hodrick-Prescott filter is used to extract the cyclical component from each time series. Then, the model is estimated by Least Squares.

The results shown in this paper are impulse-response functions, i.e. the responses of the variables in the VAR to an impulse or shock to M1 growth. From these impulse-response functions, we can analyze the sign, intensity and persistence of the effect of the shock to M1 on all the model variables.

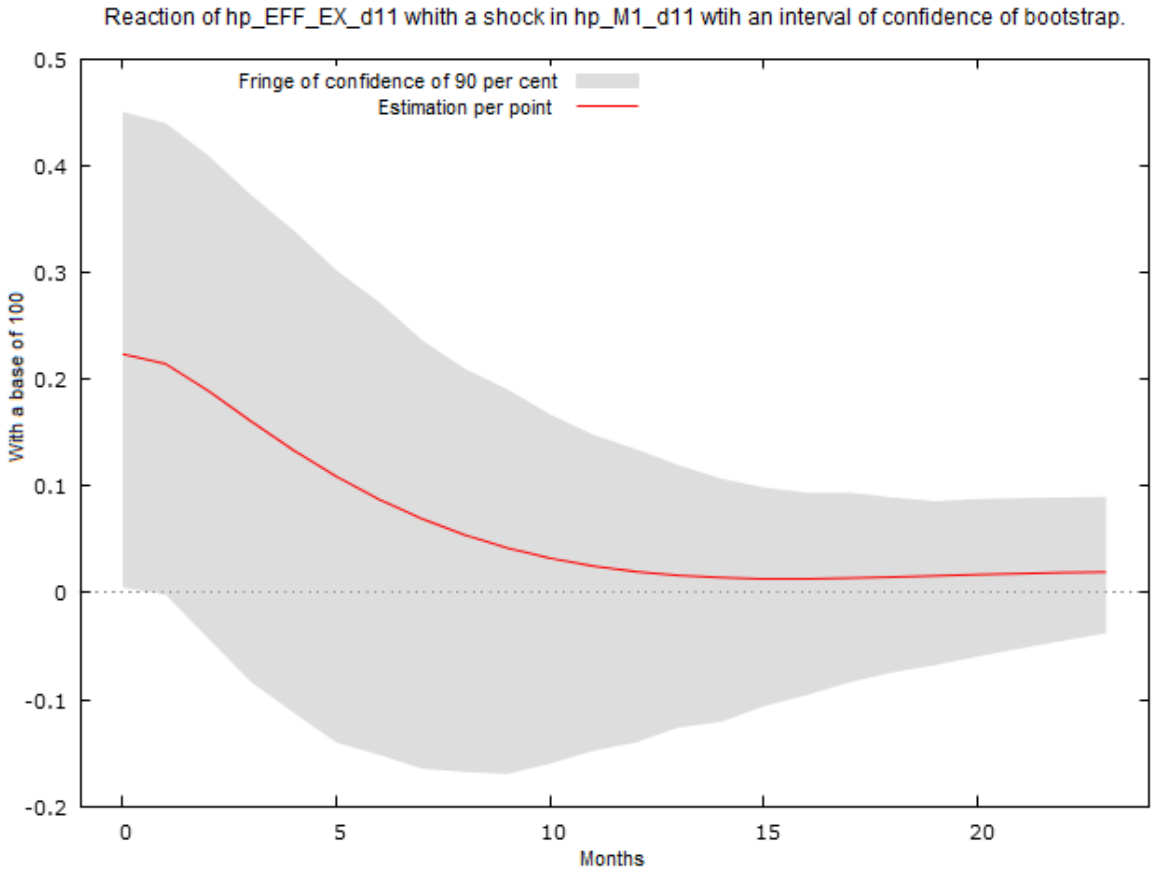
The impulse-response functions that we obtain is made with the method of bootstrap. The shock is defined as a positive shock to M1 growth with size equal to the standard deviation of the error term in the M1 equation. Each impulse-response function shown below displays a red line, which is the mean of the bootstrap

replications, and a grey range, which represents the 90% confidence interval around the red line. If the confidence interval includes zero, the response is not statistically different from zero.

