Bond Market and Macroeconomic News

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The view expressed are those of the authors and do not necessary reflect those of the ECB or the FED Board

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In this paper:

we analyze the reaction of U.S. Treasury bond market to innovations to macroeconomic fundamentals.

we identify these innovations with the macroeconomic news defined as difference between the actual release and its market expectation.

we show that macroeconomic news explain about 35% of the quarterly fluctuations in long-term bond yields. This percentage decreases to 8% when focusing on daily movements.

these results suggest that although non-fundamental factors substantially influence the day-to-day movements in bond yields their effects are mean-reverting and short-lived. The effects of macro news, instead, are longer-lasting: the surprise component of the macroeconomic releases persistently influences the yields curve.

In this paper:

When analyzing the robustness of our findings over different sub-samples we found that the interaction between macro news and yields did not break down after the zero lower bound was attained.

Our evidence suggests that the Federal Reserve non-standard monetary policies, have been successful in keeping the bond yields anchored to macro news in a period of economic uncertainty.

We use this finding to track a equal weights portfolio of excess bond returns: the only predictable part of excess bond returns is the non-fundamental mean-reverting part.

We also analyze the impact of macroeconomic fundamentals on other assets:

for S&P500 returns they have some persistent effects but not as strong as for bond yields

for exchange rate returns they do not explain low frequencies fluctuations.

Motivation

- **Macroeconomic News move financial markets**

- Event-study literature typically find that the major economic releases (although individually significant), taken together, account for only a small amount of the daily/intraday variation in asset prices

- Macro-finance literature finds that macroeconomic variables explain a significant amount of low-frequency variation (monthly/quarterly) in asset price both in-sample and out-of-sample

- Is there a way to reconcile these two apparently conflicting findings?

- YES!

Motivation

From Los Angeles Times (5 December 1987)

- Bond price fell Friday as the government reported stronger than expected employment growth [.....] Yield on 30-year Treasury edged up to 9.13% from 9.05

From Bloomberg news (10 March 2012)

- [.....] Yields on benchmark 10-year note climbed to the highest in a week yesterday after the job report reduced speculation Federal Reserve policy makers may hint at next week's meeting that they are moving closer to more monetary stimulus

From ABC (8 June 2013)

- US job creation grows, fuelling expectations of Fed stimulus reduction

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Event study Literature

- Andersen et al. (2003) and Andersen et al. (2007): macroeconomic news produce conditional mean jumps of stock, bond and foreign exchange markets in an interval of 5 minutes around the announcement

- Balduzzi, et al. (2001), macroeconomic news affect strongly bond price volatility and the adjustment occurs within one minute after the announcement

- Jones et al. (1998) find that the new information coming from data releases is immediately incorporated into bond prices.

- Gurkaynak et al. (2005) demonstrate that the daily change in long-term forward rates move significantly in response to the unexpected macroeconomic data releases and monetary policy announcements.

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Motivation

Macro-finance literature on the Yields curve

- Average level of the yield curve move with the inflation rate spread long-short rates move with the business cycle

- Macro information help to forecast interest rates and bond excess returns especially at long horizons (3- to 24-month ahead)

Ang and Piazzesi (2003), Altavilla, Giacomini, Ragusa (2013), Coroneo, Giannone and Modugno (2013), Diebold et al. (2006), Favero et al. (2012), Gurkaynak and Wright (2012), Lundvigson and Ng(2009), Monch (2008)

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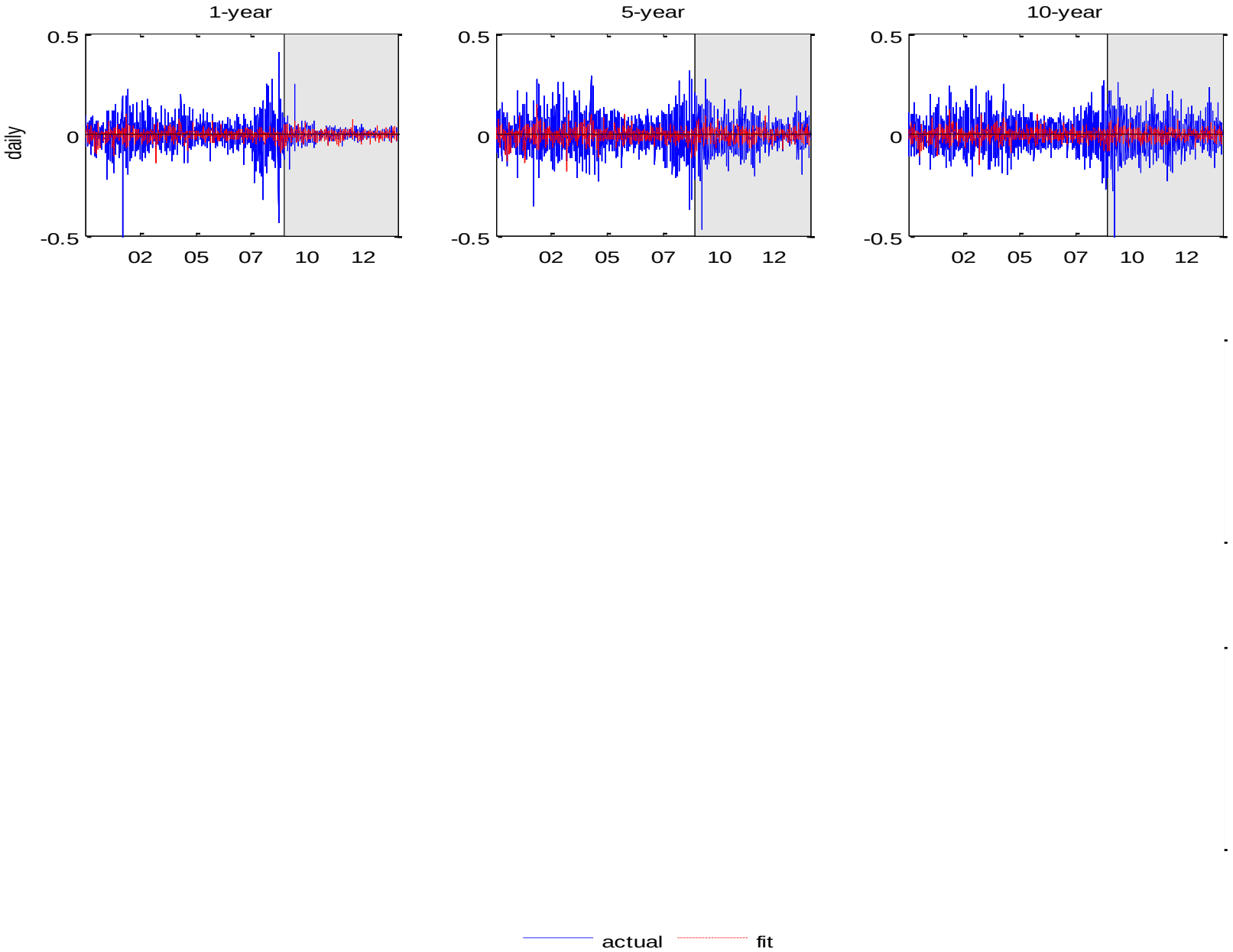
Nominal yields differences: in-sample fit



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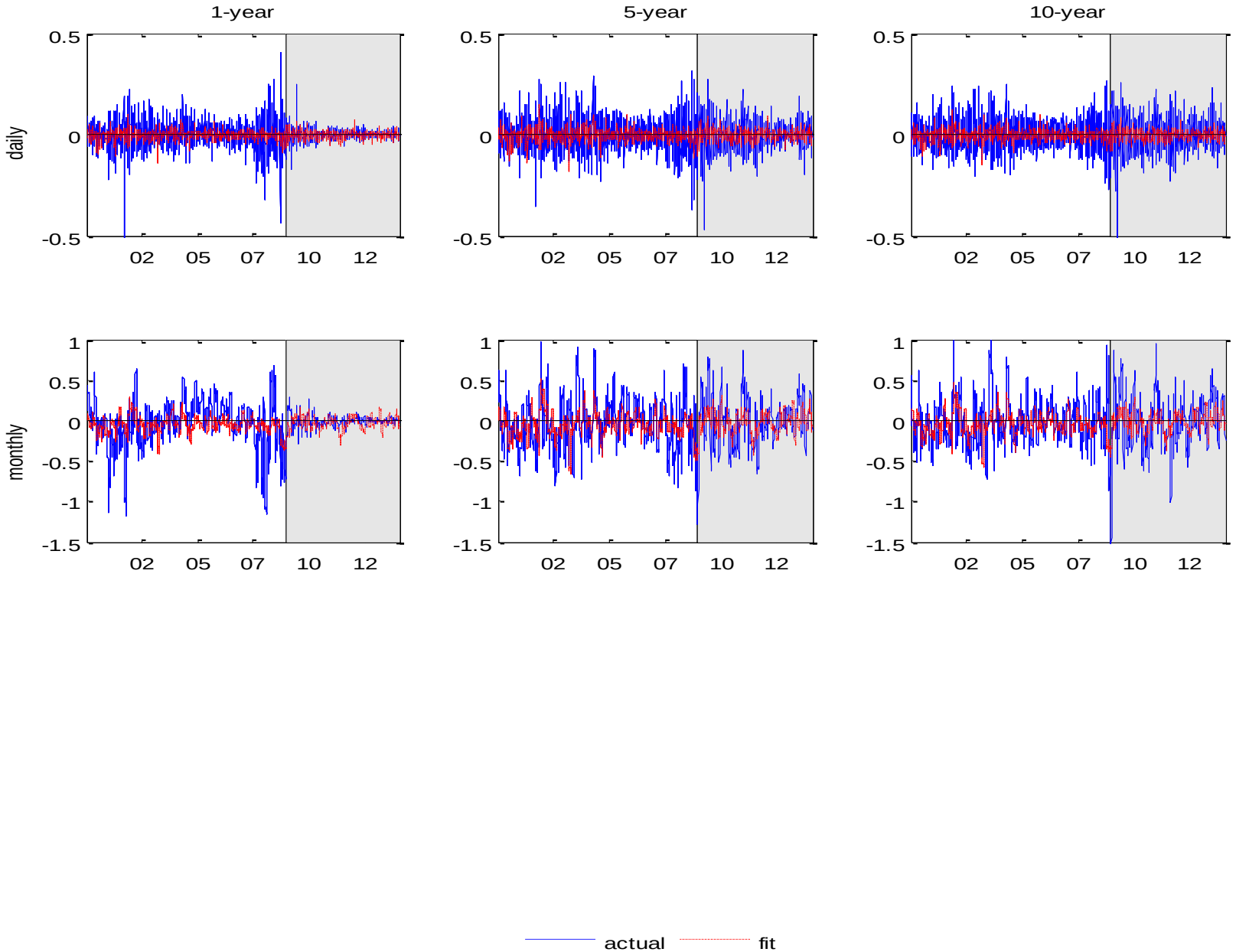

