MSCI RESEARCH INSIGHT

Investing in Inflation Protection

Inflation-Protected Bonds (IPBs)[1] — Exploring Historical Inflation, Deflation, and Diversification

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1. Investing in Inflation Protection

The Decade Ahead: Inflation or Deflation?

Both inflationary and deflationary concerns have emerged as global economies continue to struggle with recovery. Prior to the financial crisis, asset prices had soared, energy prices most spectacularly, causing inflation to peak in many western countries. US inflation, for instance, hit a high of 5.5% in July 2008. The crisis propelled the shift in economic sentiment that had already begun to deteriorate in the beginning of 2008. Inflation rates across the globe were near flat or even negative in 2009: –0.3% (US), –0.5% (UK), and –0.4% (euro area). In the US, over the 12 months ending in September, CPI-U rose 1.14%; year-to-date, the index has risen just 0.53%. Overall US inflation still remains well below the historical average.

Exhibit 1, for instance, shows the most recent consensus forecasts for US and euro area inflation provided by the Philadelphia Federal Reserve Bank's Quarterly Survey of Professional Forecasters and the ECB Survey of Professional Forecasters. These remain well below long-run rates.[2]

Exhibit 1: Consensus Forecast for Headline Inflation (US: 2010 Third Quarter Release; Europe: 2010 Third Quarter Release)

US	Forecast Inflation Rate	Europe	Forecast Inflation Rate
2010:Q3	1.4	2010	1.4
2010:Q4	1.6	2011	1.5
2011:Q1	1.8	2012	1.7
2011 Q4/Q4 Average	1.8	June 2012	1.7
2012 Q4/Q4 Average	2.1	June 2015	2.0
2010-2014 Average	2.00		
2010-2019 Average	2.30		

Sources: Philadelphia Federal Reserve (August 13, 2010); European Central Bank (August 13, 2010)

Looking forward, there are several points of debate. On one hand, inflation concerns have arisen based on low interest rates, the implementation of Quantitative Easing, the expansion of the monetary base, and the size of fiscal stimuli implemented in many countries. On the other hand, restrained economic growth, high unemployment rates, low velocity of money, and low capacity utilization have posed major risks to the recovery that continue to fuel deflationary concerns. These fears vary depending on the country in question. Inflation concern is stronger in countries with fast-rising consumption, such as China, India, and Australia. They are weaker in Western economies that have muted consumption.

The current tug of war between inflation and deflation has created considerable confusion for investors. Consequently, in this report we explore the characteristics of inflation-protected bonds to see if, and to what extent, these securities have contributed to portfolio diversification and provided investors with protection from inflation and deflation.

[2] In the US for instance, 3.4% has been the average inflation rate since 1913, when the US Bureau of Labor Statistics first started tracking it. Since 1950, it has averaged 3.8%, and since 1990, 2.8%.

Inflation and the Institutional Investor

Given the muddied inflation outlook, inflation-protected bonds can play an important role in plan sponsor allocation. Sovereign inflation-protected bonds (IPBs) are fixed income securities that carry the full faith and credit of the governments that issue them. For consistency, we refer to them as IPBs throughout the paper, though they are also called inflation-linked bonds (ILBs), inflation-indexed bonds (IIBs), and more informally, "linkers." IPBs provide inflation protection by linking to some index that reflects overall price increases in a market. While the mechanics of IPBs vary from country to country, the principal value typically is linked to an inflation index, and at maturity, the investor receives whichever is greater — the inflation-adjusted principal or the original principal.[3]

IPBs have become increasingly popular in the institutional space for hedging inflation risk.[4] If a certain cash outflow is expected in 10 years, buying at par today an IPB that matures in exactly 10 years immunizes inflation over this period. There are issues, however, that complicate the use of IPBs for inflation hedging. For one, IPBs are only a perfect hedge if the inflation index used for the IPBs matches the index used for the liabilities, which may not necessarily be the case.[5] Second, IPBs in theory do not offer the same returns as other assets (i.e., their yields are lower than their nominal counterparts as long as expected inflation is positive). Particularly if a plan is underfunded, there is a difficult tradeoff between the certainty of hedging inflation and the return sacrificed by not being in higher-earning assets.[6]

While much has been written about IPBs, most researchers have focused on one of several topics: pricing, determinants of the level of real interest rates, determinants of the real yield curve, and their use in measuring inflation expectations. Our discussion focuses on the use of IPBs by plan sponsors and other institutional investors for strategic asset allocation. We look at:

- IPB historical performance relative to other asset classes
- Their performance in different inflationary regimes (including deflation) relative to other asset classes
- How useful they have been historically for portfolio diversification.

Some caveats are in order. Past performance of course is no guarantee of future performance; moreover, the history of IPBs is relatively short, beginning for most countries in 1997. During this time, we have not witnessed any periods of significant inflation on a par with what occurred in the 1970s. In addition, IPBs experienced a major dislocation during the financial crisis. It remains to be seen to what extent the past decade is an indication of the future.

[3] Appendix 1 provides an overview on the mechanics of IPBs for readers less familiar with these instruments. Not all countries guarantee the original principal. Japan does not, for instance.
[4] Some UK pensions are required by law to buy IPBs exactly for their long-term liability matching properties.
[5] This exposes the plan sponsor to a certain amount of "basis risk."
[6] This may at least partially explain why plans implementing Liability-Driven Investment (LDI) strategies are still in the minority.

Global Performance

Over the last decade, returns to IPBs have been strong, eclipsing equities, straight bonds, and commodities. Exhibit 2 shows the annualized returns of global IPBs relative to the other major asset classes.[7] Global IPBs earned an average of 7.8% annually since 1998, outstripping all other asset classes except real estate.[8] Global IPBs also outperformed nominal bonds during this period, despite relatively muted inflation.

Exhibit 2: Relative Performance of Global IPBs as an Asset Class (Average Total Return and Risk, USD, January 1998 to September 2010)

	Global IPBs	Global Sovereign Bonds	Global Equities	Global Commodities	Global Real Estate
Annualized Return	7.8%	6.9%	3.9%	6.1%	9.6%
Annualized Volatility	7.9%	7.2%	17.3%	24.8%	20.6%
Sharpe	1.0	1.0	0.2	0.2	0.5

** Global Sovereign Bonds = BofA Merrill Lynch Global Government Bond Index; Global IPBs = BofA Merrill Lynch Inflation-Linked Bond Index; Global Equities = MSCI ACWI Equity Index; Global Real Estate = MSCI World Real Estate Index; Global Commodities = S&P/GSCI Commodity Index).*

The robust performance of IPBs during this period is especially striking when compared to the actual inflation rates of major markets. Exhibit 3 shows the average inflation and IPB returns for the five largest IPB markets. (Appendix 2 lists the data we use for inflation.) Price appreciation and demand for IPBs have been strong, driven by a host of factors that we discuss in the next section. Except for Italy and Japan,[9] IPBs have equaled or exceeded their nominal bond brethren in each country during this period. In Japan and Italy, the level of inflation has been lower than the other three countries. Later in the paper, we discuss the relative performance of nominal bonds and IPBs during disinflationary/deflationary periods.

Exhibit 3: IPBs and Inflation (January 1998 to September 2010, except where shown)

	US	UK	France (10/30/98-)	Italy (10/31/03-)	Japan (7/30/04-)
Average Annualized Total Return to IPBs	7.3%	6.9%	5.9%	4.3%	1.3%
Average Annualized Total Return to Nominal Bonds	6.2%	6.6%	5.2%	4.6%	2.3%
Average Annual Inflation (YOY %)	2.4	2.7	1.9	1.7	-0.2*

**Japan's inflation numbers are only available through August 2010.*

[7] We discuss the behavior of both yields and total returns historically. For readers less familiar with bond concepts, please refer to Appendix 1 for a brief overview.
[8] IPBs are proxied by the BofA Merrill Global Inflation-Linked Bond Indices. The BofA Merrill Lynch Global Inflation-Linked Government Index tracks the performance of investment grade inflation-linked sovereign debt. Current qualifying countries include Canada, Euro member countries, Japan, Mexico, Sweden, the US, and the UK. The Index's inception date is December 31, 1997. Comparing the inflation-linked and nominal indexes in Exhibit 2, the performance differential is not solely attributable to differences in the indexes' duration or country composition. Duration and convexity for the two indices have been roughly similar. There are, however, differences in the country composition for the two indices.
[9] Japan's price levels have stayed flat since the start of the decade, resulting in near- zero inflation. Nominal bonds generally have outperformed IPBs in periods of deflation, which we discuss in greater detail in Section 3.

