What Is the Role of Inflation-Linked Bonds for Sovereigns?

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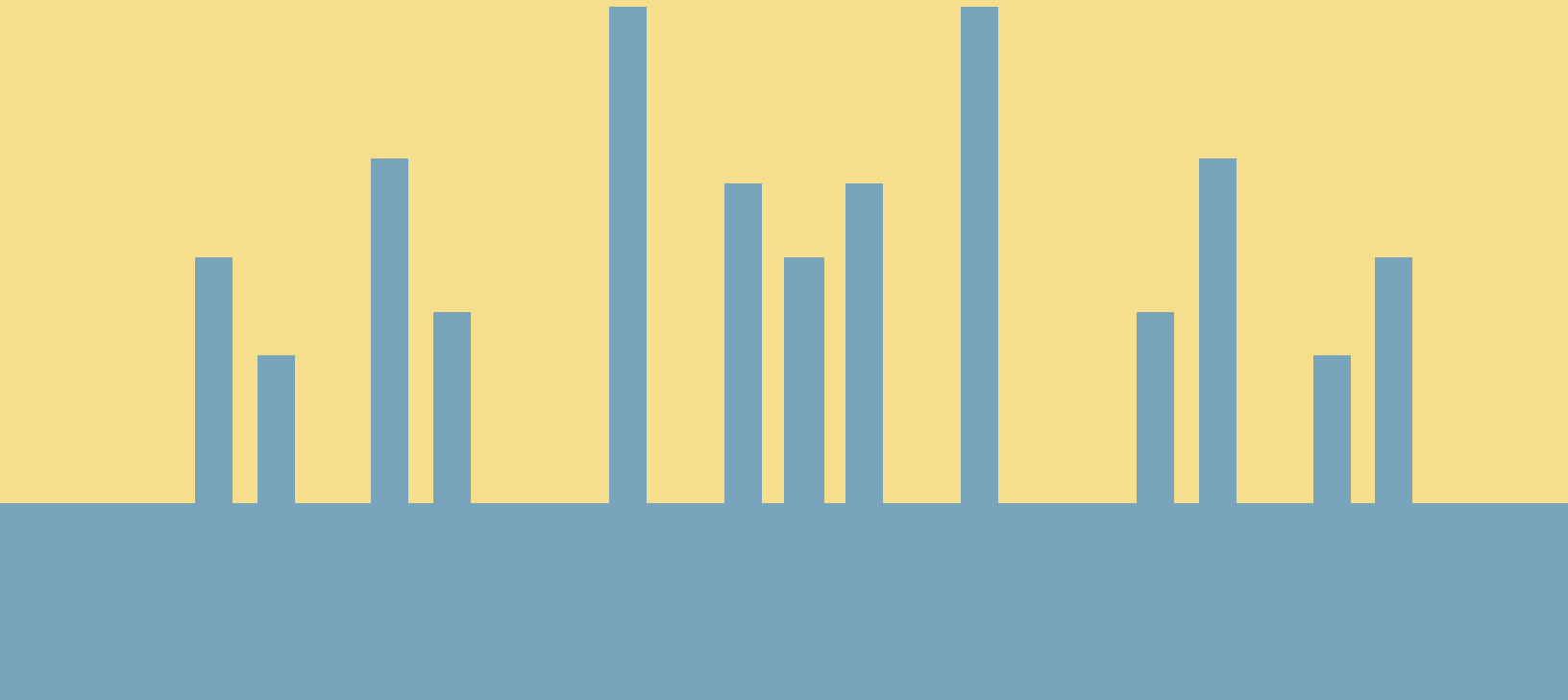

Abstract

The past two decades have seen a rising global trend in issuing sovereign inflation-linked bonds (ILBs) in both advanced and emerging economies. Despite this increase, the share of ILBs globally remains low compared to conventional bonds, and many debt management offices in emerging markets have stuck to issuing conventional bonds only.

The decision on whether to issue ILBs seems harder for emerging economies because, among other reasons, of the constraints imposed by the breadth and depth of their domestic capital markets. This paper discusses the role ILBs may play in designing and implementing government debt management strategies. More precisely, we look at the potential for ILBs to improve the cost-risk profiles of government debt portfolios and the implications of their use for the development of the domestic debt market.

While evidence on the cost-effectiveness of ILBs is mixed, there seems to be broad agreement that they do contribute to improving the portfolio risk profile. Indeed, many emerging market DMOs have used ILBs to lengthen the debt portfolio ATM, smooth its maturity profile, and replace FX-linked and FX-denominated securities. Not least important, the instrument's design (cashflow structure, choice of index, etc.) and its implementation (placement process) are also critical for its success.

Keywords: public debt management, inflation-linked bonds, debt management strategy

JEL classification: H63, H68

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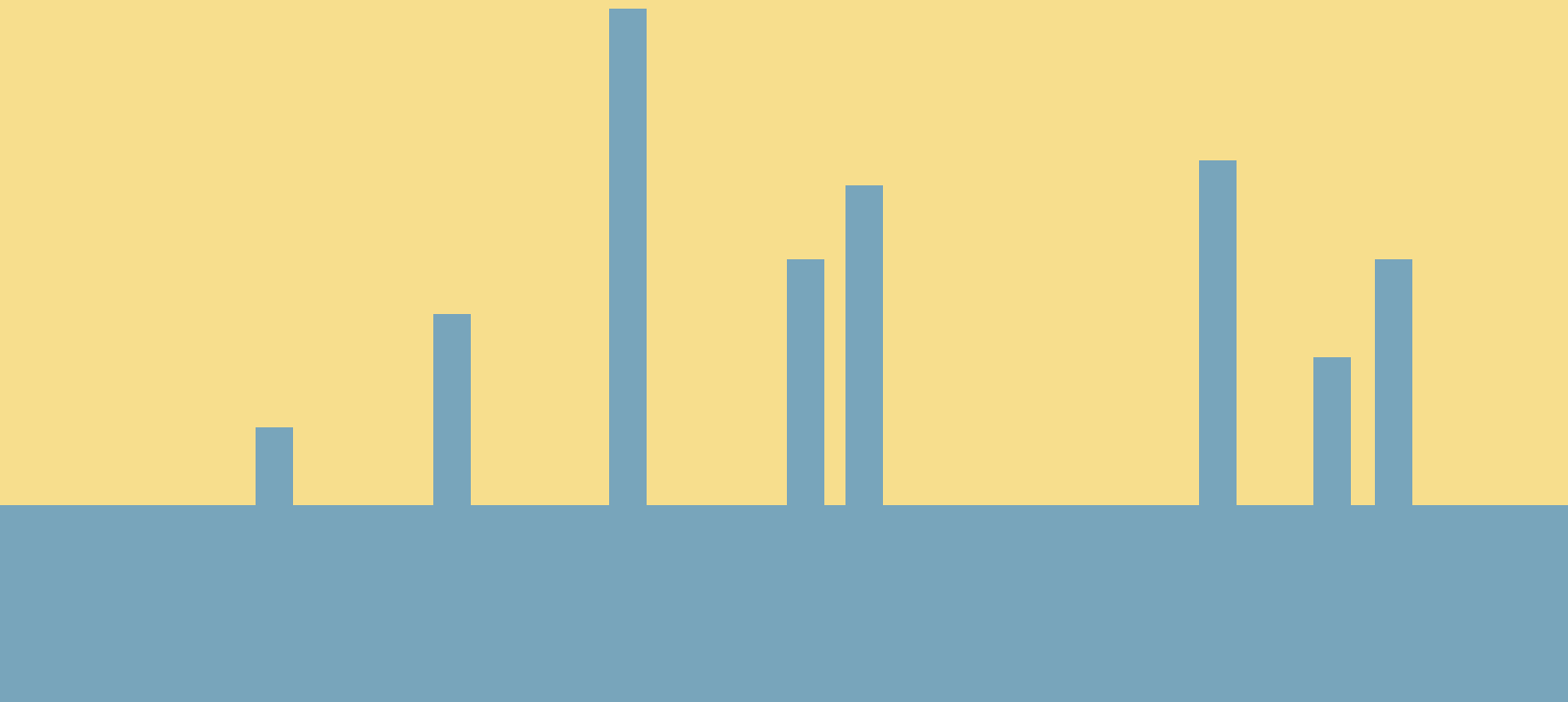

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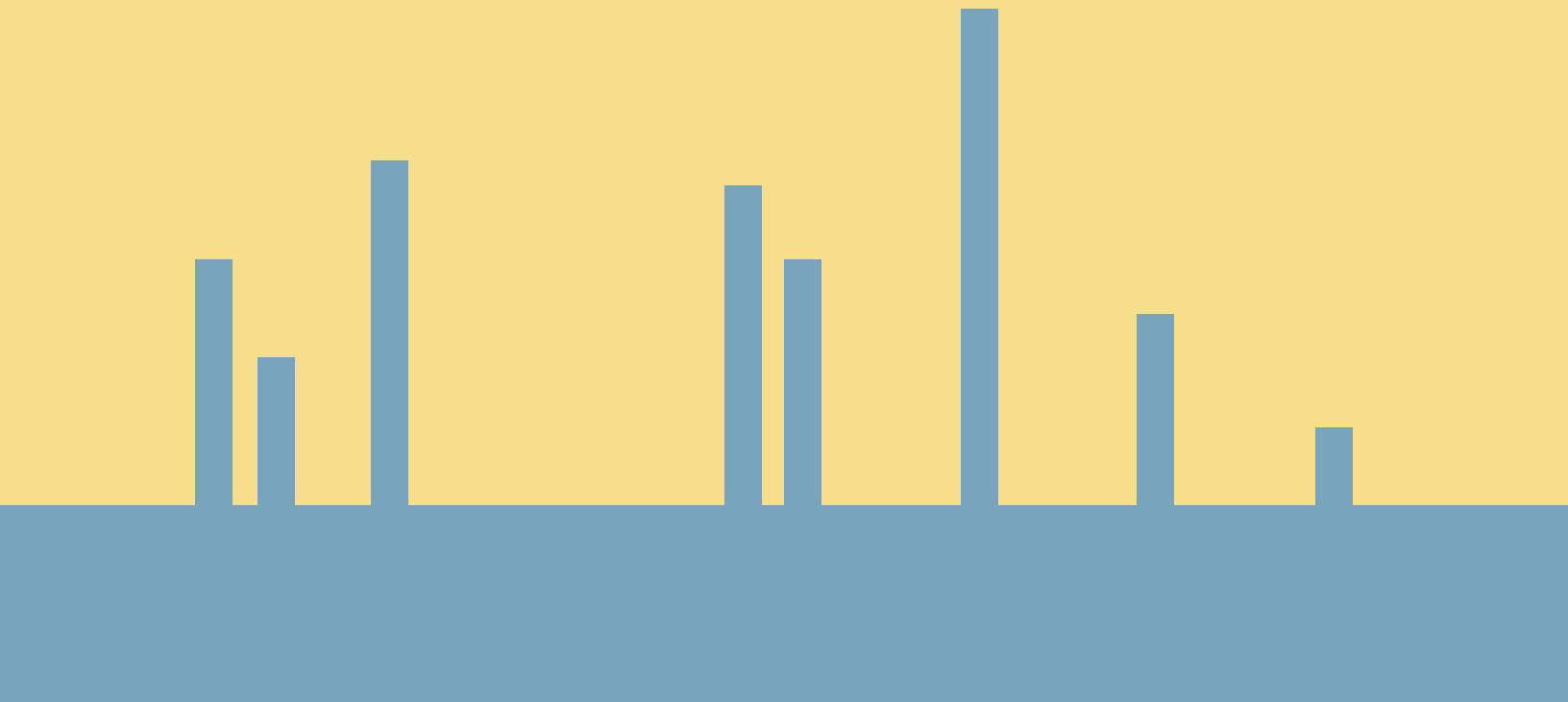
Abbreviations

ABP	Annual borrowing plan
ALM	Asset and liability management
ATM	Average time to maturity
BISL	Bloomberg Barclays Benchmark Indices
CIB	Capital indexed bond
CPI	Consumer price index
DMO	Debt management office
DMS	Debt management strategy
ECB	European Central Bank
ECI	Employment cost index
EMGBI	FTSE Emerging Markets Government Bond Index
EMGILB	Emerging Markets Government Inflation-Linked Bond Index
EUR	Euros
FX	Foreign currency
GBI-EM	JPMorgan Government Bond Index-Emerging Markets
GDP	Gross domestic product
HICP	Harmonized Index of Consumer Prices
IIB	Interest indexed bond
ILB	Inflation-linked bond
IMF	International Monetary Fund
IRR	Internal rate of return
JPY	Japanese yen
LIBOR	London Interbank Offered Rate
LPI	Limited price indexation
NZDM	New Zealand Debt Management Office
RPI	Retail Price Index (UK)
RPIX	Retail Price Index, excluding mortgage interest payments
TIPS	Treasury Inflation-Protected Securities
UGILB	Universal Government Inflation-Linked Bond Index
USD	U.S. dollars
WGBI	World Government Bond Index
WGILB	World Government Inflation-Linked Bond Index



1

Introduction

The past two decades have seen a rising global trend in the issuance of sovereign inflation-linked bonds (ILBs), accompanied, in both advanced and emerging economies, by the development of inflation derivatives. Despite this increase, the share of ILBs globally remains low compared to that of conventional bonds, and many debt management offices (DMOs) in emerging markets have stuck to issuing conventional bonds only.

The decision on whether to issue ILBs seems harder for emerging economies because, among other reasons, of the constraints imposed by the breadth and depth of their domestic capital markets. This paper discusses the role ILBs may play in the design and implementation of government debt management strategies. More precisely, we look at the potential for ILBs to improve the cost-risk profiles of government debt portfolios and the implications of their use for the development of the domestic debt market.

From the cost perspective, ILBs can lower the financing costs if the inflation premium of conventional bonds exceeds the liquidity premium of the ILBs; this seems to be the case with some DMOs in advanced economies that consider ILBs a cheap source of financing. Emerging markets with underdeveloped savings industries and/or limited borrowing requirements, however, may find that introducing ILBs further fragments the domestic debt market, driving up the liquidity premia for both ILBs and conventional securities and increasing the government funding costs.

Medium- and long-term ILBs permit governments to lengthen the debt's average maturity and allow for the substitution of riskier debt instruments, such as foreign currency (FX) linked securities or short-term local currency bonds, helping to reduce market and refinancing risks. On the other hand, economies prone to supply shocks may find that ILBs increase the debt service at times when the economy stagnates, worsening the government's financial position.

Overall, the impact of ILBs on cost and risk is best analyzed following the same process undertaken by DMOs when they prepare strategies for managing the government debt—that is, by using analytical models to simulate principal and interest cash flows under carefully selected market and macro scenarios.

The impact on broad market development is the second perspective from which debt managers need to judge whether introducing ILBs is appropriate. ILBs may contribute to a more complete financial market, since they are the only asset offering full hedge against the risk of unanticipated inflation. Another positive spillover is the setting up of a benchmark for mortgage lenders and utility providers who require a reference rate for pricing and hedging their products. ILBs can also mobilize savings that would otherwise go into real assets as the closest safe-haven alternative against inflation. Of course, these advantages may never materialize if ILBs remain isolated and illiquid, provide no useful estimate of inflation, or fail to attract interest from the private sector.

ILBs may prove a good idea from both the cost-risk and market development perspectives, but, as with any debt management strategy, the materialization of the plan requires careful implementation. A proper ILB design could attract investors, but if the choice of tenor, the architecture of the cash flows, or the selected index fail to meet their expectations, they will probably walk away uninterested. Similarly, while a clear policy for the issuance and maintenance of benchmarks could go a long way toward mitigating the natural illiquidity of the instrument,

unpredictable issuance, scattered around many securities with small volumes, would most likely kill the potential development of a secondary market.

Among implementation issues, DMOs in emerging markets have identified the incorporation in market indices as a key factor for the successful marketing of local currency securities with local and foreign investors. We argue that such incorporation is even more important for ILBs because of their consubstantial "illiquidity." Given the limits imposed by the level of borrowing and the size of the domestic emerging markets, the potential inclusion in market indices affects the size and number of ILB lines they may contemplate issuing.

DMOs differ in their debt portfolio, market, and macroeconomic conditions, which calls for specific approaches when handling ILBs. These differences exist not only between but within advanced and emerging economies (see Norges Bank 2012). While ILBs—also known as linkers—in advanced economies have generally long tenors, some emerging markets, such as Israel and Uruguay, issue them across the entire yield curve. Syndication, which is a common offering method for ILBs in the United Kingdom and continental Europe, is not used in Canada or the United States. While Brazil and the UK use a single-price format for ILB auctions, Israel uses multiple prices, the same as for conventional bonds.

Lastly, ILBs may not be suitable for all DMOs. Many developing countries find it difficult to issue linkers because they lack pension fund industries or because their domestic markets are still too small and already fragmented. Besides, the use of cash accounting can make budget expenditures very volatile in years of large ILB redemptions.

This paper aims to support sovereign debt managers in their decisions on whether to issue ILBs. We begin by describing the evolution of ILBs since they began to be used by both emerging and developed countries (section 2). Next, we compare the main characteristics of ILBs to those of conventional bonds and discuss their cash flow structure, price indices, and breakeven inflation (section 3). Section 4 answers the question of whether an emerging market DMO should issue ILBs from the standpoint of whether they fit with the DMO's debt management strategy. Section 5 addresses the key decisions around implementing a linkers program, such as those concerning instrument design and placement, while inclusion in investment indices is discussed in section 6. Finally, section 7 presents some case studies on sovereigns that issue ILBs, and final remarks are laid out in section 8.

2

Evolution of ILBs

According to the literature, the first inflation-linked bonds were issued by the Commonwealth of Massachusetts in 1780 during the American Revolution. Unable to raise taxes to finance the war, the commonwealth issued paper money that rapidly lost its purchasing power and the confidence of the holders. Soldiers, paid in local currency, quickly realized that the real pay was much smaller than promised, which strongly discouraged them and others from serving in the army. To address the disincentive, the Massachusetts legislature approved paying the soldiers with "depreciation bonds," whose value was linked to a basket of goods that included corn (5 bushels), beef (68 pounds), sheep wool (10 pounds), and sole leather (16 pounds). Because of the excessive money printing by the government, the state's inflation index went from 4 percent in 1777 to 130 percent in 1780, a 32-fold increase, but the ILBs compensated the soldiers for the dramatic loss of purchasing power in those years.[1]

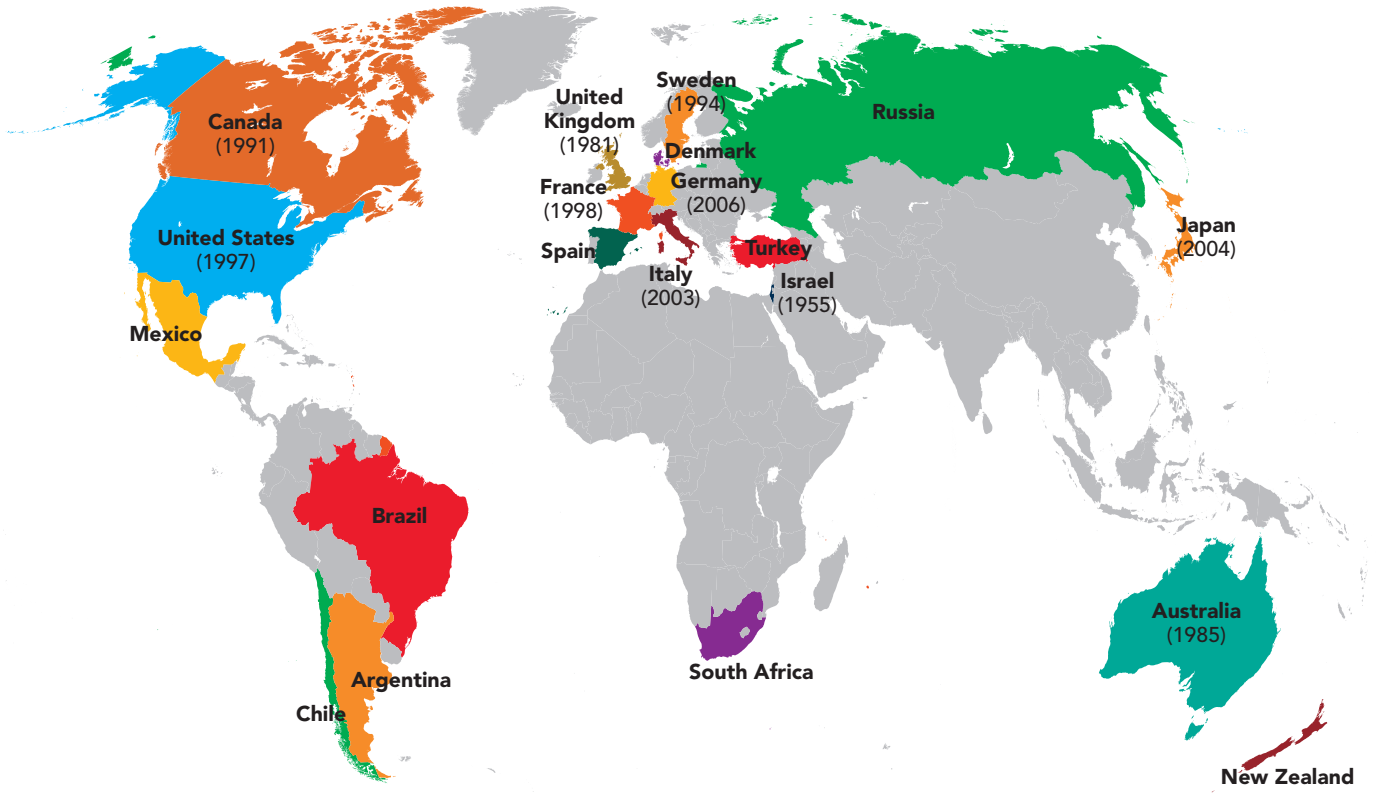
The use of ILBs by governments as a regular debt instrument, however, had to wait for nearly two centuries to become a reality. In the early 1980s, the United Kingdom became the first developed country to issue ILBs, followed by Australia (1985), Canada (1991), Sweden (1994), and other European countries in the early 2000s. The United States, which introduced Treasury Inflation-Protected Securities (TIPS) only in 1997, turned out to be the largest issuer of these instruments, followed by the United Kingdom.

