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Michael G. Arghyrou, Maria-Dolores Gadea

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JEL-Codes: F300, F360, F450, G110, G150.

Keywords: private bank deposits, macro/fiscal risk, Eurozone, TVP panel, fragmentation.

Michael G. Arghyrou
Cardiff Business School
Cardiff University
Colum Drive
United Kingdom – Cardiff CF10 3U
ArghyrouM@cardiff.ac.uk

Maria-Dolores Gadea
Department of Applied Economics
University of Zaragoza
Gran Via, 4
Spain – 50005 Zaragoza
lgadea@unizar.es

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We examine the relationship between private bank deposits and macro/fiscal risk in the euro area. We test three hypotheses: First, private bank deposits relative to Germany are determined by macro/fiscal risk factors. Second, this relationship is time-varying. Third, time-variation is driven by the level of macro/fiscal risk. Our findings validate all three tested hypotheses. They also reveal persistent fragmentation between EMU core and periphery banking systems caused by a deficit of trust in periphery banking systems, unmitigated by the introduction of OMT and European Banking Union. Our findings have implications for the introduction of the European Deposits Insurance Scheme (EDIS), for which they offer tentative support.

JEL classification: F30; F36; F45; G11; G15

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1. Introduction

The global financial crisis (GFC) of 2007-2009 and the ensuing European sovereign debt crisis (ESDC) largely reversed the process of financial integration observed across the European Economic and Monetary Union (EMU) in the 1990s and the early years of the euro.[1] Fragmentation has been documented in numerous areas of the eurozone financial system, including sovereign bond markets (see, e.g. Delatte et al, 2017; Afonso et al, 2018); interbank money markets (Mayordromo et al, 2015), corporate bond markets (Zaghini 2016, 2017; De Santis, 2018), equity markets (Bley, 2009) as well as retail banking borrowing and lending rates (Arnold and Ewjik, 2014; Rughoo and Sarantis, 2014). The majority of existing studies find a partial reversal of fragmentation following the announcement of the Outright Transactions Programme (OMT) in July 2012, also documented by the European Central Bank (2015). Nevertheless, fragmentation, has caused persistent costs, as it disrupted the transmission of the single monetary policy (Durré et al, 2014) causing economic costs (Hristov

[1] For evidence of financial integration in the euro area before the global financial crisis, see European Commission (2008) and Valiante (2016).

et al, 2012; Bijsterbosch and Falagiarda, 2015) consistent with the predictions of macroeconomic models incorporating financial frictions (Gerali et al, 2010; Bocola, 2016).

Despite its extensive coverage, however, the literature on European financial fragmentation has overlooked a significant aspect of the European financial system, namely private bank deposits. This omission is surprising for, at least, three reasons:

First, deposits are a key building block of financial intermediation, particularly in the euro area where investors (especially households), show a strong bias towards bank deposits relative to other forms of financial investment.[2] This renders deposits a very significant factor determining output developments, both in the short-run through credit provision, as well as in the long run through enhancement of the allocation of economic resources (Ramirez, 2009).

Second, the safety of deposits is a major priority for policy makers, as evidenced by the increased provision of deposits insurance in the wake of the global financial crisis (Engineer et al, 2013; Wruuck, 2014; Demirgüç-Kunt et al, 2015) and plans to introduce a European Deposit Insurance Scheme (EDIS), endorsed by the Five Presidents Report on Completing Europe's Economic and Monetary Union (see European Commission, 2015b).

Third, deposits are no exception to the fragmentation dynamics observed in other areas of the euro financial system: Figure 1 presents their evolution versus real GDP. The figure records a universal upward trend for both series prior to the GFC. During the crisis, however, the trend was discontinued or reversed in periphery countries (Greece, Ireland, Portugal and Spain). By contrast, in the remaining EMU countries it was maintained, albeit in some cases at a slower pace. Importantly, by the end of the sample deposits in periphery countries remain lower than

[2] According to the European Central Bank (2016), deposits are held by 97% of European households and possess, the largest proportion in households' portfolio of financial asset, with an average share between 30% to 40% (see also chart 18, in European Commission 2015a, p.59 and Figure 8 in Véron and Wolff, 2015). The proportion of bank deposits in household savings takes even larger values in periphery countries (see Valiante 2016, p. 91). European non-financial corporations also hold a significant share of their total financial assets in bank deposits (see European Commission 2015a, p.59). Finally, the share of deposits as a source of funding of European banks increased substantially during the crisis years (see Figure 2 in European Commission 2015b, p. 3).

their pre-crisis peak, not only in Greece, the country mostly hit by the crisis, but also in other periphery countries where economic recovery restored (Spain) or exceeded (Ireland and Portugal) pre-crisis output levels. In other words, unlike core countries, in recent years periphery countries present a disconnect between the movements of deposits and real GDP volume, suggesting substantial banking fragmentation. Unlike other financial markets, this fragmentation shows no signs of moderation following the announcement of OMT, or the introduction of the European Banking Union (EBU) in November 2014, whose principal aim is to "reinforce financial stability in EMU by restoring confidence in the banking sector" (European Commission, 2014, p. 2).

This paper aims to contribute to the literature on euro area financial fragmentation by focusing on the hitherto under-investigated, by academic research, topic of private bank deposits. Specifically, we focus on the relationship between bank deposits and macro/fiscal risk. Recent studies (e.g. Levy-Yeyati et al, 2010; Cubilas et al, 2012, 2017) provide evidence suggesting that as domestic macro/fiscal risk increases, domestic savers increasingly move away from the classic market discipline savings paradigm (Berger, 1991), where deposits are determined by idiosyncratic characteristics of individual banks, towards a savings model where savers determine deposits in the domestic banking system as a whole on the basis of aggregate macro/fiscal risk. This savings model, incorporated in DSGE macro models by Clerc et al, (2015) and Balfoussia et al, (2018), results into a mutation of market discipline from deposits' reallocation within national banking systems to international deposits' substitution and/or increasing holdings of cash. In the context of the EMU both phenomena have been observed during the GFC/ESDC period (see Kleimeier et al 2013; and Deutche Bank, 2016; Gros, 2017).

Our analysis is motivated by the insights of the recent literature quoted above. Specifically, we test three distinct hypotheses, namely that: (a) aggregate private bank deposits in EMU national banking systems relative to Germany, a country we treat, in line with numerous studies

on the ESDC (see e.g. Dellatte et al, 2017; Afonso et al, 2018) as a safe haven for investors, are determined by macro/fiscal risk factors; (b) the relationship between relative deposits and macro/fiscal risk is time-varying; and (c) time variation in the relationship between relative bank deposits and macro/fiscal factors is driven by the level of relative macro/fiscal risk.

Our analysis covers ten EMU countries, namely Austria, Belgium, Finland, France, Greece, Ireland, Italy, Netherlands, Portugal and Spain. We present results for the full panel as well as separate panels for separate core and periphery panels. We use monthly data covering the period January 1999 – July 2017. We follow an empirical approach similar to Manasse and Zavalloni (2013), Bekaert et al (2014) and Afonso et al (2018) involving two stages. The first estimates the time-varying parameter (TVP) panel model by Li et al (2011), where private bank deposits relative to Germany are modelled national macro/fiscal risk. This allows us to capture time variation in the relationship between relative deposits and their macro/fiscal determinants.

The second stage tests whether time variation in the relationship between relative deposits and their macro/fiscal determinants is driven by the level of macro/fiscal risk. Specifically, we model the time series of the TVP coefficients estimated for each of the relative deposits' determinants in the first stage of the analysis on measures of EMU-wide macro/fiscal risk. We also include two dummy variables investigating the likely impact of two distinct events. First, the announcement of OMT in July 2012. Second, the effect of introducing EBU in its current form in November 2014.

Our analysis yields a host of novel empirical findings. We document substantial time-variation in the relationship between relative deposits and their macro/fiscal determinants. This is found to be driven by the level of macro/fiscal risk in all investigated panels, full, core and periphery. This suggests that both core and periphery banking systems are potentially subject to bank stability risks, as predicted by the classic Diamond and Dybvig (1983) model predicting self-fulfilling banking crises, not justified (at least fully) by idiosyncratic fundamentals. On the

other hand, the core and periphery groups are found to differ in one significant aspect: For periphery countries we find a significant negative time effect on deposits during the crisis years which is not present in core countries, goes beyond the reduction in deposits explained by the increase in macro/fiscal risk, and persists until the very end of our sample period. Placed in the context of previous literature on the size of financial intermediation and the legacy of banking crises (see e.g. Guiso, 2004; Ramirez, 2009; Stix, 2013; Osili and Paulson, 2014), this indicates a persistent problem of trust in periphery banking systems which is not present in the core and, according to our findings, has not been mitigated by the introduction of OMT and EBU in its current incomplete form. This implications for the introduction of EDIS whose introduction, our findings suggest, could help reduce fragmentation and increase the resilience of national banking systems, both in core and periphery EMU countries.

The remainder of the paper has as follows: Section 2 presents a brief review of related literature. Section 3 discusses our empirical methodology and data. Section 4 presents and discusses the results of estimating TVP models capturing time variation in the relationship between relative bank deposits and macro/fiscal risk factors. Section 5 presents the results of the equations modelling the time-varying coefficients estimated in section 4 on proxies of euro-wide macro/fiscal risk. Finally, section 6 summarises and offers concluding remarks.

2. Related literature

The literature linking savers' behaviour with banking risk has been largely shaped by two highly influential models. The first is the market discipline model by Berger (1991) according to which savers demand higher interest rates (price discipline mechanism) from or/and reduce the volume of their deposits with banks (quantity discipline mechanism) following excessively risky business models. By reducing excessive risk-taking, market discipline, empirically

validated for various periods and markets.[3] promotes the long-run solvency of the banking system. As such, it a policy objective of high priority policy.

The second is the Diamond and Dybvig (1983) model, predicting self-fulfilling banking crises, not justified (at least fully) by idiosyncratic banking fundamentals. The high macro/welfare costs of banking failures render banking stability another policy objective of high priority, justifying deposit insurance schemes minimising the probability of bank-runs. Deposits insurance schemes, however, may cause moral hazard in banking behaviour, as extensively documented by previous studies.[4] Moral hazard may be stronger for larger banks, whose failure causes wider financial contagion (Ioannidou and Penas, 2010). The too-big-to-fail" (TBTF) hypothesis, supported by substantial empirical evidence,[5] implies that additional to explicit deposit guarantees, larger banks may also enjoy implicit government guarantees, increasing moral hazard in banking business models.[6] This implies a trade-off between market discipline and bank stability, underpinning an influential literature on the optimal regulatory balance between the two objectives (see Demirgüç-Kunt et al, 2015).

In recent years, and especially since the onset of the GFC, numerous studies have offered new insights on the relationship between bank deposits and banking risk. First, market discipline within national banking systems is found to weaken after a banking crisis (Cubilas et al, 2012). Second, during systemic national banking crises, depositors discipline the domestic banking market as a whole by withdrawing deposits and transferring them to safer banks abroad (Kleimeier et al, 2013). Third, during systemic banking crises, rather than being regarded as too-big-to-fail, large banks may be seen as too-big-to-save (Demirgüç-Kunt and

[3] See Flannery (1998), Martinez Peria and Schmukler (2001), Sironi (2003), Nier and Baumann (2006), Bennett et al (2015).
[4] See Demirgüç-Kunt and Huizinga (2004), DeLong and Saunders (2011), Karas et al (2013), Brandao-Marques (2018).
[5] See O'Hara and Shaw (1990), Balasubramnian and Cyree, (2011), Beyhaghi el al (2014), Acharya et al (2016), Cubilas et al (2017)
[6] Market discipline has also been found to decline if banks are perceived to have strong political connections (Disli et al, 2013); and when the size of government control/ownership in the banking system increases (Angkinand and Wihlborg, 2010).

Huizinga, 2013, Bertay et al, 2013), especially if public finances are already weak (Demirgüç-Kunt and Huizinga 2013, Cubilas et al, 2017).[7] Indeed, the literature has established a strong feed-back loop between fiscal and banking risk, particularly strong among eurozone countries during the ESDC (Alter and Schüler, 2012; De Bruyckere et al, 2013; Acharya et al, 2014, Gibson et al 2016, Bocola, 2016).[8]

Overall, the recent literature motivated by the GFC and the ESDC has provided new insights on bank depositors behaviour, suggesting that during periods of enhanced macro/fiscal risk, savers move away from the classic market discipline paradigm towards a model where savers determine deposits in the domestic banking system as a whole on the basis of aggregate macro/fiscal risk. This feature, incorporated in the DSGE macro models of Clerc et al (2015) and Balfoussia et al (2018), results into a mutation of market discipline from deposits' reallocation within national banking systems to international deposits substitution and/or increasing holdings of cash (see Levy-Yeyati et al, 2010). In the case of the eurozone, both effects have been observed in recent years: In addition to the cross-border deposits substitution found by Kleimeier et al (2013), the studies by Mai (2016) and Gros (2017) document a substantial increase in the use of cash in the euro area during the crisis years.

Our analysis is motivated by the insights of the recent literature quoted above. Specifically, we test three distinct hypotheses: First, private bank deposits, relative to Germany, are determined by macro/fiscal risk factors. Second, this relationship is time-varying. Third, time-variation is driven by the level of macro/fiscal risk. To the best of our knowledge, these hypotheses, summarised by a simple partial equilibrium model presented in the Appendix, are tested for the first time in the literature in the context of the euro-area.

[7] On the other hand, the interaction between a systemically weak banking system and fragile public finances may give rise to the too-many-to-fail effect, according to which a government is less likely to take over but also close a failing bank (see Acharya and Yorulmazer, 2007; and Brown and Dinç, 2009).
[8] Note also the development. in recent years, of a growing literature on the estimation of the level of systemic banking risk (see Acharya et al, 2012; Black et al, 2016; Duprey et al, 2017)

3. Empirical methodology and data

3.1.First stage of econometric analysis

Our empirical analysis follows a two-stage modelling approach, similar to those used by Manasse and Zavalloni (2013), Bekaert et al (2014) and Afonso et al (2018). The first stage estimates the TVP panel model by Li et al (2011) given by equation (1) below:

$$y_{it} = ft + \sum_{j=1}^{k} \beta_{jt}\, x_{it,j} + \alpha_i + u_{it} \quad (1)$$

In equation (1), y_{it} denotes the model's dependent variable, with $i = 1 \ldots N$ and $t = 1 \ldots T.$.; vectors $x_{it} = \left[x_{it,1}, \ldots, x_{it,k}\right]'$ and $\beta_t = \left[\beta_{t,1}, \ldots, \beta_{t,k}\right]'$ respectively include k independent variables and their corresponding time-varying coefficients; α_i captures time-invariant fixed effects;[9] the trend function f_t captures time-specific effects accounting for omitted variables having a common, over time, impact across the panel's cross sections; and u_{it} is a random error term.[10]

We define y_{it} to be the differential of the log-index of private deposits against Germany. For our benchmark specification, we set $k = 3$, with j =1,2 3 respectively denoting output, fiscal risk and inflation, with all variables expressed as differentials relative to Germany. The choice of independent variables reflects the paper's main research hypothesis according to which aggregate relative deposits are determined by macro/fiscal risk factors, as per the insights of post-GFC literature quoted above. We expect the link between relative output and relative deposits to be positive but decline in strength during periods of heightened

[9] The model allows the fixed effect terms α_i to be correlated with X_{it} and, for the purpose of identification, assumes that $\sum_{i=1}^{N} \alpha_j = 0$ (see Su and Ullah, 2006).

[10] We analysed the stationarity of the data panel for each variable entering equation (1) described below using the methodology proposed by Bai and Carrion (2009). In all cases, the presence of a unit root can be rejected, although the inclusion of structural changes is necessary in several cases. The break points are mostly related to the start of the Great Recession and the end of the most intense phase of the European sovereign debt crisis. These results are not included to preserve space but are available upon request.

macro/fiscal risk. We also expect the sign of the relationship between relative deposits and fiscal risk to decline towards negative values as macro/fiscal risk increases, in line with the hypothesis that under increased fiscal risk, savers substitute domestic deposits with foreign bank deposits and/or cash. Finally, the relationship between deposits and relative inflation is ceteris paribus is expected to be positive, as an increase in the latter increases the opportunity cost of holding cash, prompting savers to substitute cash holdings with bank deposits. However, in the context of a monetary union such as the EMU, periods of high macro/fiscal risk may result into higher redenomination risk (see De Santis, 2015), prompting savers to substitute domestic deposits with safer foreign deposits or euro cash. As a result, we expect the link between relative deposits and relative inflation to weaken under higher macro/fiscal risk.

The model by Li et al (2011) involves the choice of an estimation method and two modelling parameters. As far as the former is concerned, Li et al favor the local linear dummy variable method (LLDV) which, they show, outperforms the alternative averaged local linear method (ALLM).[11] The LLDV involves the use of bandwidth parameter, h^*, to whose value the estimation results are typically sensitive: A higher (lower) bandwidth value reduces (increases) biases in the estimated TVP coefficients but increases (reduces) their variance. To optimize on this trade-off, Sun et al (2009) and Li et al (2011) propose a data-driven, cross-validation selection method selecting h^* by minimizing the mean squared error of the resulting estimates.[12] For our benchmark specification this yields $h^* = 0.15$. Furthermore, following Dai and Sperlich (2010) we apply a bandwidth correction procedure reducing the "boundary effect" bias observed at the beginning and end of the sample. We set the value of the bandwidth

[11] Specifically, compared to the ALLM which eliminates the fixed effects by taking cross-section averages, the LLDV removes the fixed effects through a smoothed version of cross-time average from each individual cross-section, improving the rate of convergence of $\widehat{\beta_{jt}}$.

[12] An alternative method for choosing the value of h^* is a "rule-of-thumb" approach, which is computationally appealing but can lead to non-robust results in empirical applications, especially when the data present high volatility, as it the case with the time series used in our analysis.

correction parameter value $\varepsilon = 0.08$, which satisfies the restriction $0 < \varepsilon < h^*$. Finally, for each estimated TVP coefficient we calculate a 90% confidence interval by applying the wild bootstrap method.[13] This is based on the estimated residuals of the non-parametric estimated regression obtained by1000 replications, estimated using the same $h^* = 0.15$ and $\varepsilon = 0.08$ values as in the source regression.

Compared to the TVP model given by equation (1), there are two alternative approaches for capturing changes in the sign and strength of the relationship between relative bank deposits and their macro/fiscal determinants: First, panel data models accounting for structural breaks in their coefficients. The majority of such models, however, assume the absence of cross-sectional dependence (see Boldea et al, 2016), an assumption that is not suitable to eurozone financial markets, where unobservable common factors and/or spatial spill over effects are pervasive (Arghyrou and Kontonikas, 2012; De Grauwe and Yi, 2013; Afonso et al, 2018).[14]

Second, non-linear panel models, such as Hansen (1999) or the more advanced panel smooth regression transition (PSRT) model by González et al (2017) which, despite its advantages over the former [15], has its own drawbacks.[16] The TVP model by Li et al (2011) addresses these drawbacks (see Afonso et al, 2018): First, it allows the identification of

[13] We use the method proposed by McMurry and Politis (2008) to construct confidence intervals in non-parametric regressions.

[14] Baltagi et al (2016) develop a panel estimation model accounting for multiple structural breaks and cross-sectional dependence. This model, however, captures regime changes that are more likely to occur over a longer time span. This assumption is not applicable in capturing regime shifts taking place in quick succession within a relatively short period of time characterized by high data volatility. As such, they are not well suited for capturing regime shifts occurring in European financial markets occurring during the period of the GFC and the ESDC, as documented by Delatte et al (2017) and Afonso et al (2018) for the euro zone sovereign bond markets.

[15] The model by Hansen (1999) assumes discrete transition among regimes, which may not be suitable if transition between regimes is gradual Furthermore, it allows for a maximum of three regimes, when in practice the number of regimes may be higher. The PSRT model allows for smooth transition among regimes and, theoretically, a higher number of regimes, fluctuating between two extreme regimes.

[16] Specifically, the PSRT assumes a single, fixed transition variable, when in practice the transition variables may be more than one and/or change over time. Second, the PSRT is subject to technical complications when the series exhibit high volatility (as it is the case with our time series), affecting the smoothness of transition among regimes. In that case, the model may face serious problems of convergence, implying that in practice it may be difficult to identify more than two regimes. Third, the Hansen (1999) and PSRT modes assume that the different regimes are recurrent, an assumption that is not valid in the context of the euro crisis (see Afonso et al, 2018).

multiple regimes. Second, it accounts for gradual transition among the regimes, allowing the different regimes to be non-recurrent. Third, by not imposing any single transition variable it lets the data to determine freely (through observed changes in individual TVP coefficients) the driver(s) of transition between regimes. Fourth, it accounts for cross-sectional dependence. Finally, it can capture non-linearities in the relationship between dependent and independent variables: As Granger (2008, p.1) points out, "any non-linear model can be approximated by a time-varying parameter linear model". Therefore, the TVP model by Li et al captures any non-linearities that may characterize the true data generating process.

We estimate equation (1) for a panel of ten EMU countries, namely Austria, Belgium, Finland, France, Greece, Ireland, Italy, Netherlands, Portugal and Spain. We present results for the full panel as well as for a panel of core EMU-countries (Austria, Belgium, Finland, France and the Netherlands) and a panel of periphery EMU-countries (Greece, Ireland, Italy, Portugal and Spain). We use monthly data covering the period January 1999 – July 2017.

The data source for private bank deposits is the ECB. Private bank deposits, transformed into log-indexes relative to Germany (Figure A1 in the Appendix) are defined as outstanding amounts at the end of each month, expressed in millions of euros, covering maturities of all types and all currency denominations, including deposits of households, non-financial corporations and other entities excluding central government and Monetary and Financial Institutions. Given the lack of monthly data for real GDP, we approximate output relative to Germany using the log volume-index of the Economic Sentiment Indicator (ESI) available by the European Commission (Figure). We approximate fiscal risk using the 10-year government bond yield spread against the German bund, calculated using data taken from the ECB database (Figure A3). Finally, year-to-year inflation rates relative to Germany are calculated using the monthly Harmonised Index of Consumer Prices (HICP) available by the ECB (Figure A4).

3.2.Second stage of econometric analysis

The second stage of our econometric analysis models the time series obtained for each individual TVP coefficient $\hat{\beta}_{jt}$ estimated in the first stage on a vector of exogenous variables z_t as per equation (2) below, where v_t is a random error term:

$$\hat{\beta}_{jt} = \gamma + z_t' + v_t \qquad (2)$$

We estimate equation (2) using three definitions of vector z_t. The first includes aggregate euro-wide fiscal risk, approximated by the first lag of the first principal component of the ten-year government bond yields spreads against Germany of the countries included in the panel. The second adds measures of euro-wide macro risk, approximated by the first lag of the first principal components of relative (to Germany) ESI indexes and HICP inflation rates. These, however, especially the first principal component of relative ESI indexes, present high collinearity with the first principal component of spreads and/or between them, especially in the case of periphery countries (see Table A1 in the Appendix). To address this issue, we follow Bekaert et al (2009) and estimate equation (2) using orthogonalized series for the first principal components of relative ESI indexes and HICP inflation rates.[17]

We expect the relationship between TVP coefficients and fiscal risk to be negative, reflecting that a higher probability of fiscal default contributes to lower deposits. We expect the relationship between TVP coefficients and relative ESI to be positive, indicating that improving output conditions have a beneficial effect on deposits. Finally, the relationship between TVP coefficients and relative inflation has no a priori expected sign: On the one hand, and as explained above, an increase in domestic inflation increases the opportunity cost of holding cash, prompting savers to substitute cash holdings with deposits. This effect

[17] Specifically, we obtain the orthogonalized series for the first principal component of relative ESI indexes by regressing the latter on the first principal component of spreads and collecting the residuals. We then calculate the orthogonalized series for the first principle component of HICP inflation differentials as the residuals of the equation regressing this variable on the first principal of spreads and the orthogonalized first principal component of relative ESI indexes.

contributes towards a positive link between relative deposits and inflation. On the other hand, in the context of a monetary union such as the EMU, higher relative inflation results into an appreciation of the domestic country's real exchange rate increasing redenomination risk, incentivising deposits' flight to safer banking systems and/or increased cash holdings. This effect predicts a negative link between TVP coefficients and relative inflation.

Finally, we add to vector z_t two intercept dummies. The first, OMT, takes a zero value before August 2012, unity thereafter. This captures any direct effect the announcement of OMT has had on the relationship between relative deposits and their fundamental determinants, additional to the indirect effect caused by the OMT's introduction on the fiscal/macro determinants of deposits (see Altavilla et al. 2014; Delatte et al, 2017; Afonso et al, 2018).

The sign of the OMT dummy is an empirical question. OMT's critical effect on raising sovereign bond prices has strengthened bank balance sheets, thereby reducing banking risk (see Afonso et al, 2018). Reduced banking risk may have increased confidence in the safety of bank deposits, contributing to their increase. This effect would be captured by a positive OMT sign. The OMT dummy, however, may be capturing other effects too. Combined with the ECB's accommodating monetary policy in recent years, the OMT's announcement may have been perceived by savers as a long-term ECB commitment to a policy of low, or even negative interest rates. These may be causing different responses on bank deposits. On the one hand, they may discourage saving and promote consumption, an effect defined by Aizenman et al (2016), as the substitution effect of low/negative interest rates; or encourage portfolio reallocation from bank deposits to other forms of investment with higher expected returns (Bundesbank, 2015). Ceteris paribus, the substitution and portfolio reallocation effects would be reflected in a negative OMT sign. On the other hand, low/negative interest rates may increase deposits, if savers, operating under a pre-set targeted volume of savings, compensate for lower interest rates by increasing their savings' rates, an effect defined by Aizenman et al

(2016) as the income effect of low/negative interest rates. Ceteris paribus, the income effect would be reflected in a positive OMT dummy coefficient.

The second dummy, EBU, takes a zero value up to October 2014, unity thereafter. EBU aims to capture the effect of introducing of EBU in its current, incomplete form in November 2014. Like the OMT dummy, EBU' sign is an empirical question. On the one hand, the principle objective of EBU is to reinforce financial stability in the EMU by breaking the link between banking and fiscal risk and restoring confidence in the banking sector (see European Commission, 2015c). A positive EBU sign would be consistent with achieving this stabilisation/confidence-restoring effect. On the other hand, the EBU includes the single resolution mechanism, which is based on the principle of bail in in the event of banks' restructuring/resolution. Bail-in potentially includes bank depositors, as demonstrated in the case in the Cyprus banking bailout in March 2013. As a result, the bail-in principle may have been perceived by savers as an extra risk factor associated with domestic bank deposits, prompting them either to relocate deposits in safer banking systems or/and increase their cash holdings. This risk-aversion effect would give rise to a negative EBU sign.

4. Time variation in the relationship between bank deposits and macro/fiscal risk

4.1.Benchmark specification

Figure 2 presents the estimates of the benchmark model given by equation (1) for the full panel of our sample countries. For this benchmark specification, the vector of independent variables is defined to include relative ESI indexes, spreads and relative HICP inflation rates. The estimated TVP coefficients provide evidence of substantial time variation in the relationship between bank deposits and macro/fiscal risk factors. As a general feature, we observe an upward movement for all coefficients between 1999 and the onset of the GFC in

summer 2007. Note, however, that except from the trend function, the upward movement of TVP coefficients is reversed for the ESI and spread TVP coefficients in 2004-2005, and for inflation differentials in 2005-2006. These reversals follow a sharp decline in relative ESI indexes in most EMU countries in 2003 (see Figure A2 in the Appendix). Note also that before the onset of the GFC, the estimated confidence intervals include zero. This mirrors the findings of empirical literature on eurozone sovereign bond markets according to which before the GFC investors did not price macro/fiscal variables risk to a significant degree (see, among others, Arghyrou and Kontonikas, 2012; Delatte et al, 2017; and Afonso et al, 2018).

TVP coefficients enter downward pattern during the crisis period, following the onset of the GFC in summer 2007, the collapse of Lehman Brothers in September 2008 and the beginning of Greek debt crisis in autumn 2009. The decline in the estimated coefficients coincides with a significant increase in macro/fiscal risk, reflected in a marked fall in relative ESI indexes (Figure A2) and a sharp increase in spreads' values (see Figure A3). As far as the ESI coefficient is concerned, the estimated confidence intervals are negative and statistically significant over May 2010 - November 2012. The same holds true for the coefficient of spreads over December 2010 to July 2015. The coefficient of inflation differentials also records a sharp decline during the crisis period, although zero continues to be marginally included in its estimated confidence interval.

Finally, except for the ESI coefficient, the announcement of OMT in July 2012 is not followed by an increase in the estimated TVP coefficients, with those of the spread and relative inflation recording a partial recovery only towards the end of the sample. This recovery coincidences with a decline in the level of macro/fiscal risk, reflected by the stabilization of spreads at lower levels (Figure A3) as well as the partial recovery of relative ESI levels (Figure A2) and the introduction of EBU. Importantly, however, the trend function, does not recover, and continues its downward movement, even after the introduction of EBU.

Figures 3 and 4 respectively present the results of the benchmark model for core (Austria, Belgium, Finland, France and the Netherlands) and periphery countries (Greece, Ireland, Italy, Portugal and Spain). For both panels we observe an upward movement for all TVP coefficients during the pre-crisis period. For core countries we obtain evidence of positive, statistically significant ESI coefficients and relative inflation coefficients before the crisis period. In the periphery, the ESI coefficient is also positive and statistically significant for a limited number of observations before the crisis. Furthermore, and in line with the findings relating to the full panel, in periphery countries, all three TVP coefficients decline over 2003-2005. In core countries, a similar reversal is observed only for the spreads' coefficient.

