The Relationship between Oil Prices and Breakeven Inflation Rates
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Abstract

This paper explores the role of oil prices in the inflation-linked bond markets. Early proponents of inflation-linked bonds highlighted their role in protecting against future inflation, portfolio diversification, asset-liability matching, and use as a commitment tool for monetary policy in keeping inflation contained. From an investment perspective, real return assets should be attractive in prolonged periods of high inflation and unattractive in periods of low inflation resulting in increased demand for real return assets as inflation expectations grow and decreased demand as such expectations diminish. The late 1990s and early 2000s saw an expansion in the inflation-linked bond markets, with more sovereign issuers, increased issuance size and a wider range of maturities; this tremendous growth in turn fueled greater interest and participation in these markets. After a prolonged period of low and stable inflation, the rise in oil prices that began in 2003/4 coincided with the rapid expansion of the inflation-linked bond markets and the start of the Federal Reserve’s tightening cycle. In addition, the widening of the yield spread between nominal and inflation-linked bonds, or “breakeven”, during this time was seen as an indication that inflation expectations were on the rise. Much of the runup in breakevens was attributed to the observed increases in oil prices. Yet despite similar trends, over most of the sample period, breakevens and oil have not moved one-for-one. Recently, however, the decline in oil prices has coincided with a dramatic decline in breakevens and unprecedented Fed easing. The results demonstrate that the coincidence of breakeven and oil price fluctuations is a relatively recent phenomenon, unique to the US market, and mainly associated with the front end of the breakeven curve.

* Kogod School of Business, American University and National Bureau of Economic Research. The basis for the idea in this paper was formulated during the author’s time as real rate strategist at Deutsche Bank AG and was first documented in the Linkers Update article published in their Fixed Income Weekly (Lumsdaine 2004). I am most grateful to Nils Overdahl, Michiel de Pooter, Marius Rodriguez, and Mark Spindel for helpful comments on an earlier draft.

JEL classification codes: E44, G15, Q43
“…inflation expectations of financial-market participants are of particular interest to central bankers…”
“…inflation-indexed securities would appear to be the most direct source of information about inflation expectations…”
“…TIPS returns appear sensitive to fluctuations in oil prices.” – Bernanke (2004b) speech

“Measures of short-term inflation compensation derived from yields on inflation-indexed Treasury securities increased over the intermeeting period, due in part to sharply higher prices for oil and agricultural commodities” – FOMC minutes June 24-25, 2008

Introduction

This paper considers the relationship between two financial instruments used to gauge inflation expectations and the future inflation outlook: (1) the yield spreads between nominal Treasuries and Treasury Inflation-Indexed Securities (known as TIPS), commonly referred to as “breakevens” or the “breakeven curve”,¹ and (2) oil prices. As highlighted in the quotes above, conventional wisdom has held that such a relationship exists and is important to monetary policymakers. Intuitively, near-term oil prices provide information about inflation pressures and possible transmission and spillover into broader inflation indexes, while breakevens give a glimpse of the market’s inflation expectations over a variety of horizons. Thus in combination, the two can contribute to a characterization of the future path of inflation.

It is now common for policymakers and practitioners to discuss inferences regarding inflation expectations gleaned from the global inflation-linked bond markets but there is still a lot about these markets that is not well understood. Bernanke (2004b) cites a number of subtleties associated with interpreting breakevens as a measure of inflation expectations, including the possible presence of inflation risk premia and liquidity premia that are both unobservable and likely time-varying, as well as high volatility of the breakeven as compared to survey-based measures of inflation expectations. Yet policymakers also widely acknowledge the complexities involved in characterizing an oil/breakeven link, especially as it relates to policy decisions. Even without such a link, the role of oil shocks in the economy has been a subject of considerable debate, particularly since the large spike observed in the 1970s. This debate usually resurges with each new episode of high oil prices, spurring discussion in the popular press (e.g., Lueck 1999, Liesman 2000, Gogoi 2000, Munter 2004, Hernandez 2008) and among government officials (e.g., Bernanke 2004d, Kohn 2004). These episodes are also the focus of academic work that has sought to address the stability of the effects of oil shocks over time in a variety of contexts (e.g., Hooker 2002). Various authors have noted that while high oil prices have at times been associated with episodes of high inflation, the two do not always coincide (e.g., Bernanke 2004c, Roubini and Setser 2004).

