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Financial conditions and economic activity: the potential impact of the targeted longer-term refinancing operations (TLTROs)

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FINANCIAL CONDITIONS AND ECONOMIC ACTIVITY: THE POTENTIAL IMPACT OF THE TARGETED LONGER-TERM REFINANCING OPERATIONS (TLTROS)

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Abstract

This paper explores the relationship between financial conditions and real economic activity in the euro area as a whole and for Greece in particular. We use a financial conditions index (see Angelopoulou *et al.*, 2014) which is constructed using a wide range of prices, quantities, spreads and survey data in line with theory. We update the indices and use them within a VAR framework to estimate the potential impact of the TLTROs on aspects of economic activity. Our results suggest that financial conditions do have a significant effect on economic activity and thus the TLTROs, to the extent that they are designed to improve financial conditions, will provide a boost to the real economy.

Keywords: financial conditions, monetary policy, financial crisis, credit, non-standard measures.

JEL classification: E52, E51, E61, E63, E65

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I. Introduction

The relationship between money and real output has been a controversial one down through the years. Friedman (1968) thought that monetary policy could affect output in the short run, but that in the long run changes in the money supply would simply show up in inflation. New classical economists (Barro, 1976), who combined market clearing assumptions with rational expectations, believe that money cannot influence real output even in the short term. The focus of all these schools of thought is on money; money is neutral either in the long run or at any time horizon. Financial structure is also neutral (Fama, 1980).

A different strand of the literature broadens the focus beyond money, to include credit and the financial system. Gertler (1988) provides a nice overview of this strand, beginning with Gurley and Shaw's (1955) work on the importance of financial intermediation, moving to Brainard and Tobin's (1963) integration of a financial sector into macroeconomic models to that of Stiglitz and Weiss (1981) on information asymmetries and their consequence for credit rationing. In this school of thought it is financial structure rather than money that influences economic activity. Moreover, during the 1990s it further developed to include the credit channel through the bank lending and balance sheet channels (Bernanke and Gertler, 1995; Bernanke *et al.*, 1996, 1999). The emphasis here is on how financial market imperfections can amplify the effects of monetary policy through their impact on the supply of credit. This broadening from money to credit finds support in recent work by Schularick and Taylor (2012) using a very long period of data (1870-2008). They show that, while up until the 1970s money and credit followed similar paths, thereafter they decoupled with credit rather than money having more explanatory power.

Policy instruments have also evolved to meet changing needs. The response of central banks to the international financial crisis of 2008 was a move away from traditional monetary tools (such as the interest rate) to nonstandard measures, including quantitative easing and direct intervention in certain financial markets. In this context, measuring the stance of monetary policy requires a multifaceted approach which moves beyond simply either the price of credit or its quantity.

In Angelopoulou *et al.* (2014), we construct a financial conditions index by conducting a principal component's analysis with more than 20 variables, including

not only interest rates but also spreads, quantities and survey data. We show how the index moves both in the pre-crisis period and the post and how it provides a good narrative of the crisis.

Our contribution in this paper is two-fold. First, we explore the relationship between measures of economic activity and financial conditions, as captured by the aforementioned index. Our sample period begins in January 2003 and goes up to April 2014. Thus we cover both the period before the international financial crisis and the period during and after. The focus on financial conditions places our work squarely within the strand of the literature that argues that financial structure will influence economic activity. Second, we use this framework to explore the potential impact of the ECB's targeted long-term refinancing operations (TLTROs). Given the way the operations are structured, we interpret the measure as a positive shock to credit to non-financial firms and households and explore its impact on financial conditions in the euro area as a whole and in Greece in particular and, via this channel, its potential impact on real activity. The empirical results provide support for the hypothesis that financial conditions can have a significant influence on economic activity.

II. Literature review: money, financial conditions and economic activity

In keeping with the theoretical developments described above, initial papers which examined the link between finance and the real economy focused on money and monetary policy in macroeconomic VAR models (Christiano *et al.*, 1996; see also 2005)[1]. Using data on the US economy from 1960 to 1992, they find that a contractionary monetary policy is associated with, *inter alia*, a persistent reduction in real GDP and retail sales. The literature then broadened the set of variables beyond some monetary aggregate or the interest rate to include credit and share price indices (Fornari and Stracca, 2013) and house prices, spreads between long and short rates, stock prices, loans-to-GDP and loans-to-deposits (Guarda and Jeanfils, 2012). These papers focus on the impact of financial shocks on real economic activity, by incorporating into VAR models variables such as real stock prices, real house prices, the term spread, the loans-to-GDP ratio and loans to deposits. Thus, some financial

[1] Of course, there is a large microeconomics literature on estimating the impact of financial conditions on firm investment or household consumption. In this paper, we focus on the macroeconomics literature.

shocks examined are asset price shocks; others are more related to credit. Fornari and Stracca (2013) examine 21 industrial countries over the period 1985 to 2011; Guarda and Jeanfils, 19 countries, between 1980 and 2010. Both papers find that financial shocks have large effects on real economic activity (including investment). Moreover, both uncover heterogeneous effects across countries, though it is not clear what causes them in the sense that the impact of the shock does not appear to be related always with differences in financial systems or structures.

One aspect of macroeconomic-financial links in any economy which was highlighted strongly through the recent crisis is the possibility that the relationships are non-linear. To explore this possibility, a number of papers use more complex VAR-type models. Hartmann *et al.* (2013) use their Composite Indicator of Systemic Stress (CISS) in a Markov Switching Bayesian Autoregression (MS-BVAR) to capture feedback and amplification effects that may be present in macro-financial relationships. The focus is on the euro area (at the aggregate level). Effectively the framework allows for different regimes, corresponding to different degrees of financial stress. CISS focuses on systemic financial instability more than general financial conditions and it is constructed using data from money markets, financial intermediaries, bond markets, equity markets and foreign exchange markets in the euro area. The results show that in high-stress regimes there are strong real-financial links whereas when stress is at its lowest these links are weak. Other papers which explore nonlinearities are Konecny and Kucharcukova (2013) who estimate a Threshold VAR for the Czech economy and Guarda *et al.* (2012) who use a mixture VAR for Luxembourg.

Boeckx *et al.* (2014) also employ a VAR framework (SVAR model) where the focus is on the impact of all the nonstandard monetary policy measures undertaken by the ECB. The model contains output, prices, the policy rate, the CISS, the spread between the EONIA and the policy rate and, to capture the nonstandard measures, the balance sheet of the ECB. Their results suggest that balance sheet expansion has a significant but temporary impact on output. The channels through which output is affected include the exchange rate, equity prices, bank lending, sovereign spreads and bond yields. Interestingly, they find that the impact of balance sheet expansion on peripheral countries is much weaker and/or much smaller than in the more core countries.

