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A Financial Conditions Index for Greece

By Jonathan Manning and Maral Shamloo

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Abstract

We construct a Financial Conditions Index (FCI) for Greece as a surveillance tool to quantify the degree of the stress in the financial sector. We use principal component analysis to capture the information content of several financial indicators through a single index. We also construct an alternative FCI by purging the business cycle and monetary policy effects on the input variables, and argue that this alternative index is a better indicator of exogenous financial shocks, and thus could be interpreted as a measure of the efficacy of transmission mechanism. We replicate the index for the euro area (EA) as a whole and show that although the developments in the EA were qualitatively in line with those in Greece, they were quantitatively much milder. Our results confirm that monetary transmission was less effective in Greece compared to the EA as a whole. Finally, we argue that our index can be a potentially useful forecasting tool for credit growth.

JEL Classification Numbers: E5, E17, E44

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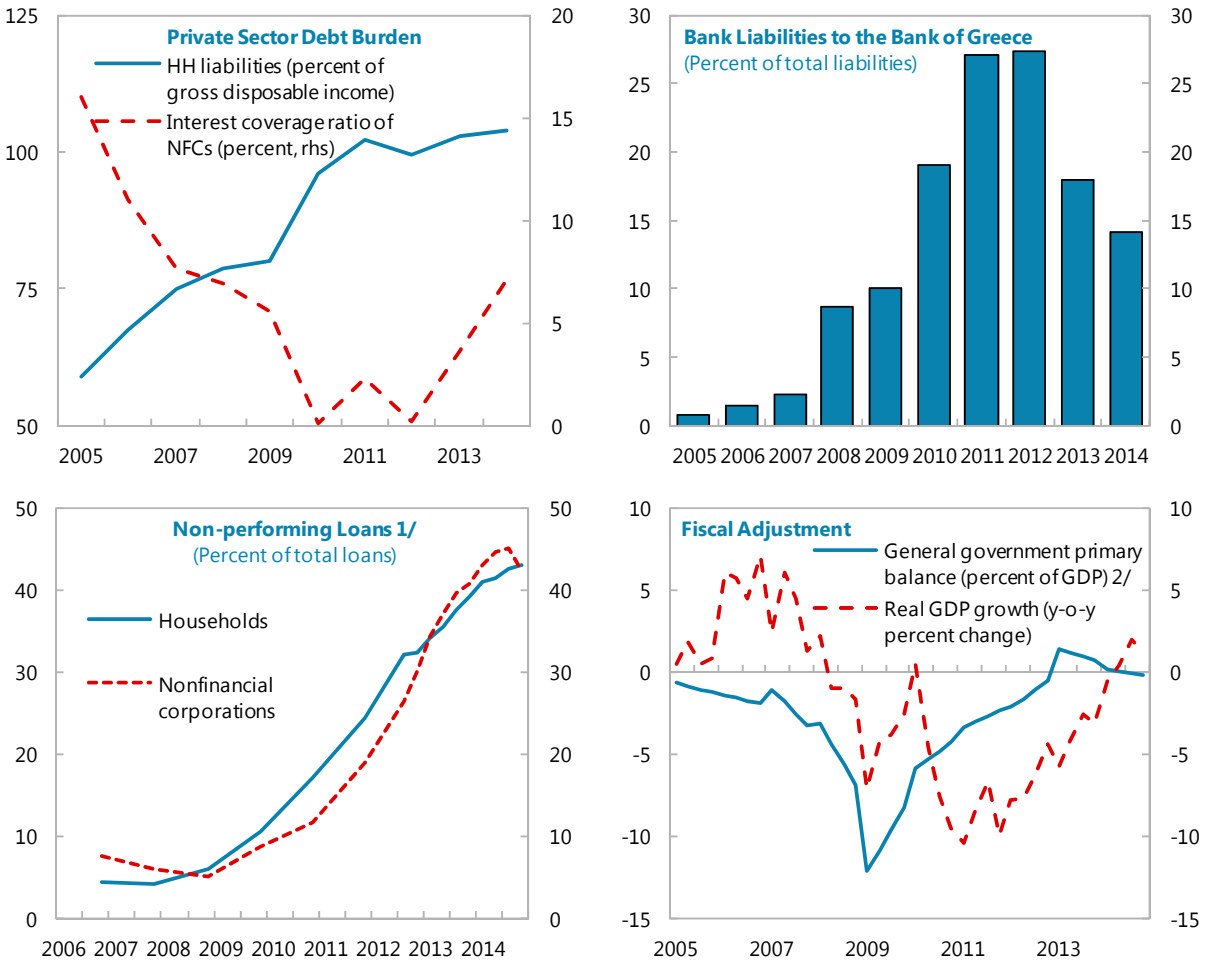
CONTENTS

I. Introduction

The crisis in Greece since 2009 has been unlike other episodes in the euro area (EA) in its depth and length. The crisis originated in the public sector balance sheet, but impacted private sector balance sheets through two channels: the first was the Private Sector Initiative (PSI), which imposed haircuts on government securities held by Greek banks, and the second was the large increases in nonperforming loans (NPLs) due to the deep and protracted recession (Figure 1). The Greek banking system entered the crisis relatively strong, but suffered severe damage during the crisis for these two reasons.

Figure 1. Greece: Private Sector Balance Sheets, 2005–14



Sources: Bank of Greece; Elstat; Eurostat; and IMF staff calculations.
1/ Includes restructured loans, which carry a high risk of turning into NPLs within one year.
2/ Accrual basis.

The PSI caused damages of about €38 billion to the aggregate banking sector balance sheet. Although the banks were eventually recapitalized, the prolonged period of operating without

sufficient capital left enduring effects on the banks' balance sheets and the financial sector as a whole. NPLs, including restructured loans, rose from 9.5 percent at the end of 2009 to about 46 percent at the end of 2014, standing at over €93 billion. Deposit outflows that started at the onset of the crisis accelerated in 2012 on the back of fears of an exit from the EA. This created a dramatic reliance on central bank funding. Having been shut out of funding markets since 2010 meant that emergency liquidity from the European Central Bank (ECB) became the only source of liquidity for Greek banks during this period.

The aim of this paper is to develop a tool to quantify the changes in the financial sector conditions and thus enable one to monitor them more systematically. Our proposed Financial Conditions Index (FCI) does exactly that: for instance, we will show how our FCI quantifies the narrative above and indicates that although financial conditions in Greece improved in 2013–14, they remain tight relative to a neutral level.[1]

We construct the same index for the EA to show that, in line with common understanding, first, financial conditions were also tighter than neutral in the EA as a whole during the crisis; and second, despite a common monetary policy stance, the degree of financial stress was far more severe in Greece.

FCIs are difficult to interpret as a measure of exogenous shocks to financial conditions, as they already incorporate responses to monetary policy as well as aggregate demand and aggregate supply shocks. In order to address this issue, we also construct a purer index of the financial shocks by "purging" our index from the endogenous response to monetary policy. This alternative FCI, representing financial shocks, is significantly more volatile in Greece compared to the EA, indicating larger financial shocks and as a result, potentially a less effective transmission mechanism in Greece compared to the EA.

We see the contribution of our paper as follows:

The FCI offers a useful tool for continuous surveillance of financial conditions in Greece. It summarizes information from several variables currently monitored independently. The analysis in this paper, for instance, illustrates how financial conditions in Greece deteriorated dramatically with the onset of the crisis and improved following the first round of bank recapitalization.

