

NBIM DISCUSSION NOTE

The Structure of Inflation-Linked Bond Markets

17/08/2012

We describe the market structure of global inflation-linked bonds to evaluate to what degree they constitute an investable and homogeneous asset class. In particular, we discuss the market's growth, size and composition relative to nominal bonds. We also pay attention to the design of inflation-linked securities across countries and market-specific demand and supply factors.

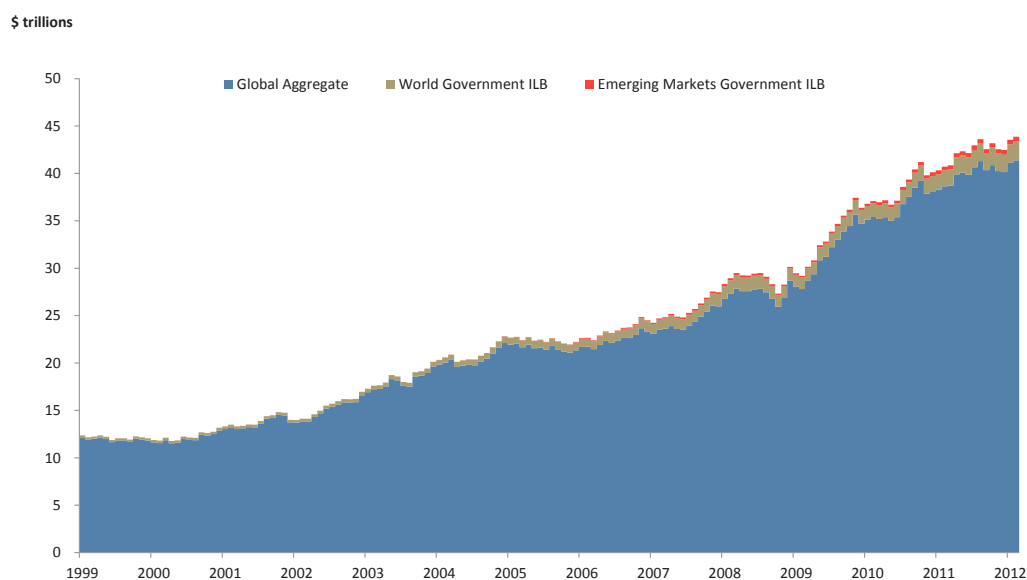
Main findings

- Despite strong growth in issuance, inflation-linked bonds still constitute a relatively small share of the fixed-income universe. The market value of sovereign linkers outstanding is about 6 percent of the capitalisation of the Barclays Global Aggregate, a commonly used approximation for the investment-grade nominal bond universe.
- In developed markets, the largest issuers of linkers are the US, the UK, France, Italy and Germany. The market capitalisation of emerging-market indexed bonds is about one-quarter that of developed-country linkers. Brazil is the largest emerging-market issuer.
- Use of inflation-linked bonds among the largest bond issuers is somewhat uneven. Whereas the market value of linkers exceeds that of nominal Treasury bonds in the relevant global government bond indices for Brazil, there are many countries among the world's largest economies that do not issue inflation-linked debt at all or use it very little (for example China, India, Russia and South Korea).
- The market weights of countries in inflation-indexed bond indices deviate substantially from their GDP weights. The UK, the US, Brazil and France are issuers whose share of the global linkers market significantly exceeds their share of world GDP. Conversely, China, Japan and Germany are three major countries whose weights in the index-linked bond indices are substantially below their share of world GDP. The timing of adoption and country-specific factors such as regulation seem to be behind these observed patterns.
- The linkers market appears to be less deep and offer less breadth for issuer diversification than the nominal bond market.
- There is substantial cross-country variation in important features of inflation-linked bonds, such as the reference price index, deflation protection and indexation lag. This may cause cross-sectional divergence in returns even under comparable economic scenarios.

1 The market structure of inflation-linked bonds

The inflation-linked market as we know it today took off in the early 1980s when the UK initiated its programme of indexed bonds. Many developed and emerging countries have followed suit over the years. While the market capitalisation of linkers has grown more rapidly than that of nominal bonds, as shown in Chart 1, real bonds still make up a relatively small share of the universe of fixed-income instruments.

Chart 1: Market value of nominal versus inflation-linked bonds



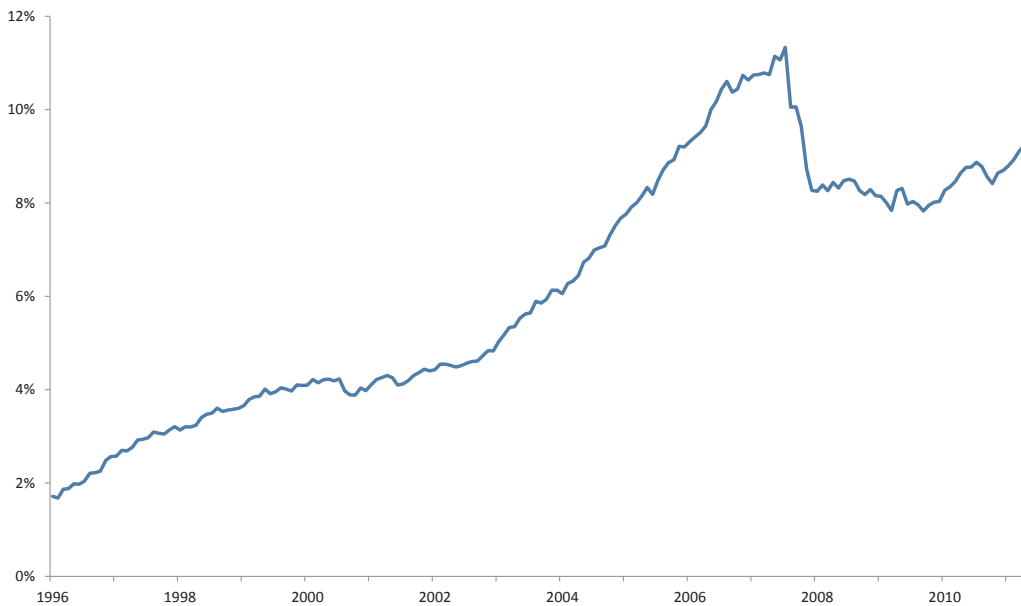
Source: Barclays

As at May 2012, the combined market capitalisation of developed- and emerging-markets inflation-linked bonds (represented by the Barclays WGILB and EMGILB respectively) is 2.4 trillion dollars. This is only about one-fifteenth of the market value of the Global Aggregate index, which captures developed-country investment-grade nominal bonds issued by sovereign and private entities.