A more structural approach to macro-financial links is provided by Bayoumi and Melander (2008). They focus on the impact in the US of a negative shock to capital adequacy ratios. The shock affects credit and, in turn, consumption, investment and, ultimately, GDP. They find that a 1 percentage point fall in the capital adequacy ratio ultimately causes GDP to fall by 1.5% through it effect on credit availability.

Finally, Diron *et al.* (2005) and English *et al.* (2005) shed light on real-financial linkages by focusing on the role of financial variables in forecasting macroeconomic aggregates (investment and GDP, respectively). The focus is on the euro area. Diron *et al.* (2005) begin by building a basic investment equation which includes real GDP growth and a measure of the long-term cost of capital. They then supplement the explanatory variables by various financial indicators (stock market capitalisation, share prices, dividends, corporate loans, profits and debt, etc) one at a time. A horse race is then held to determine whether and which financial indicators help predict investment more accurately. However, the results do not provide much support for the view that financial indicators are important in aggregate investment equations. There is some evidence that when financial conditions are bad, the lack of finance does act as a drag on investment. English *et al.* (2005) focus on forecasting GDP, investment and inflation in Germany, the UK and the US. They construct a financial conditions index in a manner similar to Angelopoulou *et al.* (2014). They then add it to the forecasting equations. The results suggest that financial factors do add significantly to the forecasting ability of models for GDP and investment. By contrast, they add little to inflation forecasting equation.

III. The Eurosystem's TLTRO programme – a point of departure

In June 2014 the ECB's Governing Council decided to introduce a series of targeted longer-term refinancing operations (TLTROs), "*designed to enhance the functioning of the monetary policy transmission mechanism by supporting bank lending to the real economy*".[2] In other words, they were designed to boost bank lending to euro-area non-financial corporations and households (mortgages excluded) by rewarding banks for extra credit provision with access to extra liquidity. According to the relevant press releases, under the scheme banks would "*initially be able to*

[2] https://www.ecb.europa.eu/press/pr/date/2014/html/pr140605_2.en.html

borrow an amount equivalent to up to 7% of a specific part of their loans in two operations in September and December 2014", while, subsequently, additional amounts could be borrowed in further TLTROs, "*depending on the evolution of the banks' eligible lending activities in excess of bank-specific benchmarks*".[3] Conversely, should they be found *ex post* to have performed worse than required in terms of their net lending to the private sector, participating banks would be obliged to an early repayment of the funds previously obtained.

The introduction of lending-contingent liquidity provision was a landmark decision for the Eurosystem, a break from a long tradition of only implicit credit-supply targeting. The underlying assumption was that an increase in credit has a short and medium-term positive impact on real growth and thus on inflation which, by end-2014, had plummeted to -0.2% for the euro area, very far from the ECB's official inflation target of "close to but below 2%".

Taking this initiative as a starting point, we attempt to explore the possible effect of credit supply and, more generally, financial conditions on real variables in the euro area as a whole and in Greece in particular.

IV. Methodology

We follow a step-wise procedure. We build on the financial conditions indices (FCIs) constructed by Angelopoulou et al (2013), which summarize and track the evolution of financial conditions over time. The FCIs are constructed by applying principal components analysis on a wide range of prices, quantities, spreads and survey data, in a way that incorporates insights from the theoretical literature and focuses on supply-side aspects of financial conditions, thus rendering them well-suited for the present exploration.

We first update the FCIs to April 2014, the end-date of the benchmark period (see Figure 1).[4] We then make the working assumption that the full amount of

[3] https://www.ecb.europa.eu/press/pr/date/2014/html/pr140703_2.en.html

[4] The variables included in each of the FCIs are: 1. Loans to non-financial corporations (flows), 2. Loans to households (flows), 3. Spread between rate on loans and deposits to NFCs, 4. Spread between rate on overdrafts and deposits to NFCs, 5. Spread between consumer loans and deposits to households, 6. Spread between mortgage loans and deposits to households, 7. Net liquidity provision by the Eurosystem, 8. Growth rate of net liquidity provision by Eurosystem, 9. Debt securities issued by NFCs (flow), 10. Debt securities issued by monetary financial institutions (flow), 11. Rate of change of residential property prices, 12. Rate of change of HICP, 13. Spread between the 3-month and overnight

liquidity allotted to euro-area banks during the initial two TLTRO rounds (i.e. 7% of their loans to the euro-area non-financial private sector outstanding on 30 April 2014) is indeed directly channeled towards loans to the private sector.[5,6] This positive one-off shock to credit supply is then inputted into the corresponding FCI components, using the loadings on loan flows to non-financial corporations and households in each of the principle components and the weight of each principle component in the FCI, and the implied positive shock to each of the FCIs, i.e. to financial conditions, is thus calculated.[7]

Subsequently we estimate alternative VAR model specifications, each of which includes a measure of real activity, the FCI and, for completeness, as external variables, inflation and the "fiscal news" variable of Gibson *et al.* (2012), appropriately updated for the purposes of this paper.[8] We then use the VARs to explore the cumulative effect of the credit shock on the real variable over the following years. Given that GDP is not available at a monthly frequency, we use instead three alternative monthly real variables as measures of real activity (see Figures 2-4), namely industrial production (IP), the volume of retail trade (RRT) and the Purchasing Managers' Index (PMI).[9] The first two variables capture the consumption and investment components of real activity, while the third is a well-known leading indicator of GDP growth.

We estimate the following specification:

$$x^{j,r}{}_t = c^{j,r} + \Sigma^{n=1\rightarrow k} a^{j,r}{}_n \, x^{j,r}{}_{t-n} + \Sigma^{i=1,2} \beta^{j,r}{}_i \, z_{i,t} + \varepsilon_t \qquad (1)$$

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rate, 14. Spread between the 2-year and 3-month EURIBOR rate, 15. Spread between the 10-year and 3-month EURIBOR rate, 16. Average spread of long-term government debt vs Germany, 17. Rate of change of stock prices, 18. Volatility of stock prices, 19. Volatility of bond prices, 20. Bank lending survey, question on banks' access to market financing, 21. Bank lending survey, question on banks' liquidity position, 22. Bank lending survey, question on housing market prospects, 23. Bank lending survey, question on consumer creditworthiness, 24. ECB refinancing rate

[5] This amounts to €400bn for the euro area and €7bn for Greece.