¹ The intuition behind this nomenclature is that the spread represents the amount of compensation a market participant would demand in order to be indifferent between a nominal Treasury and an inflation-indexed Treasury of similar maturity. Despite this name, it is widely recognized that the spread may also reflect a variety of risk premia, notably liquidity and inflation uncertainty premia, leading some to prefer the term “inflation compensation” to “breakeven”, see, for example, Gürkaynak, Sack, and Wright (2008). Note that the ability to compute breakevens at a variety of maturities gives rise to a “breakeven curve”, analogous to a yield curve, with similar nomenclature used to describe it (e.g., steepening/flattening). Thus one can think of the breakeven curve as the difference between the nominal Treasury and TIPS yield curves.
Evidence about the influence of oil on overall inflation has been mixed. Conclusions as to the extent and timing of spillover from oil to other inflation components, as well as the persistence of shocks, have varied depending on the timespan, model, and metric used in the analysis, as well as whether the shocks are demand or supply-driven and more permanent or transitory in nature. As a result, the appropriate monetary policy response to oil shocks is less than clear. Referring to the large literature that addresses aspects of the transmission of oil price increases to inflationary monetary policy, Bernanke (2004d) states:

“However, the consensus that emerges from this literature is that the relationship between commodity price movements and monetary policy is tenuous and unreliable at best. Moreover, applied to the recent experience, economic models that support the use of oil prices as a leading indicator of monetary policy make a number of other predictions that are strongly contradicted by the facts.”

Later in the same speech, in highlighting the challenges associated with determining whether increases in oil prices are more permanent or transitory, he distinguishes between direct and indirect transmission effects, noting that policymakers often focus on the core definition of inflation (that is, ex food and energy) to assess the long-run impact of earlier price increases. For example, in January 2004, Bernanke (2004a) notes that, “…rising commodity prices are a better signal of strengthening economic activity than of inflation at the consumer level”, citing the coincidence of high oil prices and a “broadly disinflationary environment”.

Likewise, evidence on the information content of breakevens in terms of inflation expectations, and hence future realized inflation, remains mixed. Neither is there clear evidence regarding the link of monetary policy to such measures; Kohn (2004) notes that the “stance of policy – measured either by interest rates or liquidity provision – is not connected in a direct and simple way to the rate of inflation.” As a further complication, TIPS are indexed to headline inflation while monetary policy tends to focus on core (i.e., ex food and energy) inflation (Bernanke 2004c). Yet the financial markets have increasingly looked to breakevens for guidance in anticipating the future direction of monetary policy moves.

While there is widespread belief that there is a link between fluctuations in oil prices and breakevens, there has been little analysis to back up that belief. In particular, the existence of a contemporaneous relationship is not necessarily intuitive, since breakevens arguably capture expectations about (non-seasonally-adjusted) headline inflation over the remaining life of the bond, while energy comprises less than ten percent of the inflation index and oil is but a small portion of the energy component. Therefore, if

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2 There are very large literatures addressing all three topics, that is, the influence of oil on inflation, the persistence of inflation shocks, and the role of inflation in monetary policy. In addition to articles referenced elsewhere in this paper, readers are referred to, among others, Bernanke (2004a, 2007), Gramlich (2004), Roubini and Setser (2004), Blanchard and Gali (2007), Mishkin (2007), Pivetta and Reis (2007), Rudd and Whelan (2007), Stock and Watson (2007), Clark and Nakata (2008), Poole (2008) and references cited therein for a more comprehensive discussion.

3 Although this paper focuses on oil futures, gas futures are also commonly employed as an inflation hedge.
Oil shocks are transitory, do not have spillover effects, or inflation components (and more generally, inflation) are not persistent, they should have little to say about the long-term path of future inflation. Hence to the extent breakevens adequately capture inflation expectations over a longer horizon, current oil shocks should be unrelated to current breakevens. Stated differently, a belief that there is a contemporaneous link between oil price shocks and breakevens rests on the following presumptions:

1. Oil price shocks persist, have spillover effects into other inflation components, or both,
2. More generally, current inflation provides information about future inflation (shocks persist)
3. New inflation information alters current inflation expectations and/or uncertainty about the path of future inflation
4. Changes to inflation expectations and inflation uncertainty are reflected in breakevens