In the UK, the introduction of ILBs was associated with the high inflation of the 1970s and the early '80s. Afterwards, with the steady reduction of inflation, the motivation shifted to satisfying the demand from pension funds, the main investor class at that point. Since their introduction in 1981, the share of ILBs has increased steadily to about a fifth of the total outstanding debt (not including the inflation uplift), and every year the UK DMO issues about a fifth of the borrowing needs using these instruments. The United States, on the other hand, introduced ILBs at a time when inflation was well under control, probably aiming to (1) offer a hedge to investors, (2) provide a measure of expected inflation, and (3) introduce an instrument of self-discipline to guard against a lax fiscal stance. The share of ILBs in the United States has since steadily increased to reach about 9 percent of the marketable outstanding debt.

Not surprisingly, ILBs were issued in emerging markets much earlier than in advanced economies. Israel was the first emerging market country to issue ILBs in 1955, and Chile came in right after, in 1956. Both struggled at that time with stubborn and high inflation, making ILBs the only alternative to fund the government budget in local currency at medium-term tenors. Brazil and Colombia launched ILBs in the 1960s and Mexico, South Africa, and Turkey before the turn of the century. At the time they introduced them, the emerging market issuers were experiencing high and volatile inflation or were adopting large stabilization programs to bring it under control. Accordingly, the common driver for launching ILBs in emerging markets was the need to find a funding instrument that was neither denominated in foreign currency nor issued at a very short tenor. Map 2.1 shows 20 countries currently issuing ILBs.

[1] For an excellent overview of this episode, see Shiller (2003).

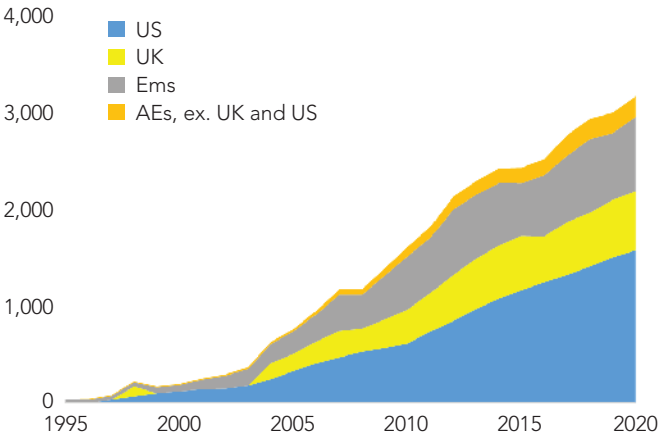
MAP 2.1. Selected ILB Issuers



A consistent trend for the past quarter-century in all these countries has been to increase the issuance of ILBs. While most noticeable in the United Kingdom and the United States, the increase has also been present in emerging markets, particularly in Brazil, Mexico, South Africa, and Turkey. Figure 2.1 presents the growth of ILB issuances in absolute terms since 1995.

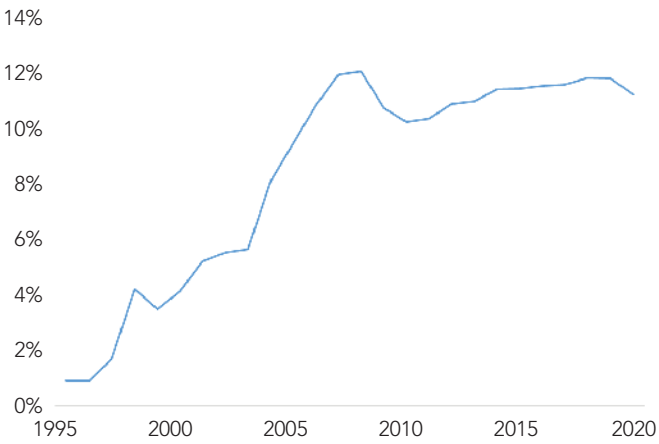
Figure 2.2 shows the clear trend of increase in ILBs outstanding as a percentage of total tradable debt that also occurred over the period. The overall percentage of ILBs in 2020 was 11 percent, as compared to 1 percent 25 years previously. This share was relatively stable, however, at around 10 percent over the last 15 years of the period shown.

FIGURE 2.1. Tradable ILBs Outstanding, 1995–2020, in USD Billions



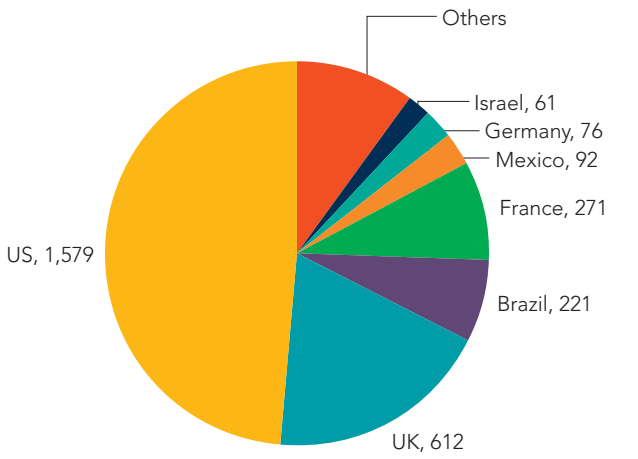
Source: Data from BIS Debt securities statistics, table C2, December 2020.

FIGURE 2.2. Share of Tradable ILBs Outstanding, 1995–2020, as a Percentage of Tradable Debt



Source: Data from BIS Debt securities statistics, table C2, December 2020.

FIGURE 2.3. Tradable ILBs Outstanding, as of End-2020, in USD Billions

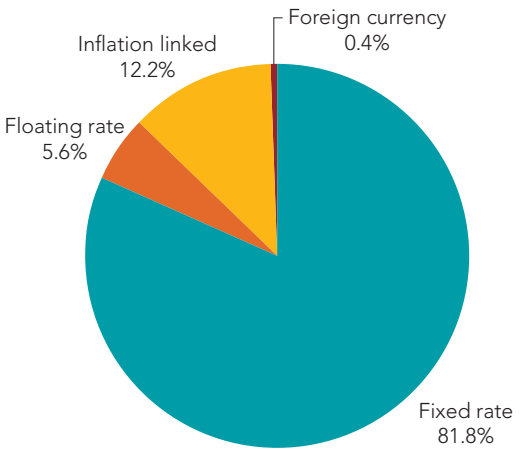


Sources: Data from BIS Debt securities statistics, table C2 central government debt securities markets; Brazilian National Treasury; Agence France Tresor; and Israel Government Debt Management Unit, December 2020.

Figure 2.3 provides a snapshot of the breakdown of ILB issuances by country. As of end-2020, the total tradable ILBs outstanding amounted to roughly USD 3 trillion. The United States issued the most, with a total of roughly USD 1.5 trillion, followed by the UK (USD 612 billion), Brazil (USD 221 billion), France (USD 271 billion), Mexico (USD 92 billion), Germany (USD 76 billion), and Israel (USD 61 billion). Note that while the United States was the largest issuer in absolute terms, ILBs accounted for only 6 percent of its total debt. As a percentage of the tradable debt, Chile accounted for the highest level—roughly 40 percent—followed by Brazil, South Africa, the UK, Israel, and Colombia.

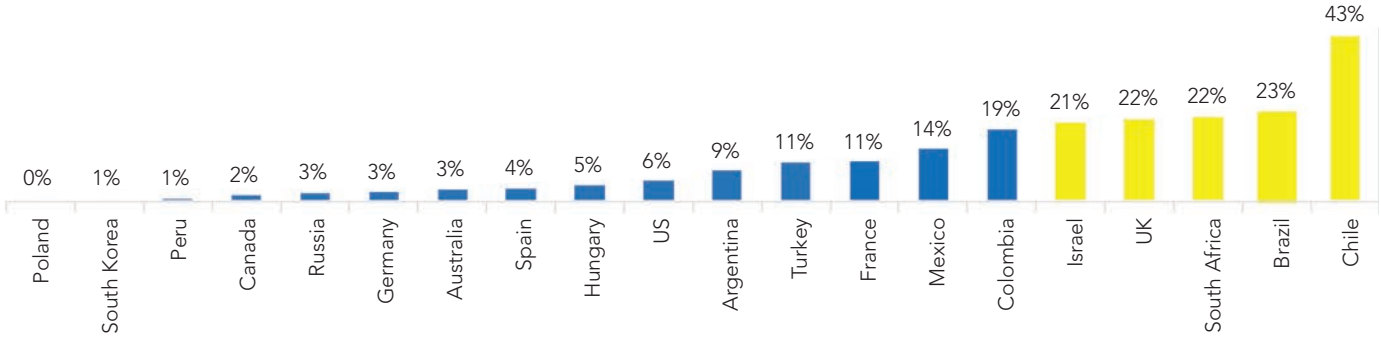
Despite their increased relevance, ILBs remain less important than conventional bonds. As shown in figure 2.4, ILBs represented on aggregate roughly 12 percent of the outstanding tradable debt of roughly $26.5 trillion at end-2020, while figure 2.5 shows that tradable ILBs accounted for less than 20 percent of the total in 15 out of 20 issuers of linkers.

FIGURE 2.4. Breakdown of Tradable Bonds by Instrument, as of End-2020, as a Percentage of Total Outstanding



Source: Data from BIS Debt securities statistics, table C2, December 2020.

FIGURE 2.5. Share of Tradable ILBs as Share of Total Debt by Countries, as of End-2020



Sources: Data from BIS Debt securities statistics, table C2; IMF Fiscal monitor October 2020, World Bank; Brazilian National Treasury; Agence France Tresor; Israel Government Debt Management Unit; Chile's Debt Management Office, December 2020.

3

Characteristics of ILBs

For ILBs to protect investors against inflation, the cash flows should be linked to a reference inflation measure. The degree of protection will depend on the type of linkage of the cash flows, the chosen price index, and the lag with which the index incorporates the inflation uplift. In this section, we focus on the three main features of ILBs that determine the level of protection:[2] the ILBs' cash flow structure and how they differ in this respect from conventional bonds; the price indices that can be considered and the lag needed to allow for the settlement of bond trades; and the breakeven inflation, a concept that will feature in the next section's discussion of the cost-risk features of ILBs.

A. The cash flow structure of ILBs

ILBs versus conventional bonds

Let us use an example to gain a better understanding of the way ILBs work. Assume a 10-year ILB[3] with a face value of $100 and a *real* coupon of 2 percent; moreover, let us suppose inflation remains unchanged at 1 percent over the 10-year period.

Table 3.1 presents the cash flows in real and nominal terms. As shown, the ILBs' principal and coupons remain unchanged in real terms over the entire period, at $100 and $2, respectively, whereas the principal and coupons in nominal terms increase over time according to the following equations:

$$[1] \qquad Nominal\ Coupon_t = Real\ Coupon \cdot (1 + Annual\ Inflation)^t$$

$$[2] \qquad Nominal\ Principal_t = Real\ Principal \cdot (1 + Annual\ Inflation)^t$$

At t = 10, for example, the nominal principal is $110.46, calculated as 100 * $(1.01)^{10}$, while the nominal coupon is $2.21, calculated as 2 * $(1.01)^{10}$.

For a conventional bond[4] to provide the same internal rate of return (IRR) as the ILB described in table 3.1, its coupons must be close to the real interest rate plus inflation. In fact, because of the impact of inflation on the coupon payments, the nominal coupon should be 3 percent, calculated as follows:

$$[3] \qquad Nominal\ Coupon = (1 + Real\ Coupon) \cdot (1 + Annual\ Inflation)$$

Table 3.2 presents the cash flows of a conventional bond that offers the same IRR as the ILB described above.[5] Note that its coupon is also the bond's IRR. All other factors aside, if inflation is expected to remain at 1 percent, investors should be indifferent between the two instruments.

[2] These features are covered in detail by Deacon et al. (2004). This section summarizes the aspects considered most relevant for emerging market DMOs.

[3] In this example, we are assuming that both the principal and interest payments are linked to the price index.

[4] In this paper, we use the terms "nominal bonds" and "conventional bonds" interchangeably.

[5] At this point, for the sake of simplicity, we are assuming no additional risk premium so that the nominal bond pays, ex ante, the same as the ILB.

TABLE 3.1. Nominal and Real Cash Flows of ILBs

Year	Nominal principal	Nominal coupons	Nominal cash flows	Real principal	Real coupons	Real cash flows
0	100.00		–100.00	100.00		–100.00
1	101.00	2.02	2.02	100.00	2.00	2.00
2	102.01	2.04	2.04	100.00	2.00	2.00
3	103.03	2.06	2.06	100.00	2.00	2.00
4	104.06	2.08	2.08	100.00	2.00	2.00
5	105.10	2.10	2.10	100.00	2.00	2.00
6	106.15	2.12	2.12	100.00	2.00	2.00
7	107.21	2.14	2.14	100.00	2.00	2.00
8	108.29	2.17	2.17	100.00	2.00	2.00
9	109.37	2.19	2.19	100.00	2.00	2.00
10	110.46	2.21	112.67	100.00	2.00	102.00
			IRR 3.02%			IRR 2.00%

In table 3.2, the principal and coupons of the conventional bond remain unchanged in nominal terms over the entire period, at $100 and $3.02, respectively. On the other hand, the principal and coupon payments in real terms decrease over time, reflecting the loss of purchasing power, according to equations [4] and [5]:

$$[4] \qquad Nominal\ Principal_t = \frac{Nominal\ Principal}{(1 + Annual\ Inflation)^t}$$

$$[5] \qquad Real\ Coupon_t = \frac{Nominal\ Coupon}{(1 + Annual\ Inflation)^t}$$

At $t = 10$, for example, the value of the principal in constant dollars is $90.53, calculated as $\frac{100}{(1.01)^{10}}$ and the coupon is $2.73, calculated as $\frac{3.02}{(1.01)^{10}}$.

TABLE 3.2. Cash Flows of Conventional (Nominal) Bonds

Year	Nominal principal	Nominal coupons	Nominal cash flows	Real principal	Real coupons	Real cash flows
0	100.00		–100.00	100.00		–100.00
1	100.00	3.02	3.02	99.01	2.99	2.99
2	100.00	3.02	3.02	98.03	2.96	2.96
3	100.00	3.02	3.02	97.06	2.93	2.93
4	100.00	3.02	3.02	96.10	2.90	2.90
5	100.00	3.02	3.02	95.15	2.87	2.87
6	100.00	3.02	3.02	94.20	2.84	2.84
7	100.00	3.02	3.02	93.27	2.82	2.82
8	100.00	3.02	3.02	92.35	2.79	2.79
9	100.00	3.02	3.02	91.43	2.76	2.76
10	100.00	3.02	103.02	90.53	2.73	93.26
			IRR 3.02%			IRR 2.00%

TABLE 3.3. Popular ILB Structures

Type of indexed bond	Interest payment	Final payment
Capital indexed bond	$r \cdot \frac{P_t}{P_0}$	$100 \cdot \frac{P_{mat}}{P_0} + r \cdot \frac{P_{mat}}{P_0}$
Interest indexed bond	$r + 100 \cdot \left(\frac{P_t}{P_{t-1}} - 1 \right)$	$100 \cdot \frac{P_{mat}}{P_{mat-1}} + r$

Types of ILBs

In the illustrations above, we assume that both the ILB coupons and its principal are indexed to inflation. Although this is the most common cash flow structure, ILBs can be designed with structures that vary depending on whether coupon and principal are both indexed, or only the principal, or only the interest. Other less common structures play with the timing of the cash flows—for instance, zero coupons or annuities. Table 3.3 shows the calculation of interest and principal payment for the two most popular structures.

In the most common structure, the capital indexed bond (CIB), both capital (principal) and interest are indexed, offering broad protection against inflation. The interest indexed bond (IIB), on the other hand, covers only interest payments and leaves the principal exposed to inflation risk. In a highly inflationary environment, the two structures would differ sharply, with the IIB accelerating the cash flows through higher coupons, while the CIB's main adjustment takes place through the principal. Other structures can also be found; in South African linkers, for example, only the principal is indexed (see box 3.1).

The differences in the cash flows of the two structures translate into differences in duration, which is a measure of the average life of a security weighted by the present value of its cash flows. In general, CIBs have longer durations than IIBs and would be better suited for pension funds.[6] By the same token, issuers would most likely prefer CIBs because the structure allows them to use the funds longer.

B. Choosing the price index and its lag

Depending upon the country, a wide range of choices may be available for the inflation index used with ILBs, including the GDP (gross domestic product) deflator, the Employment Cost Index (ECI), and consumer price indices (CPIs). The last category includes several alternatives that differ depending on the consumer group—for example, rural versus urban—or the basket of goods and services—for example, core (excluding food and energy) versus general (including food and energy). Deacon et al. (2004) argue that the chosen index should, ideally, be widely disseminated, well understood, broadly based, rarely revised, and regularly published with a short delay. Measures such as the GDP deflator, therefore, rate poorly in comparison to non-seasonally adjusted CPI; they are annual (whereas the CPI is monthly), difficult to grasp, and revised with a long lag.

Whatever index is chosen, DMOs should anticipate the need to revise the basket and/or methodology of the inflation index, including potential changes to the index as well as its rebasing. The ongoing replacement of the London Interbank Offered Rate (LIBOR) by alternative rates reminds us of the importance of anticipating these changes. Nowadays, most ILB prospectuses contain clauses that specify clearly what would happen if the inflation index were changed or rebased, or if other material changes were to take place.

Another critical feature of the selected index, particularly in emerging markets, is its integrity. The index should be reliable and, ideally, produced and published by an institution that operates at arm's length from the issuer; otherwise, investors risk losing the protection ILBs are supposed to offer. A case in point is that of Argentina in 2007, when the officials responsible for measuring and publishing the consumer price index were replaced with political appointees. This maneuver allowed the government—in this case, the National Statistics and Census Institute—to conceal the actual inflation rate, as illustrated in figure 3.1 by the International Monetary Fund (IMF). Since the official inflation figures were much lower than the true inflation, ILB holders suffered severe losses in 2007–12.[7]

[6] A zero-coupon ILB would have the longest duration, while an annuity would have the shortest.

[7] For more information, see also Cavallo (2013).

BOX 3.1. South Africa's Experience with ILBs

South Africa launched its first inflation-linked bond (with 13-year maturity and a 6.25 percent coupon) in March 2000. The authorities' motivation was threefold: (1) to signal a commitment to keep inflation under control and stick to prudent macroeconomic policies; (2) to attain cost savings by capturing the inflation premium; and (3) to provide pension funds with an effective instrument to manage their balance sheets. Since their launch, ILBs have become a recurrently used funding instrument with a strategic share close to a fifth of the total government debt portfolio.

Unlike the CIB and IIB, in South African ILBs only the principal of the bonds is indexed to inflation. While this different structure eliminates the variability in nominal coupon payments for the issuer, it leaves investors' coupon cash flows exposed to inflation. The authorities have also experimented with an amortizing structure; contrary to bullet bonds, where principal is fully repaid as a lump sum when the bond matures, ILB principal could be repaid in three equal installments over the bond's last three years. This structure would reduce refinancing risk but has not been yet adopted, possibly because of the impact on the already low liquidity of ILBs.

At present, the South African Treasury issues eight benchmarks from 5 to 32 years in uniform price auctions. The auction system was changed in October 2005 to improve competition in the primary market. Liquidity in the secondary market is much lower than that of conventional bonds, reflecting, perhaps, that like T-bills, ILBs are not part of the primary dealers' arrangements.

Source: Matsemela 2018.

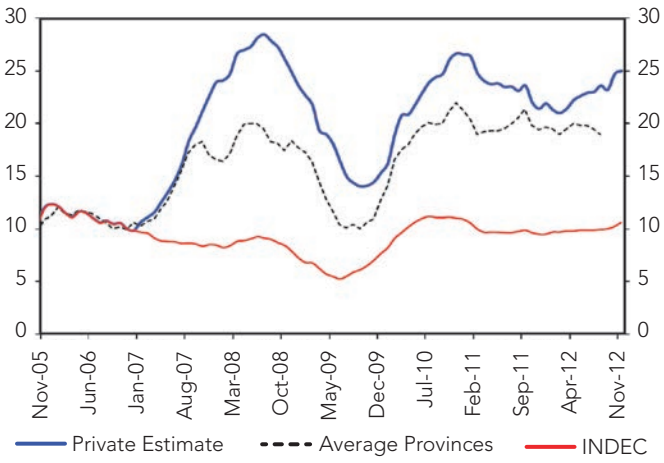
As inflation indices are not available in real time, a final consideration refers to the lag with which linkers incorporate changes in the price index. This is illustrated by the main problem with the GDP deflator, which is typically produced once a year, as noted above, with a lag of six months or longer, posing insurmountable challenges to the settlement of trades in the secondary market.[8] In contrast, a CPI that is available monthly with a much shorter delay could overcome those challenges if it were lagged at least two months. A three-month lag, which has become the standard since the Canadian model emerged, poses no issues with trading in the secondary market, as the lag is sufficient for getting all the information needed for the clearing and settlement of trades.