The Relationship between IPBs and Nominal Bonds

The main difference between IPBs and nominal bonds is the inflation adjustment. Coupons are set at the time of issue for both, so the only difference in the cash flow streams is the maturity value, which for IPBs is adjusted for inflation between the issue and maturity dates. Thus, at any point, the difference between the yields of IPBs (i.e., real yields) and those of nominal bonds typically is attributed to expected future inflation.[10]

For example, if the yield for IPBs maturing in 10 years is 2% and the yield for nominal bonds maturing in 10 years is 5%, the difference of 3% is typically thought of as the rate of inflation investors expect between today and 10 years from now. This difference is often termed the "break-even inflation" (BEI) rate, since it is the rate that needs to be realized for investors to break even on their bond investments.[11]

Therefore, the two most important drivers of real yields are inflation expectations and nominal interest rate moves.[12] In the short run, real yields move with changes in investors' perceptions of future inflation and any change in the nominal interest rate (for instance, those guided by central bank actions). In the long run, however, IPBs should in theory be relatively stable and reflect long-run economic growth and productivity.[13]

Exhibit 4 shows historical real and nominal yields in the US. On average, real yields have been roughly 200 bps lower than nominal yields over the last 7 years, corresponding to an average 2% inflation rate. Historically, real and nominal yields have tended to move together, suggesting that the spread's components — inflation expectations and risk premia — have generally been stable over this period. This stability is mirrored in the relatively flat break-even inflation rates (Exhibit 5), with the notable exception of the months around the 2008 financial crisis. As of September 2010, the break-even inflation rate (using the 10-year bonds) was 1.74%, somewhat higher than the consensus forecast of 1.4% for Q3 (Exhibit 1). Post the Fed's Quantitative Easing announcement on November 3rd, the 10 year break-even inflation rate rose further to climb over 2.00%.

[10] The Fisher equation (1930) was the first to capture the relationship between real and nominal interest rates:

$$i \approx r + \pi^e \tag{1.1}$$

$$i \equiv r + \pi^e + \lambda \tag{1.2}$$

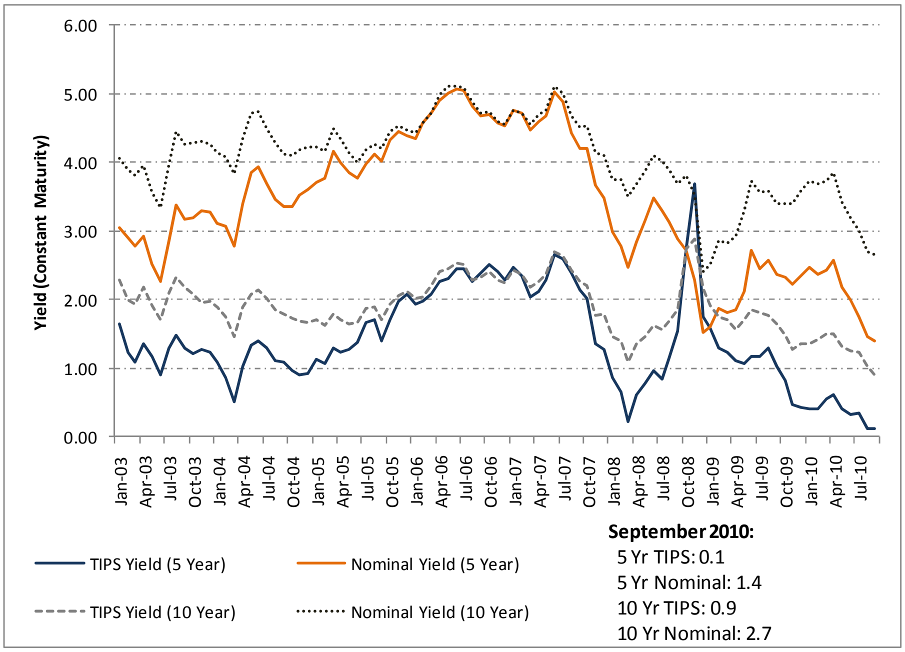
Equation (1.1) is the more famous form of the Fisher equation, where the nominal interest rate i is approximately the real interest rate r plus the expected inflation rate π^e. Equation (1.2), however, is the exact Fisher Identity: the catch-all term λ captures a risk premium that can include premia for inflation and liquidity risk.

[11] Similar to a yield curve that describes yields at various maturities, there is a break-even inflation curve.

[12] In the short-term, real interest rates are fairly sensitive to changes in nominal rates and inflation expectations. Central bank actions affect (short-dated) nominal interest rates directly and inflation expectations indirectly, either of which can cause real interest rates to move. As long as inflation expectations stay the same, real rates tend to fall when nominal rates fall; and when inflation expectations rise (and if for any unusual reason(s), nominal rates stay the same), real rates may fall, as well.

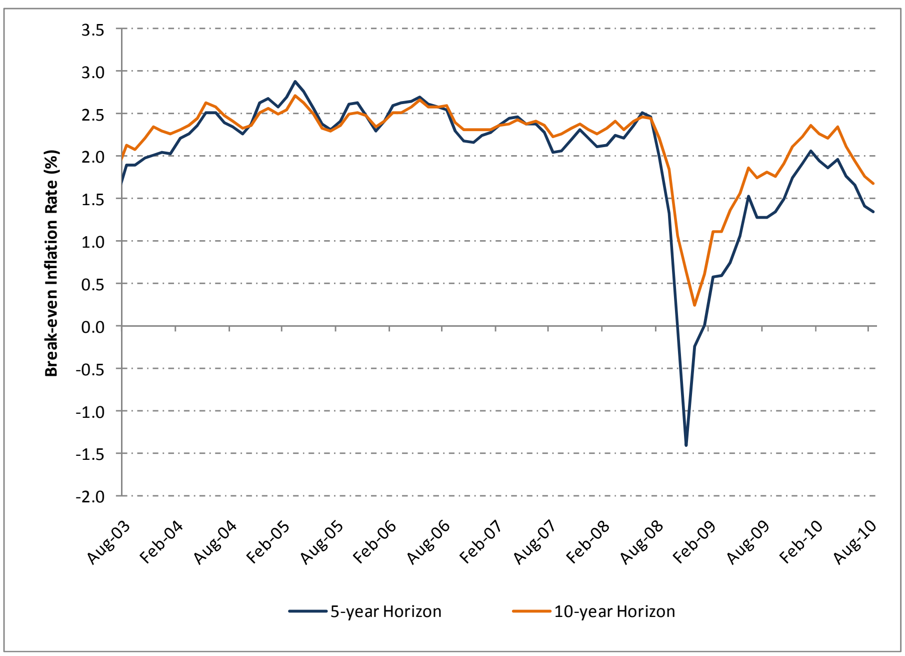
[13] In the long run, the real interest rate should equal the real return on capital, which in turn should approximately equal the potential economic growth of a country (a function of labor force and labor productivity growth rates).

Exhibit 4: US Yields (January 2003 to September 2010)



** Yields are constant maturity, quoted on investment basis (monthly) (Source: US Treasury)*

Exhibit 5: Break-Even Inflation Rate (January 2003 to September 2010)



** Difference between the yields on nominal bonds and TIPS at the 5- and 10-year horizons*

The exhibits also illustrate the spectacular rise in TIPS yields in the third and fourth quarters of 2008. The real yield went from 1.6% in September 2008 to 2.8% in October 2008 and 3.7% in November 2008. In contrast, the nominal yield experienced relatively little change during those months. This was unusual, in that nominal bonds and IPBs are typically correlated. Campbell, Shiller, and Viceira (2009) discuss whether changes in the liquidity premium might have partially explained this event.

This issue leads to other important drivers of IPBs besides inflation expectations and nominal interest rate moves. Liquidity is the first of several determinants that may drive IPBs. Past researchers have argued that investors would require a premium to hold IPBs over nominal bonds because of their relative illiquidity. A second potential risk premium suggested in the past relates to inflation uncertainty (or the volatility around future inflation) which would instead cause investors to require a premium to hold nominal bonds over IPBs. Finally, a third risk premium is that related to regulatory requirements (as in the UK) or because of tax advantages, both of which lead to a required premium for holding nominal bonds over IPBs. In sum, IPB vs. nominal bond yields (and realized returns) likely reflect various risk premia that investors require for holding one over the other.