Empirical evidence on the first three of these is mixed, at best, despite large literatures addressing each. In addition, a number of authors have documented that these relationships are time-varying. For example, in considering the pass-through from oil shocks to core inflation, Hooker (2002) identifies a structural change in the relationship at 1981Q1 using data from 1962-2000, noting that, “monetary policy did not itself become less accommodative of oil shocks, but may have helped create a regime where inflation is less sensitive to price shocks more generally”. Likewise, Roubini and Setser (2004) demonstrate that the inflationary (spillover) impact of oil shocks was larger in the 70s, noting that any policy response to rising oil prices depends on a variety of factors such as the level of inflation expectations, the level of overall inflation, the amount of slack in the economy, and the amount of household leverage. Even looking at the G7 countries, Kilian (2008a) finds that although there are differences across countries in the responses to oil supply shocks, there is little evidence that CPI inflation would have differed appreciably in the absence of such shocks.

Some authors have found strong evidence of persistence in both oil shocks and a variety of inflation measures. Using Bayesian techniques Pivetta and Reis (2007) find high levels of persistence in the GDP deflator; this persistence has remained largely unchanged over time. Cuaresma, Jumah, and Karbuz (2007) find considerable persistence in monthly front-month oil futures contracts; Büyükşahin, et. al. (2009) similarly conclude that prices of a variety of oil futures contracts are I(1). Yet others have noted a decline in inflation persistence, with many attributing this decline to the “anchoring of inflation expectations”, notably Erceg and Levin (2003) and Williams (2006). Mishkin (2007) also finds that, “(1) inflation persistence has declined, (2) the Phillips curve has flattened, (3) inflation has become less responsive to other shocks” – and interprets these facts to suggest inflation expectations have become more anchored as a

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4 Simple Augmented Dickey-Fuller (ADF) unit root tests on the monthly and daily data used in this paper corroborate these findings; results are available on request.
result of better monetary policy. Consistent with the mix of evidence, Culver and Papell (1997) demonstrate that the finding of a unit root in inflation is sensitive to the specification employed when they use panel techniques to consider cross-country variation. More generally, over the past fifty years, inflation dynamics continue to evolve and change (e.g., Cecchetti, et., al, 2007, Potter and Rosenberg 2007, and Stock and Watson 2007).

A recent speech by Poole (2008) reviews the debate regarding the relationship between inflation and monetary policy. It emphasized the distinction between temporary and permanent shocks to inflation, with the latter resulting in long-lasting shifts up/down in the Phillips curve. In particular, citing Piger and Rasche (2006), he noted that, “The dominant factor in U.S. inflation history over the past 50 years has been changes in inflation expectations, or semi-permanent shifts up and down the short-run Phillips curve.” Indeed for a number of years, it appeared that inflation expectations were in fact “anchored”. During the four years from June 29, 2004 (the last day the fed funds rate was at 1.0 percent) to June 30, 2008, the 10Y breakeven fluctuated in a fairly narrow range, from 219 to 276 basis points (bps). In the eight months following, oil retraced to nearly its initial level, while the 10Y breakeven broke out of its tight four-year trading range, dropping to as low as 4 basis points. These patterns provide yet more evidence that the relationship between oil prices and breakevens is not straightforward.

While this brief introduction cannot possibly do justice to the vast literature on oil, inflation, inflation expectations, and monetary policy, it provides a necessary backdrop for this paper. We now turn to the main focus, beginning first with a description of the data, then describing some of the key characteristics of inflation-linked bonds and their associated breakevens, before presenting empirical results.

Data

The main source of data is Bloomberg. By considering both the January 2010 TIPS and the April 2029 TIPS we have a long enough history with which to examine any potentially differential effects to the front end, back end, and slope (computed as the 2029 breakeven minus the 2010 breakeven) of the breakeven curve; analogously the 2009 and 2029 French Index-Linked Obligations Assimilables au Tresor (OATis) are used for comparison to the European inflation-linked bond market. Corresponding nominal bonds are

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1 It is important to note that much of the decline in breakevens was due to the 200bps decline in nominal Treasuries as a result of the flight to quality associated with the global crisis. In addition, severe illiquidity led many to conclude the TIPS market was ‘broken’ resulting in breakevens that were overly narrow (e.g., Campbell 2008). A recent paper by Campbell, Shiller, and Viceira (2009) discusses the TIPS market in 2008 in significant detail.

