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MONETARY POLICY EFFECTS: EVIDENCE FROM THE PORTUGUESE FLOW OF FUNDS

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June 2010

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Monetary policy effects: evidence from the Portuguese flow of funds[1]

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June 2010

Abstract

This paper uses a VAR approach to study the transmission of monetary policy shocks in Portugal, focusing in particular on the financial decisions of households, corporations (financial/non-financial), the government and the rest of the world. We confirm that, in many ways, households and firms react in a similar way as found in other countries, with evidence that the monetary policy shock has a contractionary effect on economic activity and increases the financing needs of households and non-financial corporations. We also find evidence that the financial sector plays an important role, supplying the necessary funds to these sectors. We do not find much evidence of a significant systematic behaviour of the government or the rest of the world.

JEL: E52; G11.

Keywords: Flow of funds; monetary policy transmission mechanism;

[1] We thank Nuno Ribeiro for useful comments. The views expressed in this paper are of the authors and not necessarily those of Banco de Portugal. Authors' email addresses: igameiro@bportugal.pt, jmsousa@bportugal.pt.

"... the outlook for euro area and global financial stability will increasingly depend on the interaction between macroeconomic developments and the financial system, and on how banks respond to a challenging operating environment."

Jean-Claude Trichet, Hearing at the Economic and Monetary Affairs Committee of the European Parliament, 10 September 2008.

1. Introduction

The recent financial turmoil gave rise to a renewed interest in the interaction between real and financial factors. Understanding how agents' financial decisions respond to shocks is an important step to ascertain how these may affect real decisions. This study uses flow of funds data in a VAR framework to characterize how the several sectors of the Portuguese economy respond to a monetary policy shock, focusing on the financial decisions of households, corporations (financial and non-financial), the government and the rest of the world. This research can therefore provide valuable indications for the study of the monetary transmission mechanism and for macroprudential analysis.

Previous studies using a similar methodology have been conducted for the US, Italy and the euro area (see Christiano et al, 1996; Bonci and Columba, 2008; and Bonci, 2010). They analyze the effects of a monetary policy shock with a VAR model extended to include a range of flow of funds data. We follow an analogous approach but develop an empirical model suitable for the analysis of a small economy highly integrated with the euro area. In particular, we estimate a Structural VAR model with two blocs, one for the euro area and one for Portugal and assume that the former bloc is exogeneous to the latter. This simple model is then used to assess how Portuguese flow of fund variables react to a monetary policy shock, following the marginal approach.

Although we find some puzzles, we broadly confirm that, in many respects, the Portuguese economy reacts to a monetary policy shock in a similar way as found in other studies. The net funds raised by non-financial corporations increase after a monetary policy shock, with both financial assets and liabilities rising. As for households, we find that net funds raised increase after a contractionary monetary policy shock, which results from a stronger decline in financial assets than that of liabilities. The main puzzles found are the short-run increase in loans to non-financial corporations and the higher acquisition of equity by non-financial corporations following a contractionary monetary policy shock.

The article is organized as follows. Section 2 describes the formulation and estimation of the VAR model. Section 3 draws a brief description of the Portuguese flow of funds data used in our estimations and studies the effects of monetary shocks in the euro area in the different Portuguese economic sectors' borrowing and lending activities. Section 4 concludes.

2. A restricted VAR model for the euro area and Portugal

We use a VAR model with two blocs: the euro area and Portugal. The euro area bloc influences the Portuguese bloc but is exogenous to it. This simplification is justified by the small weight of Portugal in the euro area economy. The system used is then the following (omitting constants):

$$\begin{bmatrix} A_0 & \mathbf{0} \\ A_1 & A_2 \end{bmatrix} \begin{bmatrix} Y_t^{EA} \\ Y_t^{PT} \end{bmatrix} = \begin{bmatrix} B(L) & \mathbf{0} \\ C(L) & D(L) \end{bmatrix} \begin{bmatrix} Y_{t-1}^{EA} \\ Y_{t-1}^{PT} \end{bmatrix} + \begin{bmatrix} \varepsilon_t^{EA} \\ \varepsilon_t^{PT} \end{bmatrix} \tag{1}$$

Where Y_t is a vector of endogenous variables, A_0 is the matrix of contemporary relations of euro area variables and A_1 is the matrix of contemporary reaction of Portuguese variables to euro area ones, A_2 is the matrix of contemporary reactions among Portuguese variables, B(L), C(L) and D(L) are matrix polynomials in the lag operator L and ε_t is a vector of serially uncorrelated disturbances that have a zero mean and a time invariant covariance matrix. The superscripts EA and PT indicate each of the economies. The zero restrictions impose the necessary exogeneity of the euro area bloc relative to Portugal's.

The above system can be written as:

$$\Gamma_0 Y_t = \Gamma_1 Y_{t-1} + \varepsilon_t \tag{2}$$

where:

$$\Gamma_0 = \begin{bmatrix} A_0 & \mathbf{0} \\ A_1 & A_2 \end{bmatrix}; \Gamma_1 = \begin{bmatrix} B(L) & \mathbf{0} \\ C(L) & D(L) \end{bmatrix}; Y_t = \begin{bmatrix} Y_t^{EA} \\ Y_t^{PT} \end{bmatrix}; \varepsilon_t = \begin{bmatrix} \varepsilon_t^{EA} \\ \varepsilon_t^{PT} \end{bmatrix}$$

Writing the above in reduced form gives the following representation:

$$Y_t = \Gamma_0^{-1} \Gamma_1 Y_{t-1} + e_t \tag{3}$$

The monetary policy shock is recovered from the relation between the "structural" and reduced form shocks: $e_t = \Gamma_0^{-1}\varepsilon_t$, namely from the row corresponding to the short-term interest rate equation[2].

2.1 The effects of monetary policy in the euro area

The euro area bloc is assumed to be exogenous and therefore can be estimated autonomously, as if it were a single VAR. The vector of endogenous euro area variables consists of the real GDP (y_t), the GDP deflator (py_t) and a nominal short-term interest rate which is the three-month Euribor ($r3m_t$)[3]:

$$Y_t^{EA} = (y_t, py_t, r3m_t) \tag{4}$$

The choice of the variables in our benchmark model parallels that of other VAR studies of the monetary transmission mechanism (see for instance Monticelli and Tristani, 1999, Peersman and Smets, 2001, Ciccarelli et al, 2009, Weber et al, 2009 and Bonci, 2010). The small set of variables is dictated by the short time span of the flow of funds data sample used in this paper (quarterly data over the period 1998:1-2009:2) and the need to avoid as much as possible the pre-euro period for which there is more uncertainty in the identification of the monetary policy shock (see Weber et al, 2009, and Boivin et al, 2008).

The VAR model includes two lags of each endogenous variable. This choice is based on two sets of criteria. First, we compute the results of the lag-selection criteria of the Final Prediction Error (FPE), Schwartz (SC), Akaike (AIC) and Hannan-Quinn (HQ), which suggest that we should choose one or two lags. Then, we check whether the resulting VAR residuals have autocorrelation and, if so, raise the number of lags until it is removed. As seen in Table 1, the two-lag VAR shows no signs of autocorrelation and therefore is our preferred choice[4].

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[2] It should be noted that in this study we are just identifying one single "structural shock", the monetary policy shock. Therefore, all other structural shocks in ε_t are not identified.

[3] The real GDP is obtained from the Eurostat, the GDP deflator is obtained from the ECB Area Wide Model database and the three-month Euribor rate is obtained from Reuters (backdated to 1998 using the ECB Area Wide Model database).

[4] Moreover, the hypothesis of normality of the residuals is not rejected at high significance levels.