[6] This is of course an optimistic assumption, but not a consequential one, as the results of our analysis can readily be scaled down to reflect any degree of pass-through of the TLTRO program to credit supply.

[7] A detailed account of how the FCIs are calculated can be found in Angelopoulou, Balfoussia and Gibson (2013). The updated weights and loadings differ only marginally, and are available from the authors upon request.

[8] These two variables are specified as external in the model because including their dynamics would lead to misspecification. Inflation is one of the variables used in the construction of the FCI, thus its dynamics are already, to some extent, incorporated in the FCI's dynamic structure. As for the fiscal variable, it reflects *unexpected* fiscal news, e.g. deviations from forecasts etc., which, by definition, should have very little serial correlation.

[9] The PMI data are provided by Markit Economics, while all other data are from Eurostat.

where $x^{j,r}_t = (x^{j,r}_{1,t}, x^{j,r}_{2,t})$, $x^{j,r}_{1,t}$ denotes one of the three aforementioned real variables (i.e. $r=\{IP, RRT, PMI\}$) and $x^{j}_{2,t}$ denotes the FCI for the geographical area j, i.e. for either the euro area or Greece. Both the real variables and the FCI are in first differences, as the null hypothesis of a unit root cannot be rejected at standard confidence levels (see Table 1). As external variables $z_{i,t}$ we include the rate of inflation between t and $t-12$ and the fiscal news variable. By c, a_n and β_i we denote vectors of estimated coefficients. The exact specification in terms of the VAR lags k and the external variables is the one which proves the most parsimonious, by standard diagnostics. Finally, the error term ε_t is assumed to follow an $iid\sim(0,1)$ normal distribution.

Through this two-stage procedure we are able to explore the potential impact of this particular Eurosystem non-standard measure on the real economy via its effect on financial conditions and, by implication, the potential benefit of other non-standard measures which may have an analogous effect on credit.

V. Results

Figure 1 presents the updated FCIs, with an increase in the index reflecting an easing of financial conditions and zero corresponding to a long-term mean level. Their evolution over recent years is interesting in itself, as it clearly depicts that while in the euro area the great troughs in financial conditions corresponding to the Lehman Brothers crisis and to the European sovereign debt crisis were roughly of equal magnitude, for Greece (as for many of the other peripheral countries) the sovereign debt crisis was, literally, much closer to home, as reflected in the far sharper decline of the FCI in the second trough.

A summary of the estimated coefficients of our VAR specifications for Greece and the euro area and for each of the three real variables is presented in Table 2, as are the corresponding diagnostic statistics.[10] The exact specification varies in terms of both the lag length and the exogenous variables included, the former having been selected on the basis of the AIC criterion, following Ozcicek and McMillin (1999),

[10] We only present estimates for the equations where the real variable is the dependent one. A full set of estimates is available from the authors upon request.

and the latter on the basis of their whether they contribute positively to adjusted R-squared.

Turning now to our main question of interest which is to gauge the potential impact on the real economy of a positive shock to financing conditions, stemming from an increase in credit supply, Table 3 presents the relevant Granger causality tests. They indicate Granger causality running from the FCI to the real variables in all specifications, while no Granger causality is detected in the opposite direction in all cases but one. This is interesting, given that the main caveat of this type of analysis is that bi-directional causality is typically hard to reject.

The estimated effect of the ongoing Eurosystem TLTRO programme on credit supply to the private sector and, ultimately, on real activity is depicted in Figures 5-10 which present the cumulative impulse responses of the three real variables to the change in financial conditions implied by the TLTRO shock, as described in the previous section. On the whole, the real variables' impulse responses to the TLTRO shock on the FCI are positive and significant for the euro area and for Greece. They indicate that, were the entire initial TLTRO allocation of the Eurosystem to be instantaneously channeled towards lending to the private sector, the real effects would be sizeable, namely a 5.7%, 2.9% and 4.7% cumulative increase of IP, RRT and the PMI for the euro area at the 4-year horizon and a 0.9%, 6.6% and 2.9% cumulative increase of the corresponding variables in the case of Greece. It is notable that, for the euro area, the effect on industrial production is quite sizable, possibly implying long-lasting benefits stemming from the accumulation of productive capital. Conversely, in the case of Greece the effect on industrial production is small and insignificant, reflecting the weak industrial base of the Greek economy as compared to the euro area average. The potential impact of a credit increase on real retail trade seems to be much greater for Greece than for the euro area as a whole, capturing the more consumption-driven composition of the Greek economy relative to the euro area. The effect on the PMI is significant and substantial in both cases. Given that the PMI is known to lead real growth, but exhibits a somewhat higher volatility, this finding could imply a significant, if somewhat smaller positive effect of the TLTRO shock on real GDP growth. The aforementioned findings correspond to credit elasticities of approximately 0.8, 0.4 and 0.7 for IP, RRT and PMI respectively for the euro area and

to 0.1, 0.9 and 0.4 respectively for the case of Greece. The use of these elasticities allows us to map our findings to a TLTRO pass-through of any magnitude.

While these results are intuitive and consistent across estimations, some care is needed in interpreting them. Firstly, as already mentioned, TLTROs actually "reward" not only a net increase in lending, but also a decline in deleveraging, i.e. an improvement vis-à-vis the previously established trend. Thus, the estimated impact captured by the impulse response functions should be thought of as a deviation from an existing trend, as a relative improvement over an otherwise more adverse trajectory, rather than as an end-figure. Moreover, in practice, any increase in new lending would take place over a number of months, rather than immediately, implying a slower realization of this same cumulative impact, while the degree of bank participation in the programme is also a factor which would affect its success. On the other hand, the estimates might also be biased downwards, as any policy initiative which leads to an increase in net lending would also be likely to positively affect other variables within the FCI. Thus, via the "money multiplier" effect, the end result could be higher than indicated by the above estimates.

VI. Conclusions

In summary, our empirical findings indicate that the potential impact of the Eurosystem's TLTRO programme on real economic activity is significant, both for the euro area and for individual countries such as Greece which are most in need of a boost to real economic activity at the present juncture. The transmission channel considered here is via financial conditions, an easing of which does indeed seem to positively and significantly affect a number of real economic indicators and may thus be expected to lead to an overall increase in economic growth. However, the question of whether this increase is investment-driven or consumption-based seems inalienably linked to the underlying productive structure of the economy in question.