During the crisis we observe a substantial reduction in the values of all TVP coefficients in both panels. In some cases, this reduction begins with the onset of the GFC in summer 2007, whereas in others it follows the Lehman Brothers episode in September 2008. The reduction in the coefficients' values is more pronounced in periphery countries. In core countries, the coefficients of spread and relative ESI become negative and statistically significant for a large number of observations. In periphery countries, the coefficient of spreads is negative and statistically significant for the bulk of the observations. The periphery ESI coefficient also records a sharp decline, although zero is included in the estimated confidence intervals. The same holds true for relative inflation both in the core as well as the periphery. [18]

With regards to the OMT and EBU, the evidence is mixed. For core countries, Figure 3 suggests no significant OMT effect on the coefficients' values. By contrast, it indicates a

[18] Note that for a small number of observations in Figure 4, as well as in some Figures presented in the Appendix, the point estimates of the TVP coefficients fall outside the reported confidence interval (CI). These can be regarded as outliers produced by the bootstrapping exercise, with no impact on the reliability of our results: the standard calculation of a CI involves the use of a parameter's point estimate as the central point of the CI estimation and calculation of the CI around the point estimate. This ensures that the point estimate always falls within the estimated CI bounds. Bootstrap methods, on the other hand, follow a different CI estimation approach, involving multiple estimates of the parameter in question (in our case 1000, one per bootstrap iteration) and the empirical setting of an upper and lower CI bound within which 90 per cent (or any other predetermined proportion) of these estimates fall. In this methodology, it is possible for a parameter's point estimate to fall outside the empirically constructed CI.

positive EBU effect, particularly for the ESI and inflation coefficients. For periphery countries, Figure 4 indicates a positive OMT effect on the ESI coefficient, but not so for the spread and relative inflation. Figure 4 indicates no EBU effect in the periphery panel, with the possible exception of the coefficient of relative inflation.

Finally, and quite importantly, starting from the onset of the ESDC in autumn 2009, in the periphery panel we observe a sharp downward reversal of the trend term into negative territory. This negative trend continues unabated until the end of our sample period, without any obvious mitigating OMT or EBU effect. By contrast, the trend term in core countries continues its pre-crisis upward movement, albeit at a slower pace since the Lehman Brothers episode in September 2008.

4.2. Robustness tests

4.2.1. Changing panels' composition

Models excluding Greece

We have tested the robustness of the empirical findings reported in section 4.1 through robustness tests changing the panel's composition, estimation parameters and model's specification. First, we exclude Greece from the analysis, on the grounds that Greece presents unique characteristics relative to the rest of the sample countries.[19] The results for the full and periphery panels are respectively presented in Figures 5 and 6. To facilitate comparison, the Figures report the TVP coefficients obtained by the models excluding Greece against those obtained by the benchmark model (the estimated confidence intervals for the models excluding Greece can be found in Figures A5 and A6 in the Appendix). The empirical findings remain

[19] Unlike all other sample countries, which joined the euro in 1999, Greece accessed the EMU in 2001. Also, Greece is the only country where capital controls have been in place since July 2015. Finally, Greece is the country that has been mostly hit by the crisis in all respects (size of deposits' reduction, spread increases and output reduction), a factor rendering it a likely outlier among the rest of the sample countries.

very similar to those of the benchmark model, including the estimated trend function which, during the crisis period remains downward sloping, albeit somewhat less steep.

Including Italy in the core panel

Although the literature on the ESDC typically classifies Italy among the group of periphery counties, a visual inspection of Figures 1 and A1 suggests that the movements of Italian bank deposits is closer to those of core rather than periphery countries. Therefore, our next robustness test is to include Italy in the former rather the latter group. The results of the estimations referring to the revised core and periphery groups are reported in Figures 7 and 8 respectively (the corresponding estimated confidence intervals can be found in Figures A7 and A8 in the Appendix). Once again, the empirical findings remain similar to those of the benchmark groups, albeit with some differences regarding the absolute size of the estimated TVP coefficients. The inclusion of Italy in the core group does not change the upward movement for the trend term of the core group during the crisis period; and increases the slope of the downward trend obtained in periphery countries.

4.2.2. Changing model's parameters

Using the first lag of independent variables

To address any endogeneity issues between the dependent and independent variables of equation (1), we re-estimate (1) using the first lag of the model's regressors. The results for the full, core and periphery panels are respectively reported in Figure A9, A10 and A11 in the Appendix. In all cases, these are very similar to those obtained from the benchmark model.

Using alternative bandwidth parameters

We have estimated equation (1) using alternative bandwidth parameters. Figures A12, A13 and A14 in the Appendix respectively present the estimated TVP parameters obtained for the full, core and periphery panels by setting h = 0.10, 0.20 against those obtained using the benchmark value h^* = 0.15. By construction, lower (higher) bandwidth parameter values involve higher (lower) TVP variability, which explains occasional deviations regarding the coefficients' size and turning points obtained using alternative h values. In terms of qualitative inference however, the empirical findings are consistent with those obtained using the benchmark h^* = 0.15 value.

Using alternative bandwidth correction parameters

We have estimated equation (1) using alternative bandwidth correction parameters ε , keeping the optimal bandwidth parameter h^* = 0.15 constant. Figures A15, A16 and A17 in the Appendix respectively present the results for the full, core and periphery panels, setting ε = 0.05, 0.10, against the results obtained using the benchmark value of ε = 0.08. In all three cases, the results remain almost identical to those obtained by the benchmark model.

4.2.3. Expanding the benchmark specification

Adding relative stock index returns

Our next robustness test adds stock index returns relative to Germany as an extra explanatory variable to our benchmark specification. This captures the possibility that demand for bank deposits may be affected by returns on substitute financial investments (see Tin, 1998 and the references therein). We expect the relationship between deposits and stock returns to be negative, as ceteris paribus higher stock returns trigger portfolio reallocation away from deposits towards stocks. However, the relationship may also be subject to time variation: The

stock market is a riskier form of investment strongly correlated with the business cycle (see Fama and French, 1989; Stock and Watson, 1999). Therefore, during economic downturns increased risk aversion combined with falling stock returns relative to bank deposits may result in portfolio reallocation away from the former towards the latter. Hence economic downturns, typically coinciding with increased macro/fiscal risk, may weaken the negative link between relative deposits and relative stock returns.

Figures A18, A19 and A20 in the Appendix respectively present the results of the extended specification for the full, core and periphery panels, including estimated standard errors. The point estimates of the TVP coefficients of relative stock returns present significant time variation: Before the crisis the relationship with relative deposits is increasingly negative. In all three panels, this trend is reversed abruptly just before the onset of GFC. During the crisis period, for the full and periphery panels, the coefficient of stock return differentials is in the neighbourhood of zero, taking increasingly positive values for core countries over 2010-2012. Overall, our findings relating to the coefficient of stock return differentials are consistent with our expectations for the pre-crisis period and for the bulk of the crisis period.[20] However, the coefficient of stock returns is statistically insignificant throughout the sample period, which explains the almost identical values obtained for the coefficients of the remaining variables compared to the benchmark model.

[20] The increasingly positive values obtained for the coefficient of relative stock returns towards the end of our sample are less straightforward. Given the increase in European stock indexes observed since mid-2009 and the economic recovery observed since 2013/4, these are unlikely to reflect portfolio reallocation due to increased risk aversion and/or a reduction in the return of stocks relative to deposits, as it can plausibly be argued for the early stages of the crisis. It is possible that the positive coefficients, suggesting complimentarity rather than substitutability between deposits and stock investment, may be related to the accommodating monetary policy followed by the ECB during the crisis, including the QE programme since January 2015. Authors including Sinn (2014) and Bundesbank (2016) have argued that QE may have weakened the relationship between financial assets prices and their underlying fundamentals. The positive TVP coefficients obtained for relative stock returns over the last part of our sample may be reflecting a similar effect for the link between bank deposits and stock returns.

Adding relative log house price indexes

Our last robustness test adds to our benchmark specification the log of house price index relative to Germany.[21] This captures the possibility that in addition to income, bank deposits are also a function of wealth (Bomberger, 1993), with house prices being used as a proxy for wealth (Campbell and Cocco, 2007). Ceteris paribus, we expect a positive relationship between relative deposits and relative wealth. This, however, may weaken during periods of heightened macro/fiscal risk, or even turn negative for the same reasons applying to the variables included in our benchmark specification.

The results for the full, core and periphery panels are reported in Figures 9, 10 and 11 respectively against the results of the benchmark model. Figures 9 and 11 also report the results of the extended model for the full and periphery panels excluding Greece. Figures A21, A22 and A23 in the Appendix report the corresponding estimated TVP standard errors for the extended model including Greece. In all cases, the findings relating to relative ESI, spread and relative inflation are very similar to the benchmark model, with minor differences relating to the estimated sizes and, in the case of periphery countries, the timing of the downward reversal of the TVP coefficients during the crisis period. As far as the trend function is concerned, the inclusion of relative log house price indexes mitigates, but does not cancel, the upward trend observed in core and periphery panels during the pre-crisis period. It does not, however, mitigate the divergence observed between the two groups during the crisis period. This divergence is maintained even when Greece is excluded from the extended model, although it is somewhat mitigated towards the very end of the sample (Figure 11).

Finally, in line with our expectations, for all three panels we find a positive relationship between relative deposits and relative house prices during the pre-crisis period, although in core countries this weakens significantly over the period 2001-2006, before recording a partial

[21] The data source for house price indexes is the Organisation for Economic Cooperation and Development

recovery until 2009. During the crisis period, in all three panels we observe a sharp reduction in the TVP estimate of relative house prices, with the relationship turning negative during 2012-2015. Figures A22 and A23 in the Appendix suggest that the coefficient of relative house prices is statistically significant during the pre-crisis and the crisis period, both in core as well as in periphery countries. Finally, in all three panels, the downward movement of the TVP coefficient of relative house prices seems unaffected by the OMT announcement in July 2012. Following the introduction of EBU in November 2014, it recovers and increases significantly in core countries. In periphery countries, the recovery is much more modest.

4.3.Discussion

The empirical findings of the first stage of our econometric analysis provide evidence of substantial time variation in the relationship between relative deposits and their macro/fiscal determinants, for all investigated panels. They also provide tentative support in favour of our main research hypothesis according to which this time variation is, both for core as well as periphery countries, a function of the level of macro/fiscal risk, as in general terms, the estimated TVP coefficients follow an upward movement during the pre-crisis period, when macro/fiscal risk conditions were improving, and a downward movement during the crisis period, when the level of macro/fiscal risk increased.

Having said that, the core and periphery groups differ in one significant aspect: For periphery countries we find evidence of a significant negative time effect on deposits during the crisis years which is not present in core countries, goes beyond the reduction in deposits explained by the increase in macro/fiscal risk, and persists until the end of our sample period. As explained in section 2, the trend function captures time-specific effects accounting for omitted variables having a common, over time, impact across the panel's cross sections. These include trust in the banking sector, a variable that is not directly observable but has been

previously found to determine significantly depositors' behaviour, particularly during periods of high macro/fiscal risk (Levy-Yeyati et al, 2010) and in the aftermath of banking crisis (Guiso 2004, Ramirez, 2009, Levy-Yeyati et al, 2010, Stix 2013, Osili and Paulson 2014). Placed in the context of this literature, our findings indicate a persistent problem of trust in periphery banking systems, inference validated by recent survey data suggesting that lack of trust in banking institutions is higher among periphery EMU member countries (see Crabtree, 2013). Overall, our findings indicate continued intra EMU fragmentation in the field of bank deposits, which has not been mitigated by the introduction of OMT and EBU in its current form.

5. Modelling TVP estimates on macro/fiscal risk

In this section we test the hypothesis that the relationship between bank deposits and macro/fiscal risk is driven by the level of macro/fiscal risk. We do so by estimating equation (2) modelling the TVP coefficients obtained in the first stage of our analysis (capturing the sign and size of the response of relative deposits to macro/fiscal variables) on measures of aggregate euro area fiscal and macro risk. The independent variables in equation (2) include the first lag of the first principle component of spreads (approximating fiscal risk) and the first lag of the orthogonalized first principle components of relative ESI indexes and HICP inflation rates (approximating macro risk). We also include two intercept dummies capturing the effects of OMT and EBU on the link between bank deposits and their macro/fiscal determinants.

Table 1 presents the results of the equations modelling the TVP coefficients estimated by our benchmark model, presented in Figures 2, 3 and 4. Panels A, B and C respectively report results for the full, core and periphery panels. Column (1) models the estimated coefficients on fiscal risk only; column (2) adds the two measures of macro risk; finally, column (3) adds the two intercept dummies capturing the effects of OMT and EBU.

Consistent with our expectations, in most cases fiscal risk takes a negative and statistically significant coefficient. Nevertheless, fiscal risk alone has limited explanatory power, especially in periphery countries. The addition of macro risk, captured by relative ESI index and relative inflation in column (2), improves explanatory power, particularly in the periphery. In most cases, and again consistent with our expectations, the orthogonalized first principle component of the relative ESI index takes a positive and statistically significant sign. The role of relative inflation is less prominent, as its orthogonalized first principal component is statistically significant only in a small number of equations. In the case of core countries, the sign of the two statistically significant inflation terms is negative, consistent with the redenomination risk effect discussed above. In periphery countries, the evidence is mixed, as we obtain one negative and one positive statistically significant relative inflation term.

The results reported in Table 1 suggest that in core countries the announcement of OMT in July 2012 did not cause any positive direct effect on deposits, additional to the indirect, beneficial effects OMT has caused on fiscal and macroeconomic risk (see Altavilla et al. 2014; Delatte et al, 2017; Afonso et al, 2018). By contrast, for the equation modelling the coefficient of relative ESI coefficient for the core panel, the OMT dummy is negative and significant. Given existing empirical evidence suggesting that depositors' behaviour in our reference country, Germany, has not changed in recent years (see Bundesbank, 2015), a negative and significant OMT value indicates the existence of the substitution and portfolio reallocation effects of expansionary fiscal policy discussed in section 3.2. above. A negative and significant OMT sign is also recorded in the periphery group for the equation modelling the TVP coefficient of relative inflation. On the other hand, for the periphery group the OMT dummy has a positive and significant effect on the relative ESI coefficient, rendering its overall effect on periphery deposits unclear. Finally, Table 1 suggests that the introduction of EBU in

November 2014 has caused a positive, significant effect on relative deposits in the core countries. By contrast, no such EBU effect is found for periphery countries.

We have tested the robustness of the findings reported in Table 1 by modelling the TVP coefficients obtained by the robustness tests presented in section 3.2 above. Table 2 presents the results of modelling the TVP coefficients obtained from the models excluding Greece from the full and periphery panels (panels A and B respectively). The results relating to the sign of spreads, relative ESI and OMT terms are very similar to those reported in Table 1. As far as relative inflation is concerned, excluding Greece from the analysis eliminates statistically significant negative signs, both for the full as well as the periphery panel.[22] Furthermore, it results into a negative, significant EBU term in the equation modelling the relative inflation TVP coefficient, consistent with the risk-aversion effect of EBU discussed in section 3.2 above.

Table 3 presents the results of estimating equation (2) for the TVP coefficients obtained from the models including Italy in the core group (panel A), excluding it from the periphery group (panel B). The results remain similar with those reported in Table 1. Including Italy in the core panel weakens the significance of the negative OMT effects estimated for the core group, increasing at the same time the number of statistically significant positive OMT coefficients in the periphery group, although, in line with the results reported in Table 1, the overall evidence for the OMT effect in periphery countries remains mixed. On the other hand, in line with the results reported in Table 1, Table 3 suggests a positive EBU deposits effect in the core group without any similar effect in the periphery.

Finally, we estimate equation (2) for the TVP coefficients obtained from the models adding in equation (1) relative log house price indexes as a proxy for wealth. Tables 4 and 5 respectively report the results for the models including and excluding Greece. Consistent with

[22] Given that a negative and significant sign for relative inflation is consistent with the existence of redenomination risk, this finding is quite intuitive as Greece is the country for which redenomination risk has been the highest among EMU members (see Afonso et al, 2018).

the results reported in Tables 1, 2 and 3, we obtain a negative relationship between TVP coefficients and the first principle components of spreads, and a positive relationship between the former and relative ESI indexes. As in previous cases, Tables 4 and 5 report a mixed picture for the sign of the relative inflation, although, as was the case in Table 2, excluding Greece from the analysis (Table 5) results in predominantly positive relative inflation terms.

With regards to the OMT dummy, in line with the findings reported in previous Tables, Table 4 reports negative statistically significant coefficients for core countries. It also reports a similar finding for periphery countries too, although excluding Greece from the analysis (Table 5) restores the mixed OMT evidence reported in Tables 1, 2 and 3. With regards to EBU, again in line with the findings reported in previous Tables, Table 4 confirms a strong positive effect for core countries. For periphery countries, unlike the results reported in Tables 1, 2 and 3, Table 4 reports a positive and statistically significant effect for two out of four modelled coefficients, namely those of relative ESI and relative inflation. Nevertheless, the positive EBU effect in periphery countries is less pronounced than in core countries, as it relates to two rather than three estimated EBU coefficients. Furthermore, in Table 5, where Greece is excluded from the analysis, the positive and significant EBU finding remains robust only for the equation modelling the TVP coefficient of relative ESI. In addition, Table 5 reports a negative significant EBU coefficient for the equation modelling the TVP coefficient of relative house price indexes, thus suggesting a mixed EBU effect in the periphery panel.

Overall, the empirical findings presented in this section support the hypothesis that the time variation in the relationship between relative deposits and its macro/fiscal determinants is driven by the level of macro/fiscal risk. Specifically, all reported equations, for all panels (full, core and periphery in different definitions) provide consistent evidence that higher fiscal risk weakens the link between relative deposits and macro/fiscal factors, thus impacting negatively on deposits. On the other hand, improving output conditions strengthen the link between

relative deposits and their fiscal/macro determinants, thus impacting positively on deposits. For relative inflation we obtain mixed results, although for the majority of estimated equations, especially for the models excluding Greece, we find that higher relative inflation strengthens the link between deposits and their macro/fiscal determinants.

Finally, the results reported in this section provide consistent evidence that in core countries the announcement of OMT in July 2012 has had a negative impact on relative deposits (a finding consistent with the substitution effect discussed by Aizenman et al, 2016), while the introduction of the EBU in November 2014 has had a positive impact. On the other hand, for periphery countries our findings suggest a mixed OMT effect and a weaker, at best, EBU effect, as even under the best-case scenario, any positive EBU effect in the periphery panel is less pronounced than in the core. These findings suggest that the introduction of the OMT programme in July 2012 and EBU in its current incomplete form in November 2014 have not had a beneficial effect in periphery banking systems strong enough to reduce the financial fragmentation observed in the field of private bank deposits observed between core and periphery banking systems during the crisis years.

6. Summary and concluding remarks

This paper investigated euro area financial fragmentation in private bank deposits. Motivated by previous literature linking the behaviour of aggregate bank deposits to macroeconomic and fiscal risk, we tested three distinct hypotheses: First, private bank deposits relative to Germany are determined by macro/fiscal risk factors. Second, the relationship between relative deposits and macro/fiscal risk is time-varying. Third, this time variation is driven by the level of macro/fiscal risk.

We used a panel of ten eurozone countries and monthly data over January 1999 - June 2017. We presented findings for the full panel and separate core and periphery panels. We used a

two-stage econometric methodology. The first stage estimated a time-varying parameter (TVP) model where relative deposits were modelled on national macro/fiscal risk. This allowed us to test the significance of macro/fiscal factors in the determination of relative deposits and capture time variation in this relationship. The second stage modelled the TVP coefficients estimated in the first stage on measures of EMU-wide macro/fiscal risk. This allowed us to test whether time variation in the relationship between relative deposits and macro/fiscal risk is driven by the level of macro/fiscal risk. Finally, we included two dummy variables capturing the likely impact of the announcement of the Outright Transactions Programme (OMT) in July 2012 and the introduction of the European Banking Union (EBU) in November 2014.

Our main empirical findings can be summarised as follows: First, aggregate bank deposits in the euro area relative to Germany are determined by macro/fiscal factors. Second, there is substantial time variation in this relationship. Third, time variation is driven by the level of macro/fiscal risk. These findings apply to all investigated panels, full, core and periphery. On the other hand, the core and periphery groups are found to differ in one significant aspect: For periphery countries we find evidence of a significant negative time effect on deposits during the crisis years which is not present in core countries, goes beyond the reduction in deposits explained by increases in macro/fiscal risk, and persists until the end of our sample period. Placed in the context of previous literature on the size of financial intermediation and the legacy of banking crises this finding indicates a problem of trust in periphery banking systems that has not been mitigated by the introduction of OMT and EBU in its current incomplete form. This inference is backed by the results of recent survey data suggesting that lack of trust in banking institutions is higher among periphery EMU member countries (see Crabtree, 2013).

Our analysis has implications relating to the European Deposit Insurance Scheme (EDIS), endorsed by European authorities as the third pillar necessary for the completion of the EBU (see European Commission, 2015d). EDIS remains a controversial topic, with arguments put

forward both against as well as in favour of its introduction (see Schuknecht, 2016; and Véron, 2016 respectively). Among other potential advantages, it has been argued that EDIS will increase the resilience of national banking systems and help reduce banking fragmentation in the euro area (see European Commission, 2015c).

Our findings provide tentative support in favour of this argument. Reduced trust in periphery banking systems maintains an elevated, periphery-specific probability of self-fulfilling bank failures in the event of a future adverse shock, as predicted by the Diamond and Dybvig (1983) model. Our empirical findings imply that lower fiscal/macro risk will reduce this risk through strengthening the link between bank deposits and macro/fiscal variables. They also imply, however, that improvement of macro/fiscal conditions does not guarantee a speedy restoration of trust in periphery banking systems. Deposits in periphery countries enjoy very similar level of national regulatory protection with deposits in core EMU countries. In practice, however, the credibility of this protection is undermined by the heavier fiscal legacy of the crisis years in periphery countries, reflected in higher public debt to GDP ratios, as well as weaker bank balance sheets, reflected in higher ratios of non-performing bank exposures. Reduction in fiscal/macro risk will take, on its own, a significant period of time to restore parity between periphery and core countries in these key areas. During this prolonged transition period, the persistent deficit of trust which continues to characterise periphery banking systems will render periphery banking systems vulnerable to a new crisis, triggered by an adverse economic shock (internal or external).

By offering a deposits' guarantee scheme at the union level, EDIS can disconnect national deposits guarantee schemes from national fiscal/banking fundamentals, thereby increasing depositors trust and limiting intra-EMU banking fragmentation. Indeed, recent survey data reveals that the majority of respondents in periphery and core countries believe that a deposits' guarantee scheme would be more effective if offered at the union rather than at national level

(European Parliament, 2013). Overall, the combination of: (a) further reduction in macro/fiscal risk through continued fiscal and structural reforms; (b) the strengthening of the pre-emptive and corrective arms of the EMU banking supervision/regulation framework introduced through the single supervision and resolution mechanisms; and (c) completion of the EBU through the introduction of EDIS, can result in a superior mix of risk-sharing and risk-reduction, able to achieve the twin objectives of reducing EMU banking fragmentation and increasing the resilience of national EBU banking system to future shocks.

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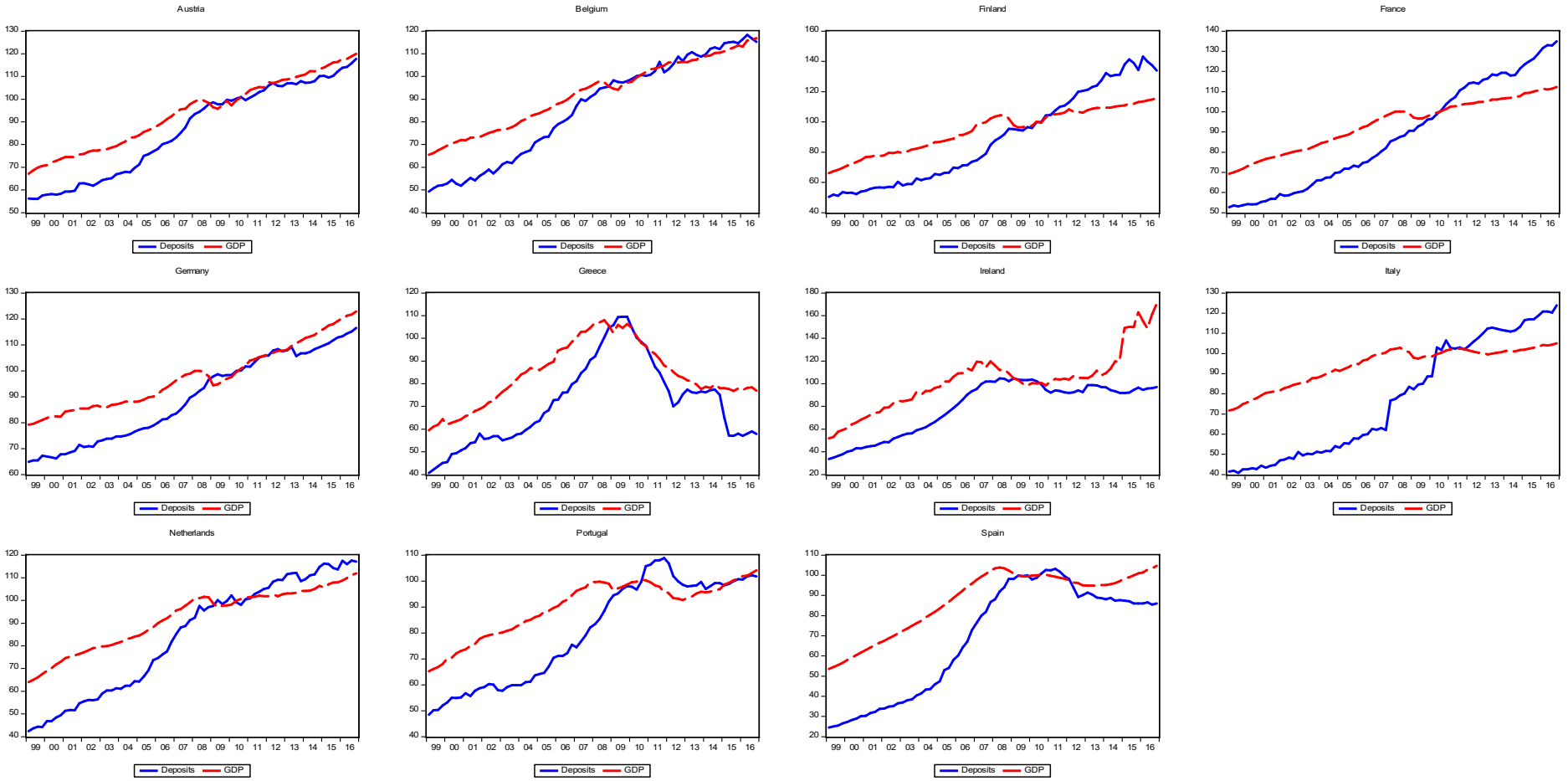
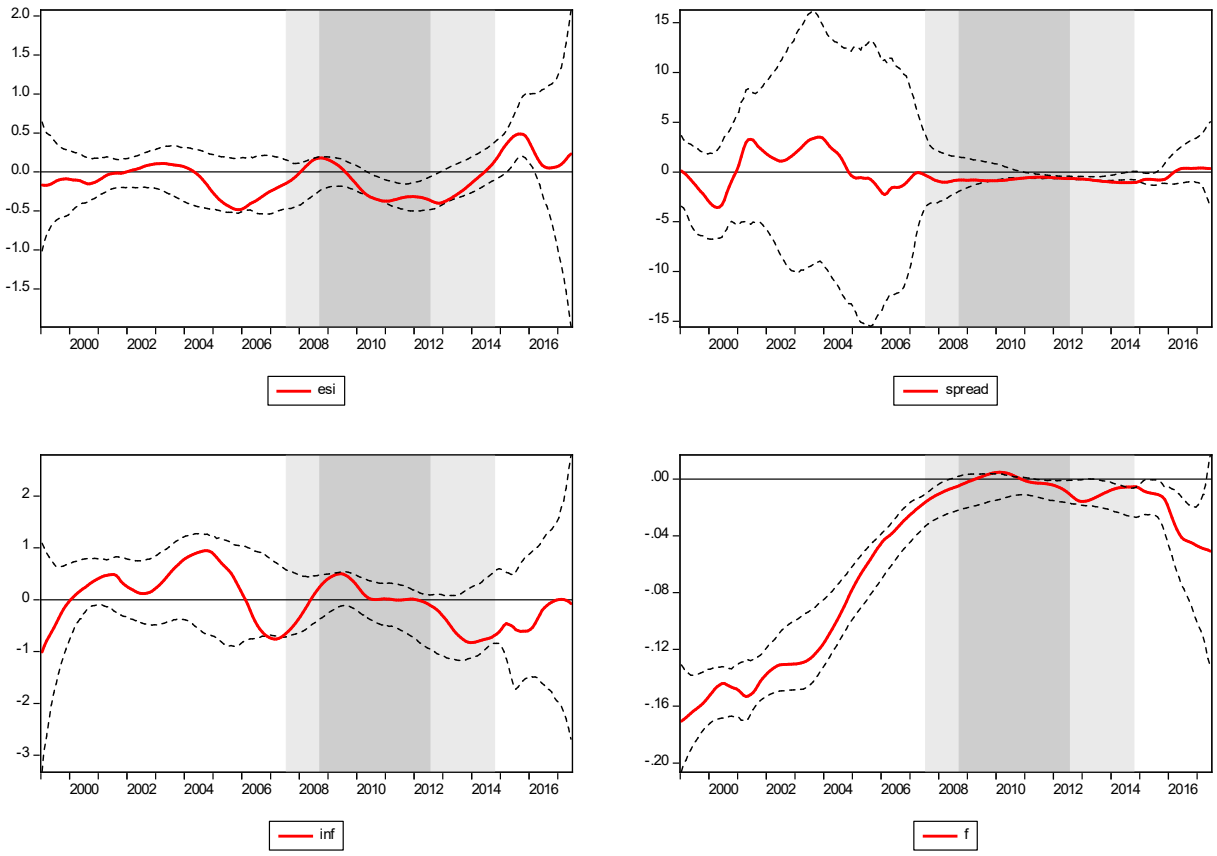
Figure 1: Private bank deposits and real GDP volume in euro area countries (index numbers)



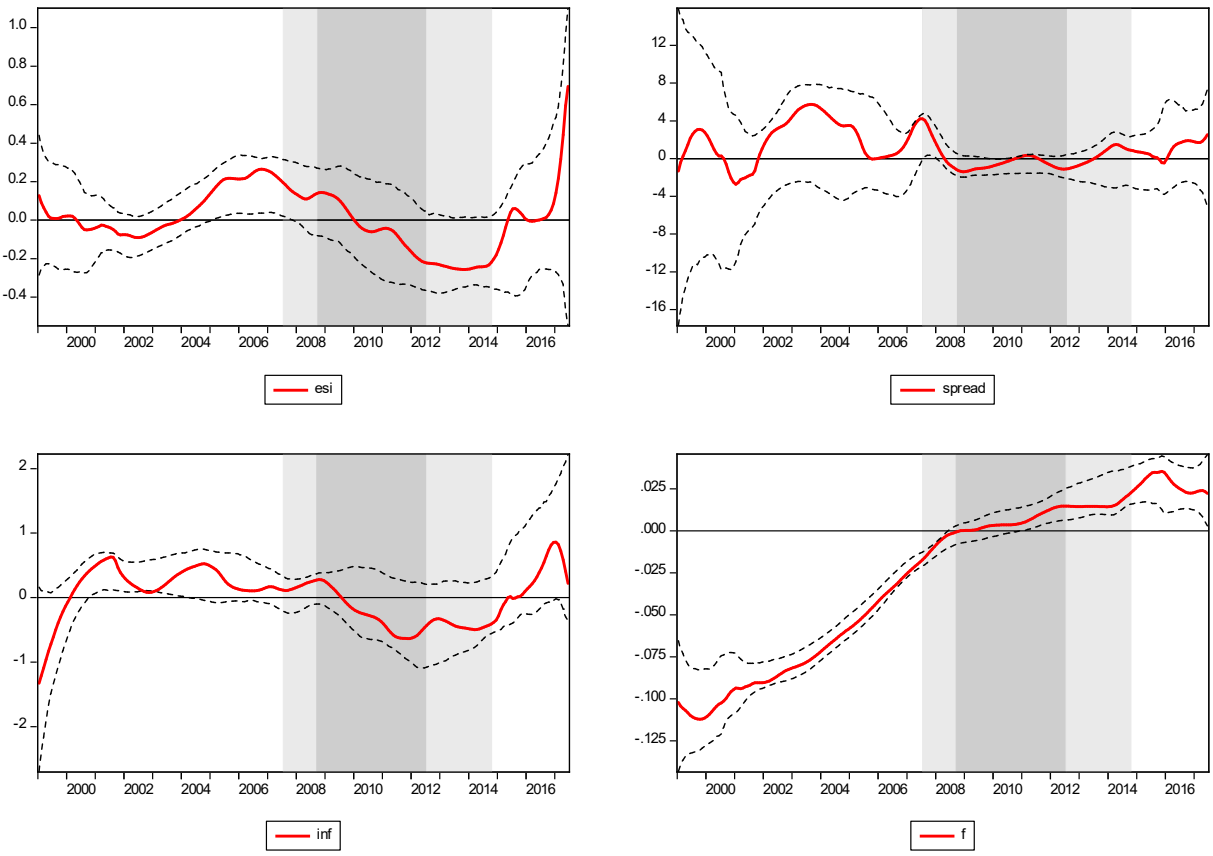
Note: Private bank deposits are defined as outstanding amounts at the end of each month covering maturities of all types and all currency denominations, for deposits of households, non-financial corporations and other entities excluding central government and Monetary and Financial Institutions. Due to lack of monthly data for real GDP volume, the figure presents data in quarterly frequency. The data sources for private bank deposits and real GDP volumes are the European Central Bank and the IMF, International Financial Statistics databanks respectively.