Table 1
VAR with two lags
Residual Serial Correlation LM Tests
(Null Hypothesis: no serial correlation at lag order h)

Lag order	LM-Stat	Prob
1	12.24143	0.2000
2	11.90347	0.2188
3	15.11111	0.0879
4	11.39944	0.2493
5	15.36234	0.0815
6	7.018356	0.6352
7	6.923889	0.6450
8	5.822902	0.7575
9	9.542523	0.3888
10	8.164126	0.5177
11	10.78991	0.2904
12	5.417976	0.7965

Probs from chi-square with 9 df.

The euro area monetary policy shock is identified through a Choleski-decomposition with the variables ordered as in (4). The policy interest rate is assumed to respond contemporaneously to changes in output and prices, but affects these variables only with a lag. This type of identification scheme has been used in several recent studies for the euro area (see Giannone et al., 2009, Cicarelli et al, 2009, Bonci, 2010). In the VAR all variables are seasonally adjusted and expressed in log-levels, except the interest rate which is in levels (Figure 1).

Figure 2
Euro Area VAR model: endogenous variables

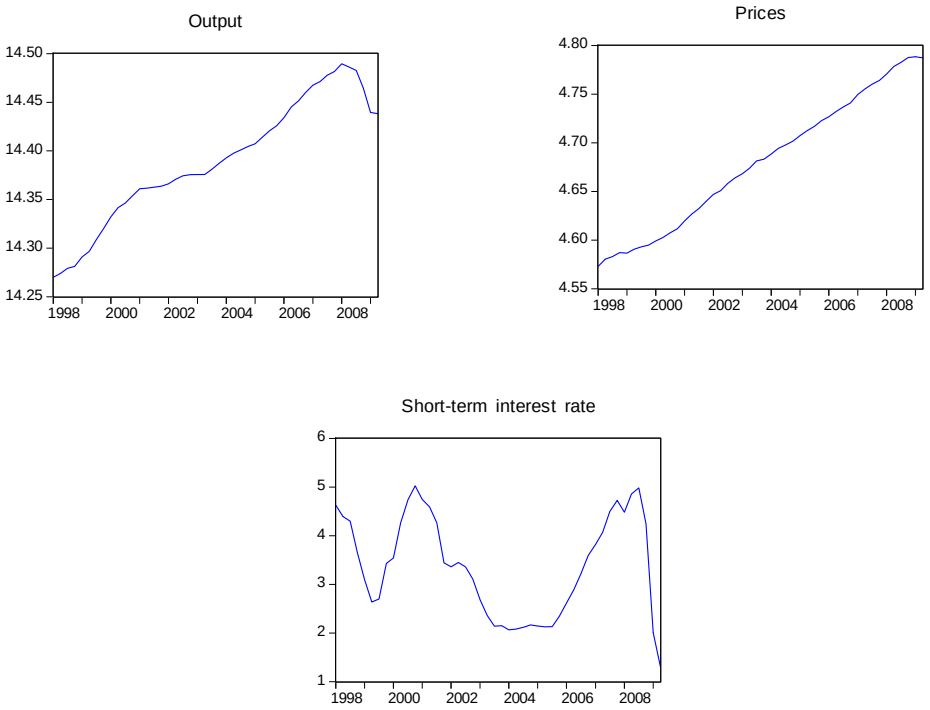


Figure 3 depicts the three quarter centered moving average of the estimated monetary policy shocks for the euro area. According to the estimates, the stance of monetary policy was relatively tight throughout the year 2000, in the second quarter of 2002 and in the third quarter of 2008. The monetary policy shocks were relatively larger at the start of the euro. They became smaller and generally negative from the start of the "pause in growth" in economic activity that took place in 2003 and until the intensification of the financial turbulence in the second half of 2008[5]. The monetary policy shocks became negative again in the second quarter of 2009, suggesting the return to an accommodative stance.

[5] It should be noted that the use of the Euribor to proxy the policy rate is more doubtful in the period since the beginning of the financial crisis in 2007. In particular, the large monetary policy shock in the third quarter of 2008 should be seen as primarily reflecting the effects of the high risk premia in the money markets in the context of the turbulence related to the failure of Lehman Brothers.

Figure 3
Estimated monetary policy shocks
Three quarters centered moving average

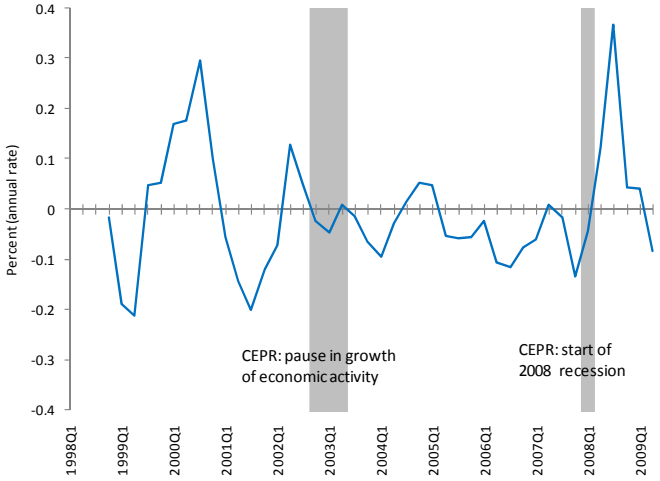
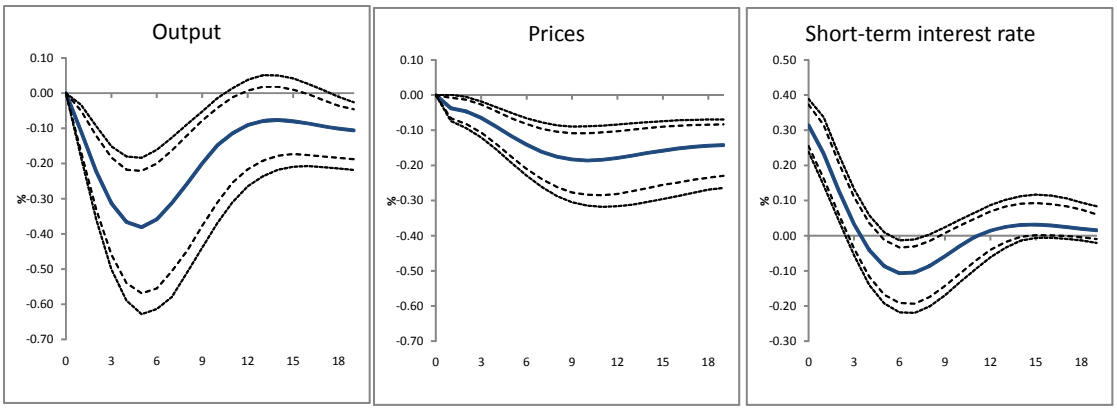


Figure 4 displays the effect of a one standard deviation monetary policy shock on euro area output, prices and the monetary policy rate. The charts display the median response together with the 90% and 80% confidence intervals (computed using a bootstrapping procedure with 10 000 draws and the correction of Kilian, 1998). The results are in line with the existing empirical evidence for the euro area. The typical monetary policy shock is about 30 basis points and the effect of the shock vanishes after about 4 quarters (i.e., the interest rate remains above the baseline by about 4 quarters). GDP falls in response to a contractionary monetary policy shock, reaching a trough after 5 quarters and returning to the baseline thereafter. The response of prices is more sluggish and more persistent, reaching a trough about 10 quarters after the shock.

Figure 4
Responses to a contractionary monetary policy shock: euro area VAR variables



Note: Deviations from baseline. The full line represents the median impulse response using bootstrap (10 000 replications) and the dashed lines represent the 90th and 80th percentiles.

