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MARKET-IMPLIED INFLATION AND GROWTH RATES ADVERSELY AFFECTED BY THE BRENT

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Market-implied inflation and growth rates adversely affected by the Brent

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Résumé

Les anticipations de taux réels et d'inflation extraites du prix des obligations nominales et indexées sont impactées de façon contradictoire par deux effets : les distorsions de prix induites par des évènements de marchés et les variations du prix du pétrole. Hors ces effets, leur corrélation parait stable et positive. Une analyse réalisée sur les données de marchés obligataires les plus importants apporte des éclairages originaux sur la relation beaucoup discutée entre anticipations d'inflation et de croissance.

Mots clés : Obligations indexées sur l'inflation, point mort sur l'inflation, hypothèse de Fisher, Brent

Codes classification JEL : E43, G15

Abstract

The inflation and the real yield component deduced from inflation-linked and nominal bond prices are adversely affected by two market effects: price distortions due to certain market-related events and oil price movements. Their underlying time-correlation without those effects is stable and positive. Market data analysis carried out on the world's major bond markets gives valuable new insight into the long-debated relationship between inflation and growth prospects.

Key words: inflation-linked bonds, breakeven inflation, Fisher hypothesis, Brent

JEL classification: E43, G15

1. Introduction

When inflation-linked bonds were introduced on the world bond markets one to two decades ago, there was positive belief that their pricing would reveal the inflation and growth expectations of the market participants. In a short version of Fisher's (1930) interest rate theory, the yield of these bonds, the real yield, reflects the economic growth forecast, while the yield differential (nominal minus real) called the breakeven inflation rate, reflects the inflation forecast. It has proven difficult though to make such assertions on the market data that has become available since.

Furthermore, it has proven difficult to learn from the bond data how inflation and economic growth mutually interact. In our previous articles (Cette and de Jong, 2008, 2013) we had made an attempt, making apparent that the time-correlation between real-bond yield (RBY) and breakeven inflation (BEIR) variations is continuously distorted within countries by market-related events. Observations made within local markets, which is the standard in the literature on inflation-linked bonds, may therefore be misleading. By taking an international approach we had been able to separate out the correlation due to country market distortions to a certain extent, so as to obtain a view on the more fundamentally-driven correlation. It showed that the correlation measured on a global aggregate scale is positive between RBY and BEIR, except during the heat of the financial crisis in 2008/2009.

What does this say about the interaction between inflation and growth prospects? We show in this article that the oil price plays an important role. There is an apparent adverse relation between breakeven inflation and real yield movements, the former being driven up by an oil price rise while the latter is pushed down. When eliminating the effect of oil from the bond prices, the net global correlation between BEIR and RBY rises. In the crisis sub-period in 2008/2009, the oil price was particularly turbulent provoking large adverse movements

Again, taking an international study approach is essential in making the observations. The influence of oil is easier to detect in global aggregate bond yield variations where the country-specific effects are diversified away and oil, a common denominator for all economies, remains. The new test results contribute to the longstanding debate on the relation between inflation and economic growth prospects.

Section 2 presents the database. Section 3 gives the correlation structure between RBY and BEIR variation and Section 4 presents the role of the oil price within this. Section 5 concludes.

2. Data

The bond market data has been retrieved from Barclays Capital. The markets, member of the World Government Inflation-Linked Bond Index (WGILB), which have been issuing inflation-linked bonds since at least a decade, have been retained.[1] They constitute, in June 2012, of nineteen Inflation-Linked Gilts issued in the United Kingdom, thirty-three Treasury Inflation-Protected Securities (TIPS) in the United States, twenty-six *Obligations Assimilables du Trésor indexées sur l'inflation* (OATi) in the Euro Area, five Treasury Indexed Bonds in Australia, six Index-Linked Treasury Bonds in Sweden and six Real Return Bonds in Canada.

For calculating the breakeven inflation rates, the Barclays Breakeven Comparator indices have been used, which are nominal bond indices purposely designed to match the characteristics of the WGILB members. This is to avoid that the breakeven rates which are simply calculated as the nominal minus the real yield, are being distorted by rotations in the yield curves. For each market and each bond type, aggregate yields are calculated by Barclays over all the maturities in the index. We refer to James (2010) for more details on Barclays' calculus.