Figure 2: Benchmark model, full panel



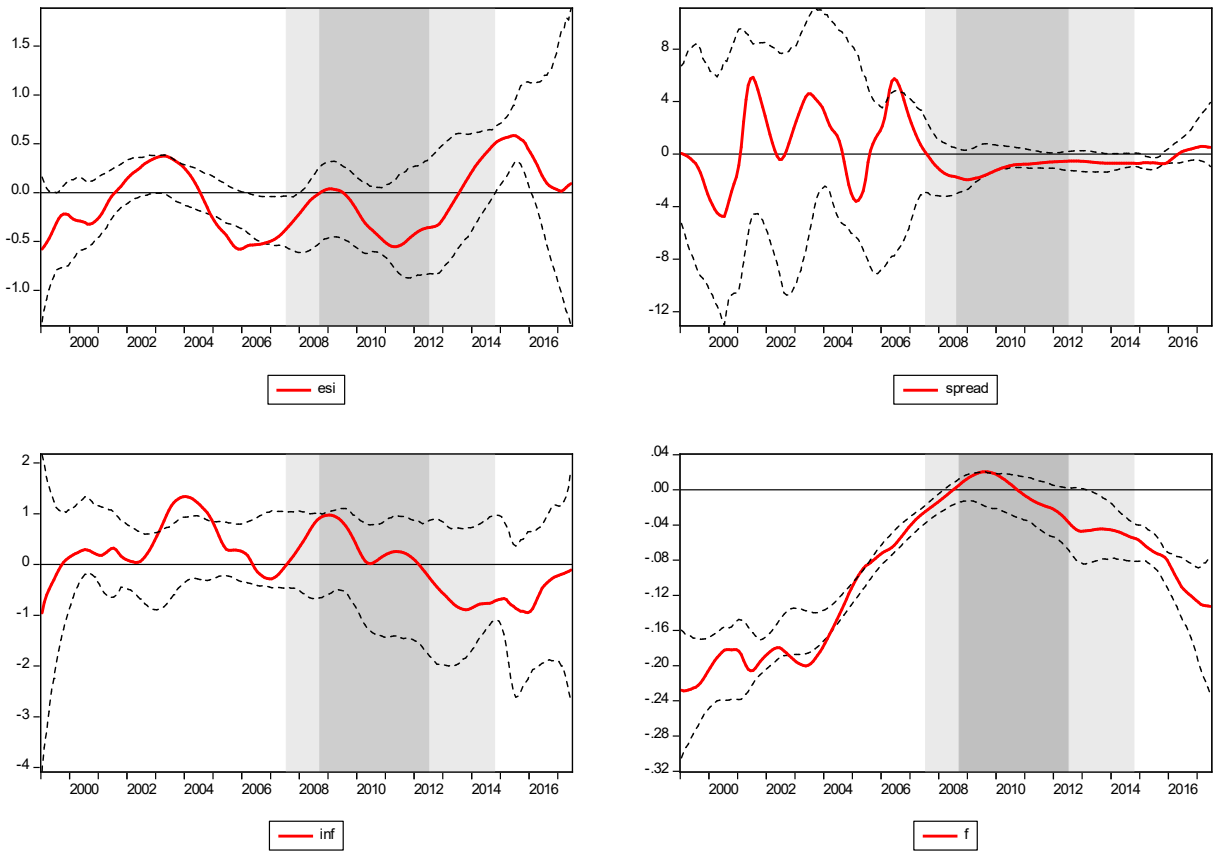
Note: The figure presents the coefficients obtained from the estimation of the time varying parameters (TVP) model given by equation (1) for the full panel over the period January 1999 - July 2017 (222 observations); and the corresponding 90% confidence intervals (dotted lines) calculated using the wild bootstrap method (1000 iterations). The estimation bandwidth parameter (h) is set to 0.15 and the bandwidth correction parameter (ε) to 0.08. The panel includes Austria, Belgium, Finland, France, Greece, Ireland, Italy, the Netherlands, Portugal and Spain. The dependent variable is the log-index of private deposits relative to Germany. The set of explanatory variables includes the log volume-index of the Economic Sentiment Indicator (*esi*) series against Germany; the 10-year government bond yield spread (*spread*) against Germany; and the year-to-year inflation rate calculated for the Harmonised Index of Consumer Prices relative to German (*inf*). The model also includes a trend function (f) capturing time-specific effects accounting for omitted variables having a common, over time, impact across the panel's cross sections. The light-shaded area covers the period July 2007 – October 2014; the dark-shaded area covers the period September 2008 – July 2012.

Figure 3: Benchmark model, core panel



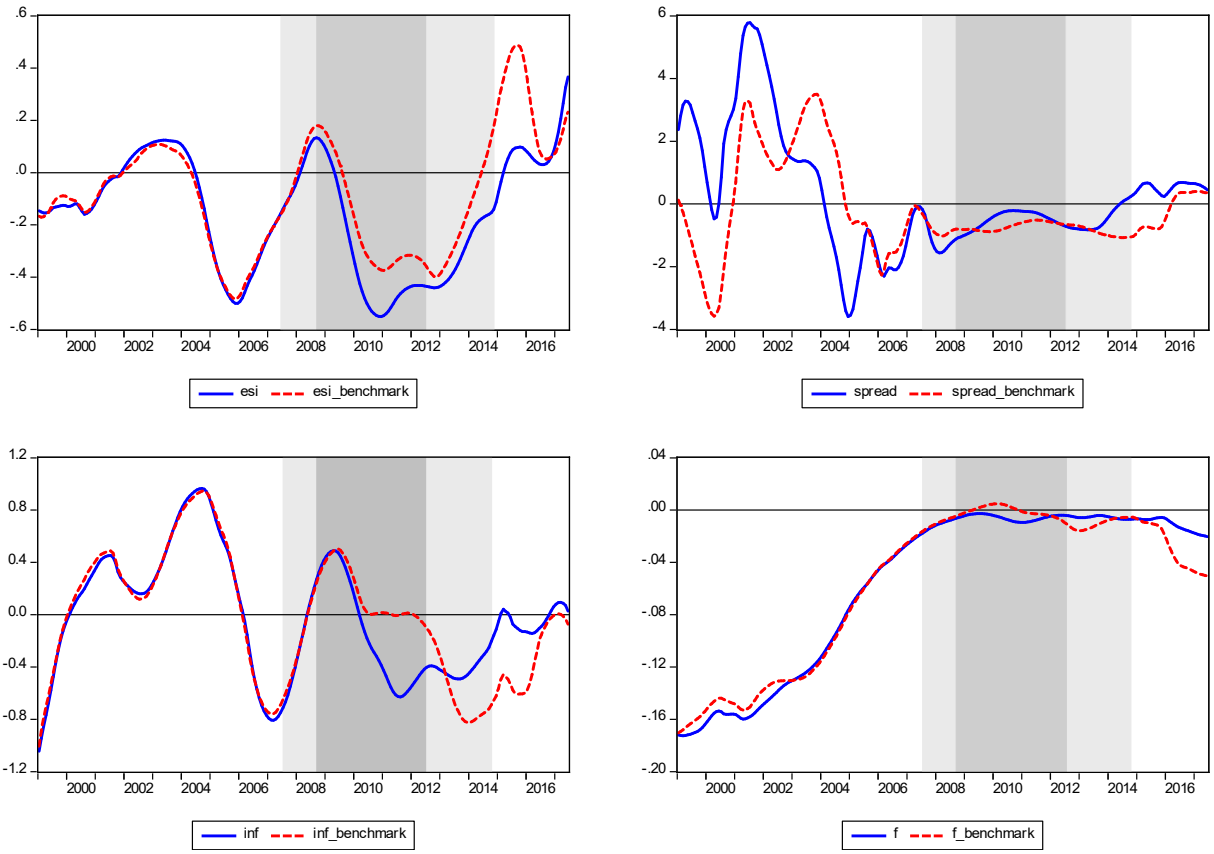
Note: The figure presents the coefficients obtained from the estimation of the time varying parameters (TVP) model given by equation (1) for the panel of core countries over the period January 1999 - July 2017 (222 observations); and the corresponding 90% confidence intervals (dotted lines) calculated using the wild bootstrap method (1000 iterations). The estimation bandwidth parameter (h) is set to 0.15 and the bandwidth correction parameter (ε) to 0.08. The panel includes Austria, Belgium, Finland, France and the Netherlands. The dependent variable is the log-index of private deposits relative to Germany. The set of explanatory variables includes the log volume-index of the Economic Sentiment Indicator (*esi*) series against Germany; the 10-year government bond yield spread (*spread*) against Germany; and the year-to-year inflation rate calculated for the Harmonised Index of Consumer Prices relative to German (*inf*). The model also includes a trend function (f) capturing time-specific effects accounting for omitted variables having a common, over time, impact across the panel's cross sections. The light-shaded area covers the period July 2007 – October 2014; the dark-shaded area covers the period September 2008 – July 2012.

Figure 4: Benchmark model, periphery panel



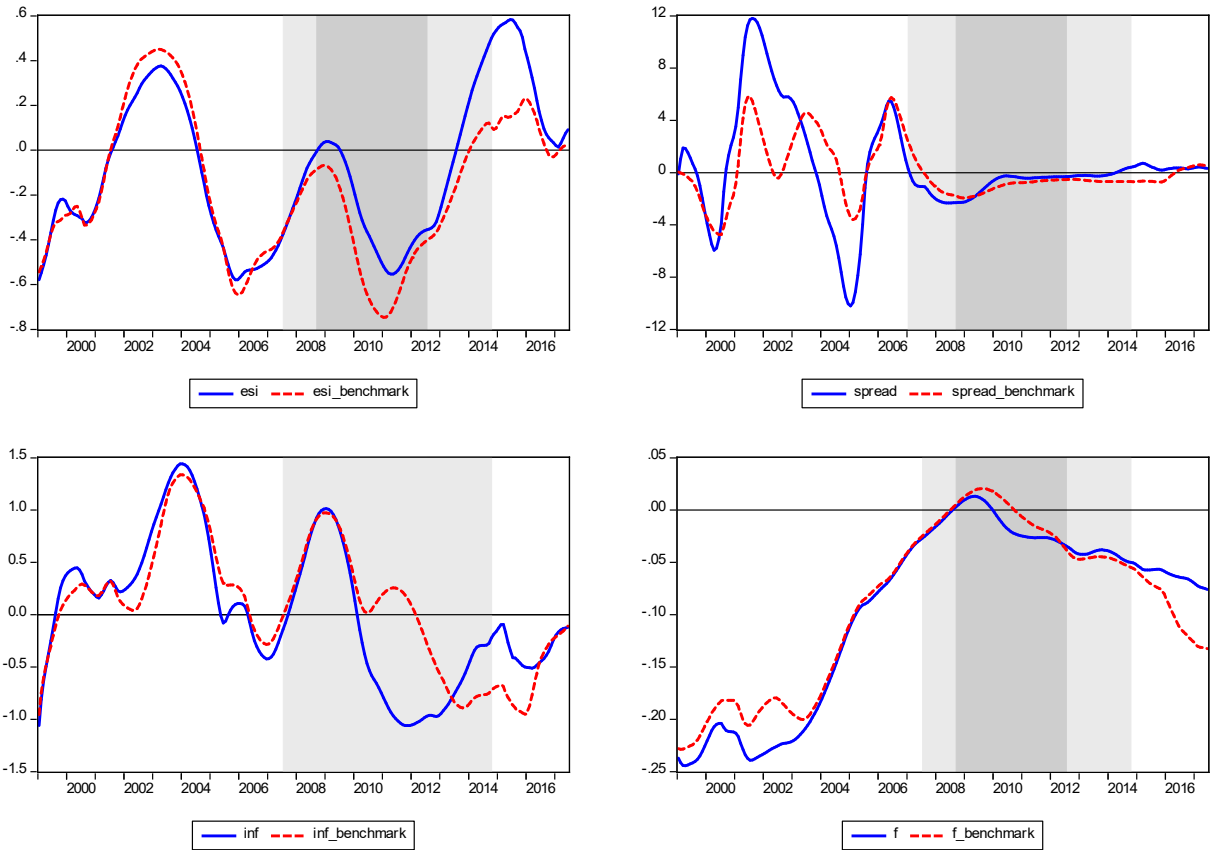
Note: The figure presents the coefficients obtained from the estimation of the time varying parameters (TVP) model given by equation (1) for the panel of periphery countries over the period January 1999 - July 2017 (222 observations); and the corresponding 90% confidence intervals (dotted lines) calculated using the wild bootstrap method (1000 iterations). The estimation bandwidth parameter (h) is set to 0.15 and the bandwidth correction parameter (ε) to 0.08. The panel includes Greece, Ireland, Italy, Portugal and Spain. The dependent variable is the log-index of private deposits relative to Germany. The set of explanatory variables includes the log volume-index of the Economic Sentiment Indicator (*esi*) series against Germany; the 10-year government bond yield spread (*spread*) against Germany; and the year to year inflation rate calculated for the Harmonised Index of Consumer Prices relative to German (*inf*). The model also includes a trend function (f) capturing time-specific effects accounting for omitted variables having a common, over time, impact across the panel's cross sections. The light-shaded area covers the period July 2007 – October 2014; the dark-shaded area covers the period September 2008 – July 2012.

Figure 5: Model excluding Greece versus benchmark model – Full panel



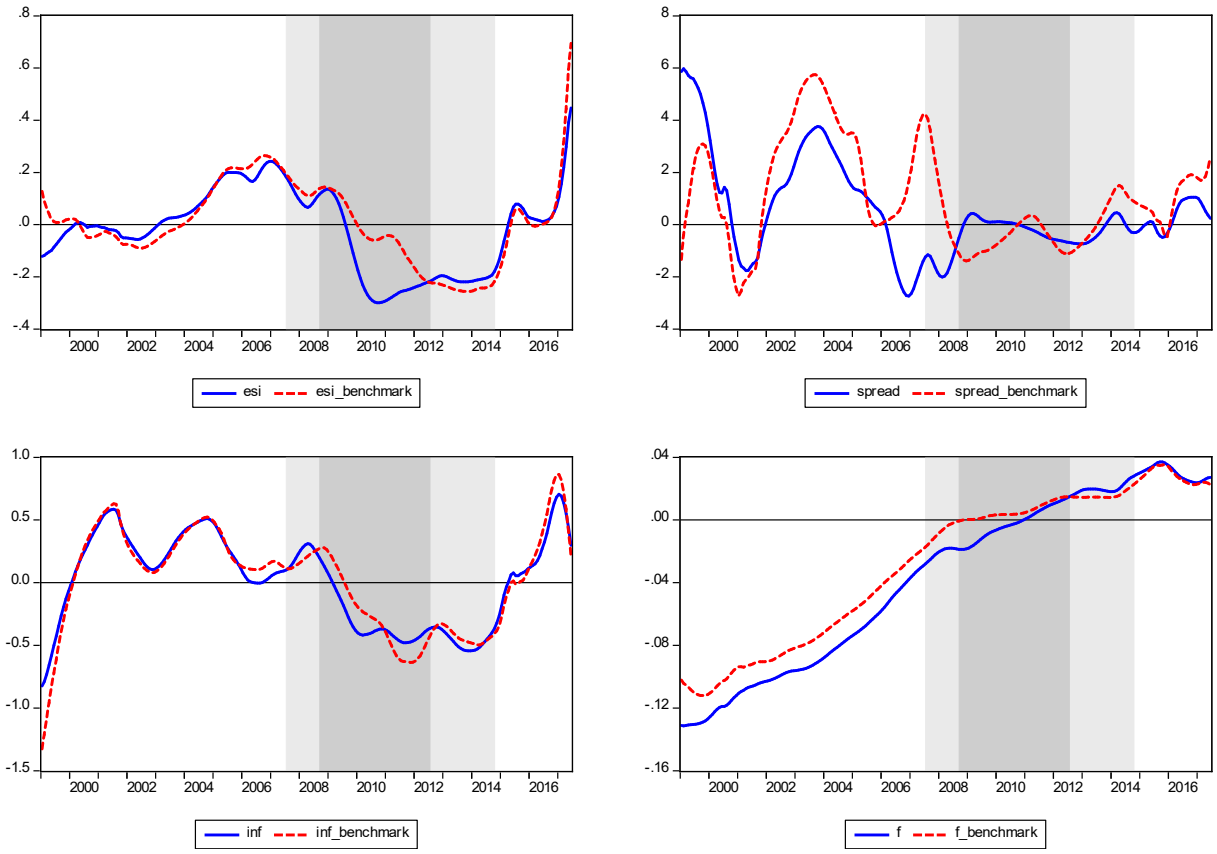
Note: The figure presents the coefficients obtained from the estimation of the time varying parameters (TVP) model given by equation (1) for the full panel excluding Greece over the period January 1999 - July 2017 (222 observations) against the TVP coefficients obtained from the benchmark model presented in Figure 2 (dotted lines). The estimation bandwidth parameter (h) is set to 0.15 and the bandwidth correction parameter (ε) to 0.08. The panel includes Austria, Belgium, Finland, France, Ireland, Italy, the Netherlands, Portugal and Spain. The dependent variable is the log-index of private deposits relative to Germany. The set of explanatory variables includes the log volume-index of the Economic Sentiment Indicator (*esi*) series against Germany; the 10-year government bond yield spread (*spread*) against Germany; and the year to year inflation rate calculated for the Harmonised Index of Consumer Prices relative to German (*inf*). The model also includes a trend function (f) capturing time-specific effects accounting for omitted variables having a common, over time, impact across the panel's cross sections. The light-shaded area covers the period July 2007 – October 2014; the dark-shaded area covers the period September 2008 – July 2012.

Figure 6: Model excluding Greece versus benchmark model – Periphery panel



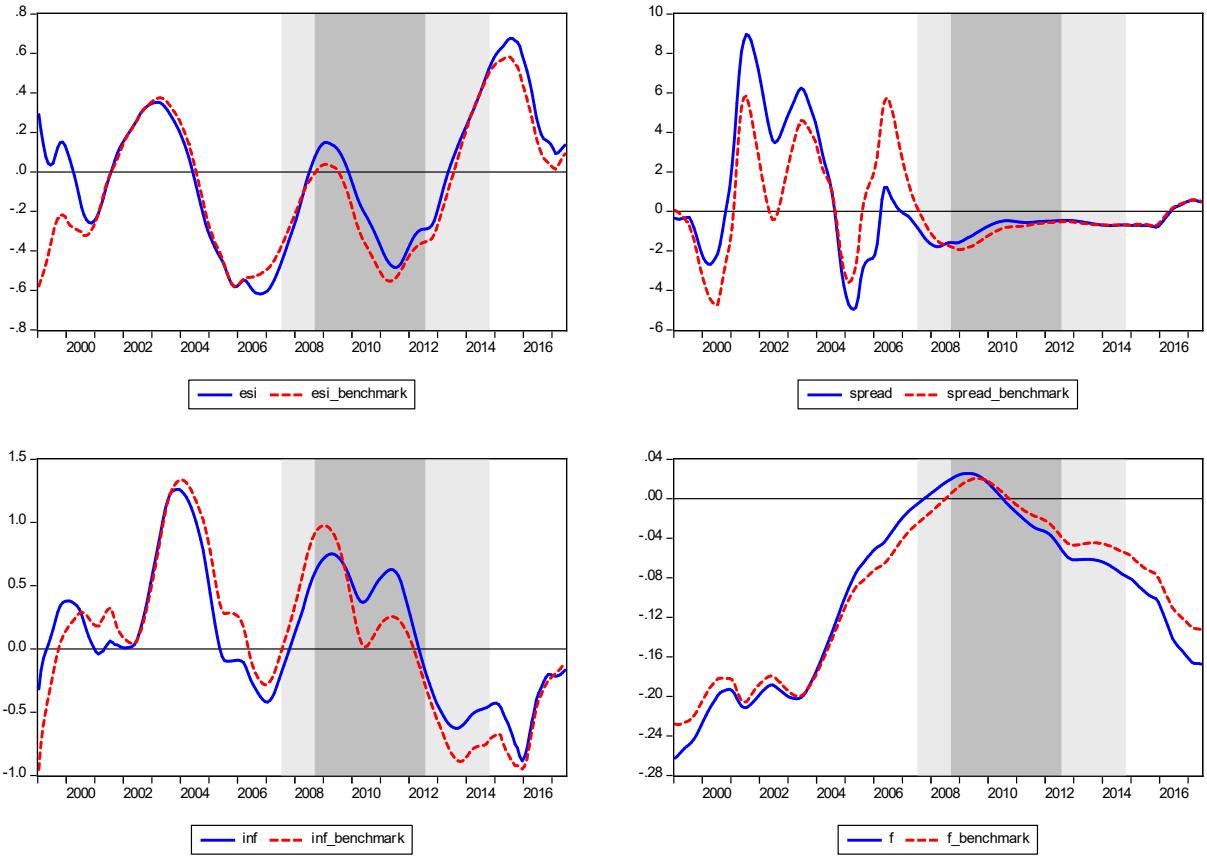
Note: The figure presents the coefficients obtained from the estimation of the time varying parameters (TVP) model given by equation (1) for the panel of periphery countries excluding Greece over the period January 1999 - July 2017 (222 observations) against the TVP coefficients obtained from the benchmark model presented in Figure 4 (dotted lines). The estimation bandwidth parameter (h) is set to 0.15 and the bandwidth correction parameter (ε) to 0.08. The panel includes Ireland, Italy, Portugal and Spain. The dependent variable is the log-index of private deposits relative to Germany. The set of explanatory variables includes the log volume-index of the Economic Sentiment Indicator (*esi*) series against Germany; the 10-year government bond yield spread (*spread*) against Germany; and the year to year inflation rate calculated for the Harmonised Index of Consumer Prices relative to German (*inf*). The model also includes a trend function (f) capturing time-specific effects accounting for omitted variables having a common, over time, impact across the panel's cross sections. The light-shaded area covers the period July 2007 – October 2014; the dark-shaded area covers the period September 2008 – July 2012.

Figure 7: Core panel including Italy versus benchmark model for core panel



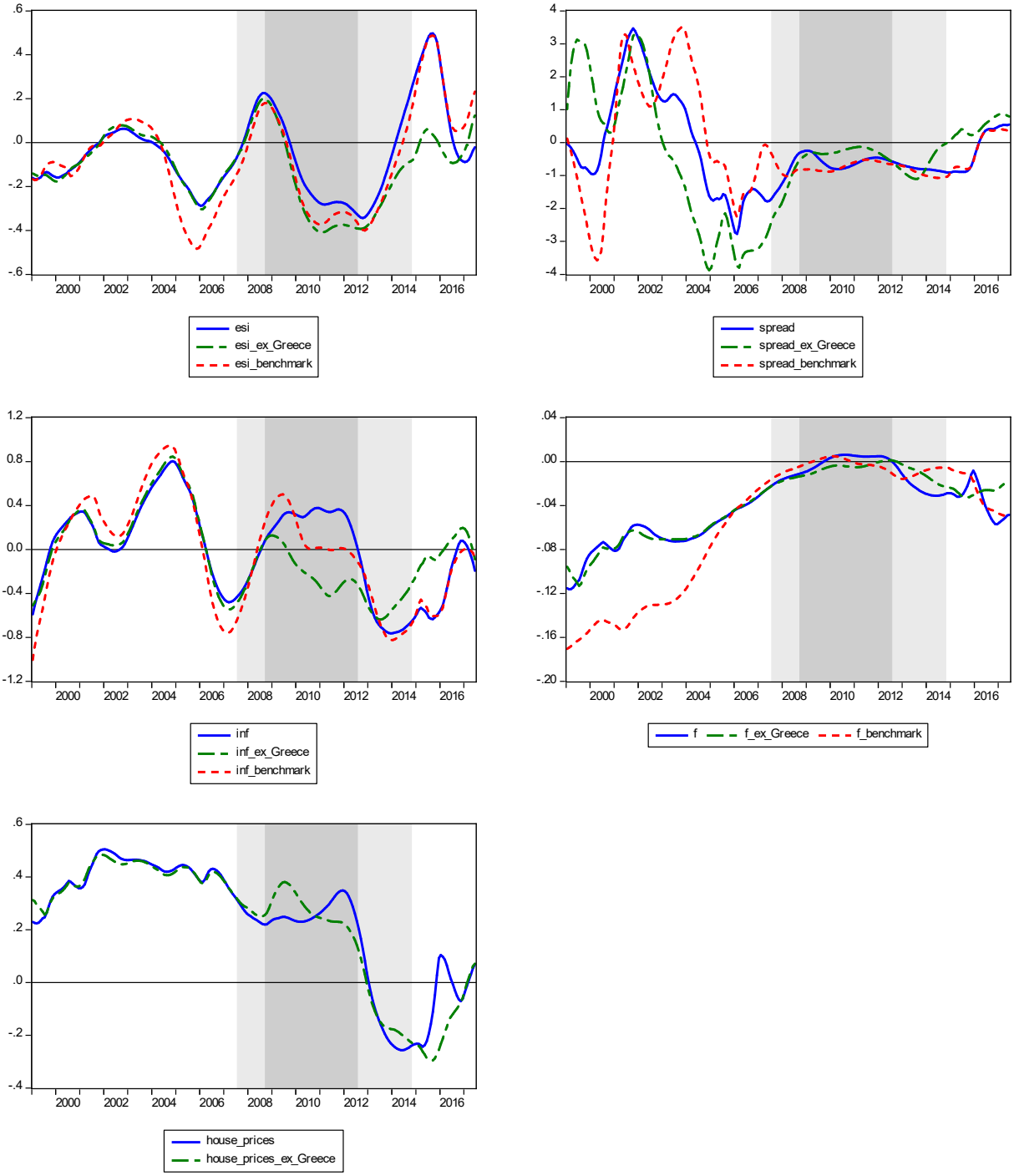
Note: The figure presents the coefficients obtained from the estimation of the time varying parameters (TVP) model given by equation (1) for the panel of core countries including Italy over the period January 1999 - July 2017 (222 observations) against the TVP coefficients obtained from the benchmark model estimated for core countries, presented in Figure 3 (dotted lines). The estimation bandwidth parameter (h) is set to 0.15 and the bandwidth correction parameter (ε) to 0.08. The panel includes Austria, Belgium, Finland, France, Italy and the Netherlands. The dependent variable is the log-index of private deposits relative to Germany. The set of explanatory variables includes the log volume-index of the Economic Sentiment Indicator (*esi*) series against Germany; the 10-year government bond yield spread (*spread*) against Germany; and the year to year inflation rate calculated for the Harmonised Index of Consumer Prices relative to German (*inf*). The model also includes a trend function (f) capturing time-specific effects accounting for omitted variables having a common, over time, impact across the panel's cross sections. The light-shaded area covers the period July 2007 – October 2014; the dark-shaded area covers the period September 2008 – July 2012.