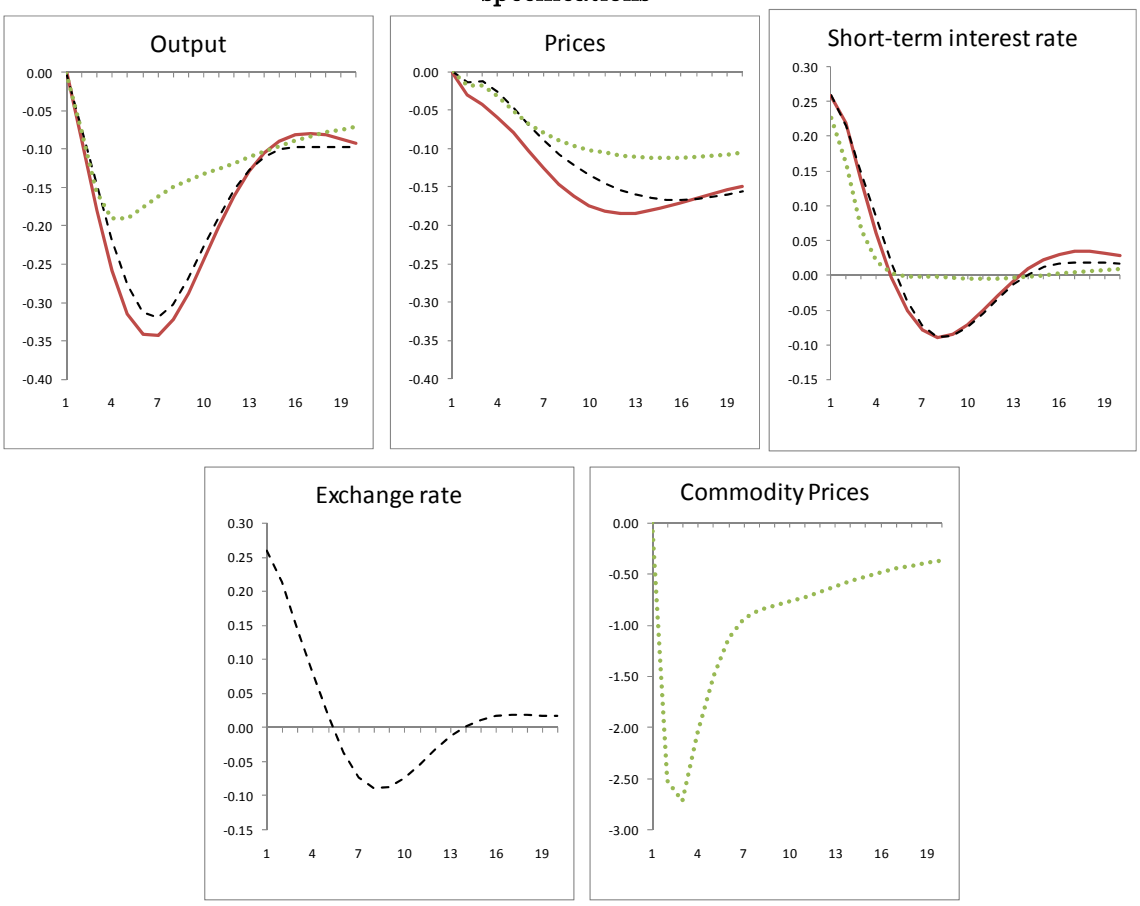
To test the robustness of our results, we compare the above benchmark specification with larger VARs. We estimate two additional VARs, extending the vector of endogenous euro area variables to include i) the (real effective) exchange rate[6] and ii) a commodity price index aggregate denominated in euros[7] (see Peersman and Smets, 2001 and Weber et al, 2009). In several empirical studies the main reason for including these additional variables is to avoid the price puzzle (a price increase following an interest rate increase). However, we do not find a price puzzle in our benchmark estimation.

We order each of the extra variables before the interest rate, thus assuming that they enter contemporaneously in the reaction function of the monetary authority but are affected by monetary policy only with a lag. The introduction of additional variables does not significantly change the results of our VAR (see Figure 5). Thus, the responses of our VAR, besides being very similar to those found in other euro area studies, appear to be robust to changes in the set of variables included in the VAR.

[6] We used the real effective exchange rate of the euro against 21 trading partners from the ECB.

[7] The commodity price index is the HWWI Index of World Market Prices of Commodities.

Figure 5
Mean impulse response functions to a monetary policy shock of alternative VAR specifications



Note: the bold solid lines refer to the benchmark model; the dashed lines refer to benchmark model + exchange rate; the dotted lines refer to the benchmark model + commodity prices. An increase in the exchange rate represents an appreciation of the euro.

2.2 The effects of a monetary policy shock in Portugal

The effects of a monetary policy shock in Portugal are obtained by estimating and simulating model (1) as a whole, thus including both the euro area and the Portuguese blocs. The Portuguese VAR comprises 2 lags of the Portuguese real GDP and the price level (measured by the CPI) as endogenous variables[8]. We add to each equation the current value of the euro area real GDP and the 3 month-Euribor lagged one period as exogenous variables (thus imposing the necessary restrictions on matrices A_1 and C(L) in (1)). The Euribor is lagged one period to mimic the timing implicit in the euro area

[8] As with the euro area VAR bloc, 2 lags were chosen in order to remove autocorrelation from the residuals. Data for Portuguese real GDP and prices are obtained from *Instituto Nacional de Estatística (Statistics Portugal)*.

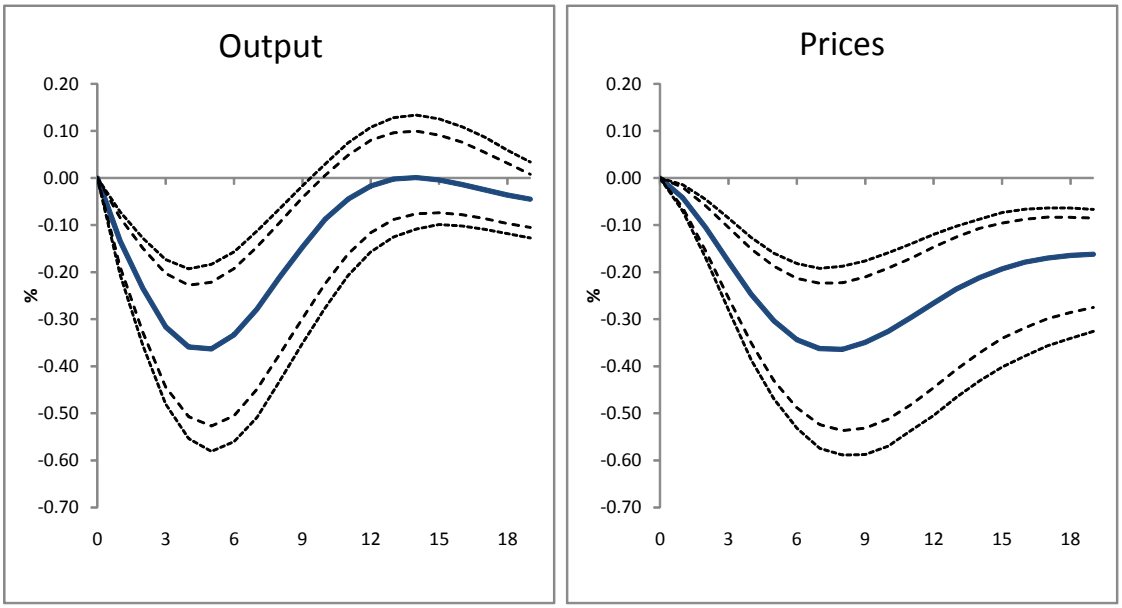
VAR in the transmission of monetary policy shocks to output and prices. We omit further lags of the exogenous variables to avoid overparameterisation of the model.

The computation of the impulse responses for Portugal involves the simulation of the monetary policy shock in the euro area bloc as done in the previous section and analysing its propagation to the Portuguese bloc[9]. The exercise thus assumes that Portuguese economic agents expect the ECB to follow the monetary policy rule implicit in the euro area VAR. Note that the monetary policy shock is transmitted to the Portuguese economy following two routes: via the direct effect of the change in the euro area short-term interest rate and via its impact on euro area GDP as given by the euro area bloc.

