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Expected fiscal policy and interest rates in open economy

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Abstract

This paper reconsiders the long term effect of fiscal policy on interest rates using a real-time dataset of macroeconomic and fiscal variables in a panel of 17 OECD countries over the period 1989-2009. We show that, after controlling for cross sectional dependence using a *Factor Augmented Panel*, interest rates are mostly related to global factors. Among domestic fiscal variables, the level of expected public debt mantains a positive correlation with interest rates, while among the global factors, the aggregate monetary and fiscal stance play a quantitatively sizeable role. We then analyze how impulses from the aggregate fiscal stance influence each country's interest rates. We find that these effects are modest in large economies and particularly strong in economies characterized by low initial financial integration, leading the way to a novel interpretation of the divergent behaviour of interest rates in the recent financial crisis.

Expected fiscal policy and interest rates in open economy

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[Preliminary Draft]

Abstract This paper reconsiders the long term effect of fiscal policy on interest rates using a real-time dataset of macroeconomic and fiscal variables in a panel of 17 OECD countries over the period 1989-2009. We show that, after controlling for cross sectional dependence using a *Factor Augmented Panel*, interest rates are mostly related to global factors. Among domestic fiscal variables, the level of expected public debt mantains a positive correlation with interest rates, while among the global factors, the aggregate monetary and fiscal stance play a quantitatively sizeable role. We then analyze how impulses from the aggregate fiscal stance influence each country's interest rates. We find that these effects are modest in large economies and particularly strong in economies characterized by low initial financial integration, leading the way to a novel interpretation of the divergent behaviour of interest rates in the recent financial crisis.

Keywords: Real time data; Fiscal Policy; Interest rates; Cross sectional dependence; Heterogeneous panels; Factor model.

JEL Classification Numbers: C10, E43, F42, F62, H68.

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1 Introduction

The global financial crisis and its adverse effects on the budget deficits of advanced economies have revived the debate on the link between fiscal policy and interest rates. The strong convergence observed among advanced countries' interest rates before the crisis came to a halt when the global recession provoked a substantial deterioration of sovereigns' fiscal deficits. Financial markets then suddenly started to discriminate between borrowers. These developments seem to suggest that: 1) under increased capital market integration, interest rates tend to follow global factors rather than domestic variables; 2) nonetheless, the effects stemming from fiscal policy can be large and substantial when sovereign face adverse budgetary shocks. The objective of this paper is thus to analyze the impact of fiscal policy on sovereign yields in a broad panel of OECD countries, taking into account the heterogeneity in responses to common shocks. In particular, we answer the following questions: How do markets discipline borrowers under high financial integration? Do global factors matter more than domestic factors? Does domestic fiscal policy affect at all the cost of borrowing for governments?

We follow and expand the existing literature along three dimensions. First, we start from the quite established result according to which the relation between fiscal policy and interest rates becomes statistically significant when using fiscal projections rather than actual data (Reinhart and Sack 2000, Canzoneri, Cumby and Diba, 2002; Gale and Orszag, 2004; Laubach 2009; Afonso 2009). Hence, we construct a real-time dataset based on macroeconomic projections collected from several vintages of the OECD economic outlook. The use of real time data serves different purposes: i) it is meant to take into account the forward looking behaviour of financial markets; ii) it avoids possible simultaneity problems arising from the use of actual data. Collecting fiscal projections from an independent agency like the OECD rather than official governments plans, is motivated by the evidence presented in Beetsma and Giuliodori (2010) and Cimadomo (2008). The authors show how governments' released budget plans tend to be overly optimistic in terms of expected fiscal outcome. Thus,

the forecasts released by the OECD are less prone to this "optimistic bias".

Second, since fiscal deficit by itself may not in fact be a proper measure of current fiscal stance, another improvement is that, following the insights of Alesina and Perotti (1996), we look at the overall policy mix instead of the budget deficit as a measure of fiscal stance. We thus decompose the expected deficit into revenue and spending as forecasted by the OECD.

Finally, our third improvement is methodological. We implement a new estimator which takes explicitely into account cross sectional dependence and heterogeneity in traditional panel models. The methodology (*Factor Augmented Panel*) consists in estimating the unobserved common factors from the data by means of principal components and plugging them back into the equation, allowing for heterogeneous propagation of the common shock. Recent econometric literature (Pesaran, 2006, Bai, 2009) shows that not accounting for these effects in panel data gives rise to biased and inconsistent estimates.

Overall, we find that using standard panel techniques provides results that are similar to those found in previous literature: the estimated effect of a 1% increase in budget deficits on long term yield is about 10 basis point; and 2 basis points for a 1% increase in public debt. However, once we account for cross sectional dependence, the estimated effect of budget deficits become smaller in magnitude or even insignificant, while the effects of public debt remains unchanged. We also distinguish the components of public deficits and find that higher government spending increases real interest rates while tax increases reduce them. Contrary to previous findings, we also find that the non linear effects of fiscal policy are not related to public debt**,** but to the difference between debt stabilizing defict and projected deficit, which tend to matter in periods of financial distress. Finally, the presence of cross sectional correlation across countries leads us to analyze the contribution of the unobservable common factors to explain domestic interest rates. Two common factors account for more than 60% of the panel variance and they represent global monetary and fiscal policy. When we analyze the effects of aggregate fiscal policy on domestic interest rates, two main results emerge. First, we find that spillovers are statistically significant and quantitatively more

important than idiosyncratic elements. Second, the effects appears to be strongly heterogeneous across countries. In fact, there appears to be clusters of countries, with the highest effects found in mediterranean countries and Ireland, and the smallest effects found in "safe heaven" countries (like the US, Germany, Norway).

We proceed as follows. In Section 2, we provide a brief review of the literature. In Section 3 we explain the methodological framework. In Section 4 we discuss our dataset and its properties. In Section 5 we present estimation results. In Section 6 we analyze the effect of fiscal policy spillovers, while in Section 7 we do some robustness checks. Section 8 concludes.

2 Literature Review

There is a large empirical literature on the effects of fiscal policy on interest rates. Despite the large production, the results are still mixed. A large body of the literature is based on US data, but an increasing number of studies is also based on European and OECD data. As reported by Gale and Orszag (2003) in their survey of existing work, out of 59 papers reviewed, 29 found a significant positive effect, 11 had mixed results, while 19 found a predominantly insignificant effect. In spite of the mixed results, we can identify few areas of consensus: 1) studies that employ measures of expected rather than actual budget deficits as explanatory variables tend to find a significant effect of fiscal policy on interest rates (Feldstein, 1986; Reinhert and Sack, 2000; Canzoneri et al. 2002; Laubach, 2009); 2) the effect of public debt appear to be non-linear (Faini, 2006; Ardagna et al. 2007); 3) the effects of public debt are quantitatively smaller than those of public deficit (Faini, 2006; Laubach, 2009); 4) the spillover effects of fiscal policy seem larger than domestic effect (Faini, 2006; Ardagna et al. 2007); 5) the effects found in cross country studies are smaller than those found in single country studies.

The papers more closely related to ours are Reinhart and Sack (2000), Chinn and Frankel

(2005) and Ardagna et al. (2007). Reinhart and Sack (2000) estimate the effects of fiscal policy in a panel of 19 OECD countries using annual fiscal projections from the OECD. The authors find that a one percentage increase in the budget deficit to GDP increases interest rates by 9 basis points in the OECD and by 12 basis points in the G7. The authors though do not consider the level of debt and do not control for global factors. Chinn and Frankel (2005) focus on Germany, France Italy and Spain, while also considering evidence for UK, the US and Japan. They use the expected debt rather than the expected deficit and also use projections from the OECD. They find mixed evidence about the effects of expected debt, but the results seem to be significant once they include the US interest rate as a proxy for the "world" interest rate. Ardagna et al. (2007) estimate the effects of fiscal policy in a panel of 16 OECD countries with annual actual data, from 1960 to 2002. They find that a one percentage increase in the primary fiscal deficit to GDP increases long term interest rates by 10 basis points, a result similar to the one in Reinhart and Sack (2000). Contrary to Reinhart and Sack (2000), Ardagna et al. (2007) also control for the level of debt, finding that the results are non linear: interest rates increase for debt to GDP level above 60%. Moreover, the authors control for global factors by including cross-sectional averages of explanatory variables. They find that average debt and deficits have significant (spillover) effects on interest rates, but domestic variables still affect interest rates while controlling for global factors.

In this paper, we follow Reinhart and Sack (2000) and Chinn and Frankel (2005) and use fiscal projections instead of actual data. On the other hand, we follow Ardagna et al. (2007) in adopting their empirical specification. However, our main difference from these papers lies in the methodology. In fact, our starting point is to recognize that interest rates are mainly driven by unobserved common factors, and that these factors affect each unit in the panel differently. The econometric literature provides different methodologies to correct for cross-sectional dependence (Bai, 2009; Pesaran, 2006). Here, we follow the methodology proposed originally by Giannone and Lenza (2010) in their study of the Feldstein-Horioka puzzle. They

show that the high correlation between domestic savings and investments found in previous studies vanishes once the panel takes into account this factor structure approach. They attribute the high correlation between domestic saving and investment previously found in the literature as a result of a misspecified regression.

3 Methodology

While the theory acknowledges that in financially integrated economies global factors play a role in determining interest rates, empirical results have proven inconclusive. Some authors have found that idiosyncratic factors play a small role in determining domestic interest rates (Ford and Laxton, 1999; Faini, 2006) other authors instead have found that that domestic conditions still play a significant role (Ardagna et al. 2007; Chinn and Frankel, 2007).

In this section we propose to approach the question with the help of a new methodology, which is meant to isolate pure idiosyncratic shocks from global factors. In particular: we first review the methodology previously used in the literature; we then show how these methodologies are not robust since they fail to properly take into account the country specific response to global shocks.

3.1 The econometric model

Let's assume that the interest rate is r_{it} for $(i = 1, \ldots, N; t = 1, \ldots, T)$ and x_{it} is a vector of controls which includes fiscal variables for $(i = 1, \ldots, N; t = 1, \ldots, T)$. A standard approach to the analysis of the effects of fiscal policy on interest rates with panel data would resolve to the estimation of the following model:

$$r_{it} = \alpha_i + \beta x_{it} + \varepsilon_{it} \tag{1}$$

where some form of heterogeneity across countries is allowed by introducing time-invariant country characteristics in the form of fixed effects (α_i). This is the model estimated by

Reinhart and Sack (2000) in a panel of 20 OECD countries. This model is likely to yield be biased estimates since it does not take into account the presence of common source of fluctuations in the level of interest rates; that is, it treats the data as if they are cross-sectionally independent while in open economies with integrated capital markets the presence of common factors that affect all interest rates simultaneously is likely to be a widespread feature (Eaton, 2000).

The literature has recognized this problem by adopting the following two empirical strategies. A first approach (Breedon et al. 1999; Chinn and Frankel, 2005) is to find an a priori *indentifiable* variable (or a subset of variables) which might affect contemporaneously the interest rates across countries, and introduce them directly in the panel, so that the regression model becomes:

$$r_{it} = \alpha_i + \beta x_{it} + \gamma z_t + \xi_{it} \tag{2a}$$

where the variable (z_t) is a vector (or a matrix) of identified common factors. An alternative approach would instead consist in accounting for unobservable common shocks by introducing "time" dummies. This would lead to the estimation of the following model (Ardagna et al. 2007):

$$r_{it} = \alpha_i + \lambda_t + \beta x_{it} + \xi_{it} \tag{2b}$$

where the time dummy (λ_t) is equivalent to assuming that in each time period there is a common shock which affects homogeneously countries' interest rates. Both $(2a)$ and $(2b)$ are then aimed at controlling for common factors in the determination of interest rates, and can then be used to test the relative importance of global versus national factors.

Both these approaches suffer from shortcomings. While acknowledging common sources of fluctuations, they impose homogeneous effects across countries. If the propagation of the common shocks is similar, though not identical across countries, the effect of fiscal policy on interest rates cannot be consistently estimated. Assume for instance that the national interest

rates are cross sectionally linked due to the presence of an unobserved "world" interest rate (Barro and Sala-i-Martin, 1990). If economies are characterized by different levels of financial integration, and/or have different sizes, then it is likely that the transmission of shocks to the common world interest rate will be different according to country specific characteristics. Failing to take into account this effect will lead to biased results. Therefore, in our estimation we will adopt the following model:

$$r_{it} = \alpha_i + \lambda_t + \beta x_{it} + u_{it} \tag{3}$$

$$u_{it} = \delta_i F_t + \nu_{it} \tag{4}$$

where F_t corresponds to the p common factors and both δ_i and F_t are unobserved, while ν_{it} is a country idiosyncratic error which is assumed to be independently distributed. In this model, if δ_i - the $p \times 1$ vector of the country specific loadings - are different from zero, and if $\delta_i \neq \delta_j$ for $(i, j = 1, \ldots, N; i \neq j)$, then not including those p factors will introduce correlation between the regressors and the error term leading to biased estimates of the β coefficients. In fact, by estimating model (3), we allow also the x_{it} to be correlated with the common unobserved factors F_t, so that the latter can impact interest rates not only through the factor structure (4) but also indirectly by affecting the regressors. Our approach is to estimate a *Factor Augmented Panel* (FAP) according to the methodology suggested by Giannone and Lenza (2010). In the next section we highlight their estimation strategy in detail.

3.2 Estimation Strategy

As a first step, we need consistent estimates of the p unobservable factors. We obtain them by means of principal components. By stacking all the observations for our N cross

sections in the matrix W_t:

$$W_t = (r_{1t}, x_{1t}, ..., r_{nt}, x_{nt})'$$

we can represent the system in the following way:

$$W_t = \Lambda F_t + W_t^{id}$$

where F_t is the $T \times p$ matrix of common factors, Λ is the matrix of factor loadings and W_t^{id} is the idiosyncratic component. Under the assumptions that common factors are pervasive and that idiosyncratic shocks are not pervasive, the matrix of common factors F_t can be consistently estimated by extracting principal components from the matrix W. In fact, under these conditions consistency is achieved as the number of series and the number of observations increase. Moreover these estimates are robust to some form of non stationarity in the data (Giannone and Lenza 2010).We then extract a number p of principal components that explain a certain threshold percentage of the panel variance[1]. We then plug these estimated factors $(\widehat{f}_{1t}, ..., \widehat{f}_{pt})$ into the equation, and allow the coefficients on these factors to differ across countries.

Our baseline equation is then:

$$r_{it} = \alpha_i + \lambda_t + \beta x_{it} + \sum_{k=1}^{p} \delta_{ik} \widehat{f}_{kt} + \upsilon_{it}$$

which can be consistently estimated by standard panel techniques. Notice that if the factors loadings (δ_{ik}) are non zero, estimation of equations $(1-2)$ leads to estimates that are biased and inconsistent since the error term contains the common factors. While we allow the response to the common factors (δ_{ik}) to vary across country, we keep the coefficient (β) on the fiscal variable of interest fixed across countries. This is meant to keep the results consistent with those obtained in previous studies who find significant effects of domestic

[1] We also apply the Bai and Ng (2002) criterion for the optimal number of factors.

fiscal policy on interest rates using homogeneous coefficients specfications.

Normally, having an estimated element in the regression would introduce a further source of uncertainty, which would require (block) bootstrapped standard errors. However, we rely on the result by Giannone and Lenza (2010), Bai (2003) and Bai and Ng (2006) according to which when the number of countries is not too small relative to the sample size there is no generated regressor problem[2].

Before turning to the discussion of the data, it is important to notice that this is not the only methodology proposed by the literature to tackle cross-sectional dependence. Other strategies can be found in Pesaran (2006) or Bai (2009). In particular, Pesaran (2006) has proposed an estimator called the Common Correlated Effects (CCE), which consists in introducing cross section averages of the dependent and the independent variables in the equation. Since cross-country aggregates average out idiosyncratic components, for large cross-sectional dimensions they tend to approximate the common factors. While this method is simple and intuitive, we believe its shortcoming is that it does not provide us with a direct estimate of what the common factors are, which is something we are interested in. Nevertheless, to make sure that our results are not driven by the choice of the estimator, in one of our robustness checks we follow the approach by Pesaran (2006). The findings point toward equivalent results.

4 Data description and properties

4.1 Data

Our data are taken from a real-time semi-annual dataset of macroeconomic and fiscal forecasts on OECD countries, based on the December and June issues of the OECD's *Economic Outlook* , from 1989 to 2009. The countries included are 17: Australia, Austria, Belgium,

[2]Bai (2003) and Bai and Ng (2006) show that factor scan be treated as known if the number of countries is larger than the square root of the sample size.

Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Norway, Netherlands, Spain, Sweden, United Kingdom and United States. Data on short term interest rate and the long term yields are taken from Datastream.

Since we are interested in isolating the effects of fiscal policy on interest rates, one should use both long term fiscal projections and expected interest rates to properly achieve identification. As noted by Laubach (2009), long-horizon projections of fiscal policy and interest rates are presumed to be little affected by the current state of the business cycle. Unfortunately, these data are not available for a large group of countries. In our dataset, the projected horizon is either one or two years ahead. In particular, in the editions from 1989 to 1994, the Outlook publishes in year t the projections for year $t+1$, both in the June and December issue. Starting from 1996, the OECD publishes also projections for year $t+2$ in the December issue, while the June issue contains only the projection for the year $t+1$. Therefore in our dataset we have: one year ahead projections for the June issue and for December issue between 1989 and 1994; two years ahead projections for the December issue from 1995 to 2009. While these forecasts embody different information sets, we pool them together to achieve higher degrees of freedom. However we checked that pooling projections at different horizons does not affect our main results.

A second issue concerns the choice of the dependent variables. Since we are not able to gather data on historical forward rates for a large group of countries, for the purpose of our analysis we use current data on three different dependent variables: the nominal long term yield ($nlty$); the ex-ante real long term yield ($rlty$); the slope, defined as the difference between long term nominal yield and short term interest rate ($slope$). For each dependent variable, we use the value observed in the month following the realease of the forecast; in particular, the January value for the December issue and the July value for the June issue. This approach is useful because the forecasts on fiscal variables are likely to take into account current markets conditions and the level of interest rates. Measuring interest rates after the release of the forecasts also reduces the problem of reverse causality. Furthermore, it only

involves the reasonable assumption that financial markets are forward looking and are able to incorporate rapidly all the available information.of three different dependent variables.