Nominal government bonds are among the world's most liquid markets. Represented by the Barclays Global Treasury and Emerging Market Local Currency Government Universal indices, they have a total market capitalisation of nearly 24 trillion dollars as at May 2012. Nominal bonds issued by governments are therefore larger than the sovereign linkers market by a factor of ten.

While linkers' share of the total amount of government bonds outstanding (i.e. nominal and real) has on balance grown over the period between 1996 to 2012, as shown in Chart 2, it peaked on the eve of the credit crisis and has not yet recovered those peak levels. The discrepancy in the size of both markets means that the linkers markets are less deep and liquid than their nominal bond counterparts. In addition, the average issue size of 13 billion dollars for linkers compared to 17 billion dollars for nominal Treasuries suggests that large investors may find it more difficult to trade in real bonds than in nominal bonds. Trading liquidity in indexed debt can temporarily dry up, as experience following the bankruptcy of Lehman Brothers in the autumn of 2008 showed.

Chart 2: Linkers as a percentage of total government bonds

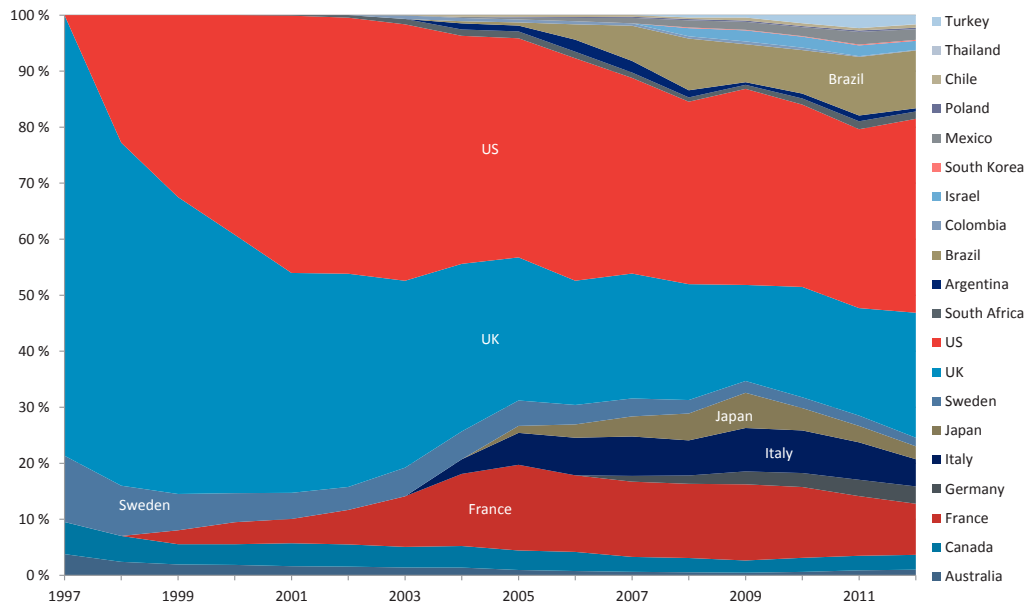


Source: Barclays

The uneven use of inflation-linked bonds among the largest bond issuers also leads to less market breadth by some measures. While 35 countries appear in the indices for nominal government bonds, only 20 countries are represented in the inflation-indexed indices. This is an improvement from the earlier days of the asset class, when the Barclays indices were first dominated by UK indexed debt and later USTIPS (see Chart 3). Until 2003 the British and US inflation-linked markets together made up at least three-quarters of the combined market value of developed and emerging-market linker indices. This issuer concentration was subsequently lessened by the entry of new countries and their relatively faster growth in market value outstanding.

Despite the increased issuer diversification in inflation-linked indices, indexed government debt remains somewhat more concentrated than the nominal bond markets. The largest four country issuers in the linkers universe – the US, the UK, Brazil and France – represent 79 percent of the market capitalisation. In the nominal Treasury market, the largest four issuers (Japan, the US, the UK and France) make up 67 percent of the market value outstanding. An alternative measure of concentration, the normalised Herfindahl-Hirschman index, confirms that the linkers universe is less diversified than its nominal counterpart.

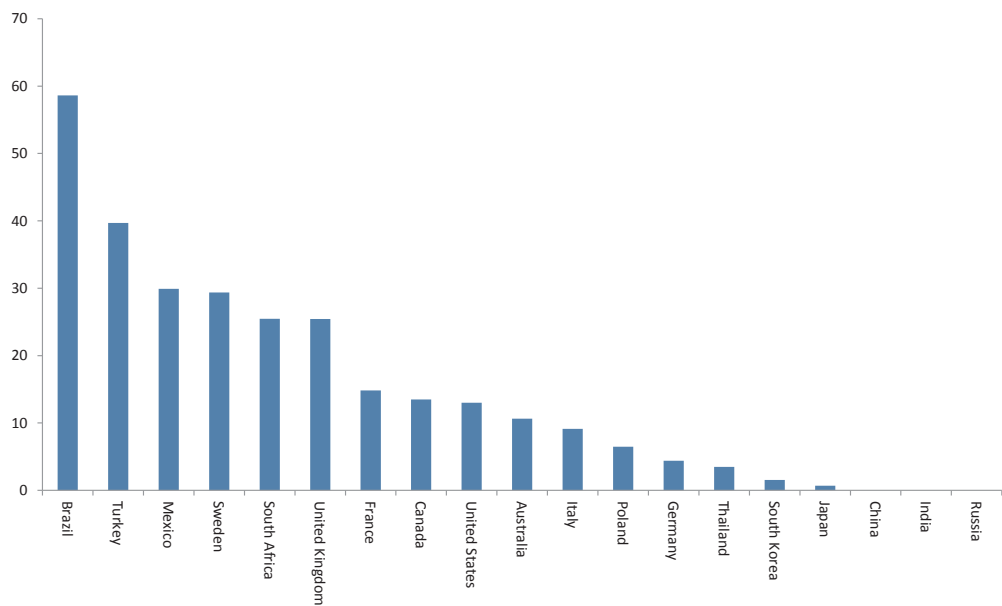
Chart 3: Share of country issuers in linkers indices



