The Case for Growth-Indexed Bonds in Advanced Economies Today

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One of the legacies of the global financial crisis is a high ratio of public debt to GDP. While current levels may be sustainable, another series of bad shocks could easily tip the balance and lead to unsustainable debt ratios and to default. In that context, growth-indexed bonds can play an important role. By decreasing payments when growth is low, they can substantially reduce the upper tail of the distribution of the debt ratio and lessen the risk of a debt explosion.

The ratio of public debt to GDP evolves over time as a function of primary deficits, interest rates, and growth rates. The higher the initial debt ratio, or the higher the volatility of future deficits, interest rates, and growth rates, the greater the probability that it will, at some time in the future, reach an unsustainable level. In these circumstances, investors may well worry, and the more worried they are, the higher the premium they will require to hold the debt, and the worse the debt dynamics will become.

Against that background, the case for growth-indexed bonds is clear. By indexing interest payments to growth, they limit the increase in the debt ratio in bad times, thus decreasing the probability that the debt becomes unsustainable. As a result,

they reduce the default risk premium, further improving the distribution of the debt ratio. The case, however, is not open and shut. As interest payments become more volatile, growth-indexed bonds might have to pay a premium in order to compensate investors for the GDP growth risk. If the bonds require a high enough premium for investors to buy and hold them, the benefits of a smaller upper tail may be more than offset by faster increases in the debt ratio under the baseline.

This *Policy Brief* explores these issues quantitatively, from the effects of the reduction of the upper tail to the effects of a larger premium. To anticipate our conclusions, we believe that, today, there is a case for a large issuance of growth-indexed bonds in advanced economies in general, and in the euro area members in particular.

ISSUING GROWTH-INDEXED BONDS—WHY ADVANCED ECONOMIES? WHY NOW?

The economic rationale for issuing growth-indexed bonds has a long intellectual history (see Borensztein and Mauro 2004, for a review, and Barr, Bush, and Pienkowski 2014, for a recent contribution). The case for linking debt repayments to measures of economic activity gained prominence in the aftermath of the debt crisis of the 1980s. A further wave of interest originated from Robert Shiller's (1993, 2003) proposal to create "macro markets" for GDP-linked securities, which, in his proposal, were to be perpetual claims on a fraction of a country's GDP. Interest in the topic typically reemerges in the aftermath of prominent debt crises (such as Argentina in 2001 and Greece in 2010) followed by difficult restructurings, when economists revisit the question of how to avoid debt defaults and their associated output costs. Indeed, in practice, securities with a return linked to economic growth have been issued only in the context of debt restructurings, including those in Bulgaria (1994), Argentina (2005), Greece (2012), and Ukraine (2015). To date, no advanced economy has issued growth-indexed bonds in normal times. We believe this is the right time to do so.

Growth-indexed bonds are potentially most useful when the debt ratio is high, but not catastrophically high. The decrease in the upper tail of the distribution from the introduction of growth-indexed bonds is unimportant when the level of

debt is low to start with, and irrelevant when the level of debt is already too high. Most advanced economies, with debt ratios often close to 100 percent, find themselves in between and, as shown in the simulations below, the reduction of the upper tail can make a substantial difference in that case.

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Playing in the opposite direction is the premium that may be required by investors to hold these bonds. The higher the premium, the worse the debt dynamics, and a sufficiently large premium may offset or even dominate the effect of a smaller upper tail. One can think of the premium as depending on four factors:

■ *Default risk.* To the extent that growth-indexed bonds are issued in sufficient quantity to reduce default risk, this actually reinforces the case for growth-indexed bonds. Lower default risk means a lower premium on public debt in general, for both growth-indexed bonds and nominal (i.e., unindexed) bonds. A reduction in the upper tail and a decrease in the premium on all public debt reinforce each other.

■ *Novelty risk.* Like inflation-indexed bonds in the past, growth-indexed bonds will initially be a novelty item, and thus will have to pay a novelty premium for some time. This premium may be lower for advanced economies than for emerging markets that issued GDP-linked warrants in the past. With relatively strong institutions and an independent statistical agency, advanced economies are in a better position to give confidence to investors that data on economic growth will remain untampered and reliable.