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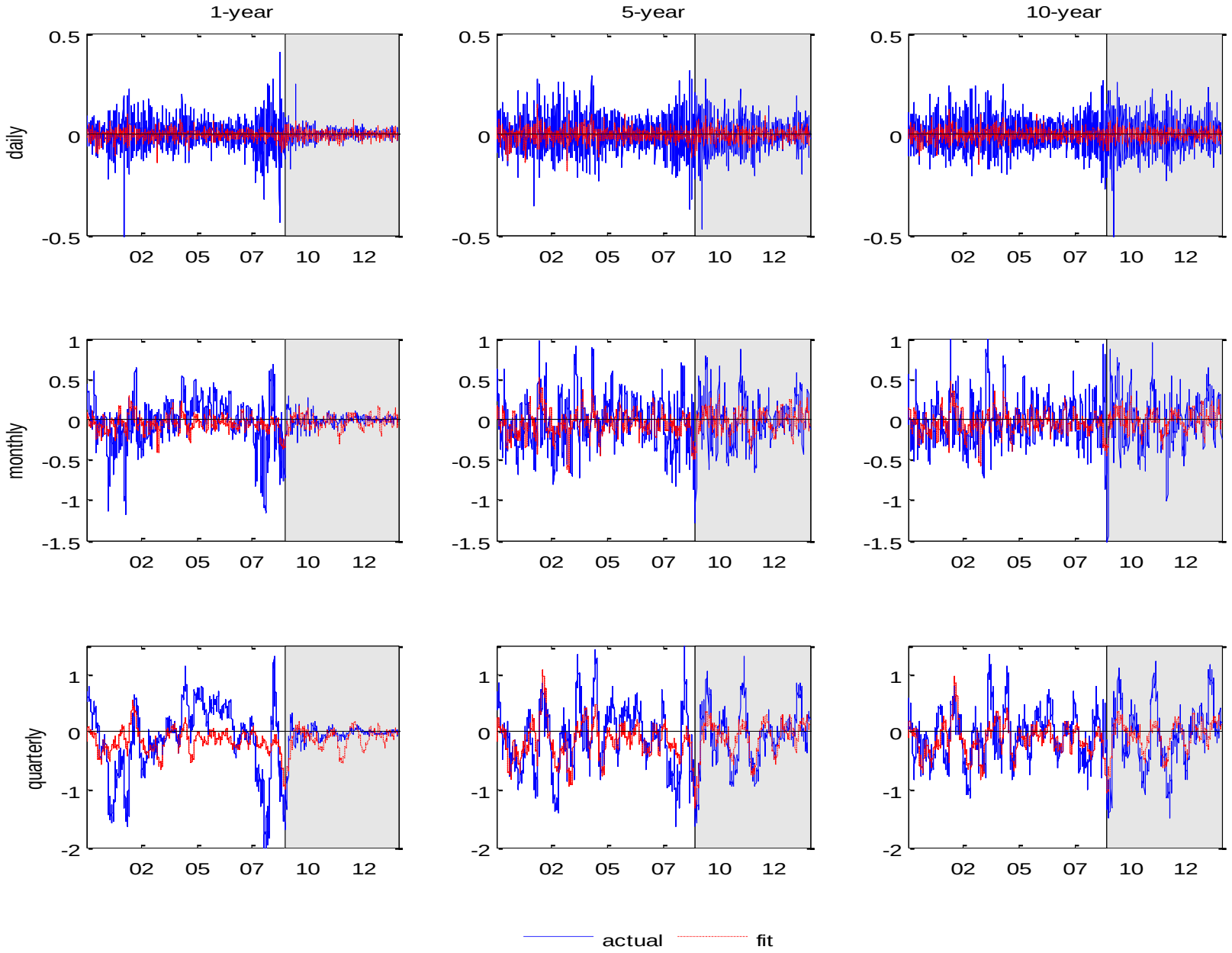
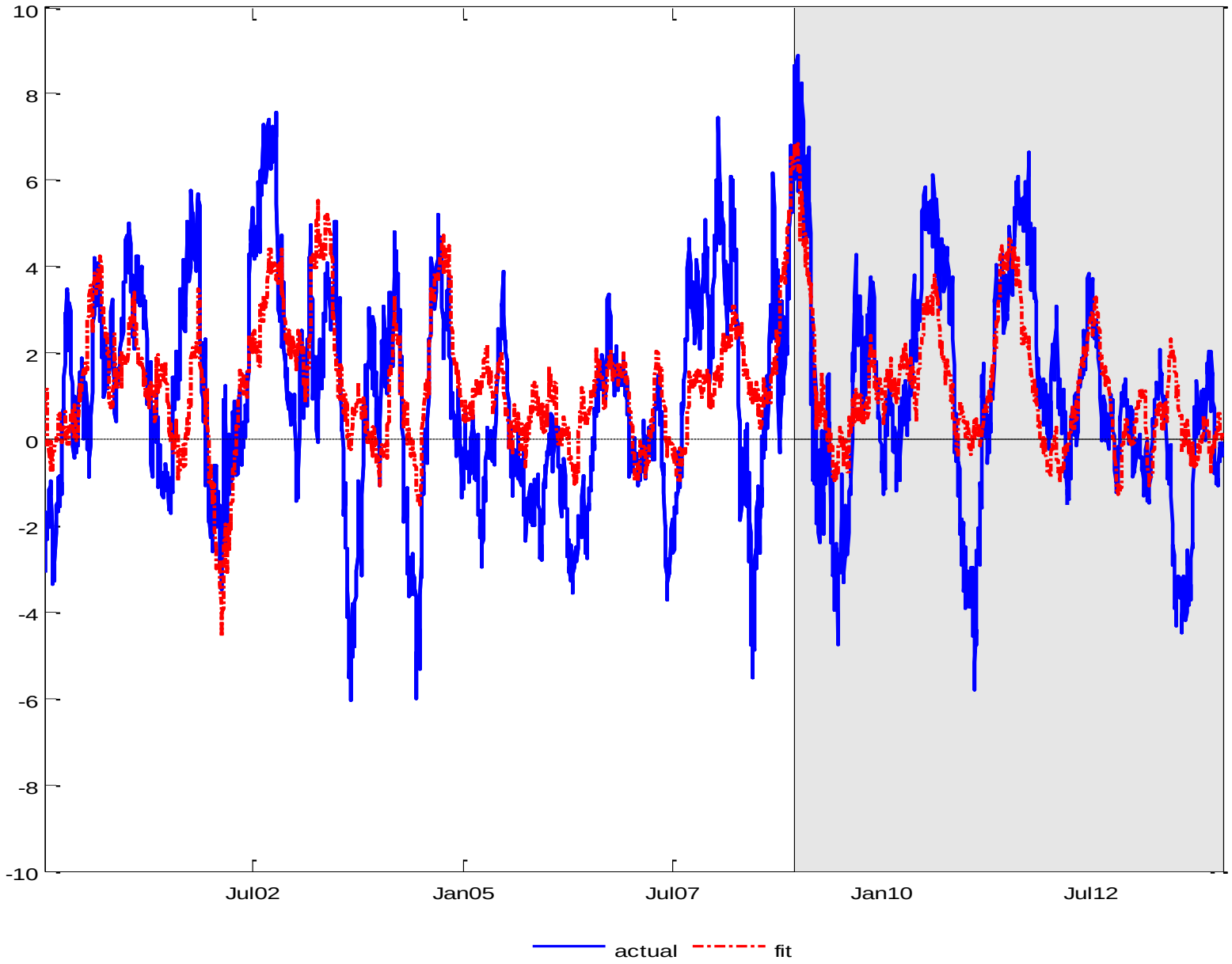


Equal-weight portfolio of bond excess returns:



Outline

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ii. Nominal yields

2. Empirical Models

i. News regressions at daily frequency
ii. Isolating low-frequencies

3. Results

i. Nominal yields
ii. Pre- and ZLB sample
iii. Excess bond returns
iv. Other markets

4. Conclusions

Data Description: Macroeconomic News

In order to mimic the macroeconomic information available in real-time to market participants we use the data contained in the Economic Calendars (ECO) provided by Bloomberg.