The FCI can also be used in reduced-form models (e.g. VARs) and structural models (e.g. GIMF and DSGE) in order to produce quarterly projections. GDP growth and the FCI are closely correlated for both Greece and the EA. This is not surprising: firms find it easier to

[1] Our analysis runs to the end of 2014, given the availability of data. We exclude the most recent episode of deposit and capital controls.

borrow in order to invest, and durable consumption by households also increases during times of easing financial conditions. In this sense, the cyclical correlation of the index with other macroeconomic variables can be a helpful tool for improving macroeconomic projections. In particular, we show that the FCI is a good leading indicator for private sector credit growth.

Finally, FCIs provide a convenient way to evaluate the effectiveness of non-conventional monetary policy such as quantitative policies. Traditional DSGE models typically have no role for non-interest monetary policy tools. FCIs offer an immediate tool to evaluate the effect of such policies on financial conditions.

This paper is organized as follows: Section II reviews the related literature. Section III outlines the data and methodology employed to construct a financial conditions index for Greece and replicates the index for the EA. Section IV assesses the ability of the financial conditions index constructed for Greece to identify historical periods of financial ease or stress and offers some analysis gleaned from the new index. Section V presents an alternative FCI, which isolates financial shocks from endogenous responses of variables to business cycle variations and monetary policy. Section VI concludes.

II. LITERATURE REVIEW

The recent work on FCIs builds on an already extensive literature on the Monetary Conditions Index (MCI). In the 1990s, the Bank of Canada engineered an MCI, which incorporated both changes in interest rates and changes in the exchange rate.[2] The index proved to better represent monetary conditions in a flexible exchange rate regime, compared to an index based on short-term interest rates alone, thus giving central banks an improved understanding of how monetary policy affects aggregate demand. The Reserve Bank of New Zealand, along with the Bank of Canada, expanded the use of the MCI by including it into Taylor-rule type equations which were used for policy implementation.[3]

FCIs can be thought of as an extension of the MCI, commonly used to track the tightness of a given monetary policy stance. MCIs were developed to understand the effectiveness of the monetary transmission mechanism. The development of FCIs was a natural extension given the role of the financial system in the transmission of monetary policy. Credit conditions, such as bank capital levels and the net worth of borrowers might explain a muted reaction of GDP to monetary stimulus. The financial system is particularly important for the credit channel of monetary policy in Europe since financial institutions account for the majority of credit provision to enterprises. Therefore, quantifying the financial stresses in the economy,

[2] Freedman (1995).

[3] Hunt and Orr (1999).

to the extent that they affect the monetary transmission mechanism, would help to gauge the effectiveness of monetary policy.

FCIs also allow us to quantify the impact of more unconventional tools. Traditional Taylor rules are unable to capture the effect of an expansion of the central bank's balance sheet or the effect of a commitment to keeping rates at a low level. The FCI reaction to a change in an unconventional policy tool (such as increasing the holdings of commercial debt by a certain amount) can be compared to its reaction to a step-reduction in rates, *ceteris paribus*, to find an equivalence between the two and therefore to calibrate the effect of the unconventional policy tool.

Finally, FCIs are widely used for forecasting. English *et al*. (2005), Swiston (2008), Hatzius *et al.* (2010), and Ho and Lu (2013) all show that FCIs are highly correlated with GDP and have a strong predictive power for future economic activity.

Earlier vintages of FCIs used a weighted sum of underlying variables to construct an index. This approach is subject to the criticism that it imposes a structure on the importance of variables for the financial conditions since the weights are often obtained using structural or reduced-form VAR models (see Dudley and Hatzius (2000), Goodhart and Hofmann (2002), Mayes and Viren (2001), and Gauthier *et al*. (2004)).

A second class of FCIs, including the one developed for this paper, uses principal component analysis (English *et al*. (2005) and Forss Sandahl *et al.* (2011)). These studies assume constant variable loadings during the period when the index is calculated. More recent work uses dynamic factor models to allow the relative importance of the variables to vary over time. For instance, a dynamic factor analysis could be adopted where weights are derived from impulse responses or Kalman filters (Montagnoli and Napolitano (2004), Swiston (2008), and Gunmata *et al*. (2012)).

A number of studies focus on specific countries and the properties of an FCI based on the country-specific available data. For Greece, this paper follows closely Angelopoulou *et al.* (2013), a study of this kind.

III. Empirical Methodology and Data

Many variables contain information on the health of financial conditions in the economy. The approach of this paper is to distill information from a large dataset of such variables into a single index to capture the financial conditions at any point in time. We do so by employing principal component analysis. Principal components of a set of observed variables are a particular linear transformation of the underlying series spanning the entire space provided by the data. The components can be sorted according to their information content. In this way, the first few principal components contain the primary drivers of a dataset while

abstracting from idiosyncratic movements in the variables. The advantage of principal component analysis is that it separates information into common drivers and idiosyncratic noise without imposing a structural framework based on *a priori* assumptions about the series.

The principal components of a set of variables are the image of the data on a space spanned by the eigenvectors of the covariance matrix. Thus, each principal component is a linear combination of the observed variables. If the principal components are ordered by descending magnitude of the corresponding eigenvalues, the first principal component (i.e., the one with the largest eigenvalue) is a linear combination of the original variables with maximum variance normalized to a vector of length one. In other words, this vector accounts for the largest share of the total covariance in the observed variables. Subsequent principal components are also orthogonal, unit length, linear combinations of the data explaining a descending share of the total variance in the dataset. The orthogonality condition implies that the principal components are uncorrelated with each other. Thus, the majority of the covariance of the data can be explained by the first few principal components.

The potential number of variables to be included in the FCI is very large. This is particularly the case because many factors contribute to the non-neoclassical transmission channel, beyond the traditional measures of the monetary policy stance (such as asset prices and user cost of capital) that are emphasized in the neoclassical models. FCIs, on the other hand, emphasize factors such as quality and availability of collateral, borrower risk and liquidity. Another key difference with neoclassical models is the importance of quantities (as well as prices, to capture credit rationing) and surveys, to separate supply and demand constraints. Most FCIs include indicators reflecting such information.

Table 1 lists the variables we use to construct the FCI for both Greece and the EA. Following the literature, we include variables representing the financial activities of nonfinancial corporations (NFCs) and households (HH), as well as the activities of financial intermediaries, labeled as monetary financial institutions (MFIs) within the EA. These variables can be separated into seven main categories:

- *Prices.* Rising prices, such as consumer or property prices, affect real interest rates and higher demand for investment. In addition, rising asset prices improve the net worth of borrowers, implying an easing of credit supply constraints.

- *Quantities.* These include variables such as loans extended to HHs and NFCs, debt securities issued by MFIs and NFCs, and the size of the ECB balance sheet. Ceteris paribus, the larger these quantities the easier are the financial conditions.

- *Risk premia.* Risk premia are represented in the dataset by variables such as interest rate spreads, which decrease as financial conditions become easier.

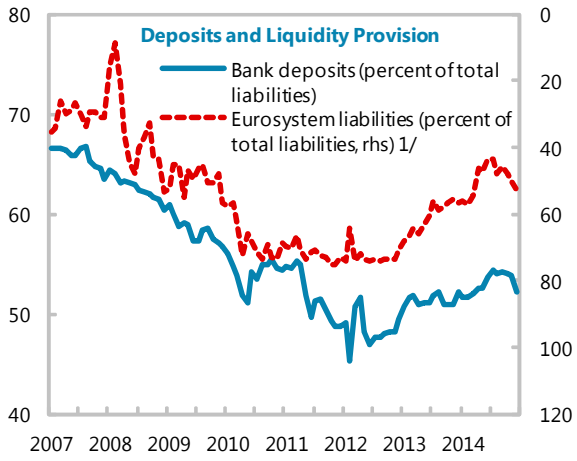
- *Volatilities.* We include in our dataset measures of volatility of bond prices, which are positively correlated with the degree of uncertainty in the financial markets, increasing as financial conditions get tight.