VII. References

Angelopoulou, E., H. Balfoussia and H.D. Gibson (2014) "Building a financial conditions index for the euro area and selected euro area countries: What does it tell us about the crisis?", *Economic Modelling*, 38, C, 392-403.

Barro, R. (1976) "Rational expectations and the role of monetary policy", *Journal of Monetary Economics*, 2, 1, 1-32.

Bayoumi, T. and O. Melander (2008) "Credit matters: empirical evidence on US macro-financial linkages", mimeo.

Bernanke, B. and M. Gertler (1995) "Inside the black box: the credit channel of monetary molicy transmission", *Journal of Economic Perspectives*, 9, 27-48.

Bernanke, B., M. Gertler and S. Gilchrist (1996) "The financial accelerator and the flight to quality", *The Review of Economics and Statistics*, 78, 1, 1-15.

Bernanke, B., M. Gertler and S. Gilchrist (1999) "The financial accelerator in a quantitative business cycle framework", *Handbook of Macroeconomics*, 1, 21, 1341-1393.

Boeckx, J., M. Dossche and G. Peersman (2014) "Effectiveness and transmission of the ECB;s balance sheet policies", Working Paper, National Bank of Belgium, no. 275.

Brainard, W. and J. Tobin (1963) "Financial intermediaries and the effectiveness of monetary control" *American Economic Review*, 53, 383-400.

Christiano, L. J., M. Eichenbaum and C. L. Evans (1996) "The effects of monetary policy shocks: evidence from the flow of funds", *The Review of Economics and Statistics*, 78, 1, 16-34.

Christiano, L. J., M. Eichenbaum and C. L. Evans (2005) "Nominal rigidities and the dynamic effects of a shock to monetary policy", *Journal of Political Economy*, 113, 1, 1-45.

Diron, M., M. Manzano and T. Westermann (2005) "Forecasting aggregate investment in the euro area: do indicators of financial conditions help?", *BIS papers*, 22.

Fama, E. (1980) "Banking in a theory of finance", *Journal of Monetary Economics*, 6, 39-57.

Fornari, F. and L. Stracca (2013) "What does a financial shock do? First international evidence", ECB Working Paper, no. 1522.

Gertler, M. (1988) "Financial structure and aggregate economic activity", *Journal of Money, Credit and Banking*, 20, 3, 559-96.

Gibson, H. D., S. Hall and G. Tavlas, (2012) "The Greek financial crisis: Growing imbalances and sovereign spreads" *Journal of International Money and Finance*, 31, 3, 498-516.

Guarda, P. and P. Jeanfils (2012) "Macro-financial linkages: evidence from country-specific VARs", Banque Centrale du Luxembourg Working Paper, no. 71.

Guarda, P., A. Rouabah and J. Theal (2012) "An MVAR framework to capture extreme events in macro-prudential stress tests", ECB Working Paper, no. 1464.

Gurley, J. and E. Shaw (1955) "Financial aspects of economic development", *American Economic Review*, 45, 515-38.

Hartmann, P., K. Hubrich, M. Kremer and R. J. Tetlow (2013) "Melting down: systemic financial instability and the macroeconomy", Beiträge zur Jahrestagung des Vereins für Socialpolitik 2013: Wettbewerbspolitik und Regulierung in einer globalen Wirtschaftsordnung - Session: Financial Stability, No. G02-V3.

Konečný, T. and O. Babecká Kucharčuková (2013) "Evaluating the links between the financial and real sectors in a small open economy: The case of the Czech Republic", ECB Working Paper, no. 1730.

Ozcicek, O. and W. D. McMillin (1999) "Lag length selection in vector autoregressive models: symmetric and asymmetric lags", *Applied Economics*, 31, 4, 517-524.

Schularick, M. and A. M. Taylor (2012) "Credit booms gone bust: monetary policy, leverage cycles, and financial crises, 1870-2008" *American Economic Review*, 102, 2, 1029-61.

Stiglitz, J. E. and A. Weiss (1981) "Credit rationing in markets with imperfect information, *American Economic Review*, 71, 3, 393-410.

VIII. Tables

Table 1. Unit root tests		
Panel tests		
Im, Pesaran and Shin W-stat		0.482
ADF - Fisher Chi-square		0.646
ADF - Choi Z-stat		0.497
PP - Fisher Chi-square		0.599
PP - Choi Z-stat		0.529
Individual tests	ADF	Phillips-Perron
Euro area FCI	0.338	0.529
Euro area IP	0.162	0.564
Euro area RRT	0.734	0.650
Euro area PMI	0.244	0.336
Greek FCI	0.706	0.865
Greek IP	0.474	0.079 *
Greek RRT	0.871	0.847
Greek PMI	0.437	0.242

Note: Null Hypothesis: presence of an individual unit root process. Exogenous variables: individual effects and linear trends. *P*-values are reported. *, ** and *** denote that the null can be rejected at the 10%, 5% amd 1% level of significance respectively.