This dataset gives for each macroeconomic release
1. the realised value and
2. the prediction formed by a panel of market participants on the same value.

ECO survey forecasts normally start one to two weeks before each release, and are updated in real-time until the macroeconomic variable is officially released.

The survey value used in the empirical analysis is the median (consensus) forecasts.

Our dataset include 42 news, all the one available on the sample under analysis (January 2000 to January 2014)

Data Description: Macroeconomic News

In this study we consider all the U.S. macroeconomic news available at least from January 1, 2000, for a total of 42 variables for two reasons:

1) macro variables are imperfectly measured and it is unlikely that they correspond to the precise economic concepts provided by theoretical models. Including all of them in our analysis allows us to not omit any information.

Several series have been used in order to capture the price concept of theoretical models: CPI, PPI, GDP deflator, etc. Ang and Piazzesi (2003) include the first principal component of several price series

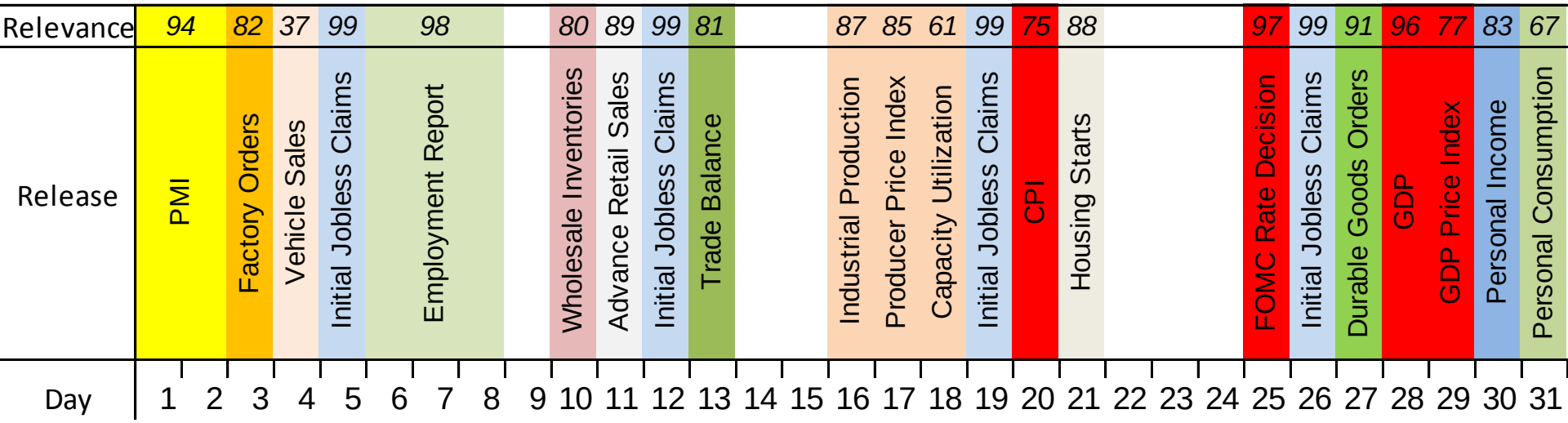
2) macro variables are released in a non-synchronous manner. Including all of them in our analysis allow us to capture the most recent developments.

GDP deflator is released at quarterly frequency, usually one month after the reference quarter, and CPI is released, on average, four days later than PPI.

Data Description: Macroeconomic News

The Real-time data flow

January 2012



Relevance:
The % of users that have set an alert for the particular event.
Ex.: 97% of the users have set an alert to be notified before scheduled release of the FOMC Rate Decision.

Publication Lag: depends on the variable

Employment report:
Change in Nonfarm Payrolls
Change in Private Payrolls
Unemployment Rate
Average Hourly Earning

Data Description: Macroeconomic News

Even if we are considering such a large set of news, most likely we are underestimating the importance of macroeconomic fundamentals for bond yields for several reasons:

1) we consider only U.S. macroeconomic news, but other countries macroeconomic news can reveal innovations in fundamentals that are important for U.S. bond yields as well.

2) There are macro fundamentals related events that can have an immediate effect on bond yields, but cannot be immediately captured by macroeconomic news, like natural disasters or political decisions.

3) In order to have a sufficiently large sample, we consider macroeconomic news that are available at least from January 2000. Since then more news of macro variables are available.

For simplicity, here we call non-fundamental the part of the bond yields not explained by macro-news; however we have to keep in mind that in there are fundamental innovations that we cannot extract.

Data Description: Nominal Yields and their decomposition

Nominal yields

Daily observations on 1-year through 10-year zero-coupon U.S. Treasury bonds Constructed by Gürkaynak, Sack and Wright (2007).
Dataset available at: http://www.federalreserve.gov/econresdata/researchdata.htm

Daily observations on 3-month Treasury bills: for the excess bond returns
Available from FRED

Data sample from January 2000 to January 2014

The regression model

Starting from:

$$\Delta y_t^{\tau} = c^{\tau} + \sum_{i=1}^{n} \beta_i^{\tau} news_{i,t} + \varepsilon_t^{\tau}$$

Where:

Δy_t^{τ} Daily change in yields at maturity τ

$news_{i,t}$ Difference between Release and its market expectation (Standardised)

Having for each macroeconomic variable both the official releases and the corresponding forecast we can reconstruct the size and the direction of all news that have hit the market at each point in time. The resulting daily index is:

$$nix_t^{d,\tau} = \hat{c}^{\tau} + \sum_{i=1}^{n} \hat{\beta}_i^{\tau} news_{i,t}$$

Releases	Relevance	Feq	Pub. Delay	1-year	5-year	10-year
Advance Retail Sales	88.79	M	15	**1.19**	**1.80**	**1.44**
Business Inventories	33.64	M	45	-0.18	-0.16	-0.02
Capacity Utilization	60.84	M	16	1.19	**1.51**	1.27
Change in Nonfarm Payrolls	98.13	M	4	**3.44**	**4.48**	**3.64**
Consumer Confidence	95.33	M	2	**0.86**	**0.96**	**0.95**
Consumer Credit	36.45	M	38	-0.16	-0.35	-0.39
Consumer Price Index (MoM)	93.46	M	16	0.27	0.49	0.12
CPI Ex Food & Energy (MoM)	74.77	M	16	0.48	0.38	0.31
Domestic Vehicle Sales	29.91	M	3	**0.89**	0.31	-0.03
Durable Goods Orders	90.65	M	21	0.49	0.80	0.71
Employment Cost Index	71.03	Q	31	0.19	0.38	0.30
Factory Orders	82.24	M	34	0.17	0.23	0.27
FOMC Rate Decision	97.20	8/year	0	1.08	1.06	1.04
Housing Starts	87.85	M	19	0.18	0.27	-0.02
Import Price Index (MoM)	77.57	M	11	0.04	-0.02	-0.16
Industrial Production	86.92	M	16	-0.02	-0.26	-0.80
Initial Jobless Claims	99.07	W	5	**-1.11**	**-1.56**	**-1.41**
ISM Manufacturing	94.39	M	2	**1.73**	**2.77**	**2.65**
ISM Non-Manf. Composite	70.09	M	2	**1.67**	**2.19**	**2.01**
Leading Indicators	84.11	M	24	0.26	0.75	**0.93**
New Home Sales	89.72	M	25	0.41	0.59	0.73
Personal Income	83.18	M	21	-0.37	-0.39	-0.32
Personal Spending	83.18	M	21	0.31	0.16	0.14
Philadelphia Fed.	74.77	M	-14	**1.10**	**1.95**	**1.73**
PPI Ex Food & Energy (MoM)	68.04	M	15	0.32	**1.13**	**1.45**
Producer Price Index (MoM)	85.05	M	15	-0.05	-0.37	-0.21
Retail Sales Less Autos	62.15	M	15	0.74	1.00	**1.28**
Trade Balance	81.31	M	41	0.20	0.85	**1.15**
Unemployment Rate	88.32	M	4	**-0.93**	-0.60	-0.37
Wholesale Inventories	79.44	M	40	0.10	0.09	0.07
GDP Annualized QoQ A	96.26	Q	26	**2.57**	**2.79**	**2.39**
GDP Annualized QoQ S	96.26	Q	59	-0.44	0.05	0.09
GDP Annualized QoQ T	96.26	Q	80	0.03	-0.91	-1.09
GDP Price Index A	77.01	Q	26	0.29	0.35	0.12
GDP Price Index S	77.01	Q	59	0.81	**1.87**	1.78
GDP Price Index T	77.01	Q	80	0.43	-1.09	-0.82
Nonfarm Productivity P	34.58	Q	31	-1.44	**-1.95**	**-1.78**
Nonfarm Productivity F	34.58	Q	65	-1.00	-0.95	-0.70
Unit Labor Costs P	27.10	Q	31	0.13	0.49	0.51
Unit Labor Costs F	27.10	Q	65	-0.10	0.22	0.34
U. of Michigan Confidence P	92.52	M	-23	**1.00**	**1.64**	**1.42**
U. of Michigan Confidence F	92.52	M	-9	0.02	-0.13	0.09

Daily regression coefficients

There are three groups of variables that are particularly important in order to explain the yields daily changes through all the maturity spectrum:

1) surveys: consumer confidence, ISM manufacturing and non-manufacturing and Philadelphia Fed. economic outlook).

they are important for their timeliness: they are the first available information relative to the current month economic situation.