- *Survey Results.* We also include direct measures of tightness in the lending markets using series from the ECB's Bank Lending Survey (BLS). The survey responses represent lenders' perceptions of credit worthiness of borrowers as well as lending standards.

- *Balance sheet indicators.* The stresses in the banks' balance sheet are important drivers of financial conditions in the economy. We include measures such as deposit flows and the share of deposits to total liabilities to capture these stresses in bank balance sheets. In addition, we include the amount of liquidity provision by the ECB. We discuss the latter variable in detail below.

- *Monetary Policy.* Finally, we include the policy rate as a measure of the monetary policy stance. Although the monetary policy response function for financial conditions is typically not explicit, monetary policy *does* respond to stresses in the financial sector at least to the extent they affect the output gap.

An informative monetary policy variable often included in FCIs is the amount of liquidity provision by the central bank. Typically, higher liquidity provision indicates easier financing conditions since banks have access to more funding. In the case of Greece (and some other periphery countries), central bank liquidity surged as deposit outflows intensified in 2011–12. Therefore, the large liquidity position was a result of the intensified stress in the banks' balance sheets. This poses two problems. First, the interpretation of large liquidity provision as a sign of easing financial conditions is less clear. Second, at times of large deposit outflows, deposit flows and liquidity provision are almost perfectly correlated (see text chart). We deal with this seemingly contradictory interpretation of liquidity provision in normal times and crisis times by including two sets of indicators: (1) deposit growth and deposits as a share of total liabilities to capture liquidity constraints;[4] and (2) the size of the ECB's overall balance sheet to capture liquidity provision by the central bank. We argue that



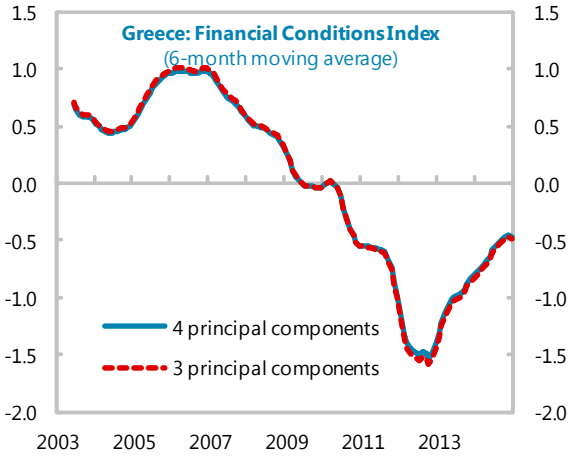
Sources: Bank of Greece; and IMF staff calculations.
1/ Scale inverted.

[4] In addition, rising deposit rates beyond nominal inflation is also a sign of liquidity pressure.

the latter eases liquidity pressures in the EA as a whole, but is not perfectly correlated with deposit outflows in Greece.[5]

To construct the FCI, the variables are normalized to ensure that the FCI is independent of measurement units. Sign transformations are applied to the original series when necessary to ensure that all the data series affect the index in the same way. Therefore, an increase in any variable results in an increase in the FCI reflecting an easing of credit conditions.

As each successive principal component explains less of the variance of the data compared to its preceding principal component, we choose to include enough principal components in our index to explain 95 percent of the variance of the data (a high bar given standards in the literature)[6]. This criterion leads us to choose the first four principal components for Greece and the first three for the EA. Note that although this share varies over time and depends on the data, the variation is small. We find that the qualitative movement in the FCI index is not too sensitive to whether three or four principal components are used (see text chart). Therefore, we keep this number of principal components constant for the entire sample as we update our index on a quarterly basis from 2003 onwards.



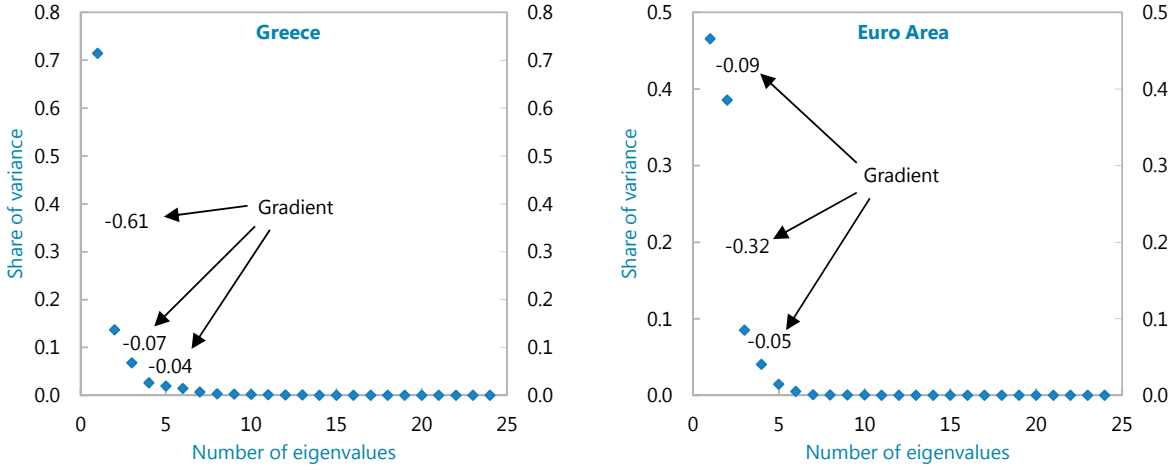
Source: IMF staff calculations.

Also note that our choice of principal components is slightly higher than would be implied if we used the curvature of the co-variance explained by the successive eigenvectors. Figure 2 graphs the share of the co-variance of the data explained by successive eigenvectors. A common method is to choose the number of principal components where the curvature of this plot becomes negative, i.e. an additional eigenvector contributes less to the share of explained variance compared to the previous eigenvector. This method suggests one principal component for Greece and two principal components for the EA. Since we do not intend to use the extracted factors in a VAR, we do not have a tight computational constraint and choose to explain a higher share of the variation in the data by adopting more factors.

[5] In the case of the EA, the average deposit share of total liabilities is not as closely correlated with the total amount of liquidity provided by the ECB. Thus, we do not have the problem of interpreting essentially the same variable in two ways.

[6] For instance, compare to Angelpoulo, et. al. In their analysis, three principal components account for 71 percent of the variance. In our case, one principal component would explain 72 percent.

Figure 2. Share of Variance Captured by Eigenvectors



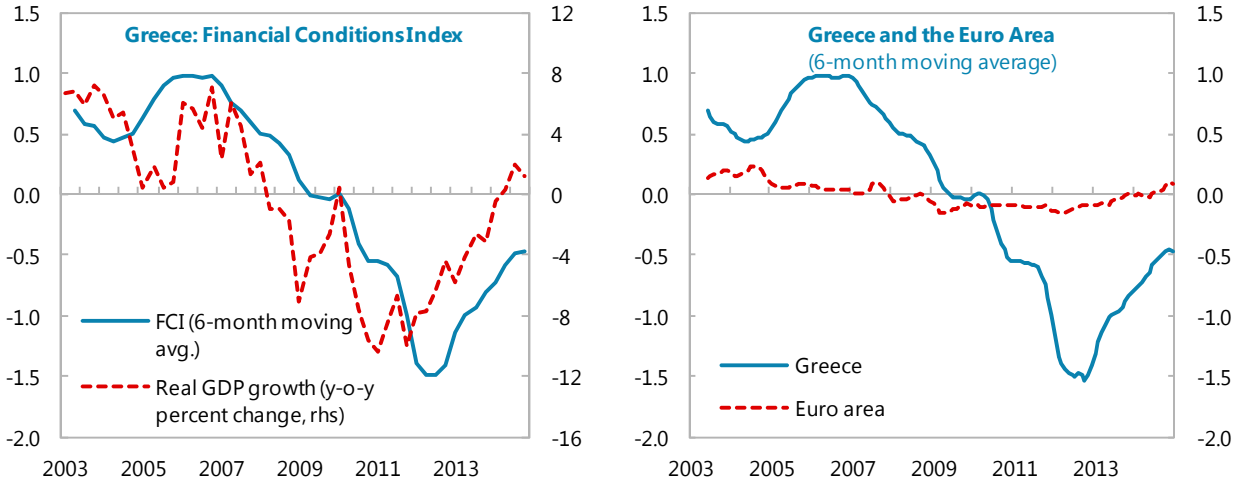
Source: IMF staff calculations.