Since the ex-ante real long term yield is unobservable, it has to be constructed from the data. In particular, what is needed is a measure of markets' expectations of inflation ten years ahead. Since the Outlook provides forecast on inflation only for the period *t+1*, we proxy inflation expectations in *t+10* with the "trend inflation" calculated with the help of a Kalman Filter applied recursively on the series of inflation expectations for the year *t+1*. As indicators of fiscal stance, we use the following variables: the expected primary deficit ($pdef$); the expected public debt ($debt$); the expected revenues (rev); the expected primary expenditure ($spend$),all measured as shares of current GDP[3]. We use primary deficit instead of total deficit to avoid the problem of reverse causality. As a measure of debt, we use the total gross financial liabilities of the general government[4]. Since it is not clear whether stocks or flows are more important and since the stock of debt represents the cumulated deficits (credit risk) we introduce both indicators throughout the estimation. In order to control for the effects of monetary policy, we add as explanatory variable the expected short term rate. and we add as further controls the exptected inflation ($\inf l$) and expected real gdp growth (g). Table 1 reports the descriptive statistics. In the next section we provide some exploratory analysis to recognize the importance of common factors in the behaviour of interest rates.

4.2 Properties

The importance of cross sectional correlation of the interest rates can be easily observed by visual inspection. We thus present our dependent variables in Figures 1 to 3. We have

[3]In one of our robustness check, we also use trend GDP measured with a Hodrik-Prescott filter as a scaling variable. Results are similar.

[4]A better measure could be the Net Financial Liabilities of the General Government. However, this measure is still subject to substantial harmonization problems since it is not yet established how to compare the value of governments' assets across countries. An even better measure would include contingent liabilities. However, there is an ever bigger issue on how to compare these items across countries. This is though an interesting area of future research.

grouped the countries from right in the following way: first are the scandinavian countries (Norway, Sweden, Denmark); then we group the EMU countries (Finland, Ireland, Italy, Spain, Austria, Belgium, Netherlands, France, Germany); then we group the anglosaxon countries (Australia, Canada, the UK); finally we group Japan and the US. Figure 1 reports the behaviour of the nominal long term rate over the entire sample. First, we notice that the beginning of the sample is characterized by higher level of interest rates, both in the EMU countries and outside. Starting after 1994, there appears to be a strong convergence in the long term rate, with an especially marked reduction of the interest rates in the peripheral EMU countries (Ireland, Italy, Spain). This is consistent with the presumption that on the accession path to the common currency and higher financial integration, the long term interest rates become endogenous. Nevertheless, the convergence is observed also outside EMU: throughout the 2000s, interest rates remain low particularly so in Japan, while they begin to diverge only during the crisis. Figure 2 reports the cross section of ex-ante real rates. We can notice a similar common trend of downward reduction, but there is overall more idiosyncracy with respect to what we observed for the nominal rates. Thus we can expect that in our quantitative analysis, idiosyncratic factors will play a bigger role in explaining real rates compared to nominal rates. Finally, in Figure 3 we report the behaviour of the slope. The slope may be correlated across countries because of common components in growth rates and monetary policy. In fact, in the period between 1995 and 2000, which was characterized by higher growth rates, we notice that the slope of the yield curve is upward trending in almost all countries in the sample. It starts to flatten in the run up to the crisis, when it again trends upward due to the common reaction of advanced countries' monetary authorities to counteract the adverse effect of the global financial shock.

Once we have gauged the importance of cross correlation, the next step is to determine the number of common factors responsible for these comovements by quantitative analysis. We perform principal component analysis on the sample[5]. As shown in Table 2 , the first

[5]See the Appendix for details on the implementation of principal component analysis.

two principal components tend to explain up to 65% of the panel variance, indicating how strong is the impact of common factors in explaining the behaviour of interest rates. When we extract these factors, we notice that for the nominal and the real rate, there is a strong correlation with the aggregate monetary and fiscal stance in the sample (Figure 4 to 5), suggesting that, under increasing financial integration, interest rates are related through the convergence of short term rates influenced by the monetary authority and through the impact on aggregate savings influenced by the aggregate fiscal policy stance. The factors for the slope (Figure 6) seem instead to be related to the aggregate fiscal stance and the aggregate level of public debt.

In order to verify statistically the importance of common factors, we test for the presence of cross sectional dependence using Pesaran's CSD test [6]. We report the results for all the variables in our sample in Table 3. We can see that there is a strong indication of cross sectional dependence, since under the null of *independence* the statistic is distributed as $CSD \sim N(0,1)$. Before turning to the estimation, we briefly comment on the results on the stationarity tests, which we report in Table 4. We first implement the Pesaran's (2007) and we find indication that all the variables can be treated as stationary. There is mixed evidence with respect to the fiscal variables. We therefore implement the Moon and Perron's test (2004) which accounts for multifactor structure, we are able to reject the null of unit

[6] This test is based on testing the following set of hypotheses:

$$\begin{cases} H_0 : \rho_{ij} = \rho_{ji} = corr(u_{it}, u_{jt}) = 0 \quad \text{for } i \neq j \\ H_1 : \rho_{ij} = \rho_{ji} \neq 0 \quad \text{for some } i \neq j \end{cases}$$

Given the estimated pairwise correlation coefficients of the residuals:

$$\widehat{\rho}_{ij} = \widehat{\rho}_{ji} = \frac{\sum_{t=1}^{T} \widehat{u}_{it}\widehat{u}_{jt}}{\left(\sum_{t=1}^{T} \widehat{u}_{it}^2\right)^{1/2} \left(\sum_{t=1}^{T} \widehat{u}_{jt}^2\right)^{1/2}}$$

Pesaran (2004) showed that the following statistic:

$$CSD = \sqrt{\frac{2T}{N(N-1)}} \left(\sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \widehat{\rho}_{ij} \right)$$

is distributed as a *Standard Normal* for $N \to \infty$ and T sufficiently large. This statistic is particularly useful as a slight modification of the CSD statistic can also handle unbalanced panels

root[7]. We thus conclude that all the variables in our panel can be treated as stationary.

5 Estimation Results

5.1 Baseline Model

We now turn to the estimation. Once we extracted the factors from the data, we introduce them in the estimation equation. Therefore our baseline model can be represented as:

$$r_{it} = \alpha_i + \lambda_t + \beta X_{t|t-1,i} + \delta_{i1}\widehat{f}_{1t} + \delta_{i2}\widehat{f}_{2t} + \upsilon_{it}$$

where r_{it} is one of our measure of interest rates and $X_{t|t-1,i}$ is the matrix of regressors, which contains: the expected short term rate; the expected inflation rate; the expected growth rate; the expected primary deficit; the expected public debt. For each variable, the projected forecast is for the next calendar year for the June issues and for the December issue between 1989 and 1994; two years ahead for the December issue between 1995 and 2009.

Tables 5-7 report the results obtained from the estimation of the baseline equation using respectively, the ex-ante real interest rate, the nominal long term interest rate and the slope as dependent variables. In each table, columns 1 and 4 report the results from the classical fixed effect estimator (FE), columns 2 and 5 report the results from the two-way FE estimator (2FE) and columns 3 and 6 report the results from the factor augmented panel estimator (FAP). Moreover, columns 1-3 show the results obtained from using the whole sample, while the columns 4-6 show the results without including the latest financial crisis[8]. Finally, in each table we report the results of two disgnostic tests. The row "CSD" shows the value

[7] We were unable to implement the Pesaran, Smith and Yamagata (2008) test, given that our time series is too small.

[8] There are few reasons in fact to suspect that results including the crisis might produce biased estimates: 1) the pace of deterioration of budget deficit was unprecedented; 2) more importantly, the measure of budget deficit and debt might fail to take into account the explicit and implicit costs of rescuing the banking sector, which might therefore affect the fiscal variables by serious measurement errors.

of the Pesaran's (2006) test to detect cross-sectional dependence; the statistic is distributed as a normal under the null of cross-sectional independence. The row "CIPS-error" reports the p-value from the Pesaran's (2003) test to detect unit root in the residual[9]. We start by looking at Table 3 which analyzes the determinants of the real interest rate.

[Table 5 here]

The results obtained from FE indicate a positive correlation between fiscal variables and real interest rates: a one percentage point increase in the expected primary deficit to GDP ratio increases interest rates by around 11 basis points if we include the crisis and 9 basis points if we exclude it. Regarding the debt, the effects are smaller: a 1% increase in the expected debt to GDP ratio increases interest rates by around 2 basis points if we include the crisis and almost 2.5 if we exclude it. The results are in line with those obtained in the literature (Ardagna et al., 2007), except that, contrary to the authors, we find that the coefficient on expected public debt is correctly signed. This may be a direct consequence of using fiscal projections rather than actual data, which reduces the problem of endogeneity. Regarding the residuals, while they seem well-behaved in terms of stationarity, the value of the CSD test indicates a strong rejection of the null of cross sectional independence. We therefore turn to discuss the results obtained from estimators that introduce unobserved common factors in the panel, the 2FE and the FAP. We notice first a strong decrease in the value of the CSD statistics (from above 40 to -4), with a better performance obtained of the FAP against the 2FE (-3 vs. -4), indicating that time effects are not enough to remove cross sectional dependence. With and without the crisis, the 2FE shows that deficit has a significant impact on interest rates, with effects between 6 and 7 basis points, while the coefficients on debt are almost unchanged. If we look at the FAP, we see that, in the specification with the crisis the effect of domestic deficits is still statistically significant, but the value of the coefficient drops to 4 basis points, while if we exclude the crisis it becomes

[9]The test detects unit roots in heterogenous panels with cross-section dependence. The Null hypothesis assumes that all series are non-stationary.

less significant and slightly weaker. This difference would be consistent with the idea that in an environment of lower de facto financial integration - as it is during a financial crisis - domestic fiscal policy can regain part of its influence. As for the level of public debt, instead its effect stays significant across all specifications and the inclusion or exclusion of the crisis does not significantly alter its magnitude. Overall, the results suggest that omitting the heterogeneous impact of common shocks in the panel provides an upward bias in the estimated coefficients.

Before discussing the other two tables of results with different left-hand side variables, we have a brief look at the other control variables. The expected short term interest rate is always positively and significantly correlated across all the specification, but the magnitude of the coefficients decreases significantly when using the FAP, indicating that the sensitivity of interest rates to own monetary policy development is smaller in an open economy setting. The coefficient on GDP growth is positively signed and its estimated effect is around 10 basis points for a 1% increase in expected growth rate; however, as for the domestic deficit, also in this case the significance is limited to the sample that includes the crisis. Finally, we find a negative relation with the expected inflation. This is a direct consequence of the open economy: if nominal rates are equalized on the world capital markets, then higher expected inflation rate will reduce the measured ex-ante real interest rate (the "Mundell-effect", Mundell, (1963)).

In Table 6 we show that the results of Table 5 are confirmed and somehow reinforced when using the nominal interest rate as a dependent variable.

[Table 6 here]

The expected deficits are not significant when using the FAP, with and without the crisis. The effect of expected public debt are also slightly smaller, going to almost 1 basis point for a one percentage increase in future public debt to GDP. We notice that, among idiosyncratic factors, only monetary policy and public debt preserve a significant correlation with nominal

rates: one interpretation of these results is that, in open economy, only monetary policy and credit risk affect the movement in long term nominal rates.

Finally, in Table 7, the results for the slope indicate that there is no significant correlation with the fiscal variables.

[Table 7 here]

This result also holds whether or not we include heterogeneous transmission of the global factors. The only significant relationship is with the expected growth rate: a 1% increase in expected growth widens the slope by almost 30 basis points. While the lack of a correlation with the public debt is at odds with findings from the literature on risk premia (Favero et al., 2003), in one of our robustness check we show that this lack of correlation can be directly attributed to the inclusion of Japan in the sample. Once we exclude Japan, public debt turns out to be an important determinant also of the slope of the yield curve.

5.2 Non linear effects of public debt

So far we have shown that, when we account for cross-sectional dependence, public debt remains the only fiscal variable that is consistently correlated with interest rates. A one standard deviation increase in public debt (which has an average value of 30% in the sample) increases nominal and real interest rates by 28 to 30 basis points. Since the literature points out that the effects of public debt on interest rates may be different at different level of public debt, in this section we investigate more in details these non-linearities. The results are reported in Tables 8 to 10. In each table, we include: the debt squared; splines for values of debt above and below the median (66% of GDP); splines for values of debt above and below the 75th percentile (83% of GDP), including (columns 1 to 3) and excluding (columns 4 to 6) the latest crisis.

[Table 8 to 10 here]

Overall, we fail to find any significant non linear effect. The results are similar to the one obtained in the baseline equation: when we the test of equality of coefficients we find statistically equivalent results. This absence of non linearities in the effect of public debt has two possible interpretations. On one hand, the non linearity previously found in the literature can be related to the omission of the common factors. In fact, whenever the correlation between the right-hand side variable and the factor changes this will change the estimated coefficient, and omitting the factor from the regression might give the appearance of a non-linear effect (or a structural change). On the other hand, it might be the case that the non linear effects of public debt are due to changes in the estimated coefficients, which are themselves function of a given set of variables. Hansen (1999, 2000), proposes a methodology to endogenously identify and deal with these threshold models. The econometric literature is currently exploring ways to combine cross-sectional dependence and non linearity (Cerrato et al., 2008, Kapetanios et al., 2008). However, the implementation of these techniques is beyond the scope of this paper, but we plan to follow it in future research.

5.3 Splitting the Deficit

In this section we show the results from splitting the primary deficit into its components. Theoretical and empirical arguments, in fact, point out that the budget deficit may be an insufficient statistics of the fiscal policy stance. For example, consider an intertemporal model with ricardian agents. If public goods are less than perfect substitutes with private goods, then an increase in public spending is less than fully offset by an increase in private savings, thus leading to an increase in consumption and an increase in interest rates. In the same setup, a tax-financed temporary increase in government spending that leaves unchanged the budget deficit will have also an effect on private savings and interest rates (Faini, 2006).

There is also a large empirical literature on the non-keynesian effects of fiscal policy (Giavazzi and Pagano, 1990). This literature shows that private consumption responds significantly to fiscal policy consolidation. One hypothesized channel of transmission is the

level of interest rates[10]: if financial markets respond significantly to changes in the fiscal policy stance, then the reduction in interest rates will affect positively consumption and investment. Moreover, the empirical literature shows that fiscal consolidation based on spending cuts higher than tax increases is more likely to produce these non-keynesian effects (Alesina and Perotti, 1995; Ardagna, 2004; Akitoby and Stratmann, 2008).

Table 11 present the results, this time reporting only the estimates obtained with the FAP. As before, Columns 1 and 2 show the results for the real interest rates; columns 3 and 4 for the nominal interest rate, while columns 5 and 6 refer to the slope; for each variable, the first column includes the crisis while the second column excludes it.

[Table 11 here]

Overall, while all the other control variables keep the same sign, significance and magnitude, we find that the fiscal variables enter the equations with the expected signs: primary spending to GDP is positively related to the various measures of interest rates, while revenues to GDP are negatively related. There are, however, huge disparities in the significance of the coefficients when changing the left-hand side variable. The estimates show that the two components of fiscal policy bear a significant correlation only when the dependent variable is the real interest rates: a one percentage point increase in spending to GDP increase real interest rates by almost 3 basis points; a one percentage point increase in revenues to GDP decreases real interest rates by 4 basis points. We do not find any significant correlation when using the nominal interest rate or the slope.

The results suggest that the composition of the fiscal policy stance is a plausible candidate in the explanation of divergent patterns of real interest rates. The lack of a significant correlation with other measures of interest rates, which more directly include risk-premia, is though at odd with previous findings (Akitoby and Strattman, 2008). A plausible reason is that we examine advanced countries while other studies, as for example Akitoby and Stratmann (2008), focus on developing countries; so the results cannot be directly compared.

[10] See, for example, Bertola and Drazen (1993) or Balduzzi et al. (1997).

5.4 The effect of EMU

The aim of this section is to check whether the introduction of a common currency within EMU represents a structural break in our sample. In fact, the highest degree of financial integration among EMU members may represent a stronger convergence, or imply that common factors are more important or different for these group of countries. In our results we do not find evidence of structural breaks in the common factors[11], but we do find some differences in the significance of the idiosyncratic factors. We have replicated the results for each dependent variable allowing for a different response of the regressors depending on weather they refer to countries that took part to the EMU after 1999. We estimated a specification with a spline, where all the regressors enter interacted with two dummy variables: one equal to 1 for the EMU countries after 1999, and another equal to 1 in all the other cases. The results are reported in Table 12.

[Table 12 here]

When we consider the real interest rate as a dependent variable, the results point towards the presence of a structural break for the deficit, which is significant for countries not belonging to the EMU. This can be explained by the strong financial integration among Euro countries, which makes idiosyncratic fiscal shocks irrelevant for the determination of the real interest rates. When we use the long term interest rate as a dependent variable, instead, we notice a break in the coefficient on the inflation rate, which is positive and significant only for countries and periods not belonging to the EMU. We interpret this result as the "credibility effect" due to the presence of an inflation averse Central Bank. Finally, when we use the slope of the yield curve as a dependent variable we find that the coefficient on the expected deficit becomes highly significant for the EMU countries when including the crisis period, suggesting that, indeed, expected deficit became an important risk factor during the

[11] We re-extracted the factors from subgroups (EMU vs non EMU) and run two separate regressions for the two subgroups. The coefficients were similar to a constrained regression where we do not interact the factors with the EMU dummy, which are the results reported in the text.

latest financial crisis.

5.5 Sovereign risk and fiscal policy

The objective of this section is to investigate the impact of fiscal policy on sovereign risk. The latest financial crisis has in fact dramatically revealed that domestic fiscal policy still bears a significant impact on domestic interest rates. The next question is then: is the response of sovereign risk premia to fiscal policy different in times of crises? To answer this question one needs first a good proxy of sovereign risk. In principle one should use the spread between a sovereign bond and a "benchmark" country (where identify the "risk-free" rate). For example, the EMU countries are often compared to Germany, so that the differential between, let's say, the Italian and German yield represents a measure of sovereign risk premium. This approach is though problematic in our sample. First, it is difficult to find a common benchmark for all the countries in our sample. Second, the presence of exchange rate risk will introduce measurement error in the left hand side variable, likely to give imprecise estimates[12]. For these reasons, we keep the slope of the yield curve as our preferred measure of risk premia. In particular, we regress the slope on our same set of controls (inflation, growth) and interact the fiscal variables with a dummy which identifies crises periods. So far we have shown results including and excluding every time the latest financial crises. In this section, we also include previous episodes of domestic financial crises as coded in the database by Laeven and Valencia (2008). The idea is to see how fiscal fundamentals are priced in times of intense distress.

Since we fail to find non linearities in the debt, we add a new explanatory variable as a regressor, which is the "*deficit gap*". The deficit gap is the difference between the surplus that - for given real interest rates and growth rates - stabilizes the debt to GDP ratio and the actual government budget balance[13]. We believe this is a more appropriate variable than

[12] A possibility could be to use interest rate swap differentials. However, we do not have this measure for many countries over the entire sample.