RESULTS

NOMINAL EFFECTIVE EXCHANGE RATE

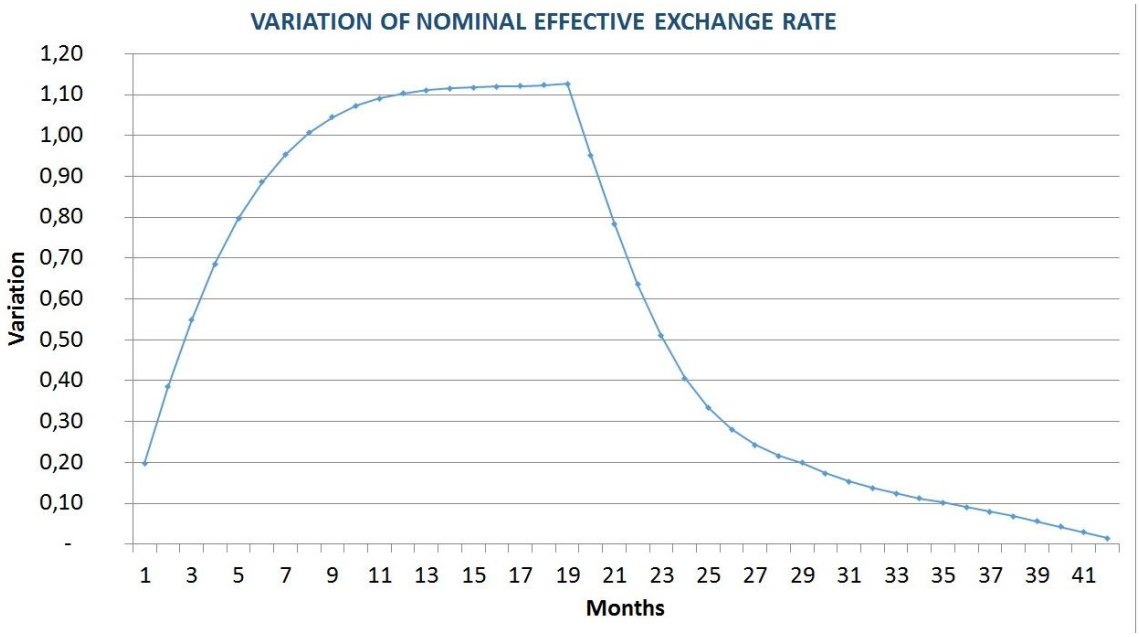
In general, when the euro depreciates, imports become more expensive and exports cheaper. Hence, it increases the amount of exports and decreases the amount of imports. Moreover, changes in exchange rates will affect **nominal interest rates, investment flows between countries and central bank reserves**.



The impulse response function shown above shows that the nominal effective exchange rate in the euro area depreciates after an unexpected increase in M1 growth. The response of the exchange rate is statistically different from zero on impact, as the grey area does not include zero.

To compute the response of the exchange rate to the ECB's QE, we first need to specify the shock to M1 growth that the QE policy implies. As QE lasts for 19 months, it is represented with a series of 19 monthly shocks to M1 growth. The size of each shock is computed by calculating the monthly growth rate of M1 after adding 60 billion euros to the existing stock of money each month.

Once the size of each shock is determined, the response of the exchange rate to the whole QE policy is the sum of the 19 responses to the 19 monthly shocks. expected. This response is shown on the chart below. The euro is expected to keep losing value for the entire duration of QE. After QE ends, the euro is expected to quickly recover its lost value in the currency market.



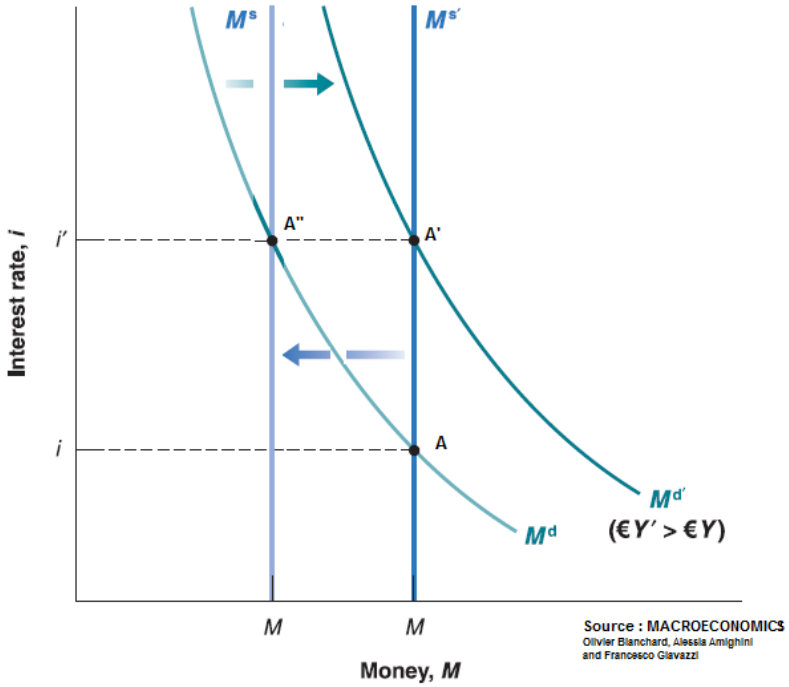
Quantitatively, the estimated effect is too small, though. The euro is expected to depreciate only around 1% as a result of the QE policy. This small effect is at odds

with the large depreciation triggered by the QE annoncement, which drove the dolar/euro exchange rate from 1.25 to 1.05.