IV. Results

A. Financial Conditions Index for Greece

Figure 3 (left chart) shows the FCI for Greece from 2003 through end-2014, obtained using the methodology described above. It shows the six-month moving average of the raw FCI to smooth out high-frequency fluctuations. Based on the convention adopted in constructing the index, positive values indicate looser financial conditions compared to the average over the sample period whereas negative values indicate periods of financial stress, or tightened conditions relative to the sample average. A value of zero by construction refers to the period average for the FCI. The FCI tracks GDP very closely. This is in line with findings in Hatzius *et al.* (2010) who compare the predictive power of a number of different FCIs with those of individual financial series (such as policy rates, term spreads, and the stock market index) for economic activity and conclude that the pooling of financial information generally improved predictive power, particularly in times of financial stress.

Figure 3. Financial Conditions Index, 2003–14



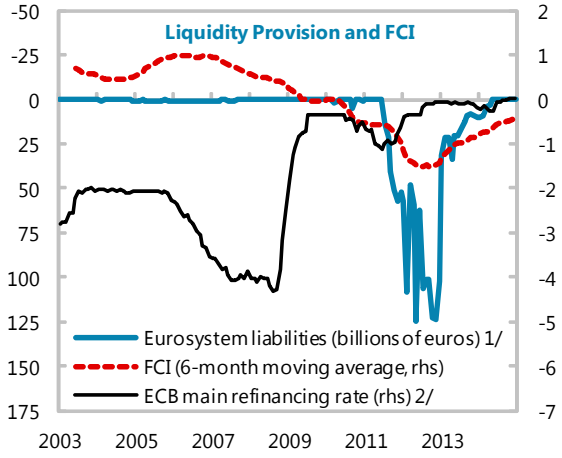
Source: IMF staff calculations.

The evolution of the FCI is consistent with the narrative of events as they evolved in the financial sector: the period soon after adoption of the euro was associated with a significant increase in credit growth, liberalization of the financial sector, convergence of lending and deposit rates, and a large increase in credit to households for consumer loans—hitherto absent in Greece. Consistent with this account, the FCI in this period is positive.

Financial conditions were at their easiest just prior to the financial crisis when a convergence of sovereign spreads meant that Greek banks had access to capital markets at historically low spreads. Further, banks managed to securitize parts of their mortgage loans via special purpose vehicles (SPVs) elsewhere in Europe (mainly London), providing them with even more access to liquidity to expand their balance sheets. The FCI shows a significant increase between 2005 and its peak in 2007, consistent with this narrative.

Conditions deteriorated rapidly with the onset of the financial crisis. Capital markets were under severe strain in 2008 and 2009, and by 2010 Greek banks were completely shut out of wholesale markets. At the same time, their securitized portfolios were repatriated, implying an increase in their risk-weighted assets (RWA), against which additional capital was needed. Finally, the PSI meant that the banks suffered large capital losses in the order of €40 billion Although they were eventually recapitalized, the prolonged period of undercapitalization meant increased funding costs as the banks only had access to expensive ELA and further reduction in the balance sheet. The nadir was in mid-2012 when political instability following two elections gave rise to fears of an exit from the EA and rapid deposit outflows ensued. The FCI accurately captures the deterioration of financial conditions during this period and the events that came to a head in mid-2012. Since recapitalization of the banking sector in early 2013 through the end of the sample period, financial conditions improved significantly, but remained significantly tighter than the pre-crisis period.

As our FCI shows, the tightness in financial conditions reached its peak at the same time as when liquidity support was also at its highest level and interest rates were exceptionally low (see text chart). Clearly, monetary policy responded to the stress in the financial system and the overall economy. But in Greece, the large financial shocks affected the functioning of the monetary transmission mechanism, in particular, the credit-related channels: the quality of borrowers' balance sheets, credit rationing due to banks' low capitalization levels, poor quality of collateral or institutional factors affecting the value of collateral, informational asymmetry, and the like. Any shock to these factors will affect the transmission mechanism and thus the link between the policy tool (typically the policy rate) and the policy targets (interbank rates or indirect targets such as price and quantity of lending to the real economy).



Sources: ECB; and IMF staff calculations and estimates.
1/ Scale inverted.
2/ Scale negated.

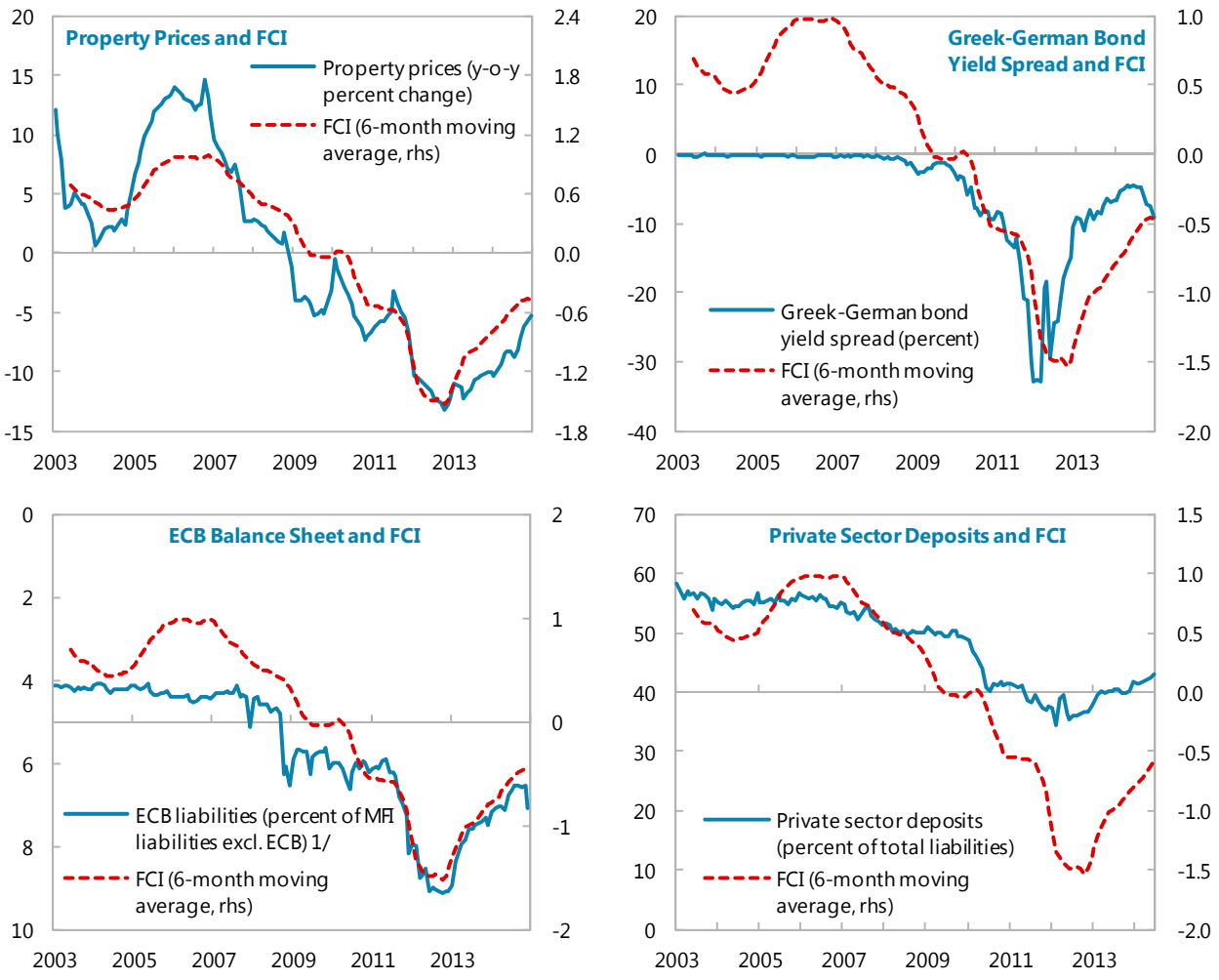
Although the monetary policy rates were lowered to historically low levels, lending rates did not decrease as banks were unwilling to lend due to severe capital and liquidity constraints. The large amount of liquidity provision by the ECB was necessary to replace the outflow of deposits, rather than to provide an additional and cheaper funding source to ease lending. This can be confirmed by noting that during this time deposit rates continued increasing as banks competed for attracting deposits.