Said another way, IPB performance may be linked to:

- Structural Demand: Regulations requiring IPB ownership, such as those in the UK, would likely drive up the prices of IPBs.
- Expected Future Inflation: Higher inflation in the future would drive up the prices of IPBs.[14]
- Volatility of Inflation (uncertainty around future inflation): Greater uncertainty around future inflation or volatility of realized inflation would likely drive up the prices of IPBs.
- Liquidity Risk: Lower liquidity in IPB markets could drive up or down the prices of IPBs depending on whether liquidity commands a premium or discount.[15]

2. The Performance of IPBs Relative to Inflation

A story familiar to most investors is that as expected inflation rises, yields on nominal bonds rise,[16] and the prices of outstanding nominal bonds fall. Put more simply, IPBs have tended to do well relative to nominal bonds when expected inflation goes up. To the extent that realized and expected inflation move in the same direction, IPBs will tend to do well when realized inflation goes up. It has not always been the case that expected inflation and realized inflation move together. For instance, in the fourth quarter of 2008, realized inflation was still positive (due to significant energy and food price increases in the summer), even as a large collapse in inflation expectations occurred following the Lehman-led crisis.

In this section, we focus on how IPB performance relates to realized inflation. Since there is a fairly close relationship between IPB performance and changes in expected inflation, we are implicitly testing how much inflation expectations and realized inflation have moved together. Our objective is to provide some insight into the historical effectiveness of IPBs against other asset classes as a hedge against changes in inflation.[17]

[14] Since expected future inflation is likely the most important driver, the standard way investors evaluate whether IPBs are an attractive buy is to compare the expected inflation rate implied by current yields (in other words, the break-even inflation rate). If the market-implied spread is less than the investor's own expectation for future inflation, IPBs are undervalued relative to nominal bonds. If the spread is greater than expected inflation, IPBs are overvalued relative to nominal bonds. From there, investors may try to adjust for various other drivers.

[15] Tax treatment can affect demand for IPBs as well, sometimes via other channels. In the US, for instance, the liquidity of IPBs is restrained by their unique tax treatment. Also in Australia, Canada, and US, the increase in the principal of an IPB is treated as current income for tax purposes. Investors without tax-exempt or tax-deferred accounts may find them less attractive. This tends to concentrate holdings among institutional investors like plan sponsors, who receive special tax treatment and tend to be long-term "buy and hold" investors.

[16] The spread between the nominal yield and IPB yield is just expected inflation, which we discuss in more detail in Section 5. Historically, real yields often rise at the same time as expected inflation (since the economic outlook often looks stronger when inflation is on the rise, and real yields reflect the real growth rate of capital). Thus, real yields and expected inflation have historically simultaneously tended to drive up the yields on nominal bonds.

[17] Note that our focus here is on IPBs as an asset class, as opposed to the idea of using individual issues to hedge inflation mechanically at various maturities, discussed in the previous section.

How Have IPBs Performed in Different Inflation Regimes?

How have IPBs and other asset classes performed in different inflationary environments?[18] We start with a snapshot of US inflation regimes over the last decade (Exhibit 6). Inflation has been relatively muted, averaging 2.4% annually over 1998-2009. The highest rate reached was 5.5% in July 2008, on the eve of the financial crisis. Shortly after, the inflation rate collapsed, going negative by December 2008. Other high points of inflation were in the summer of 2000 and the fall of 2005. In the last decade, there have been several notable periods of rising inflation, a few periods of disinflation (falling inflation), and one episode of deflation.

Exhibit 6: US Inflation Regimes (December 1998 to September 2010)

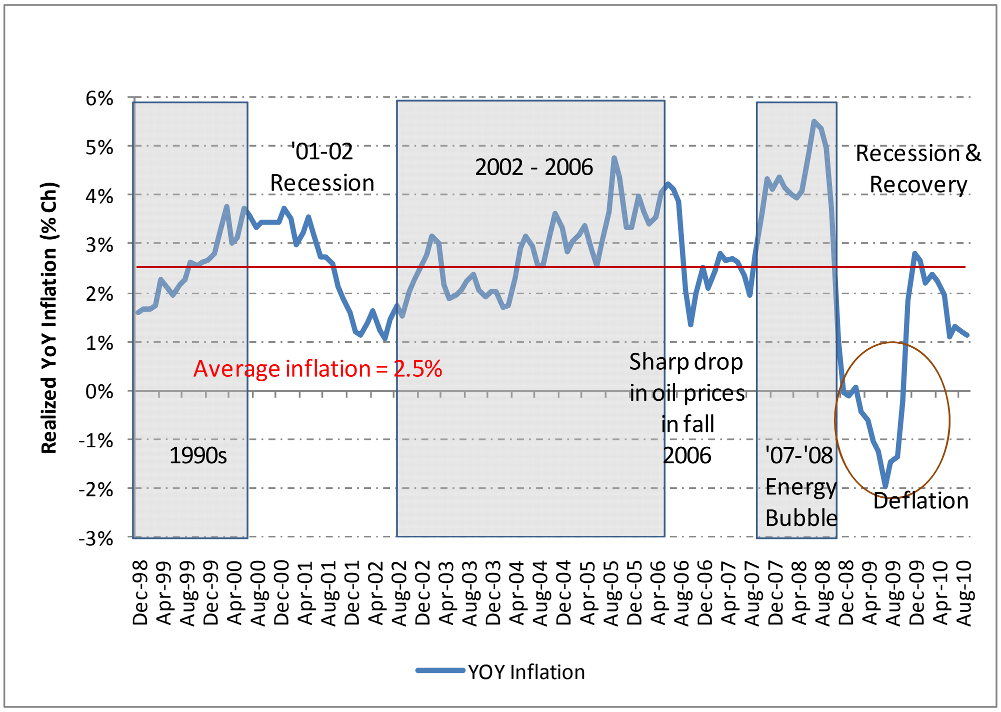


Exhibit 7 summarizes the returns by asset class that we have observed for inflationary (rising inflation) and disinflationary (falling inflation where the level of inflation is still positive) regimes.[19] (We postpone for later our discussion of deflation regimes, i.e., negative inflation.) Our history is December 1997 to September 2010, the period for which the BofA Merrill Global Bond Indices are available.[20] During inflationary periods in the US, IPBs have performed better than equities and nominal bonds, but not as well as commodities and real estate.[21] During disinflationary periods, IPBs underperformed nominal bonds but outperformed the other asset classes. All asset classes except nominal bonds tend to perform better in inflationary periods versus disinflationary periods. These results are consistent with what we expect intuitively.

[18] Because most investors are familiar with how yields move in different inflationary regimes, looking at it from this perspective also provides economic intuition for these historical relationships.
[19] We choose months based on recent inflation rate changes as discussed in the notes for Exhibit 7. Note that we could partition the regimes manually similar to what we have done in Exhibit 6. Results for this way of defining regimes are available upon request.
[20] Since our focus is on IPBs as an asset class, we use the Bank of America Merrill Lynch inflation-linked bond indices. The BofA Merrill Global Bond Index rules are available from Bank of America. A key point however is that qualifying securities must have at least one year remaining term to final maturity and interest and principal payments tied to inflation. Bills and strips are excluded from the indices; however, original issue zero coupon bonds are included in the indices and the amounts outstanding of qualifying coupon securities are not reduced by any portions that have been stripped..
[21] This implies that realized inflation and inflationary expectations tend to go in the same direction during these periods.

Exhibit 7: Average Annualized Returns to Asset Classes in the US for Different Inflation Regimes (Using Local Monthly Returns, January 1998 to September 2010)

	IPBs	Nominal	Equities	Comm.	Real Estate
Inflationary	**7.8%**	**3.4%**	**3.0%**	**36.0%**	**5.8%**
Disinflationary	**6.2%**	**11.1%**	**-10.9%**	**-23.5%**	**-0.2%**

Inflationary periods: Rising inflation (when inflation is positive) where the month-over-month inflation rate increase is greater than 0.1. Disinflationary periods: falling inflation (when inflation is positive) where the month-over-month inflation rate decrease is less than −0.1. Deflation period: negative inflation (December 2008 - October 2009). Inflationary periods and disinflationary periods are roughly equal in number.

What do we observe in the other markets? For the most part, the results are similar. IPBs have outperformed nominal bonds in inflationary periods and underperformed nominal bonds in disinflationary periods. Commodities universally tended to do better in inflationary periods than disinflationary periods; it appears to have a much higher beta to inflationary regimes. Real estate performance was mixed--the experience in the UK and Italy mirrored the US while Japan's (as well as France in disinflationary periods) runs contrary to intuition.