INTEREST RATE UP TO AND OVER A YEAR

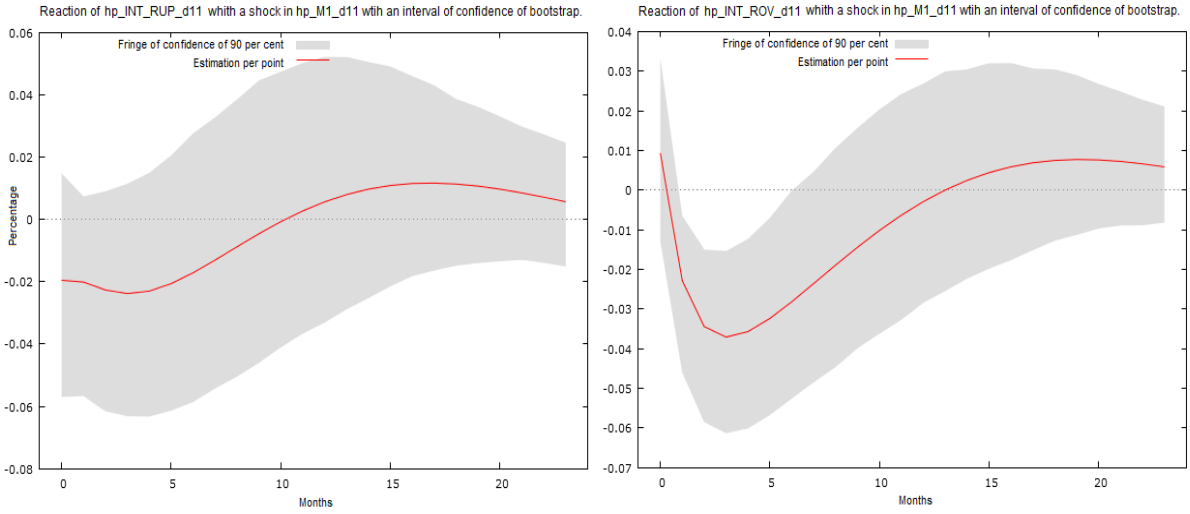
To have an equilibrium in the financial market we need money supply to be equal to money demand (Ms = Md.). In textbook analysis, the money-supply curve is independent of the interest rate, but the money-demand curve is not. In equilibrium, there will be an inverse relationship between money supply and interest rates: if money supply increases (decreases), the interest rate decreases (increases).

The equilibrium condition is represented in the chart below, which show us the relationship between money supply and demand. As Olivier Blanchard et al. explain in their book, after a decline in money supply the interest rate needs to increase to make people want to reduce their money holdings.