A disadvantage of the principal component analysis is that the principal components themselves are not easily interpreted in economic terms, since they are a linear combination of the underlying variables. However, the correlation of each variable with a particular principal component, or the variable's *loading,* indicates the importance of that variable for the particular principal component, thus providing an economic interpretation to the factors driving the FCI. Table 2 shows the factor loadings for Greece's FCI. Property prices,[1] the spread between Greek and German bond yields, and ECB liabilities in percent of EA MFIs excluding the ECB are the three variables featuring most prominently in the final index, as indicated in the last column of the table. Deposits as a share of total liabilities also figures prominently in the final index. The prominence of these factors helps explain the sharp

[1] The importance of property prices in FCI fluctuations emphasizes the role of collateral in lending activity, and, in general, the credit channel of monetary policy. The drop in property prices in Greece reflects, to a large extent, demand factors. However, structural factors are impeding the recovery in property prices. For instance, the number of transactions in the first half of 2014 has been virtually zero, pending changes to stamp duties (the Bank of Greece reports 7,011 appraisals for the first half of 2014, but almost none of them materialized into actual transactions).

decline of the FCI throughout the crisis: all four variables moved significantly from their long term or pre-crisis trends during the crisis (Figure 4).

Figure 4. Greece: Selected Variables and FCI, 2003–14



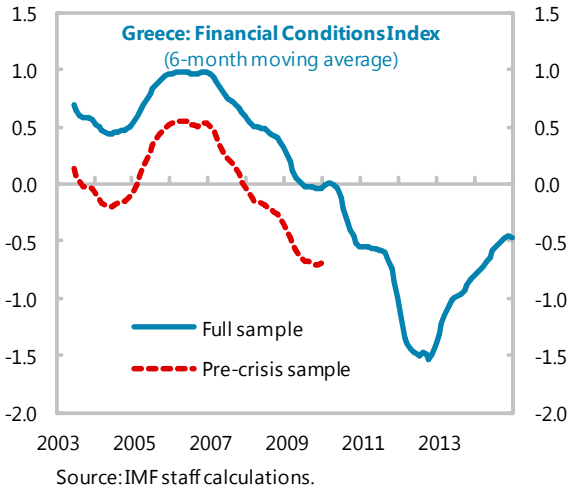
Sources: Bank of Greece; Bloomberg; ECB; and IMF staff calculations and estimates.
1/ Scale inverted.

Figure 4 shows that although each variable is strongly correlated with the FCI during certain periods, none can independently capture the dynamics of financial conditions. The peak in FCI is much more subdued than the boom observed in property prices before the crisis. The Greek government bond spreads vs. the Bund do not show any discernible dynamics until 2010, and the ECB balance sheet size (as a share of total MFI balance sheet) was also not highly correlated with the FCI before the crisis.

Note that the loadings, or the relative importance of each variable for each principal component, are based on the average contribution of the variance of the variable in question

to the covariance matrix of the data. Thus, different components may contribute to the variance of the final index differently during separate periods. For instance, if we were to split our sample into a pre-crisis (2003–09) and a post-crisis (2009–14H1) datasets, the components with the highest weighted loadings in the FCI would be different in the two sub-periods and also different from the FCI calculated over the entire period (see Table 3).

Also note that the mean of the FCI is zero over the sample period by construction. Thus, what is important for interpreting the FCI is not the level of the index but its change over different periods. The text chart shows the FCI calculated over the entire horizon, and compares it with one calculated only for a pre-crisis sample. Although the latter has a lower value throughout the sample, it only represents a level-shift compared to the full sample FCI. In other words, the relative change in the financial conditions during the pre-crisis period is the same no matter which FCI is used.



Source: IMF staff calculations.

B. Comparing Greece FCI with the Euro Area

The same index has been constructed for the EA using EA aggregates (or averages where applicable) for all of the underlying variables. The index is identical in its construction to the one for Greece. These two indices are compared in the right chart of Figure 3. Table 4 shows the factor loading for the FCI for the EA. In the EA, debt securities issued by NFCs, followed by loans to households have the largest impact on the FCI.