Interestingly, the behavior of equities was also mixed. In the UK and Japan, equities actually earned negative returns on average in inflationary periods. Unlike the case in the US, this phenomenon is in fact consistent with the established literature that finds a negative relationship between equities and inflation (discussed further in the next section).

Exhibit 8: Asset Class Performance in Different Inflation Regimes (Average Annualized Returns Using Monthly Local Returns, January 1998 to September 2010)

Inflationary Periods	IPBs	Nominal Bonds	Equities	Comm.	Real Estate
UK	**6.6%**	**5.5%**	**-3.0%**	**13.8%**	**11.6%**
France	**5.0%**	**3.7%**	**6.4%**	**35.1%**	**5.8%**
Italy	**5.8%**	**1.1%**	**2.4%**	**21.1%**	**1.1%**
Japan	**5.7%**	**5.1%**	**-20.6%**	**4.6%**	**-27.1%**

Disinflationary Periods	IPBs	Nominal Bonds	Equities	Comm.	Real Estate
UK	**5.6%**	**7.2%**	**0.4%**	**-6.1%**	**-11.9%**
France	**7.3%**	**7.7%**	**1.7%**	**-23.5%**	**21.0%**
Italy	**2.7%**	**7.5%**	**-6.5%**	**-18.7%**	**-9.1%**
Japan	**-11.6%**	**2.9%**	**-15.3%**	**-71.2%**	**6.4%**

Data sources: IPBs and Nominal Bonds: BofA Merrill Bond Indices. Equities: MSCI Country Indices. Commodities: S&P/GSCI Total Return Index (same across all countries). Real Estate: MSCI Real Estate indices for each country except for Italy where the MSCI Europe Real Estate Index is used.

In sum, IPBs have tended to do quite well in inflationary periods without losing too much value in disinflationary periods for most countries. Exhibits 7 and 8 show a strong case for the effectiveness of IPBs for hedging over this period. They earned strong, positive returns in inflationary environments (more so than equities in most countries), and while they did not perform as well as commodities and real estate, they also did not experience the dramatic decline of the latter in disinflationary periods.

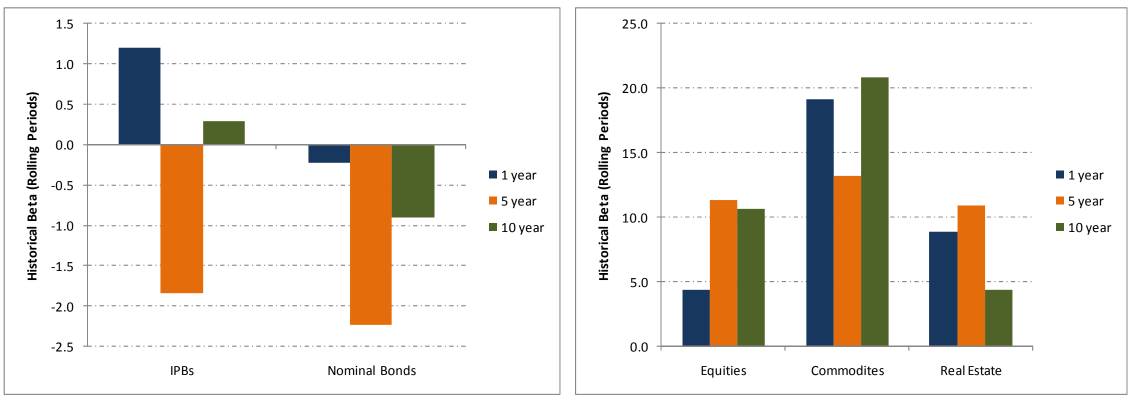
How Closely Do IPBs Move with Changes in Realized Inflation?

Next, we explicitly show how IPBs have moved with changes in the inflation rate by measuring the betas of asset classes to inflation. These betas are one way to capture the "inflation-hedging capability" of a security.[22] We use a simple approach proposed by Bekaert and Wang (2010), in which the inflation beta is computed using a simple regression:

$$\text{Nominal return} = \alpha + \beta * \text{inflation} + \varepsilon \qquad (1.3)$$

Beta captures how strongly an asset's return co-moves with inflation and whether it reacts one-for-one to inflation shocks. These betas are estimated using rolling periods; for details on the regressions, see Appendix 3. Because our focus is on longer periods, we look at how sensitive IPBs have been on average to changes in realized inflation over 1 year, 5 years, and 10 years. Exhibit 9 shows the betas (or correlation) of IPBs and other asset classes to inflation in the US.

Exhibit 9: Betas of Asset Classes to Inflation in the US (Local Returns, Using Available Returns from January 1998 to September 2010[23])



Data sources: IPBs and Nominal Bonds: BofA Merrill Bond Indices. Equities: MSCI Country Indices. Commodities: S&P/GSCI Total Return Index (same across all countries). Real Estate: MSCI Real Estate indices for each country except for Italy where the MSCI Europe Real Estate Index is used.

The betas of IPBs are 1.2, –1.8, and 0.3 at the 1-, 5-, and 10-year horizons, respectively. The 1- and 5-year results are statistically significant at the 95% confidence level. The results suggest that at least at the 1- and 10-year horizons, IPBs provided a reasonable hedge against inflation. The 5-year negative beta is puzzling. In particular, from 2005 to 2007, and again in 2009, 5-year IPB returns[24] and 5-year inflation moved oppositely. This could be a result of a disconnect between inflation and expected inflation movements or other forces driving IPB returns.

In Exhibit 9, the nominal bond betas are all negative, indicating that, as expected, they were not good inflation hedges. This is consistent with Bekaert and Wang's results; they find a small, negative, statistically significant[25] beta for US nominal bonds, using data from January 1980 to December 2009. Equities, commodities, and real estate on the other hand, have consistently high positive betas to inflation over all observed horizons.

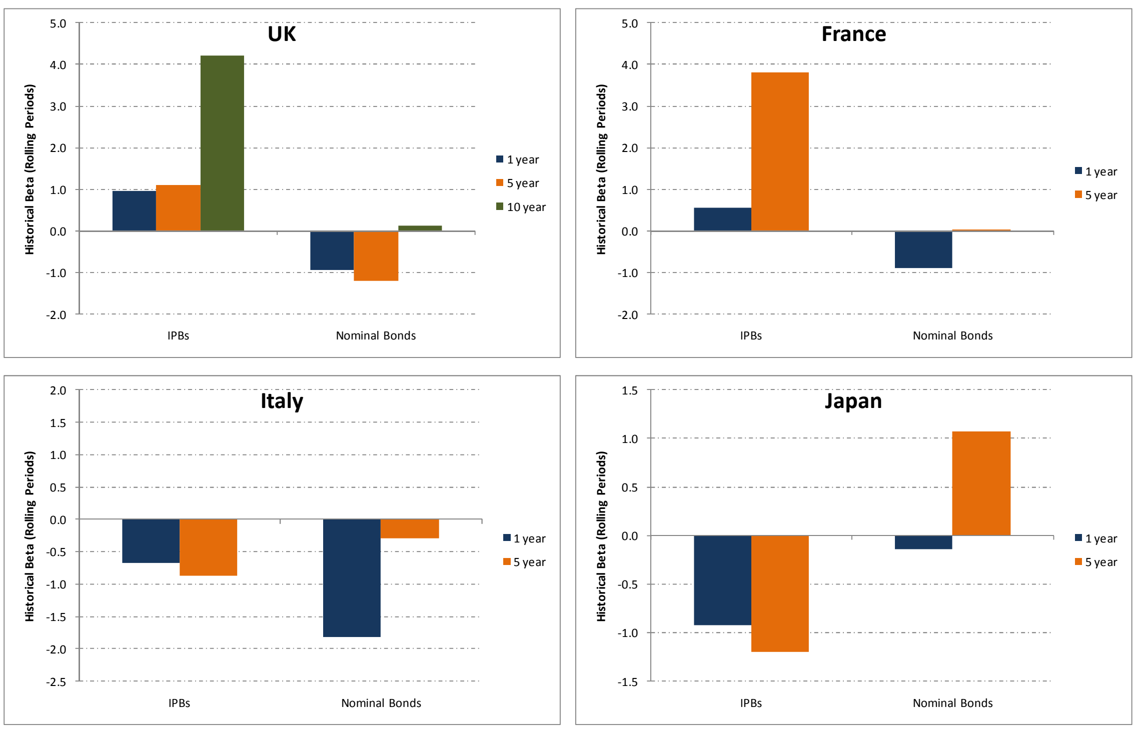
The result for equities is actually contrary to Bekaert and Wang's findings, as well as most of the empirical studies of the 1980s and 1990s, which found negative relationships between equities and inflation.[26] Bekaert and Wang report a negative beta of around –0.5, which is not statistically