The crude oil Brent FOB US dollar price series, available via Datastream, is used as the oil price.

The observation period runs over ten years from July 2002 to June 2012, tests being done on monthly data, which corresponds to 120 observations. In order to define the *crisis* months, we have measured market turbulence by means of the standard deviation of the weekly variation in the breakeven rates over four weeks over all countries in the dataset. If this measure exceeds twice its historical average, the market is deemed in crisis. Through this method, the eight months from October 2008 to May 2009 have been labelled as such.

3. Fisher's hypothesis revisited

In his seminal book *Theory of Interest*, Fisher (1930) hypothesized that the two components of the nominal interest rate, the real rate and the inflation expectation, should be unrelated to one another, this since they are driven by independent economic factors. In Cette and de Jong (2008, 2013) we find that the respective bond components, observable since the issuance of inflation-linked bonds, are not univocal on the matter. Correlations between real yield and

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[1] Japan has not been retained for this reason. This country started issuing inflation-linked bonds in 2004 and has suspended its program in 2008 until further notice. See http://www.mof.go.jp for press releases by the Ministry of Finance.

breakeven inflation variations measured locally country by country are close to zero, giving indication that Fisher’s hypothesis holds. However, their cross-border correlations are systematically positive, which indicates that it doesn’t.

The deadlock can be broken by separating local and international price effects. Through a standard regression analysis, we estimate worldwide common bond yield- and country-specific movements.[2] Ignoring the small cross-correlation terms, the complete correlation matrix between the ΔRBY and ΔBEIR over the various countries, given in Figure 1 (a), is decomposed into a common (b) and an idiosyncratic (c) correlation matrix. This exercise is carried out over the entire observation period from July 2002 to June 2012, in I, and over the period barred the crisis months, in II. The eight crisis months have been defined in the data section.

Figure 1

Decomposition of the correlation matrix between ΔRBY and ΔBEIR

Period: July 2002 to June 2012 – monthly frequency

Data source: Barclays Capital. Calculations made by the authors.

I – Entire ten-year observation period

Total correlation

ΔRBY

ΔBEIR	Australia	Canada	Euro Area	Great Britain	Sweden	United States
Australia	-0.0	-0.1	0.0	-0.0	0.2**	-0.1
Canada	0.3***	-0.4***	-0.0	0.0	0.3***	-0.0
Euro Area	0.1	-0.3***	-0.5***	-0.3***	0.2*	-0.3***
Great Britain	0.0	-0.2*	-0.1	-0.3***	0.3***	-0.2*
Sweden	0.3***	0.0	-0.0	0.1	0.0	-0.0
United States	0.1	-0.3***	-0.2*	-0.2*	0.2***	-0.3***

=

Common correlation

-0.1

+

Idiosyncratic correlation

ΔRBY

ΔBEIR	Australia	Canada	Euro Area	Great Britain	Sweden	United States
Australia	-0.4***	0.1	0.2**	0.1	-0.0	0.1
Canada	0.2**	-0.6***	0.1	0.1	-0.1	0.2**
Euro Area	0.2**	0.2***	-0.5***	-0.1	0.2**	-0.0
Great Britain	-0.2***	0.2***	0.1	-0.4***	0.1	0.1
Sweden	0.0	0.2**	-0.0	0.3***	-0.6***	0.2**
United States	0.2**	-0.1	0.1	-0.0	0.5***	-0.6***

***, **and *: significant at, respectively, the 1%, 5% and 10% level - Using an asymptotic T-test with T=120.

Schematically

$$\overbrace{\begin{bmatrix} -- & & - \\ & & \\ - & & -- \end{bmatrix}}^{(a)} = \overbrace{\begin{bmatrix} - & & - \\ & & \\ - & & - \end{bmatrix}}^{(b)} + \overbrace{\begin{bmatrix} - & & 0 \\ & & \\ 0 & & - \end{bmatrix}}^{(c)}$$

---

[2] Common movements are obtained, both for ΔRBY and ΔBEIR, by regressing on time-fixed effects. The idiosyncratic components are the residuals of the regressions. Consequently, the common correlation, in matrix (b), is identical for all countries and cross-combinations.