[13] See the Appendix C for a detailed description on how the variable is constructed.

public debt to detect the impact of fiscal policy on risk premia. Public debt is in fact a *stock* variable which represents the cumulation of past deficit. Risk premia arise when investors foresee a future *unsustainable* path for public debt; that is, they fear that the sovereign will not be able to repay interests given its expected path of future revenues. In fact, a sovereign may be able to repay interests on the current cumulated stock of debt, but may be suddenly perceived to be unable to pay interests on future expected debt. Therefore, it is important to look at expected variation in the stock of debt, and in particular, on the effort required (in terms of future revenue) to repay the future debt. As the latest crisis has shown, risk premia may not be necessarily related to the level of public debt. Ireland and Spain started in fact from a very low level of debt, but what seemed to matter for investors were their expectations about the ability of these countries to finance future debt, given that they both suffered from huge adverse effects of asset price collapse. To sketch the idea, in the appendix we provide a simple formalization on how this variable is related to risk premia.

In Table 13 we show the results obtained when interacting our three measures of fiscal policy with the dummy crisis.

[Table 13 here]

We split the columns so that in columns 1 and 3 we use the dummy which has been constructed from the database of Laeven and Valencia (2008), while in columns 2 and 4 we use a dummy that includes only the latest crisis. The results show that the level of debt fails to explain risk premia, while deficit is significant only in the latest crisis. What we observe instead is that the deficit gap explains significantly risk premia: a one standard deviation increase in the deficit gap (whose standard deviation is around 4 in the sample) leads to an increase in the slope by about 30 basis points in times of crisis. Moreover, we show that this result is not only a characteristic of the latest crisis; in fact, when we include also previous episodes of financial crises we find equivalent effects.

6 Fiscal Policy Spillovers

The results so far point at small effects of idiosyncratic fiscal factors in the determination of interest rates. In this section we therefore analyze quantitatively the importance of common factors. In particular, we will concentrate on how shocks to the aggregate fiscal stance transmit to domestic interest rates, e.g. we quantify the effects of fiscal policy spillovers. As economies become more integrated economically and financially, domestic fiscal policy tends to lose importance in explaining interest rates. However, changes in the world fiscal stance, by affecting the world savings schedule and thus the equilibrium world interest rate, will still affect the level of the domestic interest rate. The literature has already recognized the importance of these effects. Faini (2006) for example, analyzes the extent of fiscal spillovers for the EMU, a deeply integrated economic area. Ardagna et al. (2007) consider the importance of fiscal spillovers in the OECD. Recently, Claeys et al. (2008) analyze the effects of spillovers in a panel of 100 countries. In all cases, the quantified effects are economically strong and statistically significant, with fiscal spillovers dominating quantitatively domestic crowding-out effects[14].

One important issue arising from the estimation of fiscal policy spillovers is how to approximate the aggregate fiscal stance. Our framework in this respect is particularly well suited. Since the second common factor can be interpreted as the aggregate stance of fiscal policy in the OECD[15], the country specific coefficients on this variable can be directly interpreted as the spillover effects. However, a "pure" spillover measure would require to exclude the own fiscal stance from the average. As such, to check the robustness of our results, we

[14]Faini (2006) finds that while domestic policy bears an effect on interest rates, these are rather small compared to the spillover effects: a change in domestic surplus leads to a 5 basis points reduction of interest rates, while a change in the EMU surplus leads to a 41 basis points decrease in interest rates. Ardagna et al. (2007) obtain similar results for the OECD. They analyze the world fiscal stance as both the aggregate primary deficit and the aggregate debt. They find that, depending on the specification, the world deficit leads to increase in interest rates between 28 and 66 basis points, while world debt increases interest rates between 3 and 21 basis points. In both papers, the coefficients for spillovers are homogeneous across countries.

[15]The theory would suggest to use the « world » fiscal stance as control. Here, we use instead the average fiscal stance in 17 advanced economies. We believe this provides a reasonable approximation (see also Ardagna et al. (2007) on the point).

will confront the coefficients obtained using the average fiscal deficit in the OECD, with the coefficients estimated using the "corrected" average fiscal deficit, which is the average fiscal deficit minus the own country deficit. To keep consistency with previous literature, we report the results only for the real and nominal interest rate.

We report results in Table 14 and 15 and Figures 4 to 7. The vertical bars report the estimated coefficients. First, we notice that, in general, the magnitude of the coefficients estimated when using averages are bigger than those obtained when using corrected averages. Beside the differences in magnitude though, the ranking of the coefficients across countries is the same, whathever the dependent variable and the measure of spillover used is. Interastingly, there seems to be a clustering of countries, with Portugal, Ireland, Italy and Spain[16] displaying the highest coefficients. For this group of countries, a one percentage point increase in average "world" fiscal deficit increases real interest rates between 35 and 45 basis points and nominal interest rates between 35 and 60 basis points. We see that a positive spillover effects is also observed for a group of countries which includes the core EMU members (Austria, Belgium, Netherlands, France), nordic countries (Finland, Denmark, Sweden), and anglosaxon (UK and Australia). For this group, however, the range of coefficients is between 10 and 25 basis points. The last group of countries is composed of Japan, the US, Norway and Germany for which we do not observe spillover effects. This are in fact countries that are relatively "large" (US, Japan and Germany), or for which the windfall revenues of oil production is quite unique (Norway).

We then checked whether the cross sectional dispersion of the spillover coefficients can also be related to indicators of financial integration. We choose two measures of financial integration: the beginning of period *de jure* openness measured with the Quinn index (Quinn, 1997), and beginning of period interest rates, which are a *de facto* measure of financial integration. Figures 8 to 11 plot the estimated spillover coefficients against these two alternative measures. These scatterplots want to gauge how and if countries' heterogeneous response

[16] Ironically dubbed the PIIGS by the media.

to aggregate savings can be explained by an initially lower level of financial integration compared to the rest of the sample.

[Figures 8 to 11]

We can see that the spillover coefficients for the real and for the nominal interest rate seem indeed correlated with initial conditions, although the correlation seem stronger when we use a de facto measure. In both cases, the fit seems higher for the regression using the nominal rate as dependent variable.

These results then provide us with a novel interpretation for the heterogeneity of the transmission of fiscal shocks to interest rates. The common trend of fiscal consolidation observed between 1992 and 2000 has increased aggregate savings and contributed to the reduction of interest rates. In turn, this reduction of interest rates - which for some countries has been facilitated by the entry in the EMU - has created a stronger convergence in interest rates for countries initially less financially integrated. While this strong convergence of interest rates and this deeper integration has seemed beneficial, it has led to other sources of vulnerability, namely higher current account deficits and housing bubbles (Giavazzi and Spaventa, 2010). The aggregate fiscal shock that was generated by the need to increase spending to rescue ailing financial institutions coupled with the revenue losses due to the global recession, reduced the global supply of savings pushing up interest rates. However, countries normally considered "safe heavens" (the US, Germany and the UK, for example), saw their yields go down, while for the other countries, investors started to differentiate in terms of domestic vulnerabilities, and in particular, in terms of the capacity to generate future revenues, severly impaired by the severe effects of the recession.

7 Robustness Checks

In this section we report the results from some robustness check aimed at validating our results. The first check consists in replacing the factors estimated from principal components

with their economic interpretation. That is, we replicate the results in Table 5,6,7 from the FAP, with and without the crisis, but instead of the estimated factors we use: the average deficit in the sample and the average short term interest rate when we use the nominal and real interest rate as dependent variables; the average deficit and the average public debt when we use the slope as dependent variable. The results are reported in Table 14. Columns 1 and 2 refer to the real interest rate, columns 3 and 4 refer to the nominal interest rate and columns 5 and 6 refer to the slope.

[Table 16 here]

This table shows that the main results are robust once we replace the interpretation of the factors. There is no significant change in the magnitude of the coefficients. There are some minor changes in the significance of the fiscal variables. For example, in the specification of the real interest rate, the public deficit is significant also once we exclude the crisis. When instead the dependent variable is the nominal interest rate, the deficit becomes significant only when including the crisis. Finally, when we use the slope as regressor, the public debt becomes significant. Overall, we conclude that the minor effect of replacing the factors with their observed counterparts is seen on the standard errors, rather than on the coefficients.

The second robustness check we perform is a cross-validation. We check whether results are confirmed once we exclude one country at a time from the panel. The results are reported in Table 17, 18 and 19. There is no significant change in the value of the coefficients across each column. The only relevant change we find is that the public debt becomes significant in the specification for the slope once we exclude Japan. We also perform rolling regression to check whether there is any time variation in the coefficients of fiscal policy. Our findings are reported in Figures 12 to 14. Over the sample, the primary deficit remains insignificant trhoughout, with the minor exception of the specification for the real interest rate. We see that the deficit becomes significant in the period between 2007-2008, but insignificant thereafter. More interesting is the dynamic behaviour of the coefficient on public debt. Irrespectively of the dependent variable used, the magnitude of the coefficient falls across

time. There is an especially marked reduction when the dependent variable is the slope, for which there seems to be a possible break in the relation after 2004.

A third robustness check is to include the current account over GDP among the regressors. In a first step, we first check that the inclusions of the new regressor does not affect the behaviour of the extracted principal components, which is indeed the case. We then run the regressions including the current account among the regressors and the results are reported in Table 20.

[Table 20 here]

The results show that the current account is not significantly correlated with interest rates, and its inclusion does not affect the main results. A fourth robustness check is to include a third factor in the estimation and in adopting the Pesaran's Pooled Common Correlated Effects (CEEP) estimator. We report in Table 21 only the results from the CCEP since in the 3 factors panel model, the country specific coefficients on the third factor were statistically insignificant and did not affect the results.

[Table 21 here]

Overall, we find no difference between techniques. The CCEP yield virtually the same results, both in terms of magnitude of the coefficients and signficance of the explanatory variables. This is not surprising given that the two factors in the FAP are interpreted as cross section averages and, overall, the first two factors explain a substantial fraction of panel variance.

A final robustness check is to split the issues between June and December issues. The main results[17] are not changed.

[17]Not reported, but available upon request.

8 Concluding remarks

In this paper we tackled the issue of identifying the effects of fiscal policy on interest rates for a panel of 17 OECD countries. We use real time data on forecasts to limit issues of reverse causality and to better take into account the forward looking nature of the responses of financial markets. To appropriately consider the cross sectional dependence across countries' interest rates we use a factor augmented panel (FAP) as in Giannone Lenza (2010).

This methodology on one hand allows us to obtain consistent and unbiased estimates, and on the other it allows us to show that two main underlying factors can explain more than 60% of the variance in the data. We identified these factors to be the global monetary and fiscal policy stance. Once we take into account these global factors, the importance of the domestic fiscal policy variables is significantly reduced. However our results show that public debt is still a significant determinant of both real and nominal interest rates, although contributing by a modest 1 to 2 basis points. We find also, contrary to previous finding, that the non-linear effect of fiscal policy stems from the expected deficit rather than the public debt. In accordance with the theoretical models of fiscal policy in open economy, we find that global fiscal stance plays a relevant role in affecting interest rates. In particular, we show that the externalities caused by global fiscal expansion are by far quantitatively more important than domestic factors, with a significant heterogeneity in the propagation of the common fiscal shock across countries. The magnitude of these spillover effects ranges between zero and 42 basis points for the real interest rate and between 3 and 48 for nominal interst rate. Moreover the effects appear to be stronger for countries characterized by domestic vulnerabilities and that were relatively less financially integrated at the beginning of the sample. Interestingly these latter results are robust to the exclusion of the latest financial crisis.

The results show us that in open economy, a profligate fiscal policy does not translate directly into higher borrowing costs when the stimulus is country specific. Hence, as interest rates are determined on the world markets, free riding on other countries' fiscal discipline is

indeed feasible, but can be dangerous and short lived. In fact, fiscal profligacy ultimately leads to a build up of public debt which still has positive effect on interest rates. Moreover, the size of expected deficit might still impact significantly interest rates through risk premia. More importantly, when the fiscal shock is common, as in the latest crisis, this leads to an adjustment in all yields, with significant heteorgeneity in the effects across countries. Specifically, while weaker countries do indeed face the prospect of higher financing cost, countries normally considered "safe havens" see their yields go down (flight-to-quality).

Finally, the fact that these spillover effects do not seem to be related to domestic public debt or current fiscal profligacy can lead to a more general reassessment of the usefulness of quantitative caps on fiscal variables as embodied in the Stability and Growth Pact (SGP). In fact, as our paper shows, the level of interest rate is endogenous to higher capital market integration and, while fiscal indiscipline is not directly reflected into higher costs of borrowing, it is important to monitor other macroeconomic aspects that higher financial integration might transform into vulnerabilities. These include for example, competitiveness, relative productivity, credit and leverage, and - as we show - current account imbalances (Giavazzi and Spaventa, 2010). An in depth analysis of the relative importance of these factors in determining the sensitivity to spillovers is an issue we leave for future research.

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9 APPENDIX A

9.1 Factor extraction and interpretation

The aim of this section is to show the results from principal component analysis. Since we have three different dependent variables, we do principal components on three different matrices: we keep the same set of controls while we allow the dependent to differ in each case.

When the dependent variable is the real interest rate the matrix W_t^{rlty} contains the following elements:

$$W_t^{rlty} = \begin{bmatrix} rlty_t & \inf l_t & stnr_t & pdef_t & debt_t & g_t \end{bmatrix}$$

where - as mentioned in the paper - $rlty_t$ measures the real interest rate, $stnr_t$ the expected short term rate, $\inf l_t$ is the expected inflation rate, $pdef_t$ the expected primary deficit and $debt_t$ and g_t are measures of expected public debt and expected real GDP growth respectively.

When we look at the fiscal determinants of the long run nominal interest rate we use the same set of regressors Hence the matrix W_t^{nlty} contains:

$$W_t^{nlty} = \begin{bmatrix} nlty_t & \inf l_t & stnr_t & pdef_t & debt_t & g_t \end{bmatrix}$$

Finally, when we analyze the determinants of the slope of the yield curve the matrix W_t^{slope} is constructed as:

$$W_t^{slope} = \begin{bmatrix} slope_t & \inf l_t & stnr_t & pdef_t & debt_t & g_t \end{bmatrix}$$

An important point in our analysis is the determination of the number of factors to extract and to include in the panel regression. In the empirical literature on factor models, the determination of the number of factors has been a subject of intense research. For example

Forni and Riechlin (1998) propose a rule of thumb according to which one should retain the number of principal components that explains more than a certain fraction of the variance, while Bai and Ng (2002) present a formal test based on information criteria. In our case *Table 1* shows that in general the first two components explain more than 60% of the variance of the panel and the marginal contribution of the third factor is below 10%. Therefore we decide to take into consideration only the first two factors.

[Table 1 here]

Such high portion of explained variance mean that the cross sectional correlation is indeed relevant in explaining the behaviour of our dependent variables, and it points towards the presence of a small number of global shocks.

Despite being conceptually appealing and easy to implement, this methodology has an important drawback which is that factors not always have a clear interpretation.

To find the interpretation of the factors we let ourselves guide by economic intuition. It is plausible to think of the global factors driving the interest rates as being related to global monetary and fiscal policy or global economic cycle. In general this intuition is well supported by the data in all of the three cases we analyze.

In the first case, when we analyze the determinants of the real interest rate, we can see that the average of the short term interest rate of the countries in the sample and the average deficit are very much correlated with the first and the second factor respectively.

Figure 1 shows the path of the two variables plotted against the two extracted factors. Given that the extracted factors are standardized to have mean zero, we standardize the short term interest rates and the deficits before computing the averages. From the figure we can see that these aggregate values track very closely the two extracted factors, therefore supporting the idea that the major global shocks that drive the comovement of the real interest rates come from the aggregate monetary and the fiscal policy stance.

[Figure 15 here]

To give quantitative support to our interpretation, we then try to regress our estimated factors on the average short term rate and on the average deficit respectively. *Table 2* reports the results of this exercise. We can see that in both cases the constant term is very close to zero and never significant, while the coefficient on the estimated factor is pretty close to one. Moreover the R^2 indicates a very good fit.

[Table 22 here].

Even in the second case, when we look at the determinants of the long term interest rates, the interpretation of the two global factors remains unchanged. *Figure 2* shows that also in this case the average short term interest rate and the average deficit track very well the dynamics of the extracted factors.

[Figure 16 here]

Again, by regressing our extracted factors on the sample averages of short term rate and deficit (*Table 3*) we obtain a very good fit, with coefficients on the factors very close to one and coefficients on the constant term being basically zero.

[Table 23 here]

Finally, when we extract the common factors for the slope of the yield curve, we find that the two factors seem to be best approximated by the average debt to GDP ratio and by the average deficit. This indicates that the global fiscal stance has an impact on a proxy for risk premia. *Table 4* reports the results from the regression of average debt and average deficit on the factors.

[Table 24 here]

We can notice that with respect to the previous cases, the fit worsens slightly. This can be related to the fact that, as reported in *Table 1*, the common factors seem to explain less

of the slopes of the yield curves for the countries in our sample, leaving more room for the idiosyncratic components. Therefore the extracted common factors can be related to global aggregates with less precision than in the previous cases.

To conclude, *Figure 3* shows the first and the second extracted factors plotted against the average of the debt to GDP and the average deficit.

[Figure 17 here]

9.2 Deficit Gap and Risk premia

Imagine that a risk neutral investor prices the interest rate according to the following condition

$$r(1-p) = r^*$$

where r is the domestic interest rate, p is the probability of default and r^* is a benchmark rate. The default probability will determine the possible size of the risk premium, and will be related to the deficit gap in the following way:

$$p = p_1 \text{ if } gbal^* - gbal < k$$

$$p = p_2 \text{ if } gbal^* - gbal > k$$

with $p_1 < p_2$ and where $gbal^*$ is the government balance that stabilizes the debt to GDP ratio and $gbal$ is the actual government balance. So if the required adjustment is perceived as large, there will be risk premia, while it will not affect interest rates if the deficit needed to stabilize the debt is not too high. The interest rates are thus subject to multiple equilibria.

10 APPENDIX B

10.1 Variables

Variable	Description	Source
$nltr$	Long term nominal interest rate	Datastream
$rltr$	The ex-ante real interest rate. It is constructed as: $nltr - E_{t+10}(\text{inf})$	Datastream,
	where $E_{t+10}(\text{inf})$ is extrapolated with a Kalman Filter applied to $E_{t+1}(\text{ inf })$	OECD
$slope$	Long term nominal interest rate minus the short (3-month) nominal interest rate	Datastream
str	One year ahead short term (3-Month) interest rate.	OECD
inf	One year ahead GDP deflator inflation rate ($\ln(PGDP_{t+1}/PGDP_t)$)	OECD
g	One year ahead Growth rate of Real GDP	OECD
$pdef$	Government lending net of interest payments (NLG+YPEPG)	OECD
$debt$	Gross Government Financial Liabilities (GGFL)	OECD
$spend$	Primary government spending (YPG-YPEPG)	OECD
rev	Total government revenue (YPR)	OECD
$def\ gap$	$(gbal^* - gbal)$	
	with: $gbal^* = (rltr - g)\, debt$, and $gbal = -pdef$	

11 APPENDIX C: Tables and Figures

11.1 Tables

Table 1: Summary Statistics

	Rint	Ltr	Slope	Int Rate	GDP Growth	Inflation	Def/GDP(-1)	Debt/GDP(-1)	G/GDP(-1)	T/GDP(-1)
mean	3.5	5.9	1	4.9	2.4	2.5	-2.9	70	44.6	45
sd	1.8	2.3	1.5	2.6	1	1.1	3.8	29.1	7.2	7.5
min	0	0.8	-14.8	0	-1.9	-0.7	-20.2	12.1	23.2	29.2
max	9.1	14.5	4.4	15.4	7.5	8.9	11	199.8	68.2	63.2

The table reports the summary statistics of the dependent variables and the regressors used in the analysis.