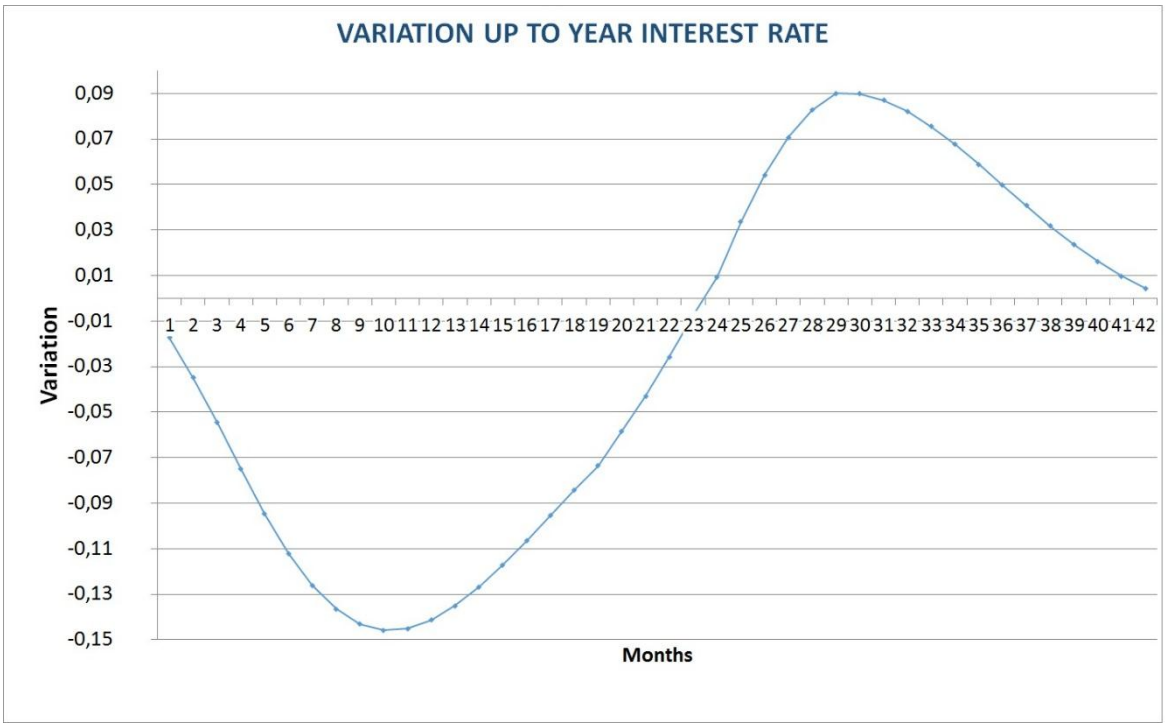


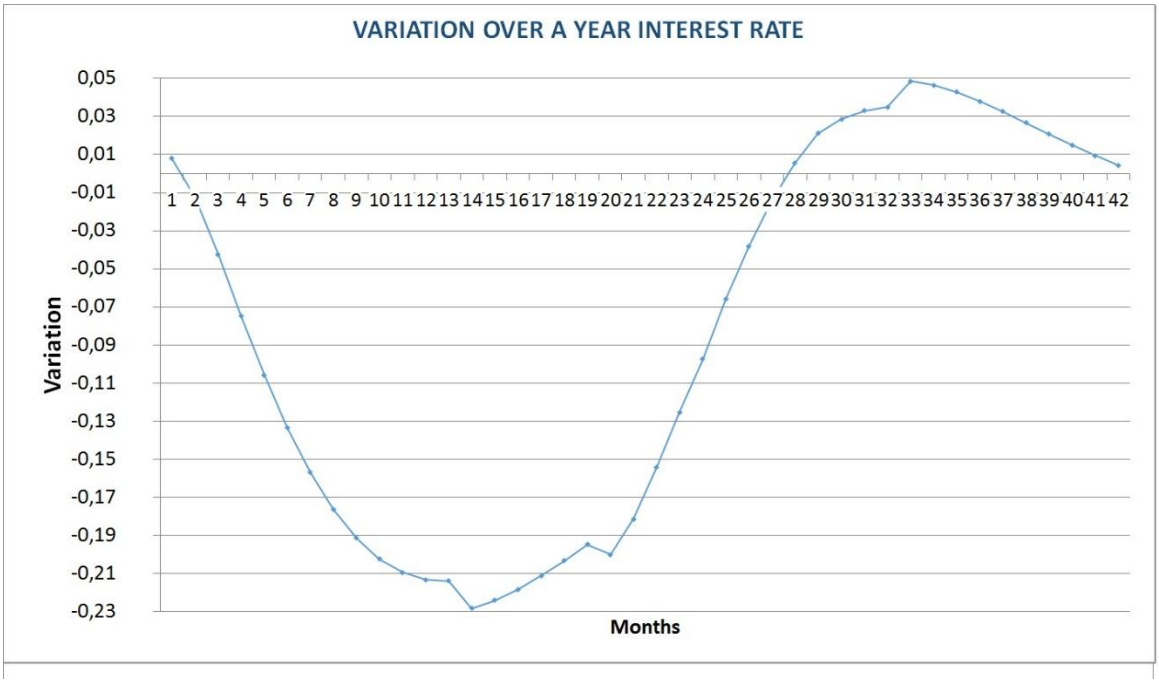
Generally, lower interest rates encourage companies to make business. This is because the companies are able to borrow at a lower cost. This provides an incentive to expand the business on borrowed funds.

What is the response functions of the interest rates to a shock to M1 growth in our VAR model? The graphs below show the response by the interest rates for loans with up-to-one-year maturity (UPi) and with maturity of more than one year (OYi) to a shock to M1 growth. The reaction is consistent with the theory presented above: interest rates tend to decline after the positive money-supply shock, but only the effect on the rate for longer maturities is statistically significant.



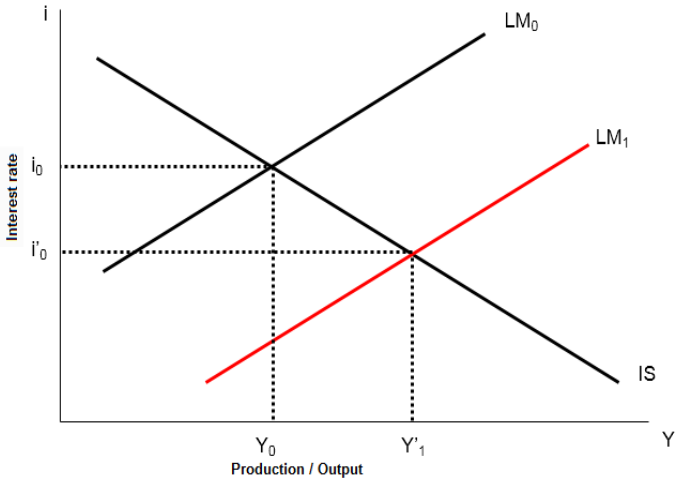
The effect on interest rates from the whole QE policy is shown on the graphs below. The effect on the short-term interest rate (with maturity of up to one year) is a reduction of around 15 basis points. The reduction is slightly larger for longer maturities (more than one year): around 23 basis points. The effects, however, seem quantitatively small: they would imply a reduction of short-term rates from 0.42% to 0.27% and of longer-term rates from 0.99% to 0.76%.