Figure 8: Periphery panel excluding Italy versus benchmark model for periphery panel



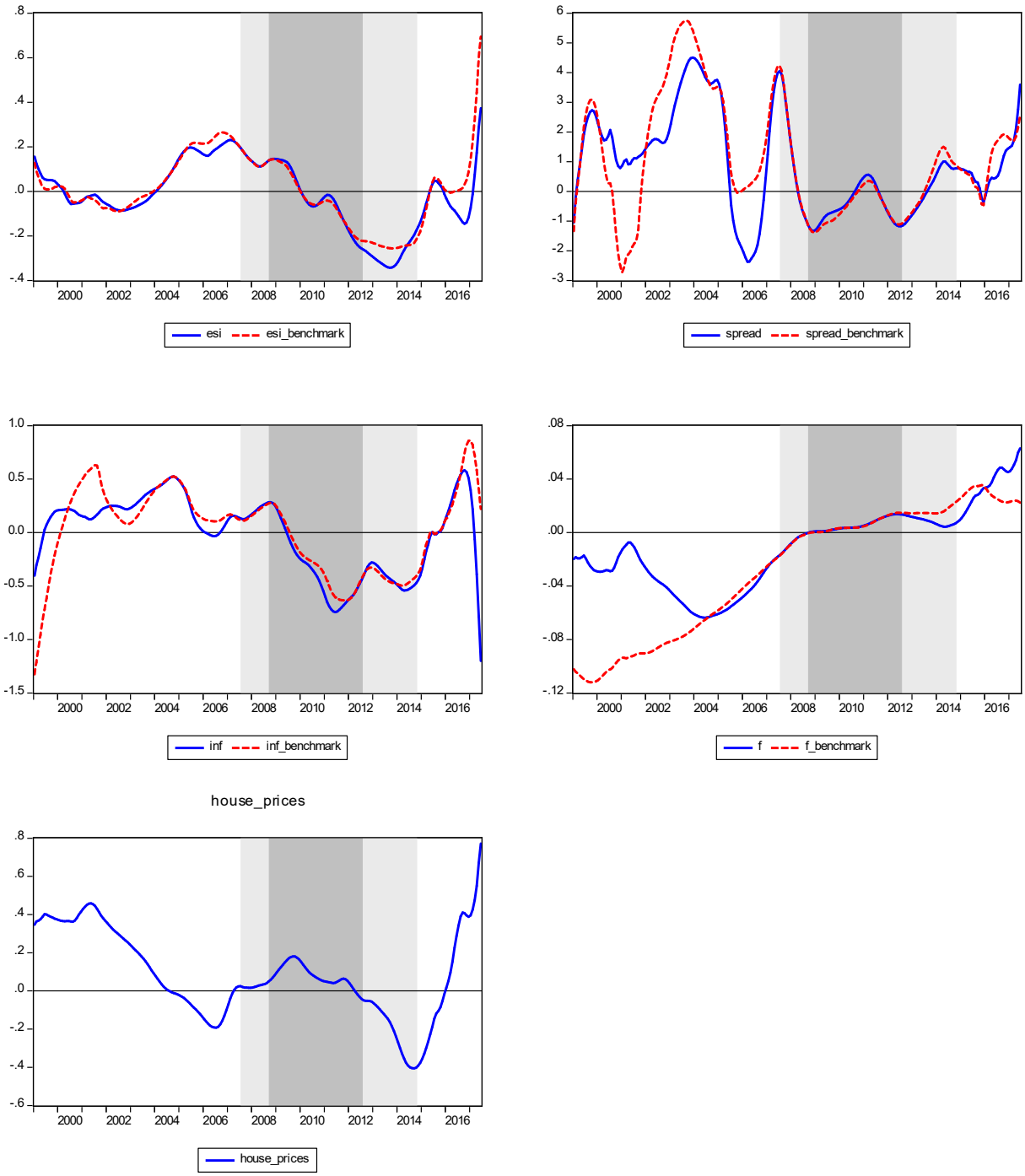
Note: The figure presents the coefficients obtained from the estimation of the time varying parameters (TVP) model given by equation (1) for the panel of periphery countries excluding Italy over the period January 1999 - July 2017 (222 observations) against the TVP coefficients obtained from the benchmark model estimated for periphery countries presented in Figure 4 (dotted lines). The estimation bandwidth parameter (h) is set to 0.15 and the bandwidth correction parameter (ε) to 0.08. The panel includes Greece, Ireland, Portugal and Spain. The dependent variable is the log-index of private deposits relative to Germany. The set of explanatory variables includes the log volume-index of the Economic Sentiment Indicator (*esi*) series against Germany; the 10-year government bond yield spread (*spread*) against Germany; and the year to year inflation rate calculated for the Harmonised Index of Consumer Prices relative to German (*inf*). The model also includes a trend function (*f*) capturing time-specific effects accounting for omitted variables having a common, over time, impact across the panel's cross sections. The light-shaded area covers the period July 2007 – October 2014; the dark-shaded area covers the period September 2008 – July 2012.

Figure 9: Adding log-house price differential against Germany (including and excluding Greece) versus benchmark model - Full panel



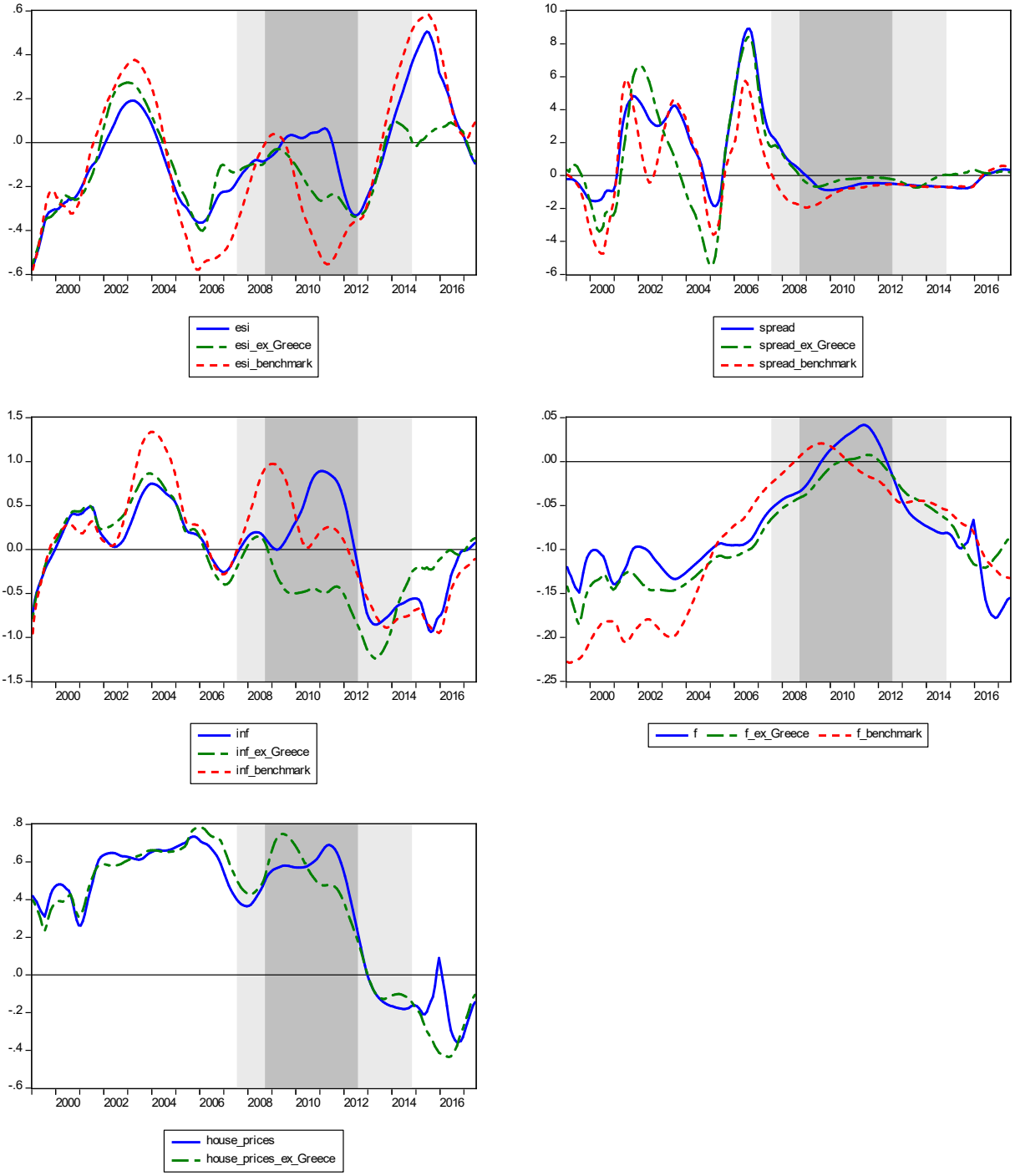
Note: The figure presents the coefficients obtained from the estimation of the time varying parameters (TVP) model given by equation (1) adding the log house price index differential against Germany, for the full panel (including and excluding Greece) over the period January 1999 - July 2017 (222 observations) against the TVP coefficients obtained from the benchmark model presented in Figure 2 (short dotted lines). The estimation bandwidth parameter (h) is set to 0.15 and the bandwidth correction parameter (ε) to 0.08. The panel includes Austria, Belgium, Finland, France, Greece, Ireland, Italy, the Netherlands, Portugal and Spain. The dependent variable is the log-index of private deposits relative to Germany. The set of explanatory variables includes the log volume-index of the Economic Sentiment Indicator (*esi*) series against Germany; the 10-year government bond yield spread (*spread*) against Germany; the inflation rate calculated for the Harmonised Index of Consumer Prices relative to German (*inf*); and the log volume-index of house prices against Germany (*house_prices*) The model also includes a trend function (f) capturing time-specific effects accounting for omitted variables having a common, over time, impact across the panel's cross sections. The light-shaded area covers the period July 2007 – October 2014; the dark-shaded area covers the period September 2008 – July 2012.

Figure 10: Adding log-house price differential against Germany versus benchmark model – Core panel



Note: The figure presents the coefficients obtained from the estimation of the time varying parameters (TVP) model given by equation (1) adding the log house price index differential against Germany, for the panel of core countries over the period January 1999 - July 2017 (222 observations) against the TVP coefficients obtained from the benchmark model presented in Figure 3 (dotted lines). The estimation bandwidth parameter (h) is set to 0.15 and the bandwidth correction parameter (ε) to 0.08. The panel includes Austria, Belgium, Finland, France and the Netherlands. The dependent variable is the log-index of private deposits relative to Germany. The set of explanatory variables includes the log volume-index of the Economic Sentiment Indicator (*esi*) series against Germany; the 10-year government bond yield spread (*spread*) against Germany; the year to year inflation rate calculated for the Harmonised Index of Consumer Prices relative to German (*inf*); and the log volume-index of house prices against Germany (*house_prices*) The model also includes a trend function (f) capturing time-specific effects accounting for omitted variables having a common, over time, impact across the panel's cross sections. The light-shaded area covers the period July 2007 – October 2014; the dark-shaded area covers the period September 2008 – July 2012.

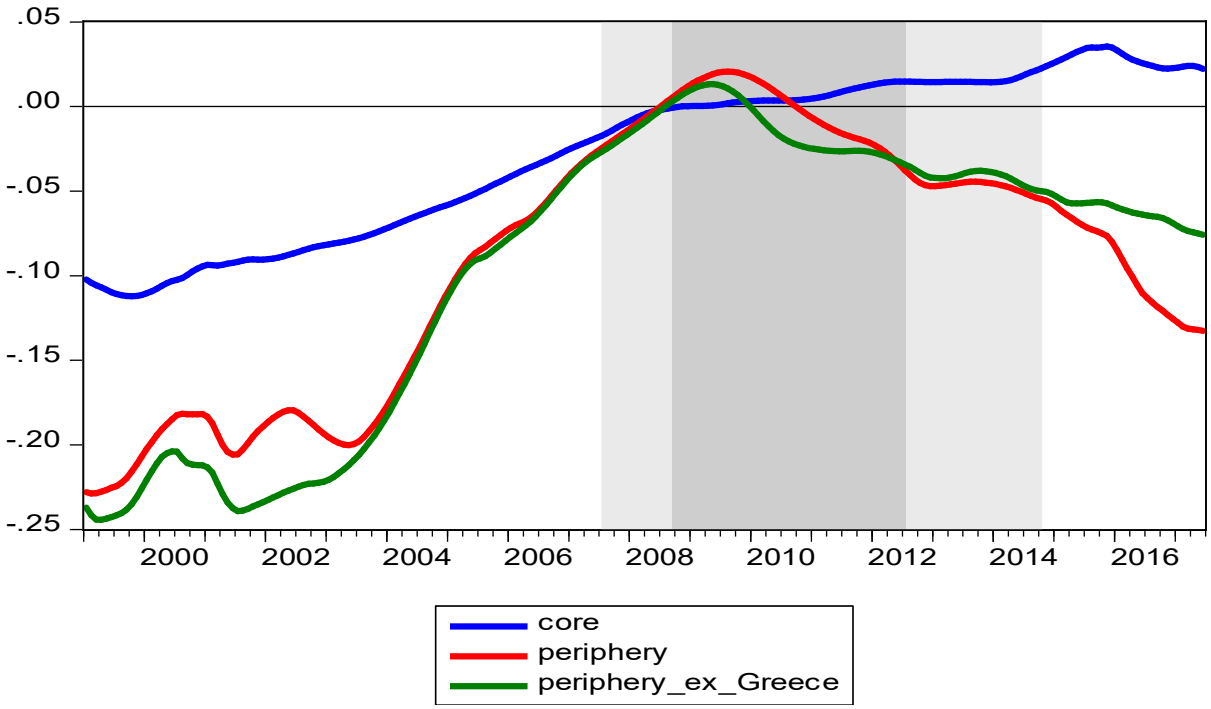
Figure 11: Adding log-house price differential against Germany (including and excluding Greece) versus benchmark model - Periphery panel



Note: The figure presents the coefficients obtained from the estimation of the time varying parameters (TVP) model given by equation (1) adding the log house price index differential against Germany, for the panel of periphery countries (including and excluding Greece) over the period January 1999 - July 2017 (222 observations) against the TVP coefficients obtained from the benchmark model presented in Figure 4 (short dotted lines). The estimation bandwidth parameter (h) is set to 0.15 and the bandwidth correction parameter (ε) to 0.08. The panel includes Greece, Ireland, Italy, Portugal and Spain. The dependent variable is the log-index of private deposits relative to Germany. The set of explanatory variables includes the log volume-index of the Economic Sentiment Indicator (*esi*) series against Germany; the 10-year government bond yield spread (*spread*) against Germany; the year to year inflation rate calculated for the Harmonised Index of Consumer Prices relative to German (*inf*); and the log volume-index of house prices against Germany (*house_prices*) The model also includes a trend function (f) capturing time-specific effects accounting for omitted variables having a common, over time, impact across the panel's cross sections. The light-shaded area covers the period July 2007 – October 2014; the dark-shaded area covers the period September 2008 – July 2012.

Figure 12: Estimated time effects, core and periphery countries (including and excluding Greece)

Panel A – Time effects estimated by benchmark model



Panel B: Time effects estimated by model adding log-house price differential against Germany

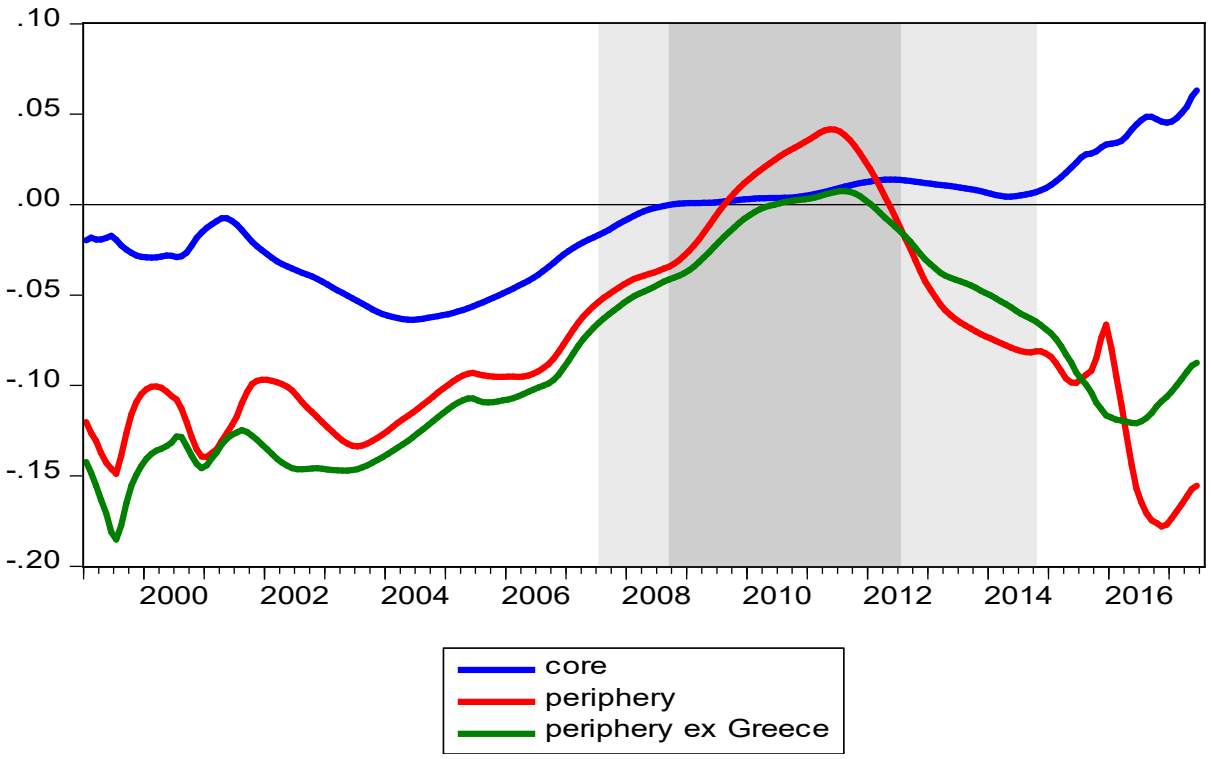


Table 1: Modelling TVP parameters obtained from the benchmark TVP model

Panel A: Full panel

		β_t^{esi}			β_t^{spr}			β_t^{inf}	
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
constant	-0.086*** (0.033)	-0.086** (0.033)	-0.170*** (0.014)	-0.220 (0.211)	-0.223 (0.190)	-0.452** (0.203)	-0.021 (0.070)	-0.022 (0.054)	0.073 (0.068)
spr_t	-0.016* (0.009)	-0.016* (0.009)	-0.023*** (0.006)	-0.106* (0.056)	-0.107** (0.047)	-0.140*** (0.050)	-0.037* (0.021)	-0.037** (0.016)	-0.014 (0.016)
esi_t		0.006 (0.018)	0.043*** (0.012)		0.322*** (0.065)	0.421*** (0.068)		0.177*** (0.036)	0.139*** (0.036)
inf_t		-0.015 (0.014)	0.016 (0.014)		0.177 (0.110)	0.261** (0.121)		0.051* (0.029)	0.016 (0.032)
OMT_t			0.094 (0.086)			0.624** (0.292)			-0.492*** (0.121)
EBU_t			0.396*** (0.094)			0.421 (0.262)			0.253** (0.112)
Adj.-R^2	0.037	0.042	0.483	0.044	0.193	0.233	0.043	0.395	0.466

Panel B: Core countries

		β_t^{esi}			β_t^{spr}			β_t^{inf}	
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
constant	0.008 (0.020)	0.009 (0.018)	0.029** (0.013)	1.050*** (0.240)	1.052*** (0.099)	0.835*** (0.312)	0.023 (0.049)	0.022 (0.046)	-0.067 (0.501)
spr_t	-0.037*** (0.009)	-0.037*** (0.008)	-0.026*** (0.008)	-0.518*** (0.103)	-0.518** (0.099)	-0.556*** (0.108)	-0.094*** (0.018)	-0.094** (0.013)	-0.096*** (0.012)
esi_t		0.020 (0.014)	0.008 (0.013)		0.192* (0.110)	0.346** (0.145)		0.089*** (0.034)	0.158*** (0.047)
inf_t		-0.030*** (0.010)	-0.037*** (0.008)		-0.220 (0.175)	-0.197 (0.173)		0.023 (0.023)	0.023 (0.022)
OMT_t			-0.231*** (0.086)			0.799 (0.543)			0.034 (0.117)
EBU_t			0.283*** (0.063)			0.016 (0.431)			0.554** (0.121)
Adj.-R^2	0.233	0.329	0.550	0.300	0.336	0.348	0.242	0.353	0.554

Panel C: Periphery countries

		β_t^{esi}			β_t^{spr}			β_t^{inf}	
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
constant	-0.087* (0.049	-0.087** (0.039)	-0.210*** (0.034)	0.031 (0.316)	0.028 (0.307)	-0.134 (0.351)	0.084 (0.082)	0.084 (0.073)	0.355*** (0.069)
spr_t	-0.021 (0.018)	-0.021 (0.015)	-0.055*** (0.012)	-0.218** (0.107)	-0.218** (0.099)	-0.267** (0.117)	-0.110*** (0.036)	-0.111*** (0.027)	-0.027 (0.024)
esi_t		0.149*** (0.028)	0.124*** (0.025)		0.291* (0.208)	0.261 (0.219)		0.035 (0.051)	0.083* (0.048)
inf_t		-0.075*** (0.024)	0.001 (0.025)		0.244 (0.161)	0.343 (0.233)		0.140*** (0.042)	-0.022 (0.041)
OMT_t			0.399*** (0.116)			0.602 (0.598)			-1.044*** (0.153)
EBU_t			0.114 (0.120)			0.016 (0.302)			0.062 (0.142)
Adj.-R^2	0.012	0.365	0.559	0.040	0.082	0.082	0.152	0.294	0.565

Note: This Table presents OLS estimates with heteroscedasticity and autocorrelation consistent standard errors (in parentheses) of the equations modelling the TVP coefficients obtained from the benchmark equation (1) over the period January 1999 – June 2017 July 2016 (221observations). *, **, *** indicate statistical significance at the 10%, 5% and 1% level, respectively. The dependent variable is, respectively, the time-varying panel coefficient obtained from the model stated above for the logarithm of the Economic Sentiment Indicators (ESI) relative to Germany, (β_t^{esi}), the 10-year government bond yield spread against Germany (β_t^{spr}), and the inflation rate of the Harmonised Index of Consumer Prices (HICP) relative to Germany (β_t^{inf}). The set of explanatory variables includes the first principle component of spreads (spr_t); the orthogonalized first principle component of relative ESI indexes (esi_t); the first principle component of relative HICP inflation rates relative to Germany (inf_t), a dummy variable taking the value of zero until July 2012, unity thereafter (OMT_t); and a dummy variable taking the value of zero until October 2014, unity thereafter (EBU_t) The full panel (Panel A) includes Austria, Belgium, Finland, France, Greece, Ireland, Italy, the Netherlands, Portugal and Spain. The panel of core countries (Panel B) includes Austria, Belgium, Finland, France and the Netherlands. The panel of periphery countries (Panel C) includes Greece, Ireland, Italy, Portugal and Spain.

Table 2: Modelling TVP parameters obtained from the benchmark TVP model excluding Greece

Panel A: Full panel

		β_t^{esi}			β_t^{spr}			β_t^{inf}	
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
constant	-0.153*** (0.030)	-0.153*** (0.030)	-0.224*** (0.032)	0.223 (0.276)	0.217 (0.241)	-0.088 (0.260)	-0.019 (0.061)	-0.020 (0.051)	-0.049 (0.068)
spr_t	-0.031*** (0.009)	-0.031*** (0.009)	-0.037*** (0.007)	-0.090 (0.068)	-0.090 (0.065)	-0.126** (0.056)	-0.067*** (0.020)	-0.067*** (0.017)	-0.068*** (0.016)
esi_t		0.032** (0.014)	0.065*** (0.014)		0.188 (0.146)	0.330** (0.155)		0.154*** (0.030)	0.167*** (0.038)
inf_t		0.006 (0.014)	0.029 (0.014)		0.486*** (0.101)	0.261** (0.121)		-0.009 (0.029)	0.001 (0.032)
OMT_t			0.101 (0.071)			0.666 (0.518)			0.012 (0.100)
EBU_t			0.299*** (0.064)			0.871* (0.458)			0.182*** (0.063)
Adj.-R^2	0.146	0.187	0.497	0.012	0.219	0.277	0.157	0.408	0.422

Panel B: Periphery countries

		β_t^{esi}			β_t^{spr}			β_t^{inf}	
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
constant	-0.163*** (0.046)	-0.163*** (0.037)	-0.264*** (0.037)	0.360 (0.571)	0.355 (0.533)	0.028 (0.776)	0.018 (0.069)	0.018 (0.065)	0.123 (0.079)
spr_t	-0.052*** (0.018)	-0.052*** (0.015)	-0.084*** (0.012)	-0.191 (0.204)	-0.192 (0.206)	-0.299* (0.160)	-0.244*** (0.027)	-0.244*** (0.021)	-0.220*** (0.024)
esi_t		0.184*** (0.030)	0.153*** (0.029)		1.015** (0.477)	0.920 (0.582)		0.134** (0.059)	0.177*** (0.064)
inf_t		-0.001 (0.022)	0.048* (0.025)		0.601*** (0.202)	0.779*** (0.307)		0.054 (0.036)	-0.010 (0.045)
OMT_t			0.383*** (0.088)			1.290 (0.872)			-0.262** (0.114)
EBU_t			-0.009 (0.073)			-0.132 (0.823)			-0.247*** (0.094)
Adj.-R^2	0.090	0.401	0.550	0.00	0.120	0.123	0.496	0.548	0.593

Note: This Table presents OLS estimates with heteroscedasticity and autocorrelation consistent standard errors (in parentheses) of the equations modelling the TVP coefficients obtained from the benchmark equation (1) excluding Greece from the analysis over the period January 1999 – June 2017 July 2016 (221observations). *, **, *** indicate statistical significance at the 10%, 5% and 1% level, respectively. The dependent variable is, respectively, the time-varying panel coefficient obtained from the model stated above for the logarithm of the Economic Sentiment Indicators (ESI) relative to Germany, (β_t^{esi}), the 10-year government bond yield spread against Germany (β_t^{spr}), and the inflation rate of the Harmonised Index of Consumer Prices (HICP) relative to Germany (β_t^{inf}). The set of explanatory variables includes the first principle component of spreads (spr_t); the orthogonalized first principle component of relative ESI indexes (esi_t); the first principle component of relative HICP inflation rates relative to Germany (inf_t), a dummy variable taking the value of zero until July 2012, unity thereafter (OMT_t); and a dummy variable taking the value of zero until October 2014, unity thereafter (EBU_t) The full panel (Panel A) includes Austria, Belgium, Finland, France, Ireland, Italy, the Netherlands, Portugal and Spain. The panel of periphery countries (Panel B) includes Ireland, Italy, Portugal and Spain.

Table 3: Modelling TVP parameters obtained from the benchmark TVP model including Italy in the core panel

Panel A: Core countries

		β_t^{esi}			β_t^{spr}			β_t^{inf}	
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
constant	-0.018 (0.018)	-0.017 (0.016)	-0.028 (0.018)	0.457* (0.250)	0.454* (0.238)	0.448 (0.370)	0.014 (0.043)	0.014 (0.040)	-0.045 (0.041)
spr_t	-0.042** (0.008)	-0.042*** (0.006)	-0.039*** (0.006)	-0.197** (0.084)	-0.197* (0.076)	-0.196*** (0.067)	-0.089*** (0.014)	-0.089*** (0.010)	-0.087*** (0.010)
esi_t		0.023** (0.011)	0.031** (0.014)		0.054 (0.130)	0.059 (0.218)		0.076*** (0.025)	0.116*** (0.031)
inf_t		-0.030*** (0.008)	-0.028** (0.007)		0.337** (0.145)	0.338 (0.138)		0.001 (0.023)	0.009 (0.019)
OMT_t			-0.071* (0.039)			-0.041 (0.640)			-0.070 (0.082)
EBU_t			0.205*** (0.040)			0.116 (0.395)			0.535*** (0.100)
Adj.-R^2	0.357	0.473	0.587	0.060	0.131	0.128	0.308	0.407	0.593

Panel B: Periphery countries

		β_t^{esi}			β_t^{spr}			β_t^{inf}	
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
constant	-0.027 (0.019)	-0.027 (0.041)	-0.143*** (0.042)	0.269 (0.401)	0.261 (0.337)	-0.059 (0.351)	0.107 (0.075)	0.106 (0.069)	0.344*** (0.072)
spr_t	-0.019 (0.021)	-0.019 (0.020)	-0.049*** (0.013)	-0.272* (0.148)	-0.273** (0.133)	-0.381*** (0.110)	-0.056 (0.036)	-0.056 (0.029)	0.020 (0.031)
esi_t		0.160*** (0.036)	0.122*** (0.032)		0.949*** (0.271)	0.859*** (0.307)		-0.019 (0.052)	0.051 (0.054)
inf_t		-0.081*** (0.024)	-0.004 (0.028)		0.759*** (0.167)	0.969*** (0.233)		0.140*** (0.045)	-0.017 (0.043)
OMT_t			0.328*** (0.112)			1.355* (0.731)			-0.914*** (0.141)
EBU_t			0.188 (0.116)			-0.298 (0.519)			0.047 (0.104)
Adj.-R^2	0.007	0.332	0.514	0.031	0.298	0.311	0.039	0.188	0.479

Note: This Table presents OLS estimates with heteroscedasticity and autocorrelation consistent standard errors (in parentheses) of the equations modelling the TVP coefficients obtained from the benchmark equation (1) including Italy in the core rather than the periphery panel, over the period January 1999 – June 2017 July 2016 (221observations). *, **, *** indicate statistical significance at the 10%, 5% and 1% level, respectively. The dependent variable is, respectively, the time-varying panel coefficient obtained from the model stated above for the logarithm of the Economic Sentiment Indicators (ESI) relative to Germany, (β_t^{esi}), the 10-year government bond yield spread against Germany (β_t^{spr}), and the inflation rate of the Harmonised Index of Consumer Prices (HICP) relative to Germany (β_t^{inf}). The set of explanatory variables includes the first principle component of spreads (spr_t); the orthogonalized first principle component of relative ESI indexes (esi_t); the first principle component of relative HICP inflation rates relative to Germany (inf_t), a dummy variable taking the value of zero until July 2012, unity thereafter (OMT_t); and a dummy variable taking the value of zero until October 2014, unity thereafter (EBU_t) The panel of core countries (Panel A) includes Austria, Belgium, Finland, France, Italy and the Netherlands. The panel of periphery countries (Panel B) includes Greece, Ireland, Portugal and Spain.