Table 2: Principal Component Analysis

		1^{st}	2^{nd}	3^{rd}	4^{th}	5^{th}
Real Int. Rate	Marginal	0.4702	0.1922	0.0962	0.0533	0.0356
	Cumulative	0.4702	0.6624	0.7585	0.8118	0.8474
Long Term Int. Rate	Marginal	0.5001	0.1645	0.0881	0.0543	0.0366
	Cumulative	0.5001	0.6647	0.7528	0.8070	0.8436
Slope	Marginal	0.4201	0.1877	0.0982	0.0787	0.0404
	Cumulative	0.4201	0.6078	0.7060	0.7847	0.8251

The table reports the marginal and cumulative proportions of the explained variance by the first 5 principal components. The principal components are extracted respectively from: W^{rlty}, W^{nlty}, W^{slope}

Table 3: CSD Tests

Variable	CD-test	p-value	corr	abs(corr)
Rint	72.22	0.000	0.886	0.886
Ltr	74.16	0.000	0.948	0.948
Slope	41.26	0.000	0.51	0.516
Int Rate - Short	67.93	0.000	0.867	0.867
Inflation	43.21	0.000	0.55	0.555
Growth	36.22	0.000	0.464	0.464
Def/GDP(-1)	43.04	0.000	0.552	0.58
Debt/GDP(-1)	20.53	0.000	0.264	0.411
G/GDP(-1)	29.25	0.000	0.36	0.438
T/GDP(-1)	8.15	0.000	0.101	0.271

Notes: Under the null hypothesis of cross-section independence CD ~ N(0,1)

Table 4: Panel Unit Root Tests

	0 lag		1 lag		2 lags			
	CIPS	p-val	CIPS	p-val	CIPS	p-val	MP	p-val
Rint	-3.97	0.00	-2.51	0.01	-1.10	0.13	-3.13	0.001
Ltr	-5.31	0.00	-3.40	0.00	-2.94	0.00	-3.515	0.000
Slope	-5.88	0.00	-4.39	0.00	-3.59	0.00	-5.643	0.000
Int Rate - Short	-5.12	0.00	-2.72	0.00	-2.21	0.01	-3.137	0.001
Inflation	-5.40	0.00	-3.52	0.00	-1.98	0.02	-4.878	0.000
GDP Growth	-9.81	0.00	-4.59	0.00	-4.21	0.00	-14.49	0.000
Def/GDP(-1)	-1.16	0.12	0.97	0.83	1.28	0.90	-1.81	0.035
Debt/GDP(-1)	0.60	0.72	1.60	0.94	1.96	0.97	-1.867	0.031
G/GDP(-1)	-0.85	0.20	-0.02	0.49	0.58	0.72	-3.963	0.000
T/GDP(-1)	-2.16	0.02	-1.04	0.15	-0.41	0.34	-6.034	0.000

Notes: CIPS is the t-test for unit roots in heterogenous panels with cross-section dependence, proposed by Pesaran (2007). The lag refers to the order of the ADF regression. Null hypothesis assumes that all series are non-stationary. MP is the Moon and Perron (2004) panel unit root test based on two extracted factors from the variable. The lag order is selected automatically. Null hypothesis assumes all series are non-stationary.

Table 5: Baseline estimation, Real interest rate

RINT	(1) All Sample	(2) All Sample	(3) All Sample	(4) No Crisis	(5) No Crisis	(6) No Crisis
Int Rate - Short	0.699***	0.554***	0.398***	0.690***	0.580***	0.393***
	[0.031]	[0.047]	[0.037]	[0.030]	[0.047]	[0.037]
GDP Growth	0.180**	0.005	0.103*	0.333***	0.105**	0.098
	[0.064]	[0.061]	[0.054]	[0.077]	[0.050]	[0.056]
Inflation	-0.294***	-0.294***	-0.210**	-0.212***	-0.228***	-0.197***
	[0.088]	[0.075]	[0.075]	[0.071]	[0.069]	[0.061]
Def/GDP(-1)	0.111***	0.071***	0.044***	0.094***	0.058***	0.036*
	[0.014]	[0.012]	[0.014]	[0.014]	[0.011]	[0.018]
Debt/GDP(-1)	0.017**	0.009***	0.011***	0.023***	0.013***	0.013***
	[0.007]	[0.002]	[0.003]	[0.007]	[0.002]	[0.004]
Observations	709	709	709	624	624	624
R-squared	0.810	0.936	0.959	0.824	0.943	0.963
Number of id	17	17	17	17	17	17
CSD	44.57	-4.22	-3.45	41.89	-4.15	-3.43
CIPS-Error	0.00	0.00	0.00	0.00	0.00	0.00
Country FE	yes	yes	yes	yes	yes	yes
Time FE	no	yes	yes	no	yes	yes
Factors	no	no	yes	no	no	yes

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

The dependent variable is the ex-ante real interest rate. The independent variables are: expected short term interest rate; expected GDP growth; expected Inflation; expected deficit as a share of current period GDP; expected gross debt as a share of current period GDP. CSD is the Pesaran's (2004) statistic to detect cross-sectional dependence; the statistic is distributed as a normal under the null of cross-sectional independence; "CIPS-error" reports the p-value from the Pesaran's (2007) test to detect unit root in the residual; null hypothesis assumes that all series in the panel are non-stationary. Columns 1 and 4 report the results from the FE; Columns 2 and 4 report the results from the 2FE; Columns 3 and 6 report the results from the FAP. Columns 1-3 include in the sample years 2008 and 2009; Columns 3-6 exclude them.

Table 6: Baseline estimation, Long term interest rate

	(1)	(2)	(3)	(4)	(5)	(6)
LTR	All Sample	All Sample	All Sample	No Crisis	No Crisis	No Crisis
Int Rate - Short	0.770***	0.607***	0.397***	0.763***	0.616***	0.381***
	[0.032]	[0.057]	[0.035]	[0.035]	[0.060]	[0.039]
GDP Growth	0.221***	0.023	0.100*	0.350***	0.087	0.083
	[0.075]	[0.068]	[0.050]	[0.102]	[0.071]	[0.062]
Inflation	0.187**	0.151**	0.078	0.252***	0.195**	0.079
	[0.078]	[0.069]	[0.046]	[0.078]	[0.077]	[0.047]
Def/GDP(-1)	0.126***	0.061***	0.016	0.111***	0.053**	0.012
	[0.017]	[0.019]	[0.013]	[0.018]	[0.019]	[0.019]
Debt/GDP(-1)	0.015*	0.004**	0.008***	0.019**	0.006**	0.009**
	[0.008]	[0.002]	[0.002]	[0.008]	[0.002]	[0.003]
Observations	709	709	709	624	624	624
R-squared	0.853	0.958	0.979	0.857	0.958	0.980
Number of id	17	17	17	17	17	17
CSD	46.45	-3.58	-3.53	42.22	-3.37	-3.29
CIPS-Error	0.00	0.00	0.00	0.00	0.00	0.00
Country FE	yes	yes	yes	yes	yes	yes
Time FE	no	yes	yes	no	yes	yes
Factors	no	no	yes	no	no	yes

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

The dependent variable is the nominal long terml interest rate. The independent variables are: expected short term interest rate; expected GDP growth; expected Inflation; expected deficit as a share of current period GDP; expected gross debt as a share of current period GDP. CSD is the Pesaran's (2004) statistic to detect cross-sectional dependence; the statistic is distributed as a normal under the null of cross-sectional independence; "CIPS-error" reports the p-value from the Pesaran's (2007) test to detect unit root in the residual; null hypothesis assumes that all series in the panel are non-stationary. Columns 1 and 4 report the results from the FE; Columns 2 and 4 report the results from the 2FE; Columns 3 and 6 report the results from the FAP. Columns 1-3 include in the sample years 2008 and 2009; Columns 3-6 exclude them.

Table 7: Baseline estimation, Slope of yield curve

	(1)	(2)	(3)	(4)	(5)	(6)
SLOPE	All Sample	All Sample	All Sample	No Crisis	No Crisis	No Crisis
Int Rate - Short	-0.341***	-0.507***	-0.652***	-0.350***	-0.499***	-0.717***
	[0.026]	[0.077]	[0.086]	[0.027]	[0.084]	[0.098]
GDP Growth	0.387***	0.180*	0.360**	0.556***	0.306***	0.299**
	[0.088]	[0.093]	[0.124]	[0.094]	[0.099]	[0.114]
Inflation	0.135	0.183**	0.146	0.244**	0.275***	0.173
	[0.108]	[0.079]	[0.095]	[0.103]	[0.085]	[0.109]
Def/GDP(-1)	0.088***	0.045	-0.016	0.042	0.033	-0.048
	[0.030]	[0.039]	[0.033]	[0.026]	[0.037]	[0.032]
Debt/GDP(-1)	0.009	-0.001	0.005	0.012*	0.002	0.007
	[0.008]	[0.003]	[0.003]	[0.006]	[0.003]	[0.004]
Observations	714	714	714	629	629	629
R-squared	0.396	0.679	0.735	0.395	0.658	0.721
Number of id	17	17	17	17	17	17
CSD	34.97	-2.98	-2.63	30.79	-2.86	-2.21
CIPS-Error	0.00	0.00	0.00	0.00	0.00	0.00
Country FE	yes	yes	yes	yes	yes	yes
Time FE	no	yes	yes	no	yes	yes
Factors	no	no	yes	no	no	yes

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

The dependent variable is the slope. The independent variables are: expected short term interest rate; expected GDP growth; expected Inflation; expected deficit as a share of current period GDP; expected gross debt as a share of current period GDP. CSD is the Pesaran's (2004) statistic to detect cross-sectional dependence; the statistic is distributed as a normal under the null of cross-sectional independence; "CIPS-error" reports the p-value from the Pesaran's (2007) test to detect unit root in the residual; null hypothesis assumes that all series in the panel are non-stationary. Columns 1 and 4 report the results from the FE; Columns 2 and 4 report the results from the 2FE; Columns 3 and 6 report the results from the FAP. Columns 1-3 include in the sample years 2008 and 2009; Columns 3-6 exclude them.

Table 8: Non Linearities with the debt level

RINT	(1) All Sample	(2) All Sample	(3) All Sample	(4) No Crisis	(5) No Crisis	(6) No Crisis
Int Rate - Short	0.399***	0.397***	0.400***	0.395***	0.392***	0.394***
	[0.038]	[0.037]	[0.037]	[0.038]	[0.037]	[0.038]
GDP Growth	0.098*	0.104*	0.103*	0.083	0.098*	0.091
	[0.055]	[0.053]	[0.056]	[0.059]	[0.056]	[0.060]
Inflation	-0.204**	-0.210**	-0.214**	-0.189***	-0.196***	-0.199***
	[0.070]	[0.076]	[0.076]	[0.057]	[0.062]	[0.063]
Def/GDP(-1)	0.044***	0.044***	0.044***	0.035*	0.036	0.036*
	[0.014]	[0.014]	[0.013]	[0.020]	[0.021]	[0.019]
Debt/GDP(-1)	0.018**			0.026**		
	[0.008]			[0.010]		
$(Debt/(GDP(-1))^2$	-0.000			-0.001		
	[0.000]			[0.000]		
Debt/(GDP(-1) < Median		0.011***			0.012***	
		[0.003]			[0.004]	
Debt/GDP(-1) > Median		0.011***			0.013***	
		[0.003]			[0.004]	
Debt/GDP(-1) < 75%			0.009***			0.010***
			[0.003]			[0.003]
Debt/GDP(-1) > 75%			0.011***			0.014***
			[0.003]			[0.004]
Observations	709	709	709	624	624	624
R-squared	0.959	0.959	0.959	0.964	0.963	0.964
Number of id	17	17	17	17	17	17
CSD	-3.47	-3.49	-3.42	-3.48	-3.49	-3.37
CIPS-Error	0.00	0.00	0.00	0.00	0.00	0.00
Country FE	yes	yes	yes	yes	yes	yes
Time FE	yes	yes	yes	yes	yes	yes
Factors	yes	yes	yes	yes	yes	yes

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1
The dependent variable is the ex-ante real interest rate. The independent variables are: expected short term interest rate; expected GDP growth; expected Inflation; expected deficit as a share of current period GDP; expected gross debt as a share of current period GDP. We tested different non linearities with respect to public debt: in columns 1 and 4 we introduced debt squared; in columns 2 and 5 we splined the debt variable according to weather the debt to GDP is lower or higher than the median of the entire sample; in columns 3 and 6 we splined the debt variable according to weather debt to GDP is lower or higher than the 3rd quartile of the entire sample. CSD is the Pesaran's (2004) statistic to detect cross-sectional dependence; the statistic is distributed as a normal under the null of cross-sectional independence; "CIPS-error" reports the p-value from the Pesaran's (2007) test to detect unit root in the residual; null hypothesis assumes that all series in the panel are non-stationary. Columns 1 and 4 report the results from the FE; Columns 2 and 4 report the results from the 2FE; Columns 3 and 6 report the results from the FAP. Columns 1-3 include in the sample years 2008 and 2009; Columns 3-6 exclude them.

Table 9: Non Linearities with the debt level

LTR	(1) All Sample	(2) All Sample	(3) All Sample	(4) No Crisis	(5) No Crisis	(6) No Crisis
Int Rate - Short	0.396***	0.396***	0.399***	0.381***	0.379***	0.383***
	[0.034]	[0.034]	[0.034]	[0.038]	[0.038]	[0.038]
GDP Growth	0.101*	0.101*	0.100*	0.082	0.084	0.078
	[0.050]	[0.049]	[0.051]	[0.063]	[0.061]	[0.064]
Inflation	0.076	0.078	0.075	0.080	0.081	0.077
	[0.048]	[0.047]	[0.046]	[0.048]	[0.048]	[0.045]
Def/GDP(-1)	0.016	0.016	0.016	0.012	0.012	0.013
	[0.013]	[0.013]	[0.012]	[0.018]	[0.018]	[0.017]
Debt/GDP(-1)	0.006			0.010		
	[0.006]			[0.009]		
$(Debt/(GDP(-1))^2$	0.000			-0.000		
	[0.000]			[0.000]		
Debt/GDP(-1) < Median		0.007**			0.008**	
		[0.003]			[0.003]	
Debt/GDP(-1) > Median		0.008***			0.009***	
		[0.002]			[0.003]	
Debt/GDP(-1) < 75%			0.006***			0.006**
			[0.002]			[0.003]
Debt/GDP(-1) > 75%			0.008***			0.009***
			[0.002]			[0.003]
Observations	709	709	709	624	624	624
R-squared	0.979	0.979	0.979	0.980	0.980	0.980
Number of id	17	17	17	17	17	17
CSD	-3.53	-3.55	-3.52	-3.29	-3.34	-3.28
CIPS-Error	0.00	0.00	0.00	0.00	0.00	0.00
Country FE	yes	yes	yes	yes	yes	yes
Time FE	yes	yes	yes	yes	yes	yes
Factors	yes	yes	yes	yes	yes	yes

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

The dependent variable is the nominal long terml interest rate. The independent variables are: expected short term interest rate; expected GDP growth; expected Inflation; expected deficit as a share of current period GDP; expected gross debt as a share of current period GDP. We tested different non linearities with respect to public debt: in columns 1 and 4 we introduced debt squared; in columns 2 and 5 we splined the debt variable according to weather the debt to GDP is lower or higher than the median of the entire sample; in columns 3 and 6 we splined the debt variable according to weather debt to GDP is lower or higher than the 3rd quartile of the entire sample. CSD is the Pesaran's (2004) statistic to detect cross-sectional dependence; the statistic is distributed as a normal under the null of cross-sectional independence; "CIPS-error" reports the p-value from the Pesaran's (2007) test to detect unit root in the residual; null hypothesis assumes that all series in the panel are non-stationary. Columns 1 and 4 report the results from the FE; Columns 2 and 4 report the results from the 2FE; Columns 3 and 6 report the results from the FAP. Columns 1-3 include in the sample years 2008 and 2009; Columns 3-6 exclude them.

Table 10: Non Linearities with the debt level

SLOPE	(1) All Sample	(2) All Sample	(3) All Sample	(4) No Crisis	(5) No Crisis	(6) No Crisis
Int Rate - Short	-0.649***	-0.653***	-0.655***	-0.712***	-0.722***	-0.720***
	[0.086]	[0.085]	[0.086]	[0.100]	[0.097]	[0.097]
GDP Growth	0.353**	0.361**	0.358**	0.288**	0.300**	0.302**
	[0.125]	[0.125]	[0.126]	[0.113]	[0.115]	[0.114]
Inflation	0.157	0.149	0.150	0.183	0.178	0.176
	[0.093]	[0.094]	[0.095]	[0.108]	[0.108]	[0.109]
Def/GDP(-1)	-0.015	-0.016	-0.017	-0.047	-0.048	-0.049
	[0.031]	[0.033]	[0.032]	[0.030]	[0.031]	[0.032]
Debt/GDP(-1)	0.015			0.020		
	[0.009]			[0.012]		
$(Debt/(GDP(-1))^2$	-0.001			-0.001		
	[0.000]			[0.001]		
Debt/GDP(-1) < Median		0.003			0.003	
		[0.005]			[0.005]	
Debt/GDP(-1) > Median		0.005			0.006	
		[0.003]			[0.004]	
Debt/GDP(-1) < 75%			0.008**			0.010**
			[0.004]			[0.004]
Debt/GDP(-1) > 75%			0.005			0.007
			[0.003]			[0.004]
Observations	714	714	714	629	629	629
R-squared	0.736	0.735	0.736	0.722	0.722	0.722
Number of id	17	17	17	17	17	17
CSD	-2.50	-2.64	-2.59	-2.06	-2.22	-2.16
CIPS-Error	0.00	0.00	0.00	0.00	0.00	0.00
Country FE	yes	yes	yes	yes	yes	yes
Time FE	yes	yes	yes	yes	yes	yes
Factors	yes	yes	yes	yes	yes	yes

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

The dependent variable is the slope. The independent variables are: expected short term interest rate; expected GDP growth; expected Inflation; expected deficit as a share of current period GDP; expected gross debt as a share of current period GDP. We tested different non linearities with respect to public debt: in columns 1 and 4 we introduced debt squared; in columns 2 and 5 we splined the debt variable according to weather the debt to GDP is lower or higher than the median of the entire sample; in columns 3 and 6 we splined the debt variable according to weather debt to GDP is lower or higher than the 3rd quartile of the entire sample. CSD is the Pesaran's (2004) statistic to detect cross-sectional dependence; the statistic is distributed as a normal under the null of cross-sectional independence; "CIPS-error" reports the p-value from the Pesaran's (2007) test to detect unit root in the residual; null hypothesis assumes that all series in the panel are non-stationary. Columns 1 and 4 report the results from the FE; Columns 2 and 4 report the results from the 2FE; Columns 3 and 6 report the results from the FAP. Columns 1-3 include in the sample years 2008 and 2009; Columns 3-6 exclude them.