Table 2. VAR Estimates and Diagnostics

Dependent variable	Euro area IP	Euro area RRT	Euro area PMI	Greek IP	Greek RRT	Greek PMI
Real variable 1st lag	-0.042	-0.614	-0.101	-0.762	-0.203	-0.089
	-0.498	*-7.398 ****	*-0.998*	*-9.219 ****	*-2.015 ***	*-0.931*
Real variable 2nd lag	0.256	-0.189	0.223	-0.225	-0.210	-0.065
	*2.984 ****	*-1.959 **	*2.173 ***	*-2.197 ***	*-2.044 ***	*-0.688*
Real variable 3rd lag	0.261	0.055	0.272	-0.180	0.139	-0.142
	*2.927 ****	*0.553*	*2.512 ***	*-1.779 **	*1.335*	*-1.577*
Real variable 4th lag	0.099	0.072	-0.008	-0.166	-0.170	-0.035
	1.125	*0.720*	*-0.074*	*-2.008 ***	*-1.641*	*-0.376*
Real variable 5th lag	-0.045	0.035	-0.064	-	0.090	-0.233
	-0.538	*0.365*	*-0.573*		*0.853*	*-2.525 ***
Real variable 6th lag	0.112	0.174	0.083	-	0.078	-0.168
	1.347	*1.886 **	*0.760*		*0.735*	*-1.794 **
Real variable 7th lag	-	0.256	0.067	-	0.091	-0.227
		*2.789 ****	*0.630*		*0.873*	*-2.521 ***
Real variable 8th lag	-	0.273	0.007	-	-0.065	-
		*2.963 ****	*0.067*		*-0.622*	
Real variable 9th lag	-	0.014	-0.075	-	0.036	-
		0.153	*-0.693*		*0.344*	
Real variable 10th lag	-	-0.017	-0.074	-	0.142	-
		-0.173	*-0.709*		*1.421*	
Real variable 11th lag	-	0.116	0.026	-	0.032	-
		1.208	*0.263*		*0.315*	
Real variable 12th lag	-	0.052	0.037	-	-0.166	-
		1.603	*1.379*		*-1.717 **	
PMI 1st lag	0.142	-0.073	0.409	0.409	1.152	1.111
	0.521	*-0.491*	*1.110*	*0.611*	*1.286*	*2.704 ****
PMI 2nd lag	0.875	0.072	0.981	1.636	0.697	1.166
	*3.160 ****	*0.466*	*2.627 ****	*2.688 ****	*0.779*	*2.656 ****
PMI 3rd lag	0.300	0.254	0.445	0.381	2.897	0.552
	1.065	*1.708 **	*1.161*	*0.621*	*3.315 ****	*1.240*
PMI 4th lag	-0.105	0.430	0.469	-0.798	0.613	0.862
	-0.372	*2.877 ****	*1.222*	*-1.196*	*0.653*	*1.989 ***
PMI 5th lag	0.175	-0.033	0.156	-	0.623	0.565
	1.631	*-0.214*	*0.403*		*0.649*	*1.293*
PMI 6th lag	-0.164	0.076	-0.273	-	-1.272	0.394
	-0.596	*0.489*	*-0.706*		*-1.328*	*0.911*
PMI 7th lag	-	0.228	-0.144	-	0.507	-0.370
		1.510	*-0.377*		*0.520*	*-0.907*
PMI 8th lag	-	-0.126	0.042	-	1.176	-
		-0.829	*0.110*		*1.223*	
PMI 9th lag	-	0.021	0.301	-	1.639	-
		0.138	*0.794*		*1.697 **	
PMI 10th lag	-	-0.002	0.021	-	-0.285	-
		-0.015	*0.055*		*-0.306*	
PMI 11th lag	-	0.368	0.258	-	-0.308	-
		*2.566 ***	*0.704*		*-0.322*	
PMI 12th lag	-	0.069	0.738	-	0.582	-
		1.483	*2.034 ***		*1.609*	
constant	0.129	0.018	0.047	-0.625	-0.768	0.162
	0.535	*0.411*	*0.446*	*-2.881 ****	*-1.371*	*0.615*
fiscal news variable		-0.168	0.109	0.180	-	-0.050
		-1.107	*1.269*	*1.688 **		*-0.288*
inflation y-o-y	-0.047	-	-	-	0.218	-0.055
	-1.414				*1.167*	*-1.605*
point dummies	2.806	1.211	-	6.498	-	-
	*4.910 ****	*7.083 ****		*4.775 ****		
R-squared	0.464	0.623	0.378	0.535	0.339	0.240
Adj. R-squared	0.398	0.519	0.215	0.495	0.165	0.173
Log lik.	-157.595	-64.838	-173.455	-286.881	-277.864	-219.193
Akaike IC	2.718	1.518	3.297	4.618	5.023	3.749
Schwarz IC	3.054	2.142	3.898	4.862	5.623	4.132
VAR Akaike IC	3.285	2.295	4.019	5.226	5.702	4.576
VAR Schwarz IC	3.957	3.542	5.221	5.714	6.903	5.342

Note: t-statistics in italics. *, ** and *** denote that the null can be rejected at the 10%, 5% amd 1% level of significance respectively. A point dummy has been included in three of the equations to capture an extreme outlier data point.

Table 3. VAR Granger Causality Wald Tests				
Granger causality from	to	Chi-squared	df	Prob.
Euro area FCI	Euro area IP	16.60 **	6	0.011 **
Euro area IP	Euro area FCI	7.20	6	0.303
Euro area FCI	Euro area RRT	29.06 ***	12	0.004 ***
Euro area RRT	Euro area FCI	15.68	12	0.207
Euro area FCI	Euro area PMI	22.46 **	12	0.033 **
Euro area PMI	Euro area FCI	20.27 *	12	0.062 *
Greek FCI	Greek IP	8.94 *	4	0.063 *
Greek IP	Greek FCI	3.14	4	0.534
Greek FCI	Greek RRT	21.15 **	12	0.048 **
Greek RRT	Greek FCI	6.70	12	0.877
Greek FCI	Greek PMI	15.51 **	7	0.030 **
Greek PMI	Greek FCI	8.76	7	0.270

Note: Null Hypothesis: no Granger causality. *, ** and *** denote that the null can be rejected at the 10%, 5% amd 1% level of significance respectively.