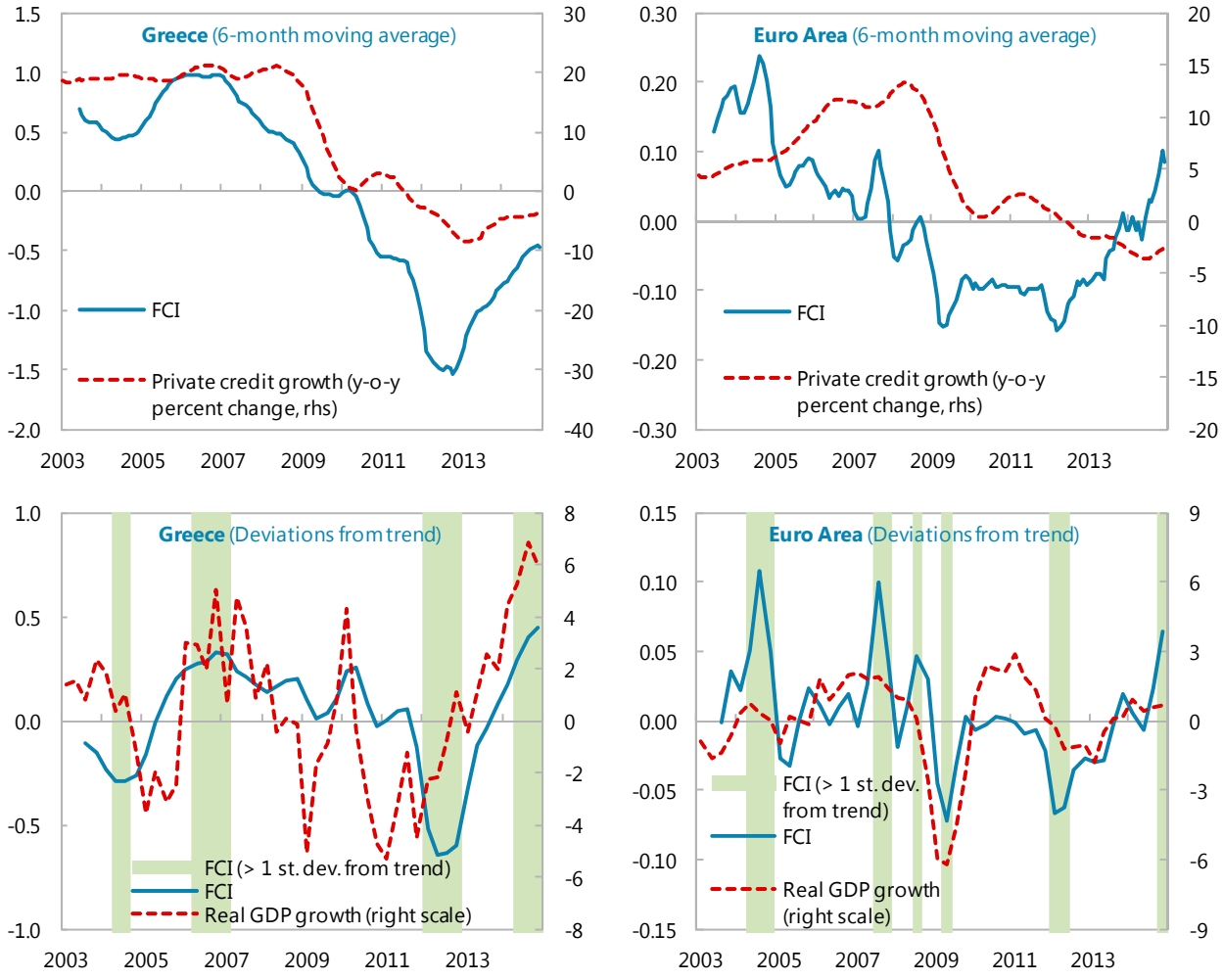
The most striking feature is the ***relative*** stability of financial conditions in the EA as a whole compared to Greece. The volatility of FCI in EA is significantly lower than in Greece, yet, a closer lookreveals a prolonged period of tightened financial conditions in the euro area following the financial crisis that only recently began to ease in the last quarter of 2014 (see Figure 5 Panel 2). While the EA financial conditions tightened following the crisis relative to the sample average, they were neither as loose as in Greece prior to the crisis, nor as tight thereafter. Although this result is to be expected, the magnitude of the difference may be somewhat surprising, reflecting fundamentally the lack of integration of the banking and capital markets in the currency union. Furthermore, the tightening of credit conditions when supply constraints became binding for Greek banks was not accommodated by a flow of capital from banks outside Greece. Although home bias is expected in lending activities, this reflects the degree to which the European banking sector became segmented, implying that

domestic supply constraints of credit institutions will be more contractionary compared to a case where firms and households have access to cross border sources of financing.

C. The Relationship between GDP, Credit Growth, and the FCI

Figure 5 shows the FCI and its relationship with GDP and credit growth.

Figure 5. FCI, Credit Growth, and GDP, 2003–14



Source: IMF staff calculations.

By construction, the FCI shows a strong correlation with credit growth, as the FCI includes loans to households and loans to enterprises. Credit growth is usually highly autocorrelated, and its AR(1) process adequately forecasts credit growth one period ahead. Importantly,

even accounting for lagged credit growth, the FCI is significant in explaining future private sector credit, both in Greece and the EA (Table 6).[2,3]

The FCI also shows a close correlation with GDP growth. This can be seen more formally by evaluating periods when GDP and the FCI are more than one standard deviation apart from their respective trends, defined by an HP filter. The deviations from trend for the two series are highly correlated. In the case of Greece, the contemporaneous correlation is 42 percent, whereas in the EA it is 44 percent. The correlation of output deviations from trend with one-period-ahead FCI deviation from its trend is also strongly positive: 46 percent in Greece and 40 percent in EA.

V. A NEW FCI

The FCI presented in the previous section does not separate financial shocks from the endogenous response of the underlying variables to business cycle fluctuations or monetary policy. In this section, we attempt to address this issue by constructing an alternative FCI. In order to isolate the financial shocks from aggregate demand and aggregate supply shocks as well as the endogenous response to monetary policy, we construct an alternative FCI, by purging the effects of these variables from our input data.[4]

Specifically, we run the following regressions on our input data:

$$x_{it} = A(L)y_t + B(L)\pi_t + C(L)i_t + \nu_{it}$$

where x_{it} is the i^{th} variable in the original series used as input into the FCI described in section III, and y_t , π_t and i_t correspond to output growth, inflation and the policy rate at time *t*, respectively. We now reconstruct the FCI using the same methodology as before, except that we use the estimated residuals $\hat{v}_{it}$ from regression above as inputs to the principal component analysis. The advantage of this method is that the responses of variables to business cycle fluctuations as well as (interest rate component of) monetary policy are purged, so the new FCI better represents the "pure" exogenous shocks to financial conditions and thus, could also be interpreted more closely as a description of the status of the monetary transmission mechanism.

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[2] Table 7 repeats this exercise using the alternative FCI constructed in Section V. The results hold.

[3] Note that by construction, principal components summarize the leading and lagging structure of the underlying data, as well as its contemporaneous correlation structure.

[4] This methodology does not identify the impulse response of the dependent variables to true innovations in interest rates, inflation and output, in the way that structural VARs do. However, the method is often used in the literature to remove the co-movements in the variables with the regressors. See, Hatzius, et. al (2010) for instance.

Note that our formulation above, only takes into account the response of variables to "conventional" or interest rate channel of monetary policy. So the estimated errors may still contain responses to non-conventional policy actions, such as balance sheet expansions or changes in liquidity provision criteria.

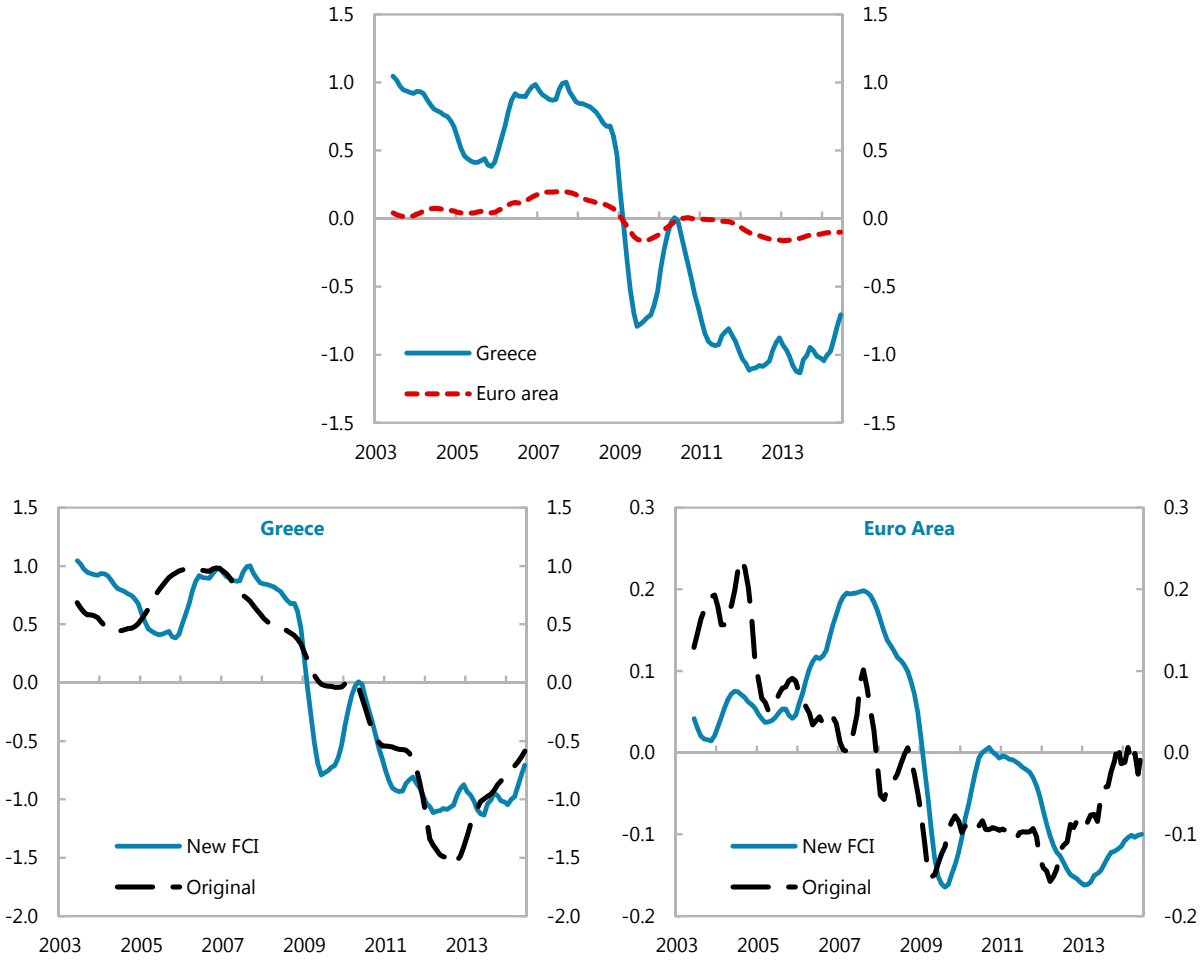
Figure 6 shows the results. There are three points worth noting regarding the comparison of the original and the alternative FCI:

First, note that even the alternative FCI shows the Greece index to be much more volatile compared to the EA one (Panel 1). In other words, the magnitude of financial shocks were much larger in Greece compared to those in EA. To the extent that these shocks affect the functioning of transmission mechanism through financial channels, then one can argue that monetary transmission was working less effectively in Greece compared to EA as a whole.

Figure 6 (Panel 2 and 3) also compares the original FCI with the alternative index for both Greece and the EA. We note that the new FCI is more volatile compared to the previous one: The relative variance of the original FCI to the alternative one is 0.92 for Greece and 0.85 for EA. We argue that this is evidence for "leaning against the wind" by monetary policy. When the response to monetary policy is included, the volatility of financial conditions decreases compared to the case when financial shocks are considered in isolation. Put differently, monetary policy is successful in decreasing the volatility of financial conditions arising from exogenous shocks.

Finally, we re-examine the variables with the highest loadings in the two FCIs (see table 5). For Greece, the three variables with the highest weighted loadings in the alternative FCI remain unchanged compared to the original index: property prices, sovereign yield spreads and the size of the ECB balance sheet are all highly correlated with the FCI. For the EA, also, the top four variables with the highest weighted loadings remain the same, although their relative ranking changes slightly.

Figure 6. Alternative Financial Conditions Index, 2003–14
(6-month moving average)



Source: IMF staff calculations.

VI. Conclusions

This paper constructs an FCI for Greece as a surveillance tool to monitor the functioning of financial conditions. We find that the evolution of the FCI is consistent with our narrative of events since the onset of the crisis. We use principal component analysis to construct the index. The relationship between different variables and the index is not derived from structural or reduced form models, but are obtained based on the observed covariance pattern of the data. We find that the FCI is a leading indicator for credit growth and tracks output growth closely. We also find that property prices, sovereign bond spreads, and liquidity provision by the central bank (represented by the size of the ECB balance sheet) are the most significant variables affecting the FCI in Greece.

We also construct an alternative FCI by purging the effects of the business cycle dynamics and monetary policy from our input variables, in order to isolate financial shocks. We argue that the large deterioration in this alternative FCI points to large exogenous financial shocks that caused a severe disruption in the transmission of monetary policy in Greece. The same conclusion can be drawn for the EA, albeit the magnitude of the shocks was much smaller.

Table 1. Greece and Euro Area: Financial Conditions Index List of Variables

Variable Name	Definition	Unit	Sign	Greece Source	Euro Area Source
Loans to NFCs	Credit in the form of loans granted by MFIs to NFCs	Billions of euros	+	Bank of Greece	ECB
Loans to households	Credit in the form of loans granted by MFIs to households	Billions of euros	+	Bank of Greece	ECB
Interest rate spread for NFCs	Lending rate on new loans to NFCs minus deposit rate on new deposits to NFCs	Percent	-	Bank of Greece	ECB
Interest rate spread for NFCs on overdrafts	Lending rate on overdrafts of new loans to NFCs minus deposit rate on new deposits to NFCs	Percent	-	Bank of Greece	ECB
Interest rate spread for consumer loans	Lending rate on new consumer loans minus deposit rate on new deposits to households	Percent	-	Bank of Greece	ECB
Interest rate spread for mortgage loans	Lending rate on new mortgage loans minus deposit rate on new deposits to households	Percent	-	Bank of Greece	ECB
Debt securities issued by NFCs	Gross issues of debt securities issued by NFCs (short and long-term)	Billions of euros	+	Bank of Greece	ECB
Quoted shares issued by NFCs	Gross quoted shares issued by domestic NFCs	Billions of euros	+	Bank of Greece	ECB
Debt securities issued by MFIs	Gross issues of debt securities issued by MFIs (short and long-term)	Billions of euros	+	Bank of Greece	ECB
Property prices	Year-on-year percent change in the price of dwellings in urban areas	Percent	-	Bank of Greece	ECB
Consumer prices	Year-on-year percent change in the harmonized index of consumer prices	Percent	+	Elstat	Eurostat
Short-term interest rate spread	3-month Euribor rate minus overnight interbank Euribor rate	Percent	+	Bloomberg	Bloomberg
Medium-term interest rate spread	2-year Euribor rate minus 3-month Euribor rate	Percent	+	Bloomberg	Bloomberg
Long-term interest rate spread	10-year Euribor rate minus 2-year Euribor rate	Percent	+	Bloomberg	Bloomberg
Greek-German bond yield spread 1/	Greek 10-year generic bond yield minus German 10-year generic bond yield	Percent	-	Bloomberg	ECB and Bloomberg
Volatility of bond prices	3-month moving standard deviation of the Greek 10-year generic bond price	Volatility	-	Bloomberg	Bloomberg
Banks' access to market financing	Survey question from quarterly bank lending survey on banks' ability to access to market financing	Index 2/	+	Bank of Greece	ECB
Banks' liquidity position	Survey question from quarterly bank lending survey on banks' liquidity position	Index 2/	+	Bank of Greece	ECB
Housing market prospects	Survey question from quarterly bank lending survey on housing market prospects	Index 2/	+	Bank of Greece	ECB
Consumer creditworthiness	Survey question from quarterly bank lending survey on consumer creditworthiness of consumers	Index 2/	+	Bank of Greece	ECB
Overnight interbank rate	EONIA	Percent	-	Bloomberg	Bloomberg
Deposit growth	Month-on-month percent change in private sector deposits	Percent	+	Bank of Greece	ECB
Deposit ratio	Private sector deposits in percent of total bank liabilities	Percent	+	ECB	ECB
Size of ECB balance sheet	Total ECB liabilities in percent of total MFI liabilities (excluding the ECB)	Percent	+	ECB	ECB

1/ For the euro area FCI, calculated as the spread between the euro area 10-year benchmark bond yield and German 10-year generic bond yield.

2/ Index from 1 to 5 with 1 representing a considerable tightening of credit lending standards and 5 representing a considerable easing of credit lending standards.