Source: Barclays

Linkers are an important part of some countries' government issuance programmes while they play no role in others. Whereas the market value of linkers exceeds that of nominal Treasury bonds in the relevant global government bond indices for Brazil, there are many countries among the world's largest economies that do not issue inflation-linked debt at all or use it very little (see Chart 4). For example, the other three BRIC economies (Russia, India and China) do not have any inflation-indexed bonds outstanding, while the share of linkers in South Korea and Japan is negligible relative to total public debt. Of the 19 countries shown in Chart 4, only five economies – Brazil, Turkey, Mexico, Sweden and the UK – have more than one-fifth of their debt outstanding (as represented in Barclays indices) in inflation-linked bonds.

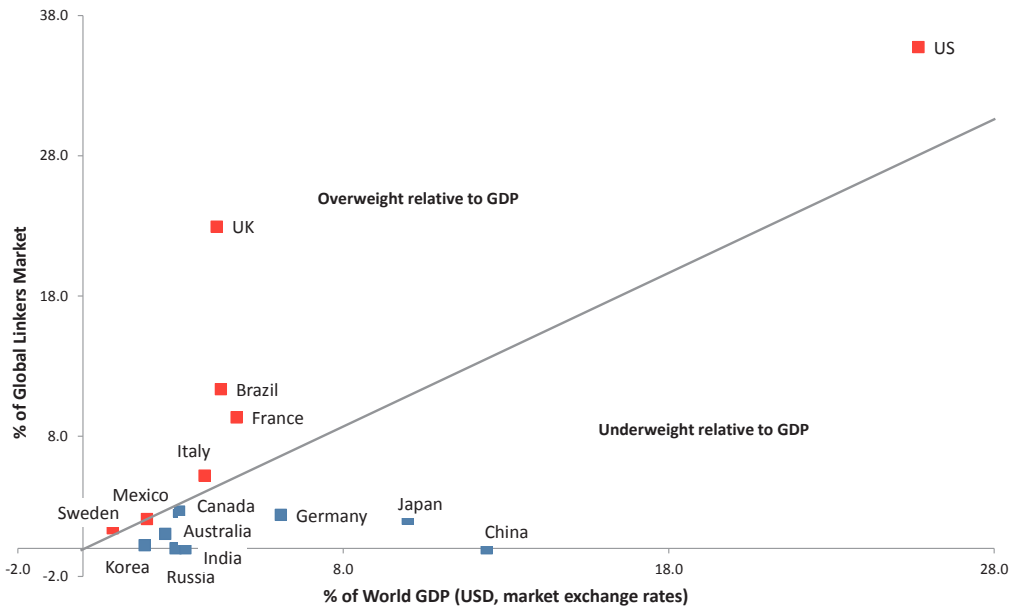
Chart 4: Share of linkers to total government bonds as represented in the Barclays indices



Source: Barclays

Finally, the market weights of countries in linkers indices deviate substantially from their GDP weights, as shown in Chart 5. Norges Bank (2011) argues that assigning weights to government bond issuers according to their GDP emphasises the production capacity of a country and may be better than weighting them according to their indebtedness, as is the case in market-weighted indices.

Chart 5: GDP weights versus share of global linkers market

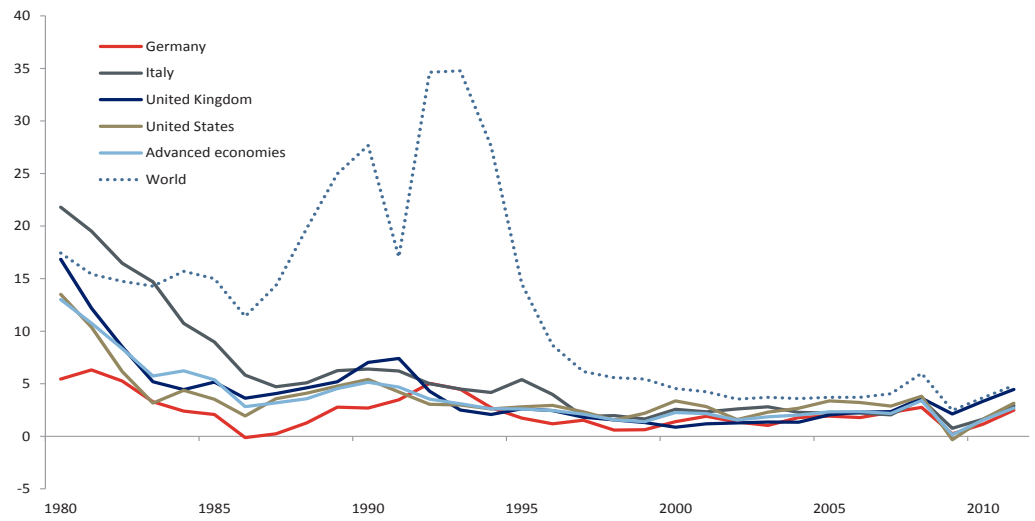


Source: Barclays, IMF (2012a)

In global inflation-linked markets, the weighting of country issuers additionally appears to be strongly influenced by historical precedence and country-specific factors. The UK, the US, Brazil and France are issuers whose share of the global linkers market significantly exceeds their share of world GDP. These are countries that have either been early in their adoption of index-linked bonds, particularly the UK and the US, or have a history of high inflation as in the case of Brazil. As will be discussed in Section 3, structural country-specific factors such as pension fund regulation may promote the establishment and growth in linkers markets. This arguably has played an important role in the development of the British inflation-linked market. Conversely, China, Japan and Germany are three major countries whose weight in the index-linked bond indices is substantially below their share of world GDP. Other important economies such as India, Russia and South Korea are entirely absent from the global linkers markets or have a negligible share of indexed debt indices.

If investors want to use inflation-linked indices to protect against unexpected changes in global inflation, as measured by a GDP-weighted average of country inflation rates, this divergence between countries' share of world GDP and their share of the linkers market represents a "basis risk." The concern is lessened somewhat by the observation that national inflation rates have become more correlated in the last 15 years or so. As shown in Chart 6, the dispersion between the selected advanced economies' inflation rates – Germany, Italy, the UK and the US – has narrowed significantly from the 1980s onwards and especially since the mid-1990s.