IX. Figures

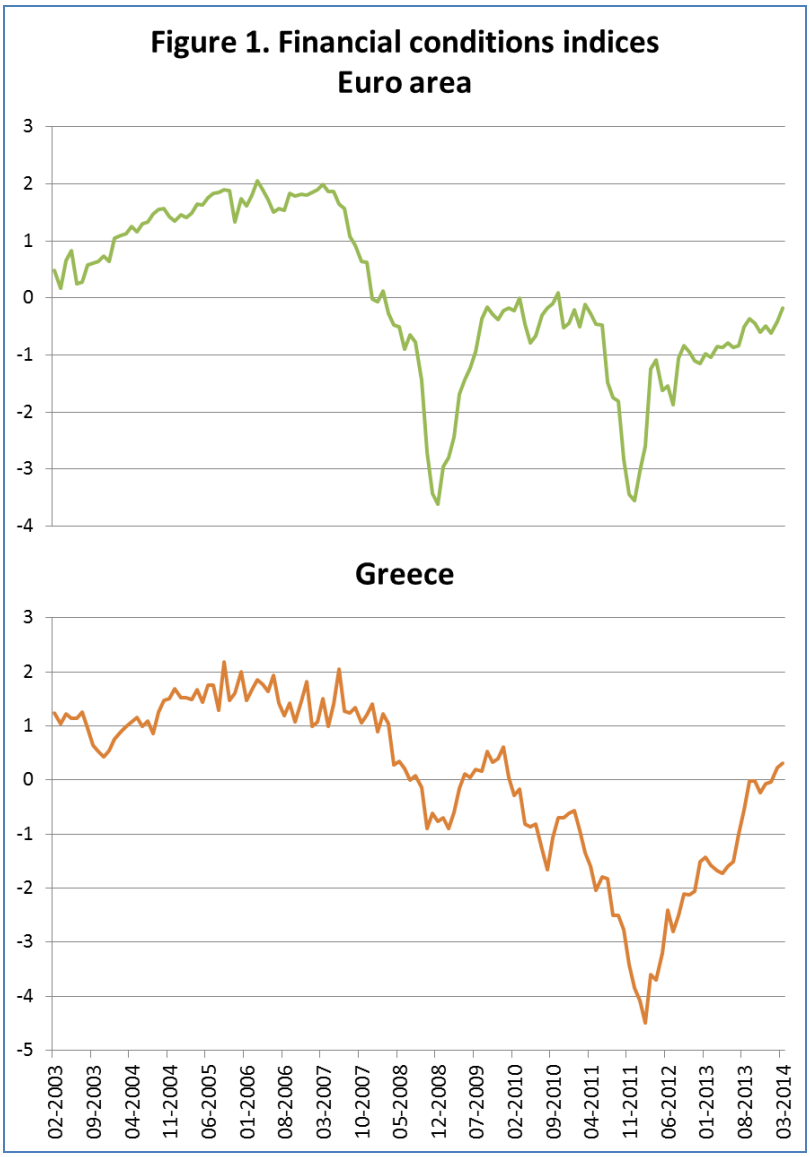


Figure 1. Financial conditions indices
Euro area
3
2
1
0
-1
-2
-3
-4
Greece
3
2
1
0
-1
-2
-3
-4
-5
02-2003
09-2003
04-2004
11-2004
06-2005
01-2006
08-2006
03-2007
10-2007
05-2008
12-2008
07-2009
02-2010
09-2010
04-2011
11-2011
06-2012
01-2013
08-2013
03-2014

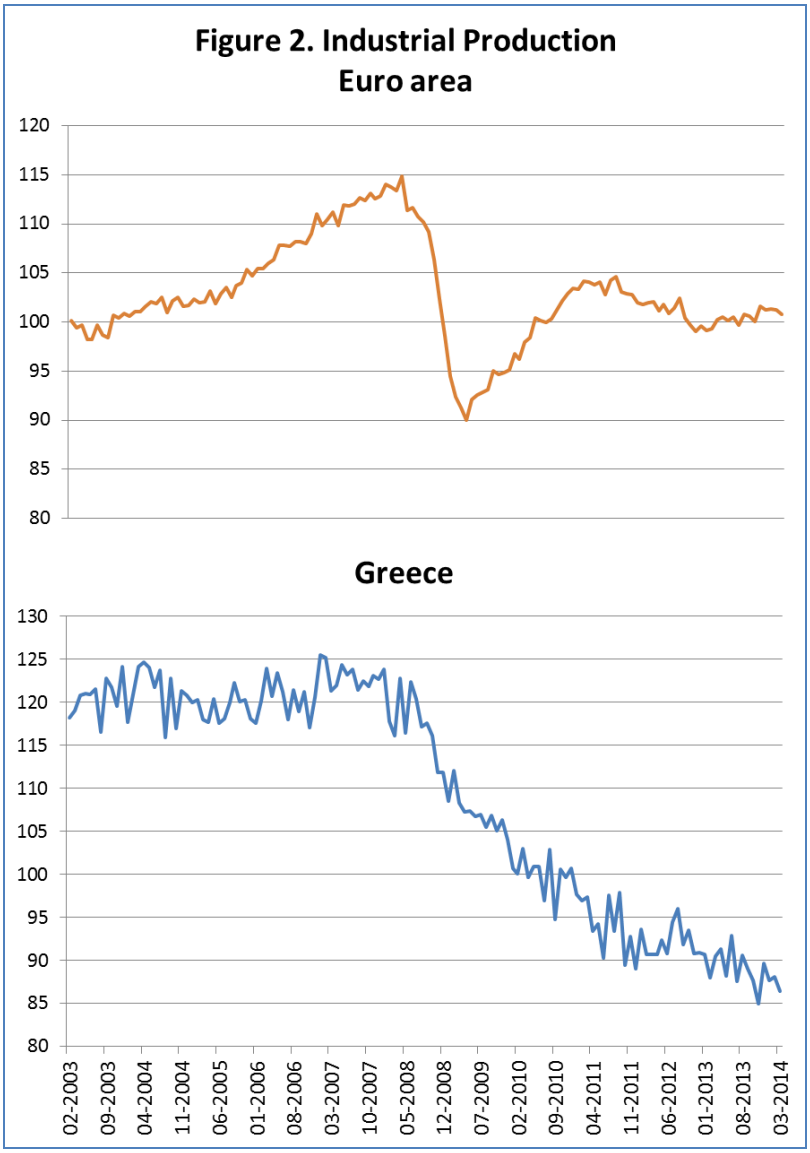


Figure 2. Industrial Production
Euro area
120
115
110
105
100
95
90
85
80
Greece
130
125
120
115
110
105
100
95
90
85
80
02-2003
09-2003
04-2004
11-2004
06-2005
01-2006
08-2006
03-2007
10-2007
05-2008
12-2008
07-2009
02-2010
09-2010
04-2011
11-2011
06-2012
01-2013
08-2013
03-2014