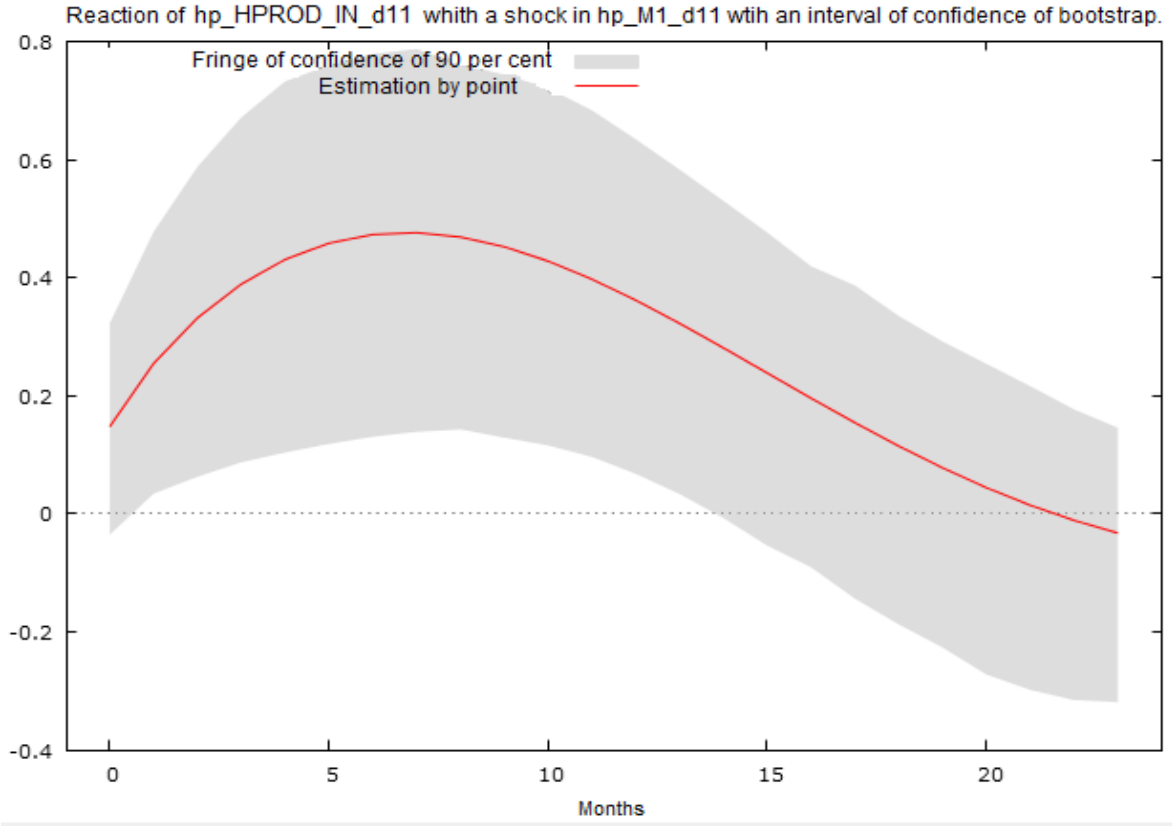

VARIATION UP TO YEAR INTEREST RATE
Variation
0,09
0,07
0,05
0,03
0,01
-0,01
-0,03
-0,05
-0,07
-0,09
-0,11
-0,13
-0,15
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42
Months


VARIATION OVER A YEAR INTEREST RATE
Variation
0,05
0,03
0,01
-0,01
-0,03
-0,05
-0,07
-0,09
-0,11
-0,13
-0,15
-0,17
-0,19
-0,21
-0,23
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42
Months

HARMONIZED INDUSTRIAL-PRODUCTION INDEX

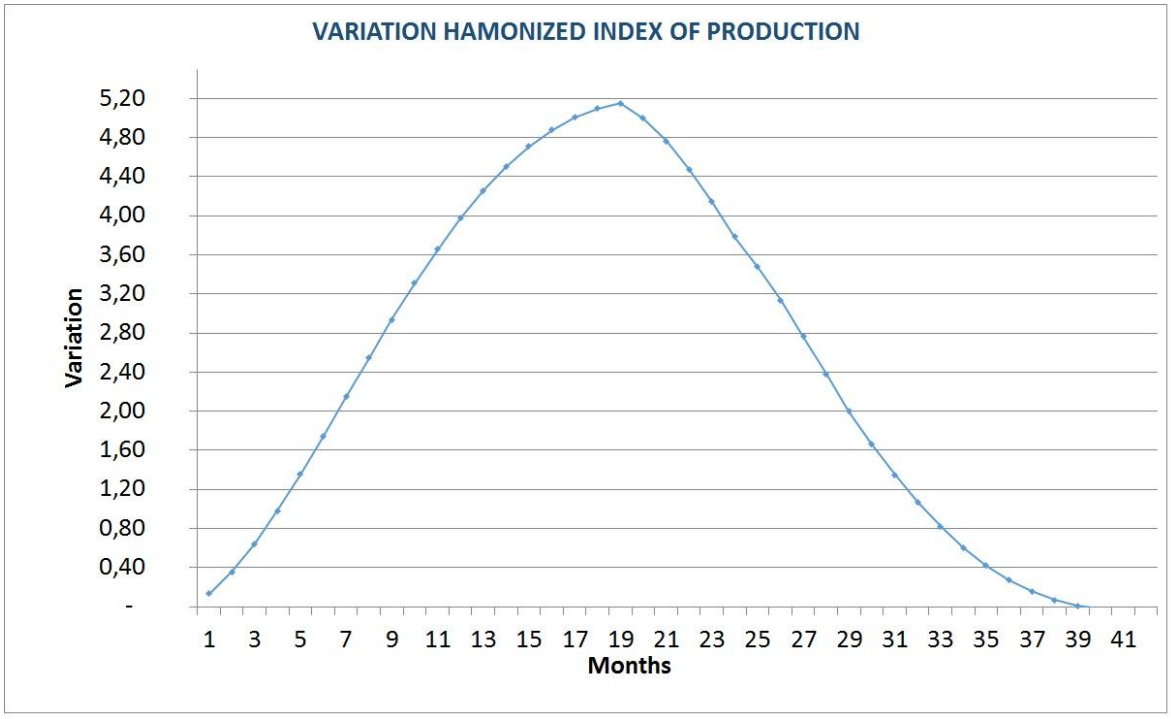
The goods market is in equilibrium when production (Y) is equal to the demand of goods. As Olivier Blanchard at al. explain in their book the relationship between investment (I) and interest rates (i) is negative: the higher the interest rate the more expensive investment is. Therefore, an increase in the supply a money is expected to contribute to higher output because interest rates fall and make investments more attractive. As we can observe in the IS-LS model, where IS represent the equilibrium in the goods market and LS the equilibrium in the financial market, if we decrease the interest rate the LM curve moves to the right and increases the level of production in equilibrium.