Table 4: Modelling TVP parameters obtained from the benchmark TVP model adding log-house price differential

Panel A: Full panel

		β_t^{esi}			β_t^{spr}			β_t^{inf}			β_t^{hp}	
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
constant	-0.051* (0.028)	-0.050* (0.027)	-0.107*** (0.024)	-0.268 (0.187)	-0.272 (0.149)	-0.588*** (0.147)	0.006 (0.062)	0.005 (0.051)	0.159*** (0.057)	0.234*** (0.031)	0.234*** (0.019)	0.321*** (0.013)
spr_t	-0.016** (0.007)	-0.016** (0.007)	-0.021*** (0.005)	-0.032 (0.056)	-0.032 (0.045)	-0.081** (0.035)	-0.018* (0.021)	-0.010** (0.016)	0.016 (0.013)	-0.030** (0.013)	-0.030*** (0.008)	-0.013*** (0.003)
esi_t		0.000 (0.015)	0.244** (0.011)		0.351*** (0.086)	0.486*** (0.088)		0.122*** (0.354)	0.059** (0.030)		0.079*** (0.013)	0.042*** (0.007)
inf_t		-0.025** (0.011)	-0.004 (0.011)		0.278*** (0.058)	0.394*** (0.061)		0.066** (0.029)	0.010 (0.127)		0.055*** (0.011)	0.023*** (0.006)
OMT_t			0.065 (0.080)			0.918*** (0.345)			-0.740*** (0.108)			-0.352*** (0.049)
EBU_t			0.268*** (0.109)			0.473 (0.344)			0.310*** (0.116)			0.042 (0.054)
Adj-R^2	0.055	0.098	0.378	0.001	0.331	0.444	0.012	0.285	0.523	0.148	0.624	0.875

Panel B: Core countries

		β_t^{esi}			β_t^{spr}			β_t^{inf}			β_t^{hp}	
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
constant	-0.012 (0.019)	-0.012 (0.017)	0.031** (0.013)	0.863*** (0.213)	0.862*** (0.214)	0.800*** (0.292)	-0.009 (0.040)	-0.009 (0.034)	-0.053 (0.038)	0.085** (0.034)	0.084*** (0.029)	0.106*** (0.031)
spr_t	-0.038*** (0.010)	-0.039*** (0.008)	-0.024*** (0.008)	-0.379*** (0.104)	-0.379** (0.104)	-0.385*** (0.097)	-0.103*** (0.018)	-0.103*** (0.013)	-0.103*** (0.013)	-0.009 (0.009)	-0.009 (0.007)	0.002 (0.008)
esi_t		0.028** (0.014)	0.000 (0.012)		0.111 (0.071)	0.157 (0.110)		0.088*** (0.024)	0.122*** (0.030)		0.046** (0.018)	0.033* (0.195)
inf_t		-0.024** (0.010)	-0.033*** (0.007)		-0.007 (0.174)	-0.004 (0.178)		0.032* (0.017)	0.031* (0.016)		0.064*** (0.014)	0.057*** (0.012)
OMT_t			-0.291*** (0.035)			0.112 (0.435)			-0.014 (0.088)			-0.245*** (0.067)
EBU_t			0.238*** (0.044)			0.219 (0.410)			0.328** (0.131)			0.303** (0.126)
Adj.-R^2	0.270	0.388	0.653	0.222	0.226	0.222	0.367	0.510	0.584	0.001	0.217	0.333

Panel C: Periphery countries

		β_t^{esi}			β_t^{spr}			β_t^{inf}			β_t^{hp}	
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
constant	-0.053 (0.033)	-0.053 (0.030)	-0.115*** (0.027)	0.918*** (0.324)	0.914*** (0.309)	0.979*** (0.368)	0.049 (0.071)	0.048 (0.059)	0.276*** (0.052)	0.365*** (0.048)	0.364*** (0.037)	0.554*** (0.022)
spr_t	0.003 (0.015)	0.003 (0.013)	-0.010 (0.012)	-0.476*** (0.127)	-0.476*** (0.108)	-0.470*** (0.119)	-0.032 (0.038)	-0.033 (0.032)	0.046* (0.025)	-0.052** (0.024)	-0.052*** (0.017)	0.002 (0.011)
esi_t		0.033 (0.027)	0.017 (0.024)		0.129 (0.239)	0.149 (0.245)		-0.055 (0.045)	-0.019 (0.038)		-0.009 (0.021)	0.027** (0.014)
inf_t		-0.050** (0.019)	-0.011 (0.021)		0.388*** (0.137)	0.345* (0.202)		0.156*** (0.030)	0.022 (0.026)		0.116*** (0.023)	0.001 (0.012)
OMT_t			0.106 (0.091)			0.012 (0.564)			-1.037*** (0.129)			-0.657*** (0.065)
EBU_t			0.235** (0.104)			-0.467 (0.288)			0.339** (0.152)			-0.093 (0.056)
Adj.-R^2	0.000	0.150	0.337	0.173	0.237	0.234	0.016	0.297	0.612	0.110	0.421	0.872

Note: This Table presents OLS estimates with heteroscedasticity and autocorrelation consistent standard errors (in parentheses) of the equations modelling the TVP coefficients obtained from the benchmark equation (1) adding log-house price differential as an extra independent variable over the period January 1999 – June 2017 July 2016 (221observations). *, **, *** indicate statistical significance at the 10%, 5% and 1% level, respectively. The dependent variable is, respectively, the time-varying panel coefficient obtained from the model stated above for the logarithm of the Economic Sentiment Indicators (ESI) relative to Germany, (β_t^{esi}), the 10-year government bond yield spread against Germany (β_t^{spr}), the inflation rate of the Harmonised Index of Consumer Prices (HICP) relative to Germany (β_t^{inf}) and the logarithm of house price index relative to Germany (β_t^{hp}). The set of explanatory variables includes the first principle component of spreads (spr_t); the orthogonalized first principle component of relative ESI indexes (esi_t); the first principle component of relative HICP inflation rates relative to Germany (inf_t), a dummy variable taking the value of zero until July 2012, unity thereafter (OMT_t); and a dummy variable taking the value of zero until October 2014, unity thereafter (EBU_t) The full panel (Panel A) includes Austria, Belgium, Finland, France, Greece, Ireland, Italy, the Netherlands, Portugal and Spain. The panel of core countries (Panel B) includes Austria, Belgium, Finland, France and the Netherlands. The panel of periphery countries (Panel C) includes Greece, Ireland, Italy, Portugal and Spain.

Table 5: Modelling TVP parameters obtained from the benchmark TVP model adding log-house price differential excluding Greece

Panel A: Full panel

		β_t^{esi}			β_t^{spr}			β_t^{inf}			β_t^{hp}	
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
constant	-0.116*** (0.021)	-0.116*** (0.020)	-0.148*** (0.026)	-0.388 (0.254)	-0.393* (0.234)	-0.713*** (0.261)	-0.033 (0.048)	-0.034 (0.040)	-0.036 (0.048)	0.222*** (0.033)	0.222*** (0.023)	0.329*** (0.007)
spr_t	-0.029*** (0.006)	-0.029*** (0.006)	-0.032*** (0.005)	0.097 (0.075)	0.096 (0.077)	0.072 (0.069)	-0.065*** (0.018)	-0.065*** (0.013)	-0.058*** (0.011)	-0.030** (0.013)	-0.036*** (0.007)	-0.019*** (0.002)
esi_t		0.028** (0.011)	0.043*** (0.011)		0.110 (0.142)	0.258* (0.153)		0.114*** (0.027)	0.115*** (0.031)		0.088*** (0.015)	0.038*** (0.005)
inf_t		-0.006 (0.009)	0.005 (0.009)		0.361*** (0.104)	0.465*** (0.105)		0.010 (0.023)	0.014 (0.025)		0.040*** (0.011)	0.009*** (0.004)
OMT_t			0.038 (0.055)			0.390 (0.528)			-0.179*** (0.067)			-0.350*** (0.040)
EBU_t			0.151*** (0.046)			1.489*** (0.460)			0.347*** (0.059)			-0.090* (0.054)
Adj-R^2	0.241	0.306	0.434	0.019	0.145	0.256	0.230	0.442	0.493	0.171	0.552	0.875

Panel B: Periphery countries

		β_t^{esi}			β_t^{spr}			β_t^{inf}			β_t^{hp}	
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
constant	-0.010*** (0.026)	-0.010*** (0.023)	-0.139*** (0.023)	0.583 (0.392)	0.581 (0.388)	0.584 (0.501)	-0.098* (0.052)	-0.099** (0.042)	-0.054 (0.049)	0.352*** (0.050)	0.351*** (0.044)	0.561*** (0.019)
spr_t	-0.023** (0.011)	-0.023** (0.010)	-0.030*** (0.010)	-0.292* (0.152)	-0.292** (0.147)	-0.285** (0.140)	-0.181*** (0.032)	-0.181*** (0.025)	-0.150*** (0.019)	-0.072*** (0.023)	-0.072*** (0.018)	-0.017* (0.009)
esi_t		0.070*** (0.019)	0.058*** (0.020)		0.027 (0.377)	0.021 (0.428)		0.139*** (0.032)	0.133*** (0.032)		-0.050* (0.029)	0.028** (0.012)
inf_t		-0.020 (0.016)	0.002 (0.019)		0.252 (0.187)	0.254 (0.256)		0.098*** (0.022)	0.083*** (0.030)		0.094*** (0.031)	-0.028** (0.013)
OMT_t			0.147** (0.060)			-0.099 (0.509)			-0.043*** (0.120)			-0.617*** (0.067)
EBU_t			0.002 (0.055)			0.161 (0.440)			0.476*** (0.116)			-0.305*** (0.069)
Adj.-R^2	0.054	0.225	0.296	0.038	0.050	0.041	0.484	0.648	0.712	0.141	0.314	0.885

Note: This Table presents OLS estimates with heteroscedasticity and autocorrelation consistent standard errors (in parentheses) of the equations modelling the TVP coefficients obtained from the benchmark equation (1) adding log-house price differential as an extra independent variable excluding Greece over the period January 1999 – June 2017 July 2016 (221observations). *, **, *** indicate statistical significance at the 10%, 5% and 1% level, respectively. The dependent variable is, respectively, the time-varying panel coefficient obtained from the model stated above for the logarithm of the Economic Sentiment Indicators (ESI) relative to Germany, (β_t^{esi}), the 10-year government bond yield spread against Germany (β_t^{spr}), the inflation rate of the Harmonised Index of Consumer Prices (HICP) relative to Germany (β_t^{inf}) and the logarithm of house price index relative to Germany (β_t^{hp}). The set of explanatory variables includes the first principle component of spreads (spr_t); the orthogonalized first principle component of relative ESI indexes (esi_t); the first principle component of relative HICP inflation rates relative to Germany (inf_t), a dummy variable taking the value of zero until July 2012, unity thereafter (OMT_t); and a dummy variable taking the value of zero until October 2014, unity thereafter (EBU_t) The full panel (Panel A) includes Austria, Belgium, Finland, France, Ireland, Italy, the Netherlands, Portugal and Spain. The panel of periphery countries (Panel B) includes Ireland, Italy, Portugal and Spain.

Appendix: A simple model of international deposits' substitution

We present a simple partial equilibrium model determining relative aggregate deposits. The model's set-up is similar to the base-line version of the flexible price monetary model of exchange rate determination assuming rational expectations, risk neutrality and full capital mobility (see Taylor, 1995). We assume that demand for aggregate real domestic deposits is a positive function of domestic output and a negative function of the domestic nominal interest rate (see Bomberger, 1993). To account for international deposits' substitution, we allow foreign (domestic) savers to save in domestic (foreign) banks. As a result, demand for domestic deposits is a function of two scale variables, namely domestic and foreign output levels:

$$d_t - p_t = \alpha_1 y_t + \alpha_2 i_t + \beta_1 y_t^* \quad (1)$$

where $\alpha_1, \alpha_2, \beta_1 > 0,$ In a similar fashion, aggregate foreign bank deposits are a function of domestic and foreign output, and the foreign nominal interest rate. For simplicity, we assume identical across countries income elasticities and interest rate semi-elasticities, so that:

$$d_t^* - p_t^* = \alpha_1 y_t^* + a_2 i_t^* + \beta_1 y_t \quad (2)$$

We assume that purchasing power parity (PPP) holds:

$$s_t = p_t - p_t^* \quad (3)$$

implying that expected exchange rate changes equal expected inflation differentials:

$$\Delta s_t^e = \pi_t^e - \pi_t^{e*} \quad (4)$$

In each country aggregate bank deposits are subject to country-specific, non-diversifiable within the domestic banking system, aggregate bank default risk, assumed to be positively corelated with sovereign default risk (see Clerc et al, 2015; Balfoussia et al, 2018). In that case, Uncovered Interest Parity (UIP) holds, adjusted for the aggregate fiscal risk differential (ρ_t) is given by:

$$i_t = i_t^* + \Delta s_t^e + \rho_t \quad (5)$$

Solving equations (4) and (5) with respect to Δs_t^e, we obtain:

$$i_t - i_t^* = (\pi_t^e - \pi_t^{e*}) + \rho_t \quad (6)$$

Assume that the two countries form a monetary union, in which case the exchange rate s_t is a constant, normalised for simplicity to zero. In that case, PPP in equation (3) becomes:

$$p_t = p_t^* \quad (7)$$

Solving equations (1) and (2) with respect to p_t and p_t^* respectively, replacing in equation (7) and re-arranging we obtain:

$$d_t - d_t^* = (\alpha_1 - \beta_1)(y_t - y_t^*) + \alpha_2 (i_t - i_t^*) \quad (8)$$

Using equation (6) to replace for $(i_t - i_t^*)$, we obtain:

$$d_t - d_t^* = (\alpha_1 - \beta_1)(y_t - y_t^*) + \alpha_2(\pi_t^e - \pi_t^{e*}) + \alpha_2\rho_t \quad (9)$$

Provided that the elasticity of domestic deposits to domestic income is higher than the elasticity of foreign deposits to domestic income ($\alpha_1 > \beta_1$), equation (9) predicts a positive link between relative deposits and relative output; as well as a positive positive link between relative deposits and relative inflation and relative fiscal risk. Note that a fully credible implies $\Delta s_t^e = \pi_t^e - \pi_t^{e*} = 0$, in which case relative deposits are given by:

$$d_t - d_t^* = (\alpha_1 - \beta_1)(y_t - y_t^*) + \alpha_2\rho_t \quad (10)$$

Assume now that the foreign country is a safe-haven for investors, i.e. it is perceived by investors (domestic and foreign) to have zero fiscal default and, by extension, zero bank default risk. On the other hand, domestic bank deposits are subject to non-zero bank default risk, driven by non-zero fiscal risk. Assume also that the behaviour of foreign investors is not

subject to any changes, i.e. the elasticity and semi-elasticity of domestic and foreign deposits to changes in foreign output levels and foreign interest rates is constant.[1]

Finally, assume that the elasticity of demand for domestic and foreign deposits to changes in domestic output, as well as the semi-elasticity of domestic deposits to changes in domestic interest rates is a function of the level of relative macro/fiscal risk, denoted by ζ_t. Specifically, assume that the elasticity of domestic deposits to changes in relative output and the semi-elasticity of domestic deposits to changes in the interest rate differential are both a positive function of relative output and a negative function of relative expected inflation and relative fiscal risk. On the other hand, the elasticity of foreign deposits to changes in relative output is a negative function of relative output and a positive function of relative expected inflation and relative fiscal risk. The intuition is that as the domestic country experiences economic downturns (captured by a fall in relative output), and/or increased fiscal default risk (captured by a higher cost of public borrowing), and/or a higher probability of exiting the monetary union (captured by real appreciation driven by a higher relative inflation differential), domestic savers, fearing wealth losses due to fiscal/banking default and/or deposits' redenomination into a new, devalued national currency, substitute domestic deposits with foreign deposits and/or cash, resulting into lower relative deposits.[2] This capital-flight effect is captured by changes in the elasticities and semi-elasticities entering equation (9), as described by equation (11) below:

$$d_t - d_t^* = \left[\left(\alpha_1(\zeta_t) - \beta_1(\zeta_t)\right)(y_t - y_t^*\right) + \alpha_2(\zeta_t)(\pi_t^e - \pi_t^{e*}) + \alpha_2(\zeta_t)\rho_t \quad (11)$$

$$(\zeta_t)' = [(y_t - y_t^*), (\pi_t^e - \pi_t^{e*}), \rho_t]'$$

[1] Existing empirical evidence (see Bundesbank, 2016) suggests that for Germany, the country used as benchmark for our analysis, this hypothesis is valid.

[2] For empirical evidence supporting this hypothesis, see Levy-Yeyati et al (2010), Kleimeier et al (2013) and Cubilas et al. (2012, 2017). For a theoretical model predicting capital flight driven by fiscal and redenomination (euro exit) risk in the context of a monetary union (applied to sovereign bond markets) see Arghyrou and Tsoukalas (2011).

$$\partial\alpha_1\,(t)/\partial(y-y^*)_t > 0,\ \partial\alpha_1(t)/\partial(\pi_t^e - \pi_t^{e*})_t < 0,\ \partial\alpha_1(t\,)/\vartheta(\rho_t) < 0$$

$$\partial\beta_1(t\,)/\partial(y-y^*)_t < 0,\ \partial\beta_1(t\,)/\partial(\pi_t^e - \pi_t^{e*})_t > 0,\ \partial\beta_1(t\,)/\vartheta(\rho_t) > 0$$

$$\partial\alpha_2(t\,)/\partial(y-y^*)_t > 0,\ \partial\alpha_2\,(t\,)/\partial(\pi_t^e - \pi_t^{e*})_t < 0,\ \partial\alpha_2(t\,)/\vartheta(\rho_t) < 0$$

Equation (11) can be econometrically tested in two steps. The first estimates a time varying parameter (TVP) panel model, such as Li et al (2011), capturing time variation in the values of parameters α_1, β_1 and α_2. The second models the time-varying estimated TVP coefficients $\alpha_1(t)$, $\beta_1(t)$, $\alpha_2(t)$ obtained in the first stage of the analysis on the level of macro/fiscal risk factors entering vector ζ_t, namely relative output, relative inflation and relative fiscal risk.

Table A1: Correlation coefficients among first principal components

Panel A: Full panel

	ESI	*inf*	*spread*
ESI	1.000		
inf	0.533 (9.353)	1.000	
spread	-0.810 (-20.499)	-0.340 (-5.361)	1.000

Panel B: Core countries

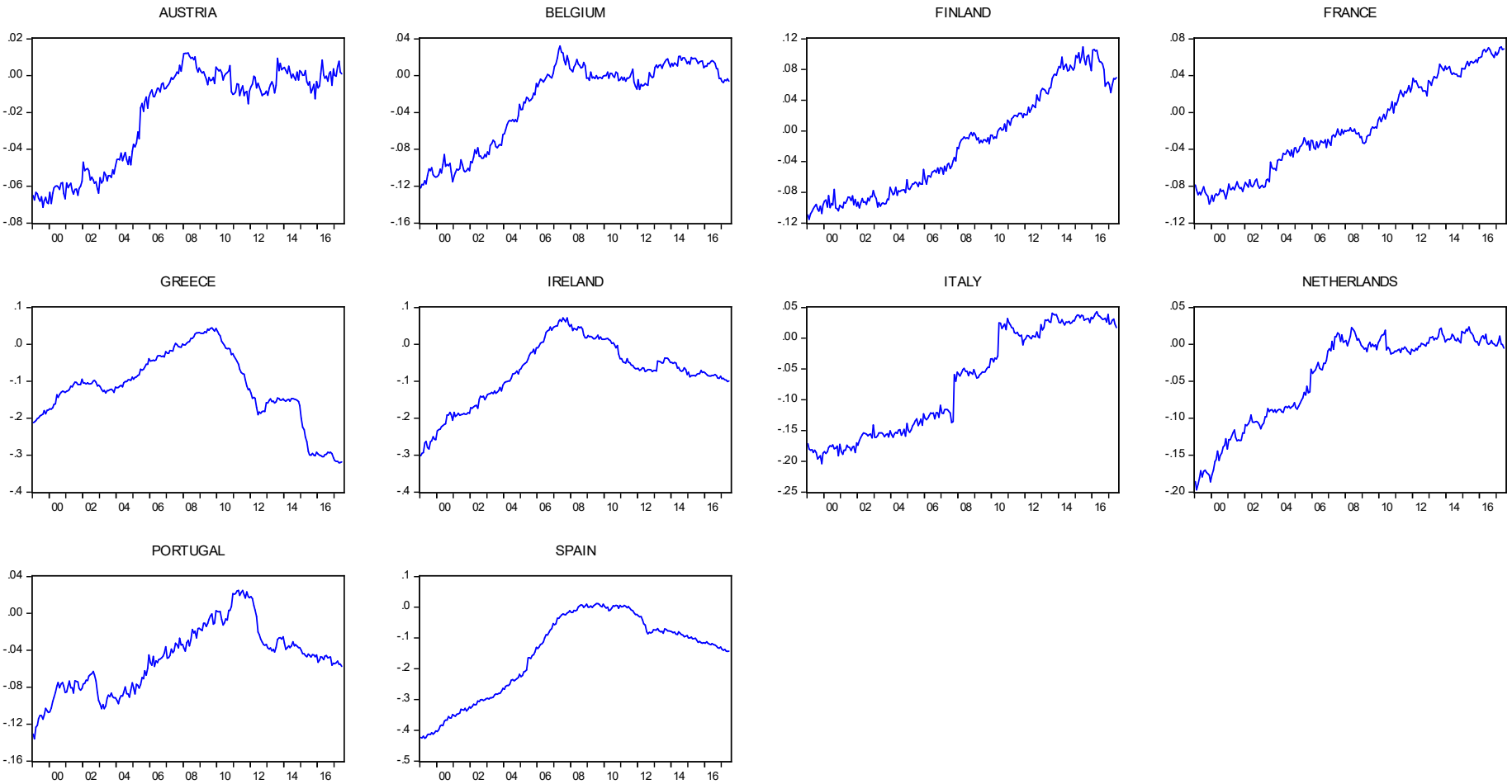
	ESI	*inf*	*spread*
ESI	1.000		
inf	-0.083 (-1.236)	1.000	
spread	-0.682 (-13.848)	0.281 (4.340)	1.000

Panel C: Periphery countries

	ESI	*inf*	*spread*
ESI	1.000		
inf	0.471 (7.913)	1.000	
spread	-0.832 (-22.270)	-0.435 (-7.175)	1.000

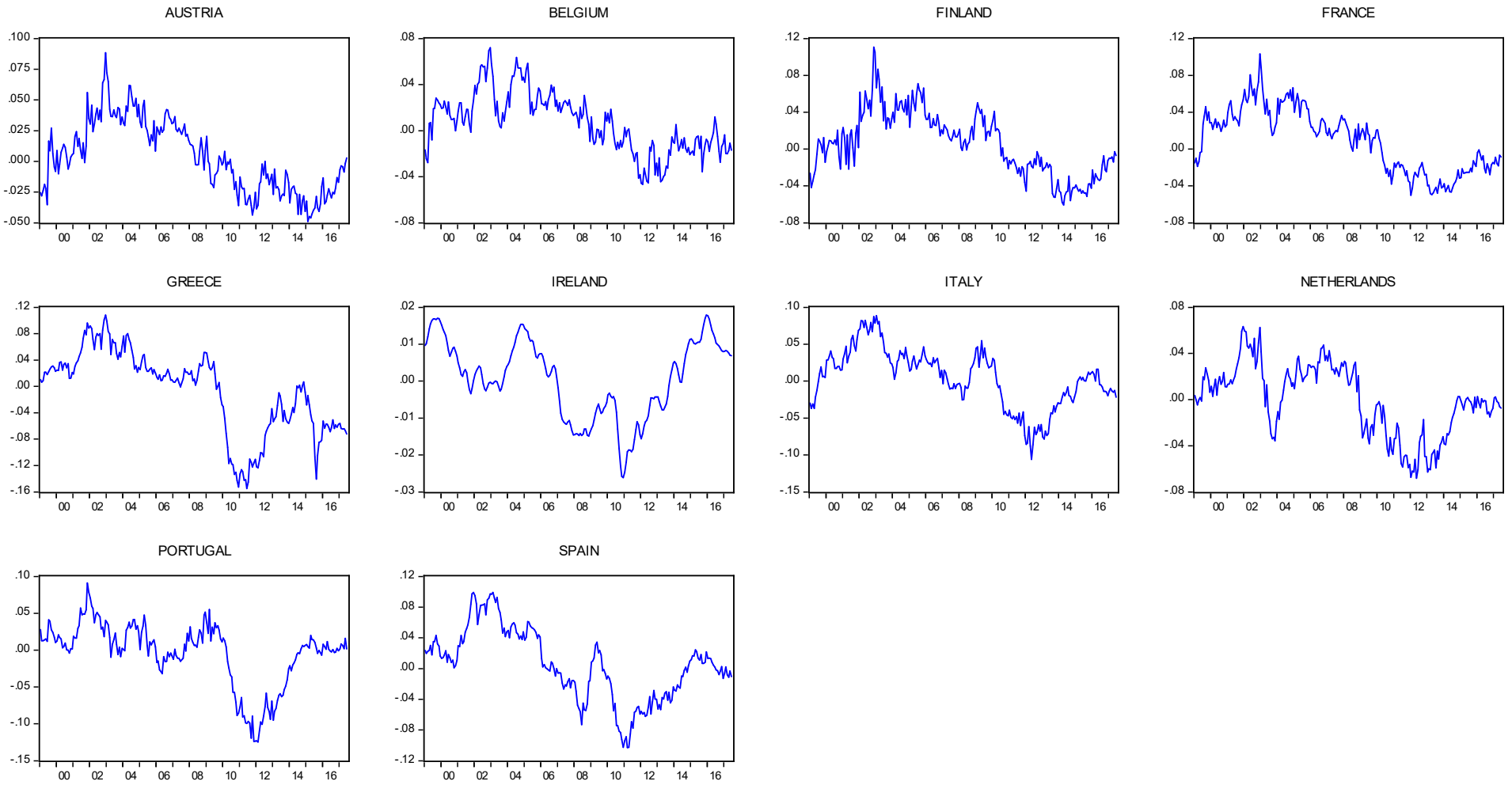
Note: *ESI*, *inf* and *spread* respectively denote the first principal components of the log volume-index of the Economic Sentiment Indicator series against Germany; the 10-year government bond yield spread against Germany; and the year to year inflation rate calculated for the Harmonised Index of Consumer Prices relative to Germany. The full panel includes Austria, Belgium, Finland, France, Greece, Ireland, Italy, the Netherlands, Portugal and Spain. Core countries include Austria, Belgium, Finland, France and the Netherlands. Periphery countries include Greece, Ireland, Italy, Portugal and Spain. The sample period covers January 1999 – July 2017.

Figure A1: Log-index private bank deposits relative to Germany



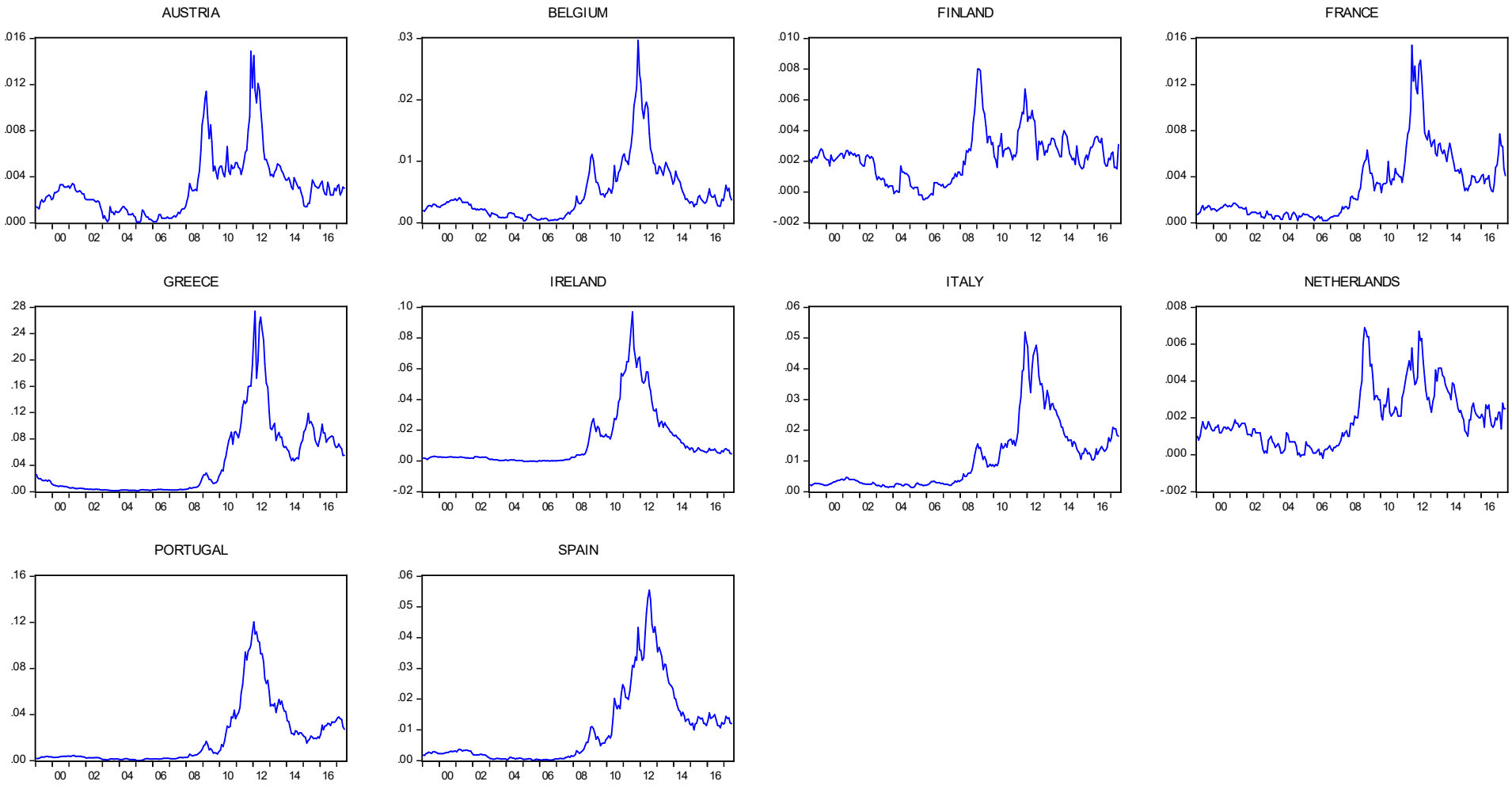
Note: Private bank deposits are defined as outstanding amounts at the end of each month covering maturities of all types and all currency denominations, for deposits of households, non-financial corporations and other entities excluding central government and Monetary and Financial Institutions. Data source: European Central Bank.