[22] See Bekaert and Wang (2010) for a discussion.
[23] A note on data availability: for the 10-year beta, we use returns and the CPI change calculated over a 10-year period. Thus the sample period starts in January 2008 and runs through September 2010. The available sample is thus very short, a point to remember when interpreting these betas.
[24] For example, the 5-year return to IPBs as of January 2005 is calculated using the price in January 2000 and the price in January 2005.
[25] They test whether betas are statistically significantly different from 1.0.
[26] There has long been an argument that equities are good inflation hedges, because they have similar cash flows to IPBs, in that dividend payments and capital value will tend to rise as the price level increases. A key difference, however (see Deacon et al., 2004), is that for

significantly different from 1, however. They mention that the coefficient becomes less negative by adding the recent crisis years, in which low stock returns and below-average inflation went hand-in-hand. This explains why we find a positive beta with our smaller sample, which has an implicitly heavier weight on the last several years. We note, however, that the high betas of equities, commodities, and real estate reflect an excessive amount of volatility; a good hedge would have a beta close to 1.

Exhibit 10 shows the IPB and nominal bond betas for the other four largest markets — the UK, France, Italy, and Japan. (Those for equities, real estate, and commodities appear in Appendix 3.) Betas for IPBs in the UK and France were positive at all observed horizons (though only the UK betas were statistically significant). IPB betas to inflation for Italy and Japan were negative (though they were only statistically significant for the 5-year case). In Japan, nominal bonds had a positive five-year beta to inflation, which is statistically significant. The case of Japan is unique, in that the last decade has been characterized by a mix of disinflation and deflation. This has made IPBs less attractive for investors and kept the size of the market relatively small. This still does not explain why nominal bonds would be positively sensitive to inflation; this phenomenon deserves further consideration.

Exhibit 10: Betas of Asset Classes to Inflation — Global Markets (Local Returns, Using Available Returns from January 1998 to September 2010)



Data sources: IPBs and Nominal Bonds: BofA Merrill Bond Indices. Equities: MSCI Country Indices. Commodities: S&P/GSCI Total Return Index (same across all countries). Real Estate: MSCI Real Estate indices for each country except for Italy where the MSCI Europe Real Estate Index is used. In France, Italy, and Japan, there is not enough history to calculate 10-year betas. History is available: France: 10/30/98-; Italy: 10/31/03-; Japan: 7/30/04.

To summarize, in the previous section, we saw that IPBs generally have done well when inflation rose. Here, we reconfirm the fact that IPBs have historically moved closely with inflation, but the results are confined to the US, UK, and France, and not at all horizons. Meanwhile, nominal

equities, other factors besides inflation will drive a stock's dividends and capital value. It turns out that equities have generally been negatively correlated with inflation historically. We find, for instance, a beta -0.9 of US equity to inflation from December 1970 to May 2010. Ibbotson (1996) and Shen (1995) discuss potential reasons.

bonds have generally moved oppositely to inflation, while equities, commodities, and real estate have moved with inflation, but with a large amount of volatility.

3. IPBs and Periods of Deflation

The way IPBs and nominal bonds behave in times of deflation deserves further discussion. All major markets experienced a short period of deflation last year, after a collapse in inflation expectations following the bank crisis. Deflation lasted longest and was most severe in Japan, the US, and the UK. Exhibit 11A shows how this period unfolded in the US. IPBs experienced a dramatic drop of 9% (monthly) in October 2008, as inflation expectations collapsed. Realized inflation also fell dramatically during the last months of 2008, but did not become negative until December 2008. That same month, IPBs started to stage a gradual comeback that picked up in the second quarter of 2009. Thus, during the actual period of deflation, IPBs earned relatively high returns (see Exhibit 11B). The Fed and other central banks were sharply lowering interest rates during this period, which signaled to the market that deflationary pressures were being addressed.

Exhibit 11A: US Deflation in 2009 (US Returns, Monthly)

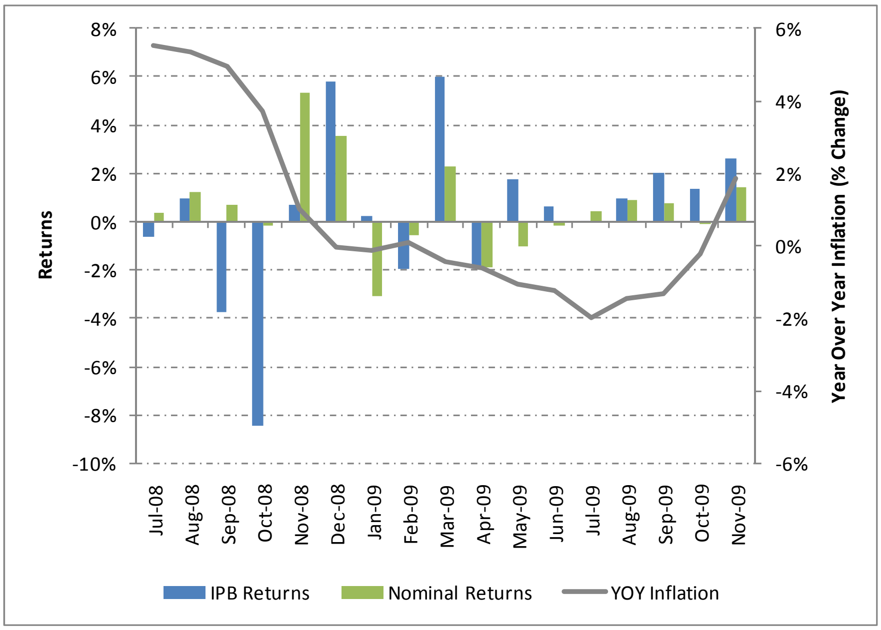


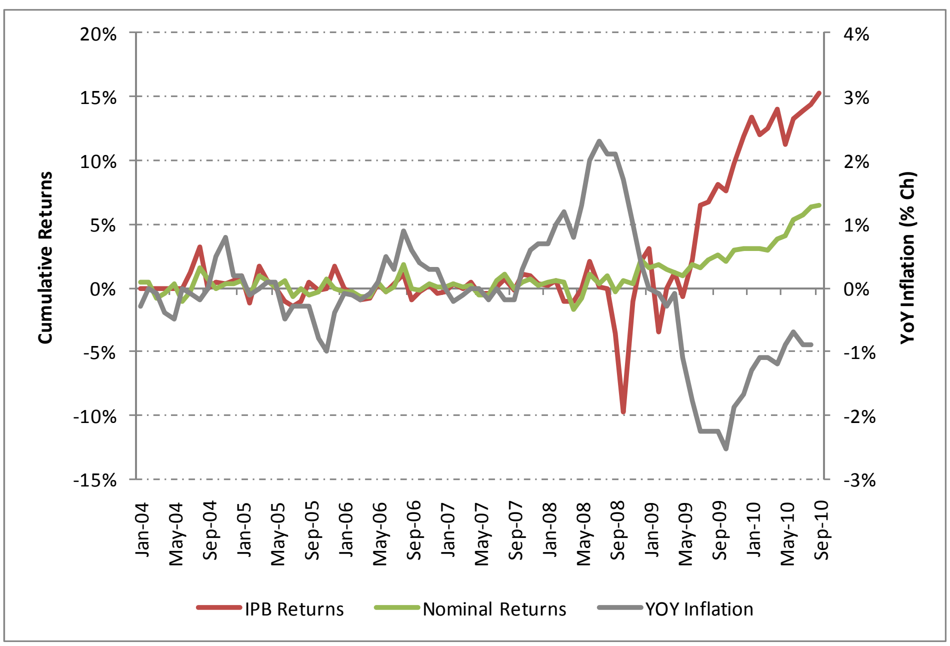
Exhibit 11B: Asset Class Performance in Periods of Deflation (Annualized Monthly Local Returns)

	IPBs	Nominal	Equities	Commodities	Real Estate
US (Dec 08 - Oct 09)	22.4%	2.1%	39.4%	7.0%	92.5%
UK (Mar 09 - Oct 09)	19.6%	6.5%	56.3%	22.2%	92.9%
France (June 09 - Oct 09)	9.4%	9.7%	32.3%	1.9%	124.8%
Italy (May 09 - Oct 09)	11.4%	8.4%	35.2%	30.4%	35.9%
Japan (Jan 05 - Apr 06)	-1.5%	-0.9%	36.4%	36.1%	66.0%
Japan (Feb 09 - Sept 10)	7.1%	3.0%	2.3%	3.9%	9.9%

What happened in the US was mirrored by the other western countries. Inflation expectations collapsed in late 2008 (and IPB prices along with them), but by early 2009, IPBs were on the rebound as expected inflation returned to positive.