Table 11: Splitting the deficit

	RINT		**LTR**		**SLOPE**	
	(1)	(2)	(3)	(4)	(5)	(6)
	All Sample	No Crisis	All Sample	No Crisis	All Sample	No Crisis
Int Rate - Short	0.388***	0.383***	0.393***	0.378***	0.393***	-0.704***
	[0.035]	[0.037]	[0.035]	[0.039]	[0.035]	[0.101]
GDP Growth	0.097*	0.090	0.097*	0.082	0.097*	0.319**
	[0.052]	[0.054]	[0.048]	[0.061]	[0.048]	[0.116]
Inflation	-0.210***	-0.195***	0.075*	0.079*	0.075*	0.183
	[0.071]	[0.056]	[0.043]	[0.044]	[0.043]	[0.117]
G/GDP(-1)	0.041**	0.029*	0.012	0.011	0.012	-0.020
	[0.014]	[0.016]	[0.014]	[0.016]	[0.014]	[0.054]
T/GDP(-1)	-0.053**	-0.043*	-0.015	-0.006	-0.015	0.07
	[0.018]	[0.024]	[0.016]	[0.020]	[0.016]	[0.078]
Debt/GDP(-1)	0.010***	0.013***	0.007***	0.009**	0.007***	0.007
	[0.003]	[0.004]	[0.002]	[0.003]	[0.002]	[0.005]
Observations	709	624	709	624	714	629
R-squared	0.959	0.963	0.979	0.980	0.979	0.724
Number of id	17	17	17	17	17	17
CSD	-3.54	-3.49	-3.52	-3.28	-3.52	-2.34
CIPS-Error	0.00	0.00	0.00	0.00	0.00	0.00
Country FE	yes	yes	yes	yes	yes	yes
Time FE	yes	yes	yes	yes	yes	yes
Factors	yes	yes	yes	yes	yes	yes

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

The dependent variable is the ex-ante real interest rate in Columns 1 and 2; the nominal long term interest rate in Columns 3 and 4; the slope in Columns 5 and 6.The independent variables in each column are: expected short term interest rate; expected GDP growth; expected Inflation; expected expenditure as a share of current period GDP; expected revenues as a share of current period GDP; expected gross debt as a share of current period GDP. CSD is the Pesaran's (2004) statistic to detect cross-sectional dependence; the statistic is distributed as a normal under the null of cross-sectional independence; "CIPS-error" reports the p-value from the Pesaran's (2007) test to detect unit root in the residual; null hypothesis assumes that all series in the panel are non-stationary. All Columns report the results from the FAP. Columns 1, 3, 5 include in the sample years 2008 and 2009; Columns 2,4, 6 exclude them.

Table 12: Controlling for Structural Breaks with the Introduction of the Euro

	RINT		**LTR**		**SLOPE**	
	(1)	(2)	(3)	(4)	(5)	(6)
	All Sample	No Crisis	All Sample	No Crisis	All Sample	No Crisis
(Int Rate)*Emu	0.495***	0.401***	0.418***	0.347***	-0.473***	-0.632***
	[0.049]	[0.035]	[0.028]	[0.032]	[0.081]	[0.103]
(Int Rate)*Non Emu	0.367***	0.379***	0.387***	0.377***	-0.669***	-0.723***
	[0.031]	[0.036]	[0.036]	[0.041]	[0.086]	[0.096]
(Inflation)*Emu	-0.422***	-0.314***	-0.015	0.029	0.051	0.091
	[0.082]	[0.063]	[0.051]	[0.042]	[0.106]	[0.183]
(Inflation)*Non Emu	-0.123**	-0.149***	0.105*	0.090*	0.169	0.171
	[0.047]	[0.044]	[0.049]	[0.050]	[0.107]	[0.120]
(Growth)*Emu	0.041	0.017	0.114*	0.090	0.448**	0.412***
	[0.069]	[0.113]	[0.061]	[0.085]	[0.173]	[0.137]
(Growth)*Non Emu	0.096*	0.090	0.092	0.071	0.377***	0.314**
	[0.051]	[0.057]	[0.053]	[0.064]	[0.127]	[0.125]
(Def/GDP(-1))*Emu	-0.010	-0.047	-0.009	-0.034	0.096**	0.022
	[0.015]	[0.029]	[0.015]	[0.020]	[0.039]	[0.060]
(Def/GDP(-1))*Non Emu	0.050***	0.041*	0.019	0.015	-0.032	-0.052
	[0.016]	[0.021]	[0.015]	[0.019]	[0.031]	[0.031]
(Debt/GDP(-1))*Emu	0.015***	0.018***	0.009***	0.011***	0.003	0.004
	[0.003]	[0.003]	[0.002]	[0.003]	[0.003]	[0.005]
(Debt/GDP(-1))*Non Emu	0.011***	0.014***	0.008***	0.010**	0.005	0.007
	[0.003]	[0.004]	[0.003]	[0.004]	[0.003]	[0.004]
Observations	709	624	709	624	714	629
R-squared	0.962	0.965	0.979	0.980	0.740	0.722
Number of id	17	17	17	17	17	17
CSD	-3.63	-3.55	-3.51	-3.31	-2.74	-2.30
CIPS-Error	0.00	0.00	0.00	0.00	0.00	0.00
Country FE	yes	yes	yes	yes	yes	yes
Time FE	yes	yes	yes	yes	yes	yes
Factors	yes	yes	yes	yes	yes	yes

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

The dependent variable is the ex-ante real interest rate in Columns 1 and 2; the nominal long term interest rate in Columns 3 and 4; the slope in Columns 5 and 6.The independent variables in each column are: expected short term interest rate; expected GDP growth; expected Inflation; expected deficit as a share of current period GDP; expected gross debt as a share of current period GDP. In this specification the variables enter interacted with two dummy variables: Emu (that takes value 1 for countries that belong to the EMU since the period of accession) and Non Emu (that takes value 1 in all other cases). CSD is the Pesaran's (2004) statistic to detect cross-sectional dependence; the statistic is distributed as a normal under the null of cross-sectional independence; "CIPS-error" reports the p-value from the Pesaran's (2007) test to detect unit root in the residual; null hypothesis assumes that all series in the panel are non-stationary. All Columns report the results from the FAP. Columns 1, 3, 5 include in the sample years 2008 and 2009; Columns 2,4, 6 exclude them.

Table 13: Controlling for Non Linearities with Financial Crises

	Deficit Gap Splined		**Deficit Splined**		**Debt Splined**	
	(1)	(2)	(3)	(4)	(5)	(6)
SLOPE	Lev. Val	2007 Crisis	Lev. Val	2007 Crisis	Lev. Val	2007 Crisis
Int Rate - Short	-0.522***	-0.516***	-0.519***	-0.518***	-0.527***	-0.523***
	[0.093]	[0.097]	[0.097]	[0.097]	[0.094]	[0.097]
Inflation	0.011	0.013	0.002	0.002	0.019	0.015
	[0.095]	[0.088]	[0.103]	[0.094]	[0.092]	[0.094]
Growth	0.346***	0.352***	0.323***	0.321***	0.314***	0.312***
	[0.086]	[0.091]	[0.094]	[0.094]	[0.099]	[0.097]
Debt/GDP(-1)	0.006*	0.007*	0.007*	0.007*		
	[0.003]	[0.004]	[0.004]	[0.004]		
NoCrisis*(Def Gap)	-0.010	0.007				
	[0.017]	[0.022]				
DCrisis*(Def Gap)	0.074**	0.069***				
	[0.030]	[0.021]				
Def/GDP(-1)					0.009	0.016
					[0.019]	[0.021]
NoCrisis*(Def/GDP(-1))			0.001	0.004		
			[0.019]	[0.025]		
DCrisis*(Def/GDP(-1))			0.064	0.068***		
			[0.038]	[0.022]		
NoCrisis*(Debt/GDP(-1))					0.007**	0.008*
					[0.003]	[0.004]
DCrisis*(Debt/GDP(-1))					0.010**	0.006**
					[0.003]	[0.003]
Observations	704	704	714	714	714	714
R-squared	0.791	0.789	0.782	0.782	0.782	0.781
Number of id	17	17	17	17	17	17
CSD	-3.11	-3.12	-3.57	-3.59	-3.67	-3.64
CIPS-Error	0.00	0.00	0.00	0.00	0.00	0.00
Test Spline	0.0362	0.00146	0.127	0.00288	0.0735	0.630
Country FE	yes	yes	yes	yes	yes	yes
Time FE	yes	yes	yes	yes	yes	yes
Factors	yes	yes	yes	yes	yes	yes

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

The dependent variable is the slope. The independent variables in each column are: expected short term interest rate; expected GDP growth; expected Inflation; expected gross debt as a share of current period GDP; deficit gap computed as the sum of the expected surplus that would stabilize the debt to GDP ratio and the expected deficit as a share of current period GDP. We test a specification with a spline on the fiscal variables according to weather or not they are measured in a period of financial crisis. Specifically in columns 1, 3 and 5 the crisis periods are taken from the database of Laeven and Valencia (2008), while in columns 2,4 and 6 the crisis period corresponds only to the last financial crisis (from the second semester of 2007). In columns 1 and 2 we tested a spline on the deficit gap, wile in columns 3 and 4 we tested a spline on the deficit over current period GDP and in columns 5 and 6 we tested a spline on the level of debt over current period GDP. CSD is the Pesaran's (2004) statistic to detect cross-sectional dependence; the statistic is distributed as a normal under the null of cross-sectional independence; "CIPS-error" reports the p-value from the Pesaran's (2007) test to detect unit root in the residual; null hypothesis assumes that all series in the panel are non-stationary. "Test Spline" reports the p value of a t-test of equality between the two coefficients on the spline for each of the specifications. All Columns report the results from the FAP

Table 14: Spillovers from global fiscal stance, Real interest rates

SPILLOVERS RINT	Replacing factors with averages		Replacing factors with corrected averages	
	(1) All Sample	(2) No Crisis	(3) All Sample	(4) No Crisis
AUS	0.114*	0.106	0.117*	0.112
	(0.066)	(0.103)	(0.066)	(0.104)
AUT	0.051	0.048	0.051	0.051
	(0.054)	(0.087)	(0.054)	(0.087)
BEL	0.096*	0.113	0.097*	0.115
	(0.056)	(0.090)	(0.056)	(0.090)
CAN	0.016	0.078	0.019	0.088
	(0.067)	(0.101)	(0.069)	(0.103)
DEU	-0.022	0.017	-0.023	0.016
	(0.054)	(0.088)	(0.054)	(0.088)
DNK	0.063	0.103	0.066	0.110
	(0.058)	(0.092)	(0.058)	(0.093)
ESP	0.326***	0.297***	0.340***	0.311***
	(0.076)	(0.114)	(0.079)	(0.116)
FIN	0.175***	0.237**	0.187***	0.258**
	(0.064)	(0.101)	(0.066)	(0.105)
FRA	0.066	0.107	0.066	0.109
	(0.053)	(0.085)	(0.052)	(0.085)
GBR	0.122*	0.154	0.127*	0.160
	(0.065)	(0.103)	(0.067)	(0.106)
IRE	0.428***	0.345***	0.445***	0.362***
	(0.082)	(0.113)	(0.085)	(0.115)
ITA	0.320***	0.363***	0.336***	0.399***
	(0.066)	(0.105)	(0.067)	(0.107)
JPN	0.024	0.129	0.028	0.134
	(0.063)	(0.100)	(0.062)	(0.099)
NLD	0.116**	0.151*	0.117**	0.148*
	(0.056)	(0.090)	(0.056)	(0.090)
NOR	-0.040	-0.084	-0.054	-0.099
	(0.067)	(0.102)	(0.068)	(0.104)
SWE	0.093	0.133	0.086	0.125
	(0.077)	(0.118)	(0.080)	(0.124)
USA	-0.066	-0.099	-0.069	-0.103
	(0.065)	(0.100)	(0.066)	(0.102)
Observations	709	624	709	624

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

In Columns 1 and 2, the average is the simple average deficit in the OECD; in Columns 3 and 4 it is replaced by the average which excludes own country deficit. Columns 1 and 3 include in the sample years 2008 and 2009; Columns 2 and 4 exclude them.

Table 15: Spillovers from global fiscal stance, Long term interest rates

SPILLOVERS LTR	Replacing factors with averages		Replacing factors with corrected averages	
	(1) All Sample	(2) No Crisis	(3) All Sample	(4) No Crisis
AUS	0.180**	0.170	0.182**	0.173
	(0.076)	(0.119)	(0.077)	(0.121)
AUT	0.107*	0.139	0.107*	0.138
	(0.061)	(0.097)	(0.061)	(0.097)
BEL	0.140**	0.180*	0.139**	0.179*
	(0.063)	(0.099)	(0.063)	(0.100)
CAN	0.085	0.181*	0.087	0.185*
	(0.070)	(0.107)	(0.071)	(0.109)
DEU	0.068	0.167*	0.066	0.165*
	(0.062)	(0.098)	(0.062)	(0.098)
DNK	0.110*	0.175*	0.111*	0.178*
	(0.062)	(0.099)	(0.063)	(0.100)
ESP	0.340***	0.428***	0.354***	0.442***
	(0.071)	(0.112)	(0.073)	(0.113)
FIN	0.248***	0.362***	0.257***	0.377***
	(0.071)	(0.113)	(0.074)	(0.117)
FRA	0.128**	0.190**	0.127**	0.189**
	(0.059)	(0.094)	(0.059)	(0.094)
GBR	0.201***	0.275**	0.206***	0.279**
	(0.070)	(0.110)	(0.072)	(0.113)
IRE	0.293***	0.257**	0.296***	0.260**
	(0.074)	(0.105)	(0.076)	(0.107)
ITA	0.427***	0.569***	0.444***	0.605***
	(0.070)	(0.110)	(0.071)	(0.111)
JPN	0.131*	0.319***	0.135*	0.325***
	(0.070)	(0.111)	(0.070)	(0.110)
NLD	0.098	0.134	0.095	0.131
	(0.062)	(0.098)	(0.062)	(0.098)
NOR	0.034	0.029	0.029	0.017
	(0.070)	(0.111)	(0.071)	(0.112)
SWE	0.174**	0.268**	0.171**	0.270**
	(0.078)	(0.121)	(0.080)	(0.127)
USA	0.042	0.051	0.039	0.045
	(0.071)	(0.110)	(0.073)	(0.112)
Observations	709	624	709	624

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

In Columns 1 and 2, the average is the simple average deficit in the OECD; in Columns 3 and 4 it is replaced by the average which excludes own country deficit. Columns 1 and 3 include in the sample years 2008 and 2009; Columns 2 and 4 exclude them.

Table 16: Robustness, factor interpretations

	RINT		**LTR**		**SLOPE**	
	(1)	(2)	(3)	(4)	(5)	(6)
	All Sample	No Crisis	All Sample	No Crisis	All Sample	No Crisis
Int Rate - Short	0.407***	0.398***	0.418***	0.395***	-0.576***	-0.624***
	[0.037]	[0.040]	[0.036]	[0.040]	[0.065]	[0.083]
GDP Growth	0.110*	0.115*	0.112*	0.113	0.241**	0.200*
	[0.057]	[0.063]	[0.059]	[0.068]	[0.104]	[0.096]
Inflation	-0.228**	-0.207***	0.070	0.078	0.121	0.209*
	[0.080]	[0.063]	[0.046]	[0.049]	[0.083]	[0.100]
Def/GDP(-1)	0.053***	0.040**	0.024*	0.015	0.003	-0.021
	[0.014]	[0.015]	[0.013]	[0.013]	[0.027]	[0.025]
Debt/GDP(-1)	0.011***	0.014***	0.008***	0.009***	0.008***	0.011**
	[0.003]	[0.003]	[0.002]	[0.003]	[0.002]	[0.004]
Observations	709	624	709	624	714	629
R-squared	0.959	0.964	0.979	0.980	0.744	0.735
Number of id	17	17	17	17	17	17
CSD	-3.72	-3.63	-3.58	-3.38	-2.09	-1.65
CIPS-Error	0.00	0.00	0.00	0.00	0.00	0.00
Country FE	yes	yes	yes	yes	yes	yes
Time FE	yes	yes	yes	yes	yes	yes
Factors	Data	Data	Data	Data	Data	Data

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

The dependent variable is the ex-ante real interest rate in Columns 1 and 2; the nominal long term interest rate in Columns 3 and 4; the slope in Columns 5 and 6. The independent variables in each column are: expected short term interest rate; expected GDP growth; expected Inflation; expected deficit as a share of current period GDP; expected gross debt as a share of current period GDP. In Columns 1 - 4, the common factors have been replaced by the average short term interest rate and the average deficit in the OECD; in Columns 5 and 6, the common factors have been replaced with the weighted average of public debt and average deficit in the OECD. CSD is the Pesaran's (2004) statistic to detect cross-sectional dependence; the statistic is distributed as a normal under the null of cross-sectional independence; "CIPS-error" reports the p-value from the Pesaran's (2007) test to detect unit root in the residual; null hypothesis assumes that all series in the panel are non-stationary. Columns 1, 3, 5 include in the sample years 2008 and 2009; Columns 2,4, 6 exclude them.