Figure A2: Log-index Economic Sentiment Indicator relative to Germany



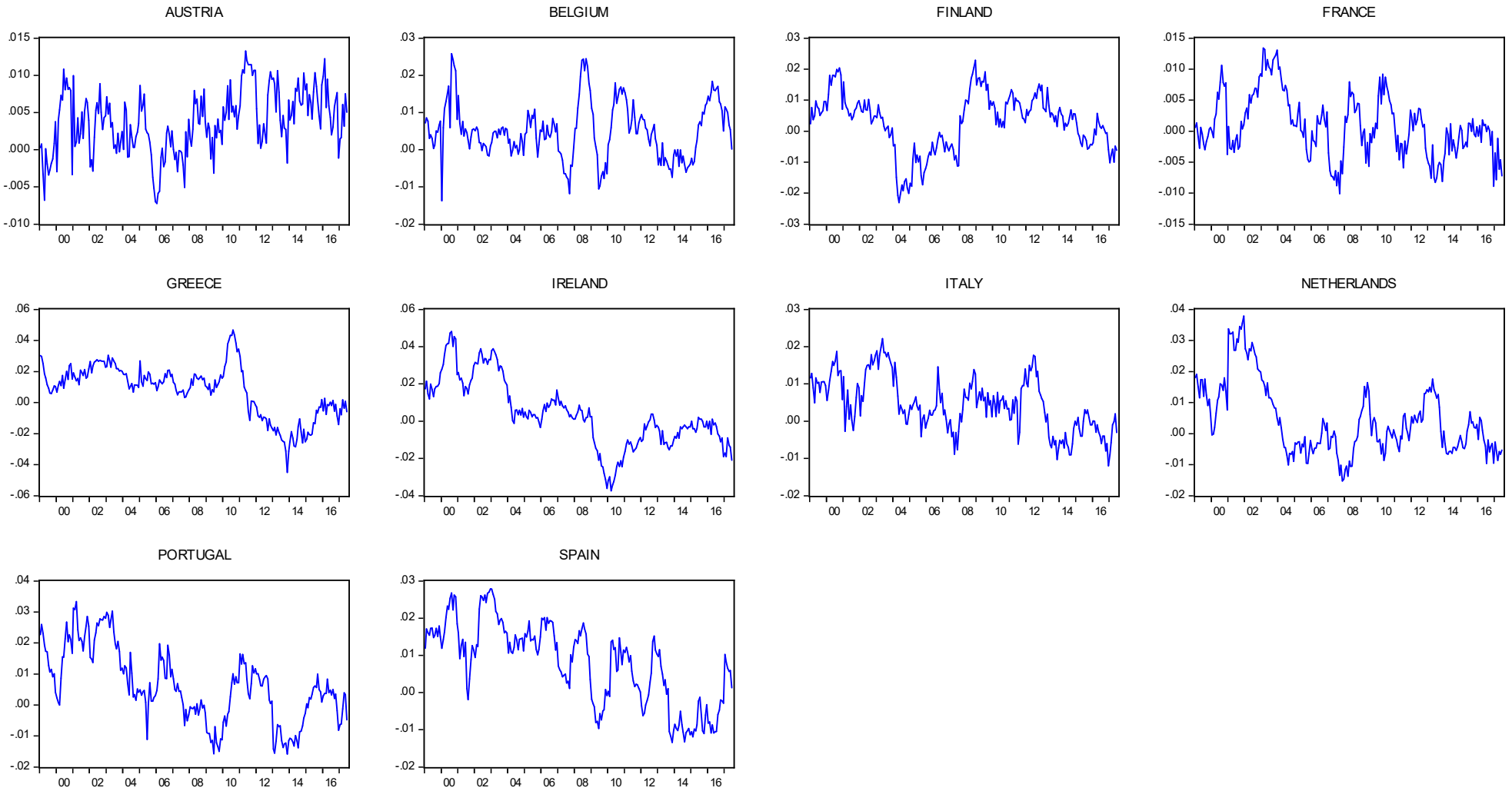
Data source: European Commission

Figure A3: 10-year government bond yield spreads against Germany



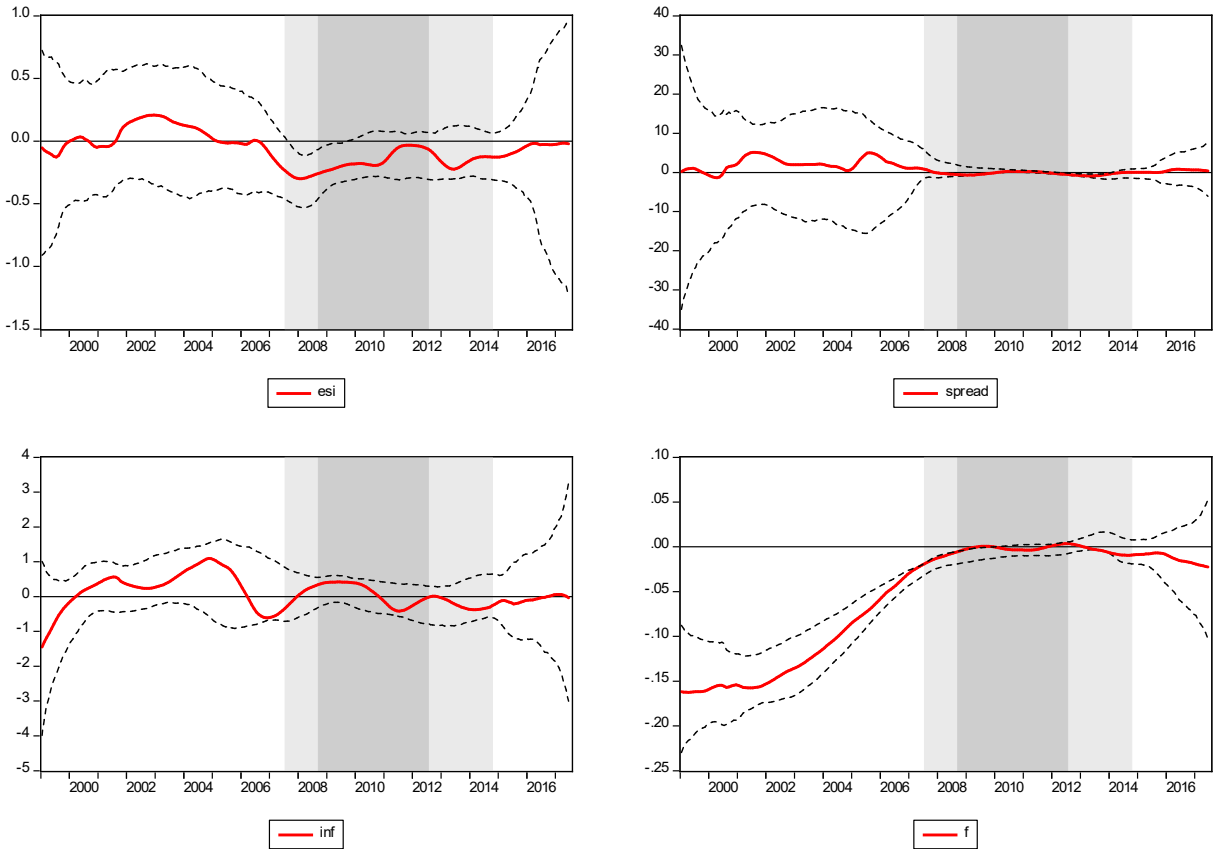
Data source: European Central Bank

Figure A4: Year-to-year HICP inflation differential against Germany



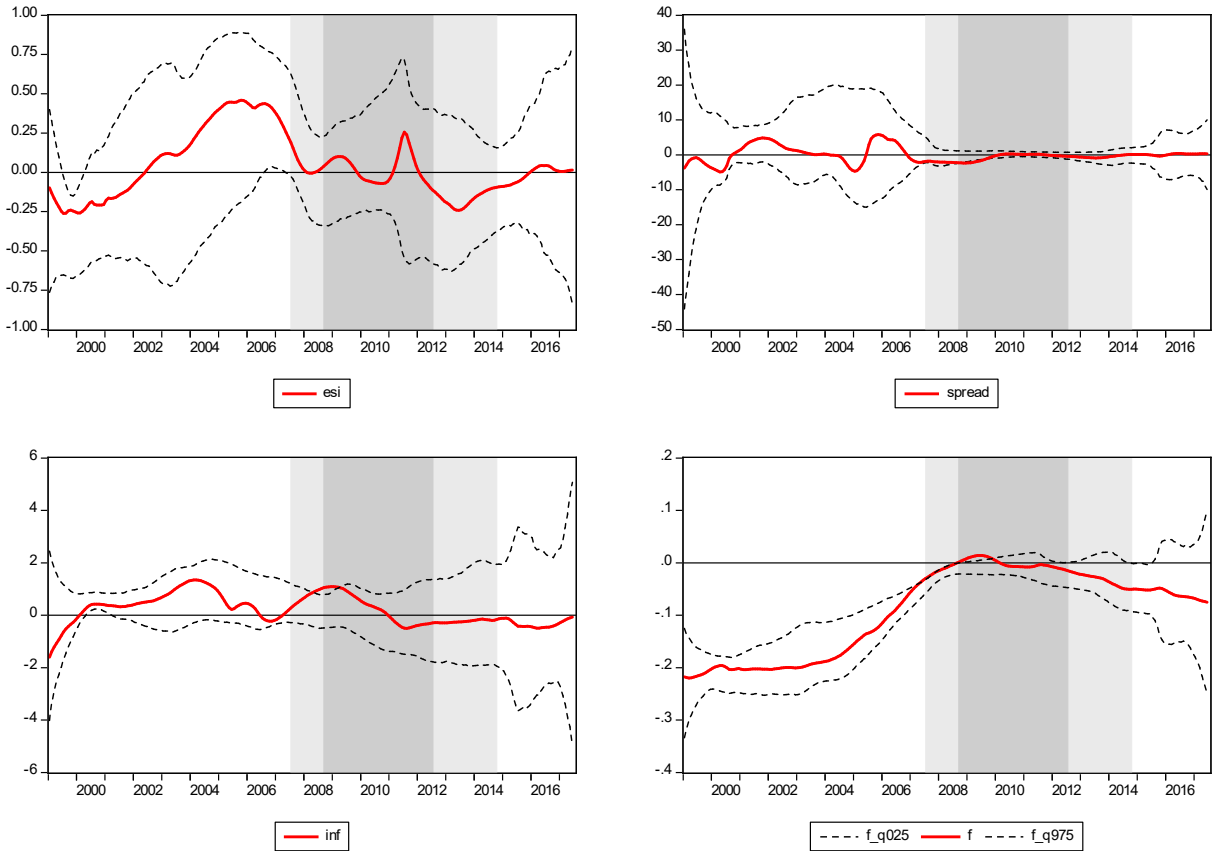
Data source: European Central Bank

Figure A5: Benchmark model excluding Greece - Full panel



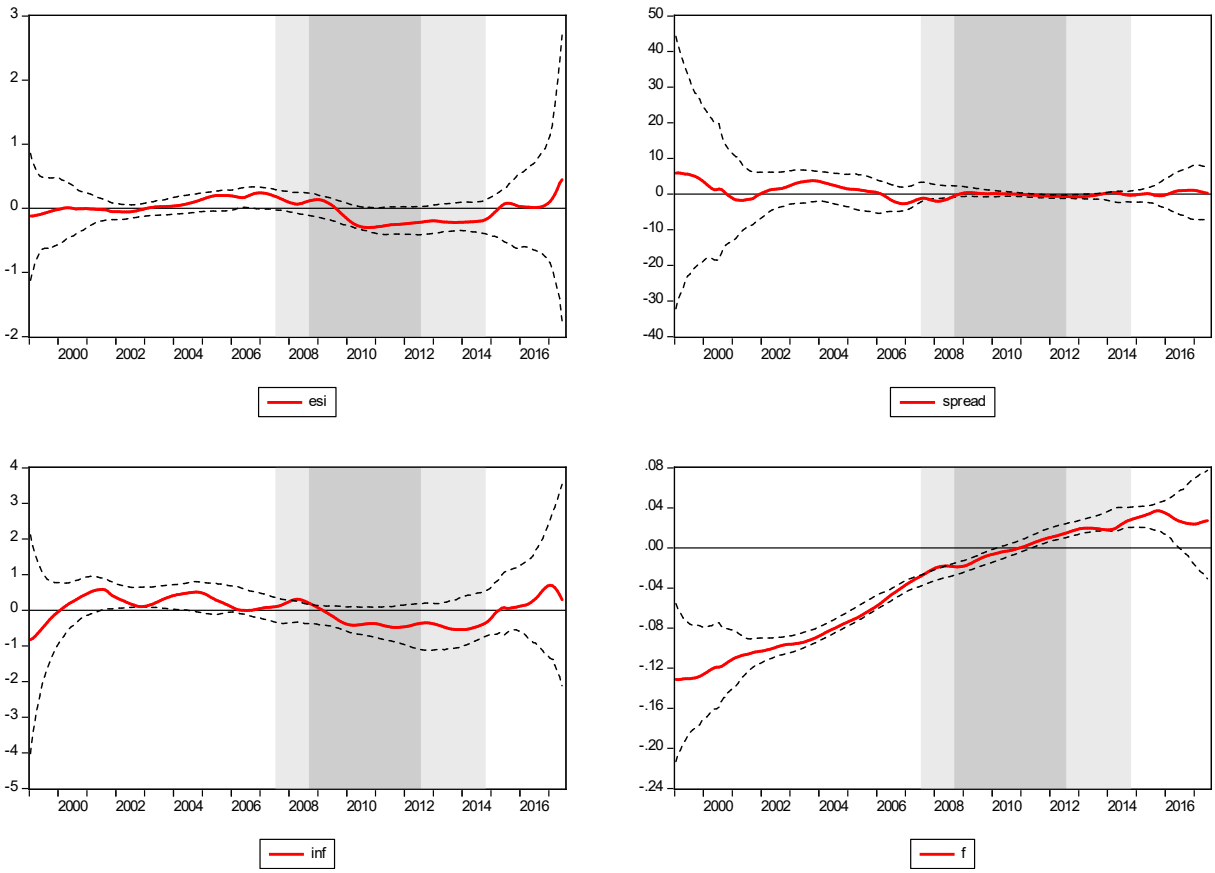
Note: The figure presents the coefficients obtained from the estimation of the time varying parameters (TVP) model given by equation (1) for the full panel excluding Greece, over the period January 1999 - July 2017 (222 observations); and the corresponding 90% confidence intervals (dotted lines) calculated using the wild bootstrap method (1000 iterations). The estimation bandwidth parameter (h) is set to 0.15 and the bandwidth correction parameter (ε) to 0.08. The panel includes Austria, Belgium, Finland, France, Ireland, Italy, the Netherlands, Portugal and Spain. The dependent variable is the log-index of private deposits relative to Germany. The set of explanatory variables includes the log volume-index of the Economic Sentiment Indicator (*esi*) series against Germany; the 10-year government bond yield spread (*spread*) against Germany; and the year to year inflation rate calculated for the Harmonised Index of Consumer Prices relative to German (*inf*). The model also includes a trend function (f) capturing time-specific effects accounting for omitted variables having a common, over time, impact across the panel's cross sections. The light-shaded area covers the period July 2007 – October 2014; the dark-shaded area covers the period September 2008 – July 2012.

Figure A6: Benchmark model excluding Greece - Periphery panel



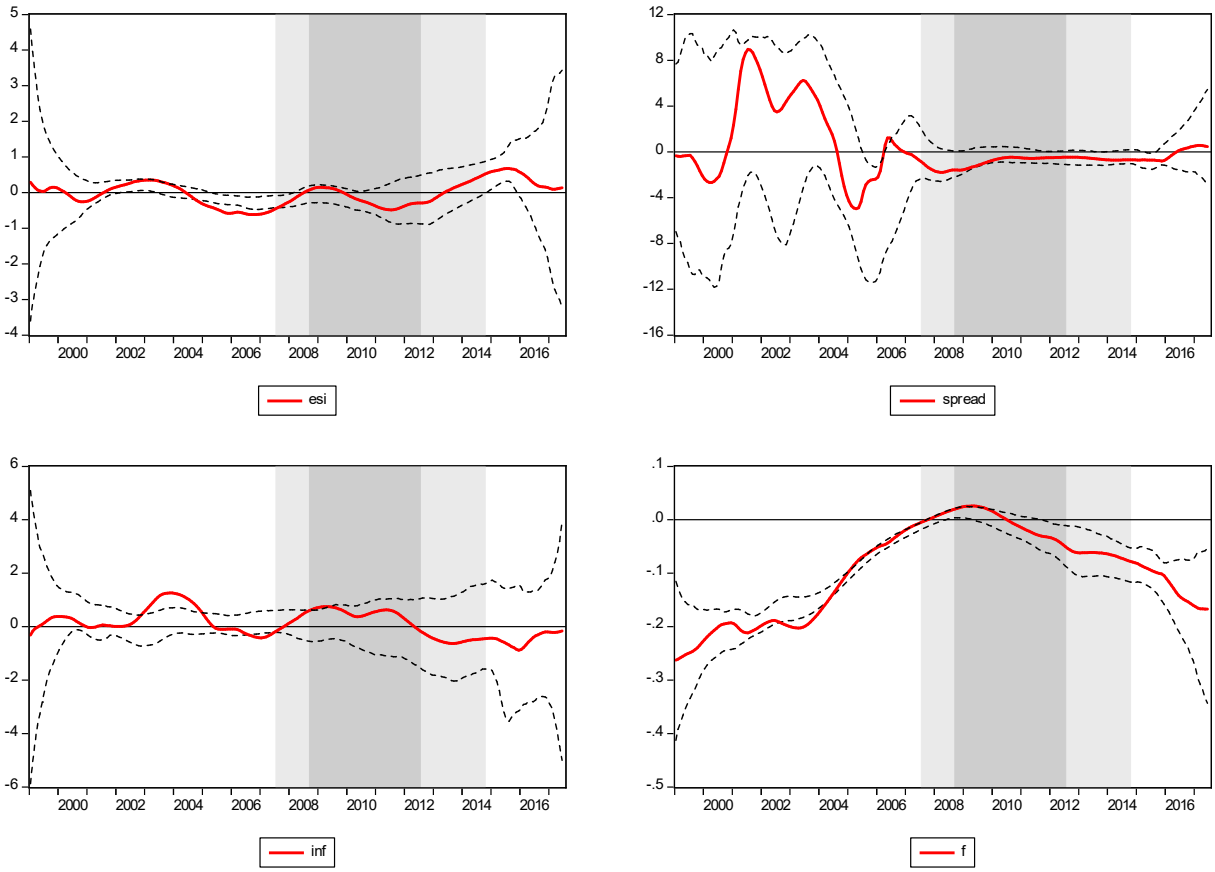
Note: The figure presents the coefficients obtained from the estimation of the time varying parameters (TVP) model given by equation (1) for the panel of periphery countries excluding Greece, over the period January 1999 - July 2017 (222 observations); and the corresponding 90% confidence intervals (dotted lines) calculated using the wild bootstrap method (1000 iterations). The estimation bandwidth parameter (h) is set to 0.15 and the bandwidth correction parameter (ε) to 0.08. The panel includes Ireland, Italy, Portugal and Spain. The dependent variable is the log-index of private deposits relative to Germany. The set of explanatory variables includes the log volume-index of the Economic Sentiment Indicator (*esi*) series against Germany; the 10-year government bond yield spread (*spread*) against Germany; and the year to year inflation rate calculated for the Harmonised Index of Consumer Prices relative to German (*inf*). The model also includes a trend function (f) capturing time-specific effects accounting for omitted variables having a common, over time, impact across the panel's cross sections. The light-shaded area covers the period July 2007 – October 2014; the dark-shaded area covers the period September 2008 – July 2012.

Figure A7: Core panel including Italy



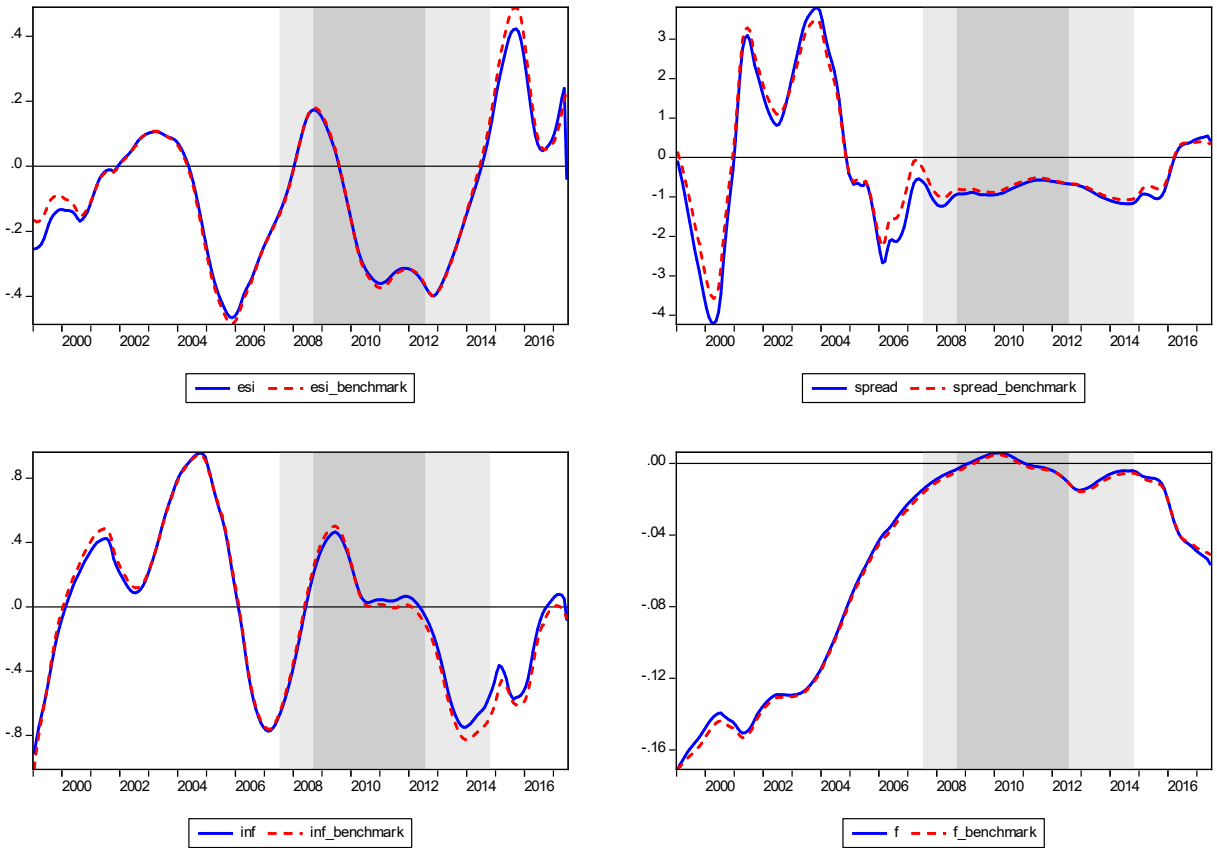
Note: The figure presents the coefficients obtained from the estimation of the time varying parameters (TVP) model given by equation (1) for the panel of core countries including Italy over the period January 1999 - July 2017 (222 observations); and the corresponding 90% confidence intervals (dotted lines) calculated using the wild bootstrap method (1000 iterations). The estimation bandwidth parameter (h) is set to 0.15 and the bandwidth correction parameter (ε) to 0.08. The panel includes Austria, Belgium, Finland, France, Italy and the Netherlands. The dependent variable is the log-index of private deposits relative to Germany. The set of explanatory variables includes the log volume-index of the Economic Sentiment Indicator (*esi*) series against Germany; the 10-year government bond yield spread (*spread*) against Germany; and the year to year inflation rate calculated for the Harmonised Index of Consumer Prices relative to German (*inf*). The model also includes a trend function (*f*) capturing time-specific effects accounting for omitted variables having a common, over time, impact across the panel's cross sections. The light-shaded area covers the period July 2007 – October 2014; the dark-shaded area covers the period September 2008 – July 2012.

Figure A8: Periphery panel excluding Italy



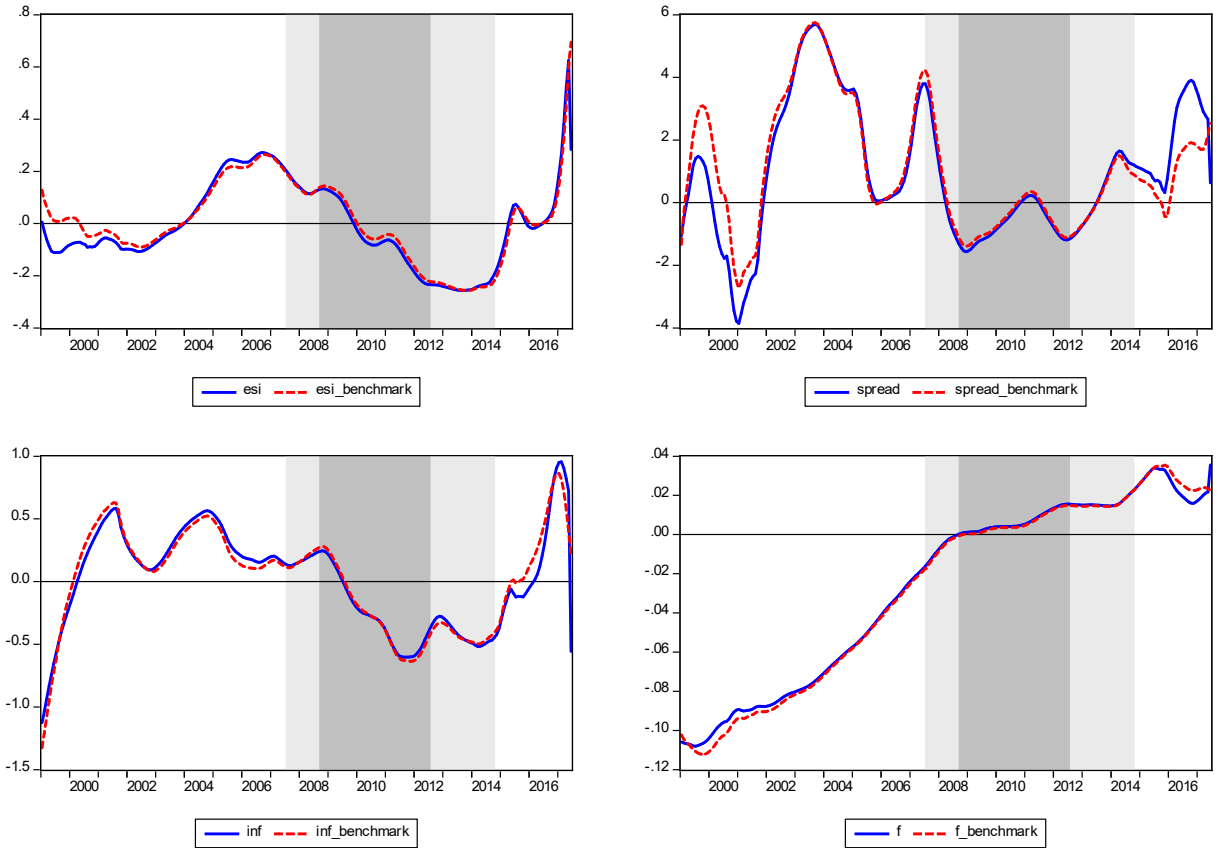
Note: The figure presents the coefficients obtained from the estimation of the time varying parameters (TVP) model given by equation (1) for the panel of periphery countries excluding Italy, over the period January 1999 - July 2017 (222 observations); and the corresponding 90% confidence intervals (dotted lines) calculated using the wild bootstrap method (1000 iterations). The estimation bandwidth parameter (h) is set to 0.15 and the bandwidth correction parameter (ε) to 0.08. The panel includes Greece, Ireland, Portugal and Spain. The dependent variable is the log-index of private deposits relative to Germany. The set of explanatory variables includes the log volume-index of the Economic Sentiment Indicator (*esi*) series against Germany; the 10-year government bond yield spread (*spread*) against Germany; and the year to year inflation rate calculated for the Harmonised Index of Consumer Prices relative to German (*inf*). The model also includes a trend function (f) capturing time-specific effects accounting for omitted variables having a common, over time, impact across the panel's cross sections. The light-shaded area covers the period July 2007 – October 2014; the dark-shaded area covers the period September 2008 – July 2012.