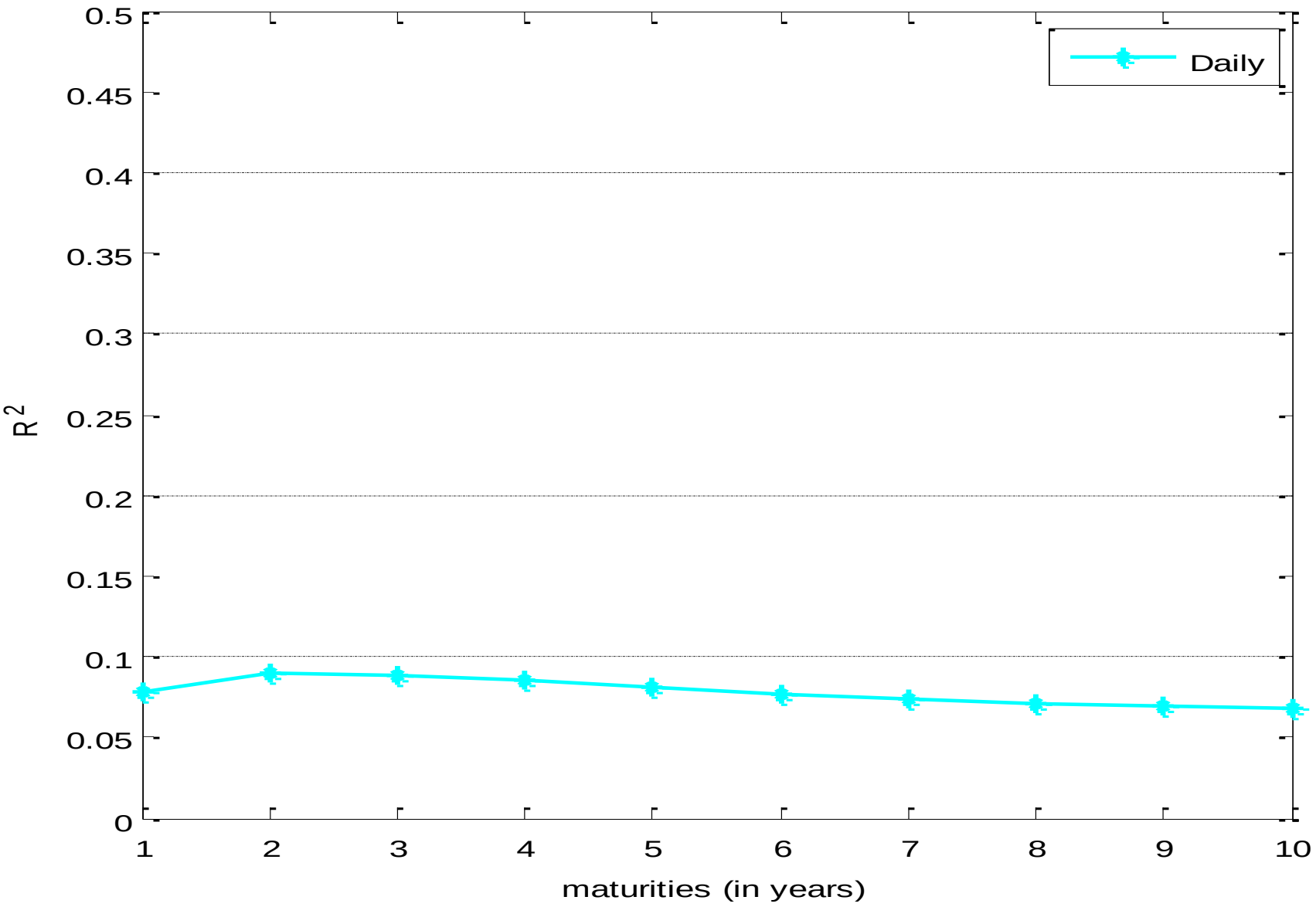
2) employment related variables (change in non-farm payrolls, initial jobless claims and unemployment).

jobless claims are released on weekly basis. Like surveys they are very timely, therefore they are important for market participants in order to understand the employment situation.

3) other macro variables (i.e. GDP, retail sales and producer price index).

among the indicators monitored by the Federal Reserve in order to decide the monetary policy stands, and therefore important for market participants.

Daily regression R^2



Market perception

From CNBC (6 June 2013)

- **The May employment report is being dubbed the most important in years, with the power to shape market expectations for weeks, if not months to come**

Interest rates have moved higher ahead of it, stocks have traded anxiously for several weeks, and Fed officials have fanned expectations that they are getting ready to consider downsizing their $85 billion a month in bond purchases.
The 30-year mortgage has even crept above 4 percent for the first time in a year last week.

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The 30-year mortgage has even crept above 4 percent for the first time in a year last week.

Then: let's take market beliefs seriously

Isolating Low-frequencies

Monthly Aggregation

$$nix_t^{m,\tau} = \sum_{j=0}^{21}\sum_{i=1}^{n}(\hat{c}^{\tau} + \hat{\beta}_i^{\tau} news_{i,t-j})$$

Estimated model

$$\Rightarrow \Delta^m y_t^{\tau} = \gamma^{m,\tau} nix_t^{m,\tau} + \upsilon_t^{\tau}$$

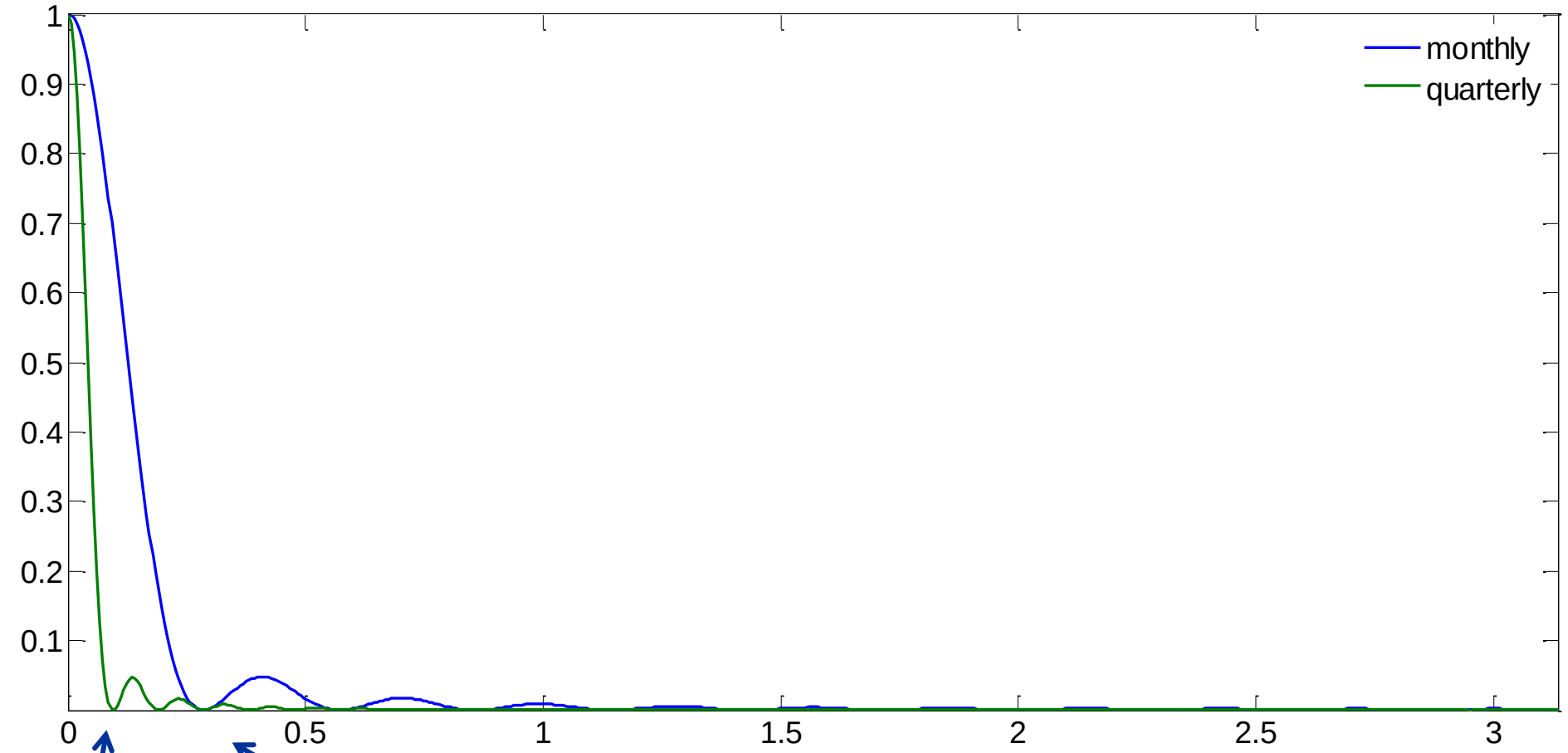
Quarterly Aggregation

$$nix_t^{q,\tau} = \sum_{j=0}^{65}\sum_{i=1}^{n}(\hat{c}^{\tau} + \hat{\beta}_i^{\tau} news_{i,t-j})$$