The results of the impact of a monetary policy shock in Portugal are shown in Figure 6 together with 90% and 80% confidence bands obtained by bootstrap. The responses of prices and real GDP in Portugal are similar to those of the euro area. Real GDP drops with the trough being reached around 5 quarters after the shock, the price level also falls relative to baseline, with the downward effect occurring around 8 quarters after the shock. Compared to the euro area results, the effect of the monetary policy shock in Portugal is quicker and stronger on prices (a drop of around 0.36 p.p. compared with 0.19 p.p. in the euro area) but similar in the case of real GDP (a drop of around 0.37 p.p. of GDP).

[9] This procedure makes use of the result that an impulse response function can be obtained as the difference between the projection of the model given the monetary policy shock and the projection of the model without the monetary policy shock.

Figure 6
Effect of monetary policy shock on macroeconomic variables in Portugal



Note: Deviations from baseline. The full line represents the median impulse response using bootstrap (10 000 replications) and the dashed lines represent the 90th and 80th percentiles.

3. The effects of monetary policy on borrowing and lending activities in Portugal

3.1 Portuguese flow of funds data

As the main focus of this paper is to determine the responses of Portuguese financial variables to a monetary policy shock, we now use the National Financial Accounts compiled by Banco de Portugal, which provide a consistent statistical system of financial transactions and stocks in the Portuguese economy. We consider the following sectors: 1) non-financial corporations; 2) households; 3) financial corporations; 4) general government and 5) rest of the world.

Following Christiano et al (1996), Bonci and Columba (2008) and Bonci (2010) we pay particular attention to the variable "net funds raised" by the different sectors, which corresponds to the difference between the issuance of financial liabilities and the acquisition of financial assets in a given period. This concept is linked to the Non-financial Accounts since for each sector the difference between fixed investment and gross savings gives rise to a net financial position towards the rest of the economy[10] (i.e. borrowing requirements if positive or lending capacity if negative). It follows that the

[10] See Banco de Portugal (2005).

balance of Financial Accounts and Non-financial Accounts tends to be the same, except for possible statistical discrepancies. For any given sector:

$$I - S = FL - FA = \textit{net funds raised}$$

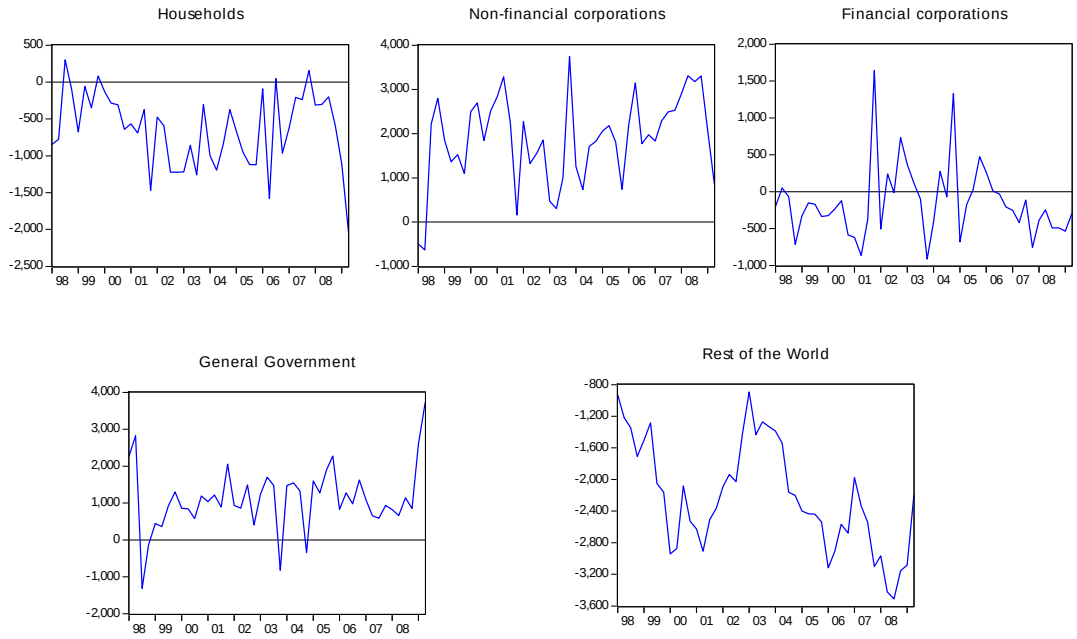
Where I represents the investment, S is saving, FL the issuing of financial liabilities and FA the acquisition of financial assets.

Figure 7 shows the quarterly net funds raised by each economic sector. The original series have been seasonally adjusted and deflated using the GDP deflator (the base year is 1998)[11]. The financial series are consolidated, so intra-sectoral transactions are netted out. Figure 7 illustrates that households are typically net lenders in Portugal. Non-financial corporations and the general government are, with few exceptions, net borrowers. The rest of the world is a net lender during the whole period. Finally, financial corporations were net lenders since 1998 until mid-2001 and mostly net borrowers thereafter until the beginning of 2006 when they again became net lenders.

In the more recent period, with the turmoil in financial markets and the deteriorating economic activity, the net lending of households increased significantly, while the net borrowing by non-financial corporations declined, resulting in an increase in net savings from the domestic private non-financial sector. In the same period, net borrowing by the general government increased significantly. In parallel, there was a relatively small decline in net borrowing from the rest of the world while net funds raised by the financial sector did not significantly change.

[11] The series were seasonally adjusted using the U.S. Census Bureau X12 seasonal adjustment program.

Figure 7
Net funds raised by sector



Note: Converted into 1998 million euros using GDP deflator and seasonally adjusted

3.2 The responses to a monetary policy shock

To analyse the effect of a monetary policy shock in the euro area on the borrowing and lending activities of the different Portuguese economic sectors, we expand the VAR of section 2, adding a financial variable at a time to the Portuguese bloc, following the so-called "marginal approach" and compute the corresponding impulse response functions to a monetary policy shock according to the approach of section 2.2.

Non-financial corporations

After a typical contractionary monetary policy shock (corresponding to an increase of the euro area short-term interest rate of about 30 basis points), Portuguese non-financial corporations raise net funds for two to three quarters (Figure 8). The peak response corresponds to 6 per cent of the average quarterly flow over the sample. The increase in net funds raised by non-financial corporations after a contractionary shock seems counter-intuitive. However, a similar result is found for the US by Christiano et

al (1996) and for the euro area as a whole by Bonci (2010) [12] (see Table 2). Christiano et al (1996) suggest that the increase in net funds raised by firms points to the existence of frictions that prevent firms from adjusting their nominal expenditures quickly after the shock. In particular, contracts in place prevent firms from adapting their level of inventories immediately to the lower level of demand brought about by the monetary policy shock. As internal funds decline due to lower corporate revenues, firms need to resort to external funds to finance their working capital, and therefore have a net borrowing position.

According to the responses of the components of the net funds raised to a monetary policy shock, non-financial corporations in Portugal increase both the acquisition of financial assets and the issuance of liabilities for two to three quarters after the shock, but with a much stronger impact on liabilities (see Figure 7). Looking further into the details of the breakdown of the liability side, it can be seen that after the monetary policy shock non-financial corporations increase their financing both through loans and via trade credit. One should, however, keep in mind that these loans include not only MFI loans but also loans provided by other sectors, including households. Thus the increase in total loans after the shock could also reflect operations involving households, for instance loans provided by shareholders to companies which have been found to be relevant in Portugal.