Figure A9: TVP estimates obtained by estimating equation (1) using the first lag of independent variables versus TVP estimates of benchmark model - Full panel



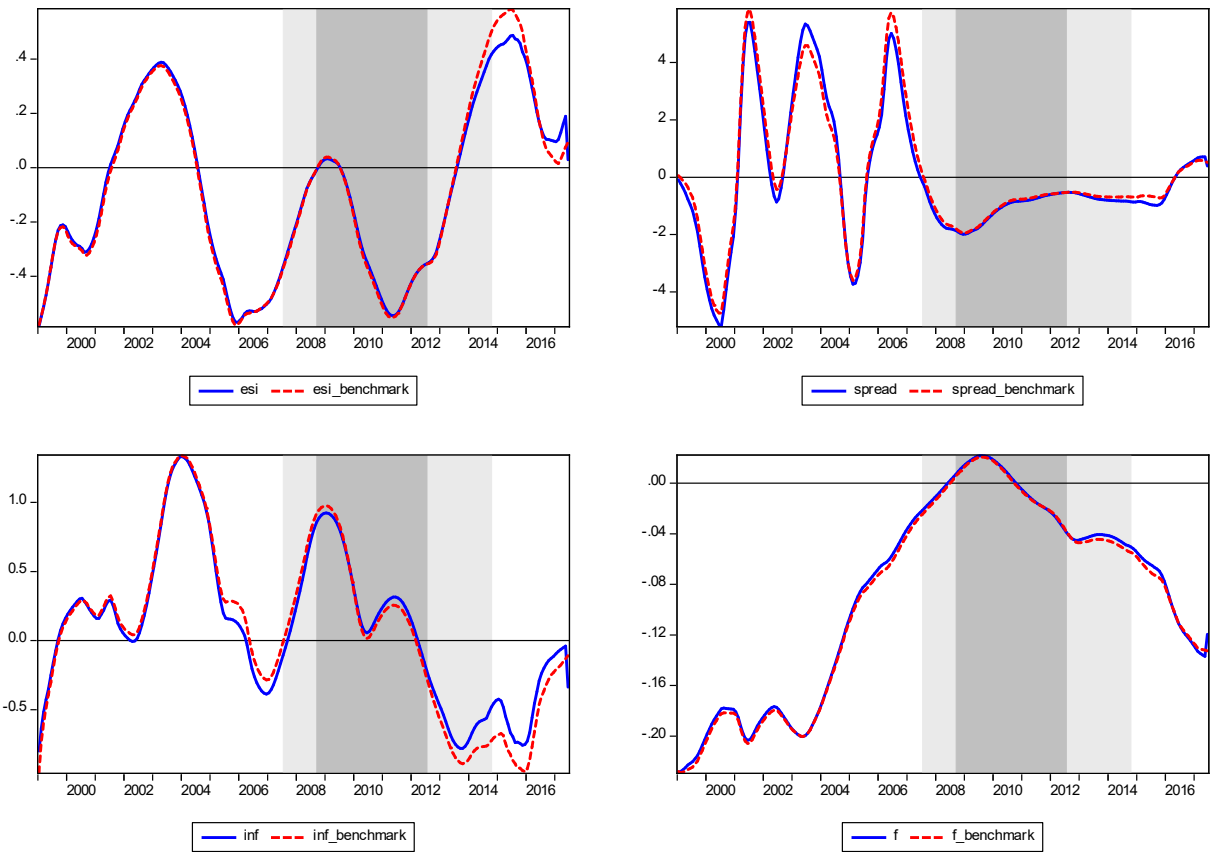
Note: The figure presents the coefficients obtained from the estimation of the time varying parameters (TVP) of model given by equation (1) estimated for the full panel using the first lag of independent variables over the period January 1999 - July 2017 (222 observations) against the TVP coefficients obtained from the benchmark model presented in Figure 2 (dotted lines). The estimation bandwidth parameter (h) is set to 0.15 and the bandwidth correction parameter (ε) to 0.08. The panel includes Austria, Belgium, Finland, France, Greece, Ireland, Italy, the Netherlands, Portugal and Spain. The dependent variable is the log-index of private deposits relative to Germany. The set of explanatory variables includes the log volume-index of the Economic Sentiment Indicator (*esi*) series against Germany; the 10-year government bond yield spread (*spread*) against Germany; and the year to year inflation rate calculated for the Harmonised Index of Consumer Prices relative to German (*inf*). The model also includes a trend function (f) capturing time-specific effects accounting for omitted variables having a common, over time, impact across the panel's cross sections. The light-shaded area covers the period July 2007 – October 2014; the dark-shaded area covers the period September 2008 – July 2012.

Figure A10: TVP estimates obtained by estimating equation (1) using the first lag of independent variables versus TVP estimates of benchmark model - Core panel



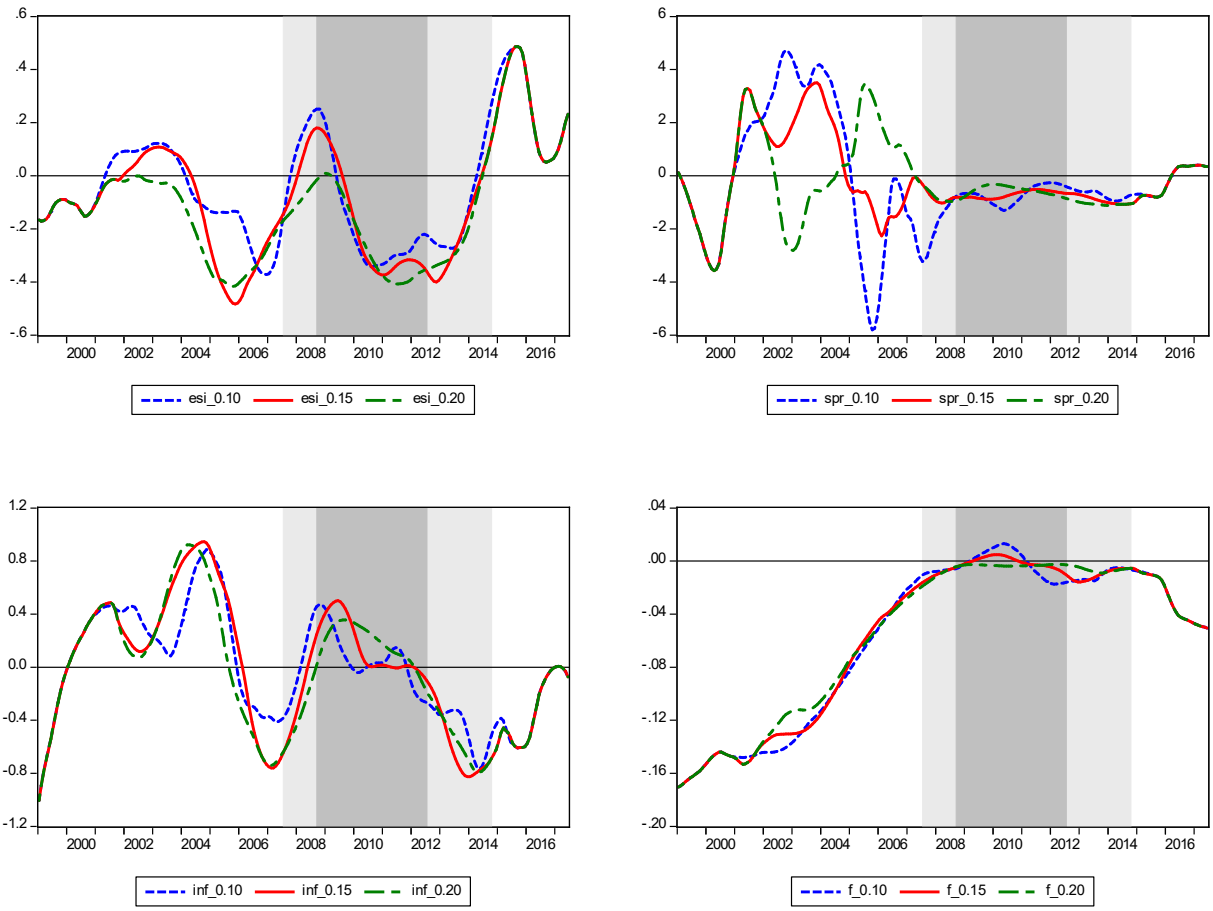
Note: The figure presents the coefficients obtained from the estimation of the time varying parameters (TVP) of model given by equation (1) estimated for the panel of core countries using the first lag of independent variables over the period January 1999 - July 2017 (222 observations) against the TVP coefficients obtained from the benchmark model presented in Figure 3 (dotted lines). The estimation bandwidth parameter (h) is set to 0.15 and the bandwidth correction parameter (ε) to 0.08. The panel includes Austria, Belgium, Finland, France and the Netherlands. The dependent variable is the log-index of private deposits relative to Germany. The set of explanatory variables includes the log volume-index of the Economic Sentiment Indicator (*esi*) series against Germany; the 10-year government bond yield spread (*spread*) against Germany; and the year to year inflation rate calculated for the Harmonised Index of Consumer Prices relative to German (*inf*). The model also includes a trend function (f) capturing time-specific effects accounting for omitted variables having a common, over time, impact across the panel's cross sections. The light-shaded area covers the period July 2007 – October 2014; the dark-shaded area covers the period September 2008 – July 2012.

Figure A11: TVP estimates obtained by estimating equation (1) using the first lag of independent variables versus TVP estimates of benchmark model - Periphery panel



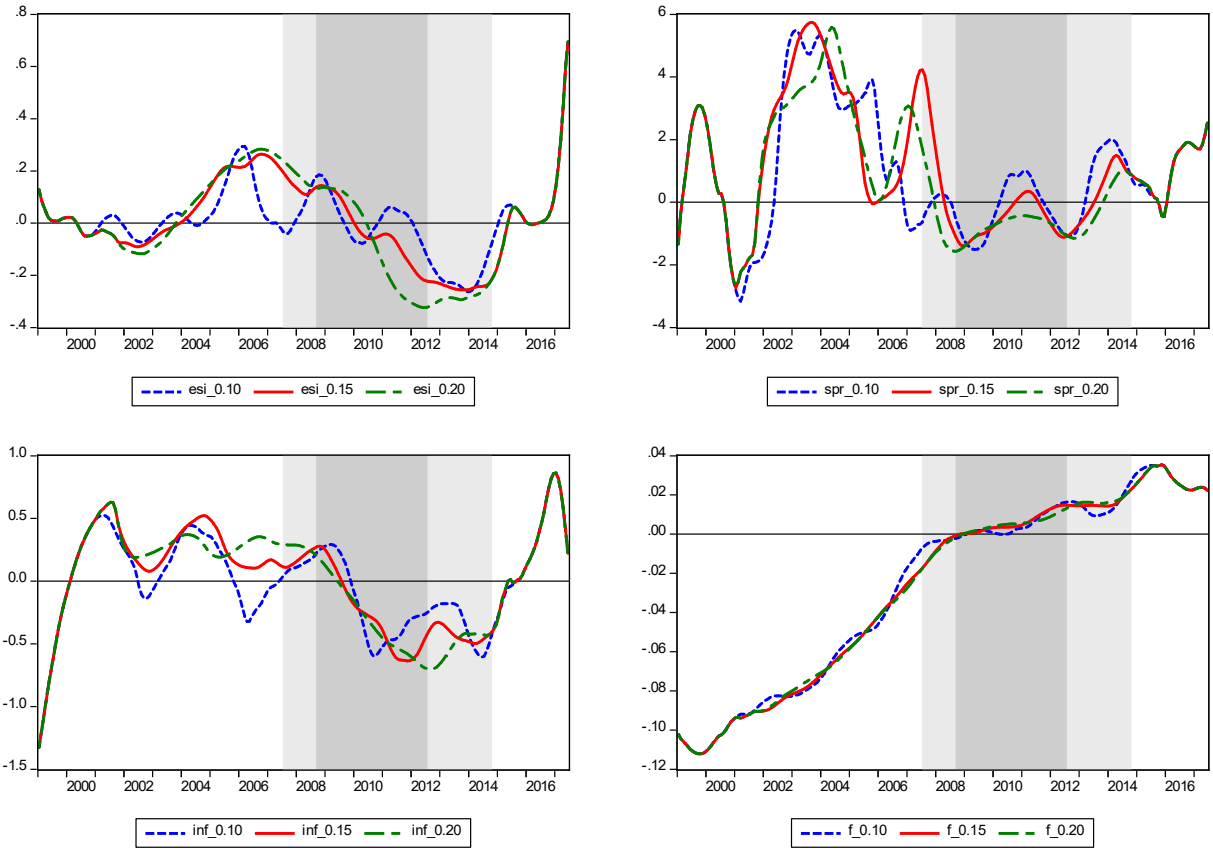
Note: The figure presents the coefficients obtained from the estimation of the time varying parameters (TVP) of model given by equation (1) estimated for the panel of periphery countries using the first lag of independent variables over the period January 1999 - July 2017 (222 observations) against the TVP coefficients obtained from the benchmark model presented in Figure 4 (dotted lines). The estimation bandwidth parameter (h) is set to 0.15 and the bandwidth correction parameter (ε) to 0.08. The panel includes, Greece, Ireland, Italy, Portugal and Spain. The dependent variable is the log-index of private deposits relative to Germany. The set of explanatory variables includes the log volume-index of the Economic Sentiment Indicator (*esi*) series against Germany; the 10-year government bond yield spread (*spread*) against Germany; and the year to year inflation rate calculated for the Harmonised Index of Consumer Prices relative to German (*inf*). The model also includes a trend function (*f*) capturing time-specific effects accounting for omitted variables having a common, over time, impact across the panel's cross sections. The light-shaded area covers the period July 2007 – October 2014; the dark-shaded area covers the period September 2008 – July 2012.

Figure A12: TVP estimates obtained by estimating equation (1) using alternative bandwidth parameters *(h)* - Full panel



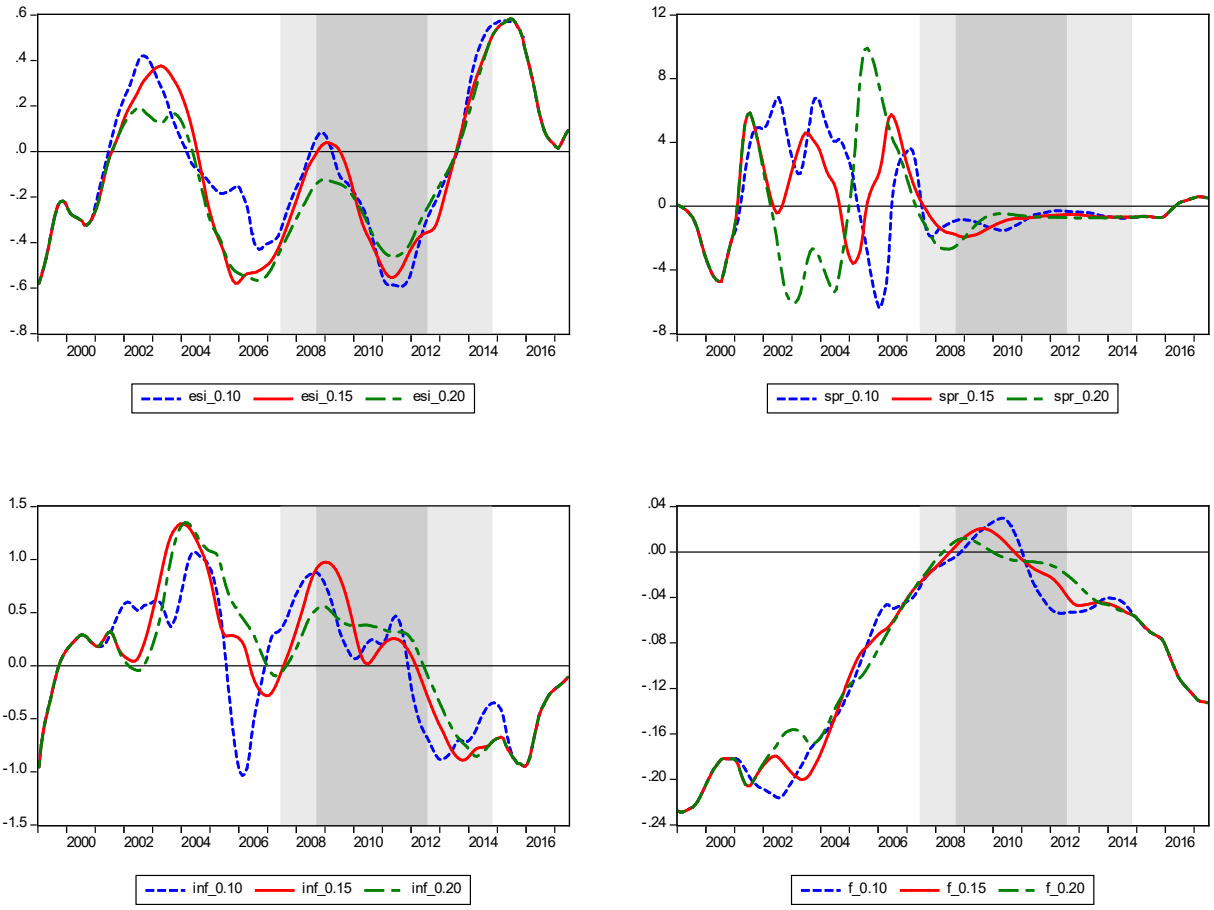
Note: The figure presents the coefficients obtained from the estimation of the time varying parameters (TVP) model given by equation (1) using three different values of the bandwidth parameter h = 0.10, 0.15, 0.20, for the full panel over the period January 1999 - July 2017 (222 observations). The benchmark model sets h = 0.15. In all cases the bandwidth correction parameter (ε) is set equal to 0.08. The panel includes Austria, Belgium, Finland, France, Greece, Ireland, Italy, the Netherlands, Portugal and Spain. The dependent variable is the log-index of private deposits relative to Germany. The set of explanatory variables includes the log volume-index of the Economic Sentiment Indicator (*esi*) series against Germany; the 10-year government bond yield spread (*spread*) against Germany; and the inflation rate calculated for the Harmonised Index of Consumer Prices relative to German (*inf*). The model also includes a trend function (*f*) capturing time-specific effects accounting for omitted variables having a common, over time, impact across the panel's cross sections. The light-shaded area covers the period July 2007 – October 2014; the dark-shaded area covers the period September 2008 – July 2012.

Figure A13: TVP estimates obtained by estimating equation (1) using alternative bandwidth parameters *(h)* - Core panel



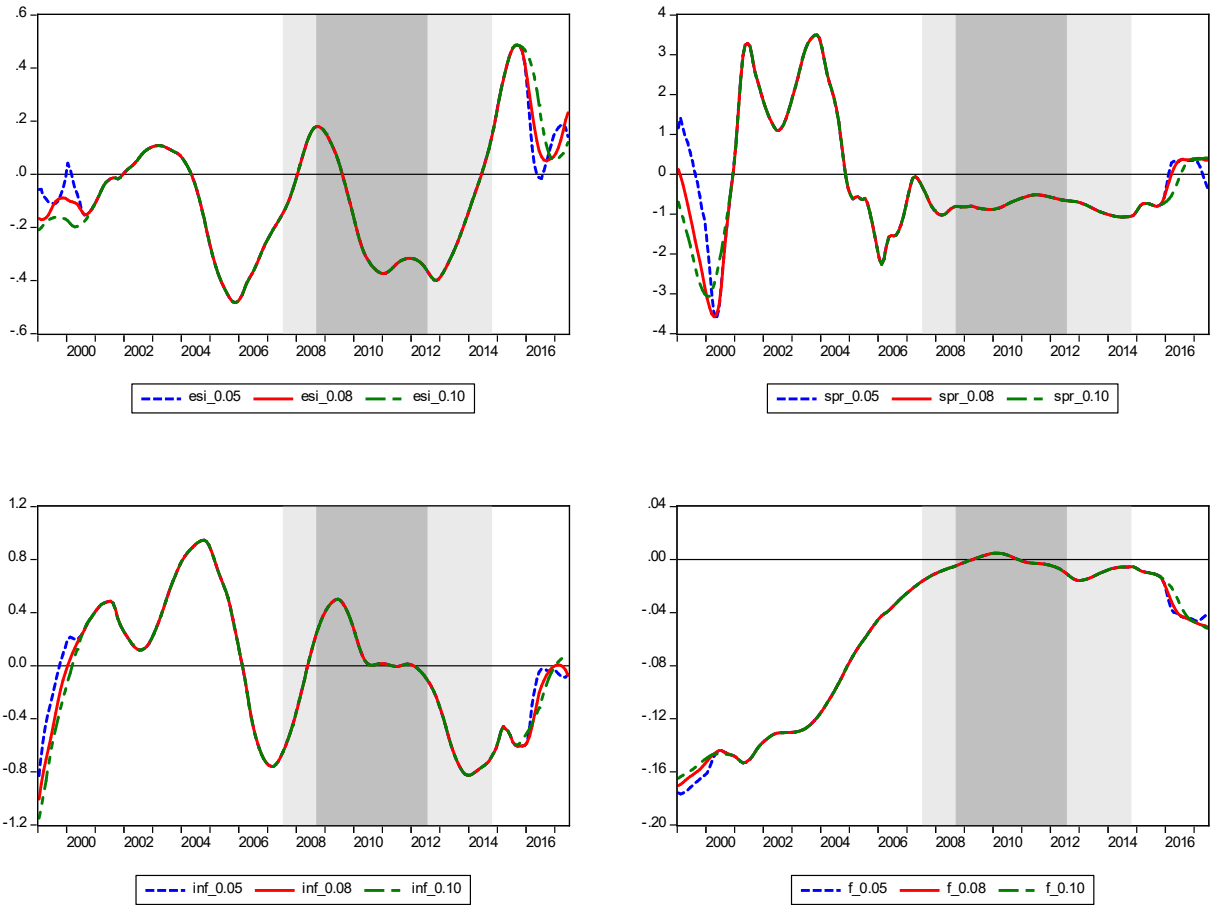
Note: The figure presents the coefficients obtained from the estimation of the time varying parameters (TVP) model given by equation (1) using three different values of the bandwidth parameter h = 0.10, 0.15, 0.20, for the core panel over the period January 1999 - July 2017 (222 observations). The benchmark model sets h = 0.15. In all cases the bandwidth correction parameter (ε) is set equal to 0.08. The panel includes Austria, Belgium, Finland, France and the Netherlands. The dependent variable is the log-index of private deposits relative to Germany. The set of explanatory variables includes the log volume-index of the Economic Sentiment Indicator (*esi*) series against Germany; the 10-year government bond yield spread (*spread*) against Germany; and the year to year inflation rate calculated for the Harmonised Index of Consumer Prices relative to German (*inf*). The model also includes a trend function (*f*) capturing time-specific effects accounting for omitted variables having a common, over time, impact across the panel's cross sections. The light-shaded area covers the period July 2007 – October 2014; the dark-shaded area covers the period September 2008 – July 2012.

Figure A14: TVP estimates obtained by estimating equation (1) using alternative bandwidth parameters *(h)* – Periphery panel



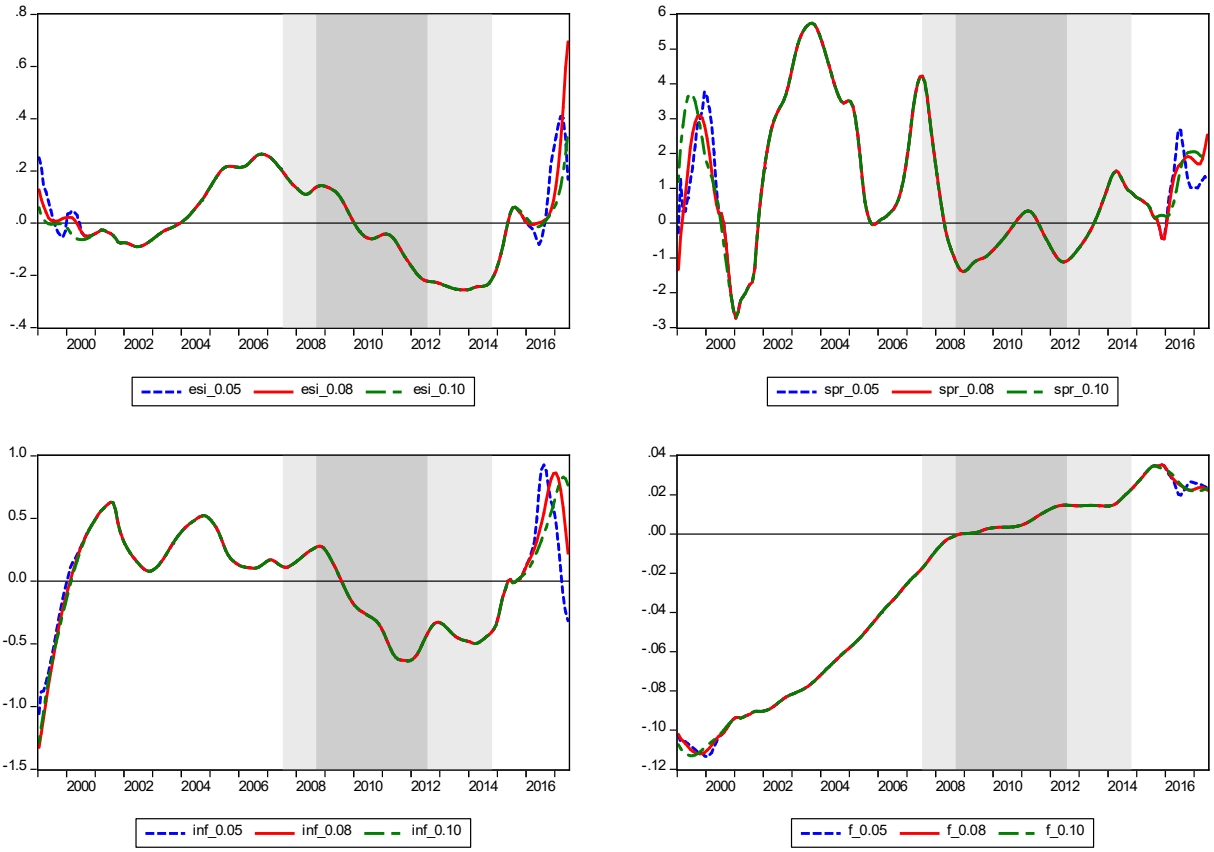
Note: The figure presents the coefficients obtained from the estimation of the time varying parameters (TVP) model given by equation (1) using three different values of the bandwidth parameter h = 0.10, 0.15, 0.20, for the periphery panel over the period January 1999 - July 2017 (222 observations). The benchmark model sets h = 0.15. In all cases the bandwidth correction parameter (ε) is set equal to 0.08. The panel includes Greece, Ireland, Italy, Portugal and Spain. The dependent variable is the log-index of private deposits relative to Germany. The set of explanatory variables includes the log volume-index of the Economic Sentiment Indicator (*esi*) series against Germany; the 10-year government bond yield spread (*spread*) against Germany; and the year to year inflation rate calculated for the Harmonised Index of Consumer Prices relative to German (*inf*). The model also includes a trend function (*f*) capturing time-specific effects accounting for omitted variables having a common, over time, impact across the panel's cross sections. The light-shaded area covers the period July 2007 – October 2014; the dark-shaded area covers the period September 2008 – July 2012.

Figure A15: TVP estimates obtained by estimating equation (1) using alternative bandwidth correction parameters *(ε)* – Full panel



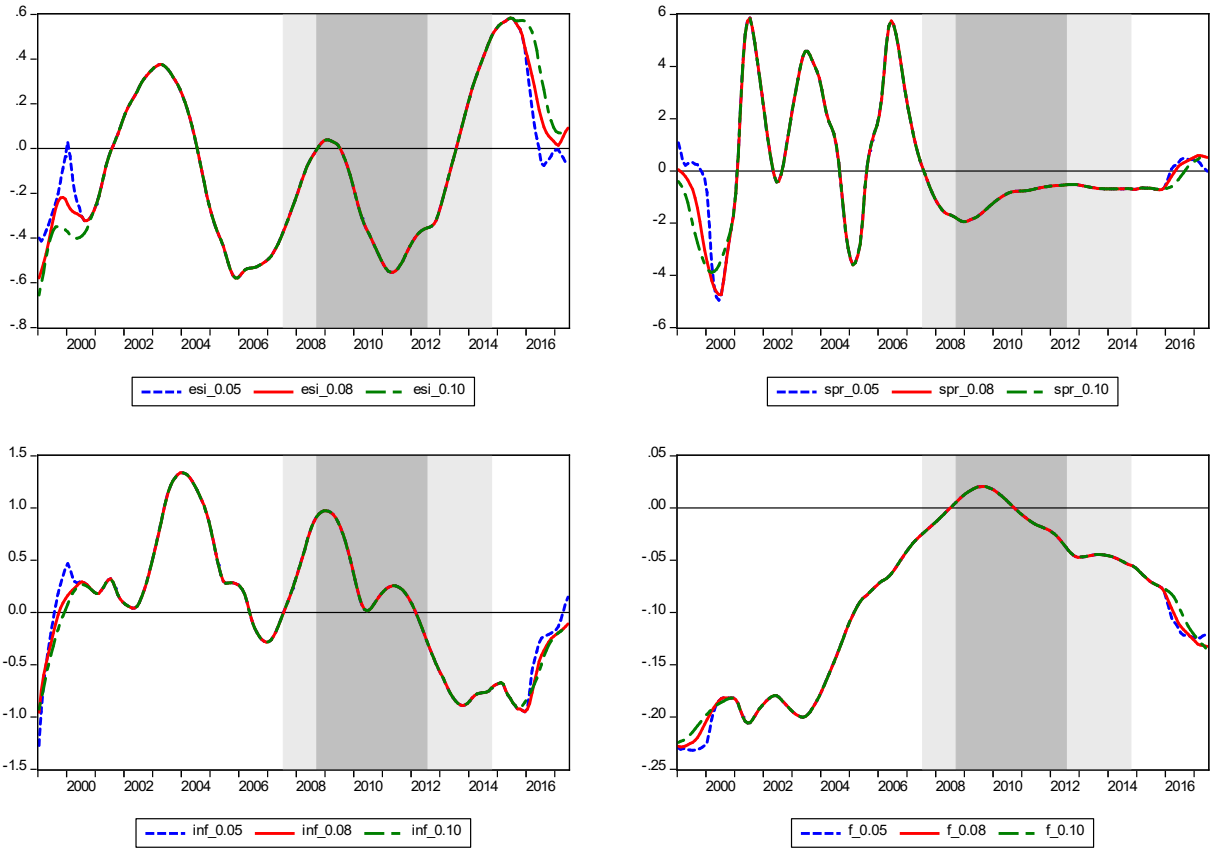
Note: The figure presents the coefficients obtained from the estimation of the time varying parameters (TVP) model given by equation (1) using three different values of the bandwidth correction parameter ε = 0.05, 0.08, 0.10, for the full panel over the period January 1999 - July 2017 (222 observations). The benchmark model sets ε = 0.08. In all cases the bandwidth parameter (h) is set equal to 0.15. The panel includes Austria, Belgium, Finland, France, Greece, Ireland, Italy, the Netherlands, Portugal and Spain. The dependent variable is the log-index of private deposits relative to Germany. The set of explanatory variables includes the log volume-index of the Economic Sentiment Indicator (*esi*) series against Germany; the 10-year government bond yield spread (*spread*) against Germany; and the year to year inflation rate calculated for the Harmonised Index of Consumer Prices relative to German (*inf*). The model also includes a trend function (f) capturing time-specific effects accounting for omitted variables having a common, over time, impact across the panel's cross sections. The light-shaded area covers the period July 2007 – October 2014; the dark-shaded area covers the period September 2008 – July 2012.