2 The French linker market is chosen for comparison due to similarities with the US market in terms of structure, inception, and maturity breadth and depth. It is also fairly liquid. In contrast, the UK’s gilt linker market, despite a longer history, differs from the TIPS market in a number of important ways, namely the UK linkers have varying structure (older issues use an 8-month inflation lag while newer ones have adopted the 3-month lag convention) and no deflation floor. In addition, pension regulation in the UK creates demand for linkers resulting in an inverted real yield curve. Other developed markets such as Canada, Australia, and Sweden do not have enough maturity variety or liquidity to be comparable.
used for computation of the breakevens, specifically the 6.5% February 2010 and 5.25% February 2029 Treasuries and the 4% April 2009 and 5.5% April 2029 OATs. For oil prices we use the 4th nearest futures contract (CL4) in order to diminish well-documented effects of expiry and roll on the front-month contracts. The daily data span the years February 2002-February 2009 in order to avoid the effects of the maturity of the 2002 TIPS, the relative lack of liquidity of the TIPS market in its first 5 years, and to capture the previous episode of low yields and the run-up of oil prices. Due to the changing maturity embedded in using actual bonds, at times we instead use 5-year (5Y) and 10-year (10Y) constant maturity yields obtained from the US Treasury, where noted.7

The typical structure of a sovereign inflation-linked bond

Although the specific characteristics of inflation-linked bonds (“linkers”) vary across countries, there are some general attributes that are common to all sovereign linkers, briefly summarized in this section.8 Most have coupon frequency and settlement characteristics that match their corresponding nominal market. A daily inflation adjustment is made to the nominal principal based on a commonly available reference index (e.g., the non-seasonally-adjusted CPI-Urban in the US); typically this adjustment is made with a 3-month lag9. For example, the inflation index for a US TIPS on January 15 will be computed by interpolation between the October and November CPI indices in the previous year. Each associated coupon payment is based on the inflation-adjusted principal (also known as the ‘accreted principal’) at the time the coupon is paid. In addition, at maturity, the bondholder receives inflation-adjusted principal that accounts for the change in the inflation index since the bond’s inception. Many, although not all, linkers also have a deflation floor provision, ensuring that the principal at maturity will not fall below par. Thus while both principal and coupons are protected from inflation, only the principal is protected against deflation. Because of this embedded inflation protection, linkers usually offer lower yields than nominal bonds of similar maturities. Both the TIPS and OATs considered in this paper use the 3-month lag, have coupon frequency that matches their corresponding nominal market (i.e., semi-annual for TIPS and annual for OATs), and have a deflation floor provision.

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7 Using CMT yields is sometimes preferred to avoid market imperfections such as, for example, the effect of different coupon dates, on-the-run premia, both in academic studies and in practice when generating forecasts from a benchmark model in the context of rich/cheap analysis. Using actual bonds, however, provides a more realistic setting in many cases, particularly when comparisons to market data are involved (as in this paper). Specifically, since there are not equivalent series for oil prices, we have opted to use market levels for the main analysis. Sensitivity analysis using the CMT yields have been conducted where appropriate (as noted below); the results are qualitatively similar. The constant maturity data are available at http://www.treas.gov/offices/domestic-finance/debt-management/interest-rate/yield_historical.shtml

8 More thorough descriptions can be found in a variety of comprehensive industry publications, e.g., Deutsche Bank (2003), State Street Global Advisors (2004), Barclays Capital (2008).

9 The three month lag is often referred to as the “Canadian model”, so-called because it was first introduced by the Canadian government as the structure for its linker in 1991. Most other countries have adopted this convention. In the UK, gilt linkers used to have an 8-month lag structure; in 2005, the UK debt management office changed to the Canadian model for all new gilt linker issues.
As noted above, the spread between nominal and real bond yields is commonly referred to as the “breakeven” (or “breakeven inflation”). Discussions of breakeven inflation usually involve two somewhat-related but distinct interpretations: (i) as the inflation rate that renders a bondholder indifferent between investing in linkers versus similar-maturity nominal bonds, if held to maturity, and (ii) as a measure of the market’s expectation of average inflation over the remaining life of the bond. Note that the spread is an approximation to the Fisher equation.10