Chart 6: Inflation rates



Source: IMF

Even more striking is the convergence between the world inflation rate reported by the IMF, which includes all emerging and developing economies, and the inflation rate of advanced countries during the second half of the 1990s. If the tighter correlation of country inflation rates persists, broad representation of countries in the linkers market according to their economic weight may not be necessary to achieve a reasonable hedge against global inflation. Convergence and tight inflation correlation should not be taken for granted, however, as the experience of the late 1980s and 1990s shows when differences between high- and low-inflation countries widened dramatically. Economic representativeness and broad diversification are therefore still desirable but not yet the status quo in global linkers markets.

2 Global inflation-linked bond indices

The two most commonly used inflation-linked indices are the World Government Inflation-Linked Bond (WGILB) Index for the developed markets and the Emerging Markets Government Inflation-Linked Bond (EMGILB) Index for emerging markets, both provided by Barclays. As their names suggest, these indices contain sovereign debt only. Quasi-government and corporate bonds are not included.

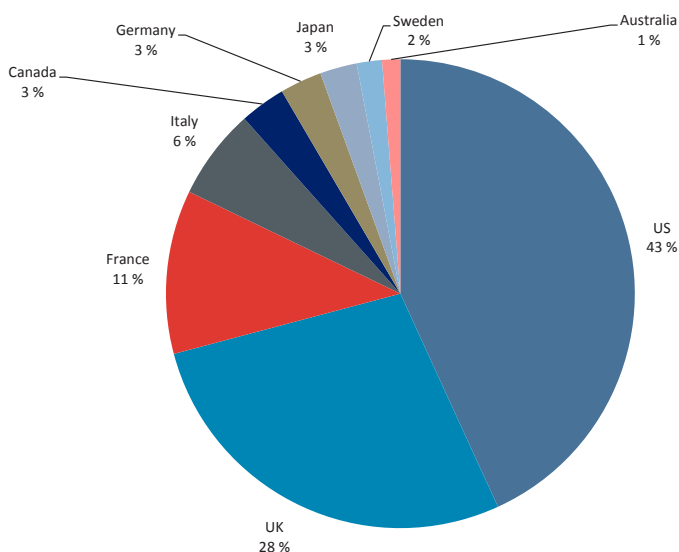
The Barclays Universal Government Inflation-Linked Bond Index (UGILB) combines the World and EM government bond indices. The UGILB includes inflation-linked government bonds from 20 countries: the US, the UK, France, Brazil, Italy, Japan, Canada, Sweden, Germany, Argentina, Mexico, South Africa, Australia, Turkey, Colombia, Chile, Poland, South Korea, Israel and Thailand.

2.1 WGBILB – Barclays World Government Inflation-Linked Bond Index

The WGILB measures the returns of the developed-country government linkers markets. The index is designed to include only those markets in which a global government inflation-linked fund is likely and able to invest. Markets currently included in the index are (in order of inclusion) the UK, Australia, Canada, Sweden, the US, France, Italy, Japan and Germany. To be included, a market must have aggregate issuance of 4 billion dollars or more and have a minimum rating of A3/A- for G7 and euro area issuers, Aa3/AA- otherwise, using the middle rating from Moody's, S&P and Fitch ("two out of three" rule). There are indices for each individual country and maturity bucket within each country. The index currently has a market capitalisation of more than 2 trillion dollars.

The Barclays Inflation-Linked Index family also includes several legacy benchmarks that were published by Lehman Brothers. Designated as "Series-L" these indices are available only for government linkers in developed markets¹. The Series-L equivalent of the WGILB, for example, is the Global Inflation-Linked Index. Although it covers most of the same markets as the World Government Inflation-Linked Bond Index (WGILB), there are some differences in index rules and conventions. For example, the "Series-L" version includes countries that have an investment-grade rating of at least BBB- (using the middle rating of Moody's, S&P and Fitch).

Chart 7: WGILB index by country



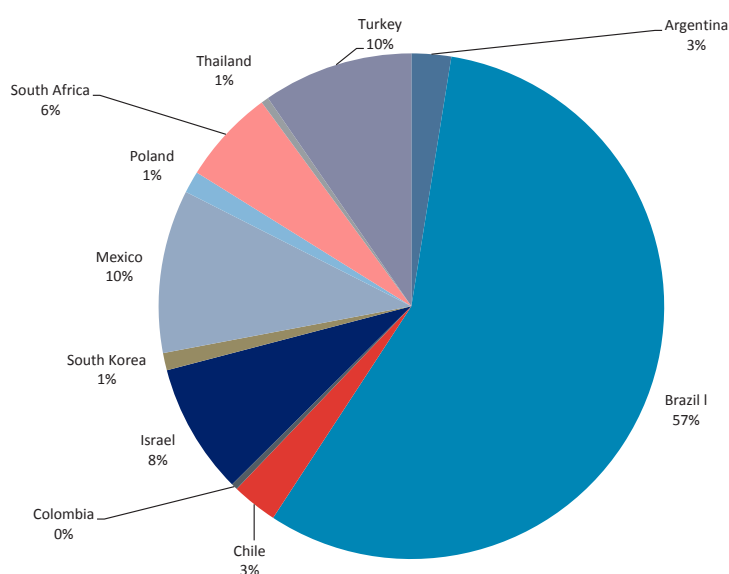
Source: Barclays, as at 14 May 2012

¹ The "Series-L" version is the benchmark for the linkers portfolio of the Government Pension Fund Global.

2.2 EMGILB – Barclays Emerging Markets Government Inflation-Linked Bond Index

The Barclays Emerging Markets Government Inflation-Linked Bond Index (EMGILB) captures the performance of inflation-linked bonds from the major emerging-market countries. The index was launched in October 2007, with daily index history backfilled to 31 December 2003. In terms of its geographic composition, the EMGILB is dominated by Latin American issuers which make up well in excess of two-thirds of the market value of the index (see Chart 8). Issuers of the EMEA region constitute more than a quarter and Asia-Pacific the remainder of the EMGILB. In contrast to its developed-country counterpart, more than 60 percent of the market capitalisation is in issues that have maturities of less than ten years. However, the duration of linkers tends to be longer than that of nominal government debt in both developed and emerging markets.