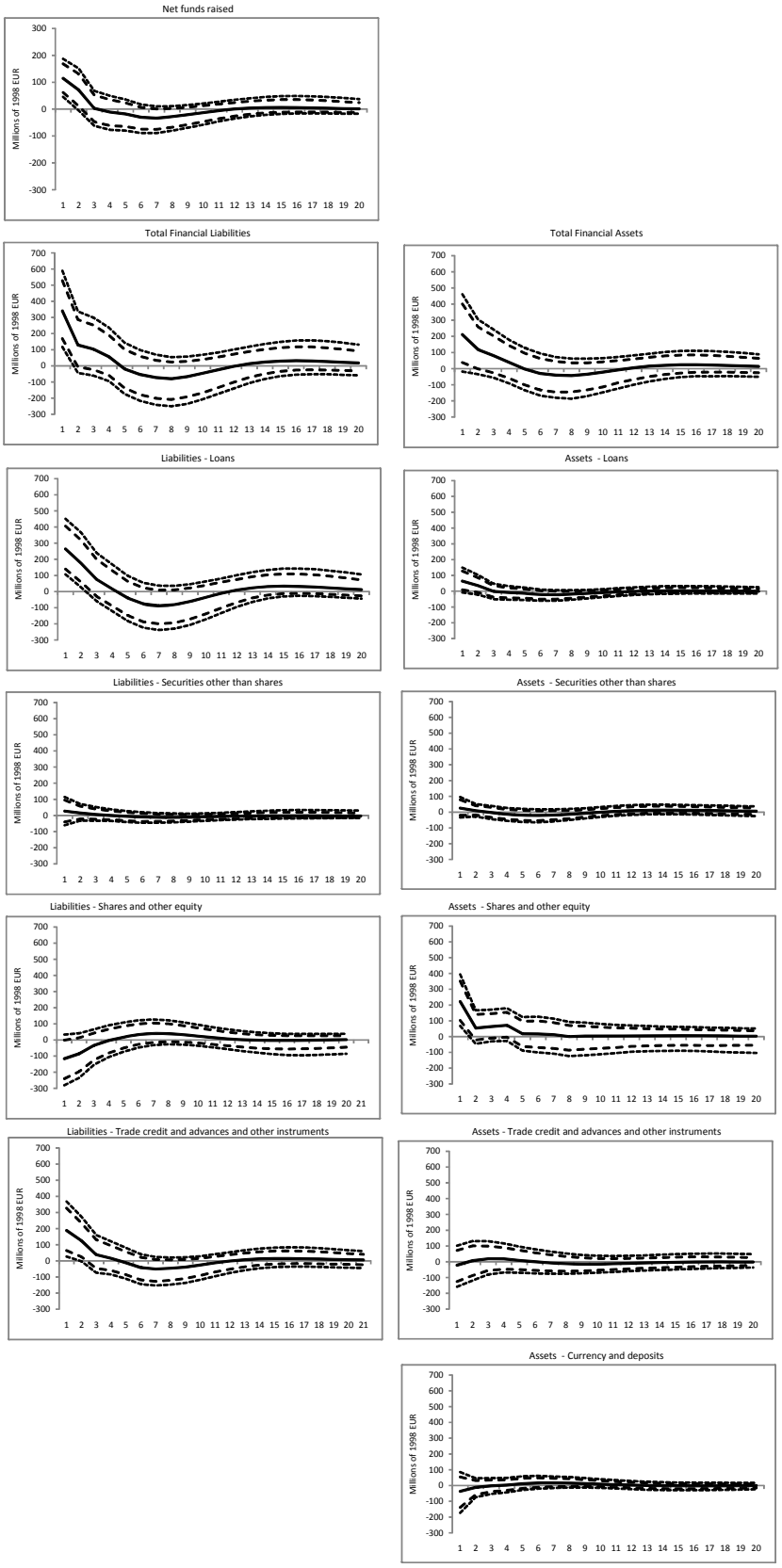
To characterise further the response of loans, we also looked at MFI data. We conclude that after the monetary policy shock the response of total MFI loans is statistically insignificant (see Figure 8). This is in contrast with the results of Bonci (2010) for the euro area who concludes that MFI loans to non-financial corporations decline after a contractionary monetary policy shock. Using data by maturity, we see that the statistically insignificant response of MFI loans masks different behaviour of short-term and long-term loans. In fact, very short-term MFI loans (with maturities up to one year) rise, but the response of longer maturity loans is statistically insignificant. This reaction of short-term financing is in line with the existence of frictions, as short-term loans are typically more associated with the financing of inventories and working capital (see Christiano et al., 1996).

[12] It should be noted that the confidence level used to assess the statistical significance of the impulse responses in this paper is higher than those of the other studies conducted for the US, Italy and the euro area, which rely on plus or minus one-standard error bands.

Giannone et al (2009) suggest additional explanations for an increase in MFI loans in response to a monetary policy tightening, namely that this might reflect the use of committed credit lines, which are not necessarily drawn by the borrowers at the time of the agreement. Once committed, the terms of the loan cannot be generally modified before it reaches the agreed maturity. In this sense, companies with pre-committed loan facilities might still be able to obtain funds on cheaper terms. They may also be less subject to quantitative borrowing restrictions. This argument also stands if banks adjust their lending rates with a delay, which appears to be the case in Portugal (see Castro and Santos, 2010). In this case, companies might be tempted to front-load loans bearing in mind expectations of an increase in the cost of loans in the near future.

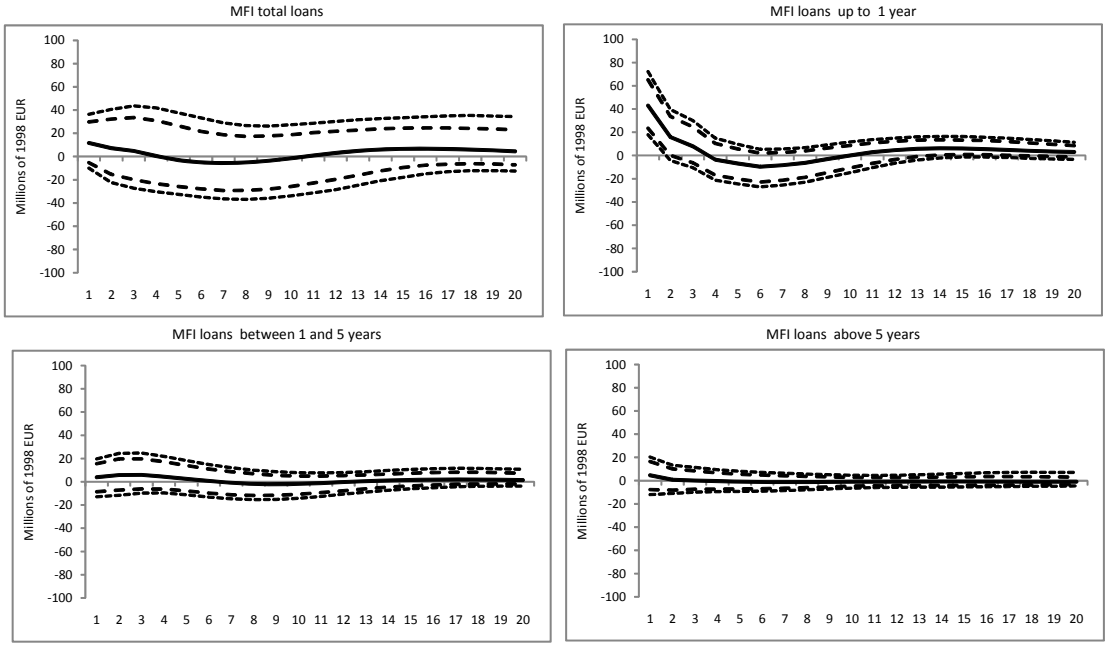
As for the asset side, non-financial firms buy more equity after a contractionary monetary policy shock and, to a lesser extent, also grant more loans to other sectors. The higher accumulation of equity is a puzzling result. Bonci (2010) finds a similar result for the euro area, and tentatively argues that it might reflect augmented M&A activity, reflecting firms' willingness to re-organize themselves in view of the decreased profitability associated with the expected slowdown of economic activity. This kind of argument is more difficult to apply to the case of Portugal given that, contrary to the euro area data, the Portuguese flow of funds data used in this study are consolidated. Therefore, the shares and other equity acquired by Portuguese non-financial firms can only have been issued by the financial sector or by foreign firms. A tentative explanation of this result is that it might reflect financial operations between firms of the same economic group.