C. Breakeven inflation

Since their total returns depend to a large extent on inflation expectations, ILBs offer the debt manager a useful tool with which to compare the cost effectiveness of these instruments to that of conventional bonds. Tables 3.1 and 3.2 showed that if inflation remains at 1 percent over the 10-year period of the bonds, the 2 percent 10-year ILB and the 3.02 percent 10-year conventional bond provide, on an ex post basis, the same rate of return: 3.02 percent. While nobody knows what the future inflation rate will be, investors do have expectations, and we argue that if they expect inflation to remain constant at

[8] Let's assume an ILB linked to the GDP deflator, with a 10-year tenor and annual coupons issued in January 2021. Let's further assume that the DMO uses the index with a one-year lag, so that the coupon paid in 2031 is determined with the GDP index calculated for 2030. The principal and the last coupon that should be paid in January 2031 cannot be calculated until the deflator for 2030 is published by, say, June 2031. This drawback becomes insurmountable when looking at the trades conducted in the first semester of any year in the secondary market; as discussed above, all calculations of accrued interest of the current coupon will have to wait until the deflator for the previous year is available.

FIGURE 3.1. Consumer Prices: Official, Provincial, and Private Estimates (Y/Y Percentage Change)



Source: IMF 2016.

1 percent over the 10-year period, they should be indifferent between buying either security at time $t = 0$.[9] Similarly, if the same expectation is held by the debt manager, other factors being equal, the debt manager should be indifferent between issuing one or the other, since both will bear the same financial cost. The inflation rate that equates the internal rate of return of an ILB with that of a conventional bond with the same tenor is called the *breakeven inflation rate*; in our example, that rate is 1 percent.

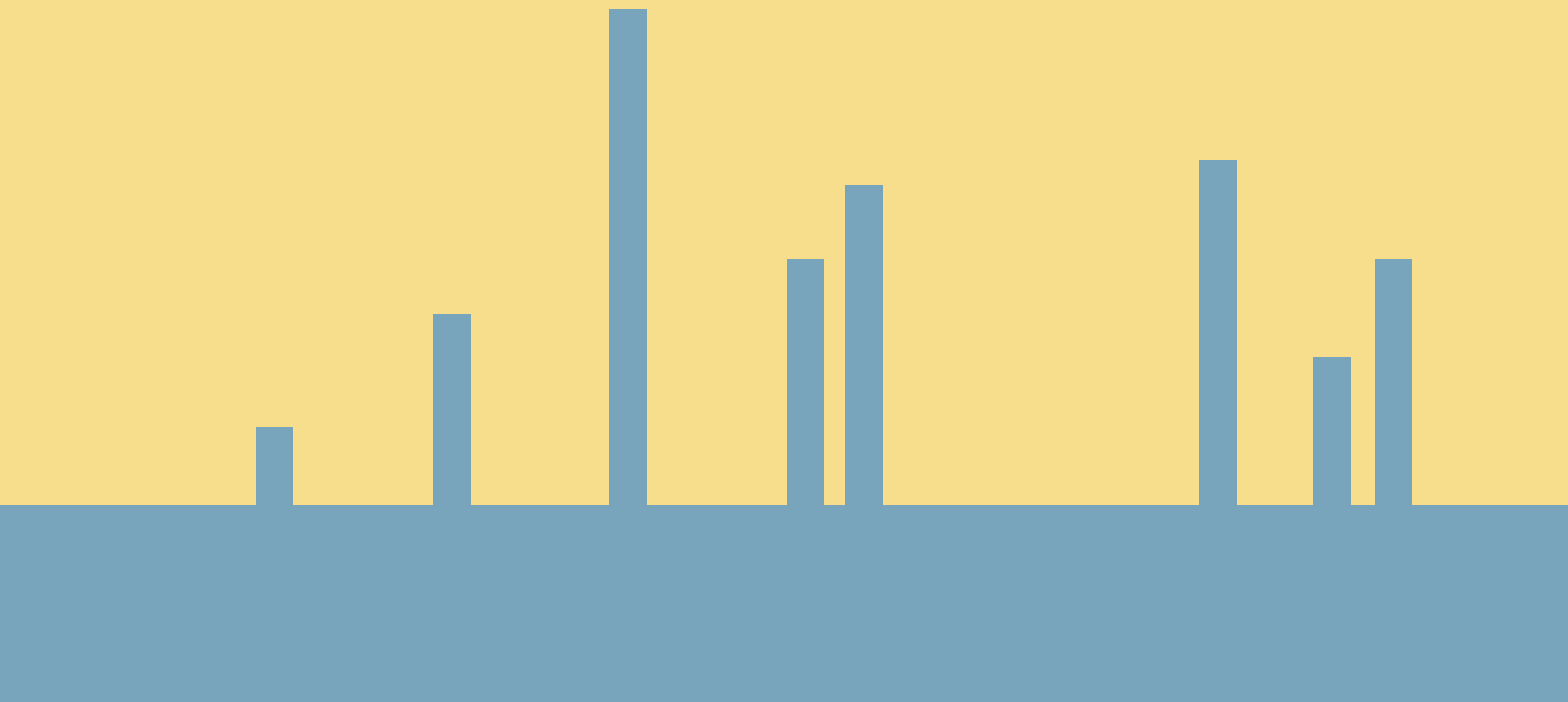
The breakeven inflation approximates the difference between the nominal and the real yield for the same maturity and is calculated according to equation [6]:

$$[6] \qquad \textit{Breakeven Inflation} \approx \frac{1+\textit{Nominal yield}}{1+\text{Real yield}} - 1$$

In our example, if the DMO-expected inflation exceeds the 1 percent breakeven rate, issuing ILBs will be more expensive since the debt service will be higher, driving the IRR over and above the 3.02 percent of the conventional bond. By the same token, investors projecting inflation to surpass the 1 percent breakeven rate will find ILBs more attractive than conventional bonds. In practice, as we will discuss in more detail later, the comparison between ILBs and conventional bonds is more complicated, as it entails an inflation risk premium for the conventional bonds and a liquidity risk premium for ILBs, as well as other considerations related to capital market development. Nonetheless, the inflation breakeven rate is a key concept in defining the cost effectiveness of ILBs.

Since the definition of the breakeven rate relates to the inflation level at which investors are indifferent between ILBs and conventional bonds, it can be used as an estimate of inflation expectations. Central banks frequently look at this measure in the formulation of monetary policy, and it is also useful to investors and other agents in the economy. As we will see in further detail in the next section, this feature of ILBs is a major externality providing useful information for the decision making by central banks and all economic agents.

[9] Assuming risk neutrality.



4

Should an Emerging Market Issue Linkers?

This section tries to answer the question of whether an emerging market DMO should issue linkers from the standpoint of whether they fit with the DMO's debt management strategy (DMS). Before undertaking such an analysis, a precondition needs to be met: there should be natural demand for ILBs; otherwise, the DMOs run the risk of getting the paper in the wrong hands, and a failed experience may hurt the future prospects of these instruments, as we discuss below.

Assuming demand exists, the fitness of ILBs within the DMS can be assessed by examining their impact on the individual components of the strategy: (1) the analysis of cost, risk, and the cost-risk tradeoffs; (2) compliance with the market development program and constraints; and (3) consistency with the macroeconomic policy framework.[10] In practice, debt managers go back and forth reviewing how alternative strategies fare with regard to these three components until the right balance is found. To answer the question, we focus on the impact of ILBs on each DMS component separately.

A. Demand for ILBs: A precondition

Most countries in which DMOs issue linkers have established pension funds and insurance industries. Pension funds are responsible for managing retirement accounts, which are usually maintained by employers to give employees a fixed payout—annuity or lump sum—at retirement. Pensions typically depend on the length of time worked and the salary of the employee. Pensioners expect their benefits will allow them to maintain a given standard of living, with some pension plans including a provision for the annuity to increase annually at the rate of inflation. Insurance companies sell protection against loss and offer saving products in exchange for premia from customers collected well before the payout. Similarly, these insurance products are bought with the expectation that the payout is hedged against the risk of inflation, which is particularly important for life insurance policies.

Since in both cases—pensions and life insurance—the cash inflows long precede payouts that are real in nature, pension funds[11] and insurance companies prefer investing in long-term assets linked to inflation. This way, they reduce risk by matching the financial characteristics of their assets with those of their liabilities, while retaining liquidity to meet potential payouts. In a nutshell, by issuing ILBs, DMOs allow the long-term savings industry to manage its balance sheet (through asset and liability management, or ALM) better.

Without a savings industry, there may be no natural demand for ILBs and, thus, these instruments may hold little appeal unless the economy experiences high and/or volatile inflation and a significant degree of indexation. Indeed, some examples that will be covered later on, such as the cases of Brazil and Mexico,

[10] See World Bank and IMF (2019) for a description of the methodology to develop a medium-term debt management strategy.

[11] This may be different for pension funds that have reached a mature state.

demonstrate that even where no developed pension fund industry existed when the government started issuing ILBs, there was demand from other types of investors (nonresidents, for example) who were looking for protection against currency depreciation. Brazil successfully used ILBs, for instance, to replace domestic securities linked to FX and lengthen domestic debt maturities.

Authorities may also use administrative controls to impose on banks or other investors an obligation to buy these securities, but such an approach, as with most administrative controls, will distort interest rates, causing an inefficient allocation of capital and delaying the development of a market for government securities. A better alternative is reform of the pension and insurance industries.

As presented in section 6, countries whose ILBs are part of the major global indices all have fairly robust savings industries; those emerging markets without them that launched ILBs before the 1990s saw the demand for these instruments languish over time and had to wait for the emergence of pension funds before ILBs became a true debt market instrument.

B. ILBs and the DMS

According to guidelines provided by the World Bank and IMF (2014), public debt management is the process of establishing and executing a strategy for managing the government's debt to raise the required amount of funding at the lowest possible cost over the medium to long run, consistent with a prudent degree of risk.

The cornerstone of a debt management strategy and the first step in its design is the evaluation of the cost, risk, and cost-risk tradeoffs of alternative government debt structures or borrowing compositions. Cost refers to the expected debt service in cash flow terms of the coupon payments over a selected time horizon.[12] Risk refers to the uncertainty (due to changes in interest rates, exchange rates, and inflation) in the debt servicing cost. Finally, cost-risk tradeoffs occur because instruments with low cost, such as T-bills or foreign currency loans, are typically more exposed to the abovementioned risks than more costly instruments, such as long-term fixed-rate securities in local currency. To identify and manage these tradeoffs, debt managers develop risk management frameworks that quantify cost and risk using scenarios for interest and exchange rates, based on history and the economic and financial shocks to which the country is potentially exposed.

The second component of the strategy is the state development of the domestic debt market. When formulating a DMS, the depth and breadth of the domestic debt market determine the amount of freedom the debt manager has to borrow in local currency. The choice of instruments in local currency in emerging markets is often limited because of the volume and composition of the investor base and the authorities' concern with the potential crowding out of financing to the private sector. The choices made in the strategy are vital because they can promote or hinder the development of the domestic debt market and a broader capital market, which is critical to financing economic growth.

The third and final component is the macroeconomic context. The strategy cannot be formulated in a vacuum; it must be consistent and take into consideration the constraints imposed by the macroeconomic framework. A large domestic savings gap, for instance, may call for the mobilization of foreign financing, whereas a central bank monetary policy that lacks credibility or concerns about the sustainability of the debt may force the debt manager to reject the use of long-term fixed-rate bonds in local currency.

Next, we review how ILBs can be viewed from the perspective of each of these three components.

Cost, risk, and cost-risk tradeoffs

Below we review the most relevant considerations for DMOs when designing a debt management strategy in terms of ILBs' impacts on cost, risk, and cost-risk tradeoffs.

Cost considerations. The comparison of the expected cost of ILBs to that of nominal instruments depends on two opposing forces: on the one hand, investors acquiring conventional bonds

[12] Multiple ways are available to measure cost. To be able to capture a comprehensive picture of the debt dynamics, debt managers typically choose at least one measure related to the flows and one to the stock.

demand a premium for the protection against inflation, which makes these instruments more expensive to use than ILBs; on the other, investors acquiring ILBs demand a premium because linkers are typically less liquid, making them more expensive than conventional bonds. Which premium weighs more is difficult to determine ex ante, and, in many cases, the difference between the expected costs of nominal bonds and ILBs could be negligible. In emerging markets where inflation is high and volatile, however, the premia for inflation insurance could be significant, and DMOs may find ILBs attractive from the cost perspective. Also, if the volume issued is enough to generate benchmark sizes for both conventional and inflation-linked bonds, the liquidity premium may be of less concern (as in the case of France, for example). Conventional bonds may be more attractive in economies with small and shallow markets where ILBs' lack of liquidity becomes a dominant factor.

The relatively high cost of conventional bonds, driven by investors demanding a significant inflation premium, was the main argument for the Bank of England to launch ILBs. Indeed, the UK's first index-linked gilt issued in 1981 had a breakeven inflation rate of 11.5 percent, far higher than the 5.9 percent recorded over the life of the bond, which made it a highly cost-effective funding source.[13] At the beginning of the millennium, Chile also expected cost savings from launching ILBs associated with the inflation risk premium derived from the volatility of inflation (see IMF 2004). The Netherlands Bureau for Economic Policy Analysis, however, found the liquidity premium larger than the inflation premium (Westerhout and Ciocyte 2017), making unattractive the use of inflation-linked bonds to finance its public debt. Similar concerns were expressed by the U.S. Department of the Treasury (2008). All these examples reinforce the argument that these competing factors—inflation premium and liquidity—may have different impacts on the expected cost of ILBs for different countries and markets.

Note, however, the emphasis on *expected* rather than *actual* cost. The actual cost of ILBs depends largely on observed inflation; other things being equal, ILBs are cheaper in periods when actual inflation is lower than anticipated in ILBs' price at the time of issuance, and they will be more expensive in periods when unexpected high inflation takes investors by surprise. Since DMOs don't know in advance whether actual inflation will exceed or fail to meet market expectations, the relevant comparison to judge the cost effectiveness of ILBs is between the breakeven inflation rate at issuance and the DMOs' expectation for inflation over the life of the bond.[14]

Risk considerations. ILBs have the potential to reduce or increase the risk of the government's debt portfolio. Risk can be reduced through three avenues: (1) by substituting riskier debt instruments (FX bonds) and increasing the share of long-term local currency debt; (2) by lengthening the debt redemption profile; and (3) by helping lower the volatility of the government budget by allowing better asset and liability management of economies facing demand shocks. On the other hand, ILBs can increase the risk of the government debt portfolio during supply shocks and in countries where expenditures are more closely correlated to inflation than revenues (see Danmarks Nationalbank 2011, chapter 10).

The first avenue for reducing the risk of the government debt is the use of ILBs to replace riskier instruments. DMOs' inability to issue long-term fixed-rate bonds in local currency is often associated with the perception that these bonds are at too high a risk of losing value when weak macroeconomic fundamentals trigger a sharp increase in interest rates or the depreciation of the local currency. Since investors in these cases take refuge in short-term local or foreign currency securities, and to the extent that ILBs provide them with another alternative to hedge against interest or exchange rate risk, linkers offer a superior choice to DMOs. This was the case in Brazil[15] at the beginning of the 2000s and in other emerging market economies where investors found a strong correlation between the depreciation of the local currency and inflation. DMOs were able to reduce the share of FX debt at the expense of ILBs.

ILBs' second avenue for reducing risk lies in their contribution to lengthening the average life of the debt portfolio, thereby reducing its rollover and interest rate exposure. The presence

[13] According to Knight (2013), the high breakeven rate reflected the market's lack of faith in the government's ability to reduce inflation significantly (the prevailing inflation rate at the time was 12.6 percent).

[14] See Knight (2013) for further discussions on cost effectiveness.

[15] The Brazilian case will be further discussed in section 7.

of pension funds and insurance companies, both comfortable with long-duration assets, allows DMOs to exploit the back-load feature of ILBs' cash flows, which elongate the security's time to maturity and provide welcome protection against the exposure to interest rate and rollover shocks. ILBs' contribution to lengthening the portfolio average life has proved particularly useful to countries suffering from chronic inflation, where DMOs find it hard to convince investors that the future will be different and that fixed-rate medium-term nominal securities returns are, indeed, fair and attractive.

The third and last avenue relates to features of ILBs in the broader context of the government's assets and liabilities. DMOs with debt management strategies based on asset and liability management considerations are clearly better off integrating ILBs in their strategies in economies often subject to demand shocks. In effect, during such shocks, the positive correlation between inflation and growth makes ILBs ideal instruments to mitigate budget volatility, since the debt service will rise at the time economic activity picks up, driving up government revenues, and diminish when economic activity slows down, driving down government revenues. So, the government faces lower debt services in moments of weaker revenues, and vice versa. Using data for Canada, Bolder and Deeley (2011) found that such correlation indeed reduced both debt charges and budget volatility for the period 1994–2007. More recently, New Zealand also decided to increase significantly the share of ILBs in its debt portfolio, based on ALM considerations (see box 4.1).

BOX 4.1. New Zealand's Experience with ILBs

Until 2012, the share of ILBs in New Zealand's government debt portfolio, at around 2 percent, was negligible. At that point, however, the New Zealand Debt Management Office (NZDM) undertook significant research, using a sovereign asset and liability management (ALM) approach to identify the optimal debt portfolio composition within the framework of the Crown's Balance Sheet.

The research concluded that ILBs provide a better match than conventional bonds to the flow of revenues used to service the debt—that is, general taxation. The rationale is that during the expansion phase of the economic cycle, inflation tends to rise, causing an increase in ILB debt servicing costs; such an increase in the budget expenditures, however, will not harm the government's financial condition because it is accompanied by a parallel increase in tax revenues. Conversely, during the contraction phase of the cycle, inflation tends to fall, causing a decrease in ILB debt servicing costs that mitigates the stress on the government's financial condition triggered by a parallel fall in tax revenues. It follows that ILBs help smooth the fiscal balance over the economic cycles.

Based on these findings, the NZDM implemented a significant transformation in the composition of the Crown's debt portfolio, increasing the share of ILBs from 2 percent in 2012 to 23 percent in 2019 and adopting a suggested optimal share of 25 percent of ILBs.

The authorities found that the reshuffle of the portfolio, introduced thanks to the application of the sovereign asset and liability management framework, brought other important benefits that helped improve management of NZ debt. Indeed, ILBs attracted new investors to the NZ market—those with longer-date mandates or inflation mandates—and helped reduce refinancing risk in a period when the country was borrowing more.

Sources: Based on Hagan 2016 and NZDM 2020.

Impact on the exposure of the government debt portfolio is not a one-way street, and ILBs can also make debt managers' lives more difficult. While inflation linkers are an appropriate choice for DMOs of countries exposed to frequent demand shocks,[16] they are a source of increased budget volatility in those more vulnerable to supply shocks. Let us suppose an emerging economy is experiencing a severe contraction in oil imports generated by external events. The supply shock is likely to cause a sudden and sharp downturn in the aggregate supply. The economic activity will contract at a time when a substantial increase in the price of intermediate goods, like fuel and imported food, quickly extends over the general price level. During these inflationary outbursts, the debt service of ILBs increases right when government revenues are contracting, worsening the government's financial condition.

For economies subject to both supply and demand shocks, the impact of ILBs is rather ambiguous and depends on the sensitivity of primary revenues and expenditures to inflation. In countries where government expenditures respond quickly and fully to inflation while revenues experience longer lags in adjusting to changes in the price level, ILBs increase the volatility of budget outturns more than conventional bonds. On the other hand, if some expenditures are set in nominal terms and tax revenues adjust faster and more fully to unexpected changes in inflation, ILBs could mitigate budget volatility compared to relying only on conventional bonds.[17]

Note that the impact of ILBs on the volatility of budget outturns does not refer to expected inflation because rational investors would price these expectations into their bids for nominal bonds, rising their yields in advance. In cases of unexpected changes in inflation, debt servicing charges will unquestionably vary relative to the issuance of just conventional debt, but the impact of ILBs on the budget will depend on the response of the government's primary revenues and expenditures.

Cost-risk tradeoff considerations. DMOs typically use quantitative models to measure cost-risk tradeoffs and support strategy development.[18] Such models use scenario analysis—either deterministic or stochastic—to simulate how alternative debt management strategies perform under baseline and risk scenarios. They provide useful inputs to debt managers, complementing other qualitative analysis and enabling the quantification of cost-risk tradeoffs.

The models' starting point is a clear definition of cost and risk, which seems trivial but is not. Often, debt managers use two measures of risk, one related to the cash flows and the other to the debt stock. Risk can always be measured by the increase in cost under a shock—FX or interest-rate—scenario.

These models are a cash flow simulation engine that reproduces the annual budget process. For the first year ($t = 1$), the borrowing requirements are the sum of amortization and interest payments plus the primary balance; both are known at $t = 0$, and the funding gap is filled using a given strategy, such as a combination of ten-year USD bonds and one-year local currency bills. For the second year ($t = 2$), the debt service adds the service of the debt contracted in year 1—that is, the rollover of one-year bills issued in $t = 1$—to the debt servicing flows of the debt stock outstanding at $t = 0$. The funding requirements at $t = 2$ are the sum of the estimated primary deficit and the debt service generated by the model. This funding gap, again, is filled following the same strategy of ten-year USD bonds and one-year local currency bills. The process continues iteratively until the end of the selected period—for example, five years.