Table 17: Cross validation test, Real interest rates

RINT	All Sample	No AUS	No AUT	No BEL	No CAN	No DEU	No DNK	No ESP	No FIN
Int Rate - Short	0.398***	0.380***	0.397***	0.397***	0.409***	0.403***	0.409***	0.379***	0.392***
	[0.037]	[0.036]	[0.038]	[0.038]	[0.037]	[0.037]	[0.037]	[0.037]	[0.037]
GDP Growth	0.103*	0.105*	0.107*	0.094	0.099	0.113*	0.115*	0.137***	0.071
	[0.054]	[0.056]	[0.058]	[0.056]	[0.061]	[0.053]	[0.054]	[0.042]	[0.051]
Inflation	-0.210**	-0.216**	-0.209**	-0.210**	-0.204**	-0.207**	-0.218**	-0.172**	-0.198**
	[0.075]	[0.078]	[0.075]	[0.076]	[0.078]	[0.077]	[0.077]	[0.069]	[0.079]
Def/GDP(-1)	0.044***	0.043***	0.046***	0.042***	0.051***	0.042***	0.046***	0.042**	0.043**
	[0.014]	[0.014]	[0.014]	[0.014]	[0.013]	[0.014]	[0.014]	[0.015]	[0.015]
Debt/GDP(-1)	0.011***	0.012***	0.011***	0.012***	0.011***	0.011***	0.011***	0.011***	0.012***
	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
Observations	709	667	668	667	667	667	667	667	667
R-squared	0.959	0.960	0.959	0.958	0.959	0.959	0.957	0.959	0.957
Number of id	17	16	16	16	16	16	16	16	16
CSD	-3.45	-3.32	-3.84	-3.73	-3.28	-3.85	-3.55	-3.35	-3.34
CIPS-Error	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Country FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
Time FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
Factors	yes	yes	yes	yes	yes	yes	yes	yes	yes

	No FRA	No GBR	No IRE	No ITA	No JPN	No NLD	No NOR	No SWE	No USA
Int Rate - Short	0.399***	0.399***	0.379***	0.393***	0.391***	0.401***	0.411***	0.409***	0.403***
	[0.037]	[0.040]	[0.036]	[0.042]	[0.038]	[0.038]	[0.039]	[0.041]	[0.038]
GDP Growth	0.106*	0.092	0.096	0.092	0.084	0.110*	0.106*	0.117*	0.095
	[0.055]	[0.057]	[0.065]	[0.057]	[0.059]	[0.056]	[0.057]	[0.055]	[0.062]
Inflation	-0.214**	-0.199**	-0.169**	-0.220**	-0.223**	-0.208**	-0.262***	-0.234**	-0.212**
	[0.075]	[0.078]	[0.073]	[0.077]	[0.077]	[0.080]	[0.068]	[0.087]	[0.075]
Def/GDP(-1)	0.045***	0.042**	0.048**	0.048***	0.048***	0.042***	0.043*	0.033**	0.046***
	[0.014]	[0.015]	[0.016]	[0.015]	[0.015]	[0.014]	[0.023]	[0.012]	[0.015]
Debt/GDP(-1)	0.011***	0.012***	0.011***	0.011***	0.013***	0.011***	0.012***	0.009***	0.011***
	[0.003]	[0.003]	[0.003]	[0.003]	[0.004]	[0.003]	[0.003]	[0.002]	[0.003]
Observations	667	667	667	671	667	667	667	667	667
R-squared	0.957	0.960	0.960	0.958	0.962	0.959	0.961	0.960	0.962
Number of id	16	16	16	16	16	16	16	16	16
CSD	-4.01	-3.28	-3.33	-3.39	-3.56	-3.81	-3.57	-3.37	-3.48
CIPS-Error	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Country FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
Time FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
Factors	yes	yes	yes	yes	yes	yes	yes	yes	yes

Robust standard errors in brackets; *** p<0.01, ** p<0.05, * p<0.1

Table 18: Cross validation test, Long term interest rates

LTR	All Sample	No AUS	No AUT	No BEL	No CAN	No DEU	No DNK	No ESP	No FIN
Int Rate - Short	0.397***	0.367***	0.399***	0.397***	0.411***	0.401***	0.404***	0.389***	0.391***
	[0.035]	[0.026]	[0.036]	[0.036]	[0.034]	[0.035]	[0.034]	[0.036]	[0.036]
GDP Growth	0.100*	0.104*	0.109*	0.094*	0.098	0.110**	0.112**	0.117**	0.057
	[0.050]	[0.051]	[0.052]	[0.051]	[0.057]	[0.049]	[0.052]	[0.048]	[0.035]
Inflation	0.078	0.072	0.079	0.081	0.087*	0.074	0.078	0.092*	0.095*
	[0.046]	[0.049]	[0.047]	[0.047]	[0.047]	[0.048]	[0.049]	[0.044]	[0.048]
Def/GDP(-1)	0.016	0.014	0.016	0.015	0.023*	0.015	0.018	0.017	0.013
	[0.013]	[0.012]	[0.013]	[0.012]	[0.012]	[0.013]	[0.013]	[0.014]	[0.013]
Debt/GDP(-1)	0.008***	0.009***	0.008***	0.008***	0.008***	0.008***	0.008***	0.008***	0.008***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.003]	[0.003]
Observations	709	667	668	667	667	667	667	667	667
R-squared	0.979	0.980	0.979	0.979	0.979	0.979	0.978	0.978	0.978
Number of id	17	16	16	16	16	16	16	16	16
CSD	-3.53	-3.52	-3.90	-3.75	-3.42	-3.85	-3.61	-3.46	-3.37
CIPS-Error	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Country FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
Time FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
Factors	yes	yes	yes	yes	yes	yes	yes	yes	yes

	No FRA	No GBR	No IRE	No ITA	No JPN	No NLD	No NOR	No SWE	No USA
Int Rate - Short	0.397***	0.399***	0.392***	0.388***	0.393***	0.397***	0.397***	0.407***	0.406***
	[0.035]	[0.038]	[0.035]	[0.038]	[0.036]	[0.036]	[0.039]	[0.035]	[0.036]
GDP Growth	0.101*	0.090	0.100	0.094*	0.085	0.106*	0.108*	0.108*	0.095
	[0.051]	[0.053]	[0.062]	[0.053]	[0.051]	[0.051]	[0.054]	[0.053]	[0.056]
Inflation	0.077	0.088*	0.088	0.070	0.060	0.078	0.079	0.040	0.080
	[0.047]	[0.048]	[0.050]	[0.048]	[0.047]	[0.048]	[0.054]	[0.038]	[0.046]
Def/GDP(-1)	0.016	0.015	0.015	0.018	0.019	0.015	0.025	0.006	0.018
	[0.013]	[0.013]	[0.014]	[0.014]	[0.013]	[0.013]	[0.019]	[0.009]	[0.013]
Debt/GDP(-1)	0.008***	0.008***	0.008***	0.008***	0.009**	0.008***	0.008***	0.006***	0.008***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.003]	[0.002]	[0.002]	[0.001]	[0.002]
Observations	667	667	667	671	667	667	667	667	667
R-squared	0.978	0.979	0.979	0.978	0.980	0.979	0.980	0.979	0.980
Number of id	16	16	16	16	16	16	16	16	16
CSD	-4.12	-3.41	-3.39	-3.42	-3.50	-3.90	-3.53	-3.49	-3.56
CIPS-Error	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Country FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
Time FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
Factors	yes	yes	yes	yes	yes	yes	yes	yes	yes

Robust standard errors in brackets; *** p<0.01, ** p<0.05, * p<0.1

Table 19: Cross validation test, Slope of the yield curve

SLOPE	All Sample	No AUS	No AUT	No BEL	No CAN	No DEU	No DNK	No ESP	No FIN
Int Rate - Short	-0.652***	-0.591***	-0.651***	-0.665***	-0.650***	-0.656***	-0.637***	-0.687***	-0.644***
	[0.086]	[0.082]	[0.088]	[0.085]	[0.099]	[0.087]	[0.082]	[0.091]	[0.087]
GDP Growth	0.360**	0.373**	0.365**	0.343**	0.295**	0.349**	0.406***	0.394***	0.388**
	[0.124]	[0.129]	[0.127]	[0.125]	[0.123]	[0.125]	[0.116]	[0.123]	[0.134]
Inflation	0.146	0.176*	0.159	0.157	0.154	0.151	0.110	0.179*	0.118
	[0.095]	[0.095]	[0.098]	[0.096]	[0.098]	[0.099]	[0.091]	[0.093]	[0.099]
Def/GDP(-1)	-0.016	-0.015	-0.019	-0.021	-0.012	-0.020	-0.017	-0.021	-0.018
	[0.033]	[0.032]	[0.033]	[0.033]	[0.035]	[0.033]	[0.034]	[0.032]	[0.033]
Debt/GDP(-1)	0.005	0.004	0.005	0.006	0.005	0.005	0.006	0.005	0.005
	[0.003]	[0.003]	[0.003]	[0.004]	[0.003]	[0.003]	[0.004]	[0.003]	[0.003]
Observations	714	672	672	672	672	672	672	672	672
R-squared	0.735	0.736	0.727	0.730	0.731	0.727	0.737	0.730	0.729
Number of id	17	16	16	16	16	16	16	16	16
CSD	-2.63	-2.34	-2.93	-2.94	-2.36	-3.05	-2.68	-2.55	-2.45
CIPS-Error	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Country FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
Time FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
Factors	yes	yes	yes	yes	yes	yes	yes	yes	yes

	No FRA	No GBR	No IRE	No ITA	No JPN	No NLD	No NOR	No SWE	No USA
Int Rate - Short	-0.662***	-0.632***	-0.624***	-0.693***	-0.660***	-0.659***	-0.674***	-0.665***	-0.627***
	[0.084]	[0.094]	[0.076]	[0.095]	[0.089]	[0.088]	[0.091]	[0.089]	[0.096]
GDP Growth	0.351**	0.337**	0.328**	0.383***	0.370**	0.356**	0.419***	0.359**	0.300**
	[0.126]	[0.130]	[0.144]	[0.126]	[0.133]	[0.128]	[0.121]	[0.128]	[0.136]
Inflation	0.150	0.128	0.105	0.131	0.126	0.153	0.213**	0.133	0.168
	[0.097]	[0.093]	[0.097]	[0.101]	[0.096]	[0.101]	[0.096]	[0.117]	[0.097]
Def/GDP(-1)	-0.017	-0.024	-0.030	-0.010	-0.013	-0.018	0.034	-0.020	-0.011
	[0.035]	[0.027]	[0.027]	[0.038]	[0.034]	[0.034]	[0.034]	[0.035]	[0.034]
Debt/GDP(-1)	0.004	0.006	0.006	0.005	0.010**	0.005	0.005	0.004	0.005
	[0.003]	[0.004]	[0.003]	[0.003]	[0.004]	[0.003]	[0.003]	[0.003]	[0.003]
Observations	672	672	672	672	672	672	672	672	672
R-squared	0.731	0.724	0.799	0.743	0.745	0.727	0.743	0.735	0.740
Number of id	16	16	16	16	16	16	16	16	16
CSD	-2.65	-2.36	-4.06	-2.31	-2.35	-3.12	-2.52	-2.45	-2.29
CIPS-Error	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Country FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
Time FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
Factors	yes	yes	yes	yes	yes	yes	yes	yes	yes

Robust standard errors in brackets; *** p<0.01, ** p<0.05, * p<0.1

Table 20: Introducing the Current Account on the right-hand side

	(1) RINT	(2) LTR	(3) SLOPE
Int Rate - Short	0.449***	0.429***	-0.556***
	[0.064]	[0.049]	[0.091]
Inflation	0.088	-0.188**	0.164*
	[0.059]	[0.075]	[0.091]
Growth	0.068	0.085	0.341**
	[0.059]	[0.055]	[0.138]
Def/GDP(-1)	-0.000	0.034	0.014
	[0.023]	[0.022]	[0.037]
Debt/GDP(-1)	0.010***	0.013***	0.007
	[0.003]	[0.003]	[0.004]
CA/GDP(-1)	0.002	0.006	0.027
	[0.009]	[0.009]	[0.019]
Observations	709	709	714
R-squared	0.968	0.951	0.733
Number of id	17	17	17
CSD	-2.62	-3.03	-2.61
CIPS-Error	0.00	0.00	0.00

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

CSD is the Pesaran's (2004) statistic to detect cross-sectional dependence; the statistic is distributed as a normal under the null of cross-sectional independence; "CIPS-error" reports the p-value from the Pesaran's (2007) test to detect unit root in the residual; null hypothesis assumes that all series in the panel are non-stationary.

Table 21: Common Correlated Effect (CCE) estimator

	(1) RINT	(2) LTR	(3) SLOPE
Int Rate - Short	0.313***	0.297***	-0.622***
	[0.040]	[0.037]	[0.108]
Inflation	0.095**	-0.103**	0.134
	[0.042]	[0.042]	[0.103]
Growth	0.040	0.027	0.203*
	[0.052]	[0.053]	[0.099]
Def/GDP(-1)	0.024	0.049**	-0.079
	[0.014]	[0.019]	[0.074]
Debt/GDP(-1)	0.001	0.005*	0.001
	[0.002]	[0.003]	[0.008]
Observations	624	624	629
R-squared	0.987	0.979	0.808
Number of id	17	17	17
CSD	-3.53	-3.60	-2.79
CIPS-Error	0.00	0.00	0.00

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

CSD is the Pesaran's (2004) statistic to detect cross-sectional dependence; the statistic is distributed as a normal under the null of cross-sectional independence; "CIPS-error" reports the p-value from the Pesaran's (2007) test to detect unit root in the residual; null hypothesis assumes that all series in the panel are non-stationary.

Table 22: Real interest rate

	Factor1 RINT	Factor2 RINT
Average IRS	0.970***	
	(0.0356)	
Average DEF		0.909***
		(0.0609)
Constant	-9.83e-10	-5.08e-09
	(0.0352)	(0.0603)
Observations	49	49
R-squared	0.941	0.826

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

In Column 1, the dependent variable is the first factor extracted from W_t^{rlty} while the independent variable is the average interest rate in the OECD; In Column 2; the dependent variable is the second factor extracted from W_t^{rlty} while the independent variable is the average deficit in the OECD.

Table 23: Long term interest rate

	Factor1 LTR	Factor2 LTR
Average IRS	0.979***	
	(0.0297)	
Average DEF		0.903***
		(0.0626)
Constant	3.31e-09	6.08e-09
	(0.0294)	(0.0619)
Observations	49	49
R-squared	0.959	0.816

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

In Column 1, the dependent variable is the first factor extracted from W_t^{nlty} while the independent variable is the average interest rate in the OECD; In Column 2, the dependent variable is the second factor extracted from W_t^{nlty} while the independent variable is the average deficit in the OECD.

Table 24: Slope of the yield curve

	Factor1 SLOPE	Factor2 SLOPE
Average DEBT	0.877***	
	(0.0595)	
Average DEF		0.887***
		(0.0672)
Constant	1.87E-07	-2.73E-09
	(0.0587)	(0.0666)
Observations	42	49
R-squared	0.845	0.787

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

In Column 1, the dependent variable is the first factor extracted from W_t^{slope} while the independent variable is a weigthed average of the debt to GDP ratio in the OECD; In Column 2, the dependent variable is the second factor extracted from W_t^{slope} while the independent variable is the average deficit in the OECD.

11.2 Figures

Figure 1: Nominal Long term interest rates, 1990-2010

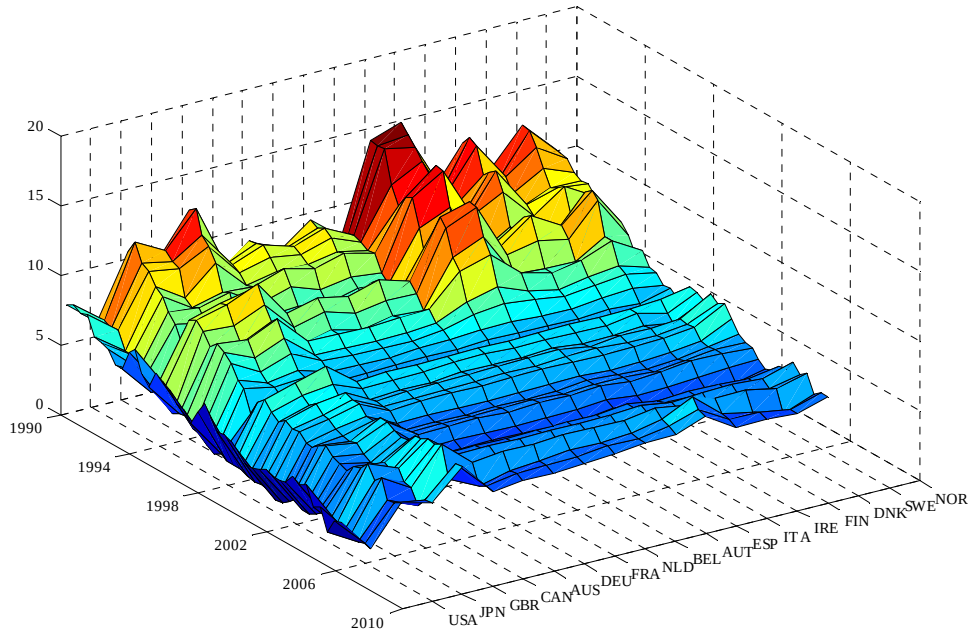

Figure 2: Ex-Ante Real Long term interest rates, 1990-2010

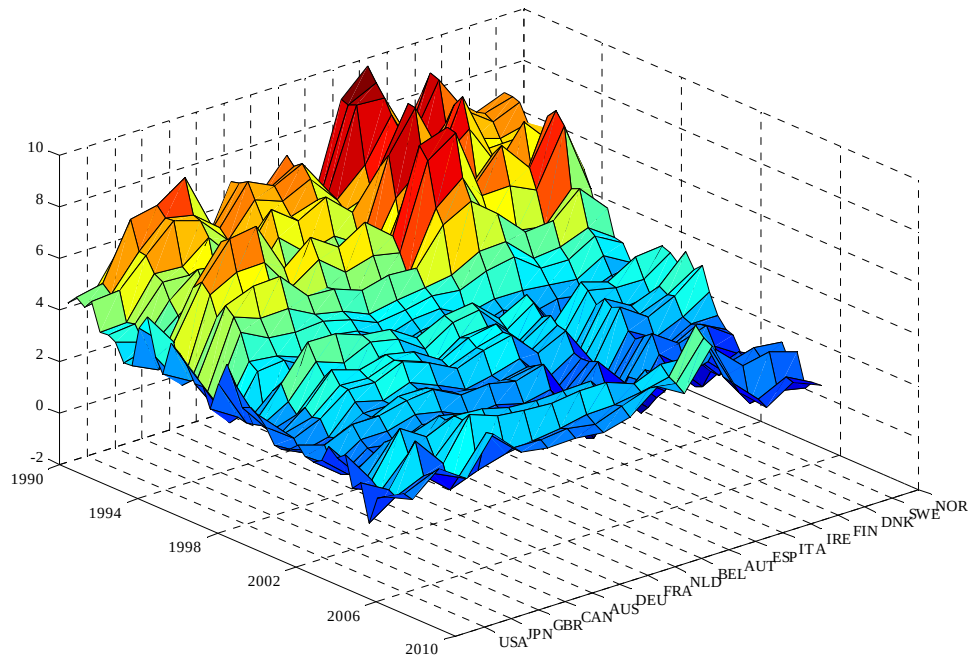

Figure 3: Slope of the yield curve, 1990-2010

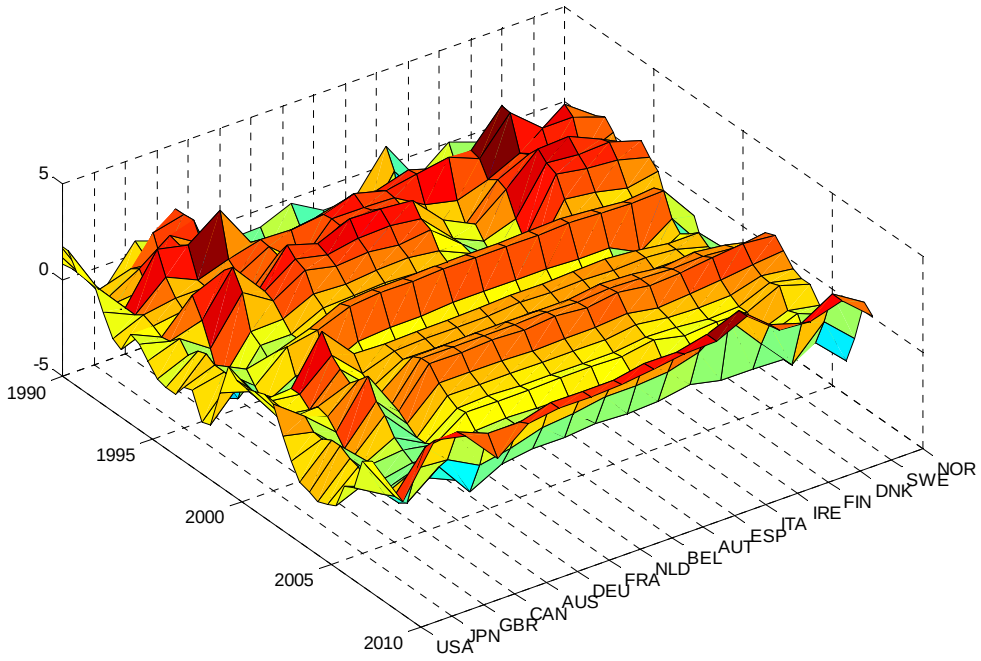

Figure 4: Spillover coefficients for the Real interest rate – using simple averages