Figure 8
Non-financial corporation's financial flows
Response to a contractionary monetary policy shock



Note: Deviations from baseline. The full line represents the median impulse response using bootstrap (10 000 replications) and the dashed lines represent the 90th and 80th percentiles.

Figure 9
MFI loans to non-financial corporations
Response to a contractionary monetary policy shock



Notes: Deviations from baseline. The full line represents the median impulse response using bootstrap (10 000 replications) and the dashed lines represent the 90th and 80th percentiles.
The flows on MFI loans are obtained from the relation between the outstanding amounts of bank loans, adjusted for securitisation operations, and the monthly transactions, which are calculated from the outstanding amounts corrected of reclassifications, write-offs/write-downs, exchange rate changes and price revaluations.

Households

The reactions of the lending and borrowing of households to a contractionary monetary policy shock are displayed in Figure 10. As non-financial corporations, households also significantly increase net funds raised. This behaviour could be related to consumption smoothing given that typically disposable income is negatively affected by the shock. The maximum effect is reached in the first quarter, corresponding to about 9 per cent of average quarterly flows, and the impact vanishes in the third quarter. The increase in the net funds raised by households results from a fall in the acquisition of assets that exceeds the decline of liabilities.

The evidence of other studies regarding the response of households is heterogeneous. The results of Bonci (2010) for the euro area are qualitatively similar to those for Portugal: after the shock, euro area households initially increase net funds borrowed by reducing the acquisition of financial assets by more than they decrease their liabilities

(see Table 2). By contrast, Bonci and Columba (2008) find evidence that net funds borrowed by Italian households after a contractionary monetary policy shock decline as households issue less liabilities and acquire more financial assets. Finally, Christiano et al (1996) find a small or insignificant effect of the shock on US households' acquisition of financial assets or issuance of financial liabilities. Christiano et al (1996) attribute this result to the limited participation of households in capital markets which prevents them from adjusting their financial assets and liabilities or net funds raised immediately after the monetary policy shock.

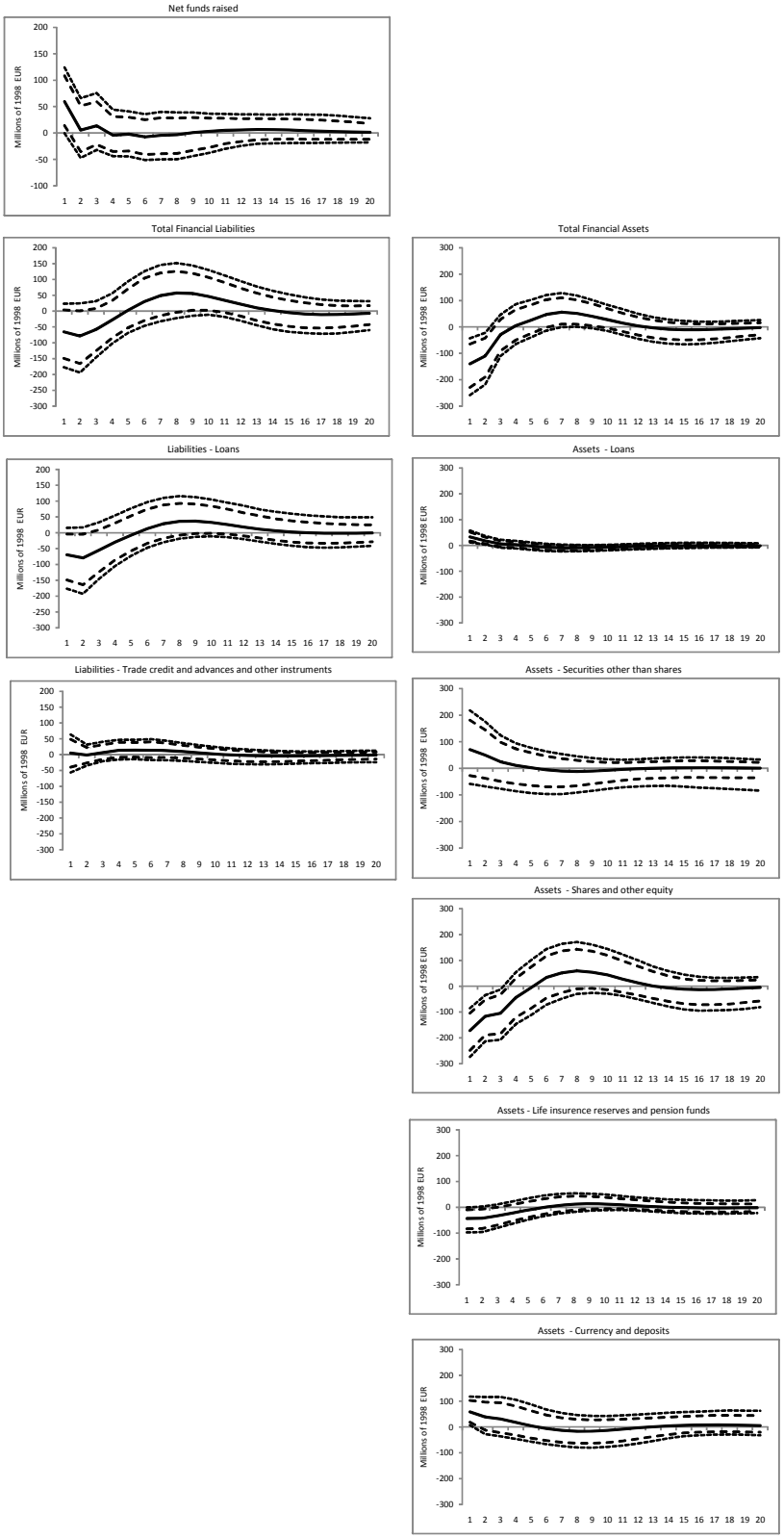
The contrast between the insignificant reaction of households in Christiano et al (1996) and the significant results of other studies (including our study for Portugal) might in part be explained by the differences in sample periods. In fact, over the last fifteen years the proportion of financial wealth in the total assets of households has significantly increased in several countries, including the US, which suggests an increasing participation of households in capital markets. The same development appears to apply to Portugal, as several studies show that the participation of in capital markets has risen over time (see, for example, Cardoso et al, 2008).

Overall, in response to a contractionary monetary policy shock households not only reduce the accumulation of financial assets but also adjust their financial portfolio composition. In particular, in the context of a deterioration of economic perspectives, households move out from less liquid and riskier assets towards more liquid and safer instruments. The responses of the subcomponents of the Portuguese households' financial assets show that the decline in financial assets is mainly driven by a strong reduction of shares and other equity (including investment funds units), amounting to around 15 per cent of the average quarterly flows of this item. This may reflect expectations of a deterioration of firms' profits following the shock. Note that shares and other equity is an important component of the financial portfolio of Portuguese households, having a similar weight as currency and deposits (around 34 per cent before the onset of the recent financial crisis). The acquisition of life insurance and pension funds assets also falls, which may partially reflect that this type of insurance is required by credit institutions for house purchase loans that also decline in response to the monetary policy shock as we will see bellow. On the other hand, households increase the holdings of currency and deposits as well as loans granted to other sectors.