Estimated model

$$\Rightarrow \Delta^q y_t^{\tau} = \gamma^{q,\tau} nix_t^{q,\tau} + \omega_t^{\tau}$$

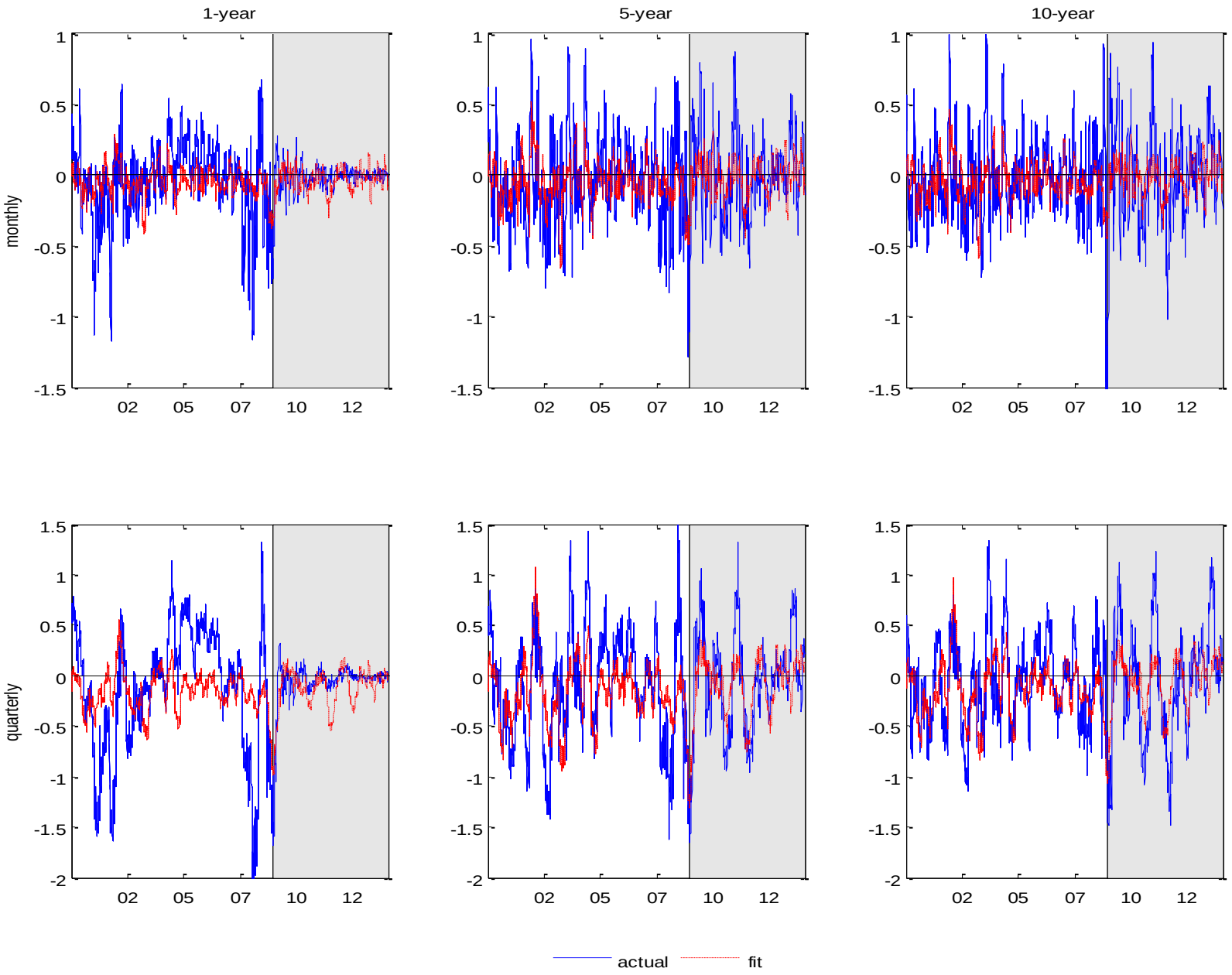
The effect of filtering



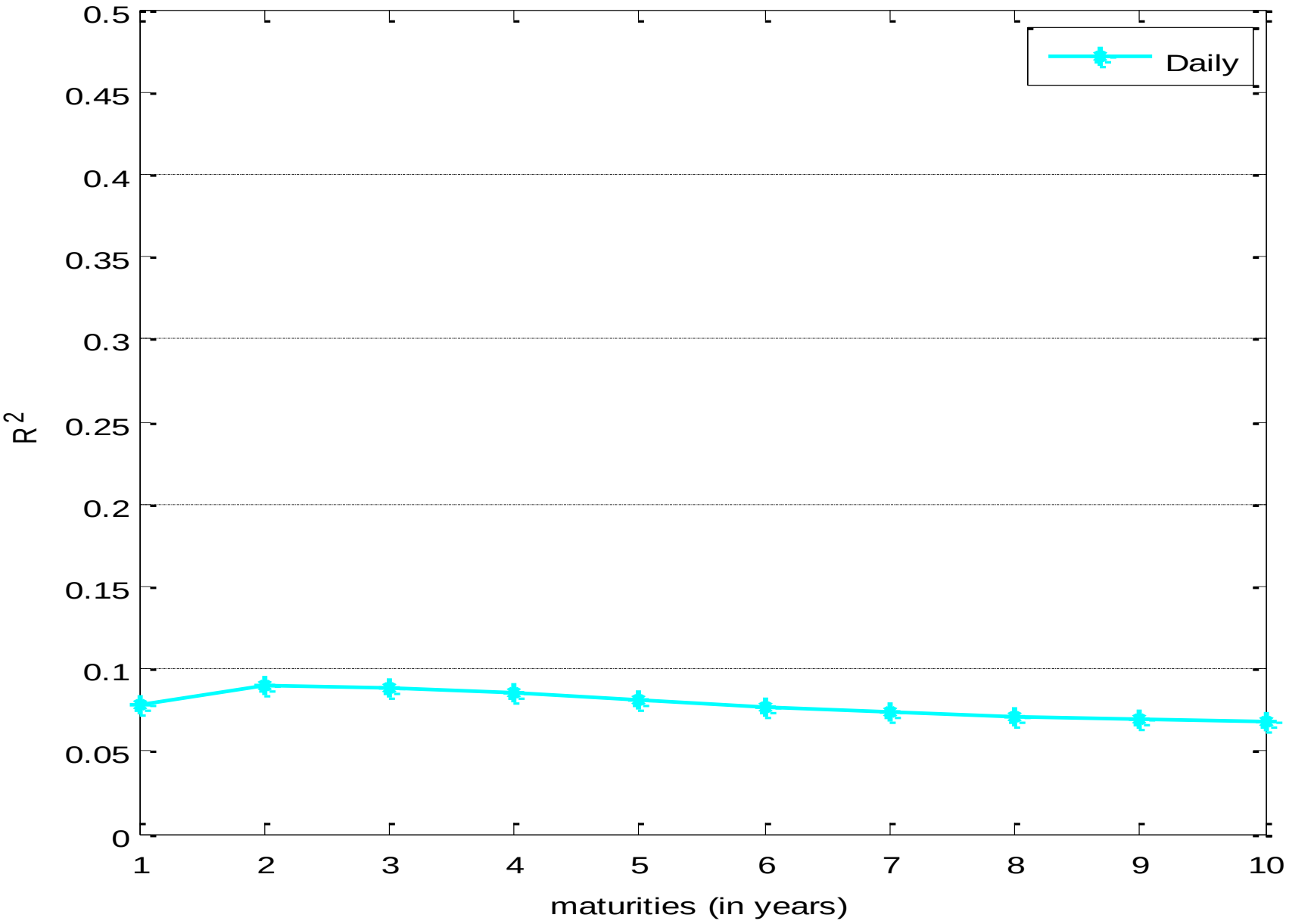
$2*\pi/66 = 0.0952$

$2*\pi/22 = 0.2856$

Nominal yields: in-sample fit



Variance explained by the News Index