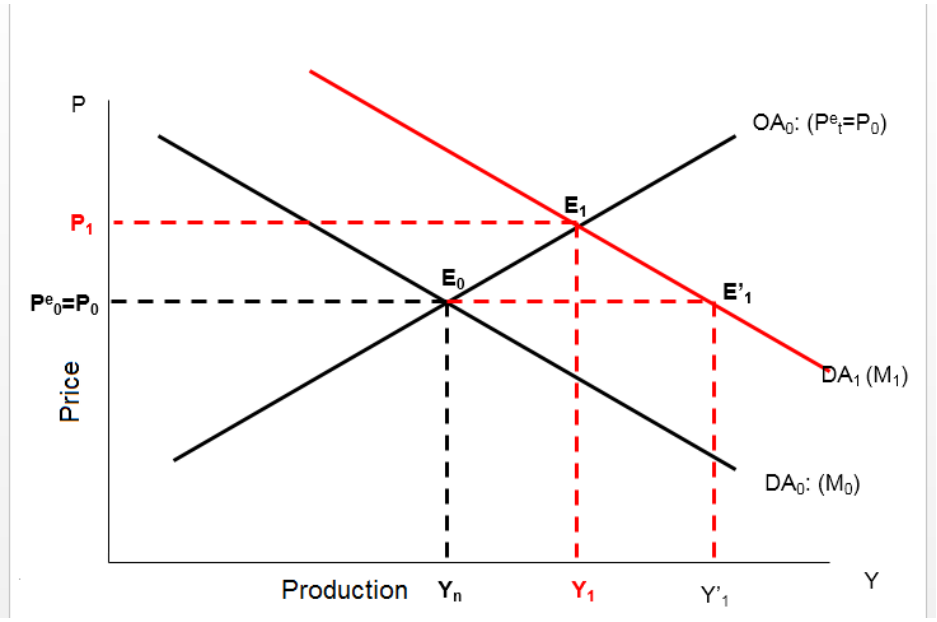
What is the response of industrial production to a shock to the growth rate of M1 in our VAR model? It is the one we expected (see the graph above): significantly higher output growth in response to the shock from the second to the fourteenth month after the shock.

The chart on the next page shows the results of the QE policy on the growth rate of industrial production in the euro area. QE is expected to increase the growth rate of industrial production by around 5 percentage points after one year and a half. This is a very big effect and, if it materializes, it would contribute very significantly to the recovery of the euro-area economy. Having said this, the effect, as any effect of monetary policy on the real side of the economy, is temporary and vanishes after three years.