II – Ten-year observation period barred the crisis months from October 2008 to May 2009

Total correlation
ΔRBY

ΔBEIR	Australia	Canada	Euro Area	Great Britain	Sweden	United States
Australia	0.2***	-0.0	0.2*	0.3***	0.4***	0.2**
Canada	0.5***	-0.4***	0.1	0.2**	0.3***	0.1
Euro Area	0.5***	-0.0	-0.3***	0.2*	0.2**	0.1
Great Britain	0.3***	-0.1	0.1	0.0	0.3***	0.1
Sweden	0.4***	0.0	-0.0	0.2***	-0.0	0.1
United States	0.4***	-0.3***	0.0	0.1	0.3***	-0.1

=

Common correlation

0.2**

+

Idiosyncratic correlation
ΔRBY

Australia	Canada	Euro Area	Great Britain	Sweden	United States
-0.4***	-0.0	0.2*	-0.0	0.1	0.2**
0.2	-0.6***	0.1	0.1	0.1	0.0
0.2*	0.4***	-0.6***	0.1	-0.0	0.1
-0.3***	0.3***	0.2*	-0.4***	0.1	0.1
0.1	0.2**	-0.0	0.1	-0.6***	0.1
0.3***	-0.3***	0.1	0.1	0.4***	-0.5***

***, **and *: significant at, respectively, the 1%, 5% and 10% level - Using an asymptotic T-test with T=112.

Schematically

$$\overbrace{\begin{bmatrix} -+ & + \\ & \\ + & -+ \end{bmatrix}}^{(a)} = \overbrace{\begin{bmatrix} + & + \\ & \\ + & + \end{bmatrix}}^{(b)} + \overbrace{\begin{bmatrix} - & 0 \\ & \\ 0 & - \end{bmatrix}}^{(c)}$$

It can be noted that (i) country-specific correlation is systematically negative, and (ii) the correlation between the global RBY and BEIR movements is usually positive, yet negative in the crisis. In our previous articles we explained these stylised facts. The negative idiosyncratic correlation can be directly related to market-related events that distort bond prices. As soon as an inflation-linked bond price is being distorted whilst not the nominal, the (differential) breakeven inflation rate moves in exactly opposite direction as the real yield. Those local market events are recurrent, resulting in systematically negative correlation over time. The global correlation turning negative in the crisis months can be explained by the fact that in this period the market events were concerted over the globe and distorted prices on a global scale.