Since the portfolio includes foreign and local currency instruments issued at fixed and floating rates, assumptions about future exchange rates and yield curves need to be fed from the start so we can compute the debt service of the instruments issued on $t = 1, 2 \ldots, n$. The model is run with a baseline scenario of interest and exchange rates to provide a cost estimate that could be expressed in terms of the debt servicing flows or the stock. When the model is run with a shock to the interest or exchange rates, the resulting increase in the debt servicing flows

[16] Even in such cases, the volatility of ILBs' debt service may create problems for countries with budget rules that monitor public expenditures irrespective of the changes in revenue (blind to the ALM perspective).

[17] Indeed, for Brazil, "the main characteristic of taxes is that they are denominated in domestic currency and are spread out over time, moving in tandem with GDP growth with a certain lag. So, a strategy based on the issuance of medium- and long-term inflation-indexed securities and long-term fixed-rate bonds would be efficient to balance financial revenues and outlays" (Brazilian National Treasury 2002).

[18] See Cabral (2015) for a survey of DMOs' practices when developing debt management strategies, including the use of analytical tools.

or the stocks provides an estimate of the risk of the strategy under analysis—in this case, the ten-year USD bonds and one-year local currency bills.

The same process is followed for alternative debt management strategies, for which the model will provide estimates of cost and risk that can be compared with those of the initial strategy. Simulating the different strategies under the baseline and risk scenarios allows debt managers to measure cost-risk tradeoffs, which is fundamental to their decisions regarding the desired composition of the government debt portfolio.

These cash flow simulation models can be easily adapted to deal with ILBs by treating them as another currency. Accordingly, ILB real coupons work the same as the coupons of foreign currency securities, and the payment of interest in real terms will be like interest payments in a foreign currency. To bring interest payments to nominal values we need to multiply by the inflation index, the same as we multiply by the exchange rate to bring foreign interest payments to local currency. In fact, foreign debt is just debt indexed to a foreign currency, with the exchange rate as the index.

The reader can quickly appreciate that indexing debt to inflation poses significantly less risk than indexing debt to a foreign currency. Indeed, inflation is more under the control of the monetary authority and should be easier to predict than the value of foreign currencies. Also, as explained above, the correlation to inflation of the government revenues could make ILBs a suitable vehicle for mitigating the government exposure to macroeconomic shocks, reinforcing the expected contribution of ILBs to reducing risk.

Nonetheless, in the design of the scenarios, it is important to emphasize that the paths for inflation and exchange rates should be consistent. It is unlikely, for instance, for an economy to experience a significant resurgence of inflation while the local currency appreciates against the currencies of the major trading partners. In the opposite direction, in countries with a significant pass-through, what occurs to the exchange rate tends to be reflected quickly in the inflation index. A major depreciation, for instance, would result in a parallel increase in inflation through increases in the price of imports in local currency that would quickly transmit to the rest of the economy.

Market development

ILBs have the potential to help further the development of the domestic markets in several ways. The most important is that they help complete the financial market, since they are the only asset providing full hedge against unanticipated inflation.[19] This is fundamental for pension funds and life insurance companies searching for assets with financial characteristics that match those of their liabilities. The specialization of market participants in two segments—conventional and ILBs—not only helps the issuer with the diversification of the investor base but could improve price discovery, reducing funding costs and promoting a more efficient allocation of capital.[20] ILBs are also beneficial to other market participants, as their coexistence with nominal bonds allows them to take positions if their inflation expectations differ from those implied in the breakeven rate.

Second, the introduction of ILBs may be accompanied later by the introduction of derivatives, which has occurred both in advanced economies and emerging markets. In the United States, the Chicago Board of Trade introduced futures and options referenced to five- and ten-year ILBs after Treasury Inflation-Protected Securities (TIPS) were issued for the first time in 1997. In France, a deep market for swaps of ILBs and conventional bonds has, since 2002, offered an alternative vehicle for gauging inflation expectations.[21] In Israel, well-established ILB markets for both the government and corporate issuers have generated an active derivatives market for short-term inflation products using CPI forwards and for long-term ones using inflation swaps. Brazil has also seen a recent

[19] Short-term bills or foreign currency bonds may offer some degree of protection against unanticipated inflation, but it will be partial, depending upon the sensitivity of short-term interest rates and exchange rates to inflation.

[20] In countries where ILBs are attractive to nonresident investors, the contribution to market development grows. In addition to the net additional demand for ILBs, these new investors require assistance with clearing, settlement, and custody, expanding the demand for financial services. ILBs are often a good port of entry for nonresidents, as they offer long durations with some protection against currency depreciation. They can help attract nonresidents who, in a second step, may also be interested in medium-term fixed-rate bonds.

[21] The bonds issued by France indexed to the inflation indices of France and the eurozone are the most widely used in the pricing of ILB swaps and in hedging positions in the euro swap market; see ECB (2003).

surge in inflation-linked derivatives that were introduced in 2016.[22] In turn, the development of a derivatives market provides additional liquidity to ILBs as more players are attracted to it.[23]

Third, the DMO can enhance its communication and outreach strategy (that is, its investor relations function) to promote the securities, especially among those investors—such as pension funds and insurance companies—that should be the natural buyers.[24]

And, fourth, ILBs could help mobilize savings that would otherwise go into real assets as the closest safe-haven alternative against inflation. The increase in financial savings and their more efficient allocation could contribute to the development of the financial sector and to economic growth.

While all this sounds attractive, countries with small debt markets might find it difficult to reap these benefits, and DMOs need to be careful in their implementation of ILB programs to avoid the risk of fragmenting the domestic market and losing the gains achieved in the market for conventional bonds (see next section). Again, in some economies, the introduction of ILBs may not trigger the development of a derivatives market for inflation products, as such an endeavor requires other conditions that cannot be met. Similarly, if the liquidity premium is significant and volatile, and derivative products do not develop, the potential for market participants to hedge from unanticipated inflation will also be limited.

Finally, although in theory the DMOs' issuance of ILBs sets up a benchmark for the corporate sector interested in issuing debt linked to inflation—for instance, mortgage lenders whose loans are linked to inflation and utilities with administered prices adjusted to the CPI[25]—in practice, the corporate sector issues very few ILBs in advanced economies and almost none in emerging ones.[26]

Macroeconomic context

DMOs can also weigh in on how ILBs affect the overall macroeconomic context. Three issues can be considered: (1) ILBs' contribution to the credibility of monetary policy; (2) the DMO's issuance policy in an inflationary environment; and (3) ILBs' contribution to the tools available for the central bank to measure inflation expectations. While the contribution of ILBs to the improvement of macroeconomic policies through these factors varies depending on the individual country case, we feel these considerations are less relevant than the first two components of the debt management strategy to the decision of whether emerging market DMOs should issue them.

ILBs' contribution to the credibility of monetary policy. The idea that the issuance by governments of ILBs makes monetary policies more credible found support in the economic literature and in the central bank community during the 1980s. According to Calvo's seminal paper, a credible anti-inflationary policy prevents high nominal interest rates through price indexation of the public debt and restraint from issuing new debt when the interest rate exceeds well-defined bounds (Calvo 1988). The Bank of England, when introducing ILBs in 1981, stated that "only a Government committed to a substantial reduction in inflation would wish to issue them" (UK HM Treasury 1981).

The merits of this idea could be judged empirically by considering the experience of two groups of countries that introduced ILBs in very different macroeconomic and institutional environments. The first group includes economies, developing at the time, that launched ILBs between 1950 and 1980, when inflation levels and volatility were high, macroeconomic fundamentals were weak, and extending central bank monetary financing to the governments was common. The second group

[22] The increase in the use of inflation-linked derivatives in Brazil is connected to the rise of local hedge funds that seek to trade actively on inflation expectations and to the development of the corporate inflation-linked market, as private issuers often want to hedge part of their inflation-linked liabilities. Obstructing the further development of such derivatives—as opposed to the nominal interest-rate derivatives—are the buy-and-hold and less-sophisticated characteristics of pension funds, which are the major holders of inflation-linked bonds.

[23] ILBs can also be very attractive to retail investors, which are often looking for long-term investments that would preserve their purchase power. In Brazil, for example, bullet ILBs became the most popular instrument sold through the retail program.

[24] Later on, the Brazilian case will address this point.

[25] See discussion in Martellini and Milhau (2011).

[26] In the United States, corporates find it more efficient to issue nominal bonds and immediately hedge with ILBs. The lack of interest from corporates may also reflect unfavorable accounting treatment; see U.S. Department of the Treasury (2008).

comprises advanced economies that launched ILBs when independent central banks had already established credibility after achieving low and stable inflation during the 1990s.

The countries in the first group—Iceland and Israel in 1955, Chile in 1966, Brazil in 1964, Colombia in 1967, Argentina in 1972, and Mexico in 1989—most likely started issuing ILBs for practical reasons, since they were the only instruments with medium- or long-term tenors that issuers could sell in local currency. In fact, none of these countries experienced a strong disinflationary period after the introduction ILBs; in some cases, inflation actually increased at a faster pace, opening to question the principle that ILBs are the "sleeping police" that prevent the monetary authority from falling to the temptation of inflating the debt away.

The countries in the second group—Canada in 1991, Sweden in 1994, Australia and New Zealand[27] in 1995, the United States in 1997, France in 1998, Greece in 2003, Japan in 2004, and Germany in 2006—had already made their central banks independent of the executive and achieved price stability for several years. As the European Central Bank pointed out, the macro and institutional environment in these countries in all likelihood made the governments less leery about the potential increase in debt service because of unexpected inflation (see Garcia and van Rixtel 2007). Certainly, in this group of countries, price stability–oriented monetary policy contributed to the issuance of ILBs, rather than the other way around.

Although the empirical evidence does not seem to support the contention that ILBs contribute to the credibility of monetary policy, it is true that the extended use of the instrument limits the government's ability to inflate the debt away. While this "solution" to a structural fiscal imbalance may be costly in the long term, surrendering this option, which has been repeatedly used in the past in a number of emerging markets, could limit the freedom of policymakers and force other forms of default that could even be costlier.

In sum, when considering introducing ILBs, emerging market DMOs should focus more on cost-risk and market development considerations and less on the potential for reinforcing the credibility of monetary policy.

[27] New Zealand relaunched its ILB program in 2005.

ILBs in an inflationary environment and indexation. As discussed above, most emerging markets launched ILBs when their macroeconomies exhibited weak fundamentals, including high and volatile inflation. ILBs were the only instruments DMOs could issue in local currency at fixed rates and medium tenors. Without them, DMOs had to rely on FX, short-term, or floating-rate bonds, which exposed their budgets to refinancing and market risks. Indeed, indexation became the way for the economy to adjust to an inflationary environment, and government securities were not an exception.

A fear regarding ILBs is that businesses and other market participants will become accustomed to high inflation rates, which would undermine the credibility of economic policy. Considering the hyperinflationary experience of the 1920s, when wages and contracts were indexed to inflation, the Deutsche Bundesbank was strongly opposed to ILBs, which explains why Germany was last among G7 countries to issue ILBs, doing so only in 2006.[28] With ILBs now issued in most advanced and emerging economies, discussion about the danger of indexation has practically disappeared, and there is no evidence that ILBs have triggered wider indexation in economies or have reduced public support for central banks in their efforts to maintain price stability by making it easier to live with inflation (see Garcia and van Rixtel 2007, section 3.7).

ILBs as providers of inflation expectations. There is broad consensus on the relevance and usefulness of the comparison of conventional bonds and ILBs as providers of a direct estimate of inflation expectations. Such an estimate is valuable to central banks, investors, and other agents in the economy.

As explained in section 3C, two zero-coupon bonds, one conventional and the other linked to inflation, with the same maturity date, should, in principle,[29] yield the same total return to the investor. The inflation rate that equates both yields, known as the breakeven inflation rate, measures the investor expectations of inflation over the life of the bonds. The advantage of the breakeven inflation rate, calculated as the difference between the yields of the two bonds, is that it can be observed

[28] In Germany, the Currency Act of June 20, 1948, prohibited the indexing of contracts, and this prohibition remained in place until 1998.
[29] Assuming risk neutrality.

in real time, providing a measure of inflation expectations that is always up to date.[30]

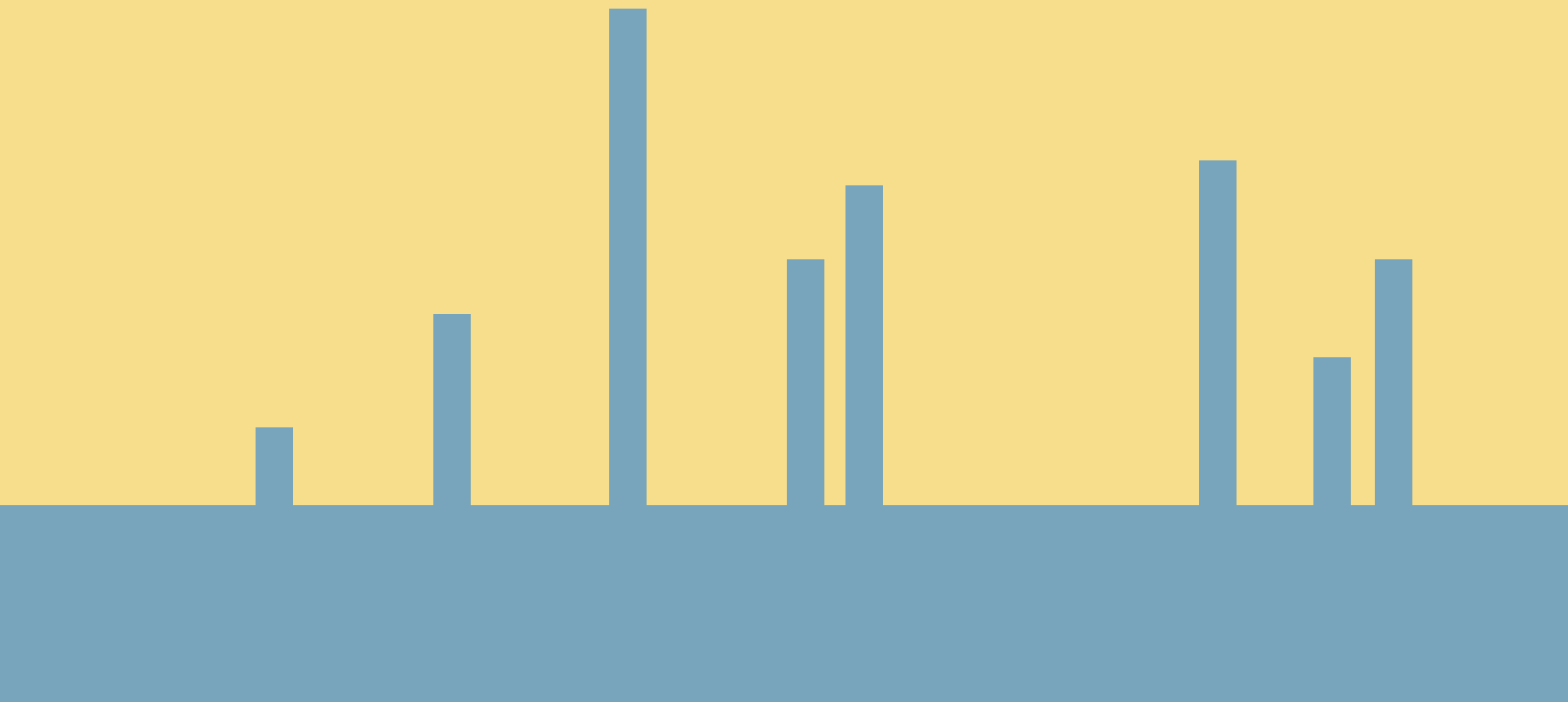
On paper, the yield differential should always reflect the market expectations of future inflation. Abnormally high yields of ILBs imply an inflation rate that is below what the market expects. In pursuit of these abnormally high returns, rational investors would buy the ILBs, driving prices up and reducing the yield to the point where implied inflation aligns with market expectations. The premise is that investors should not make abnormal returns just because they invest in indexed securities.

While the yield differential between conventional bonds and ILBs is a useful proxy for inflation expectations, it encompasses other factors, as well: first, conventional bond yields include a premium that investors require to assume the risk of inflation; and, second, ILBs' lack of liquidity translates into a liquidity premium. Accordingly, an increase in the yield of a conventional bond relative to an ILB may indicate an increase in the inflation risk premium or a reduction in the liquidity premium, rather than a gloomier investor view of future inflation. Technical factors can also trigger movements in relative yields of ILBs and conventional bonds that have little to do with inflation expectations. This is the case in periods of market turbulence that may alter the risk premia of these securities; this happened, most notably, during 2008 and the subsequent euro crisis (see Garcia and van Rixtel 2007, section 4, and Danmarks Nationalbank 2011, chapter 10).

Even with these limitations, the introduction of ILBs augments the information available on inflation expectations that is widely used by central banks, issuers, and investors across all markets. As the European Central Bank points out, however, it is advisable to focus on changes rather than levels of the yield differential when interpreting them in terms of long-term inflation expectations and to combine the measure with those of other financial instruments, as well as with survey measures of long-term inflation expectations (see Garcia and van Rixtel 2007, 33).

Again, the fact that ILBs are providers of inflation expectations does not justify their issuance by the DMO. While this could be an extra benefit, the decision on whether to issue ILBs has to be justified on the grounds of the cost-risk and market development considerations.

[30] This is why the Federal Reserve Bank of Richmond in its 1991 annual report proposed that the U.S. Treasury issue half the bonds in conventional zero-coupon bonds and the other half in zero-coupon ILBs; see Hetzel (1992).



5

Implementing a Linkers Program

In the previous section, we discussed the critical factors a DMO should consider when deciding whether to include linkers in its debt management strategy. This section covers practical decisions debt managers face when implementing the issuance of ILBs. The way ILB programs are introduced can mitigate or exacerbate the potential disadvantages of these instruments and amplify or reduce their benefits.

The implementation takes into consideration decisions regarding four main factors: (1) instrument design; (2) placement of ILBs, including benchmark creation, issuance program, and mechanism of issuance; (3) accounting and budget considerations; and (4) taxation.

A. Instrument design

The first decision for a debt manager who has opted for ILBs as a regular funding vehicle concerns the design of the instrument. As described in section 3, the main features in the ILB design are its cash flow structure, the selection of the price index, and the index lag. Together, these features will define the protection investors will receive and will determine, to a large extent, the demand for ILBs and the effectiveness of ILBs for the issuer.

The selection of a capital indexed bond (CIB) structure that indexes both principal and coupon cash flows has the advantage of using a standard most investors, especially nonresidents, are familiar with. Provided the index is appropriate, this structure provides comprehensive inflation protection appealing to pension funds and other long-term investors. The more popular the chosen structure is, the more likely that ILBs will attract widespread demand, ensuring healthy competition in the primary and secondary markets and making them cost effective for the issuer. While another structure, such as the interest indexed bond (IIB), may appeal to the issuer because it reduces the inflation uplift and refinancing risk at maturity, these advantages could be easily offset by poor demand and may even impede the debt manager in including ILBs in a primary dealer program.

Another consideration in the cash flow structure is the protection against deflation. In the United Kingdom and most other advanced economies, ILBs have no protection against deflation, so the principal at maturity could be below the security face value, and coupon payments could be negative. The United States is an exception; the principal at maturity is at least equal to the security face value, but coupon payments could be negative if deflation exceeds the *real* coupon. In Israel, tradable ILBs known as Galil had a deflation protection, but the floor was lifted toward the middle of the millennium's first decade after the DMO decided investors should bear the risk of a negative inflation. As of this writing, no emerging market has used structures with floors on ILB principal or coupons.

The selection of the inflation index is the second critical factor in the instrument design. As discussed in section 3, the chosen index should be well understood, rarely revised, regularly published with a short delay, and credible (Deacon et al. 2004). In addition, emerging markets with histories of high and volatile inflation may present an opportunity for ILBs to reinforce monetary policy credibility; in these countries, it may make sense to choose the same index used by the central bank for its inflation targeting.

In most countries, a non-adjusted general CPI is likely to comply with most of the properties listed above.[31] It should be emphasized, however, that for the inflation index to be credible, the institution producing it must be trustworthy. Argentina's experience in 2007 illustrates that since bond issuance is like a repetitive game, manipulation of the index can quickly elevate the risk premium and ruin the debt manager's ability to use ILBs in the future. Finally, because the entity producing the inflation index, or the index itself, can change, most DMOs include in their ILB prospectuses clauses that specify clearly what will happen if such changes materialize.

The more frequently the inflation index is published, the shorter is the lag needed to update the ILB's inflation uplift. Most consumer price indices are produced monthly, so a three-month lag, which has become a standard since the Canadian model was introduced, is short enough to ensure adequate inflation protection to the investor and long enough to allow a smooth clearing and settlement of transactions in the secondary market. The United Kingdom used an eight-month indexation lag prior to 2005 and moved to the three-month standard afterwards. Brazil and Israel, on the other hand, use one- and two-month lags, respectively.[32]

B. Placement of ILBs

Policies for creation and maintenance of benchmark bonds

Debt managers accustomed to working with conventional bonds will find ILBs have startling differences that determine a very different way to approach the placement of the securities, both in terms of the design of the issuance plan (securities, tenors, volumes) and the mechanism of issuance (the type of auction or syndication).

Clear policies to create and maintain benchmarks are essential to mitigate the "natural" illiquidity of ILBs. The larger the volume of securities outstanding in the market, the more likely they can be traded in the secondary market. This is particularly important, given that some pension funds and insurance companies prefer to buy and hold the ILBs to maturity, thereby reducing the supply available to the secondary market.[33] In some cases, liability management operations, such as regular repurchase auctions, can help alleviate liquidity concerns.