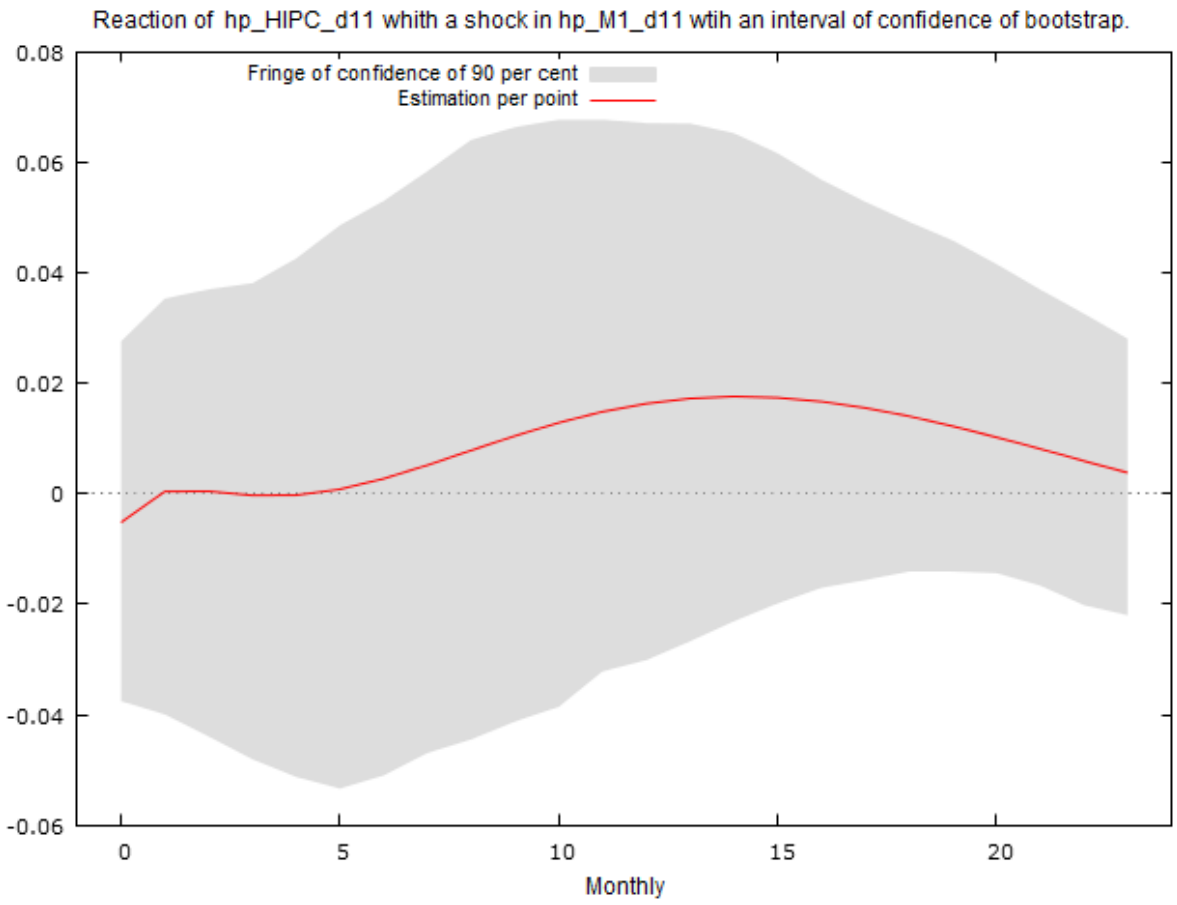


HARMONIZED INDEX OF CONSUMER PRICES

As demand for goods (investment and consumption) is expected to increase after a positive shock to the money supply, prices should rise in response. The graph below exemplifies it.

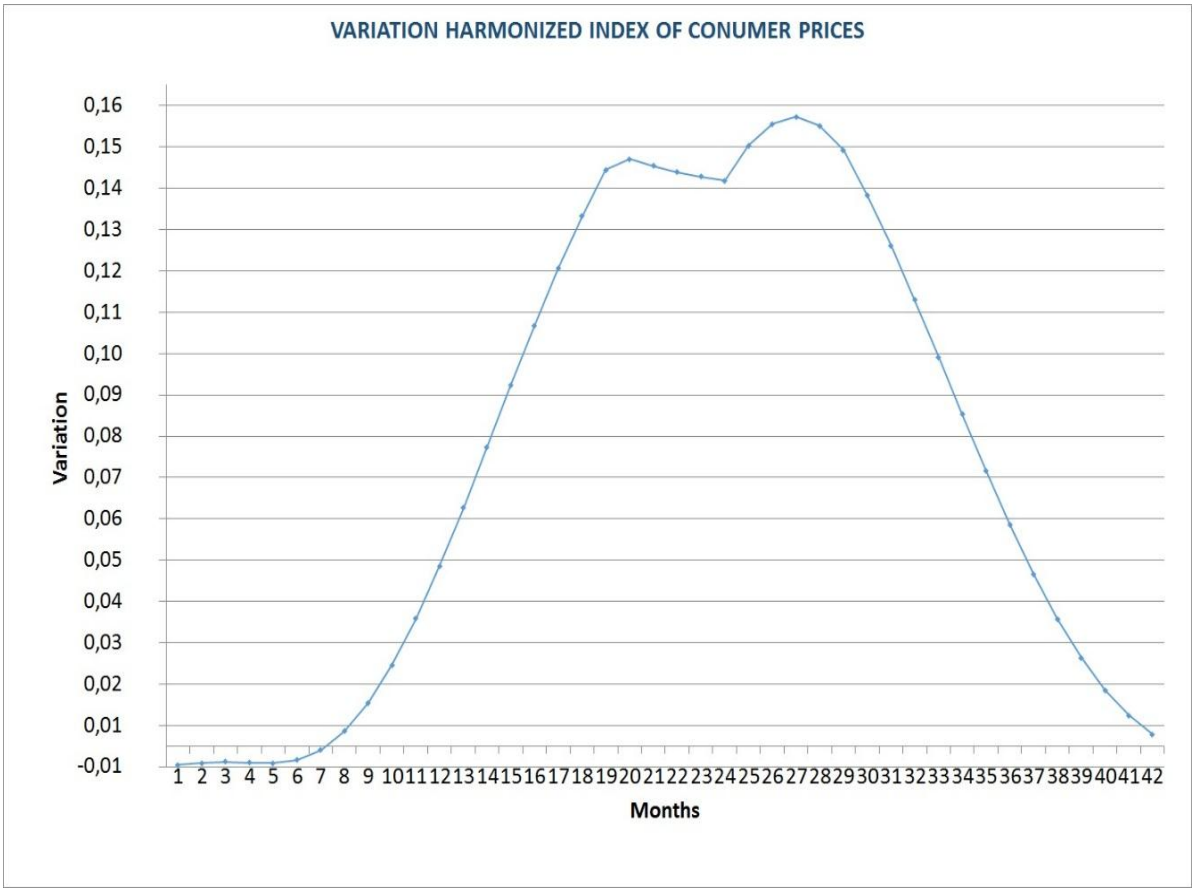


As aggregate demand increases, prices tend to increase, even though the short-term impact is expected to be larger than the long-term effect.



What is the expected impact of an unexpected increase in the growth rate of M1 on HICP inflation in the euro area according to our VAR model? As expected (see the graph above), the effect is positive but, unfortunately, not statistically different from zero.