**Yield environment and breakeven directionality**

It has sometimes been argued that TIPS will underperform nominal Treasuries in a falling nominal yield environment and outperform in a rising yield environment (e.g., Barclays Capital (2008), p. 6), yet the intuition underlying this pattern is predicated on a positive correlation between growth shocks and inflation shocks11 and the recognition that TIPS provide insulation from inflation shocks. As a result, breakevens would be expected to be highly directional, widening as nominal yields rise and tightening as nominal yields fall. Yet the association is far from perfect, as seen in Figure 1 which graphs the 10Y constant maturity nominal yields and corresponding breakevens (BE).12 The rise in the nominal yield of more than 100bps that preceded the June 2004 start of the Fed’s tightening cycle was accompanied by a breakeven increase of only half that size, although arguably increasing inflation expectations were evident in breakevens earlier, beginning in the summer of 2003. And the nearly 200bps decline in nominal yields from mid-June 2007 through mid-March 2008 saw almost no change in the breakevens over the same time period. However, as seen from Figure 1, breakevens became highly directional as the recent crisis intensified.

**FIGURE 1 HERE**

**Spillover, inflation expectations and breakevens**

If oil shocks spill over into other inflation components, then higher energy prices can be expected eventually to boost headline inflation, rendering investment in inflation-linked bonds more attractive as a hedge against future inflation. As the top panel of Figure 2 shows, increases in the price of oil through 2004 — due primarily to supply constraints, growing global demand, and geopolitical concerns — pushed TIPS breakevens wider, to levels not seen since 1997, the first year of TIPS trading. However, the subsequent rapid increase in oil prices that occurred from mid-2004 to mid-2008 saw little associated move in breakevens, as seen in the lower panel of Figure 2, until the significant oil price contraction that occurred during the second half of 2008. During the six months that followed, breakevens also collapsed, although it

10 That is, \((1+n) = (1+\pi)(1+r)\), where \(n\) is the nominal yield, \(\pi\) is the inflation rate, and \(r\) is the real yield. Solving this for the inflation rate and taking natural logarithms gives \(\ln(1+\pi) = \ln(1+n) - \ln(1+r)\), which leads to \(\pi\) approximately equal to \(n-r\) for \(n,r\) small.

11 As might arise, for example, from estimation of a Phillips curve, see, e.g., Sims (2008) and Stock and Watson (2008), and references therein.

12 The shorter sample period is because the Treasury only began publishing constant maturity real yields in January 2003.
is important to note that the timing of these declines coincided with the global crisis. In particular, during this time, TIPS did not benefit from the flight to quality seen in the nominal Treasury market, most likely due to the existence of a significant liquidity risk premium, since liquidity for TIPS was often severely compromised. In the first two months of 2009, breakevens recovered significantly, although the front end was still negative while oil continued its fall.\textsuperscript{13} Hence a possible explanation for the recent observed increase in comovement is that it is due to an exogenous factor (e.g., “market stress”) rather than evidence of a greater direct link between oil and breakevens.

\textbf{FIGURE 2 HERE}

\textbf{Inflation expectations at different horizons}

Intuitively, evidence of higher inflation should affect inflation expectations at different horizons in different ways, depending on the anticipated timing of the expected increase, leading to a steepening or flattening of the breakeven curve.\textsuperscript{14} Yet for much of the sample period, the TIPS and OATi breakeven curves have remained relatively stable. Specifically, if price shocks such as increases in crude oil are considered largely temporary, they would be expected to have a larger effect on near-term expectations than longer-term expectations. An examination of the relationship between crude oil prices and the slopes of both the TIPS and OATi breakeven curves (Figure 3) finds some modest evidence to support this intuition; as oil prices increased, the breakeven slopes flattened; the pace of breakeven flattening picking up somewhat as oil prices catapulted above $100 per barrel. However, while the TIPS breakeven curve steepened dramatically during the sharp decline in oil prices that began in the middle of 2008, it subsequently reflattened even as oil prices continued their decline. Strikingly, the OATi breakeven curve followed a very similar pattern to the TIPS breakeven curve through the end of October 2008, its steepening then halted but has remained elevated since. It is important to note, however, that much of the breakeven steepening during the global crisis, even as oil prices fell, likely reflects a fear of significant inflation stemming from non-oil sources at some time in the future, despite evidence of near-term deflationary pressures.