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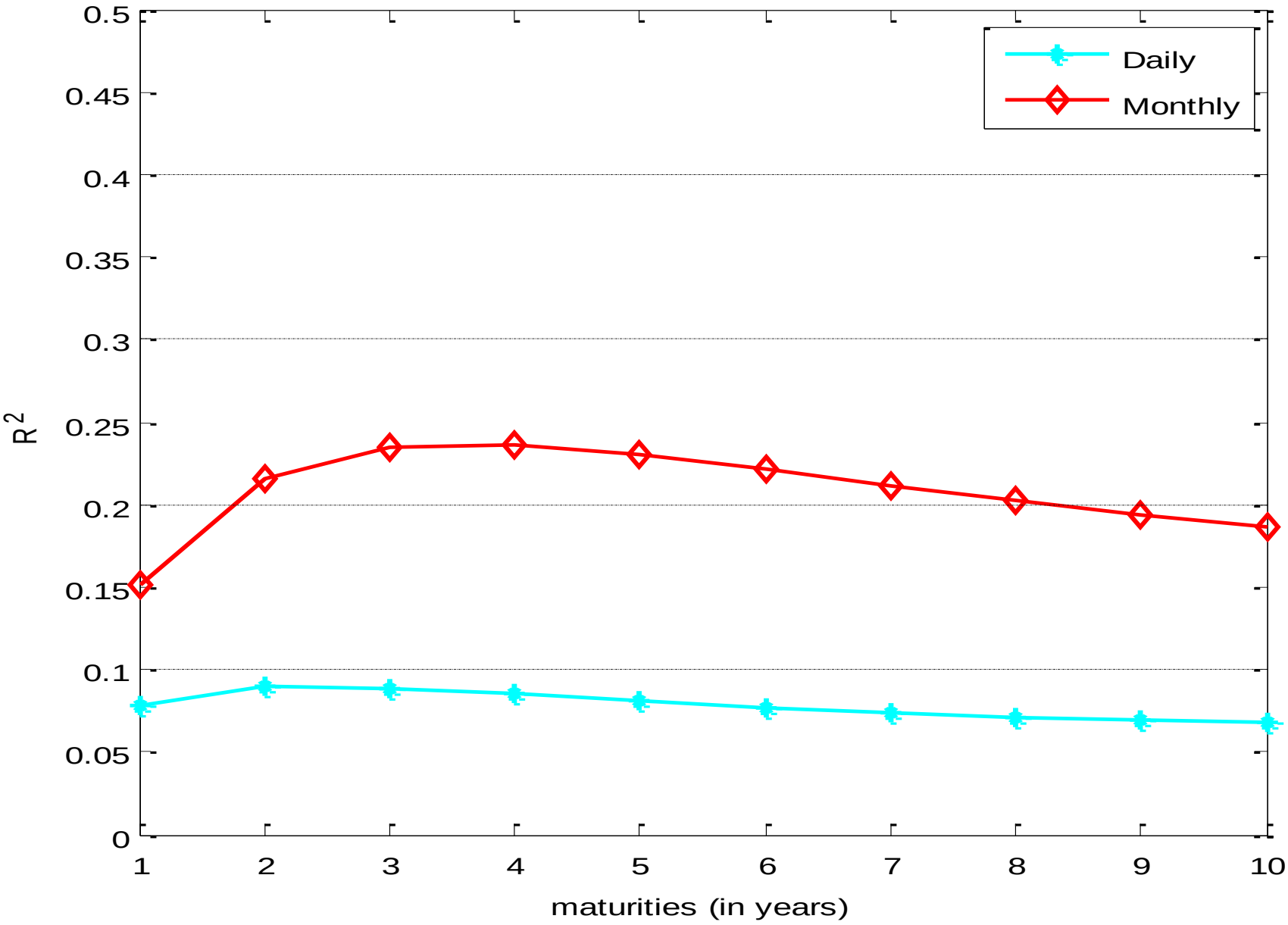

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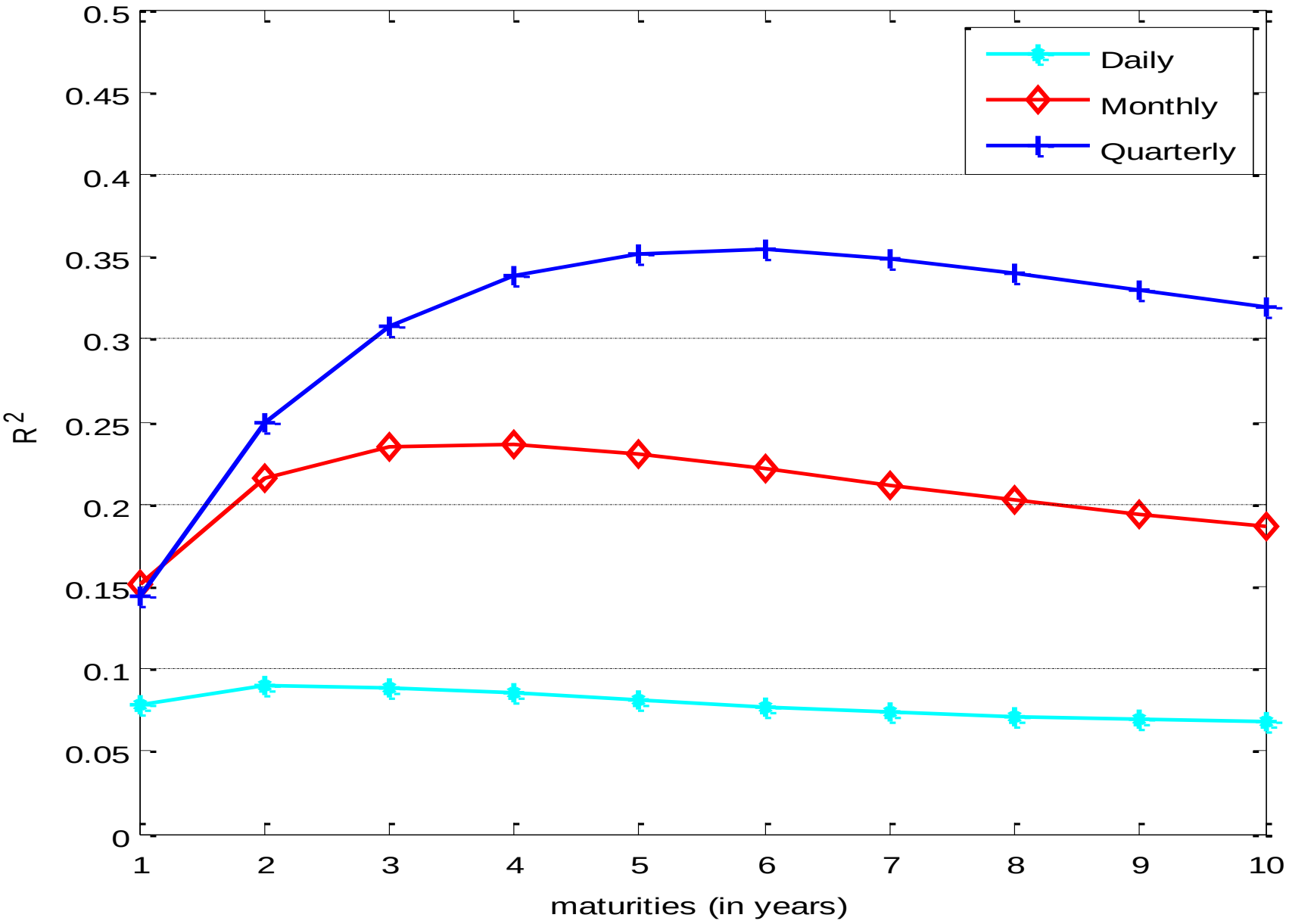


Zero lower bound

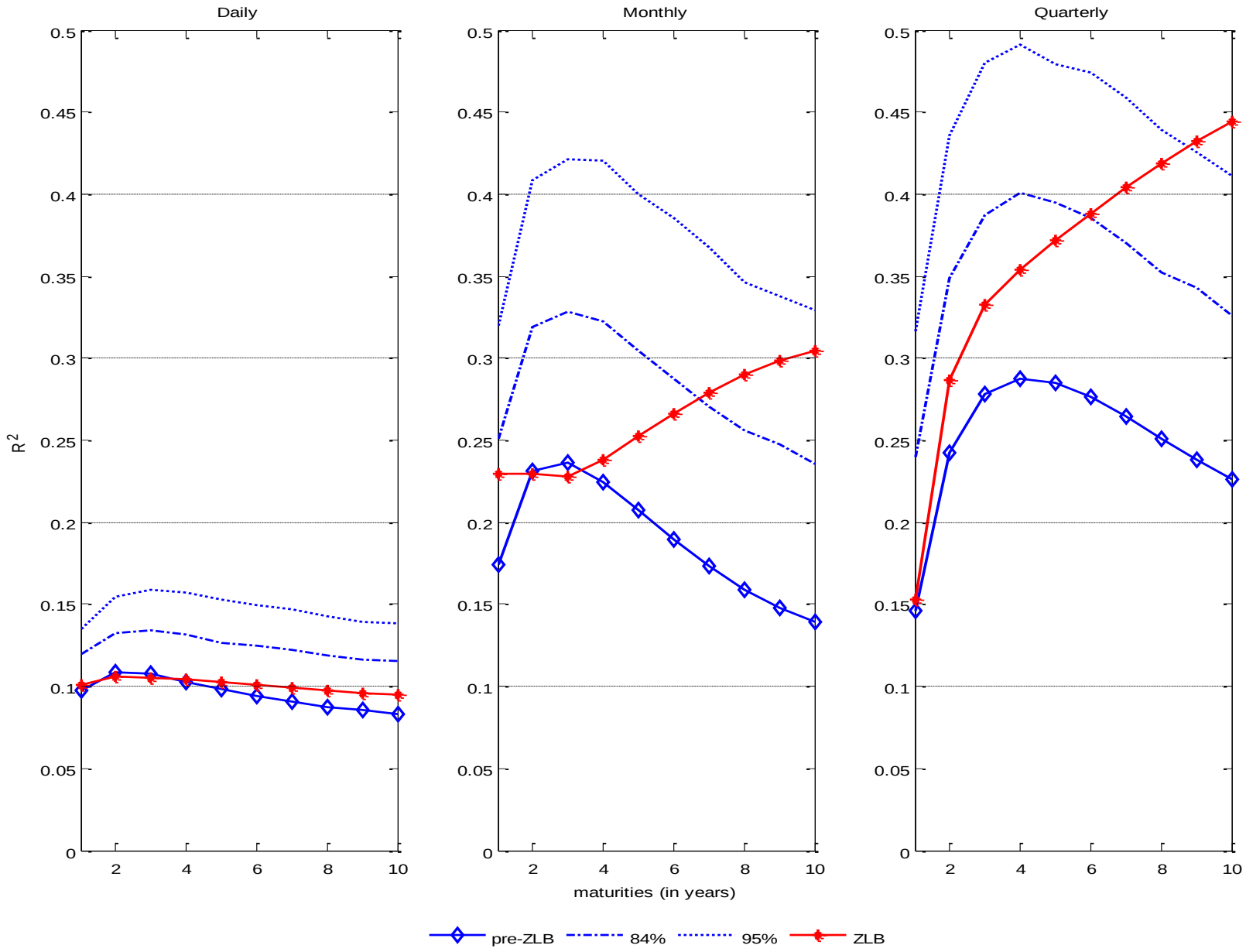
We analyze the robustness of our findings over the zero lower bound sub-sample:

Holding the expectation hypothesis, away from the zero lower bound, the normal conduct of monetary policy provides a link between macro news and Treasury bond yields: the central bank react to macro news and therefore all the yield curve react

Policy concern:

At the zero lower bound this mechanism wouldn’t work: the interaction between macro news and yields could break a part

Zero lower bound



Zero lower bound

These results provide evidence that the measures adopted by the Federal Reserve at the ZLB, i.e. forward guidance and large-scale asset purchases, did not break a part the relation between bond yields and macroeconomic news.

The non-standard monetary policies are actually strengthening the relation between macro news and bond yields at low frequencies.

Possible interpretation:

non-standard monetary policies have a real macroeconomic target, i.e. they will be pursued until the unemployment rate will be above 6.5%;

market participant pay more attention to macro news in order to understand the state of the economy, employment in particular, and eventually to eventually anticipate decision of the Federal Reserve about the future conduct of non-standard monetary policies.

Implication for bond risk premia

Apart from being relevant in their own right, monthly and quarterly fluctuations of the yields have an additional economic interpretation:

excess bond returns with a holding period of a month (quarter) are a linear function of monthly (quarterly) bond yield changes and, therefore, of their fundamental and non-fundamental part.

Excess bond return is a proxy of real risk premia:

An important implication of our results is that macroeconomic news considerably influences the dynamics of real risk premia when the holding period goes beyond a single day.

Implication for bond risk premia

The 3-month holding period excess bond return for a bond with maturity τ is:

$$rx_{t+k}^{k,\tau} = -(\tau - k)y_{t+k}^{\tau-k} + \tau y_t^{\tau} - y_t^{k}$$

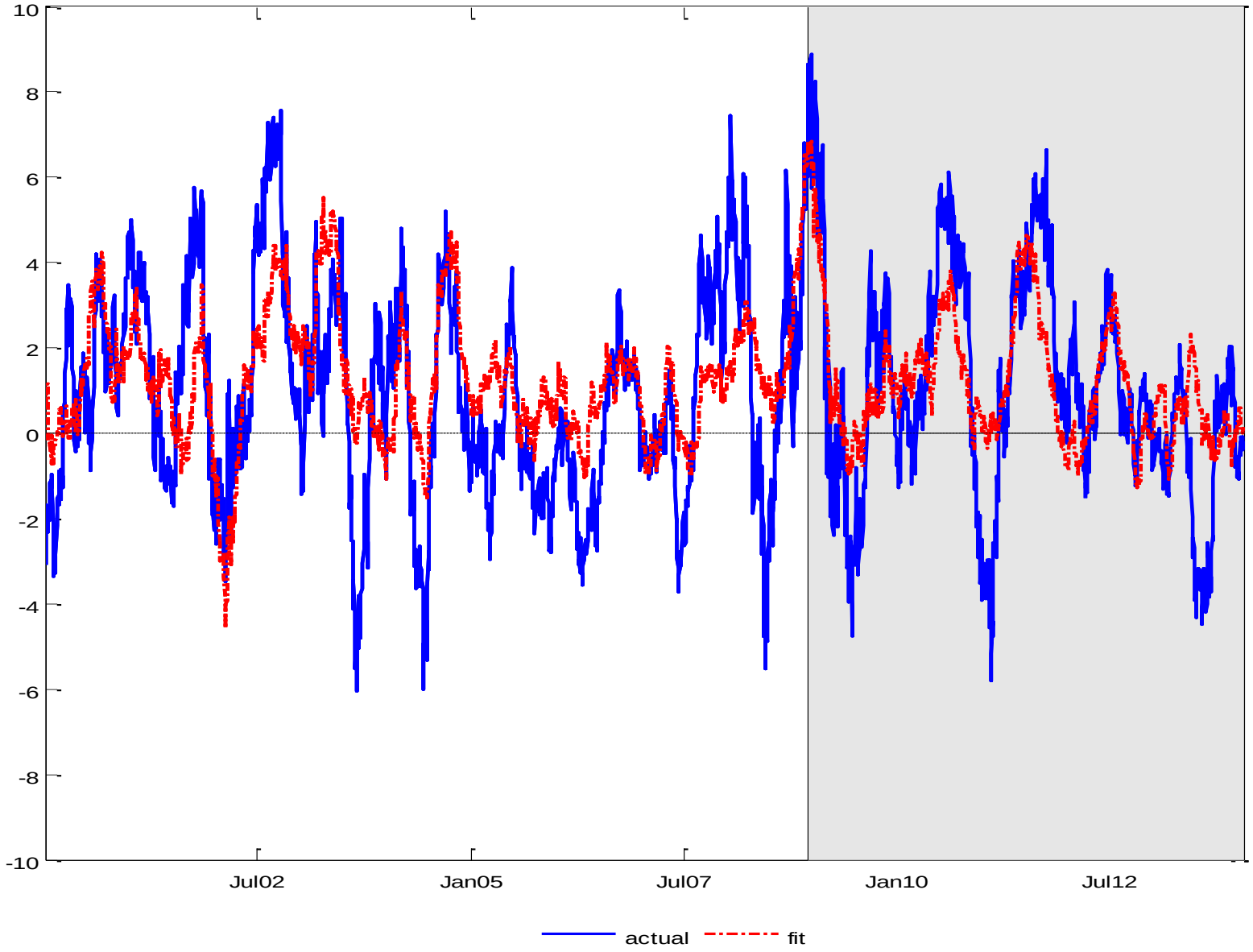
But this can be rewritten as:

$$rx_{t+k}^{k,\tau} = -(\tau - k)y_t^{\tau-k} - (\tau - k)\sum_{i=1}^{t+k} \Delta y_{t+i}^{\tau-k} + \tau y_t^{\tau} - y_t^{k}$$

We fit the 3-month holding period excess bond return

$$rx_{t+66}^{66,\tau} = -(\tau - 66)y_t^{\tau-66} - (\tau - 66)\gamma^{q,\tau-66} nix_t^{q,\tau-66} + \tau y_t^{\tau} - y_t^{66}$$

Implication for bond risk premia



Explaining the results: Market News are Fundamentals

Let me define:

$$f_t^{\tau} = (\tau - 66)\gamma^{q,\tau-66} nix_t^{q,\tau-66}$$

the fundamental part of the excess bond returns, and:

$$nf_t^{\tau} = rx_t^{\tau} - f_t^{\tau}$$

the non-fundamental part. We first show that the non-fundamental part is mean-reverting:

$$nf_{t+k} - nf_t = b_0 + b_1(rx_t - f_t) + \eta_t$$

b_1=-1.15 and the *R^2=57%: whenever the excess bond return is different from its fundamental the non-fundamental part reverts*.

Explaining the results: Market News are Fundamentals

The predictability of excess bond returns is an open debate:

1) Cochrane and Piazzesi (2005) show that the yield curve itself has forecasting power for excess bond returns.

2) Ludvigson and Ng (2009) show that macro variables contribute to forecast excess bond returns beyond the predictability of the yield curve.

Our contribution to this debate is to disentangle what can be predicted by macro variables and what can be predicted by the yield curve itself.

Explaining the results: Cochrane and Piazzesi (2005) factor

Cochrane and Piazzesi (2005) shows that a linear combination of 1-year bond yield and 1-year forward rates can explain the **35%** (sample Jan 64 – Dec 03) of the 1-year bond risk premium fluctuations in a 1-year ahead predictive regression.

We replicate their exercise for 3-month bond risk premium

$$rx_{t+k}^{\tau} = \beta_0^{\tau} + \beta_1^{\tau} y_t^k + \sum_{m=264:264:2640} \beta_m^{\tau} f_t^{m,m-k} + \eta_t \qquad k = 66$$

The **R^2** of this regression is **22%** (sample Jan 00 - January 14) the Cochrane and Piazzesi factor (CP_t) is the fit of this regression.