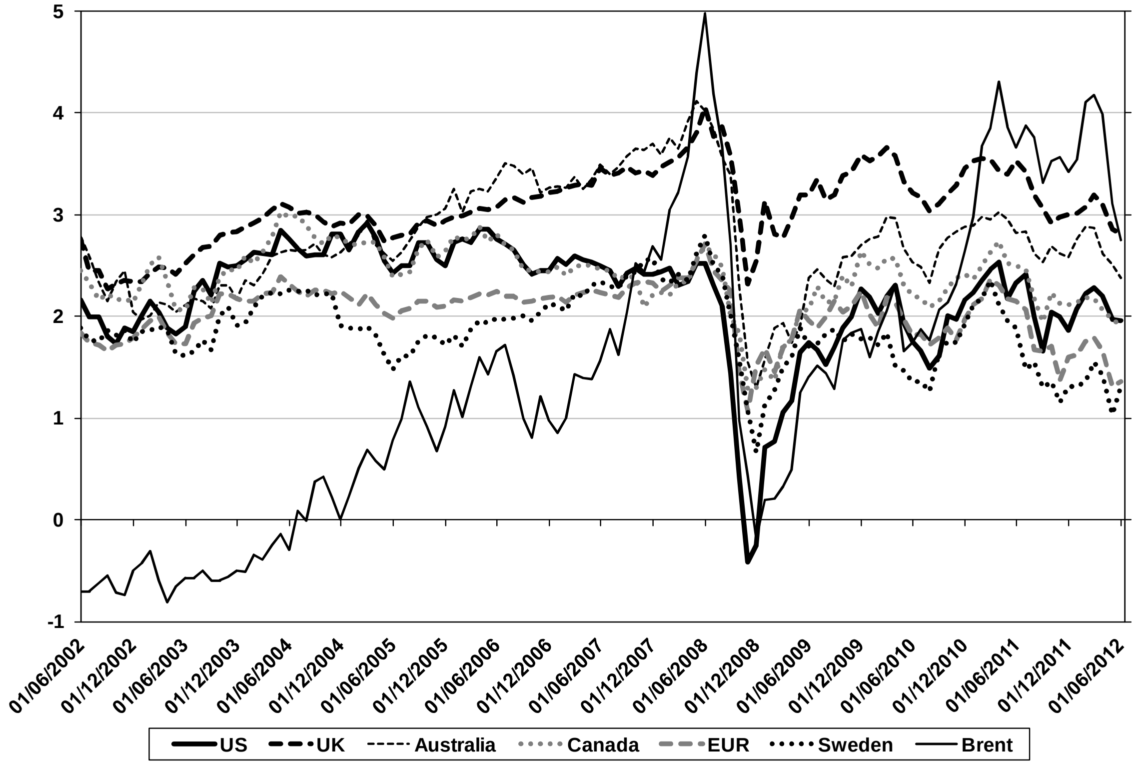
The market distortions are discussed in the finance literature (see Christensen *et al*, 2004, for a survey). They are recognised to lead to a price premium; less attention is paid to their influence on the correlation structure between bonds. A series of articles mention that liquidity problems on the inflation-linked bond market are the main cause of the price distortions (see for example Sack and Elsasser, 2004, Shen, 2006, D'Amico *et al*, 2010, and Gürkaynak *et al*, 2010). Another series of articles points rather at the behaviour of investors. Hesitance in taking on inflation risk makes prices fluctuate (see for example Hördahl and Tristani, 2007, on Euro Area data, Ejsing *et al*, 2007, or Emmons, 2000, on US data). A few recent articles recognise both causes and estimate the respective price premiums simultaneously (see Pflueger and Viceira, 2011, Haubrich *et al*, 2011, and Christensen and Gillan, 2012).

The global market distortion in 2008-2009 is discussed in the literature as well. James (2010) and Campbell *et a*l (2009) report massive flights to liquidity. Hu and Worah (2009) as well as Bekaert and Wang (2010) mention that the bankruptcy of Lehman Brothers has added to the turmoil, for it was the world leader in inflation-secured investment instruments. Pond (2012) actually mentions that in this period the usual price relations were inverted. Figure 2 below makes the situation clear. It shows that in the developed countries, the breakeven inflation level dropped dramatically in late 2008, to renormalize in early 2009, back to pre-crisis levels. The abnormal BEIR levels stem from a simultaneous decrease in the nominal yields and increase in the real yields.

In the same Figure, the oil price is displayed which is remarkably synchronised with the breakeven levels.

Figure 2

BEIR in the developed world (in %, left scale) and Brent value (in $ per Barrel, right scale)



4. Impact of the Brent

Regarding Figure 2, it seems relevant to take account of the oil price, and decompose the common correlation between RBY and BEIR (matrix *b* in Figure 1) further in a Brent-induced component (b_1) and a residual component (b_2). The Brent-induced correlation should be negative. Oil being an important factor of inflation, it should be positively correlated to inflation expectations and thus the ΔBEIR (see for example Chen, 2009, and De Gregorio *et al*, 2007). Meanwhile, the oil price has an opposite impact on the economic activity engendering negative correlation with growth and thus the ΔRBY (see Barsky and Kilian, 2004, and Cuñado and Pérez de Gracia, 2003).

The negative impact of oil on the economy may pass through two channels: a production cost effect (an increase in the production costs decreases the output equilibrium level) and a Mundell-Tobin effect, which is a behavioural effect (in reaction to an oil price rise households increase their savings which lowers the output equilibrium level). Ang *et al* (2008) find (weak) evidence of the Mundell-Tobin effect in American bond data.