Fortunately, DMOs don't need to issue along the entire yield curve. Different from those of conventional bonds, benchmarks for ILBs do not have the goal of building a yield curve. Although a nominal yield curve for nominal securities is essential to provide a basis for pricing almost any financial nominal asset, this rationale does not apply to financial real assets—first, because the supply of financial real assets is often restricted to the ILBs issued by the DMO, unless the economy is highly indexed; and, second, because the demand for ILBs from the saving industry and nonresidents is typically restricted to the long end of the curve.

Consequently, DMOs tend to issue fewer ILB benchmarks than conventional ones and in smaller sizes. The priority given to conventional bonds and the specialized niche of demand for ILBs also result in a slower pace to build up ILB benchmarks as compared to conventional bonds. The slower pace is more noticeable in countries where the DMO uses auctions as the issuance mechanism.

When designing ILB benchmarks, DMOs should carefully assess the market absorption capacity, taking into consideration the stage of the pension fund industry. A nascent pension fund industry, for instance, typically builds up long-term assets with few short-term cash outflows, making pension funds more likely to gobble up all supply of ILBs and keep them in their books. A more mature pension system, on the other hand, will have significant cash outflows to pensioners, making pension funds more active in the secondary market.

Design of the issuance plan

When introducing a new borrowing instrument, debt managers aim to avoid cannibalization between instruments and

[31] Brazil, however, started issuing ILBs linked to a wholesale price index because investors found the correlation of the index with the exchange rate stronger than that of the CPI; later, the wholesale price index was replaced by the same CPI used by the central bank for its inflation-targeting policy.

[32] In Brazil, the National Bureau of Statistics releases the intermediary CPI changes every 15 days. This information is used to update the price index more frequently.

[33] And, often, pension funds, less concerned about liquidity, pressure the government to issue more maturities to facilitate their ALM.

fragmentation of the market, which can lead to reduced liquidity. This is no different with linkers.

With ILBs it's essential to carefully consider which tenors to offer and the relative prices of the debt instruments.[34] Some countries, for example, will concentrate the issuance of linkers in the very long end of the yield curve, where fixed-rate instruments are not offered. In general, it may not make sense to issue short-term linkers, as this would go against the natural habitat of the investors who would be mostly interested in them. A careful organization of the maturities—aiming to create benchmarks for each security—would also mitigate the risk of cannibalization.

In markets with limited liquidity, the debt manager may have greater influence on the pricing of the instruments and should monitor the relative prices to avoid cannibalization. If one security becomes much more attractive than another—a distorted risk-return profile—investors may be biased by it. Another way to avoid cannibalization is to offer securities on different selling dates—for example, alternating between ILB auctions and fixed-rate auctions instead of having them together.

Also, when introducing a new instrument, the debt manager must be mindful of the number of different securities or lines. Other things being equal, the more securities outstanding, the lower the liquidity of each. In some cases, ILBs may be introduced to replace other types of bonds (FX-linked or floating rate, for example) and it's important to make sure one does, indeed, replace the other, instead of just adding a new security to the menu. Again, concerns on cannibalization and fragmentation are much more pressing in developing, nonliquid markets, and the way the issuance plan is formulated matters.

Choice of issuance mechanism and liability management operations

In most cases, even in advanced economies, ILBs are less liquid than fixed-rate bonds. This comes from the buy-and-hold nature of pension funds and insurance companies. To deal with this specificity, some DMOs have different auction types or issuance mechanisms for the linkers.

In some countries, even though the DMO uses multiple-price auctions for fixed-rate bonds, it switches to single-price auctions for ILBs. Single-price auctions reduce the winner's curse[35] effect and attract more demand for less liquid securities. Other DMOs use syndications instead of auctions when launching a new ILB benchmark so they can issue a more substantial volume from the start and provide more liquidity to the new security.

Several DMOs in emerging market countries use liability management operations (namely, buybacks and switches) to accelerate the buildup of benchmark bonds and mitigate their consubstantial liquidity in the secondary market.

C. Inflation uplift: Accounting and long-term impact

As noted, ILBs can be structured in different ways, but, most commonly, both the interest payments and the principal are linked to the inflation index. Given the usual long tenor of ILBs, the nominal uplift in the principal payment is quite substantial and may present challenges to the accounting and the monitoring of the debt structure.

On the one hand, the DMO must know how to account for such instruments and their impact on the public financial statements. The treatment will vary, depending on whether the country is using cash, accrual, or semi-accrual accounting, but, in all cases, the effect is relevant. Where cash accounting is used, the uplift creates peaks of redemptions in the government accounts that should be properly anticipated by the budget unit.[36]

[34] In liquid and developed markets, pricing is exclusively formed by the market.

[35] In a multiple-price auction, winners may get all their bids but, at the same time, find out they have paid higher prices than everyone else in the market. The less liquid a market is, the more uncertainty participants will have around pricing, and so the more likely it will be for one participant to offer a "wrong" price. This could restrain some participants from joining the auction, reducing the overall demand for the security. This effect becomes much less important—even negligible—when markets are very developed and liquid. The winner's curse was first pointed out by Capen, Clapp, and Campbell (1971) in oil lease auctions. For an early discussion of types of auctions for the U.S. Treasury's market see, for example, Bikhchandani and Huang (1993).

[36] This is why France introduced an exception to its cash accounting framework, so that the increase in principal in ILBs was included in the budget deficit calculation every year.

On the other hand, the uplift introduces a vegetative growth of the ILBs' stock that will drive an increase in their share of the total public debt, even if their supply is not increasing. When developing the medium-term debt management strategy and deciding upon the strategic direction of the debt portfolio, the debt manager must make sure to incorporate that effect.

D. Taxation

Tax regulations affect the demand for ILBs, as investors focus on the after-tax return. Since future inflation is uncertain at the time of purchase, the after-tax rate of return is uncertain, and ILBs do not fully protect investors against inflation. This deficiency is minor, however, compared to the total exposure of conventional bonds.

In most jurisdictions, taxes are levied on nominal returns, whether these originate in coupons or capital gains. Since there is no discrimination between the real and inflation components of the returns, in an inflationary environment, taxes establish a bias in favor of ILBs, as illustrated in table 5.1. The table provides the example of two securities: an ILB with a 3 percent real coupon and a 4 percent coupon conventional bond; both have a 4 percent nominal yield under a baseline scenario of a 1 percent inflation over the life of the bonds.

While tax exemptions may remove some distortions created by tax regulations, they also harm government finances, as they deprive the government of a stream of revenues and defeat the cost savings argument for introducing ILBs in the first place.

Emerging markets that have different tax rates for coupons and capital gains should be aware that taxation will lead investors to prefer some instruments over others. If the tax rate for capital gains is below that for coupons, for instance, a zero-coupon ILB would, other things being equal, offer better returns than CIBs and IIBs. The advantage of a zero-coupon ILB is even greater if taxes are only charged when the bond is redeemed at maturity.

Finally, consideration should also be given to potential taxing of the inflation uplift of the ILB. Some advanced economies consider the accrual of the inflation uplift as current income. While this is not a problem for CIBs and IIBs, as the holders are collecting part of the inflation uplift through the coupons, a zero-coupon ILB holder will be paying taxes on income that has not materialized—the so-called "phantom income." Again, if taxes are only effective at the time of collecting the cash flow, ILBs have an advantage over conventional bonds.

TABLE 5.1. Effect of Taxes Under Different Scenarios

Effect of taxes on ILB and conventional bonds						
	Inflation	**Pre-tax real yield**	**Pre-tax nominal yield**	**30% tax rate**	**Post-tax nominal yield**	**Post-tax real yield**
	(1)	**(2)**	**(3) = (1) + (2)**	**(4) = 30% * (3)**	**(5) = (3) – (4)**	**(6) = (5) – (1)**
ILB	1%	3.0	4.0%	1.2%	2.8%	1.8%
ILB	7%	3.0	10.0%	3.0%	7.0%	0.0%
Conventional	1%	3.0	4.0%	1.2%	2.8%	1.8%
Conventional	7%	–3.0	4.0%	1.2%	2.8%	–4.2%

Source: Deacon et al. 2004, 32.

6

ILB Investment Indices

As with conventional bonds, the inclusion of benchmark bonds in ILB indices is a highly effective tool to attract investors, especially nonresidents, to the local currency emerging markets. The Bloomberg Barclays Benchmark Indices (BISL), JPMorgan Government Bond Index-Emerging Markets (GBI-EM), and FTSE Emerging Markets Government Bond Index (EMGBI, formerly Citi) are among the most popular indices in the asset management industry. The inclusion of ILBs in these indices triggers immediate demand from investors who follow passive strategies and put the securities on the radar of active management investors, as well.[37]

The Bloomberg Barclays government inflation-linked bond indices cover the ILB universe. The Universal Government Inflation-Linked Bond Index (UGILB) is the aggregate of two separate indices: the World Government Inflation-Linked Bond Index (WGILB), for developed countries, and the Emerging Markets Government Inflation-Linked Bond Index (EMGILB), for developing ones.[38]

Inclusion in the Bloomberg Barclays index depends on such factors as reliability of the CPI, liquidity, and market accessibility (which includes consideration of taxation and capital controls). The securities must have at least one year remaining to maturity, and the index must include subindices by maturity bucket. It is rebalanced on the last day of each month.[39] Valuation of the index is based on mid-market prices from specific providers at given times of the day, and pricing quotes and settlement adopt local market conventions. Bonds should be available, in whole or in part, to foreign investors.

For ILBs to be included in the Bloomberg Barclays index, they also need to comply with minimum amounts outstanding in local currency terms. These minimum amounts are revised annually, taking into account issuance trends, exchange rate movements, and local market conditions, and they tend to be lower than those applicable to conventional bonds, as indicated in table 6.1. In addition, the minimum amounts are much lower than those required for issuers in developed countries—for example, USD 500 million for the United States, EUR (euros) 500 million for the European Union, and JPY (yen) 50 billion for Japan (see Bloomberg Barclays 2016, 2).

The restricted supply of ILBs compared to conventional bonds is illustrated by the UGILB's comprising only 20 countries, of which 9 are developed and 11 emerging markets. The relative scarcity of ILBs is far more acute in the emerging market world; only 11 countries are included in the EMGILB, compared to 18 for government securities in local currencies and 74 for bonds in hard currencies. In three out of the seven regions, only one country is represented in the ILB index (see table 6.2).[40]

[37] Participation in an index, however, can also trigger capital outflows from nonresidents, as was witnessed with emerging market conventional bonds, when the recognition of the progressive opening of China's financial market triggered the inclusion of nine of its bonds in the index as of February 2020, setting China's share in the local currency government bond index at the 10 percent cap and reducing by about 1 percent the weight of countries like Colombia, Malaysia, Poland, South Africa, and Thailand.

[38] For the EMGILB, countries are classified as low or middle income according to the World Bank or as non-advanced countries as classified by the International Monetary Fund (IMF); see Bloomberg Barclays (2017, 36).

[39] The index methodology and factsheets, together with the current performance of selected indices, can be found at www.bloombergindices.com. Also, in Bloomberg terminals, INDEX<Go> displays a dashboard for index-related information, including data for the different indices, as well as publications with methodologies, factsheets, reports, and so on.

[40] To be considered for inclusion in the World Government Inflation-Linked Bond Index, a market must exceed an outstanding of USD 4 billion equivalent; this minimum is USD 1 billion less than the floor applicable to conventional bonds. The threshold for existing markets is lowered, however, to USD 2 billion to prevent unnecessary turnover due to short-term fluctuations in exchange rates or issuance. The existing market minimum is assessed annually; see Bloomberg Barclays (2017, 32).

TABLE 6.1. Minimum Size for ILBs' Inclusion in the Bloomberg Barclays Indices (as of November 25, 2020)

Country	Minimum size in local currency			
	Currency	Conventional	ILB	USD eq
Chile	CLP	100tn	1bn	1.3mn
Brazil	BRL	1bn	400mn	75mn
South Africa	ZAR	2bn	400mn	26mn
Turkey	TRY	2bn	500mn	63mn

Source: Bloomberg Barclays 2017.

The issuance of ILBs in much smaller volumes than conventional bonds results in the indices being dominated by those countries with relatively large domestic markets, like the United States among developed countries and Brazil among emerging market countries (see figure 6.1). While the United Kingdom and United States represent about 75 percent of the index for advanced economies (WGILB), Brazil and Mexico account for more than 60 percent of that for emerging markets (EMGILB). Although Brazil's weight in the index diminished from 53 percent in June 2017 to 42 percent in June 2020 (see figure 6.2), the EMGILB unquestionably has always been highly concentrated in a few countries, which has limited the benefits of a diversification typical of an index of an asset class.

Figure 6.3 compares the returns of conventional bonds and ILBs. For conventional bonds, we use the FTSE World Government Bond Index (WGBI), and ILB returns are measured by the Bloomberg Barclays indices. The comparison is made in dollar terms, which is far from ideal, since these are not USD-based investments. Bearing these constraints in mind, the following conclusions can be drawn:

(1) Returns on ILBs in emerging markets (EMGILB) are far more volatile than for ILBs in advanced economies (WGILB), most likely because of the volatility of BRL (Brazilian reais), MXN (Mexican pesos), and ILS (Israeli new shekel) versus the USD; remember that three-quarters of EMGILB is BRL, MXN, and ILS, whereas 45 percent of WGILB is USD.

(2) WGBI and WGILB returns are close, with conventional bonds offering better performance until 2011 and ILBs outperforming since 2014; a possible explanation is that linkers in the United States have outperformed conventional bonds for the last six years.

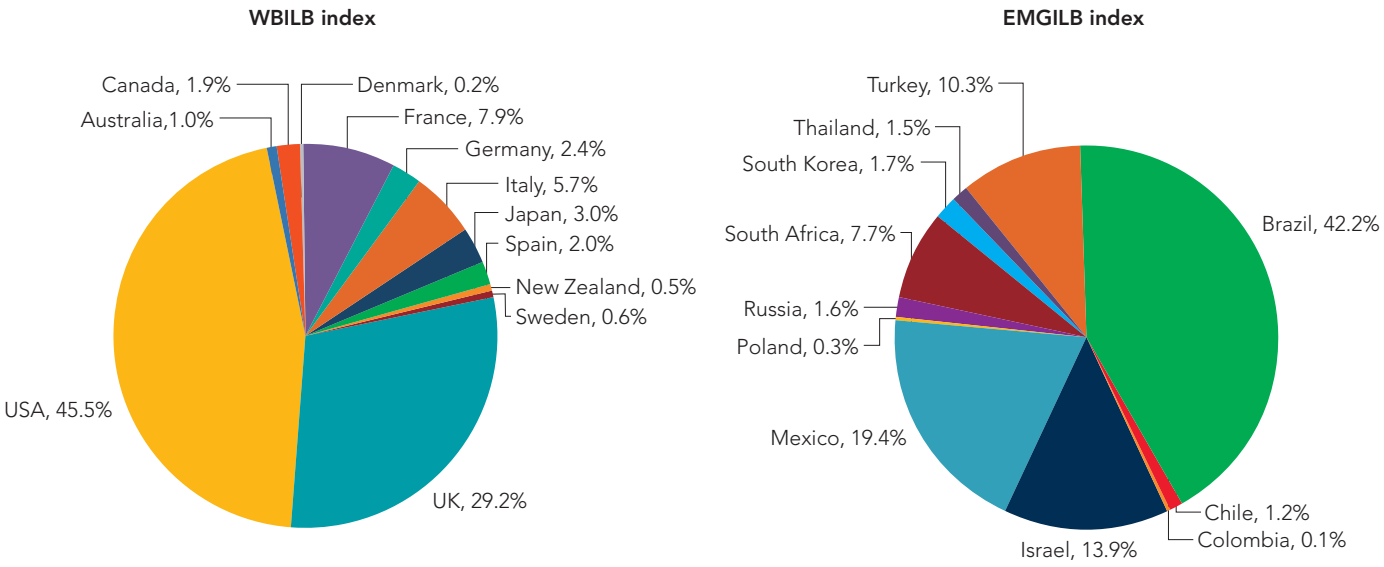
(3) The consistent outperformance of ILBs for almost the entire period is striking and implies that the interest rate differential adjusted by inflation has exceeded the depreciation of emerging market currencies. Accordingly, judging from the last 10 years, a long-term investor based in USD should consider ILBs from emerging markets, since the FX risk tends to be compensated by the USD returns of these securities.

TABLE 6.2. Countries Represented in the Emerging Market Indices, by Region

Region	Number of countries represented in the emerging market indices				
	Hard ccy	LX Sov	LX Gov	LX GovUniv	LX Linker
East Asia & Pacific	9	6	5	6	2
South Asia	4	2	0	2	0
Europe & Central Asia	12	12	6	7	2
Middle East & North Africa	13	12	1	2	1
Sub-Saharan Africa	13	13	1	2	1
South America	11	11	4	4	4
Central America & Caribbean	12	11	1	1	1
Total	74	67	18	24	11

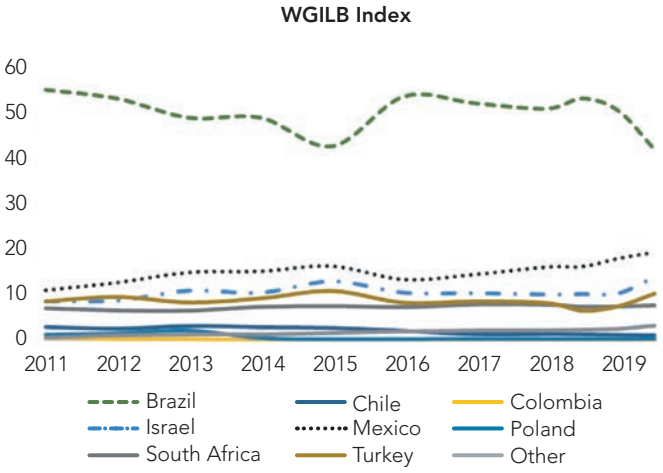
Source: Derived from table in Bloomberg Barclays 2017, 37–39.

FIGURE 6.1. Conventional and ILB Indices: Composition by Issuer



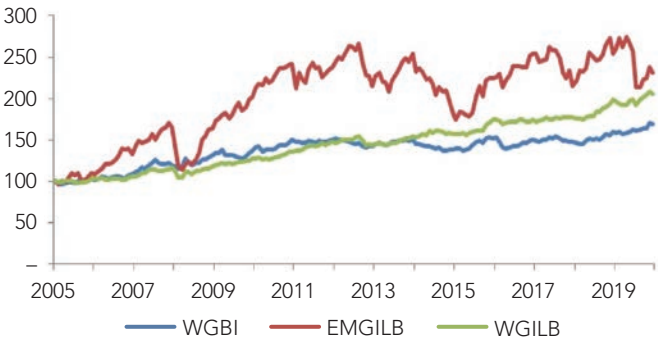
Source: Bloomberg Barclays 2017.
Note: The current WGILB includes countries that were added throughout the period so the total adds up to 100 percent for all quarters. The current EMGILB does not include countries removed from the index, so the total does not add up to 100 percent for some quarters.

FIGURE 6.2. Evolution of the Composition of the ILB Index by Issuer, 2011–20

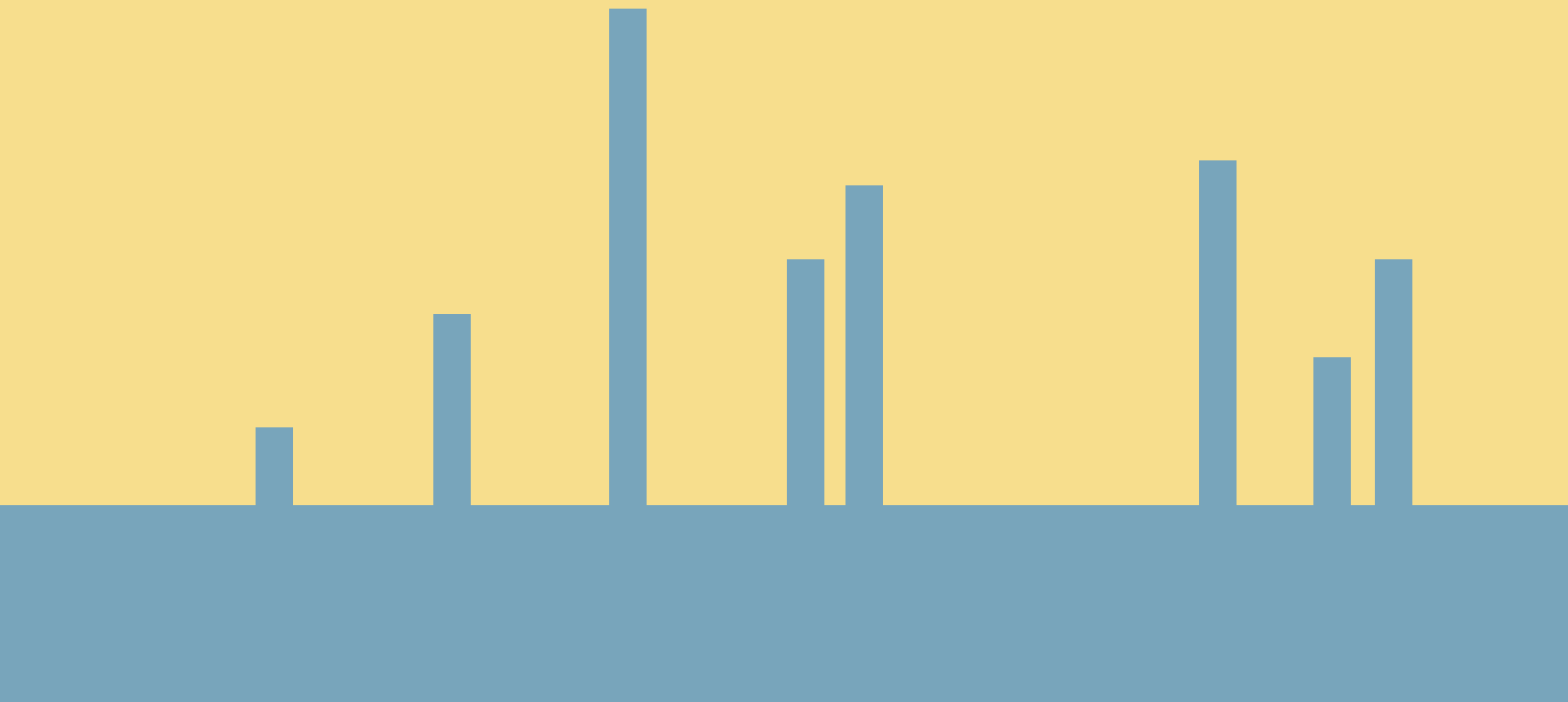


Source: Bloomberg, as of December 2020

FIGURE 6.3. USD Returns of Conventional and ILB Indices, 2005–20 (Index 2005 = 100)



Source: Bloomberg, as of December 2020.