\textbf{FIGURE 3 HERE}

\textsuperscript{13} At the time of writing (July 2009), oil prices have followed the lead of the breakevens, increasing 50%, and breakevens have increased a further 150bps, since the end of the dataset.

\textsuperscript{14} D’Amico, Kim, and Wei (2008) use a 3-factor term structure model to consider the information content in TIPS breakevens.
**How much do oil and breakevens comove?**

While there is good evidence of a link between breakevens and their respective inflation indices, despite more muted evidence with respect to oil – namely the modest sensitivity of the breakeven curve to changes in oil prices, the relatively low weight of oil/energy to those indices, and the relatively low persistence of the oil/energy component within those indices – the perception of an analogous link between breakevens and oil prices also exists.\(^{15}\) This perception first surfaced in force in mid-2004, where a rapid rise in both breakevens and oil prices fueled market perceptions that the two were linked or highly correlated, even at high (e.g., daily) frequencies, despite little historical evidence of such an association prior to April of that year (Lumsdaine 2004). Since then, however, the suggestion of a link has persisted, perhaps more so than the series themselves demonstrated, with evidence that by 2006 market perception had become fact\(^ {16}\). The recent precipitous decline in oil, and associated decline in breakevens, has done little to dispel this view. This section investigates the merits of the perception by considering the relationship between daily changes in crude oil and daily changes in breakevens, using three measures of breakevens: 1) the shortest maturity (2009 for French OATi and 2010 for TIPS) breakevens under the assumption that there is greater sensitivity to inflation shocks at the front end, 2) the 2029 breakevens as a representative measure for assessing the longer-term effects of changes in oil, 3) the spread between the two, in order to consider how changes in inflation outlook affect the slope of the breakeven curve.

The first measure of comovement we consider is the R-squared from a regression of changes in breakevens on changes in crude oil futures for both the US (TIPS) and French (OATi) markets. The full-sample R-squared using daily data over the past seven years is less than 0.12 for all three breakeven measures in the US and less than 0.02 in France. Yet a 2-month rolling R-squared suggests that the comovement has increased dramatically in the US over the past three years (Figure 4, top chart). As one would expect, the comovement is much more pronounced and persistent at the front end of the breakeven curve than at the back end. As a result, the TIPS slope sensitivity is similar to its front end sensitivity. Even with the increased comovement, these flare-up episodes tend to be relatively short-lived. In addition, the recent sharp decline in both markets appears to have returned the rolling R-squareds to historical levels. Finally, despite the increased comovement in the US market, there has not been a commensurate increase in France (Figure 4, bottom chart). While the rolling R-squared for the OATi09BE was somewhat elevated at the peak of the rise in oil prices, for the most part there appears to have been little change in the comovement between oil prices and French breakevens over the entire sample period.

**FIGURE 4 HERE**

\(^{15}\) This no doubt stems from the perception of a link between oil shocks and inflation; for discussion of the evidence and literature behind the oil/inflation link, see, e.g., Barsky and Kilian (2004) and Kilian (2008b,c).

\(^{16}\) This timing roughly coincides with the expansion of the introduction of NYMEX listings of all maturity months up to five years of WTI light sweet crude futures in March 2006 (see Büyükşahin, et. al., 2009).
More formally, a test for structural change in either the mean or slope of the bivariate relationship when the potential breakpoint is unknown was performed (e.g., Banerjee, Lumsdaine, and Stock 1992). Comparing changes in the three breakeven measures in both countries to changes in oil futures prices, in no case was the null hypothesis of no break rejected\textsuperscript{17}.

Another way to assess the extent of comovement is to count the fraction of days that the series moved in the same direction. The first row of the table below demonstrates there is some evidence that over the past eight years oil and breakevens have moved in the same direction, with both TIPS10 and TIPS29 breakevens moving with oil 63\% and 57\% of the time, respectively. In addition, the TIPS slope steepened with a rise in oil prices and flattened with a decline only 40\% of the time, corroborating the evidence of more of a reaction at the front end than the long end of the curve. Consistent with the evidence from the rolling R-squared measure, in contrast, there is no evidence of a comovement between oil futures prices and French breakevens, as seen from the first line of the second half of the table.\textsuperscript{18}

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<th>vs 29BEs</th>
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*Source: author’s calculations using data from Bloomberg*

One reason the market may believe that there is more association than there actually seems may be that it is predominantly large moves in oil that elicit a response from breakevens, for instance due to a greater news/headline focus on inflation implications associated with such moves.\textsuperscript{19} The tables also report the fraction of days of directional comovement within the subset of days where oil had a large move, defined either as $0.50, $1.00, and $1.50 moves (corresponding roughly to a one, two, and three standard deviation

\textsuperscript{17} Results are available on request.