To integrate the Brent in our tests, we augment the regression equations that were used in the decomposition discussed in previous section by a term that captures the country-common reaction to the Brent (x_t). Thus, we estimate:

$$(1)\quad y_{it} = \underbrace{\beta_y \cdot x_t + \gamma_{yt} \,.\, I_t}_{\textit{common component}} + \varepsilon_{yit}$$

where y_{it} are the bond yield variations (*ΔRBY* and *ΔBEIR*) in country *i* over month *t*, x_t is a function of the Brent price variation, β_y measures the sensitivities of the two yield variations to the Brent, I_t are time dummies, γ_{yt} measures the non-Brent common variation and ε_{yit} are the residuals, which are assumed to be identically and independently distributed, and represent the idiosyncratic variation component of y_i.

For both ΔRBY and ΔBEIR the model is estimated through Ordinary Least Squares on the whole period in two steps. First the common- and idiosyncratic variation is split, and then the common component is split further into a Brent and non-Brent sub-component. Best results are obtained with a non-linear impact of the oil price. To capture nonlinearity, we mount the oil price (*P*) log-returns to the power three, i.e. $x_t = \ln (P_t/P_{t-1})^3$. We have deliberately kept the specification and estimation of the model simple.

The second-step estimation results are given in Table 3. The sensitivities to the oil price have the intuitive signs as commented above. Interestingly, the total effect of the oil price on the nominal yield, which is by construction the sum, $\beta_{\Delta NBY} = \beta_{\Delta RBY} + \beta_{\Delta BEIR}$, is non-significantly different from zero. It is perhaps for this reason that there is little discussion in the literature on the effect of oil on bonds. The introduction of inflation-linked bonds on the capital markets has made this observable.

Table 3

Estimation results

The common component of *y* is regressed on the Brent price changes
Explanations in the text

	y=ΔBEIR	*y=ΔRBY*
β_y	8.07	-4.95
T-statistic	6.95	-3.90
$\mathbf{R^2}$	0.11	0.04
N obs.	120	120

The regression results are inserted into the correlation decomposition given in Figure 1. The split of the common correlation matrix (*b*) is displayed in Figure 4. It can be seen that the Brent-induced correlation (b_1) is negative and the ex-Brent correlation (b_2) positive.

Figure 4

Schematic decomposition of the correlation matrix between *ΔRBY* and *ΔBEIR*

I – Entire ten-year observation period

$$\overbrace{\begin{bmatrix} -- & - \\ & \\ - & -- \end{bmatrix}}^{(a)} = \overbrace{\overset{[-0.1]}{\overbrace{[-0.2]}^{(b_1)} + \overbrace{[0.1]}^{(b_2)}}}^{(b)} + \overbrace{\begin{bmatrix} - & 0 \\ & \\ 0 & - \end{bmatrix}}^{(c)}$$

II – Ten-year observation period barred the crisis months from October 2008 to May 2009

$$\overbrace{\begin{bmatrix} -+ & + \\ & \\ + & -+ \end{bmatrix}}^{(a)} = \overbrace{\overset{[0.2]}{\overbrace{[-0.1]}^{b_1} + \overbrace{[0.3]}^{b_2}}}^{(b)} + \overbrace{\begin{bmatrix} - & 0 \\ & \\ 0 & - \end{bmatrix}}^{(c)}$$

We find the three components constituting the correlation between RBY and BEIR to have stable signs, yet the total correlation (the sum) to be unstable over time. The net sum depends on the share of each component, which is time-varying.

V. Conclusion

We have shown that the breakeven inflation and real yields deduced from the developed bond markets are adversely affected by two factors: price distortions due to market-related events and oil price movements. Without the influence of those, their correlation is positive. This finding contributes, we reckon, to a better understanding of the long-debated complex interrelationship between inflation and economic growth prospects. The effect of oil on bond prices has become measurable thanks to the emergence of inflation-linked securities on the markets. The results fit in with macroeconomic theory. An oil price rise drives up inflation and slows down economic growth.

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