In deflationary periods, nominal bonds have tended to benefit, at least at first. This is because during the initial shift from inflationary to deflationary expectations, nominal bonds benefit from having a relatively wide inflation expectation spread built into the coupon. This pattern occurred in all the major markets last year. As inflation expectations shrink, and thus the spread between nominal bonds and IPBs narrows, their yields would converge. During a prolonged period of deflation or deflationary expectations (when the spread is narrow and inflation expectations are not changing) nominal bonds should not have a wide advantage over IPBs. Exhibit 12 shows the cumulative returns to nominal bonds and IPBs in Japan over the last half decade. As the inflation rate fluctuated between positive and negative between 2004 and 2007, the two classes of bonds experienced mixed performance.

Exhibit 12: In Prolonged Periods of Deflation, IPBs and Nominal Bond Returns Can Vary (Japan Local Cumulative Returns, Monthly, January 2004 – September 2010)

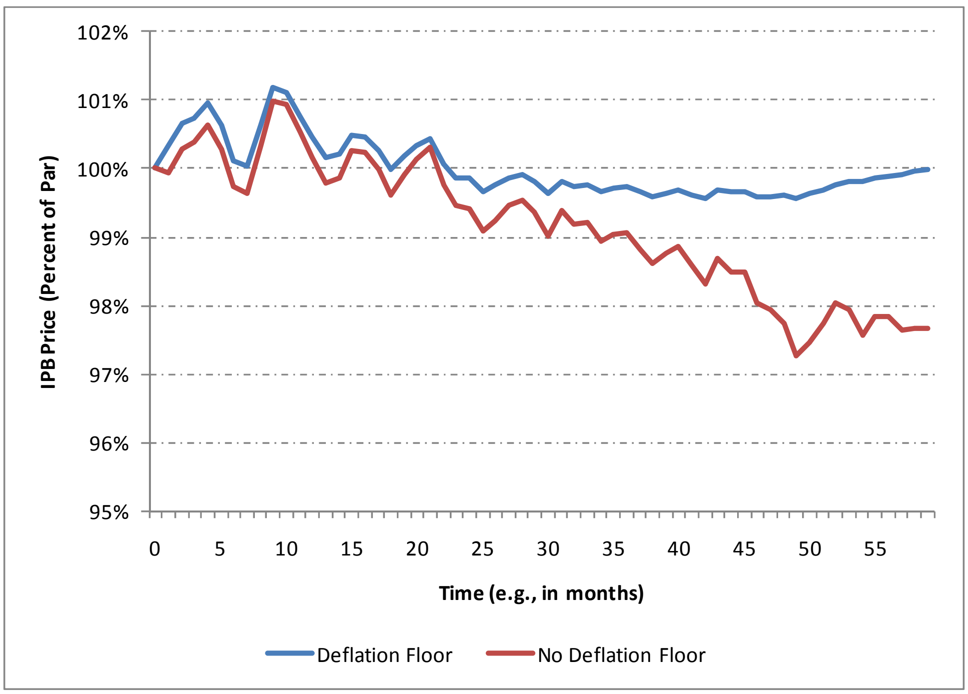


Japan's government, however, does not guarantee the principal amount. Thus, in the event of a prolonged period of deflation in the US, the performance of IPBs and nominal returns could be quite different from what is shown in Exhibit 12. The deflation floor is an attractive but less appreciated feature of IPBs issued in certain countries in that it provides an embedded deflation protection. Recall that in the US, an IPB's redemption value can never go below par. In other words, an investor who holds the IPB to maturity will either receive the par value (if deflation occurs over the life of the bond) or an amount higher than par value (if inflation occurs over the life of the bond). This feature is akin to (inflationary) call optionality or (deflationary) put optionality in the event that there is a period of prolonged deflation.[27]

We highlight, however, that this option-like feature assumes that the investor holds the bond to maturity. An investor who sells the IPB before maturity may not receive the full value of the deflation floor, since bond prices reflect some uncertainty around the actual path of future inflation.

Exhibit 13 illustrates hypothetical prices of a 5-year IPB issued at time $t = 0$ with and without the deflation floor in the event of prolonged deflation. For illustrative purposes, we use CPI changes experienced by Japan from January 1998 to January 2003.[28] The price of the IPB with the deflation floor still falls initially as deflation sets in. As it nears the maturity date, however, the price converges to its par value.

Exhibit 13: Hypothetical Japan-like Deflation for US TIPS[29]



[27] As such, there may be a premium (though likely small) attached to IPBs to compensate for this option-like feature, particularly for newly issued, short-dated securities.
[28] We price the bonds at the beginning of each month. Coupon rates for both bonds are 4%, while a hypothetical set of yields is generated that corresponds to the changes in prices.
[29] This chart shows how the maturity of an IPB would change in the event of a prolonged deflation scenario similar to what occurred in Japan. To show the price of the bond as it evolved, we would need to take into account the coupons and make some assumptions about the yield curve for discounting the cash flows. Assuming the yield curve remains fixed over the life of the bond, the simulated prices would evolve approximately the same way as the figure above.

4. IPBs and Diversification for Institutional Investors

IPBs are often thought to be attractive for their portfolio-diversification potential. We look at how effective IPBs and nominal bonds have been in this regard. Globally, IPBs have had relatively low correlation with other asset classes over the observed period (with the exception of nominal bonds). However, in comparison to nominal bonds, IPBs have had higher correlation with equities, real estate, and commodities,[30] perhaps because these securities are presumed to have stronger call optionality on inflation, as we discussed earlier.[31]

Exhibit 14: Global Correlations (Monthly Returns, USD, January 1998 to September 2010)

	Global IPBs	Global Sovereign Bonds	Global Equities	Global Commodities	Global Real Estate
Global IPBs	1.00				
Global Sovereign Bonds	0.80	1.00			
Global Equities	0.36	0.14	1.00		
Global Commodities	0.38	0.14	0.36	1.00	
Global Real Estate	0.47	0.26	0.80	0.31	1.00

** Global Sovereign Bonds = BofA Merrill Lynch Global Government Bond Index; Global IPBs = BofA Merrill Lynch Inflation-Linked Bond Index; Global Equities = MSCI ACWI Equity Index; Global Real Estate = MSCI World Real Estate Index; Global Commodities = S&P/GSCI Commodity Index)*

Next, we consider correlations in the context of two specific cases. First, we look at the standard perspective of a domestic US investor. Second, we look at a more representative large institutional investor who can invest in foreign assets without restriction. Exhibit 15 shows the situation of an investor who invests only in domestic assets. Using local returns, we show the historical correlations for the five largest IPB markets.

Exhibit 15: Diversification for a Domestic Investor (Correlation of Local Monthly Returns, January 1998 to September 2010)

US	IPBs	Nom. Bds.	Eq.	Comm.	RE
IPBs	1.0				
Nominal Bonds	0.7	1.0			
Equities	0.0	-0.3	1.0		
Commodities	0.3	-0.1	0.2	1.0	
Real Estate	0.2	-0.1	0.6	0.2	1.0

UK	IPBs	Nom. Bds.	Eq.	Comm.	RE
IPBs	1.0				
Nominal Bonds	0.6	1.0			
Equities	0.1	-0.2	1.0		
Commodities	0.1	-0.1	0.2	1.0	
Real Estate	0.2	0.0	0.5	0.1	1.0

[30] The higher correlation with commodities makes sense, since IPBs are typically linked to price indexes that include energy and food costs.
[31] However, nominal bonds possess strong deflationary protection, lacking in equities, real estate, and commodities.