Chart 8: EMGILB by country



Source: Barclays, as at 14 May 2012

3 Security design and market structure

Investors in linkers must be aware that the market is more heterogeneous than the nominal government bond market in terms of security-specific features as well as supply/demand dynamics. First, we discuss idiosyncrasies in the security design of the major inflation-linked markets and their implications for investors. Subsequently, we provide a country-by-country description of the evolution of the main linkers markets, their investability, tax treatment, regulation and other factors affecting the supply/demand balance.

3.1 Heterogeneity of security design

Inflation-indexed markets exhibit greater cross-sectional variation in important features than is the case for nominal government bonds. This is illustrated in Table 2, which provides a schematic overview of the security design of the important developed-country linkers markets. The UK and Australia were the first two countries in the list to initiate issuance of inflation-indexed bonds, in 1981 and 1985 respectively. The UK and Australian linkers designed in the 1980s are different from (and arguably less intuitive than) Canadian-style linkers in the way that inflation is incorporated into the coupon payments.

In 1991, the Canadian Treasury pioneered the security structure that has since been copied by many issuers of inflation-linked bonds. The mechanics of Canadian-style linkers are illustrated in a simplified example in our separate discussion note entitled “Risks and Rewards of Inflation-Linked Bonds”. Nearly all the developed-country issuers, including the US, the euro area issuers, Sweden and Japan, follow the basic structure of Canadian inflation-indexed bonds. Before 2005, UK index-linked Gilts had an eight-month indexation lag and their cash flows were based on a formula only used in the UK. The British Treasury eventually switched to the Canadian model after 2005, but both the UK and Australia still have inflation-linked bonds outstanding that do not follow the Canadian model.

Despite some international standardisation due to the success of the Canadian-style security, some differences remain with regard to the reference index used, whether indexed bonds guarantee redemption at par, the indexation lag and coupon frequency.

Table 1: Security design and market structure of main developed-country linkers markets

Market	US		EMU			Sweden	Canada	Japan	UK		Australia
		France	Italy	Germany							
First issue date	1997	1998	2001	2003	2006	1994	1991	2004	2005	1981	1985
Reference index	US CPI-U	France CPI ex tobacco	EMU HICP ex tobacco	EMU HICP ex tobacco	EMU HICP ex tobacco	Sweden CPI	Canada CPI All Items	Japan Core CPI ex fresh food		UK RPI	Australia CPI
Security type				Canadian model					New Canadian style	Old-style linkers	Similar to UK old-style linkers
Floor	Minimum redemption at par (deflation protection from issuance date)								No floor		Minimum redemption at par
Lag				Three months						Eight months	Six months
Frequency	Semi-annual	Annual		Semi-annual	Annual				Semi-annual		Quarterly
Issues outstanding	33	5	7	9	4	6	6	16	13	6	5
Market value outstanding (\$ bn)*	871		228	126	58	35	64	51		559	25
Average maturity (years)*	9.2		9.2	10.7	6.2	8.6	21.8	4.6		21.8	10.2

Source: Barclays (2010), Deacon et al (2004), national treasuries and debt agencies.

*As at May 2012

Reference index

Inflation-linked bonds are usually referenced to a relevant domestic cost-of-living index. For example, US TIPS are indexed to the non-seasonally adjusted CPI for All Urban Consumers (the CPI-U).

Often, the reference index for linkers is also the inflation measure that is targeted by the respective central bank for its monetary policy. One notable exception is the UK, where indexed bonds are tied to the Retail Prices Index (RPI). The RPI differs from many other countries' consumer price indices as it is based on arithmetic rather than geometric aggregation. It has been argued that arithmetic aggregation produces a statistical upward bias because it does not take into account substitution of products by consumers as relative prices shift. Historically, the RPI has been somewhat higher due to the aggregation and composition effects than the UK CPI, which is the official inflation measure for the monetary policy framework of the Bank of England. However, since most UK pension fund liabilities are implicitly or explicitly linked to the RPI and it is expected to measure a higher rate of price inflation in the long run than the CPI, it may not be a disadvantage for investors.

Recently, the UK Office for National Statistics has looked into moving the calculation of RPI to geometric aggregation in line with CPI methodology (Johnson 2012). Due to the persistently higher rate of RPI inflation, such a change would probably be detrimental to the holders of UK inflation-linked bonds. Changes in the methodology for the reference index can be an additional risk to the holders of inflation-linked securities.

Another quirk in the use of reference indices is observed in the euro area where the so-called HICPx, the euro area Harmonised Index of Consumer Prices excluding tobacco, is the main reference index for sovereign inflation-linked bonds. For historical reasons, indexation to tobacco prices was not legal in France and the ex-tobacco index has been the relevant index ever since. Due to its low weight in the basket of goods and services, the omission of tobacco is fairly inconsequential. Currently, around three-quarters of tradable issues by face value are linked to it. The remainder are linked to domestic price indices, mostly the French and Italian CPIs.

Redemption floor

Some issuers, including the US and the euro area countries, equip their inflation-indexed bonds with a floor at maturity. These linkers guarantee redemption at par, i.e. even if there is price deflation in the reference index between issuance and maturity, the linkers will not pay less than par. When bought at issuance, linkers provide not only a hedge against inflation but also deflation insurance. UK and Japanese sovereign linkers, however, do not offer that guarantee and no such deflation protection exists. Securities of different issuers, where one offers the redemption floor and the other does not, can be expected to behave differently under a deflation scenario.

The redemption floor is effectively a put option that can be exercised by the bondholder. The value of that option is influenced by the evolution of the relevant price index from the time of issuance. With inflation and a rising consumer price index, the option moves “out of the money” and could ultimately become worthless. In such an environment, a recently issued inflation-linked bond of the same issuer is more attractive than a seasoned bond, even when all other things are equal, because the put option is at the money.

Indexation lag and coupon frequency

Canadian-style index-linked bonds usually operate with an indexation lag of three months. In other words, it takes three months from the incidence of price inflation (the month when a reference index reading is recorded) until it is incorporated into the coupon payment of the inflation-linked bond. This lag is eight months for old-style UK linkers and six months for Australian linkers.