7

Selected International Experience

This section presents three case studies of countries where ILBs play a major role in the management of government debt: Israel, the United Kingdom, and Brazil. Israel was the first emerging market to issue ILBs on a regular basis in a highly indexed economy, while the United Kingdom was the first advanced economy to use ILBs and remains the most frequent user of these instruments among its peers. The role of ILBs in Brazil is unique, as they help mitigate the financial risk of the government debt portfolio and attract nonresident investors.

A. The first emerging market country issuing ILBs: The case of Israel

In Israel, ILBs are closely linked with the history of the state.[41] The widespread use of ILBs since its creation is explained by the stubborn inflation already erupting in the 1950s, along with the expansion of the pension system.[42] Although inflation has remained under control since the end of the 1990s, these instruments continue to play a major role by assisting debt managers in efficiently managing the portfolio cost-risk tradeoffs and supporting the long-term savings industry.

Background: The history of inflation and the pension system

Israel lived through high inflation from its foundation in 1948 until the mid-1990s. A structurally large budget deficit, associated mainly with hefty defense expenditures, triggered a process that started with one-digit inflation from the mid-1950s to the end of the 1960s, increased to two digits in the 1970s, and rose to three digits in the first half of the 1980s. Throughout this period, the Israeli economy adapted to persistent rising prices by indexing salaries, rents, savings accounts, life insurance policies, and all financial commitments— including those associated with the government debt—to the CPI.

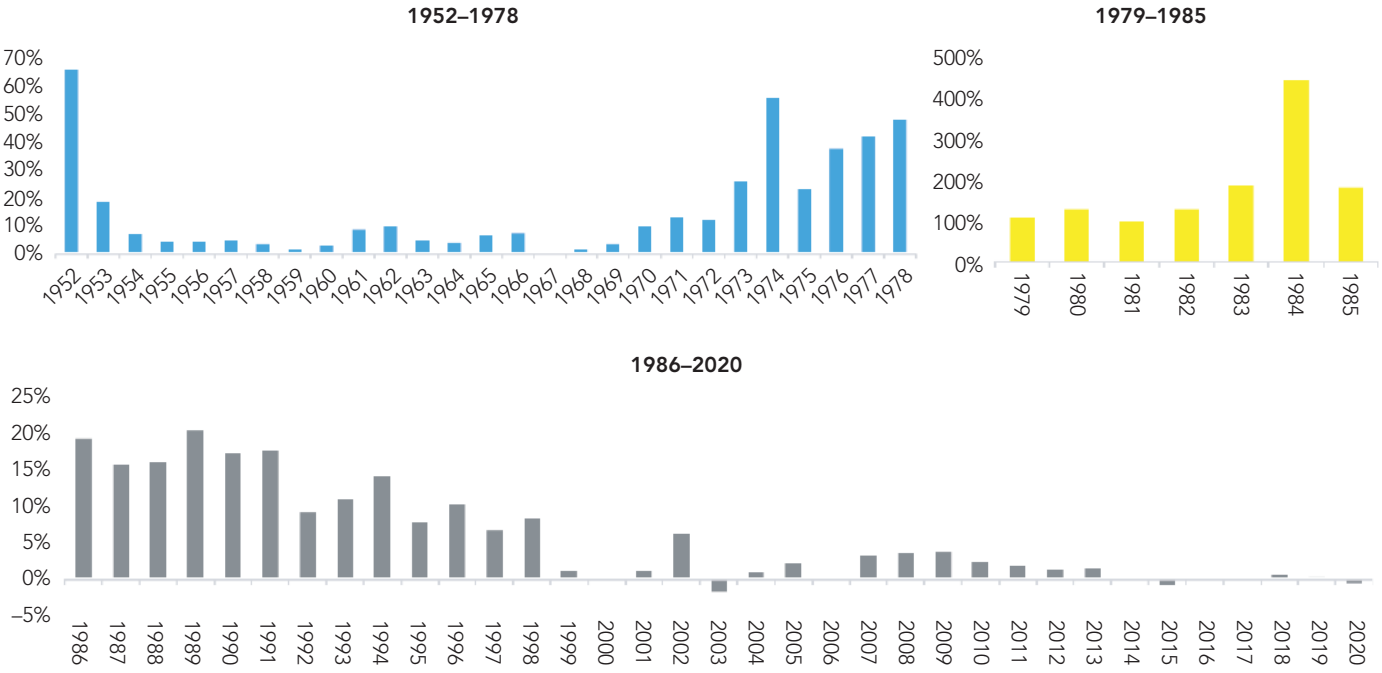
Only in 1985, after several failed attempts, was a government of national unity able to implement a stabilization program based on a drastic reduction in the budget deficit, temporary wage and price controls, a fixed exchange rate regime, and a ban on monetary financing by the central bank. The plan, devised by Yitzhak Moda'i and Michael Bruno (see Liviatan 1988), was a resounding success. Inflation dropped to single digits in the late 1990s and has since stayed within or below the 1 percent to 3 percent band set by the Bank of Israel in 2003 (see figure 7.1).

Unquestionably, for Israel to issue conventional medium- and long-term bonds amid an accelerated inflationary process would have been extremely difficult. ILBs, therefore, offered a unique alternative well suited to the specific macro conditions that prevailed for most of the second half of the 20th century. The inflationary process does not provide the only explanation for the growth of ILBs, however. The pension system, which expanded rapidly to cover the entire workforce, developed with strong government support and relied heavily on the issuance of generous ILBs.

[41] Israel is a developed small open economy with 9 million inhabitants. At the end of 2020, GDP per capita was close to USD 43,000, the ratio of public debt to GDP was 72 percent, and the credit rating by S&P was AA–, with a stable outlook.

[42] The pension system consists of five types of pension savings vehicles: old pension funds, new pension funds, new general pension funds, provident funds, and life insurance. The vehicles have different characteristics.

FIGURE 7.1. Actual Inflation, 1952–2020 (YoY)



Source: Data from the Central Bureau of Statistics of Israel, December 2020.

The pension system and the role of non-tradable ILBs

The pension system in Israel consists of a relatively small public sector component for civil servants and a larger private sector component that employees are legally required to join. Over their working lives, civil servants pay fixed contributions from their salaries to the National Insurance Institute, and at retirement they receive pensions proportionate to their final salaries that come directly from the state budget. The private pension system started as labor union–bargained pension plans with *defined benefits* and evolved to systems of *defined contribution* after recurrent deficits forced the government to undertake major pension reforms in 1995 and 2002. After the insolvency of the old pension funds was addressed and they were closed to new members, different types of private pension funds emerged in the early 2000s. *New pension funds* would provide coverage to employees and independent workers not protected by collective agreements; *new general pension funds* would offer a voluntary savings vehicle without insurance for disability and death; and *provident funds* and *insurance policies* would offer flexibility for the withdrawal of the funds.[43]

Non-tradable ILBs with subsidized coupons were the main vehicle for the government to ensure the financial viability of the old pension funds, as they were not fully funded; for instance, *Meron* ILBs were issued in the mid-1950s with 20-year tenor and a 5.56 percent coupon, for a total of 93 percent of the old pension funds' assets. The government did not limit its support to the long-term savings industry to the old pension funds, however; the new pension funds were also given access to non-tradable ILBs; for example, *Arad* ILBs were issued in 1995 with 15-year tenor and a 5.05 percent coupon, for a total of 70 percent of their assets. And life insurance companies offering both savings for retirement and coverage for death and disability were initially allowed to buy non-tradable ILBs; for example, *Hetz* ILBs were issued in the early 1960s with 12-year tenor and 4 percent to 6 percent coupons.

[43] For a description of the pension system, see OECD (2011). This document was prepared as part of the process of Israel's accession to OECD membership.

The reforms undertaken in 1995 and 2002[44] offered a long-lasting solution to the challenges of the industry. In the end, the financial responsibility for the old pension funds was transferred to the plan members. Similarly, the new pension funds, created as defined contribution plans, were designed to remain fully funded and had limited need for government support. The government financial support to pension funds, together with the issuance of non-tradable ILBs, thus waned considerably over time, with access to non-tradable ILBs paying a semiannual coupon of 4.8 percent currently limited to 30 percent of assets for old pension funds and new pension funds and other types of funds unable to invest in these instruments. As a consequence, there was a significant drop in the participation of non-tradable ILBs in the government debt portfolio, from 37 percent in 1997 to 28 percent in 2020.

Tradable ILBs

In the context of a broad capital market program, Israel's experience with tradable ILBs, beginning at the end of the 1970s, holds particular interest for debt managers in emerging market countries.

In terms of their design, Israel's tradable and non-tradable ILBs follow the Canadian model, with both capital and coupons indexed to the country's consumer price index, which is reported monthly by the Central Bureau of Statistics, a public sector entity independent of the Ministry of Finance. The CPI is general and includes food, fuel, and rent. Neither seasonally adjusted nor revised, it is the same index used for the preparation of the government budget. Since ILB coupons are annual and use the CPI with a one-month lag, information is always available to calculate accrued interest for any transaction in the secondary market. Secondary legislation specifies what will happen if the index, or the entity producing the index, is to change; these legal provisions appear in the prospectus and cannot be modified unilaterally by the Ministry of Finance.

[44] Although the major reform of the pension system was adopted in 1995, it was only put into effect several years later when the actuarial deficits of the old pension funds had worsened. A definite solution had to wait until 2002, when the government committed to the last capital injection (NIS 80 billion over 35 years), which was accompanied by a modification of the pension calculation, increases in retirement age and contribution rates, and the establishment and regulation of private pension funds.

Current tradable ILBs, known as ILCPI, do not protect investors if the bonds fall below their original face value.[45]

Tradable ILBs are issued through the whole spectrum of the yield curve from the short term (between 3 and 5 years), to the medium (10 years) and long terms (30 years). After opening a new series, the bond is reopened several times to increase its outstanding volume to levels of ILS 15–20 billion. Typically, 3- and 5-year securities remain on the run for a year, whereas 10-year securities do so for 2 years and 30-year ILBs for about 5. Because of the inflation uplift, the ILBs' benchmark is smaller than that of nominal fixed-rate bonds.

While issuing several benchmarks raises challenges to ensuring liquidity, the diversity of securities allows the DMO to adjust tactically to the investor demand and reduces refinancing risk.

Auctions of tradable ILBs are held every Monday, and the amounts auctioned are typically smaller than those for conventional bonds. Like nominal fixed-rate and floating-rate bonds, tradable ILBs are auctioned through a multiple-price system; primary dealers are well acquainted with it, and the authorities are not concerned about potential detrimental effects of the winner's curse. In general, auctions of ILBs work well; in 2020, for example, which was a record year in terms of issuance, the average bid-to-cover ratio of ILBs was 3.3, compared to 3.7 for conventional bonds. Since the placement mechanism has functioned reasonably well, syndications have not been considered.

Evolution of the role played by ILBs in debt management

ILBs have played two distinct roles since their introduction in 1954. During the inflationary period and until the stabilization process gained sufficient credibility, they were the only debt instrument providing financing in local currency beyond the short-term ones. Once inflation expectations fell in line with the Bank of Israel projections, they were issued according to cost-risk and demand considerations, very much like conventional bonds.

[45] In the past, Israeli authorities issued tradable ILBs, known as Galil, with a deflation floor, but they subsequently concluded investors should bear the risk of deflation and lifted such floors.

The first role played by ILBs in Israel is illustrated by the composition of the government debt portfolio in 1997. As illustrated in figure 7.2, the history of high inflation, together with the compulsory investment by the long-term savings industry, led to ILBs' representing 64 percent of the government debt portfolio, while foreign currency denominated and local USD indexed bonds represented 29 percent. In sum, in 1997, 93 percent of the government debt was indexed either to the CPI or to the exchange rate; the share of nominal fixed-rate debt, on the other hand, was insignificant, comprising only 3 percent of the government debt portfolio.

As the stabilization program succeeded in bringing down inflation, the DMO was able to modify its debt management strategy by reviving the role of fixed-rate debt instruments, which had been muted because of the lack of investor appetite. In this new macroeconomic context, ILBs lost their dominance, allowing a more balanced composition that reflected the cost-risk tradeoffs and the change in investor demand. The proportion of nominal fixed-rate securities increased from 3 percent in 1997 to 31 percent in 2020, at the expense of a reduction in the share of ILBs (both tradable and non-tradable) and foreign currency bonds.

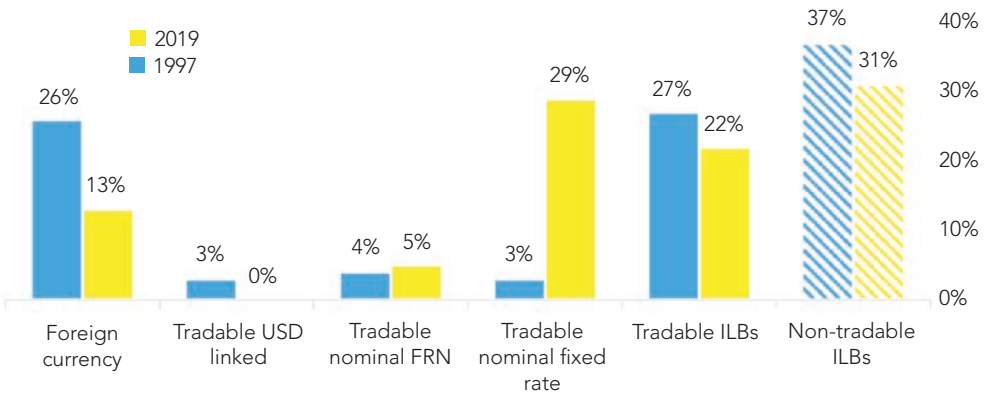
The DMO's response to the success of the stabilization program is best illustrated by analyzing the breakdown of the marketable debt, which is the portion of the debt portfolio over which debt managers have clear discretion. As shown in figure 7.3, the share of fixed-rate bonds in the period 1997–2020 increased by over 45 percentage points, confirming a clear intention to de-index the portfolio and increase the share of conventional bonds.

Over the last 10 years, the composition of the tradable debt portfolio has converged to 50 percent fixed-rate bonds, 40 percent ILBs, and 10 percent floating-rate notes, in line with the output of an internal cost-at-risk model and the need to provide the market with two active yield curves. While a share of 40 percent for tradable ILBs seems high compared to other countries, to a large extent it reflects the composition of the investor base, with a long-term savings industry that holds close to 50 percent of the stock of government securities (see figure 7.4). Furthermore, the DMO feels that ILBs relative to conventional bonds are probably more cost effective in Israel than in other countries because the inflation premium tends to be significant, reflecting a history of high and volatile inflation, whereas the ILBs' liquidity premium may be less relevant, given the long history of these instruments.

B. The first developed-country issuer: The case of the United Kingdom

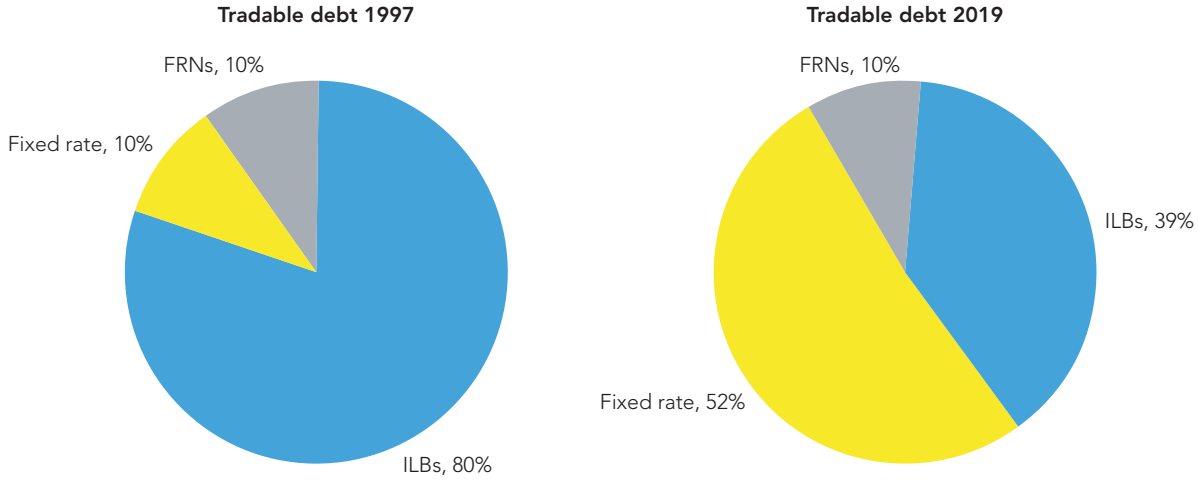
The UK has not only been the first G7 issuer of ILBs; it is the one with the highest share of linkers as a proportion of its marketable debt. Over time, the UK DMO has adjusted the

FIGURE 7.2. Evolution of the Composition of the Government Debt, by Instrument (Share of Total Debt)



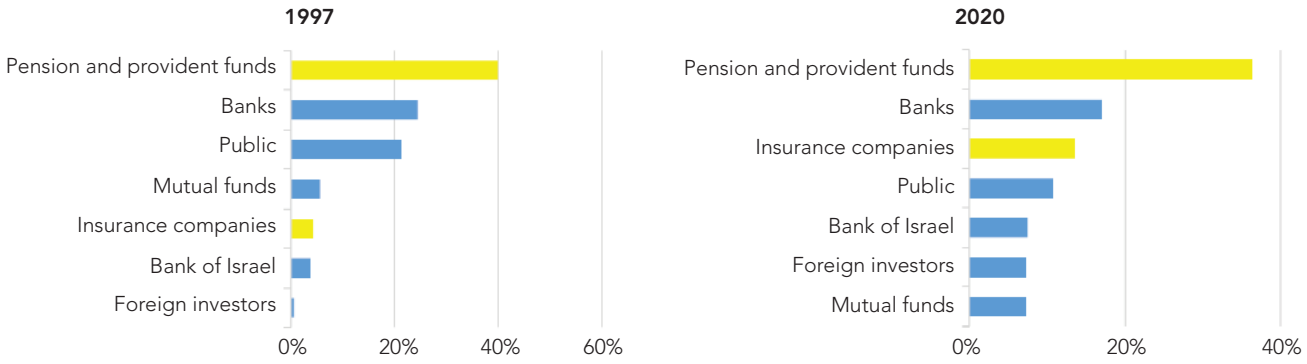
Source: Data from the Ministry of Finance, Israel.
Note: FRN are floating rate notes

FIGURE 7.3. Tradable Local Debt Breakdown, by Instrument



Source: Data from the Ministry of Finance, Israel.

FIGURE 7.4. Tradable Local Debt Breakdown, by Investor (Share of Total Tradable Debt)



Source: Data from the Bank of Israel.
Note: The provident fund is a long-term savings vehicle for retirement that enjoys tax benefits.

mechanism of issuance and the design of the instrument, with all changes preceded by a formal consultation with market participants. This process accelerated with the transfer of the debt management function from the Bank of England to Her Majesty's (HM) Treasury in 1998.