As regards financial liabilities, households reduce the funds borrowed through loans after the shock. A more detailed analysis of household loans on the basis of MFI data

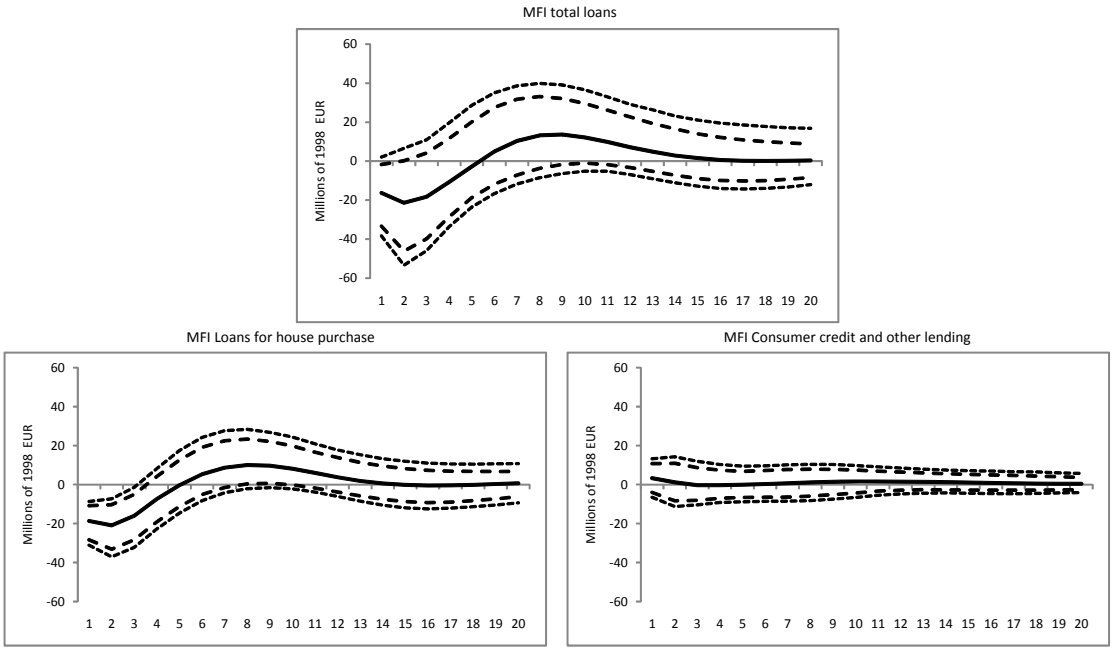
suggests that this is due to a significant fall in loans for house purchase that lasts for about one year (Figure 11). By contrast, the response of consumer loans is not significant. The decline in MFI loans to households for house purchase relative to the baseline is probably caused by demand and supply factors as credit institutions might adjust credit standards in response to a deteriorating macroeconomic outlook. The observed fall in loans for house purchase in Portugal is consistent with the euro area evidence provided by Bonci (2010) and by Giannone et al (2009). The latter also find that euro area consumer loans are not responsive to a monetary policy shock. One tentative explanation is that bank lending rates on consumer loans carry a substantial risk premium and, as shown in Castro and Santos (2010), seem to be less reactive and not to adjust completely to changes in money market rates.

Figure 10
Households' financial flows
Response to a contractionary monetary policy shock



Note: Deviations from baseline. The full line represents the median impulse response using bootstrap (10 000 replications) and the dashed lines represent the 90th and 80th percentiles.

Figure 11
Bank loans to households
Response to a contractionary monetary policy shock



Note: Deviations from baseline. The full line represents the median impulse response using bootstrap (10 000 replications) and the dashed lines represent the 90th and 80th percentiles. The flows on bank loans are obtained from the relation between the outstanding amounts of MFI loans, adjusted for securitisation operations, and the monthly transactions, which are calculated from the outstanding amounts corrected of reclassifications, write-offs/write-downs, exchange rate changes and price revaluations.

Financial sector

The importance of fluctuations in the size of financial intermediaries balance sheets for signalling future real activity has been recently emphasised (Adrian and Shin, 2008 and 2009). This literature focuses on the credit supply channel and on the amplification effects of financial frictions in the lending sector (in contrast with the financial accelerator of Bernanke and Gertler, 1989, that is due to financial frictions in the borrowing sector). Financial intermediaries have an impact on financial conditions, affecting real economic outcomes, in particular GDP components that are more sensitive to credit supply (housing investment and durable goods consumption). Adrian and Shin (2009) find that expectations of an increase in the Federal funds target are associated with declines in US broker-dealers/investment banks assets as they induce reductions in leverage. However, the evidence for commercial banks suggests that the growth of the total assets of these financial intermediaries is not significantly affected by changes in monetary policy rates. Adrian and Shin (2009) argue that the different behaviour of the two types of financial intermediaries is due to the stronger reliance of

broker-dealers on market financing than commercial banks. As the funding of the latter is less sensitive to changes in short-term interest rates, commercial banks may not manage their balance sheet so actively as broker-dealers[13].

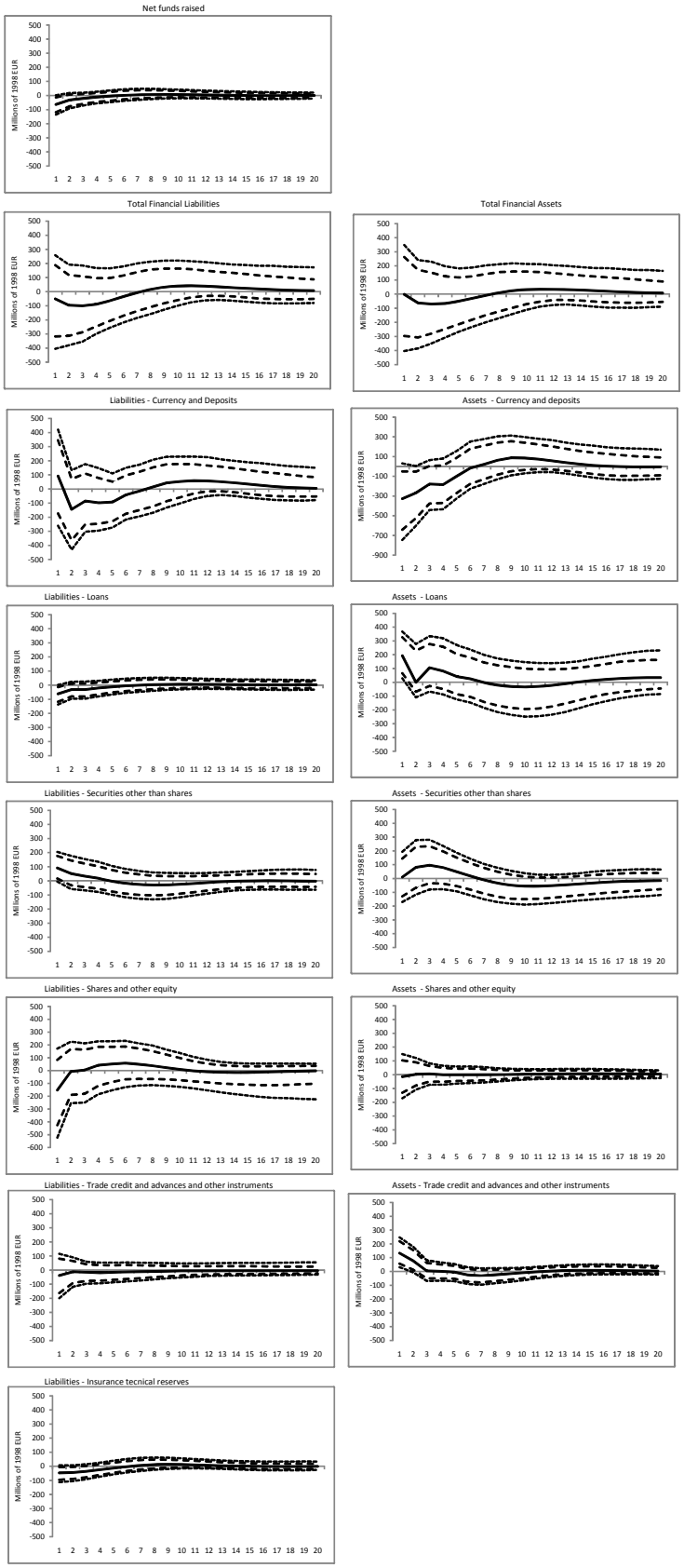
In the case of Portugal, following a monetary policy tightening net funds raised by financial corporations (which include MFIs, other financial intermediaries and financial auxiliaries, insurance companies and pension funds) decline in a statistically significant manner in the first two quarters, by about 16 per cent of the quarterly average flows (Figure 12). This result is in line with the one of Adrian and Shin (2009) for broker-dealers in the US that found out that an increase in interest rates induce a reduction in leverage by these institutions.