\textsuperscript{18} To control for the price of oil being denominated in dollars, the analysis was also conducted for French breakevens using prices converted into euros. The results are qualitatively similar and therefore omitted; they are available on request.

\textsuperscript{19} The evidence of a link is relatively recent, however; earlier work found little relationship in the first half of the sample for either TIPS or OATIs. The lack of earlier evidence, combined with the conventional wisdom that a link existed, motivated the approach of isolating only the larger moves in oil. See, for example, Lumsdaine (2004).
move prior to the large runup in oil over the past three years), respectively, or as a 1%, 2%, or 3% move in price (to account for the large swing in the price of oil in recent years); the results are reported in the table above. Indeed, there is evidence that the larger the move in oil, the greater the fraction of days that breakevens moved in the same direction, at both ends of the TIPS curve. There is similarly evidence of curve flattening in conjunction with these big moves, however, indicating greater sensitivity to large oil shocks at the front end of the TIPS breakeven curve and consistent with the evidence that shocks to oil tend to be largely transitory. There is moderate evidence that the front end of the OATi breakeven curve also comoves more the larger the move in oil but there is little evidence of a response at either the back end or with respect to the slope of the OATi breakeven curve.

Finally, we consider whether there is more evidence of comovement at longer horizons, as daily data are often perceived to be too noisy to provide useful inference (see next table). The results are qualitatively similar using non-overlapping weekly data (i.e., 364 observations). At a monthly frequency there does appear to be slightly more association as measured by the R-squared between changes in oil and changes in breakevens, although we caution against putting too much emphasis on these last results given the smaller sample size (85 non-overlapping observations). The directional metric is surprisingly consistent across the three frequencies.

<table>
<thead>
<tr>
<th>More of a link at lower frequencies?</th>
<th>Frequency</th>
<th>metric</th>
<th>vs 10BEs</th>
<th>vs 29BEs</th>
<th>vs 29/10 slope</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Weekly</td>
<td>R-squared</td>
<td>0.17</td>
<td>0.02</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td>Weekly</td>
<td>Directional</td>
<td>65%</td>
<td>58%</td>
<td>37%</td>
</tr>
<tr>
<td></td>
<td>Monthly</td>
<td>R-squared</td>
<td>0.40</td>
<td>0.15</td>
<td>0.42</td>
</tr>
<tr>
<td></td>
<td>Monthly</td>
<td>Directional</td>
<td>66%</td>
<td>56%</td>
<td>36%</td>
</tr>
</tbody>
</table>

Source: author’s calculations using data from Bloomberg

Conclusions

This paper has examined the conventional wisdom among policymakers and market participants that there is a link between oil prices and breakevens. Lack of consensus regarding the evidence on the spillover from oil shocks to the broader inflation index, the persistence of inflation and its influence on future inflation expectations, and the way such expectations relate to breakevens suggested a complex relationship that has varied over time.

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20 There are a number of possible explanations and interpretations of this result. For example, it could stem from greater consensus of view regarding inflation expectations (in other words, less expectations heterogeneity, e.g., Mankiw, Reis, and Wolfers 2003). It is also consistent with the literature on asymmetry in response to oil shocks (e.g., Kilian and Manganelli 2008, Kilian and Vígfusson 2009).

21 The monthly results are due primarily to the influence of the past year’s rapid increase and then decrease in both series. For all three breakeven measures, the monthly R-squareds are 0.16, 0.01, and 0.18, respectively, when one excludes the past 12 months’ observations.
The results demonstrate that in the run-up to the start of the Fed’s tightening cycle in June 2004, both oil and breakevens appeared broadly to comove; yet rolling correlations exhibited little evidence at a daily frequency. In contrast, during the pronounced increase in oil prices that followed, breakevens remained relatively stable, although the correlations of daily breakeven changes with daily oil price changes increased dramatically. The collapse of oil prices and the onset of the financial crisis contributed to a renewed linkage, although recent evidence suggests the comovement may have subsided. The analysis found significant evidence that breakevens increased (decreased) on days of oil price increases (decreases), particularly when the magnitude of the oil price change was large. Consistent with the notion that oil prices have a greater influence on near-term inflation expectations than longer-term, this directional coincidence was more pronounced at the front end of the breakeven curve than at the long end. By comparison, among all of the metrics considered, there was little evidence of a link to French breakevens, indicating that any oil/breakeven link may be largely a US phenomenon.\textsuperscript{22} Taken altogether, the evidence of a link is modest.