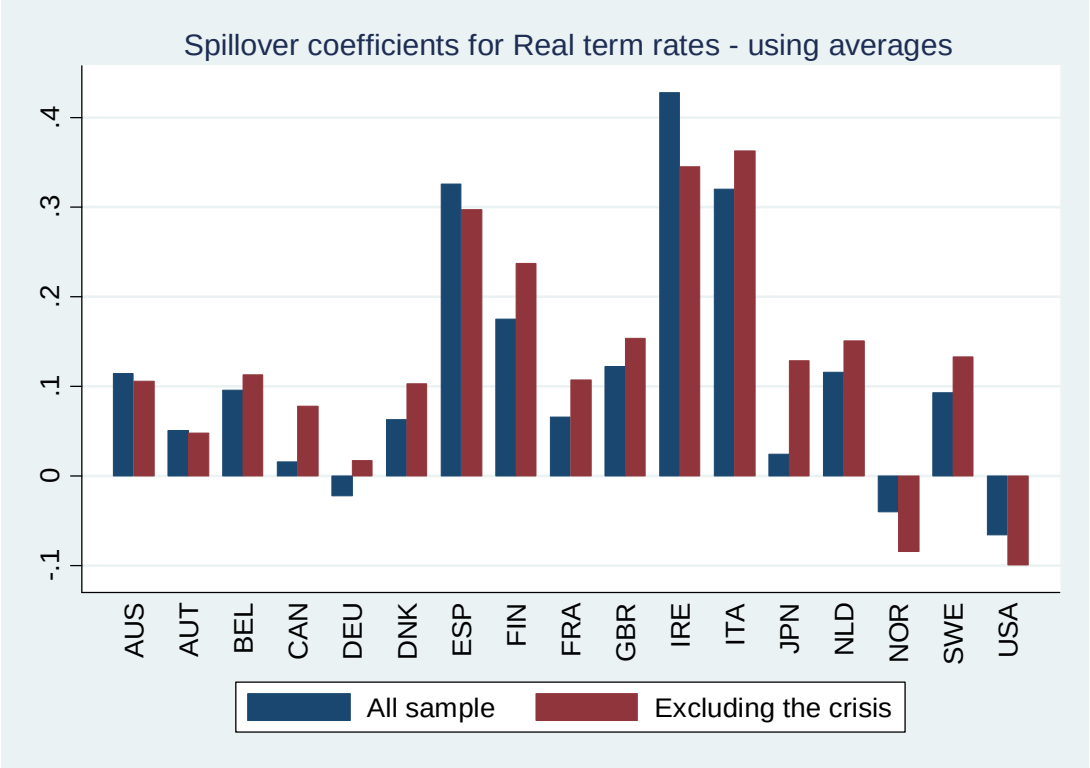

Figure 5: Spillover coefficients for the Real interest rate – using corrected averages

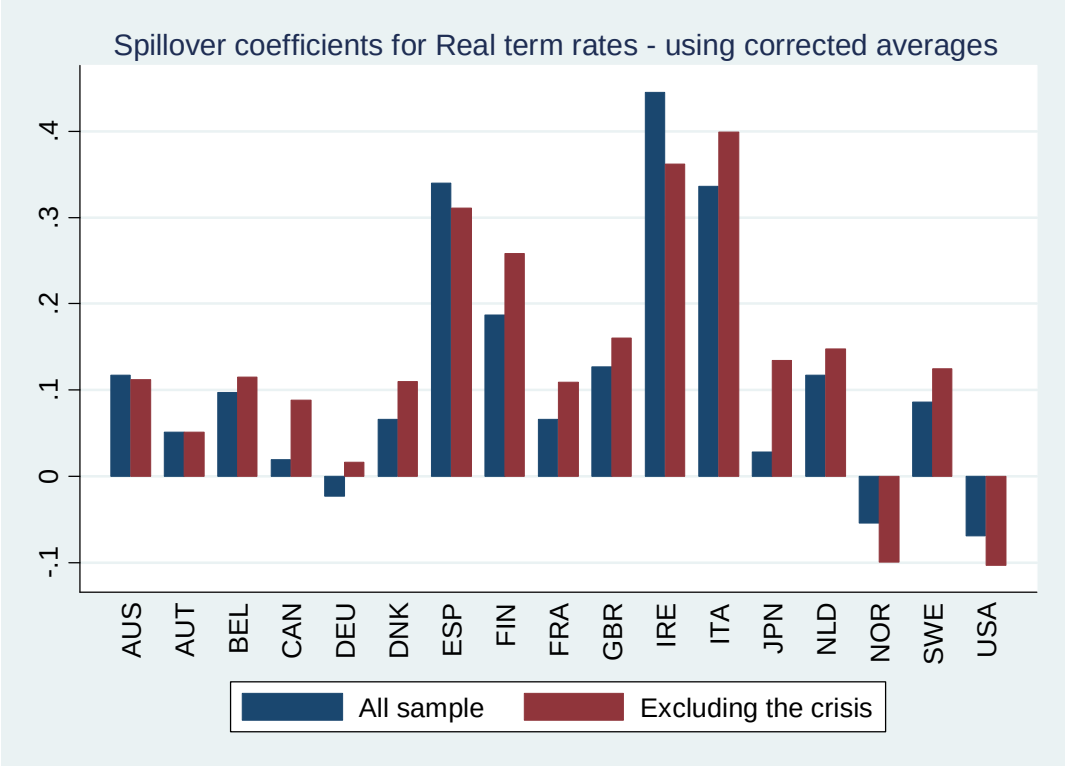

Figure 6: Spillover coefficients for the Long term interest rate – using simple averages

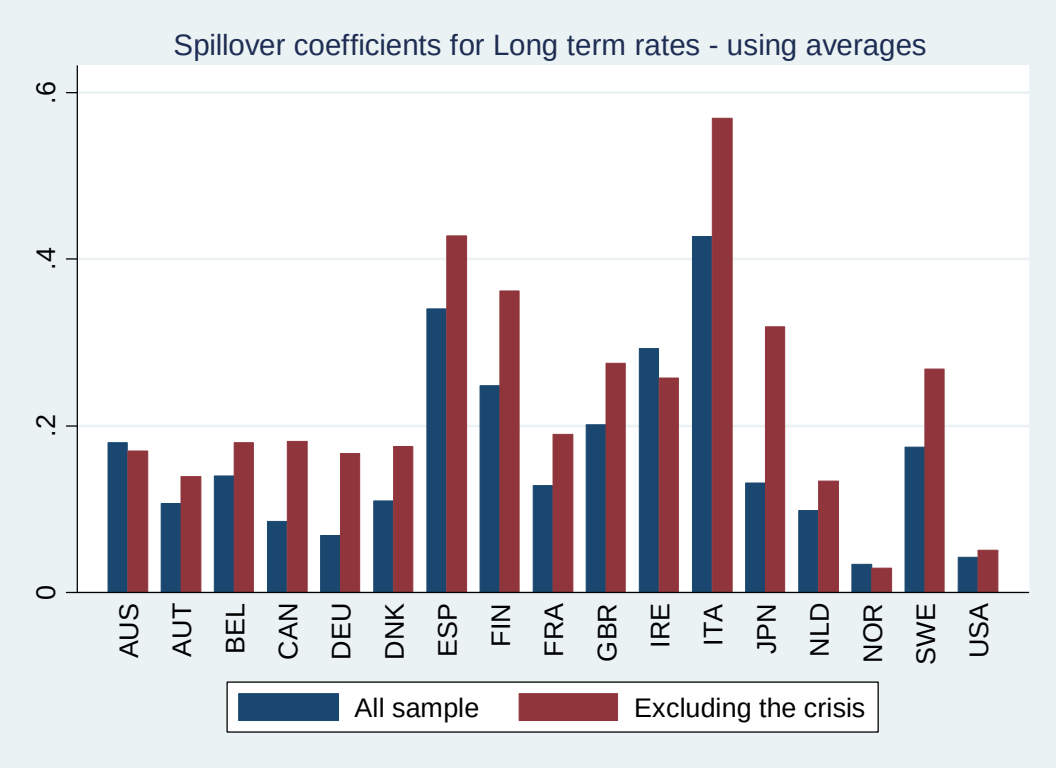

Figure 7: Spillover coefficients for the Long term interest rate – using corrected averages

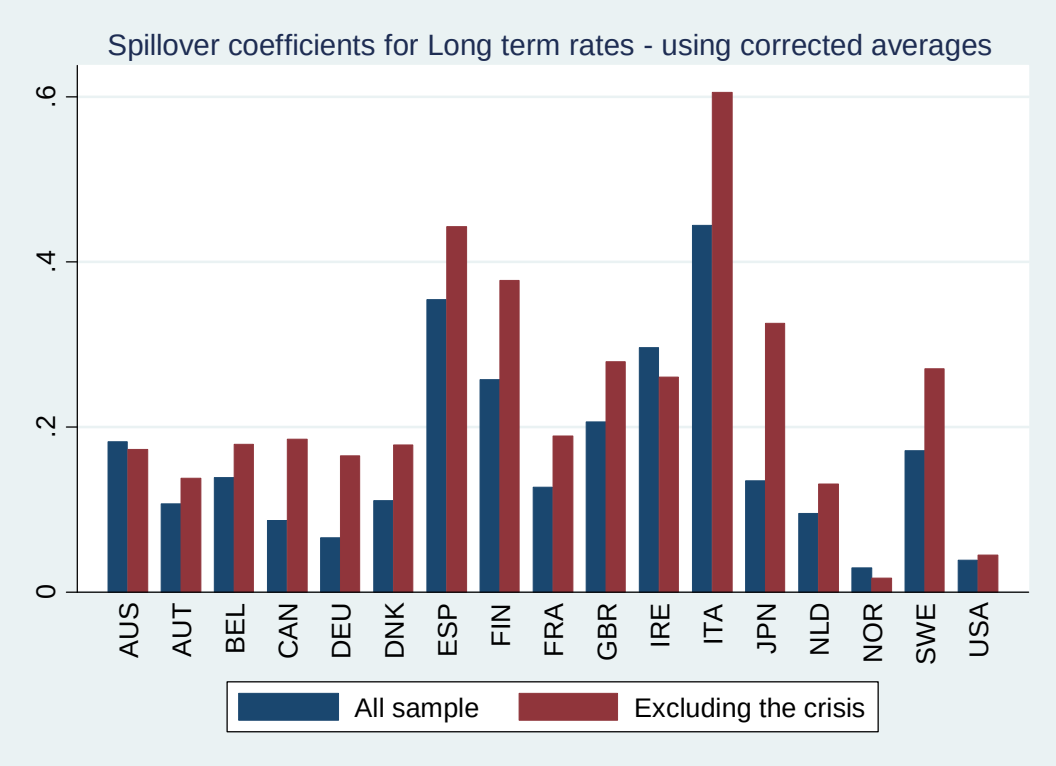

Figure 8: Spillover Coefficients for Real interest rate and initial openness

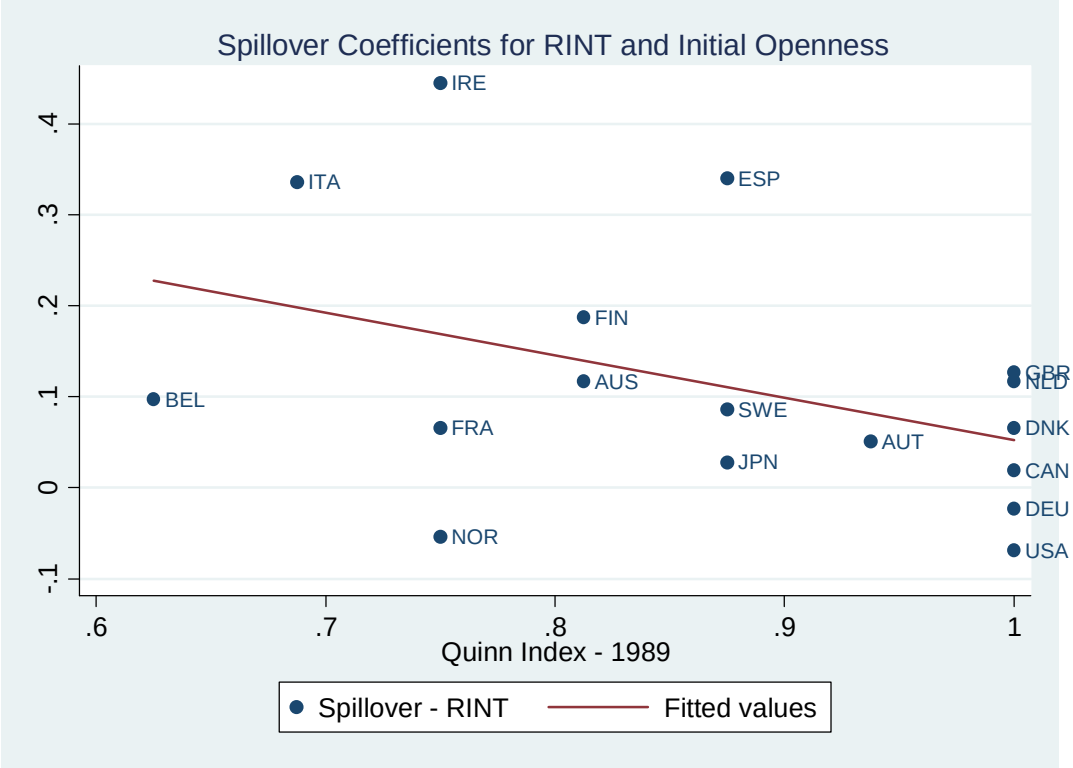

Figure 9: Spillover Coefficients for Long term interest rate and initial openness

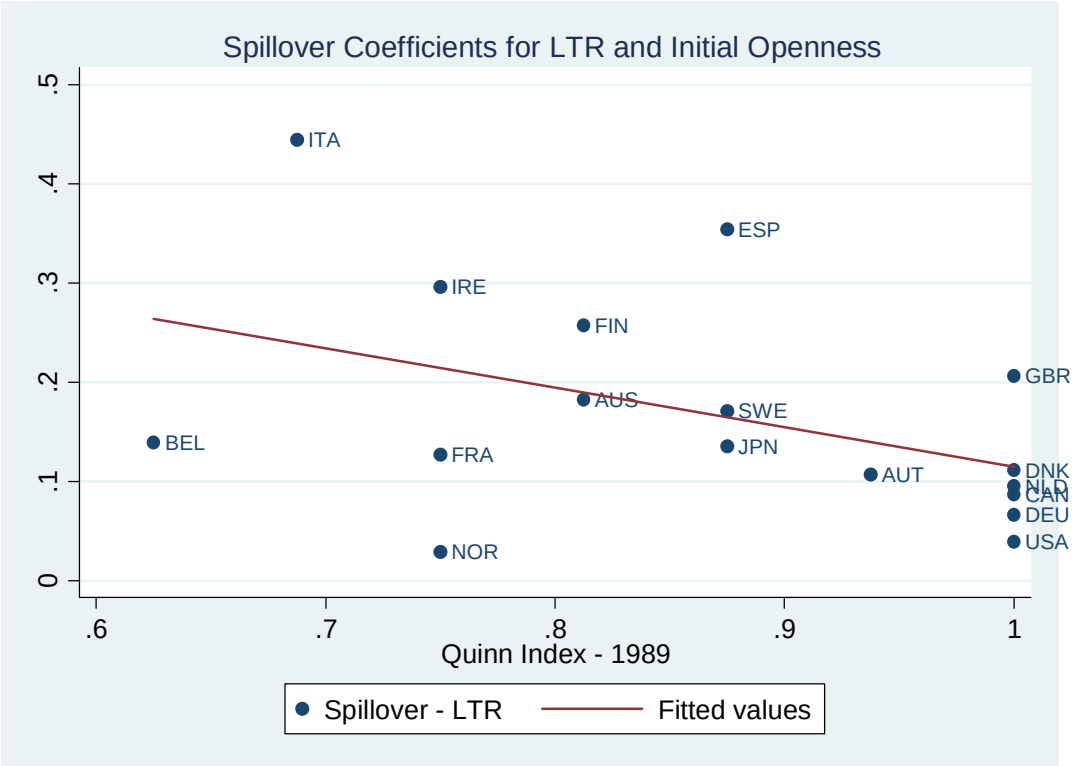

Figure 10: Spillover Coefficients for real interest rate and real interest rate at the beginning of the sample