Explaining the results: Cochrane and Piazzesi (2005) factor

We regress the fundamental and the non-fundamental part of bond excess returns on the Cochrane and Piazzesi factor:

$$f_{t+k} = \beta_0 + \beta_1 CP_t + v_{t+k}$$

The R^2 of this regression is 2%

$$nf_{t+k} = g_0 + g_1 CP_t + u_{t+k}$$

The R^2 of this regression is 20%

→ CP factor predict the non-fundamental part of the risk-premia

→ There is a fundamental part that depends on macroeconomic news and it is unpredictable: *macroeconomic news* can be considered *unpredictable innovations to the market participants information set*

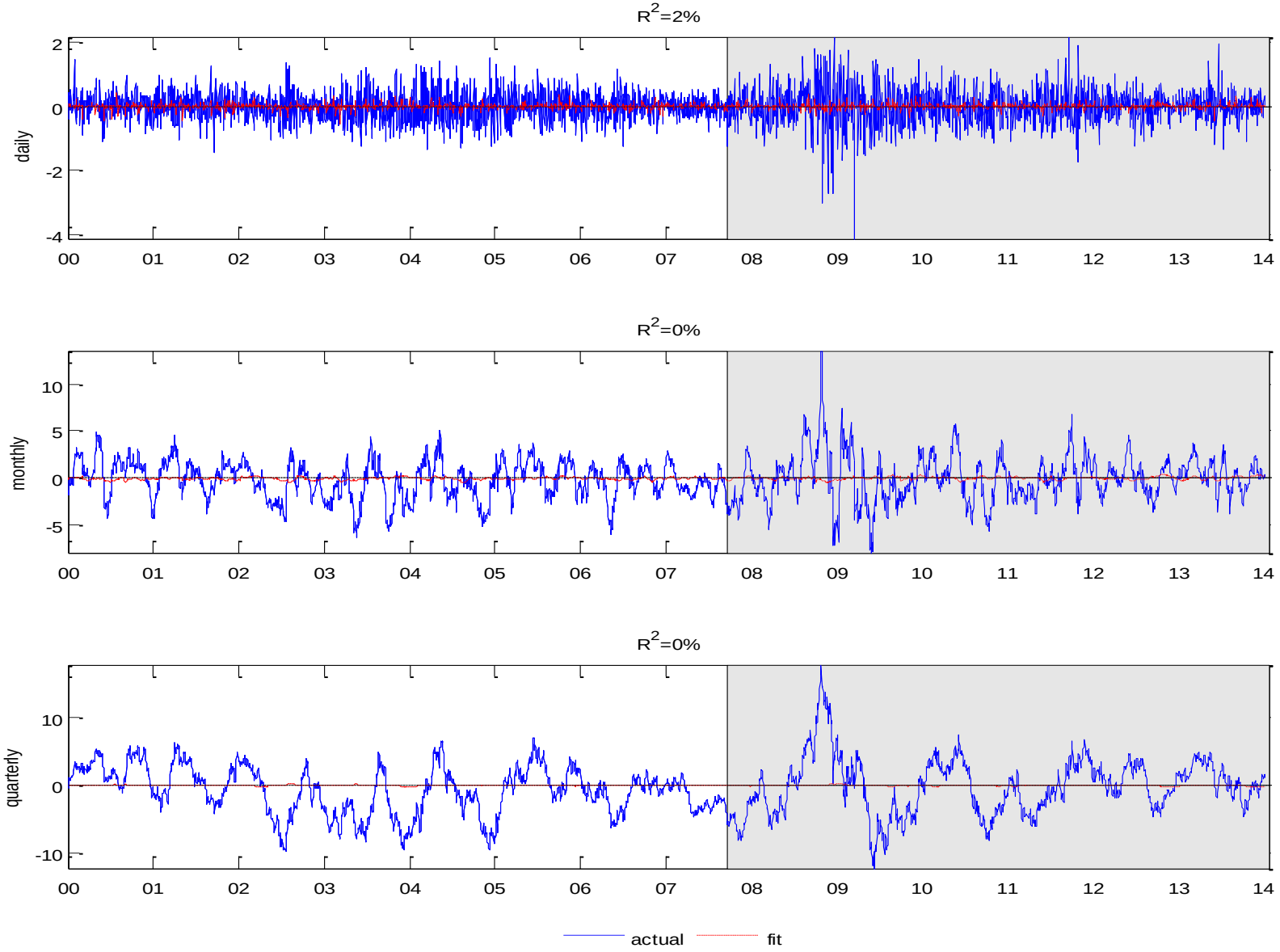
Other Markets

Is this result common to other asset prices?

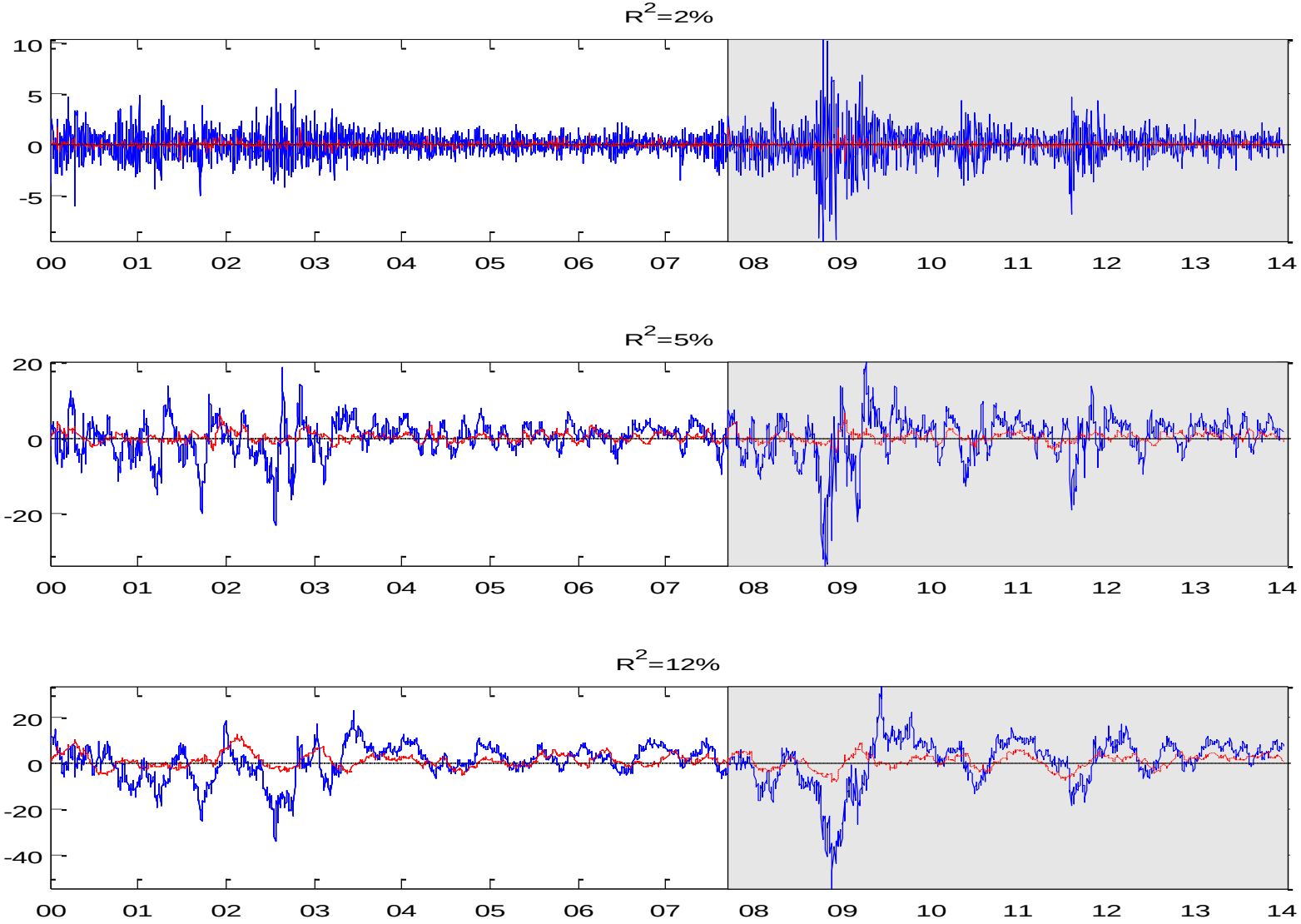
We perform the same exercise done for the change in yields for other two markets:

- Exchange rate returns
  (trade weighted U.S. dollar index, major currencies)
- S&P 500 returns

Exchange rate



S&P500


R2=2%
10
5
0
-5
00
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R2=5%
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R2=12%
20
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14

Conclusions

We identify innovations to macroeconomic fundamentals with macroeconomic news: they explain a large fraction of bond yields fluctuations at low frequencies and this fact is robust and stable.

When analyzing the robustness of our findings over different sub-samples we found that the interaction between macro news and yields did not break down after the zero lower bound was attained.

Our evidence suggests that the Federal Reserve non-standard monetary policies, have been successful in keeping the bond yields anchored to macro news in a period of economic uncertainty.

We use this finding to track a equal weights portfolio of excess bond returns: the only predictable part of excess bond returns is the non-fundamental mean-reverting part.