France	IPBs	Nom. Bds.	Eq.	Comm.	RE
IPBs	1.0				
Nominal Bonds	0.6	1.0			
Equities	-0.1	-0.3	1.0		
Commodities	0.0	-0.2	0.2	1.0	
Real Estate	0.1	-0.1	0.4	0.0	1.0

Italy	IPBs	Nom. Bds.	Eq.	Comm.	RE
IPBs	1.0				
Nominal Bonds	0.6	1.0			
Equities	0.4	0.1	1.0		
Commodities	0.1	-0.2	0.3	1.0	
Real Estate	0.4	0.1	0.8	0.2	1.0

Japan	IPBs	Nom. Bds.	Eq.	Comm.	RE
IPBs	1.0				
Nominal Bonds	0.3	1.0			
Equities	0.4	-0.3	1.0		
Commodities	0.3	-0.3	0.5	1.0	
Real Estate	0.3	-0.3	0.8	0.4	1.0

In Exhibit 15, the question of diversification potential depends partially on the context. If the choice is between IPBs and nominal bonds for hedging the equity-commodities-real estate portion of the portfolio, then nominal bonds appear to have been a better diversifier. However, the IPB correlations were not substantially higher and still in fact quite low.

In a second example, we look at diversification from the perspective of a US investor with broad access to foreign assets. Exhibit 16 shows the correlations of the assets with a 60/40 US equity/bond portfolio during the January 1988 to September 2010 period. Among the potential US assets, all of the correlations have been relatively low, with Real Estate being the highest at 0.6. IPBs, Oil, and Gold all have had relatively low correlations with the 60/40 portfolio.

Exhibit 16: Diversification for an International Investor (Correlation of Assets to a 60/40 US Portfolio, Using Monthly Returns, USD, January 1998 to September 2010*)

US Assets		Foreign Assets	
IPBs	0.2	Foreign Equities	0.9
Commodities	0.2	Foreign IPBs:	
Oil	0.2	UK IPBs	0.3
Gold	0.1	France IPBs	0.3
Real Estate	0.6	Italy IPBs	0.6
		Japan IPBs	0.6
		Foreign Bonds:	
		UK Nominal	0.2
		France Nominal	0.2
		Italy Nominal	0.6
		Japan Nominal	-0.1

** Periods for France, Italy, and Japan begin later, due to the available history for IPBs. France: 10/30/98-; Italy: 10/31/03-; Japan: 7/30/04. The 60/40 portfolio is comprised of the MSCI USA Equity Index and the BofA Merrill Lynch US Bond Index. For IPBs and Nominal Bonds in the US and other markets, the BofA Merrill Lynch Bond Indices by country are used. For Foreign Equities, we use the MSCI ACWI World ex USA Index. For Commodities, Oil, and Gold, we use the S&P/GSCI Commodity Indices. For Real Estate, we use the MSCI USA Real Estate Index.*

Conclusion

IPBs serve a unique role among asset classes, offering features that blend those of the other asset classes. We find that IPBs have exhibited some distinct differences from other asset classes during the past decade. We highlight the following:

1. IPBs as an asset-class-level inflation hedge: We find that IPBs provided reasonable protection against inflation during this period. In the US and UK, IPBs moved closely with inflation, outperforming equities and nominal bonds in inflationary periods. Nominal bonds tended to move inversely to inflation. Commodities also moved strongly with inflation but experienced greater declines when inflation fell.
2. IPBs in a deflation scenario: Nominal bonds had stronger protection (or put optionality) on deflation relative to IPBs during the last decade. During a shift from inflationary to deflationary expectations, existing nominal bonds have benefited from having a relatively wide inflation expectation spread built into the coupon. This, in fact, occurred in all the major markets last year. This relative disadvantage (on the part of IPBs) can erode, however, when the spread is narrow, for instance in the event of a prolonged period of near-zero or negative inflation. In a prolonged deflation scenario, holders of IPBs would benefit from a guaranteed redemption value, the so-called “deflation floor.”
3. IPBs for portfolio diversification: The correlations of IPBs with other asset classes have been relatively low for equities, commodities, and real estate, and only slightly higher than correlations of nominal bonds with those assets. IPBs exhibited relatively low correlations over the last decade with other asset classes, both from a domestic perspective and the perspective of a US international investor, supporting their attractiveness for diversification purposes.

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Appendix

1. Introduction to Government-Issued IPBs

Inflation-protected bonds have been around for more than half a century, though they remained a relatively small market until 2000. The first to issue them were developing countries experiencing high and volatile inflation, which made IPBs a necessity for raising long-term capital — for instance Chile (in 1956), Brazil (in 1964), Colombia (in 1967), and Argentina (in 1973) (see Garcia and van Rixtel, 2007). Beginning in the 1980s, developed countries like the UK (in 1981), Australia (in 1985), Sweden (in 1994), and New Zealand (1995) all started issuing inflation-linked bonds, not out of necessity, but as the result of a deliberate policy choice. According to Garcia and van Rixtel (2007), the issuance of inflation-linked debt served both to add credibility to the government's commitment to these policies and to reduce its cost of borrowing by capitalizing on excessive inflation expectations in the market. Lastly, beginning in the 1990s, various countries such as Canada (in 1991), the US (in 1997), France (in 1998), Greece and Italy (in 2003), Japan (in 2004), and Germany (in 2006) started to issue IPBs as a supplementary offering for investors seeking diversification or an explicit inflation hedge, given their fairly low and stable inflation and inflation expectations.

Sovereign inflation-protected bonds are fixed income securities that carry the full faith and credit of the governments that issue them. Unlike (nominal) straight bonds, their cash flow is explicitly linked to an inflation index. Inflation-protected bonds can have different cash flow structures. The most common forms are capital-indexed bonds (CIBs) and interest-indexed bonds (IIBs). Others that have been implemented are current pay, indexed annuity, and indexed zero-coupon bonds.

CIBs are by far the most common. These include Australia, Canada, France, Italy, Germany, New Zealand, South Africa, Sweden, the UK, and the US. For these bonds, the inflation adjustment is applied to the principal, and not the interest rate. The adjustment is reflected daily for trading and valuation purposes but the accumulated adjustment is not realized until maturity. CIBs provide better inflation protection than IIBs, because they have lower reinvestment risk. Coupons are paid semi-annually or annually.

In the US, France, Italy, South Africa, and Sweden, the investor receives the inflation-adjusted principal or the original principal, whichever is greater at maturity. These governments guarantee redemption at par, a feature which implicitly provides investors deflation protection through a "deflation floor."

At the time of purchase, the real return to maturity on an IPB is known, while its nominal return is uncertain, since this will depend on the realized future path of the inflation index. (In contrast, the reverse is true for a nominal bond). In practice, even the real return to maturity of an IPB is not completely known. First, any given price index provides only an approximation to the individual's consumption basket. Second, price indexes cannot be published continuously and instantaneously, so there is an "indexation lag" that must be taken into account. Third, tax rules change and affect the final real yield.

Government-issued IPBs are issued by a wide variety of techniques, including auctions, subscriptions, taps, and private placements. Auctions are the predominant method of issue among the major issues of indexed debt. Only the French government deviates, using a syndicate system for the initial issue (Deacon et al., 2004).

The mechanics of IPBs are similar across most countries. In the US, the principal for TIPS is adjusted according to the Consumer Price Index (CPI)[32]. The interest rate, which is paid every 6 months, is a fixed rate determined at auction. (France, Sweden, Greece, and Germany pay coupons annually.) Inflation indexes are country or region specific; some examples are listed in Exhibit A1.

Exhibit A1: Inflation Indexes: Select Markets

	Issue	Inflation Index
U.S.	Treasury Inflation-Protected Securities (TIPS)	US Consumer Price Index (CPI)
U.K.	Inflation-linked Gilt (ILG)	Retail Price Index (RPI)
France	OATi and OAT€i	France CPI ex-tobacco (OATi), EU HICP (OAT€i)
Canada	Real Return Bond (RRB)	Canada All-Items CPI
Australia	Capital Indexed Bonds (CAIN series)	Weighted average of Eight Capital Cities: All-Groups Index
Germany	Bund index and BO index	EU HICP ex Tobacco
Italy	BTP€i	EU HICP ex Tobacco
Japan	JGBi	Japan CPI (nationwide, ex fresh food)
Sweden	Index-linked treasury bonds	Sweden CPI
Greece	--	EU HICP ex Tobacco
New Zealand	Inflation-indexed bonds (IIBs)	New Zealand “All-Groups” CPI
Poland	COI bonds	Poland CPI
South Africa	RSA bonds (“SAIL”)	South Africa CPI (All Items for Metropolitan Areas)

[32] CPI-U measures prices for urban consumers and includes food and energy. Critics have raised the issue that CPI-E which measures prices for the elderly may be more appropriate for some plan sponsors depending on the objectives.