Inflation-indexed bonds also differ in the frequency at which coupons are paid. France, Germany and Sweden pay annually. The US, the UK, Italy, Canada and Japan pay coupons semi-annually and Australian linkers pay on a quarterly basis.

The indexation lag and coupon frequency affect how well linkers compensate for contemporaneous inflation. The shorter the lag and the more often coupons are paid, the closer inflation-indexed debt is to that ideal of contemporaneous compensation.

In summary, differences between countries in the reference index used, the presence or absence of a redemption floor, the indexation lag and coupon frequency can cause inflation-linked bonds of different issuers (and even of the same issuer) to exhibit divergent return patterns even under comparable economic scenarios.

3.2 Structure of selected developed-country linkers markets

Investors should be aware of the different factors that affect demand and supply in the different national markets. The demand for relatively safe Treasuries, nominal and real alike, has risen in the aftermath of the 2007-2009 credit crisis due to heightened uncertainty and regulatory reforms, while the supply of such securities has declined (IMF 2012b). In addition, there are markets where there is strong structural demand for linkers in particular, and others where these instruments are used much more opportunistically. In the US and Japan, for example, there is no mandated structural demand and therefore hedge funds and other speculative market participants have been quite prominent in recent years. This resulted in the famous “flight to liquidity” from linkers into nominal bonds in the wake of the Lehman bankruptcy in 2008. Some European countries, in particular the UK, have very strong structural demand, driven by pension fund regulation. Because their pension liabilities are inflation-indexed, UK pension funds have a strong incentive to hedge inflation risk and real linker

yields are therefore generally low at long maturities. In euro area countries, there is some structural demand from Dutch pension funds and French savings account providers. Being unaware of these structural issues can leave investors blindsided by market developments. This section discusses the market evolution, structure and supply/demand issues in the major developed-country linkers markets.

3.2.1 US

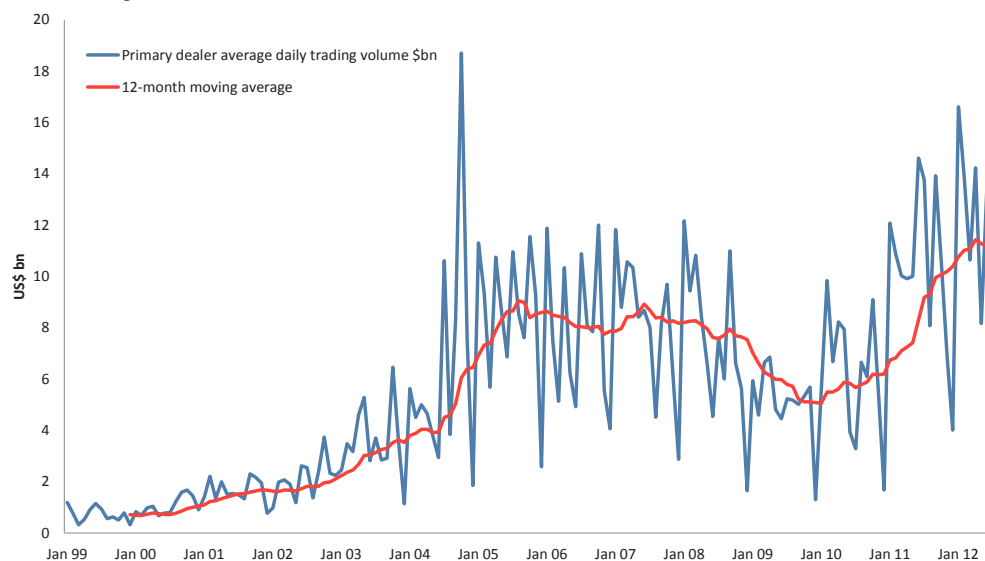
The US is by far the largest inflation-linked government debt market globally with a market value outstanding of 871 billion dollars, a 43 percent share of the Barclays WGILB index and a 35 percent share of the UGILB as at May 2012. US Treasury inflation-linked bonds, commonly known as TIPS, were first issued in 1997 with the aim of broadening its investor base, diversifying its debt service costs and creating liabilities that are more closely aligned with tax revenues.

TIPS are issued with 5-, 10- and 30-year maturities. Like most major inflation-linked markets, TIPS are structured according to the Canadian model. The reference price index is the non-seasonally adjusted CPI-U and the indexation lag is three months. TIPS come with a floor on the principal at maturity so the investor is protected from deflation from issue date to maturity. Deflation in the intermediate term, however, may still hurt the investor.

Despite the global benchmark role of US TIPS, structural demand from pension funds and institutional investors has not been as strong as in Western Europe. In addition, the inflation escalation of principal is taxable as income on an annual basis in the US, even if the cash flow compensation for realised inflation on the principal does not occur until maturity. For investors that are not tax-exempt, such as insurance companies and individual investors, this “phantom inflation tax” may render ownership of TIPS unattractive.

When they first were issued in 1997, the number of market participants was small and TIPS were mainly used opportunistically. Consequently, trading volumes tended to be thin and the beta of real with respect to nominal bonds was low. The relatively high real yield of TIPS in the early years could arguably be attributed to a substantial liquidity premium over conventional Treasuries. 2004 represented a turning point as demand for indexed bonds increased and the US Treasury responded by issuing nearly as many TIPS that year as it did in the previous three. As Chart 8 shows, trading activity also picked up significantly, although speculative and tactical investors such as hedge funds contributed as much as half of TIPS market flows on the eve of the financial crisis in 2008 (Barclays 2010).

Chart 9: Trading volumes recover after the financial crisis



Source: Federal Reserve Bank of New York

The aftermath of Lehman Brothers' bankruptcy in September 2008 marked another milestone in the development of the market. Due to a "flight to liquidity" caused by the deleveraging of hedge funds and the unwinding of their positions in linkers, the yield spread between nominal Treasuries and equivalent indexed bonds narrowed substantially and linkers underperformed spectacularly vis-à-vis nominal bonds. The liquidity risk that an investor in linkers is exposed to relative to conventional government bonds had materialised, as signified by the drop in primary dealer trading volumes in late 2008 and 2009², and altered the composition of market participants in USTIPS. Longer-term investors such as pension funds and insurance companies took up some of the positions that were unwound by hedge funds to build strategic exposure to inflation-linked bonds. Later, after the acute phase of the crisis had passed but concerns over the unconventional monetary policy measures began to emerge, foreign central banks and sovereign wealth funds increased their interest in USTIPS as a de-facto currency hedge.