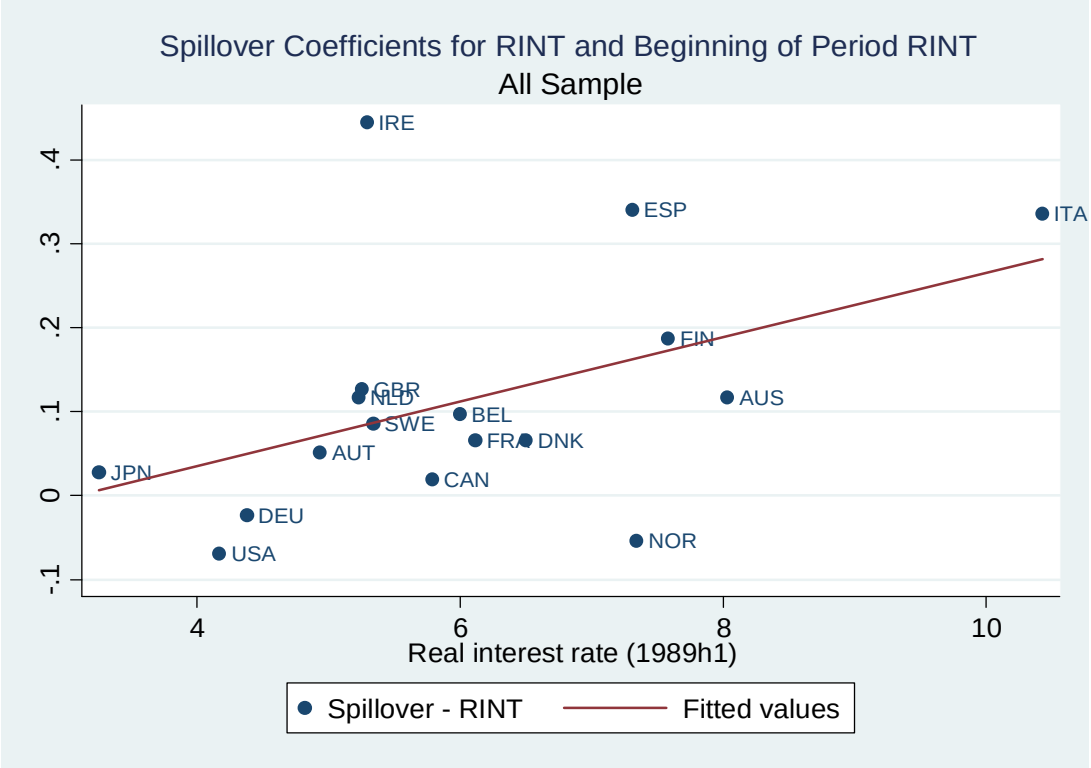

Figure 11: Spillover Coefficients for Long term interest rate and long term interest rate at the beginning of the sample

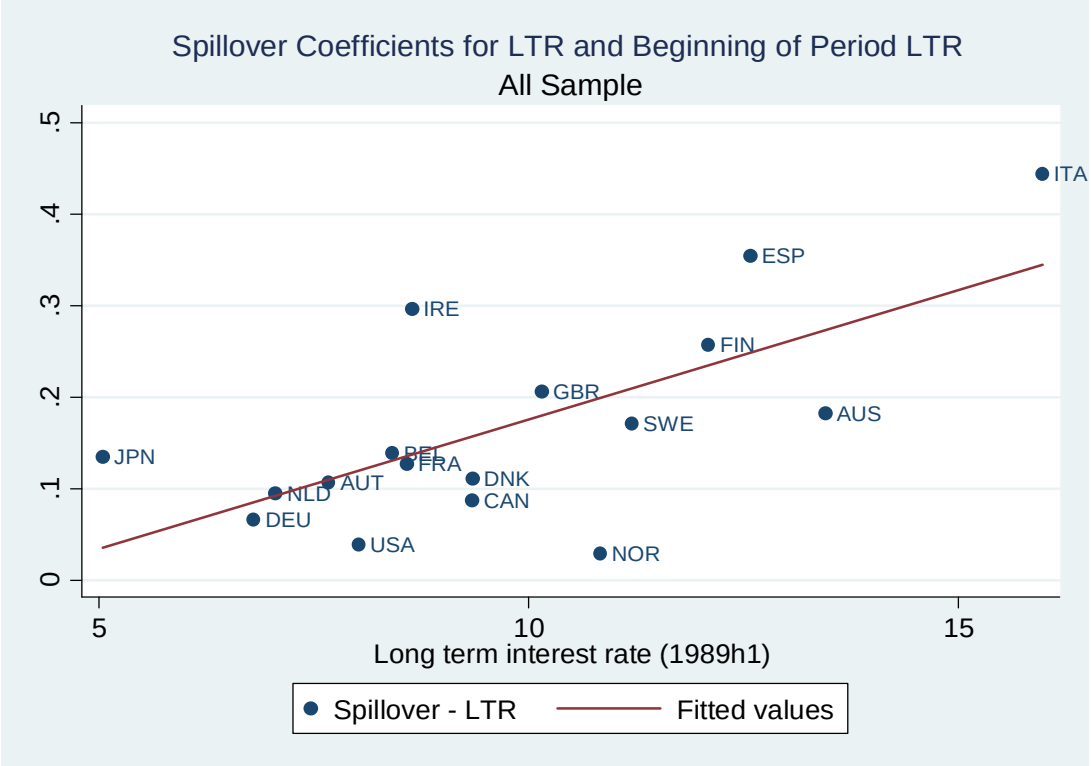

Figure 12: Rolling Window Estimates

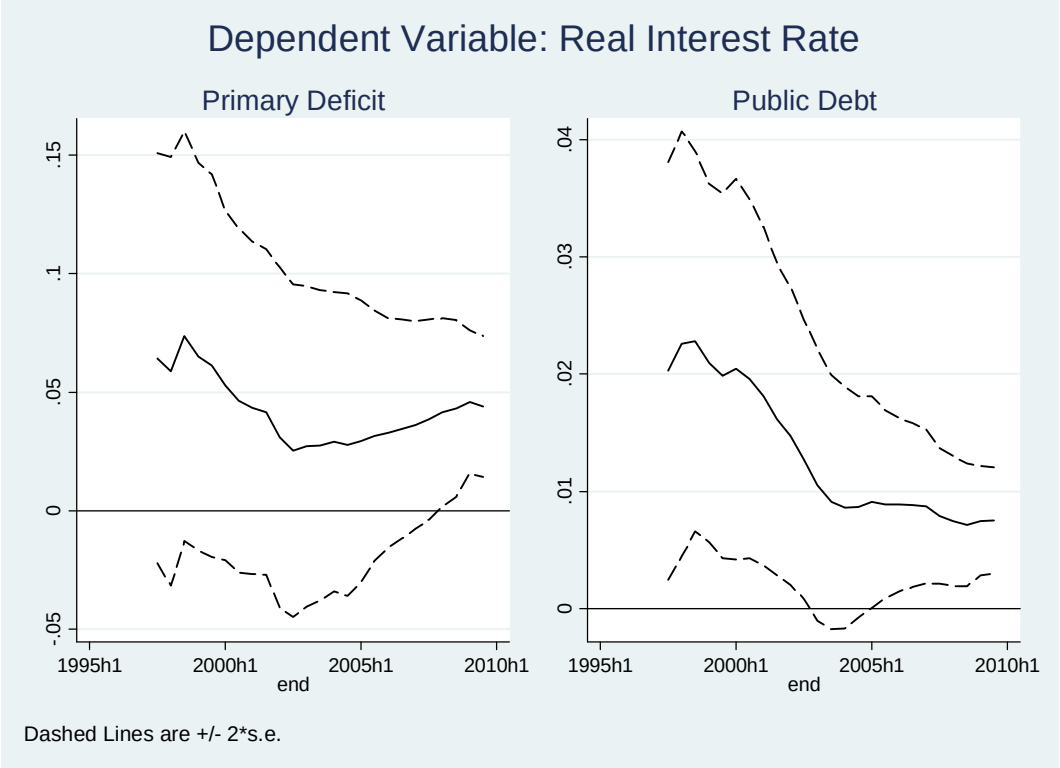

Figure 13: Rolling Window Estimates

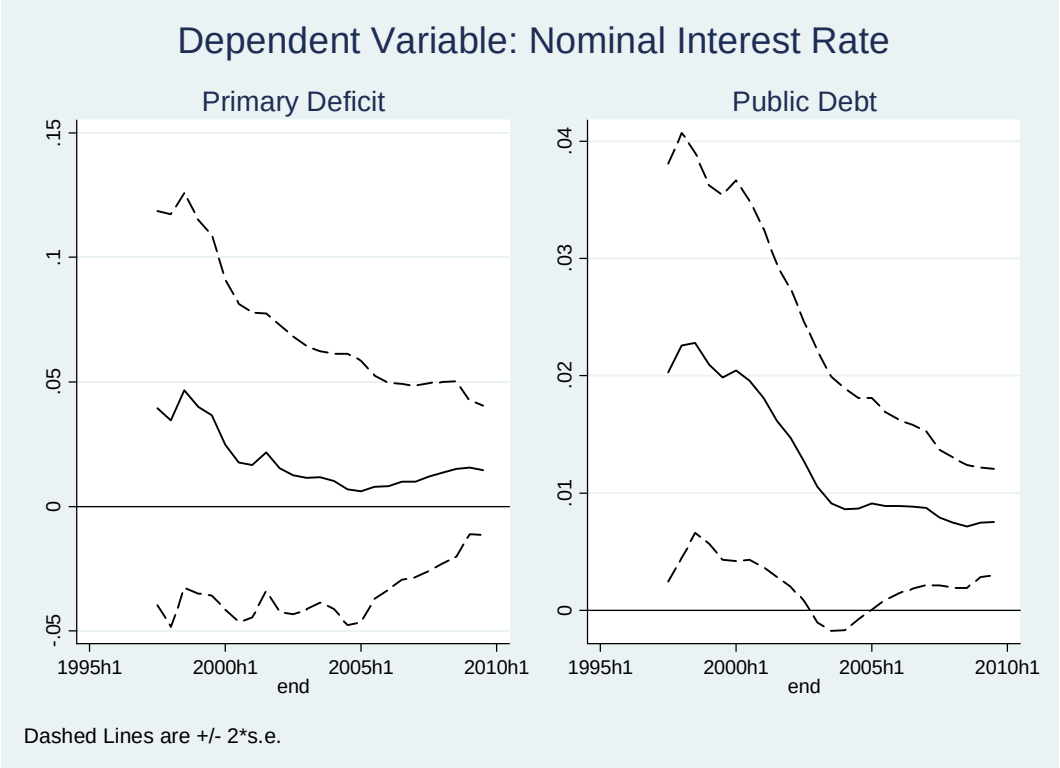

Figure 14: Rolling Window Estimates

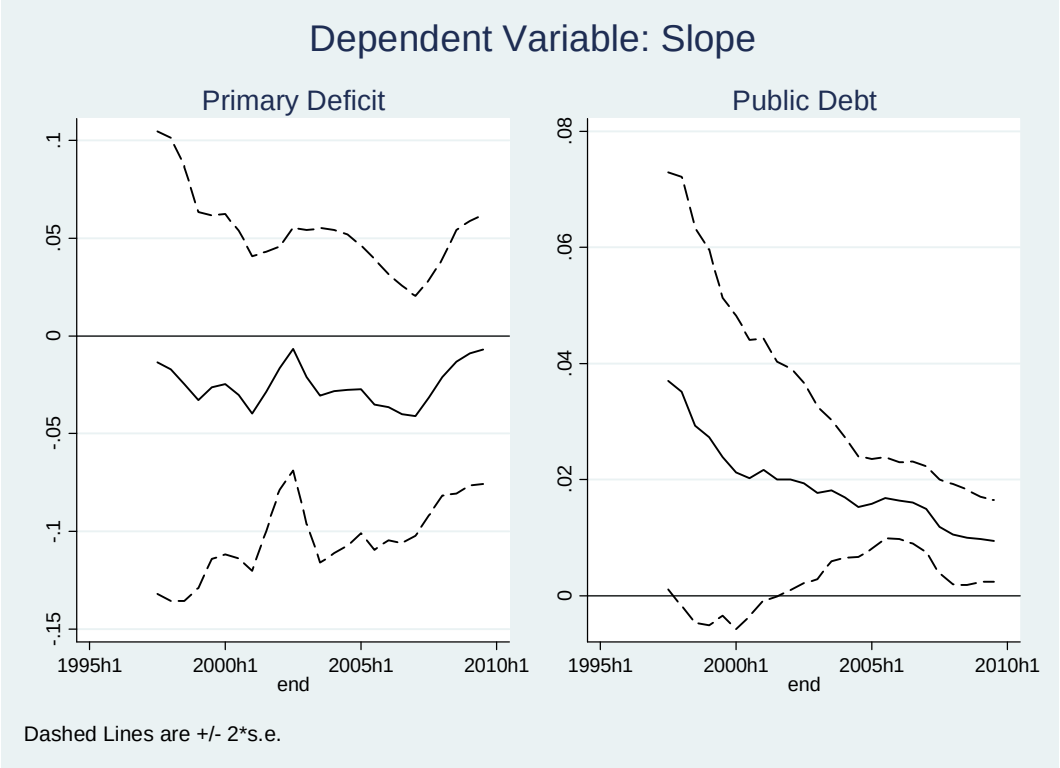

Figure 15: Interpretation of the common factors extracted from W_t^{rlty}

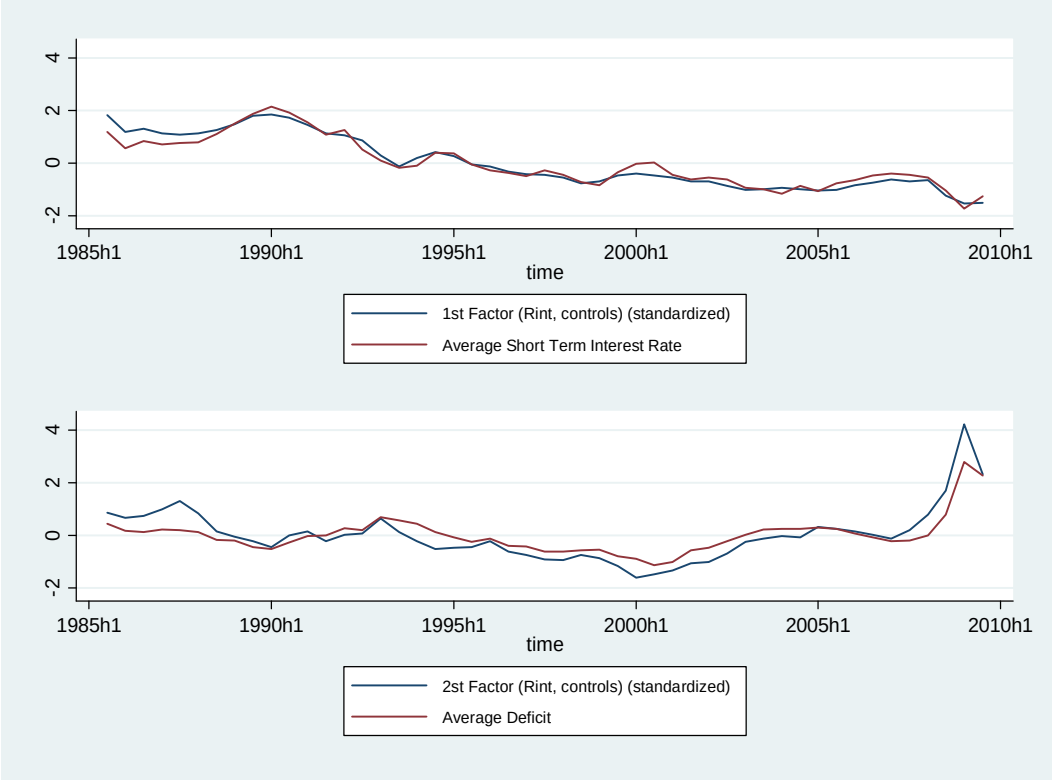

Figure 16: Interpretation of the common factors extracted from W_t^{nlty}

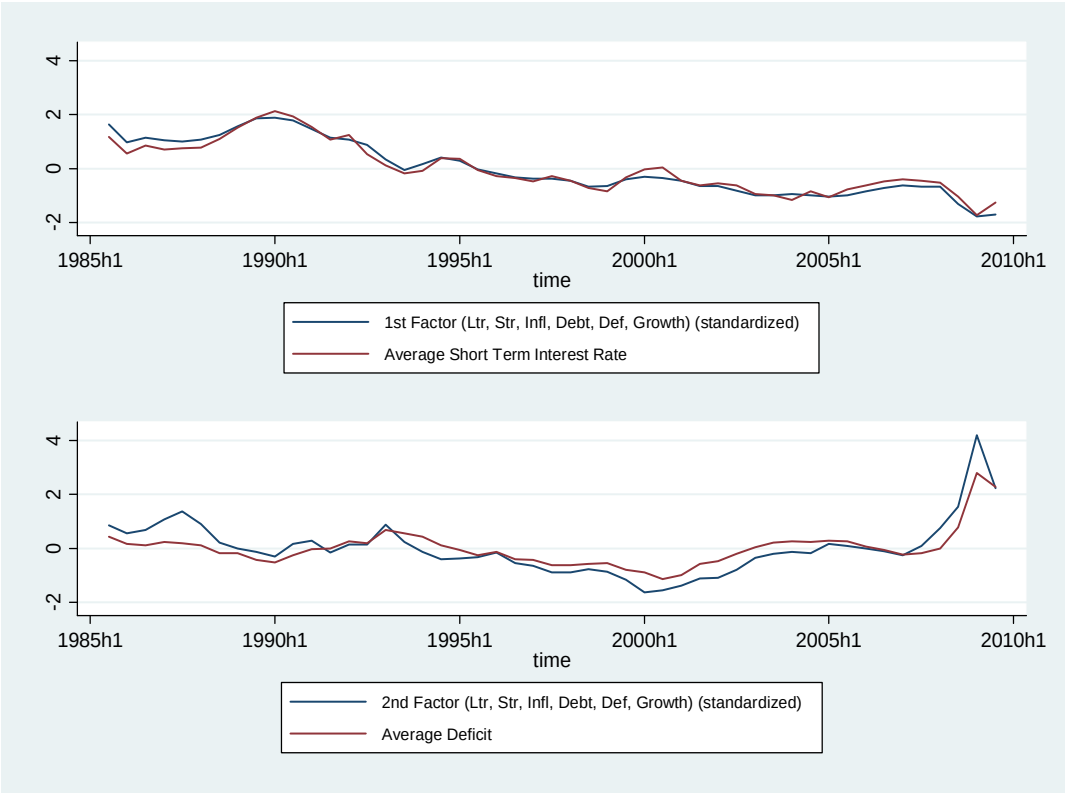

Figure 17: Interpretation of the common factors extracted from W_t^{slope}