Exhibit A2 shows the markets for which governments issued inflation-protected bonds. Smaller markets not shown are Israel, Chile, and South Korea.

Exhibit A2: Global Markets for Government-Issued Inflation Protected Bonds (Ranked by Size of Market in USD)

	Year First Issued	Total Amount (USD, Millions)	Total Amount (Local Currency, Millions)	Number of Issues	As Fraction of the Nominal Debt Market
Developed Markets					
U.S.	1997	$564,811	564,811	29	11%
U.K.	1981	$334,685	220,638	17	31%
France	1998	$219,637	1,064,758	11	20%
Italy	2003	$127,307	94,086	7	10%
Japan	2004	$60,298	5,634,209	14	1%
Germany	2006	$45,943	33,954	3	4%
Canada	1991	$45,622	46,286	5	14%
Israel	N/A	$35,825	132,348	9	N/A
Sweden	1994	$33,103	238,244	4	45%
Greece	2003	$16,983	12,551	2	6%
Australia	1985	$11,999	13,073	3	12%
New Zealand	1996	$1,614	2,275	1	N/A
Emerging Markets					
Brazil	N/A	$192,216	343,048	14	N/A
Mexico	N/A	$35,820	441,495	10	35%
Turkey	N/A	$31,540	48,010	5	N/A
South Africa	N/A	$19,642	144,252	4	N/A
Poland	N/A	$3,720	10,613	1	3%

** As of March 31, 2010. Universe defined by the BofA Merrill Lynch Global Inflation-Linked Bond Indices. Nominal bonds markets defined by the BofA Merrill Lynch Government Bond Indices.*

Valuation of IPBs is similar to that of straight bonds, except for the inflation-adjustment piece. For intuition, consider the standard price-to-yield calculation for nominal bonds:

$$P_N = \sum_{j=1}^{n} \frac{C_N}{\left(1+y_j\right)^j} . + \frac{R_N}{\left(1+y_n\right)^n} \tag{1.3}$$

where P_N is the price of the bond, C_N is the coupon payment, R_N is the maturity value, and y_j is the spot interest rate on a loan repayable at date j.[33] If we assume an IPB is perfectly indexed to inflation, the calculation for it is exactly the same, only now all the variables are in real terms and the interest rates r are real spot rates.

$$P_R = \sum_{j=1}^{n} \frac{C_R}{\left(1+r_j\right)^j} . + \frac{R_R}{\left(1+r_n\right)^n} \tag{1.4}$$

Thus, the price of an IPB is a function of the real coupon rate and the real maturity value. Alternatively, we can think of the price of an IPB as a function of its coupon, which is known when it is issued, the maturity value, which ultimately will depend on the path of inflation until the maturity date, and the real term structure. Real yields have an easy interpretation. They are the interest rates required over some horizon by investors net of future inflation changes. (In the same vein, nominal yields are just the interest rates required once inflation has been taken into account.) Yields are forward looking, in contrast to returns. Total returns for bonds are just a function of the change in price (which move opposite to yields) and the coupon (which is fixed for outstanding issues).

In practice, IPBs are not perfectly indexed to inflation, however. (Full pricing methodology for IPBs by country is shown in Deacon et al., 2004). Since price indexes cannot be published continuously and instantaneously, there is always a lag between the relevant period for which an index value is computed and the date on which that number is published. This “indexation lag” (and/or the “publication” lag)[34] becomes more problematic as inflation becomes more unstable. This is part of the reason why IPBs are not considered to be as useful in hyperinflationary environments[35] as in moderate to high inflation environments. To deal with the indexation lag, many countries use interpolation techniques to come up with an inflation approximation, for instance, US, Canada, France, Sweden.[36] The greater the indexation lag, the more uncertain is the approximation.

IPB prices can be quoted either in nominal or real terms. They can also be quoted as dirty prices or clean prices.[37] If they are quoted in nominal terms, they must be converted for real yield analysis. If they are quoted as clean prices, accrued interest calculations are needed. We leave aside the particulars here, but in both cases the indexation and publication lags will impact the calculations.

Two additional issues deserve some mention. First, the issue of seasonality in the price index can confuse the pricing. All else equal, the use of yield formulae conventions (which do not take into account seasonality) implies that quoted yields will fluctuate throughout the year based on seasonal patterns (Deacon et al., 2004). Second, standard duration analysis has a different interpretation for IPBs. Since the nominal size of an IPB’s cash flows increases over its life, relative to a conventional bond issued at the same time and with the same maturity date, its duration will generally be longer. In other words, the quoted duration of IPBs will always be

[33] Solving for a single value of y from the observed price gives us the yield to maturity.
[34] Technically, the publication lag is the time it takes to publish the numbers, while the indexation lag is the time it takes to index the bonds to the new published numbers.
[35] Even a short lag in indexation can leave investors seriously undercompensated.
[36] Authorities have to publish an official price-yield equation for settlement purposes
[37] The dirty price of a bond is the actual price paid for it. It contrasts with the clean price, which is not adjusted for accrued interest.

greater than that of similar-maturity, conventional bonds, assuming inflation is positive on average over their lifetimes.

For more details on IPBs, see Deacon et al. (2004) and Brynjolfsson and Fabozzi (1999).

2. Inflation Data

For inflation data, we use the following sources:

US: Consumer Price Index — All Urban Consumers (CPI-U), seasonally adjusted. All-items. Base period: 1982-84 = 100. Source: US Bureau of Labor Statistics.

Euro area (Italy): Harmonised Index of Consumer Prices (HICP). Monthly; Reference area. euro area (changing composition). Adjustment indicator: Neither seasonally nor working-day adjusted. Institution originating the data flow: Eurostat. Source: ECB.

France: France CPI ex-tobacco, Indice des prix à la consommation - IPC - Indice des prix à la consommation harmonisé - France (Identifiant: 671193). Source: Institut national de la statistique et des etudes economiques.

UK: Retail Price Index — All Items. January 1987 = 100. Source: UK Office for National Statistics.

Japan: Japan CPI. Source: Statistics Bureau, Director General for Policy Planning (Statistical Standards) & Statistical Research and Training Institute.

3. Details on Regressions

The basic regression uses logarithmic returns for assets over a 1-year horizon. Therefore, in time t, the return for each asset r_t is simply the logarithm of the price at t minus the logarithm of the price at time $t-12$.

Year-on-year inflation in time t, where CPI is the relevant price index for that country, is

$$\pi_t = \ln\left(\frac{CPI_t}{CPI_{t-12}}\right).$$

The univariate regression is $i \approx r + \pi^e$.

Because of monthly data and overlap in the observations, we correct the errors for serial correlation using Newey-West.

For a 5-year horizon, we use 60 months, instead of 12 above. For the 10-year horizon, we use 120 months.

Detailed results follow on the next page.

Exhibit A3: 1-Year Betas to Inflation (Local Returns, January 1998 to September 2010)

	IPBs	Nominal Bonds	Equities	Comm.	Real Estate
US	1.2*	–0.2	4.4	19.1*	8.9*
UK	1.0*	–0.9*	4.0*	10.4*	8.0*
France	0.6	–0.9	–0.9	21.4*	-2.6
Italy	–0.7	–1.8*	0.8	23.3*	1.4
Japan	–0.9	–0.1	–5.6	13.1*	–7.1

Exhibit A4: 5-Year Betas to Inflation (Local Returns, January 2002 to September 2010)

	IPBs	Nominal Bonds	Equities	Comm.	Real Estate
US	–1.8	–2.2*	11.3*	13.2*	10.9*
UK	1.1*	–1.2*	10.2*	–3.0	3.8
France	3.8	0.0	9.9	31.1*	21.6*
Italy	–0.9	–0.3	10.0*	25.9*	16.6*
Japan	–1.2	1.1*	2.6	1.4	8.5*

Exhibit A5: 10-Year Betas to Inflation (Local Returns, January 2007 to September 2010)

	IPBs	Nominal Bonds	Equities	Comm.	Real Estate
US	0.3	–0.9*	10.7*	20.8*	4.4
UK	4.2*	–0.1	12.1*	12.3	20.7*

Note: Statistically significant betas (at the 95% c.i.) are asterisked. Periods for France, Italy, and Japan begin later due to available history for IPBs. France: 10/30/98-; Italy: 10/31/03-; Japan: 7/30/04. For Italy Real Estate, the MSCI Europe Real Estate Index is used.

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