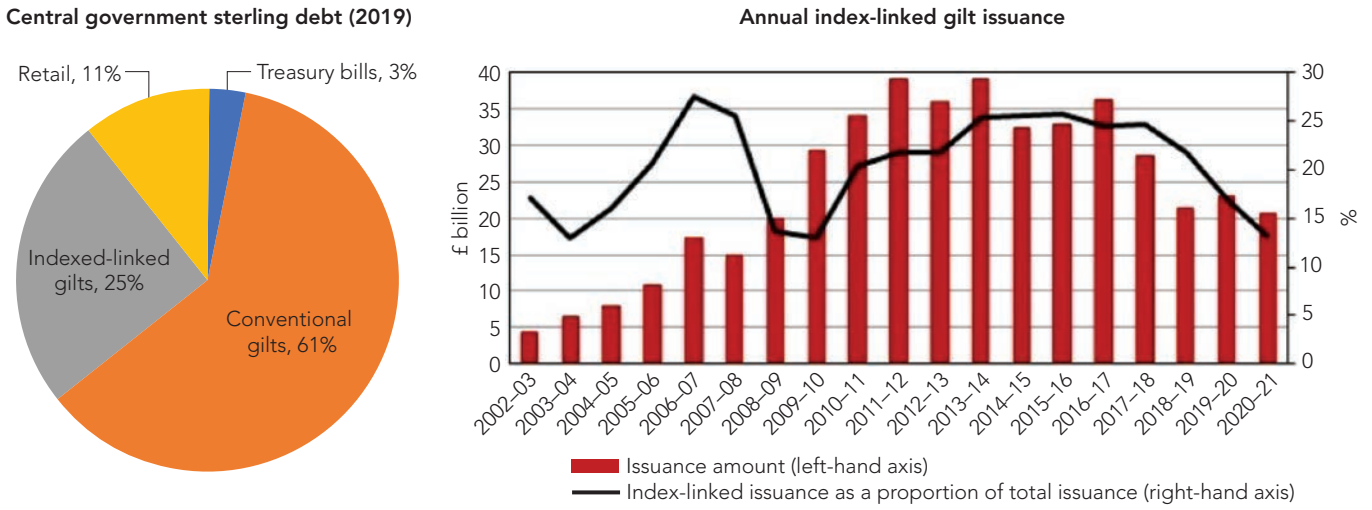
The unique characteristics of the ILB market have driven the UK DMO to adopt a tailor-made approach toward issuance that differs from that of conventional bonds by using uniform- as opposed to multiple-price auctions, more lines of smaller-size securities, and a more frequent use of syndications.

Evolution of the ILB market in the United Kingdom

Following the Wilson Report's recommendation in 1980, the United Kingdom was the first G7 country to issue ILBs, on March 27, 1981.[46] Originally, the rationale for issuing the ILBs comprised four motives: (1) to reinforce the UK government's credibility with regard to fighting inflation; (2) to increase the

[46]The first issue of GBP 1 billion was conducted through a single-price auction restricted to pension funds; restrictions on the ownership of index-linked gilts were removed in March 1982.

FIGURE 7.5. ILBs as Percentage of the Total Debt and Annual Issuance



Source: Data from the Debt Management Office, United Kingdom.

flexibility of the issuances by allowing the government to borrow even in times of uncertainty about high inflation; (3) to reduce the debt servicing costs, due to investors' willingness to accept lower real returns in exchange for inflation protection; and (4) to benefit the pension industry by providing additional flexibility in tailoring the benefits on offer (UK HM Treasury 1981).

Given the high and volatile inflation in the 1970s, the first motive was probably the most important at the time of launching the index-linked gilts. With the strengthening of the macro fundamentals, however, including the steady reduction in inflation since the early 1980s, the satisfaction of the demand from the pension industry and the reduction of debt servicing costs became more relevant (see Stheeman 2018).

As presented in figure 7.5, the issuance of ILBs in the UK increased steadily and, when including the inflation uplift, represented 25 percent of the total debt as of 2020—a share larger than any other advanced economy, including Sweden. The share of linkers increased rapidly in the late 1990s and early 2000s and for many years represented 20–25 percent of the annual financing. In 2018, however, the UK DMO revised its borrowing strategy and reverted the trend, partly in response to a report from the Office for Budget Responsibility the previous year pointing out the interest rate risks associated with a sustained resurgence of inflation (UK Office for Budget Responsibility 2017).[47] As shown in figure 7.5, the share of ILBs in total issuance fell from about 25 percent in 2017–18 to less than 15 percent in 2020–21.

Unlike conventional bonds, ILB issuance has concentrated on the long end of the curve, increasing the portfolio's average time to maturity (ATM) and facilitating the smoothing of the redemption profile of the government debt portfolio.

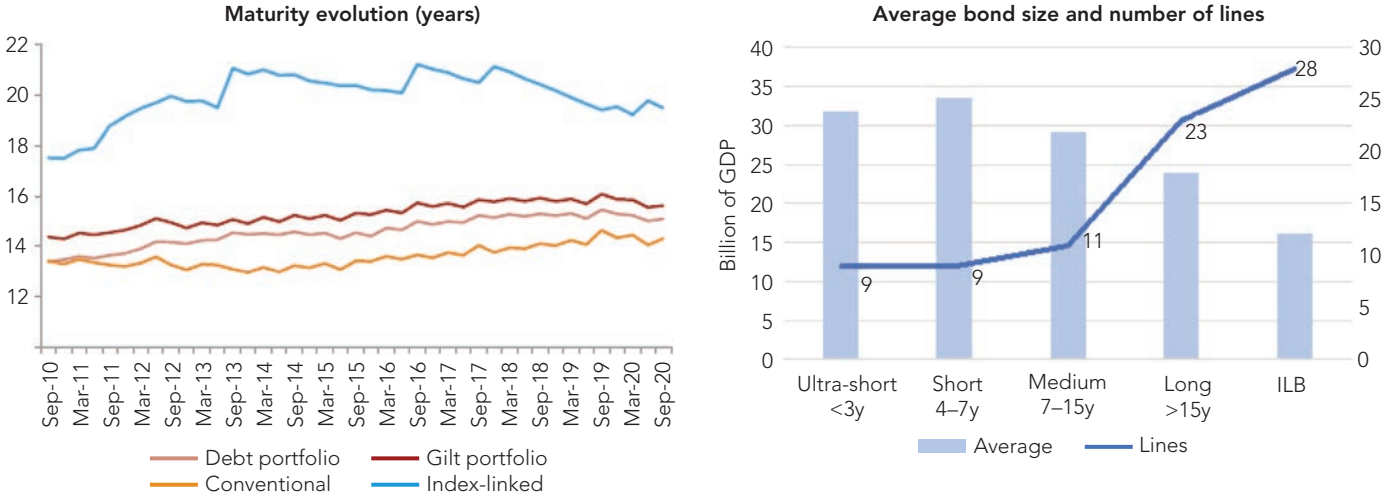
The management of ILBs also differs from conventional bonds in the mode of issuance. As figure 7.6 shows, ILBs are, on average, 60 percent the size of long conventional bonds (GBP 15 billion versus GBP 25 billion) and are spread over more lines (28 versus 23). As explained next, the specific market dynamic and illiquidity of ILBs drove the UK DMO to use a different format for the auctions (uniform price rather than multiple price) and syndications more frequently than with conventional bonds.

Major revisions to the ILB program

The United Kingdom's experience with ILBs is rich and well documented. As the first issuer, the UK experimented with the

[47] The problems potentially resulting from the rising proportion of ILBs were also picked up by the National Audit Office in "Evaluating the Government Balance Sheet: Borrowing" (UK HM Treasury 2017) and were reflected in the debt management reports of several years; see, for example, UK HM Treasury 2020.

FIGURE 7.6. ILBs: Maturity Evolution, Average Bond Size, and Number of Lines, 2020



Based on net uplifted values

Source: UK HM Treasury 2020.

placement mechanism, adjusted the instrument's design, and introduced reforms to improve liquidity in a market where trading paled compared to that of conventional bonds. It is worth noting the establishment in 1995 of a formal process of market consultation[48] to ensure decisions crucial to the functioning of the government debt market would be adopted only after ample discussion with all involved stakeholders and with full transparency.

Placement mechanism

Single-price auction was the preferred method to sell index-linked gilts until 1988, when it was replaced by taps. Although by the mid-1990s the authorities were leaning toward auctions for conventional bonds,[49] index-linked gilts, which accounted for 10 percent of the government debt in 1995, continued being placed by taps until the end of 1998, when single-price auctions were reintroduced.[50]

To date, uniform-price auctions continue to be used for the placement of index-linked gilts, while the multiple-price format is used for the offering of conventional gilts. The justification is that the pricing of ILBs is more difficult because their market is considerably less liquid. Accordingly, adopting the multiple-price format will increase the potential for the winner's curse, making ILB market makers more cautious and reducing their demand for these securities.

Finally, in addition to auctions, the UK DMO introduced syndications in 2005 to launch the first index-linked gilt with a three-month indexation lag for GBP 1.25 billion (the change in the indexation lag is discussed further below). Syndications were used again in 2009[51] and have been used thereafter every single year; the maximum use of this modality occurred in 2011 and 2012, with placements close to GBP 18 billion each year. Although the stock of conventional bonds is about three times that of ILBs, the accumulated issuance by syndication in both cases is very similar,[52]

[48] In the 1995 report, it was agreed that "the authorities will introduce a formal consultation process to enable them to ascertain the views of market participants on strategic debt management policy issues" (UK HM Treasury and Bank of England 1995, 3).

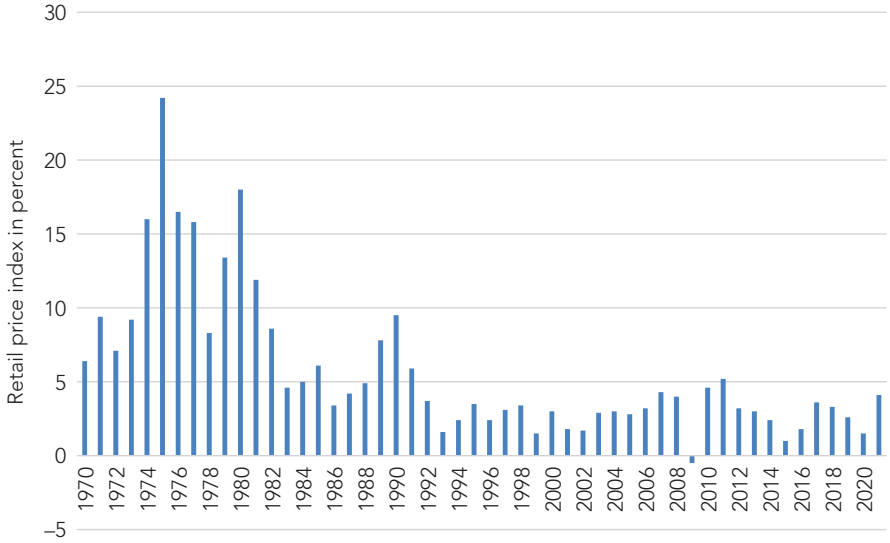
[49] "**Tap sales** . . . will not normally constitute more than 10 percent of total issuance" (UK HM Treasury and Bank of England 1995, 3).

[50] The reintroduction was preceded by a consultation with the market on (1) the size, frequency, and annual calendar of the auctions; (2) the use of a single- versus a multiple-price format; (3) whether to keep taps to supplement auctions; and (4) the merits of establishing a separate list of ILB market makers. See Bank of England (1998, 62).

[51] In 2009–10, the UK DMO decided to use syndications alongside the auction program to issue larger volumes of long-dated conventional and index-linked as but anticipated that syndicated issuance would occur no more frequently than once in any quarter.

[52] Syndications for conventional bonds started in 2009. By the end of 2019, the UK DMO had placed GBP 128.2 billion by this method in 26 transactions; syndications for ILBs started in 2005 and totaled GBP 128.7 billion by the end of 2019 in 37 transactions.

FIGURE 7.7. Annual Retail Price Index (in Percent)



Source: Data from the Office for National Statistics, United Kingdom, 2020.

which suggests that syndications are a particularly efficient offering method for index-linked gilts.

Revision of the instrument design

By design, both the principal and interest payments of the inflation-linked gilts were—and still are—linked to the Retail Price Index (RPI) published by the United Kingdom's Office for National Statistics. Figure 7.7 shows the substantial reduction in the level and volatility of inflation after ILBs were introduced in 1981.

While the RPI has been retained as the reference index, its application has been modified. Originally, index-linked gilts had an eight-month indexation lag: two months to allow for publication of the RPI and six months so the next coupon could be known at the start of the relevant coupon period to facilitate the calculation of accrued interest; in addition, the index ratio changed only once a month. In 2005, the indexation lag was shortened from eight to three months, aligning the security to the Canadian design, also used by France, Sweden, and the United States. The design was also modified to allow for each day change in the index ratio in the calculation of accrued interest.

More importantly, since the pension industry switched to the CPI, the debate to change the RPI deepened. While the Harmonized Index of Consumer Prices (HICP) and a modified RPI excluding mortgage interest payments (RPIX) were discarded in 2001/2002, the UK DMO introduced in the prospectuses a provision allowing the Chancellor of the Exchequer to change the index after consultation with independent experts with proven experience in the construction of price indices. In 2011, the UK DMO reconsidered a move to a CPI but discarded the change again with the argument that it might not be cost effective, while involving several risks (see UK DMO 2002, 3; UK DMO 2011, 3).

Another key feature of index-linked gilts revisited has been their tenor. After steadily increasing the tenor since the first 15-year issue in 1981, the UK DMO in 2005 approved extending the maximum maturity from 30 to circa 50 years (UK DMO 2005, 2).[53] The extension was designed with a view to cost savings, given the shape of the yield curve; the DMO responded by increasing the share of ultra-long conventional gilts by 6 percent and ultra-long ILBs by about 4 percent over this period. In 2012, against the backdrop of historically low

[53]Proposals for issuing fixed-term index-linked annuities and index-linked bonds with limited price indexation properties (LPI bonds)—that is, where the indexation of the cash flows to the reference price index is capped to the upside and/or to the downside—were rejected.

long-term interest rates and strong demand for long maturity gilts, the DMO examined the case for issuance of gilts with maturities in excess of 50 years and revisited the potential issuance of perpetual gilts. A decision was made to remove the maturity cap on gilt issuance set at around 50 years, but the idea of introducing perpetual gilts was again rejected (UK DMO 2012).

Other revisions to the ILB design have included a change in the coupon dates and the rounding of cash flows. Coupons have always been semiannual and aligned to the redemption date; what has changed is the redemption date. Initially, redemptions were spread throughout the year toward the second half of the month, with no preference for a particular day. After the indexation lag was shortened to three months, maturity dates were modified so that most coupon dates fall on May 22 and November 22 or March 22 and September 22. This must have facilitated the UK DMO cash management process. Finally, cash flows on the three first issues were rounded down to two decimal places, extended to four decimal places in 1982 and to six in 2002; the last change made treatment of ILBs consistent with that of conventional bonds.

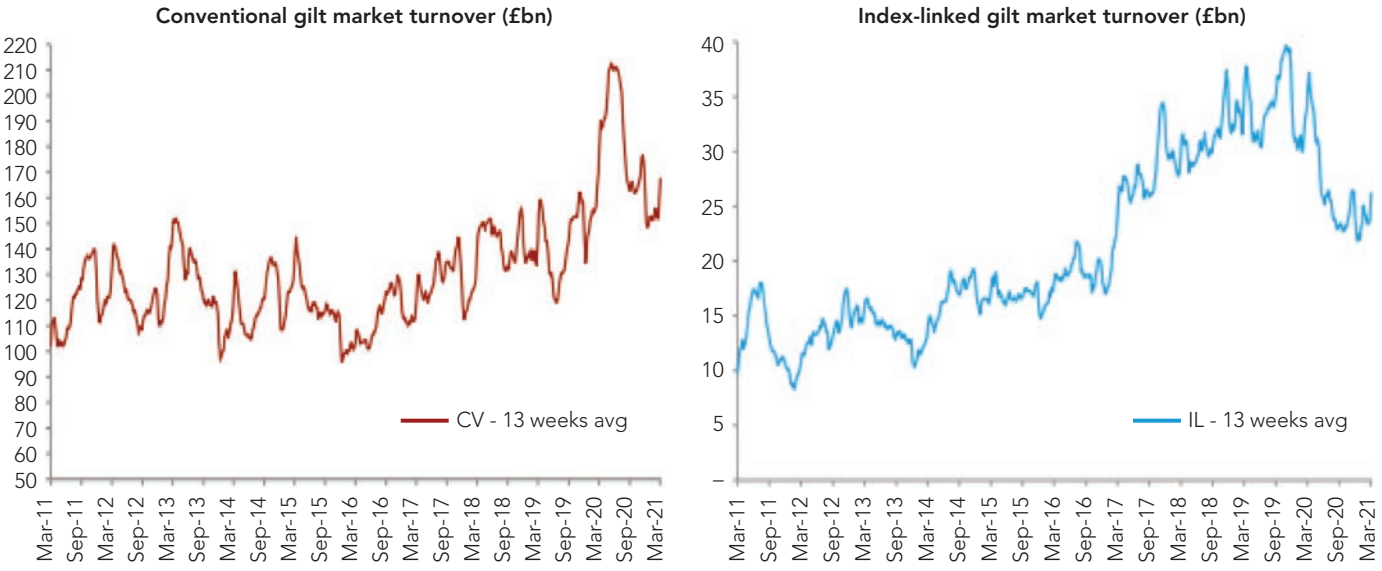
Improving market liquidity

Figure 7.8 shows the weekly turnover of conventional bonds and ILBs since 2011. Several observations can be drawn from the charts. First, the turnover shows a positive trend during the last decade, more prominent in the case of ILBs, as their share in the portfolio was also growing. Second, turnover volumes increased sharply after the outbreak of the pandemic, possibly linked with the expansionary policy adopted by the Bank of England through the purchase of government securities. Finally, and more relevant to our discussion, even after taking into account the relative size of their stocks, conventional bonds traded significantly more than ILBs.

A better comparison of the relative liquidity of ILBs is illustrated by figure 7.9, with the turnover ratios calculated as annual absolute turnover over the average stock of the securities in a given year. The improvement in the relative liquidity of ILBs over the last decade is striking, yet conventional bonds at the end of the period traded about twice as much as their indexed cousins.

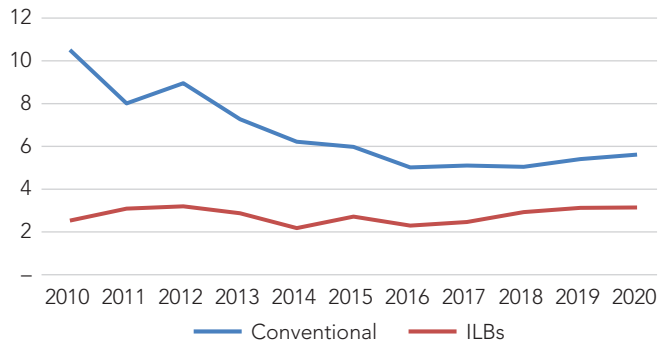
The UK DMO's concern about liquidity in the ILB market was reflected in several ways: (1) contrary to conventional gilts, the

FIGURE 7.8. Turnover of Conventional and Inflation-Linked Bonds, 2020–21 (Weekly Averages in GBP Billions)



Source: UK HM Treasury 2021.
Note: Market turnover in weekly averages.

FIGURE 7.9. Annual Turnover Ratios of Conventional and Inflation-Linked Bonds, 2010–20



Source: Calculations based on data from UK DMO quarterly reports.

DMO avoided building large benchmark bonds and issued smaller securities, distributed evenly across the longer maturities; (2) ILB auctions were conducted through a uniform- rather than a multiple-price format; and (3) the market making system was reformed in 1998 with the appointment of specialized ILB market makers.

Subsequently, in the late 1990s, the UK DMO established a backstop facility that allowed the issuer to bid for any ILB in the hands of market makers; it was replaced by a reverse tapping facility in 2001. Finally, also in 2001, the UK DMO introduced index-linked gilt switch auctions, allowing investors to replace off-the-run securities with more current ones; this mitigated the liquidity snag triggered by bonds that fall out of the relevant indices due to the passage of time.

C. Reducing risks within an ALM approach: The case of Brazil

Although Brazil had used inflation-linked debt before, the systematic use of ILBs came in the beginning of the 2000s. With the country's history of high inflation, ILBs were an effective instrument to lengthen the average maturity of the debt portfolio, which had been as short as a few months in the late 1990s. ILBs have since become important funding instruments, and Brazil has an explicit target of around 35 percent for the share of ILBs in the government debt portfolio. Brazil considers ILBs an effective instrument within a sovereign asset and liability management framework.

1980s to 1994: A background of high and volatile inflation and indexation of the economy

In the decade between 1984 and 1994, Brazil experienced very high and volatile inflation. Since the 1940s, 12-month inflation in Brazil had been consistently above 10 percent, hovering around 30 percent in many years. During the mid-'80s, however, Brazil experienced unprecedent levels of inflation that included a period of hyperinflation in the first months of 1990,[54] peaking at levels close to 2,500 percent in 1993 (see figure 7.10).