Looking at the components, we conclude that there is a larger fall in liabilities than in assets. However, these responses are hard to interpret as they are statistically insignificant. Nevertheless, the impulse response functions of some sub-components of assets and liabilities are statistically significant. On the liability side there is a decline in the issue of loans following the shock (which are mainly loans obtained from the rest of the world) and in the issue of insurance technical reserves, while the issuance of securities other than shares increases. On the asset side, there is an increase in loans granted to other sectors, which is consistent with the rise in loans obtained by non-financial corporations described above.

The combination of this information with the previous findings suggests that the financial sector seems to act as a buffer, providing extra funds to the non-financial sector when there is a contractionary monetary policy shock. However, it is hard to find a clear pattern in the reaction of the sub-components but it seems that financial corporations increase the amount of loans that they provide to other sectors and at the same time increase the issuance of securities other than shares.

[13] For the US, Adrian and Shin (2009) also suggest that the insignificant response of commercial banks' balance sheet items may alternatively reflect that their balance sheets have historically not been marked to market.

Figure 12
Financial corporation's financial flows
Response to a contractionary monetary policy shock

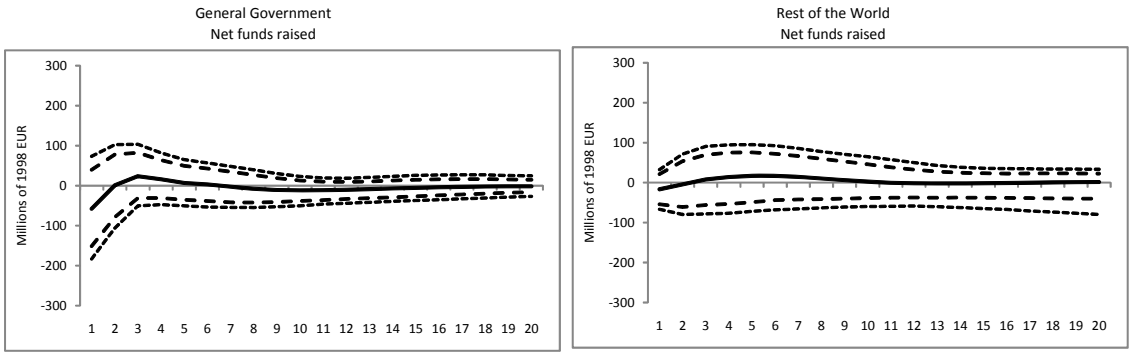


Note: Deviations from baseline. The full line represents the median impulse response using bootstrap (10 000 replications) and the dashed lines represent the 90th and 80th percentiles.

Other sectors

In addition to the three sectors mentioned above, we also compute the reponses of flow of funds data for the general government and the rest of the world. In both cases the response of net funds raised is not statistically different from zero which limits the interpretation of the results (Figure 13). For the foreign sector an identical outcome was found for the US and Italy, where no significant response of net borrowing by the foreign sector was found, while for the euro area net funds raised by the foreign sector decrease after the shock (see Table 2). As regards the general government, results for the US and the euro area point to an initial decrease in net funds raised, whereas in the case of Italy there is an increase in net funds raised by the general government after a monetary policy tightening.

Figure 13
Response to a contractionary monetary policy shock



Note: Deviations from baseline. The full line represents the median impulse response using bootstrap (10 000 replications) and the dashed lines represent the 90th and 80th percentiles.

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Table 2
Impact of a contractionary monetary policy

	USA Christiano, Eichenbaum and Evans (1996) Sample 1961:1992	**Euro Area** Bonci (2010) Sample 1999q1: 2009q2	**Italy** Bonci and Columba (2008) Sample 1980:2002	**Portugal** Gameiro and Sousa (2010) Sample 1998q1: 2009q2
	Response	Response	Response	Response
Non-financial coporations				
Net funds raised	Increase	Increase	Small increase	Increase
Financial liabilities	Increase	Increase	Decrease	Increase
Financial assets	Increase	Increase	Decrease	Increase
Households				
Net funds raised	Unchanged	Increase	Decrease	Increase
Financial liabilities	Small decrease	Decrease	Decrease	Decrease
Financial assets	Not significant	Decrease	Increase	Decrease
Government				
Net funds raised	Decrease	Decrease	Increase	Not significant
Financial Sector				
Net funds raised	Not significant	Negligible	Increase	Decrease
Foreign Sector				
Net funds raised	Increase	Not significant	Increase	Not significant

4. Conclusions

This paper analyses the response of the flow of funds of different economic sectors in Portugal to a monetary policy shock. For this purpose we estimate a SVAR with two blocs, one for the euro area and one for Portugal, imposing zero restrictions that guarantee the exogeneity of the euro area bloc. This assumption is justified by the small weight of Portugal in the euro area economy. Given the exogeneity of the euro area bloc it is estimated autonomously and the monetary policy shock is identified in the euro area VAR using a Choleski decomposition.

The results obtained for the euro area are in line with the existing empirical evidence, with GDP and prices falling in response to a contractionary monetary policy shock. The responses of prices and real GDP in Portugal are similar to those of the euro area, however the effect of the monetary policy shock on Portuguese prices occurs earlier and is stronger than in the euro area.

We find that Portuguese non-financial corporations and households initially increase their net funds raised following a monetary policy shock in the euro area. The initial rise in net funds raised by non-financial corporations reflects an increase in both the accumulation of assets and liabilities, but with a much stronger impact on liabilities. This result is also found for the US and the euro area and points to a certain degree of frictions that prevent firms from adjusting their nominal expenditures quickly after the shock. In particular, this may reflect constraints posed by the contracts in place that prevent firms from adjusting immediately their level of inventories to the lower level of demand and which compels them to resort to external finance.

After a contractionary monetary policy shock, the net financial position of households deteriorates, reflecting a fall in the acquisition of assets that exceeds the decline of liabilities. This is possibly related with consumption smoothing behavior. Households also adjust their financial portfolio switching from less liquid and riskier assets towards more liquid and safer instruments such as currency and deposits. The behavior of households in Portugal is qualitatively similar to that found for the euro area, while for the US the evidence points to a small or insignificant effect of the shock on households' acquisition of financial assets and issuance of liabilities.

The initial increase in net funds raised by non-financial corporations and households coincides with a decrease in net funds raised by the financial sector. This behaviour of the financial sector is, to some extent, consistent with a view that this sector may cushion the impact of the monetary policy shock on households and non-financial corporations by providing the necessary net funds to these sectors.

Finally, we were unable to uncover evidence of a clear systematic response of the general government and the rest of the world to a monetary policy shock as in both cases the response of net funds raised is not statistically different from zero.

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