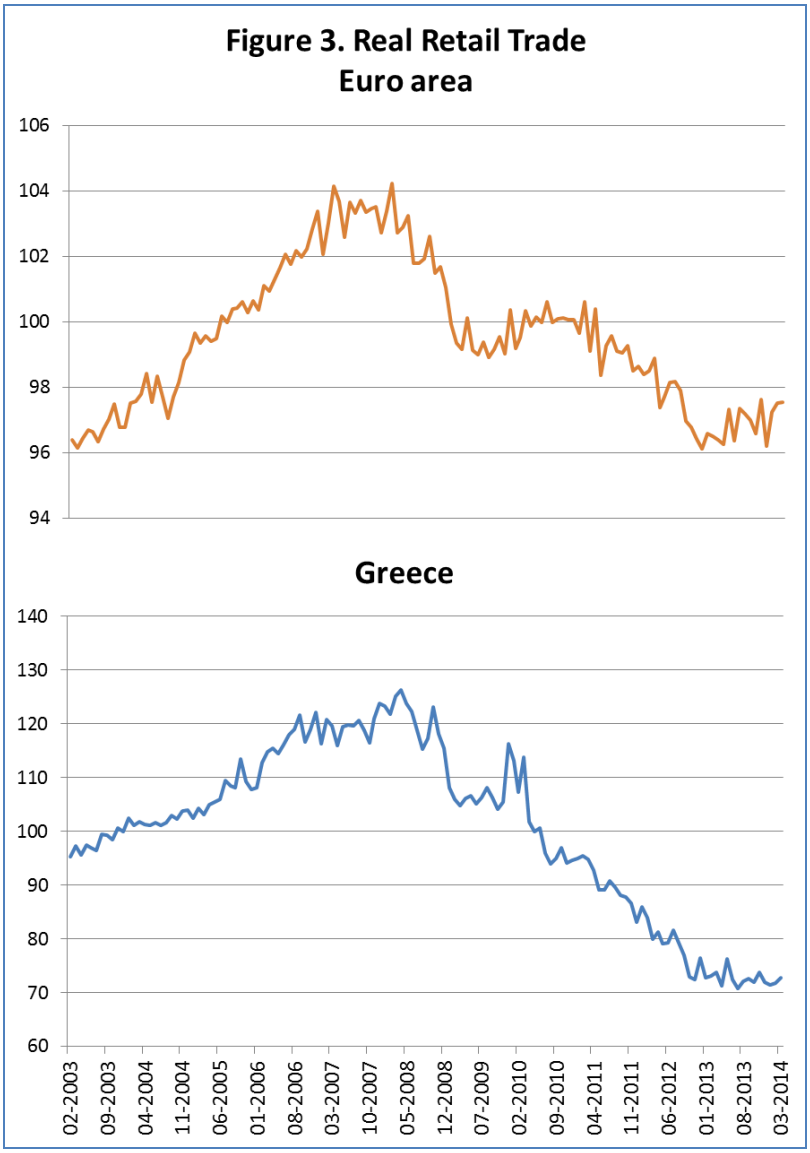


Figure 3. Real Retail Trade
Euro area
106
104
102
100
98
96
94
Greece
140
130
120
110
100
90
80
70
60
02-2003
09-2003
04-2004
11-2004
06-2005
01-2006
08-2006
03-2007
10-2007
05-2008
12-2008
07-2009
02-2010
09-2010
04-2011
11-2011
06-2012
01-2013
08-2013
03-2014

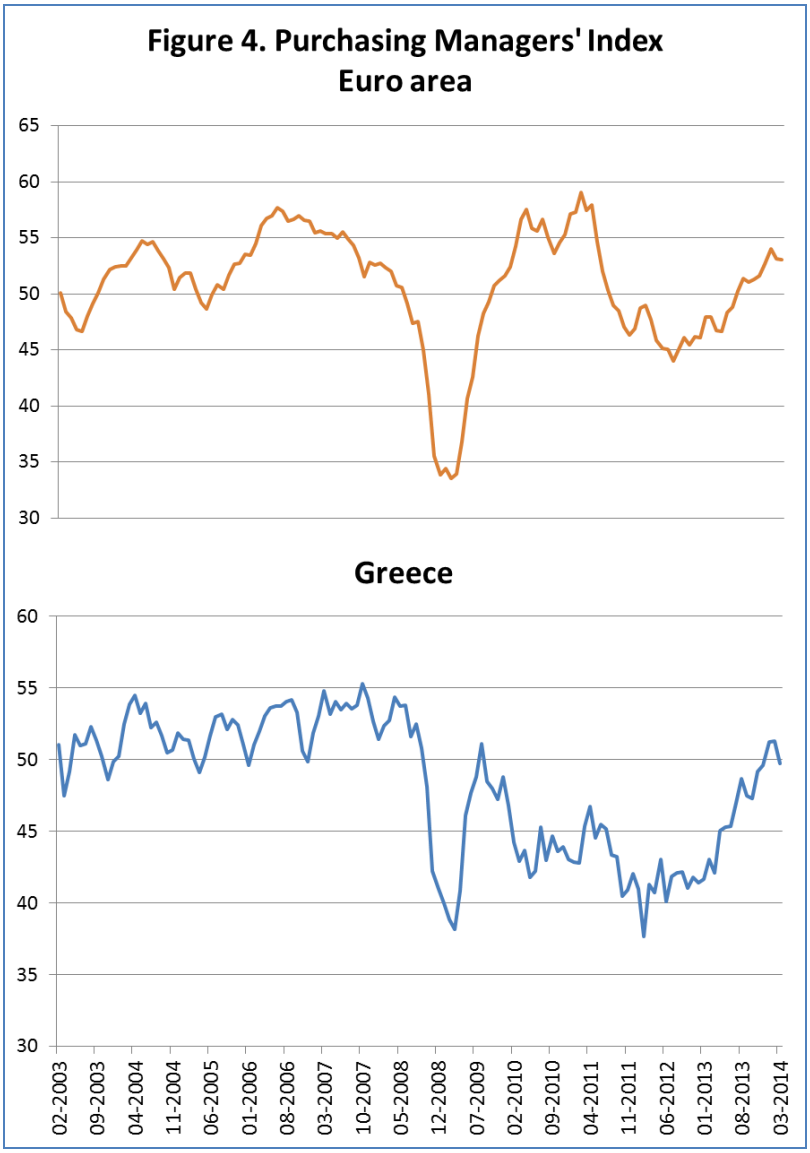


Figure 4. Purchasing Managers' Index
Euro area
65
60
55
50
45
40
35
30
Greece
60
55
50
45
40
35
30
02-2003
09-2003
04-2004
11-2004
06-2005
01-2006
08-2006
03-2007
10-2007
05-2008
12-2008
07-2009
02-2010
09-2010
04-2011
11-2011
06-2012
01-2013
08-2013
03-2014

Figure 5. Cummulative impulse response of Euro area Industrial Production to a TLTRO-induced shock to the FCI

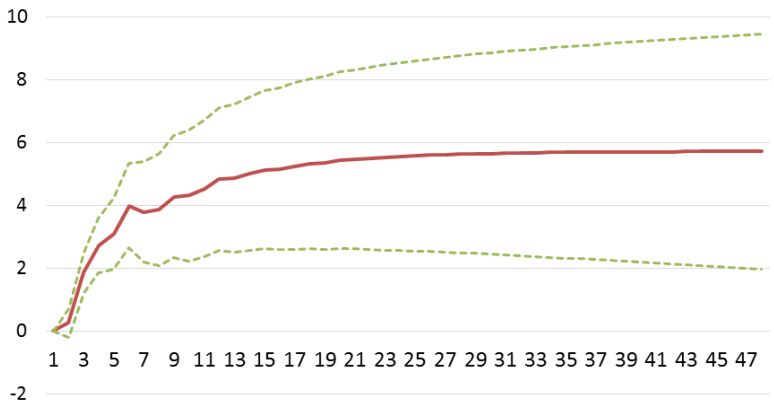


Figure 6. Cummulative impulse response of Euro area Real Retail Trade to a TLTRO-induced shock to the FCI