As regards, the impact of the QE policy on HICP inflation, inflation is expected to rise from the ninth month after the start of the policy but the effect is quantitatively very small: inflation is expected to increase by around 0.15 percentage points after two years. This very small effect is consistent with the very mild increase in inflation in the euro area during the last few months (it was -0.1% in September 2015). Moreover, it suggests that the ECB may not be successful in bringing inflation rates back to the policy target by September 2016 as planned.



CONCLUSIONS

This work tries to quantify the effects of the QE policy implemented by the European Central Bank in 2015 on some macroeconomic variables of the euro area: the exchange rate, short and long-term interest rates, industrial production and inflation.

We estimate a VAR with monthly data for the euro area from January 2003 to December 2014 and obtain impulse-response functions to an unexpected increase in money supply. The main results of the analysis may be summarized as follows: the euro is expected to depreciate by around 1 percentage point against the basket of currencies of our main reading partners; short-term interest rates are expected to decline by around 15 basis points, while longer-term rates may fall by around 23 basis points; the growth rate of industrial production may surge by around 5 percentage points by end 2016; and the inflation rate may increase by around 0.15% after two years.

Hence, our results are quite enlightening: we understand why the ECB decided to apply this non-conventional measure, but we expect that its effect on inflation will probably be much smaller than expected by the ECB.

If the expected results shown in this paper materialized, we would be right now in the middle of an economic recovery. But this analysis has not taken into account the behavior of banks, which so far have used the funds injected by the ECB to improve their profitability instead of increasing credit to firms and households. Similarly, recent declines in oil prices have not been included in the analysis and may have a sizeable effect on the euro-area economy.

To be honest, I think that we need more laws and more rules to prevent that this behavior by banks happens again. The importance of banks in the current economic environment has made citizens and the economy much more affected by the banks' behavior than before. That is why it is important to act now, or the positive effects of QE on the economy may never materialize.

REFERENCES

ECB MonthlyBulletin May (2002) " *The liquidity management of the ECB"*

ECB Monthly Bulletin May (2009) "*Governing Council Decisions On Non-Standard Measures "*

ECB Monthly Bulletin May (2010) "*Economic And MonetaryDevelopments"*

Pablo Alvarez-De-Toledo, Adolfo Crespo , Fernando Núñezy CarlosUsabiaga*"Introducción de elementos autorregresivos en modelos de dinámica de sistemas*"

Cemal Karakas (2015) Briefing European Parliamentary Research Service "*The ECB and the financial crisis Rigid theory vs a pragmatic approach*"

Leonardo V. VeraLuis Zambrano Sequín (2001) "*Reservas Bancarias Y Gestión De La Políticamonetaria Algunas consideraciones para el casovenezolano*".

Reglamento (CE) n° 2531/98 del Consejo del 23 de noviembre de 1998 relativo a la aplicación de las reservas mínimas por el Banco Central Europeo [Diario Oficial L 318 de 27.11.1998].

Frost, P. (1971), *"Banks Demand for Excess Reserves*", The Journal of Political Economy. Vol. 79, No. 4 (Jul. – Aug., 1971), pp. 805 -825.

Tarron Khemraj Christian R. Proaño (2011) *"Excess Bank Reserves and Monetary Policy with a Lower-Bound Lending Rate"*

Friedman, M. (1972), "Have monetary policies failed?", American Economic Review

Andrés Rodríguez-Pose, George Petrakos (2004) "Integración económica y desequilibrios territoriales en la Unión Europea"Revista Eure (Vol. XXX, N°89), pp. 63-80.

Web pages:

https://www.euro-area-statistics.org/bank-interest-rates-deposits?cr=eur&cr1=eur&lg=en&page=1

http://www.investopedia.com/terms/forex/i/international-currency-markets.asp

http://sdw.ecb.europa.eu/browseSelection.do?DATASET=0&FREQ=M&CURRENCY=E7&CURRENCY_DENOM=USD&node=2018795

http://www.bankofengland.co.uk/statistics/Pages/iadb/notesiadb/effective_exc.aspx

http://sdw.ecb.europa.eu/home.do

https://sdw.ecb.europa.eu/print.do?printType=full&trans=N&start=01-01-2000&end=01-08-2015&SERIES_KEY=120.EXR.M.E1.EUR.EN00.A&node=qview

https://www.ecb.europa.eu/stats/prices/hicp/html/inflation.en.html

http://www.eleconomistaamerica.com/datos-macro/Zona-Euro/Indice-de-Produccion-Industrial

http://ec.europa.eu/eurostat/data/database

http://es.investing.com/economic-calendar/industrial-production-160

http://ec.europa.eu/eurostat/tgm/web/navigation/nuiLinks.jsp?pcode=teiis080

http://www.expansion.com/diccionario-economico/reservas-bancarias.html

http://sdw.ecb.europa.eu/browseSelection.do?DATASET=0&DATASET=1&BS_ITEM=AN02&node=bbn135

http://sdw.ecb.europa.eu/browseSelection.do?DATASET=0&DATA_TYPE=4&node=8549734

http://sdw.ecb.europa.eu/quickview.do?SERIES_KEY=123.ILM.M.U2.C.L022.U2.EUR&start=01-01-2000&end=01-08-2015&submitOptions.x=22&submitOptions.y=5&trans=N

http://sdw.ecb.europa.eu/browseSelection.do?DATASET=0&DATA_TYPE=4&node=8549734