Table 2. Greece: Financial Conditions Index Components

(Loadings of the principal components included in the index)

Variable Name	Loadings for PC1	Loadings for PC2	Loadings for PC3	Loadings for PC4	Weighted Loadings
Loans to NFCs	-0.024	0.031	-0.030	-0.021	-0.016
Loans to households	-0.004	0.050	-0.054	0.040	0.001
Interest rate spread for NFCs	-0.025	0.045	-0.017	-0.066	-0.015
Interest rate spread for NFCs on overdrafts	-0.040	0.070	-0.028	-0.074	-0.024
Interest rate spread for consumer loans	-0.072	0.036	-0.070	0.254	-0.047
Interest rate spread for mortgage loans	-0.126	-0.004	-0.063	0.044	-0.099
Debt securities issued by NFCs	-0.055	0.023	-0.050	-0.012	-0.042
Quoted shares issued by NFCs	-0.060	0.021	-0.054	-0.024	-0.047
Debt securities issued by MFIs	-0.186	-0.011	0.939	0.161	-0.070
Property prices	0.622	0.681	0.071	0.028	0.574
Consumer prices	0.008	0.194	0.068	-0.471	0.026
Short-term interest rate spread	-0.073	0.030	-0.044	-0.046	-0.056
Medium-term interest rate spread	-0.065	0.011	-0.048	-0.105	-0.054
Long-term interest rate spread	-0.090	-0.040	-0.042	-0.214	-0.083
Greek-German bond yield spread	0.611	-0.630	0.129	-0.053	0.378
Volatility of bond prices	0.049	0.000	-0.155	0.729	0.046
Banks' access to market financing	-0.076	-0.019	-0.047	-0.029	-0.064
Banks' liquidity position	-0.074	-0.020	-0.038	-0.039	-0.063
Housing market prospects	-0.080	-0.002	-0.062	-0.031	-0.066
Consumer creditworthiness	-0.069	-0.022	-0.061	-0.006	-0.060
Overnight interbank rate 1/	-0.151	-0.051	-0.052	-0.133	-0.129
Deposit growth	-0.005	-0.053	-0.117	0.206	-0.014
Deposit ratio 1/	0.225	-0.274	-0.083	-0.128	0.121
Size of ECB balance sheet	-0.241	-0.067	-0.092	-0.011	-0.198
Share of total variance explained	75.530	14.470	7.200	2.800	100.000

Source: IMF staff calculations.

1/ For some periods (e.g., 2003 through 2013), the deposit ratio has a slightly higher weighted loading than the overnight interbank rate making these two variables very close in importance.

Table 3. Greece: Financial Conditions Index Components With Largest Weighted Loadings

Pre-Crisis Sample		Post-Crisis Sample		Entire Sample	
Variable Name	Weighted Loading	Variable Name	Weighted Loading	Variable Name	Weighted Loading
Property prices	0.777	Greek-German bond yield spread	0.528	Property prices	0.574
Size of ECB balance sheet	-0.141	Property prices	0.234	Greek-German bond yield spread	0.378
Debt securities issued by MFIs	-0.119	Deposit ratio	0.218	Size of ECB balance sheet	-0.198
Short-term interest rate spread	-0.075	Size of ECB balance sheet	-0.160	Overnight interbank rate	-0.129

Source: IMF staff calculations.

Table 4. Euro Area: Financial Conditions Index Components

(Loadings of the principal components included in the index)

Variable Name	Loadings for PC1	Loadings for PC2	Loadings for PC3	Weighted Loadings
Loans to NFCs	0.708	-0.472	-0.381	0.123
Loans to households	0.383	0.010	0.888	0.275
Interest rate spread for NFCs	-0.053	-0.087	-0.006	-0.063
Interest rate spread for NFCs on overdrafts	-0.069	-0.096	-0.023	-0.076
Interest rate spread for consumer loans	-0.084	-0.116	-0.023	-0.092
Interest rate spread for mortgage loans	-0.083	-0.067	-0.018	-0.070
Debt securities issued by NFCs	0.460	0.735	-0.228	0.511
Quoted shares issued by NFCs	-0.076	0.044	-0.004	-0.020
Debt securities issued by MFIs	-0.062	-0.127	0.027	-0.081
Property prices	0.053	-0.011	0.055	0.027
Consumer prices	-0.061	-0.037	-0.011	-0.046
Short-term interest rate spread	-0.078	-0.045	-0.022	-0.059
Medium-term interest rate spread	-0.073	-0.035	-0.007	-0.051
Long-term interest rate spread	-0.080	-0.007	0.005	-0.042
Euro area-German bond yield spread	-0.052	-0.050	-0.006	-0.047
Volatility of bond prices	-0.074	-0.063	-0.026	-0.065
Banks' access to market financing	-0.079	0.008	-0.021	-0.038
Banks' liquidity position	-0.079	0.009	-0.021	-0.038
Housing market prospects	-0.079	0.006	-0.020	-0.038
Consumer creditworthiness	-0.079	0.006	-0.023	-0.039
Overnight interbank rate	-0.112	-0.036	-0.017	-0.072
Deposit growth	-0.072	-0.036	-0.008	-0.051
Deposit ratio	-0.123	0.408	-0.059	0.101
Size of ECB balance sheet	-0.137	0.060	-0.052	-0.048
Share of total variance explained	49.724	41.171	9.105	100.000

Source: IMF staff calculations.

Table 5. Greece: FCI and Alternative FCI Components With Largest Weighted Loadings

Greece				Euro Area			
Financial Conditions Index		Alternative Financial Conditions Index		Financial Conditions Index		Alternative Financial Conditions Index	
Variable Name	Weighted Loading	Variable Name	Weighted Loading	Variable Name	Weighted Loading	Variable Name	Weighted Loading
Property prices	0.574	Property prices	0.650	Debt securities issued by NFCs	0.511	Loans to NFCs	0.639
Greek-German bond yield spread	0.378	Greek-German bond yield spread	0.476	Loans to households	0.275	Debt securities issued by NFCs	0.305
Size of ECB balance sheet	-0.198	Size of ECB balance sheet	-0.240	Loans to NFCs	0.123	Loans to households	0.281
Overnight interbank rate	-0.129	Debt securities issued by MFIs	-0.151	Deposit ratio	0.101	Deposit ratio	-0.126

Source: IMF staff calculations.

Table 6. Estimation of Credit Growth: Autoregressive Process with One Lag, 2003–14

Dependent variable: credit growth in current period	Greece	Euro Area
Lag of credit growth		
Lag of credit growth	0.992***	0.990***
Constant	-0.367	-0.060
Number of observations	47	47
Adjusted R^2	0.975	0.956
Lag of credit growth and lag of FCI		
Lag of credit growth	0.832***	0.956***
Lag of FCI	2.461**	4.680***
Constant	1.075*	0.106
Number of observations	47	47
Adjusted R^2	0.978	0.963

Source: IMF staff calculations.

1/ *** indicates variable is statistically significant at the 99% level or above; ** at 95%; and * at 90%.

Table 7. Estimation of Credit Growth using the Alternative FCI, 2003–14

Dependent variable: credit growth in current period	Greece	Euro Area
Lag of credit growth		
Lag of credit growth	0.992***	0.990***
Constant	-0.367	-0.060
Number of observations	47	47
Adjusted R^2	0.975	0.956
Lag of credit growth and lag of alternative FCI		
Lag of credit growth	0.747***	0.814***
Lag of alternative FCI	3.600***	9.489***
Constant	1.832***	0.730***
Number of observations	47	47
Adjusted R^2	0.984	0.964

Source: IMF staff calculations.

1/ *** indicates variable is statistically significant at the 99% level or above; ** at 95%; and * at 90%.

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