Figure A16: TVP estimates obtained by estimating equation (1) using alternative bandwidth correction parameters *(ε)* – Core panel



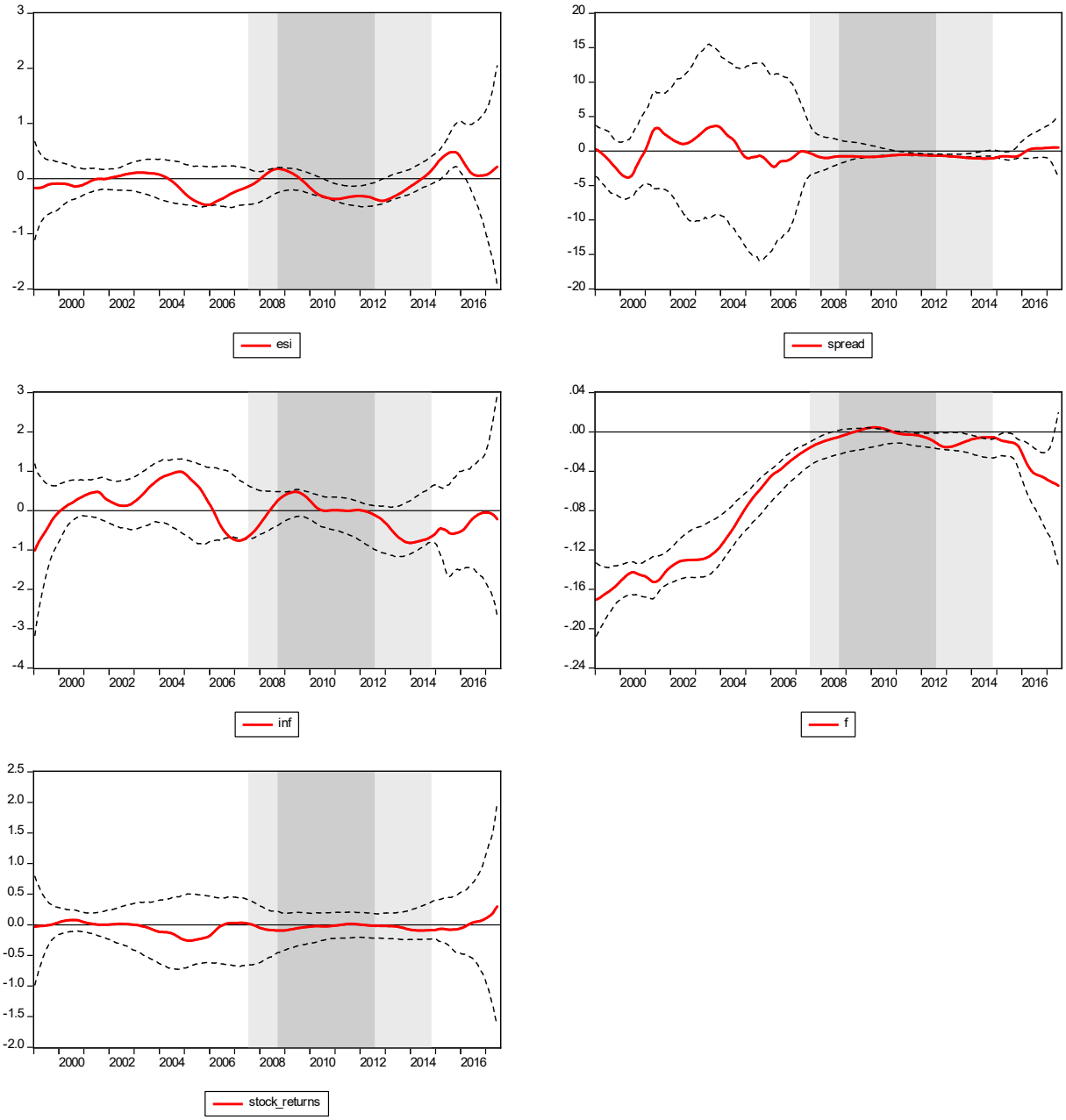
Note: The figure presents the coefficients obtained from the estimation of the time varying parameters (TVP) model given by equation (1) using three different values of the bandwidth correction parameter ε = 0.05, 0.08, 0.10, for the core panel over the period January 1999 - July 2017 (222 observations). The benchmark model sets ε = 0.08. In all cases the bandwidth parameter (h) is set equal to 0.15. The panel includes Austria, Belgium, Finland, France and the Netherlands. The dependent variable is the log-index of private deposits relative to Germany. The set of explanatory variables includes the log volume-index of the Economic Sentiment Indicator (*esi*) series against Germany; the 10-year government bond yield spread (*spread*) against Germany; and the year to year inflation rate calculated for the Harmonised Index of Consumer Prices relative to German (*inf*). The model also includes a trend function (f) capturing time-specific effects accounting for omitted variables having a common, over time, impact across the panel's cross sections. The light-shaded area covers the period July 2007 – October 2014; the dark-shaded area covers the period September 2008 – July 2012.

Figure A17: TVP estimates obtained by estimating equation (1) using alternative bandwidth correction parameters *(ε)* – Periphery panel



Note: The figure presents the coefficients obtained from the estimation of the time varying parameters (TVP) model given by equation (1) using three different values of the bandwidth correction parameter ε = 0.05, 0.08, 0.10, for the periphery panel over the period January 1999 - July 2017 (222 observations). The benchmark model sets ε = 0.08. In all cases the bandwidth parameter (*h*) is set equal to 0.15. The panel includes Greece, Ireland, Italy, Portugal and Spain. The dependent variable is the log-index of private deposits relative to Germany. The set of explanatory variables includes the log volume-index of the Economic Sentiment Indicator (*esi*) series against Germany; the 10-year government bond yield spread (*spread*) against Germany; and the year to year inflation rate calculated for the Harmonised Index of Consumer Prices relative to German (*inf*). The model also includes a trend function (*f*) capturing time-specific effects accounting for omitted variables having a common, over time, impact across the panel's cross sections. The light-shaded area covers the period July 2007 – October 2014; the dark-shaded area covers the period September 2008 – July 2012.

Figure A18: Adding stock index return differential against Germany– Full panel

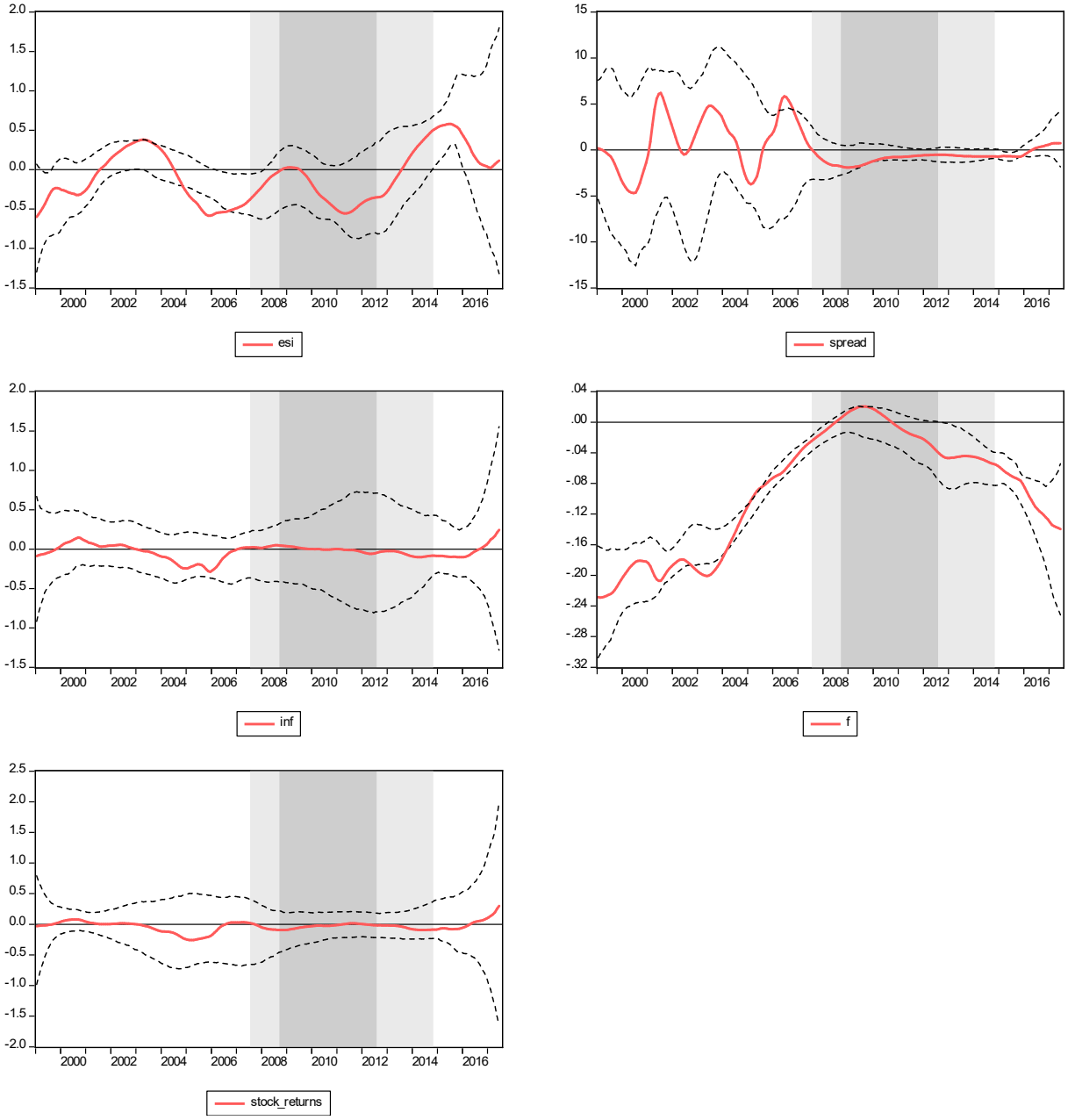


Note: The figure presents the coefficients obtained from the estimation of the time varying parameters (TVP) model given by equation (1) adding stock index returns relative to Germany as an additional independent variable for the full panel over the period January 1999 - July 2017 (222 observations); and the corresponding 90% confidence intervals (dotted lines) calculated using the wild bootstrap method (1000 iterations). The estimation bandwidth parameter (h) is set to 0.15 and the bandwidth correction parameter (ε) to 0.08. The panel includes Austria, Belgium, Finland, France, Greece, Ireland, Italy, the Netherlands, Portugal and Spain. The dependent variable is the log-index of private deposits relative to Germany. The set of explanatory variables includes the log volume-index of the Economic Sentiment Indicator (*esi*) series against Germany; the 10-year government bond yield spread (*spread*) against Germany; the year to year inflation rate calculated for the Harmonised Index of Consumer Prices relative to German (*inf*); and stock returns relative to Germany *(stock_returns*). The model also includes a trend function (*f*) capturing time-specific effects accounting for omitted variables having a common, over time, impact across the panel's cross sections. The light-shaded area covers the period July 2007 – October 2014; the dark-shaded area covers the period September 2008 – July 2012.

Figure A19: Adding stock index return differential against Germany – Core panel

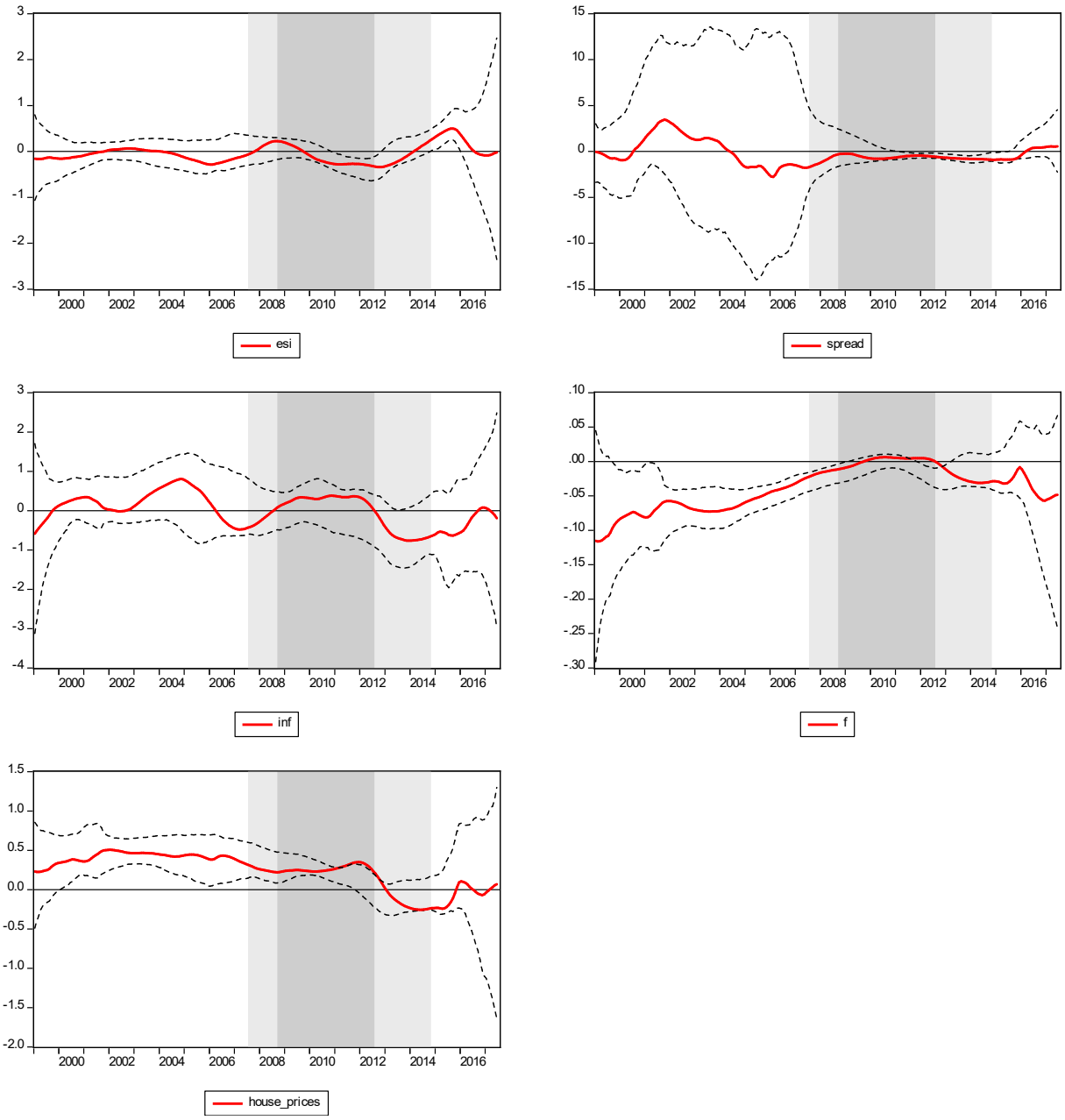
Note: The figure presents the coefficients obtained from the estimation of the time varying parameters (TVP) model given by equation (1) adding stock index returns relative to Germany as an additional independent variable for the core panel over the period January 1999 - July 2017 (222 observations); and the corresponding 90% confidence intervals (dotted lines) calculated using the wild bootstrap method (1000 iterations). The estimation bandwidth parameter (h) is set to 0.15 and the bandwidth correction parameter (ε) to 0.08. The panel includes Austria, Belgium, Finland, France and the Netherlands. The dependent variable is the log-index of private deposits relative to Germany. The set of explanatory variables includes the log volume-index of the Economic Sentiment Indicator (*esi*) series against Germany; the 10-year government bond yield spread (*spread*) against Germany; the year to year inflation rate calculated for the Harmonised Index of Consumer Prices relative to German (*inf*); and stock returns relative to Germany *(stock_returns*) The model also includes a trend function (*f*) capturing time-specific effects accounting for omitted variables having a common, over time, impact across the panel's cross sections. The light-shaded area covers the period July 2007 – October 2014; the dark-shaded area covers the period September 2008 – July 2012.

Figure A20: Adding stock index return differential against Germany – Periphery panel



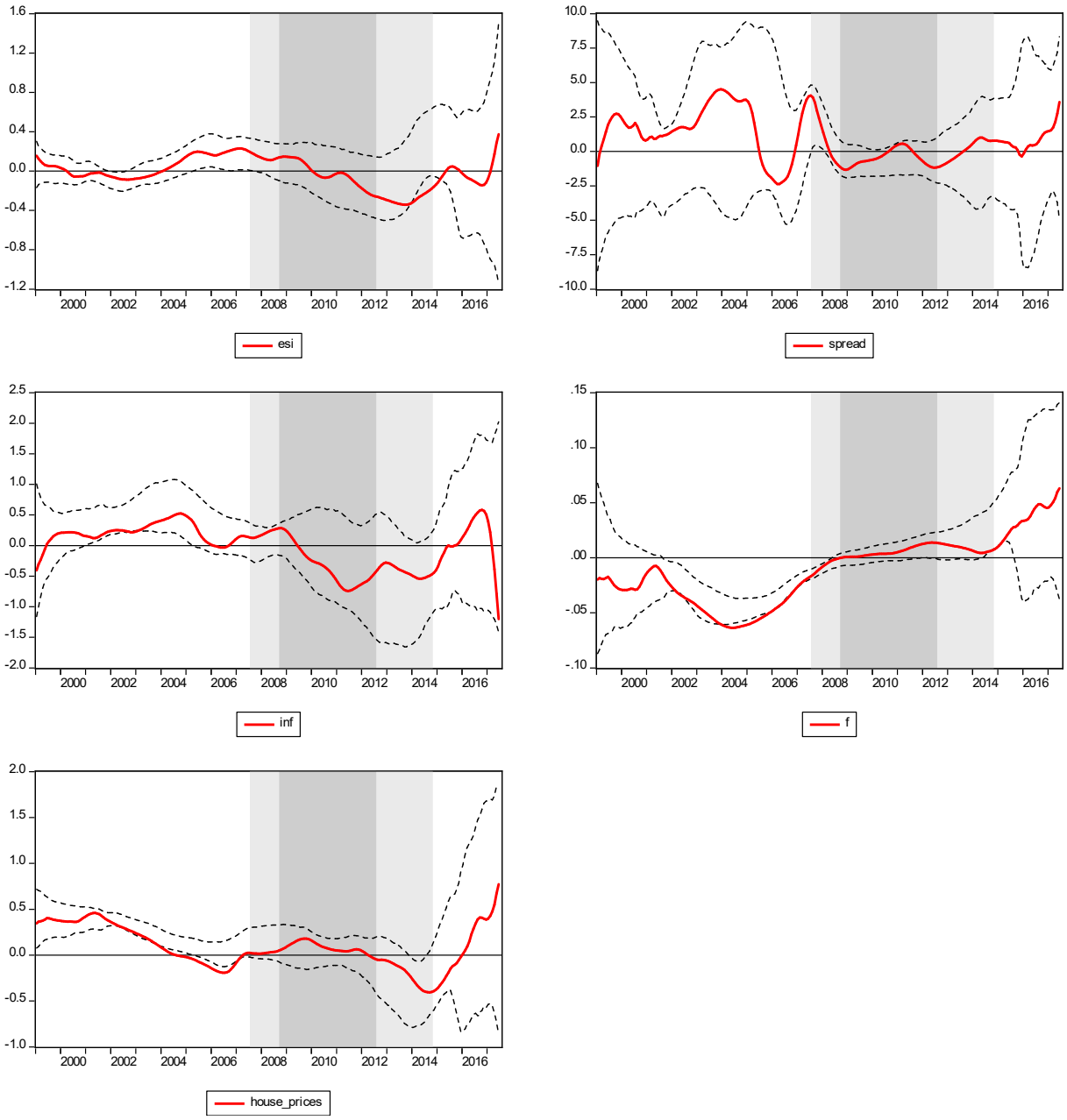
Note: The figure presents the coefficients obtained from the estimation of the time varying parameters (TVP) model given by equation (1) adding stock index returns relative to Germany as an additional independent variable for the periphery panel over the period January 1999 - July 2017 (222 observations); and the corresponding 90% confidence intervals (dotted lines) calculated using the wild bootstrap method (1000 iterations). The estimation bandwidth parameter (h) is set to 0.15 and the bandwidth correction parameter (ε) to 0.08. The panel includes Greece, Ireland, Italy, Portugal and Spain. The dependent variable is the log-index of private deposits relative to Germany. The set of explanatory variables includes the log volume-index of the Economic Sentiment Indicator (*esi*) series against Germany; the 10-year government bond yield spread (*spread*) against Germany; the year to year inflation rate calculated for the Harmonised Index of Consumer Prices relative to German (*inf*); and stock returns relative to Germany *(stock_returns*). The model also includes a trend function (*f*) capturing time-specific effects accounting for omitted variables having a common, over time, impact across the panel's cross sections. The light-shaded area covers the period July 2007 – October 2014; the dark-shaded area covers the period September 2008 – July 2012.

Figure A21: Adding log house-price index differential against Germany - Full panel



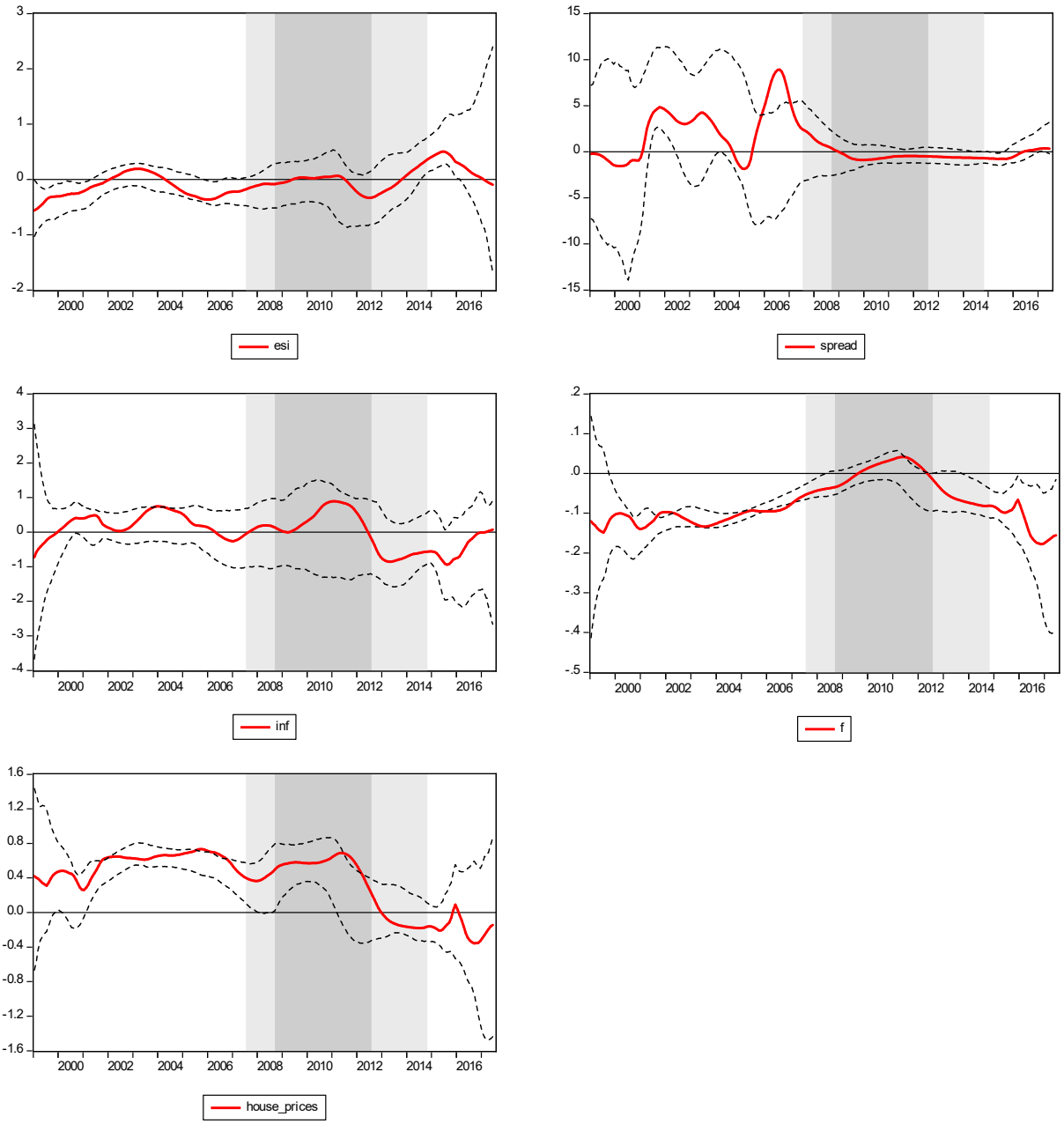
Note: The figure presents the coefficients obtained from the estimation of the time varying parameters (TVP) model given by equation (1) adding log house price index relative to Germany as an additional independent variable for the full panel over the period January 1999 - July 2017 (222 observations); and the corresponding 90% confidence intervals (dotted lines) calculated using the wild bootstrap method (1000 iterations). The estimation bandwidth parameter (h) is set to 0.15 and the bandwidth correction parameter (ε) to 0.08. The panel includes Austria, Belgium, Finland, France, Greece, Ireland, Italy, the Netherlands, Portugal and Spain. The dependent variable is the log-index of private deposits relative to Germany. The set of explanatory variables includes the log volume-index of the Economic Sentiment Indicator (*esi*) series against Germany; the 10-year government bond yield spread (*spread*) against Germany; the year to year inflation rate calculated for the Harmonised Index of Consumer Prices relative to German (*inf*); and log house price index relative to Germany *(house_prices*). The model also includes a trend function (*f*) capturing time-specific effects accounting for omitted variables having a common, over time, impact across the panel's cross sections. The light-shaded area covers the period July 2007 – October 2014; the dark-shaded area covers the period September 2008 – July 2012.

Figure A22: Adding log house-price index differential against Germany – Core panel



Note: The figure presents the coefficients obtained from the estimation of the time varying parameters (TVP) model given by equation (1) adding log house price index relative to Germany as an additional independent variable for the core panel over the period January 1999 - July 2017 (222 observations); and the corresponding 90% confidence intervals (dotted lines) calculated using the wild bootstrap method (1000 iterations). The estimation bandwidth parameter (h) is set to 0.15 and the bandwidth correction parameter (ε) to 0.08. The panel includes Austria, Belgium, Finland, France and the Netherlands. The dependent variable is the log-index of private deposits relative to Germany. The set of explanatory variables includes the log volume-index of the Economic Sentiment Indicator (*esi*) series against Germany; the 10-year government bond yield spread (*spread*) against Germany; the year to year inflation rate calculated for the Harmonised Index of Consumer Prices relative to German (*inf*); and log house price index relative to Germany *(house_prices*). The model also includes a trend function (f) capturing time-specific effects accounting for omitted variables having a common, over time, impact across the panel's cross sections. The light-shaded area covers the period July 2007 – October 2014; the dark-shaded area covers the period September 2008 – July 2012.

Figure A23: Adding log house-price index differential against Germany – Periphery panel



Note: The figure presents the coefficients obtained from the estimation of the time varying parameters (TVP) model given by equation (1) adding log house price index relative to Germany as an additional independent variable for the periphery panel over the period January 1999 - July 2017 (222 observations); and the corresponding 90% confidence intervals (dotted lines) calculated using the wild bootstrap method (1000 iterations). The estimation bandwidth parameter (h) is set to 0.15 and the bandwidth correction parameter (ε) to 0.08. The panel includes Greece, Ireland, Italy, Portugal and Spain. The dependent variable is the log-index of private deposits relative to Germany. The set of explanatory variables includes the log volume-index of the Economic Sentiment Indicator (*esi*) series against Germany; the year to year 10-year government bond yield spread (*spread*) against Germany; the inflation rate calculated for the Harmonised Index of Consumer Prices relative to German (*inf*); and log house price index relative to Germany *(house_prices*). The model also includes a trend function (f) capturing time-specific effects accounting for omitted variables having a common, over time, impact across the panel's cross sections. The light-shaded area covers the period July 2007 – October 2014; the dark-shaded area covers the period September 2008 – July 2012.