As the inflation-linked bond market has increased in both size and scope, market participants and policymakers have looked to it to gauge market perceptions regarding inflation. This paper takes a first look at what might be gleaned from considering breakevens and oil prices together. In summary, it seems that the emphasis that has been placed on the association between oil and breakevens is not commensurate with the evidence. While we recognize inflation expectations are embedded in the breakevens and hence some influence of oil prices might be expected, the historically transitory nature of oil price shocks and the likelihood of a time-varying inflation uncertainty risk premium provide two possible reasons that the influence may be less than market perceptions seem to suggest. Indeed, the large literatures on the relationships between oil price shocks, inflation, inflation expectations, and monetary policy attest to their complex and time-varying nature.\textsuperscript{23} There is some evidence that on days when there is an especially large move in oil prices, there is similarly a large move in breakevens, suggesting that on these days, market participants are more focused on inflation concerns and may be updating their inflation expectations accordingly.

\textsuperscript{22} This also may be a result of nonsynchronous trading bias since the trade times for French linkers do not exactly coincide with those of the oil futures (I thank Michiel de Pooter for this possible explanation). To try to address this possibility, I also considered the lead and lags of the French linkers versus oil prices; the results are not appreciably different. Ideally one would consider the price movements during the overlapping trading periods but tick data are not readily available to this researcher.

\textsuperscript{23} A number of authors address some of these time-varying aspects via term structure models, e.g., Buraschi and Jiltsov (2005), Diebold and Li (2006), Durham (2006), Ang, Bekaert, and Wei (2008), Christensen, Lopez, and Rudebusch (2008), D’Amico, Kim, and Wei (2008), Haubrich, Ritchken, and Pennacchi (2009), and Wright (2009).
References


Notes: Ten-year constant maturity data from http://www.treas.gov/offices/domestic-finance/debt-management/interest-rate/yield_historical.shtml. The nominal yield (left axis) is in percentage points; breakeven is expressed in basis points.
FIGURE 2: Comovement between oil futures and breakeven inflation rates

Notes: Data are from Bloomberg. CL4 shows the oil futures price while TIPS2010BE is the breakeven inflation rate for the January 2010 TIPS (i.e., the difference between the yields of the February 2010 nominal Treasury and the January 2010 TIPS). The top graph shows the comovement of the series over the first half of the sample and the bottom graph shows the second half of the sample; note the scales of the two graphs differ in order to better depict the comovements. In particular, during the large runup in oil prices during 2007 and the early part of 2008, breakevens were relatively stable but became highly directional as the global crisis unfolded.
FIGURE 3: Oil prices versus breakeven curve steepness

Notes: Constructed using data from Bloomberg. CL4 shows the oil futures price while the 29/10 TIPS BE slope and the 29/09 OATi BE slope are the slopes of the TIPS and OATi breakeven curves, respectively (i.e., 29/10 TIPS BE slope = the difference between (a) the spread between the yields of the February 2029 nominal Treasury and the April 2029 TIPS, and (b) the spread between the yields of the February 2010 nominal Treasury and the January 2010 TIPS, and 29/09 OATi is the corresponding difference using French bonds). The graph shows that increasing oil prices has typically been associated with a flattening of breakeven curves, consistent with the explanation that oil price moves have a greater effect on near-term inflation expectations.
FIGURE 4: 2-month rolling $R^2$, oil prices versus breakevens

Notes: Data are from Bloomberg. The charts show the $R^2$ from regressions of various breakeven inflation rate measures on oil futures prices using a 2-month (44-day) rolling estimation window. The top graph shows the rolling $R^2$ with respect to TIPS for the front-end (TIPS10BE), back-end (TIPS29BE) and slope of the TIPS breakeven curve (29/10BE slope) while the bottom graph shows the corresponding results using French linkers (OATi09BE, OATi29BE, and 29/09BE slope, respectively).