This economic environment severely constrained public debt management. The lack of credibility in monetary policy led to a high indexation in the prices of goods and services that extended to the capital market, where investors adopted the overnight interest rate as their main benchmark. In such an environment, the government could not issue medium- or long-term fixed-rate bonds and instead relied on short-term bills and domestic bonds indexed to the USD, or to the overnight rate.[55]

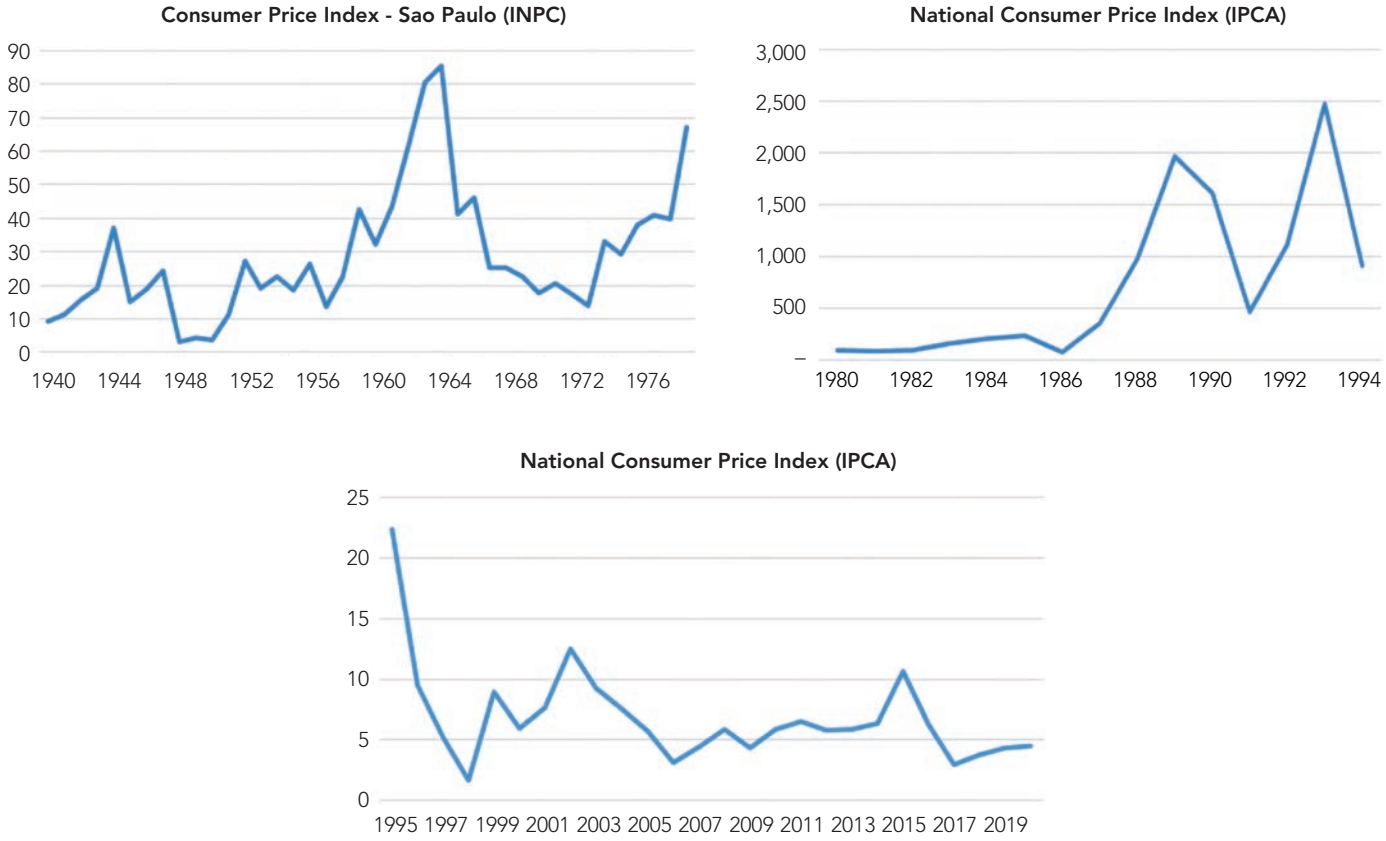
1994 to 2001: Price stabilization and enabling environment for debt management

The price stabilization process after 1994 and subsequent economic reforms paved the way for the change of the debt composition implemented in the first years of the new century. After failed attempts to control inflation in the previous decade,

[54] The definition of hyperinflation by Cagan (1956)—that is, consecutive periods of monthly inflation above 50 percent lasting for at least one year—is considered a reference. The literature has, however, often considered any yearly three-digit inflation (above 100 percent) as very high and disruptive to the economy.

[55] With demand very limited even for T-bills, the government introduced in the late 1980s a zero-coupon bond indexed to the overnight interest rate. Investors were willing to carry these bonds, as they were indexed to their benchmarks and would offer some protection against inflation. For the government, it was almost the only way to get the necessary funding and start reducing the overwhelming refinancing risk; the average time to maturity (ATM) of the domestic debt came down to a few months.

FIGURE 7.10. Brazil: Consumer Price Index (Percentage Accumulated in 12 Months)



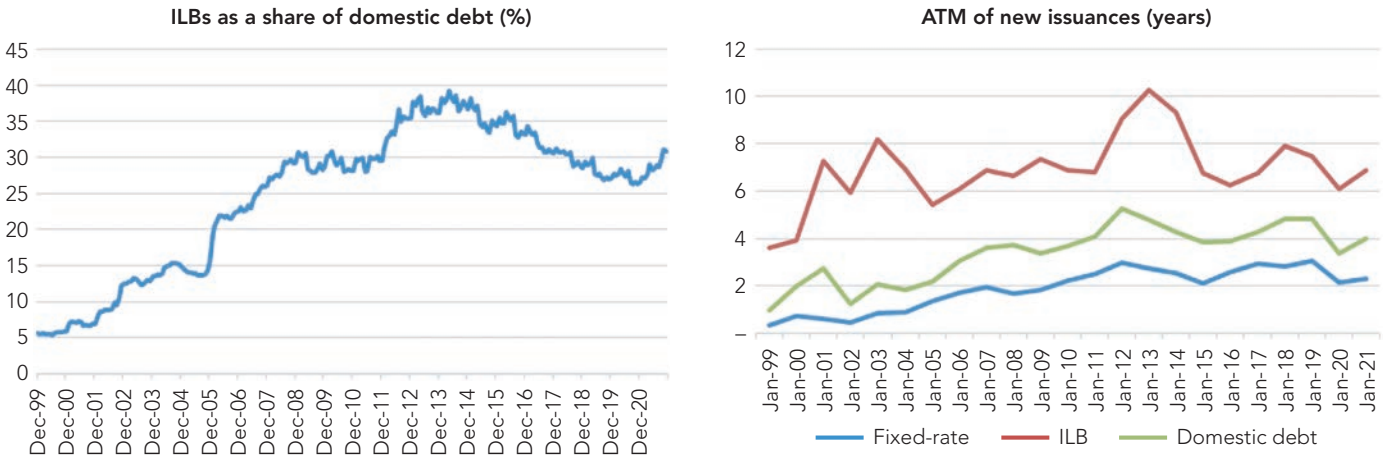
Source: Data from the Brazilian Institute of Geography and Statistics, 2020.

the "Plano Real" (the "Real Plan") in 1994 finally succeeded in anchoring expectations and consistently reducing inflation to one-digit levels after 1996. The stabilization of monetary conditions and a gradual path to fiscal consolidation were the main components of a comprehensive package of macroeconomic reforms that created the enabling environment for public debt managers to change the composition of the government debt. Improving the composition of the government debt was a priority because, by the late 1990s, 90 percent of the overall public debt portfolio was linked either to FX or to the overnight interest rate, exposing the government budget to substantial market risk.

In parallel to the macroeconomic reforms, public debt management went through a process of modernization and professionalization. In 1999, the Brazilian National Treasury initiated a series of institutional reforms to reorganize its DMO in 2000. A middle office was established with the core functions of risk management and strategy development. The first formal strategic approach to public debt management started with the publication of an annual borrowing plan (ABP) in 2001. Albeit with a relatively short horizon (one year), the ABP formally established, for the first time, the objectives of public debt management.

Key goals of the 2001 ABP were to reduce market and refinancing risks. The priorities were to reduce the exposure to foreign exchange risk—both in external and domestic debt—and the refinancing risk of the domestic debt portfolio. The National Treasury also aimed to reduce the share of bonds indexed to the overnight interest rate and implement measures to develop the domestic market for government securities. Inflation-linked bonds would become a key instrument in achieving most of these goals.

FIGURE 7.11. Brazil: Evolution of Inflation-Linked Bonds, November 2021



Source: Data from the Ministry of Finance, Brazil.

After 2002: A strategic approach to inflation-linked bonds

In the early 1990s, Brazil started issuing ILBs linked to the wholesale price index, which captured well the indexation of the economy.[56] ILB issuance, relatively small at the beginning, grew significantly by 2001, together with the credibility of the Plano Real. The National Treasury started issuing larger volumes of inflation-linked bonds to increase the average time to maturity (ATM) and reduce the refinancing risk of the public debt portfolio.

In 2002, the Brazilian National Treasury started using an asset and liability management (ALM) approach that would lead to a stronger focus on ILBs. In the 2002 ABP, the DMO laid out the basis of this approach by looking at the stock of financial assets and liabilities of the central government, as well as the expected cash flows. The financial balance sheet of the central government showed a substantial net asset position linked to inflation as a result of large Treasury claims on the states and municipalities. Even more substantially, the Treasury also considered the characteristics of government taxes, which were denominated in local currency, spread out over time, and with some lagged link to the nominal GDP. Based on such analysis, the Treasury concluded that a combination of medium- and long-term ILBs and fixed-rate bonds in the government debt portfolio would help the central government improve the match between revenue and expenditure flows.[57]

Also in 2002, the DMO started issuing ILBs linked to the consumer price index (CPI). Brazil focused on issuing the more "regular" type of ILBs, and these securities became an effective way to increase the ATM and comply with the ALM strategy described above. The change to the CPI also followed the central bank's launch of an inflation targeting regime using that same index. A consumer price index would make more sense from an economic point of view (maintaining the purchase power of end investors), and the use of the new index would reinforce the credibility of the monetary policy.

A consistent goal in the following years was to increase the share of ILBs in the government's overall financing. Replacing bonds indexed to the USD and to the overnight rate with both fixed-rate and inflation-linked securities became a key goal of the Treasury, as stated in the ABPs of 2001–10 (see figure 7.11).

[56] There was a strong pass-through from devaluations of the currency to the wholesale price index.

[57] In the 2002 annual borrowing plan, Brazil defines this ALM strategy by stating that "the main characteristic of taxes is that they are denominated in domestic currency and are spread out over time, moving in tandem with GDP growth with a certain lag. So, a strategy based on the issuance of medium- and long-term inflation-indexed securities and long-term fixed-rate bonds would be efficient to balance financial revenues and outlays" (Brazilian National Treasury 2002).

TABLE 7.1. Brazil: Debt Management Strategy

	Long-term targets	
	Reference	**Range**
Composition (%)		
Fixed rate	40	+/– 2
Inflation linked	35	+/– 2
Floating rate	20	+/– 2
FX	5	+/– 2
Maturity Structure		
% maturing in 12 months	20	+/– 2
Average maturity (years)	5.5	+/– 0.5

Source: Data from the Ministry of Finance, Brazil.

Today, ILBs play a central role in the government's funding and its long-term strategy. In 2011, the Brazilian National Treasury started publishing a long-term debt management strategy, represented by targets for the composition and maturity structure of the portfolio. At present, the target range in the ABP for the share of ILBs in the overall debt portfolio is 30–35 percent, but the current long-term strategy points to a target of 35 percent, with a tolerance of two percentage points higher or lower (see table 7.1).

The development of the domestic investor base in Brazil has been crucial for increasing the share of ILBs. At the beginning of the 2000s, Brazil had a large mutual fund industry that offered a range of products mainly benchmarked against the overnight interest rate, due to the relatively high interest rates and strong inflationary past. Between 2000 and 2010, new regulations provided incentive for the growth of the nascent pension fund industry; managers of the new pension funds by and large managed their assets like mutual funds with short-term benchmarks and were heavy buyers of short-term fixed-rate bonds and bills. The National Treasury engaged in a comprehensive outreach strategy to convince them that ILBs would provide a much more appropriate risk-return profile for their assets, given the nature of their liabilities. Nonresident investors were the second key component of the diversification of the investor base,[58] holding around 10 percent of outstanding ILBs at some point; but the importance of nonresidents to the ILB market would decrease over time (currently, nonresident holding of ILBs is around 3 percent).

Thanks to the increasing participation of pension funds and nonresidents, the investors' base these days is reasonably diversified and facilitates the placement of ILBs. Around a quarter of government bonds are held by pension funds, another quarter by financial institutions, and a third quarter by mutual funds (see figure 7.12). Nonresidents account for around 10 percent, followed by insurance companies and government entities at around 4 percent each. Although usually treated as one category, nonresident investors can be very diverse. When the government facilitated the entry of nonresidents, the first to come were hedge funds, but the nonresidents' group is now also well diversified, with a significant share of real money investors.

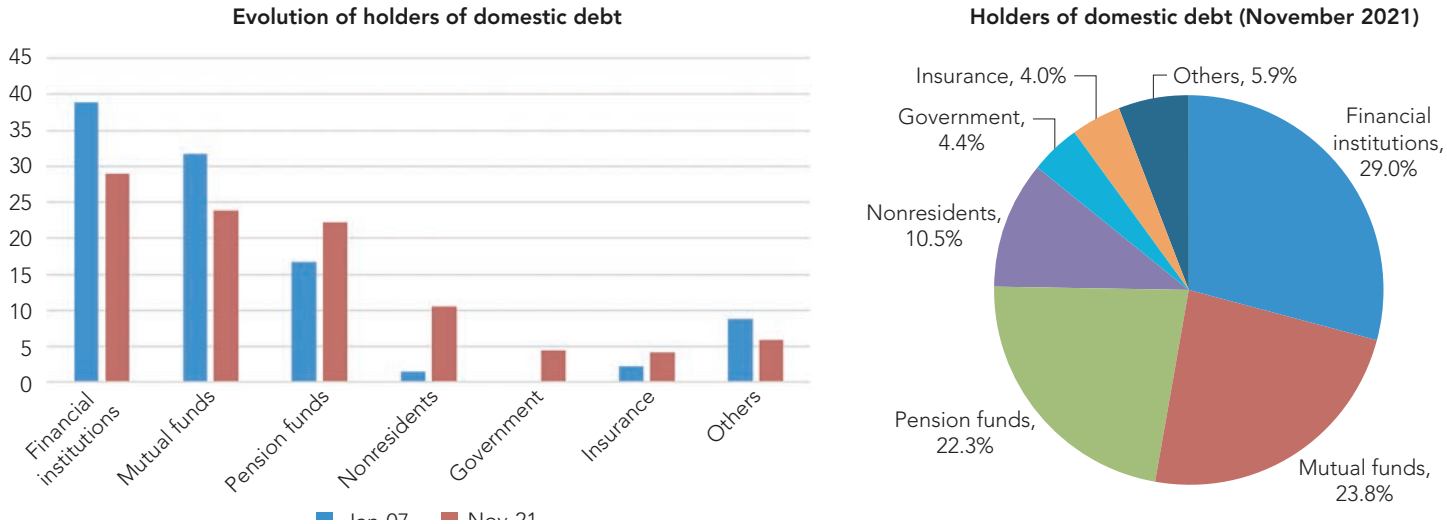
As expected, the main holders of ILBs are the pension funds, currently holding almost 50 percent of ILBs, followed by mutual funds, with a bit more than 23 percent of the total (see figure 7.13). To combat indexation to the overnight rate in the mutual fund industry, the government supported the creation of different market benchmarks based on the different types of government bonds. This helped the development of mutual funds that track the return of the linkers. As mentioned before, nonresident holdings of ILBs are currently limited.

Given the buy-and-hold nature of the main holders (pension funds), liquidity in the secondary market is lower than liquidity of conventional bonds.

The Brazilian National Treasury has adopted specific practices for the issuance of linkers. First, while conventional bonds are sold through multiple-price auctions, uniform- (or single-) price auctions are used for linkers. The maturity dates are also organized according to the year of maturity. Even and odd maturity years have coupon payments on different days so they jointly create a quarterly cash flow that is appreciated by pension funds. The key benchmarks are currently 5, 10, 20, and 40 years. Two ILB auctions take place per month, with the shorter maturities offered in the first and longer maturities in the second (see Brazilian National Treasury 2020). In contrast to the UK example, the number of lines has been reduced over time to help build market liquidity.

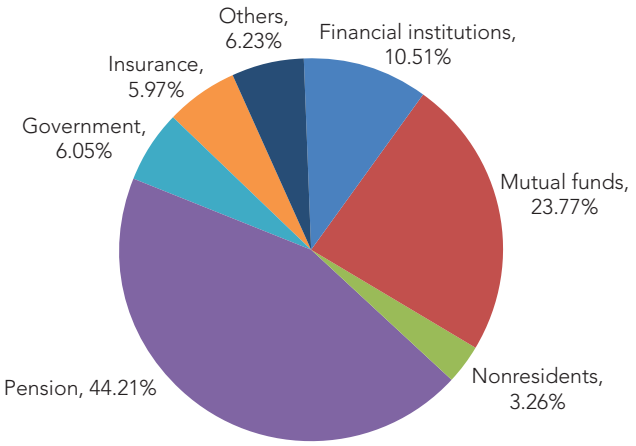
[58] Until 2005, the share of nonresidents in the domestic bond portfolio was negligible. To increase it, the National Treasury proposed the elimination of the withholding tax and the simplification of foreign exchange controls. Both measures greatly facilitated the entry of nonresident investors into the domestic debt market.

FIGURE 7.12. Brazil: Breakdown of Domestic Government Debt, by Holders



Source: Data from the Ministry of Finance, Brazil.

FIGURE 7.13. Holders of Inflation-Linked Bonds (NTN-B), as of November 2021



Source: Data from the Ministry of Finance, Brazil.

In the beginning, Brazil used liability management operations to foster the development of the secondary market and offer liquidity options to ILB holders. Currently, only quarterly switch auctions are conducted, where investors can exchange shorter-dated for longer-dated ILBs.

Some factors have driven the demand for ILBs down over the last few years. First, the fiscal situation has moved the demand toward the shorter tenors. Second, the pension fund industry is now more mature, and many funds are no longer in the accumulation phase. In particular, the defined benefit funds are not net buyers of ILBs. Third, the combination of a lower interest rate environment with the fact that many pension funds still keep their actuarial benchmark rates high (above available ILB rates in some periods) has led pension funds to look for higher-return securities.

8

Final Remarks

The history reviewed for this paper shows that DMOs arrive at the issuance of ILBs by two main avenues: either high and unpredictable inflation make these securities the only viable alternative to finding medium-term fixed-rate financing in local currency, or the ILBs fit gracefully into the DMO's strategy for managing the government debt. Taking the first avenue, many developing countries issued ILBs decades before advanced ones did. Except for heavily indexed economies such as Chile and Israel, however, those experiences were short lived, as natural demand was absent and the authorities relied on forced placements to the public sector and commercial banks.

Nowadays, ILB issuers mainly take the second avenue. All regular emerging market ILB issuers count on a steady demand from the long-term savings industry and nonresidents, with little need of forced placements. They include their ILBs in the popular indices, which requires commitment to market standards in terms of liquidity, transparency, and availability to foreign investors. For emerging market countries without private pension funds or investors looking for inflation protection, this journey may prove too hard, and DMOs should not hold high expectations for the potential of ILBs, since the securities may end up in the hands of investors without the balance sheet or the capacity to manage the instrument's inherent risks. If worse comes to worst, a failed launch may lock out the DMO's access to ILBs in the future.

The paper, therefore, focused on the second avenue, by which the issuance of ILBs depends on whether they fit into a government debt management strategy. To determine that, DMOs need to assess the interaction of the instrument with macroeconomic policies, the impact on the overall market development process, and the cost-risk implications for the debt portfolio. Essential in the macroeconomic analysis are the potential impact to and from monetary policy of launching ILBs and the correlation of debt servicing flows with the government revenues and expenditures. The role of ILBs in and their impact on the development of the domestic debt market relate to the value of providing a full hedge against the risk of unanticipated inflation, which tends to be crucial for pension funds and life insurance companies, but also depend on the size of the market and the risk that fragmentation will translate into loss of activity in the secondary market. Lastly, the cost-risk analysis aims to find the share of the instrument that will result in a portfolio composition with cost and risk levels with which the debt manager is comfortable under a given set of macro and market scenarios.

Within the cost-risk analysis, some DMOs pay particular attention to ILBs' cost effectiveness. Since breakeven inflation is the inflation rate at which investors are indifferent between conventional bonds and ILBs, debt managers can compare this rate with their own inflation forecast; if the breakeven inflation is higher than their expectations, ILBs will be cost effective. ILBs tend to be more attractive to DMOs in markets where the inflation premium dominates because the market is skeptical about the central bank's ability to rein in inflation or because the history of inflation weighs too much. On the contrary, in ILB markets with weak demand and poor liquidity, the liquidity premium tends to dominate, and the DMO may find ILBs expensive relative to conventional bonds.

While evidence on the cost effectiveness of ILBs is mixed, agreement seems to be broader that they do contribute to improving the portfolio risk profile. Indeed, many emerging market DMOs have used ILBs to lengthen the debt portfolio ATM, smooth its maturity profile, and replace FX-linked and FX-denominated securities.

After confirming that ILBs fit with their debt management strategies, DMOs proceed to design the instrument, making sure to suit the needs of investors and, to the extent possible, aligning with international sound practice. Most DMOs use the Canadian design, with a cash flow structure that links both principal and coupon to the inflation index, without a deflation floor. The chosen index, typically a general CPI, is well understood, rarely revised, regularly published with a short delay, and credible; the last feature is essential because if investors feel the index could be manipulated, they will find alternative assets that offer better protection against inflation.

Finally, DMOs must decide on how to offer their ILBs. The manner of placement can determine the ILBs' price discovery process, the strength of bidding in the primary market, and the level of trading in the secondary market. A major risk for emerging markets is the potential fragmentation between conventional bonds and ILBs and the cannibalization of demand. Organization of maturities and auction dates, determination of the number and size of lines, selection of the mechanism of placement by auction or syndication, and, in the case of auction, the format (single or multiple price) are all decisions that will affect the success of ILBs as a funding instrument.

While it's tempting to conclude that DMOs could handle ILBs like any other debt instrument, it's worth reminding debt managers of the continual battle they fight to develop their domestic debt markets and the major challenge ILBs pose because of the consubstantial illiquidity resulting from the buy and hold nature of investors. The advantage for those emerging market DMOs planning to debut in the ILB arena is that others have already traveled that route and have left a bundle of experiences, some of which might be valuable, such as well-designed Primary Dealer programs to promote trading and ILBs' incorporation in the global indices to attract non-resident investors.

9

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