3.2.2 UK

Having pioneered the modern linkers markets in the early 1980s, the UK is still the second-largest sovereign inflation-indexed market in the world. An ongoing commitment from the Treasury and healthy demand from long-term investors have seen the market grow to 559 billion dollars by market capitalisation as at May 2012. The UK market in particular is characterised by idiosyncrasies in security design, choice of inflation index and demand dynamics that are worth discussing.

There are two types of UK inflation-linked Gilts. Before 2005, Gilts with an eight-month indexation lag were issued whose cash flows were based on a formula only used in the UK.³ From 2005 onwards, the UK Treasury switched to Canadian-style linkers with a three-month indexation lag. The new-style issues are almost identical in design to USTIPS and pay semi-annual coupons. The only difference is that, unlike TIPS, they have no deflation floor (they can be redeemed below par if the price index falls over the lifetime of the bond).

UK inflation-linked bonds are tied to the Retail Prices Index (RPI). The RPI differs from many other countries' consumer price indices as it is based on arithmetic rather than geometric aggregation. Arithmetic aggregation produces a statistical upward bias, often referred to as the "formula effect". The UK also publishes an alternative inflation index based on geometric aggregation, the CPI, which is a harmonised index of consumer prices that employs Eurostat's HICP principles. Apart from aggregation methodology, the composition of the RPI and CPI also differ in their treatment of owner-occupied housing costs. While around 17 percent of the weight of the RPI is linked to house price elements, those are not included in the CPI.

Historically, RPI inflation has tended to be slightly higher than CPI inflation. Estimates by the Bank of England put the sum of the formula and the composition effect at 0.75 percent. Over the long run, RPI inflation is expected to exceed CPI inflation by that amount due to the aggregation method and housing costs escalating at a higher rate than general prices. Although the RPI was the main measure of UK headline inflation for over 50 years, it was never formally adopted as a target of monetary policy. Instead, the Bank of England chose the CPI as the metric for its inflation targeting framework in December 2003. Whereas monetary policy is now focused on CPI inflation, the UK inflation-linked market is still almost exclusively linked to the RPI. This could be a concern for investors in indexed debt. However, since most pension fund liabilities are implicitly or explicitly linked to the RPI and it is expected to measure a higher rate of price inflation in the long run than the CPI, it may be an advantage for investors.

Pension fund regulation and corporate accounting standards have contributed to strong structural demand for long-term bonds in general and linkers in particular. The UK has been at the forefront of a global development towards marking-to-market the assets and liabilities of pension schemes, resulting in greater transparency of their funding status. Hence, occupational defined-benefit schemes in Britain have been under close scrutiny from the regulator and under pressure to make good any

2 Fleming and Krishnan (2009) find that trading activity and the prevalence of quotes are better measures of TIPS liquidity than bid-ask spreads.

3 Due to the complexity of the UK method, a full discussion of yield and return calculations is beyond the scope of this note, but details can be found at <http://www.dmo.gov.uk/documentview.aspx?docname=/giltsmarket/formulae/yldeqns.pdf>

funding gaps. It is likely that some of the regulatory pressure provided incentives for pension funds to extend maturities in their bond portfolios in order to reduce the duration mismatch between assets and liabilities, and hedge inflation-linked liabilities by buying indexed debt. Given the relatively limited supply of conventional and index-linked government bonds maturing in more than ten years, this demand has probably depressed market interest rates at the long end of the maturity spectrum.

UK Gilt linkers also enjoy a more favourable tax treatment than UK corporate or international government bond issues. The idea behind the tax relief granted is that investors are only taxed on their real return, not on inflation compensation. In effect, this means that the increase in principal due to inflation is not taxable.

All in all, the pioneering work of the UK Treasury has combined with regulatory and tax factors to create one of the most highly developed linkers markets in the world.

3.2.3 Euro area

France, Italy and Germany are the main issuers of sovereign inflation-linked bonds in the euro area. Growing issuance by sovereign and corporate borrowers and enhanced availability of different maturities have contributed to an improvement in the liquidity of the euro area inflation-linked bond market. With a combined market value of inflation-linked bonds outstanding at 427 billion dollars as at May 2012, the three large euro area issuers are slightly smaller than the UK market.

The so-called HICPx, the euro area Harmonised Index of Consumer Prices excluding tobacco, is the main reference index for sovereign inflation-linked bonds in the single currency area. The HICPx is a weighted average of the individual euro area countries' harmonised price indices. As at the end of 2011, around three-quarters of tradable issues by face value were linked to it. The headline all-items HICP Index, also known as the MUICP or Monetary Union Index of Consumer Prices, is the main inflation reference for monetary policy for the European Central Bank (ECB). The ECB has a mandate to maintain price stability, which has been defined by the ECB as a level of MUICP inflation close to but below 2 percent. As French and Italian inflation-linked bonds use the HICP excluding tobacco for legal and historical reasons (indexation to tobacco prices was banned in France), the HICPx has become the standard reference for both bonds and swaps in the euro area.

The structural demand for inflation-linked bonds from institutional investors in the euro area is significant, albeit not as strong as in the UK. The largest potential for inflation protection demand is in the Netherlands, given the size of Dutch defined-benefit pension schemes. Indexation of pension liabilities is usually to domestic or sectoral wage inflation, for which no one-to-one hedge exists. Given the liquidity of the euro HICPx market and the absence of any other suitable alternative, pension funds have often reverted to using inflation-linked government bonds to hedge their wage inflation risk.

France

France initiated the index-linked market in the euro area with an issue linked to the French CPI ex-tobacco in 1998 and launched its first bonds linked to the euro HICPx in 2001. France adopted the Canadian methodology for its linkers, but like the US, it included a deflation floor.

France was overtaken by Italy as the largest issuer of linkers in the euro area in the mid-2000s, but has regained its status as the top euro area inflation-indexed market, with real bonds outstanding at a market value of 228 billion dollars as at May 2012.