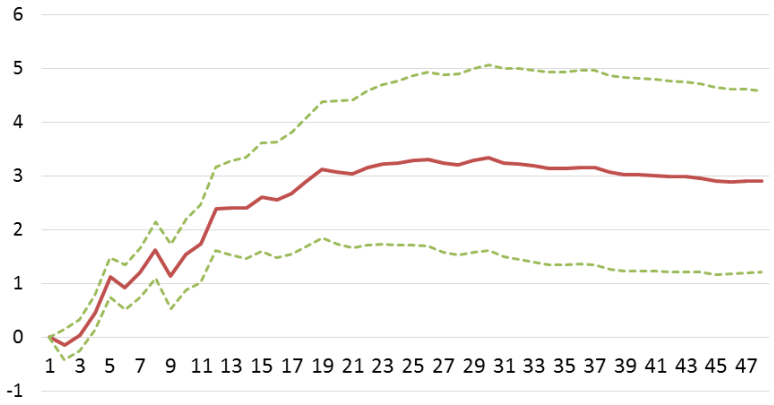


Figure 7. Cummulative impulse response of Euro area PMI to a TLTRO-induced shock to the FCI

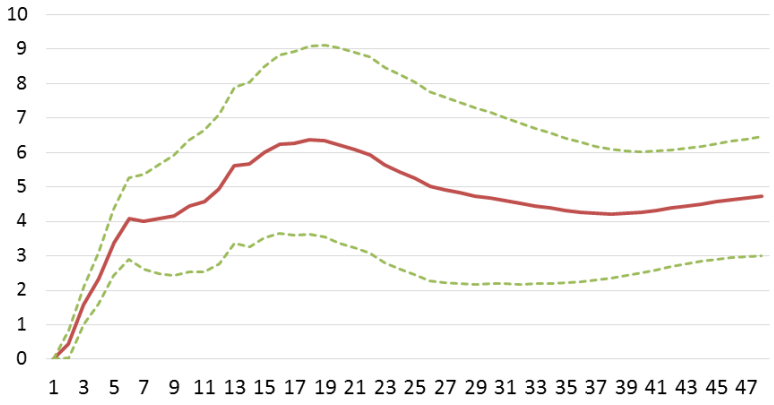


Figure 8. Cummulative impulse response of Greek Industrial Production to a TLTRO-induced shock to the FCI

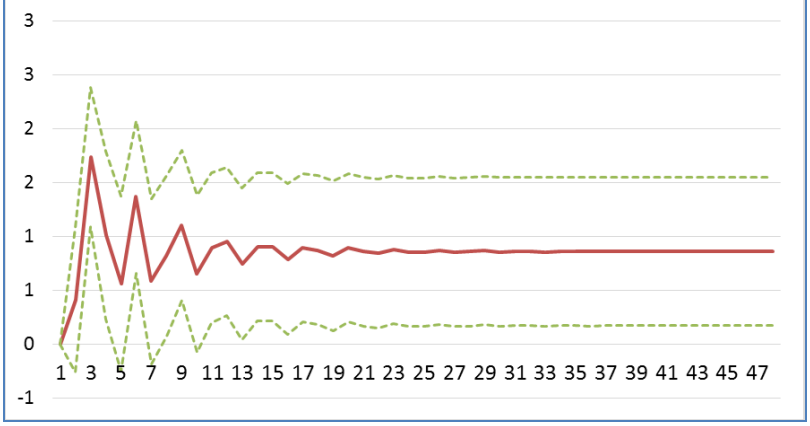


Figure 9. Cummulative impulse response of Greek Real Retail Trade to a TLTRO-induced shock to the FCI

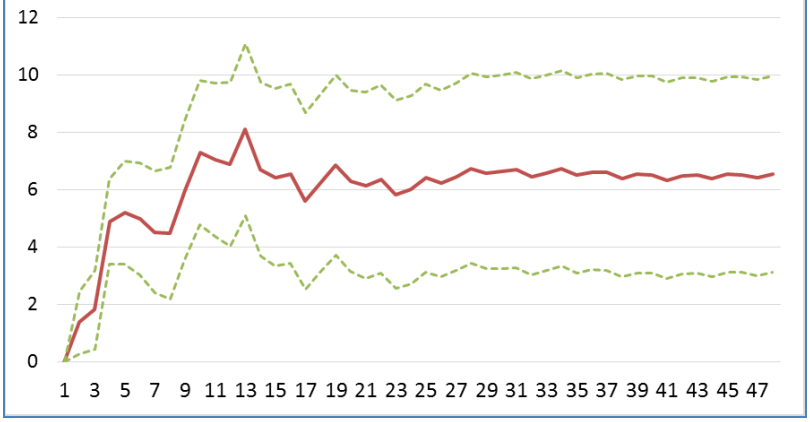
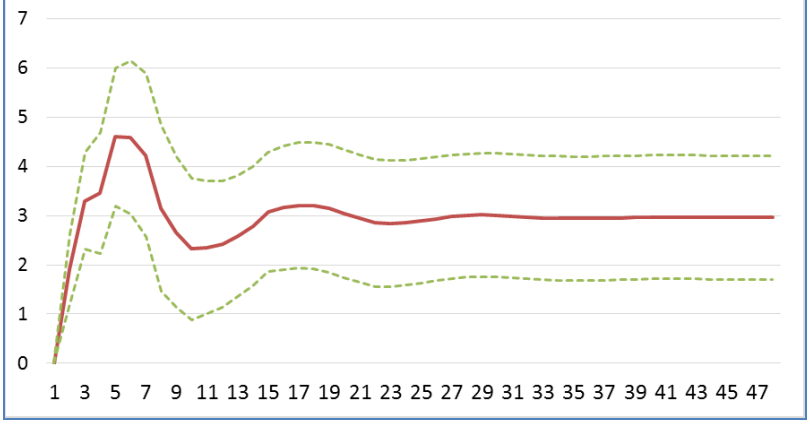


Figure 10. Cummulative impulse response of Greek PMI to a TLTRO-induced shock to the FCI



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