Notably, France has a sizeable share of linkers that are indexed to domestic French inflation (FRCPIx), which has largely been driven by the decision to partially link the remuneration rate on Livret A savings accounts to the FRCPIx inflation rate. In recent years, however, the once strong formulaic association between the Livret A rate and French inflation was relaxed and hedging demand in domestic inflation reduced.

Italy

Italy issued its first inflation-linked BTP€i in 2003, indexed to the euro HICPx. As with nominal Italian government bonds, a BTP€i pays its coupon semi-annually. Italy chose the same inflation index as France mainly for market convenience, as it is the index most widely used in euro real bonds and

inflation swaps. The Italian linker market is currently the second-largest in the euro area with 126 billion dollars in market value outstanding as at May 2012.

Germany

As the benchmark issuer of nominal government bonds in the euro area, the debut of Germany in the inflation-linked market was eagerly awaited. The German finance ministry announced its intention to issue euro HICPx-linked bonds in November 2004, but it was not until March 2006 that the initial bond was launched. Since then, new inflation-linked bonds have been issued regularly. German linkers follow the Canadian model and are in structure very similar to the French OATie. As at May 2012, the market value of German inflation-linked bonds outstanding has reached 58 billion dollars.

3.2.4 Other developed-country markets

Other developed-country linkers markets make up a little less than 10 percent of the market value of the World Government Inflation-Indexed Bond Index. Among these, Canada and Japan are the largest, followed by Sweden and Australia.

Canada

Canadian Real Return Bonds (RRBs) were first issued by the Canadian government in 1991. Issuance has always been concentrated in the 30-year sector to meet pension fund demand. Canadian RRBs are indexed against the All Items Consumer Price Index. The Canadian authorities pioneered the security structure that has since been copied by many issuers of inflation-linked bonds. The market value outstanding of Canadian Real Return Bonds is 64 billion dollars as at May 2012.

Japan

Japan has been issuing inflation-linked government bonds (JGBi) since 2004. Japanese linkers pay semi-annual coupons, like nominal JGB. The reference index is the Japanese CPI excluding fresh foods, with an indexation lag of three months. Similar to UK Gilts, JGBi do not have a principal floor at par, i.e. there is no deflation protection for the term of the bonds.

By late 2008, the market value outstanding had nearly reached 100 billion dollars. However, the global financial market crisis laid bare the unbalanced ownership of JGBi, which was heavily tilted toward foreign leveraged investors. Lack of demand following the turmoil in the autumn of 2008 forced a suspension of the programme.

The Ministry of Finance subsequently tried to absorb excess supply from the secondary market via buyback auctions. Forty per cent of JGBi originally issued were retired by the end of 2009. In May 2012, the market value outstanding had declined from the peak to 51 billion dollars.

Sweden

The Swedish authorities have been issuing inflation-linked bonds since 1994 and target a 25 percent share of indexed bonds relative to central government debt. Swedish inflation-linked bonds are referenced to the domestic CPI, a chain-weighted index. Calculations for Swedish linkers are slightly more complex than for those markets which employ the standard Canadian model. As at May 2012, the market value of Swedish inflation-linked bonds outstanding is 35 billion dollars. Insurance companies own the majority of that market, as a hedge against real liabilities.

Australia

The Australian government issued inflation-linked bonds (commonly called Treasury Indexed Bonds, TIB) between 1985 and 2003. The reference index for Australian inflation-linked government bonds is the Australian CPI and they are similar in structure to old-style UK linkers. In 2003, Australia suspended the TIB programme due to ongoing budget surpluses. In 2009, however, issuance resumed, and the size of the market reached 25 billion dollars by May 2012.

3.3 Emerging markets

Emerging-market linkers have grown 25-fold since the inception of the Barclays EMGILB in 2003 and reached a market capitalisation of 486 billion dollars by May 2012, about one-quarter of the value of developed-country linkers markets.

Brazil is by far the largest issuer of inflation-linked bonds in the emerging markets, making up 57 percent of the EMGILB as at May 2012. The country has been issuing inflation-linked bonds since 1964. After having been the most important form of local-currency debt through hyperinflation periods, indexed bonds fell to a small share of national debt by 2003. Since then, the country has sought to increase linker issuance to replace floating and foreign-currency debt. Currently, Brazil is the fourth-largest issuer globally after the US, the UK and France.

In Table 2, we summarise the security design of the main emerging inflation-indexed markets represented in the Barclays EMGILB. According to HSBC (2011), the prospects for further issuance appear to be good, as demand for inflation-linked bonds in emerging markets is likely to be driven by the needs of domestic institutions such as pension funds for diversification and hedging. Due to better growth prospects, inflation pressures in emerging markets may be higher than in developed countries as well, making inflation protection particularly relevant.

In addition to the countries represented in the EMGILB, Hong Kong started an inflation-linked issuance programme in 2011. India recently announced its intention to issue inflation-linked debt.

Table 2: Overview of emerging linker markets (May 2012)

Country	Brazil	Mexico	Argentina	Chile	Colombia	Israel	South Africa	Turkey	Poland	South Korea	Thailand
No of bonds outstanding	12	9	5	19	3	11	5	10	2	3	3
First issue date in current format	May-00	May-96	Dec-03	Sep-02	Oct-02	Jun-06	Mar-00	Feb-07	Sep-03	Feb-07	Jul-11
Reference index	IPCA, IGPM	Unidas de Inversion (UDI)	CER Consumer Price Index	UF Consumer Price Index	UVR Consumer Price Index	Israel CPI	South Africa CPI NSA	Turkish CPI	Polish CPI	Korean CPI	Thailand CPI
Floor	No floor	No floor	No floor	No floor	No floor	Coupon and principal par floor (galils), no floor (ILCPI)	Par floor	Par floor	Par floor	No floor	No floor
Indexation lag	Up to 4 weeks, includes forecast	Up to 2 weeks	T-5, T-10 to AC-ERER Index	1 month to 9th of month	1 month to 15th of month	Up to 1.5 months, adjusted on inflation release	3-4 months	2-3 months	2-3 months	2-3 months	2-3 months
Coupon frequency	Semi-annual	Semi-annual	Monthly or semi-annual	Semi-annual	Monthly	Annual	Semi-annual	Semi-annual	Annual	Semi-annual	Semi-annual

Source: Barclays (2012), national treasuries and debt agencies

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