■ *Liquidity risk.* A frequent problem with new financial instruments is lack of liquidity in the secondary market. This suggests that successful introduction may require large scale right from the start, to reassure potential investors that the market will be sufficiently liquid in the event they decide to unwind positions. Standardization of instruments (with broadly similar contracts in the countries involved) can facilitate attaining the requisite scale and portfolio diversification.[1] At a recent workshop, the Bank of England put forward a common term sheet template, which could

serve as a template for the introduction of such bonds.[2] The evolution of the novelty and liquidity premia is difficult to predict, but the available evidence, in particular from the inflation-indexed bonds in the United Kingdom, suggests that they can gradually decrease and become quite small.[3]

■ *Growth risk.* By construction, growth bonds pay more when times are good, less when times are bad. In standard finance terms, they are higher beta instruments than ordinary bonds, because their return is more volatile and procyclical. From that perspective, other things equal, growth bonds would require a premium relative to nominal or inflation-indexed bonds. How much depends on their design and maturity and the nature of investors. Long maturity bonds may look more like equities, short maturity bonds less so. Because growth rates are imperfectly correlated across countries, the country-specific growth risk is lower when the bonds are held by foreign investors. This is another argument for the simultaneous introduction of growth-indexed bonds in a number of advanced economies. In the context of the euro area, such cross-border holdings of growth bonds can indeed be seen as a (partial) market solution to a fiscal transfer union, which is likely to occur slowly, if at all, as evidenced by the cautious tone of the Five Presidents' Report.[4]

In short, growth-indexed bonds have two effects on debt dynamics. They decrease the upper tail of the distribution of

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2. See http://www.bankofengland.co.uk/research/Pages/conferences/301115.aspx.

3. The history of the introduction of inflation-linked bonds sheds some light on the novelty and liquidity premium of new instruments. Several advanced and emerging economies have issued inflation-linked bonds, in some cases beginning in the 1950s. The dates of introduction and the size of the market (ranging up to a third of all government bonds in the United Kingdom and more than half in Chile and Israel) vary across countries with no obvious patterns with respect to inflation history or economic and financial development (Borensztein and Mauro 2004). Recent studies seeking to estimate the premium have focused on the United States, where acceptance is still below 9 percent of total marketable government debt (December 2015 data available at https://www.fiscal.treasury.gov/fsreports/rpt/treasBulletin/b2015_4.pdf). While the results depend on the methodology used, a consensus seems to be emerging that the premium was as high as 100 basis points upon the TIPS' introduction in January 1997 with a $7 billion issuance (0.2 percent of U.S. government marketable debt) and gradually declined to a few tens of basis points from the early 2000s, though experiencing a spike when liquidity collapsed at the peak of the global economic and financial crisis in late 2008 (Christensen and Gillan 2011; D'Amico, Kim, and Wei 2014; Pflueger and Viceira 2013). Premia have long been much lower, arguably negligible, in noncrisis years in the United Kingdom (D'Amico, Kim, and Wei 2014). Further research into the behavior of the novelty and liquidity premium for other countries would be highly valuable.

4. "Completing Europe's Economic and Monetary Union," available at www.consilium.europa.eu/en/press/press-releases/2015/06/22-tusk-5-presidents-report-economic-monetary-union.

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1. The benefits of diversifying a portfolio of growth-indexed bonds are estimated in Callen, Imbs, and Mauro (2015).

the debt ratio. But they may also require a premium, which may lead to a worse baseline and offset the first effect. Which of these factors would prevail is not clear, and we try and give a sense of the magnitudes in the next section.

GAUGING THE BENEFITS OF GROWTH INDEXATION

Our starting point is the well-known equation for the dynamics of debt as a share of GDP:

$$d - d_{-1} = (r - g)d_{-1} - s$$

where d is the debt-to-GDP ratio, r and g are the interest and growth rates, and s is the primary fiscal balance (surplus) as a share of GDP. Thus, debt dynamics depend on the joint distribution of r, g, and s. Our objective is to compare such dynamics under the two scenarios in which the government finances itself through (1) ordinary nominal bonds or (2) growth-indexed bonds. To make things concrete, we present results for Spain, whose gross general government debt-to-GDP ratio at end-2015 is estimated at about 100 percent, close to the average for the advanced economies. To give a sense of the differences across countries, however, we also report some results for Italy, which starts with an even higher debt ratio, 134 percent, and—at the opposite end of the spectrum among large European economies—for Germany, with a lower ratio, 70 percent.

We proceed in three steps. Throughout, we take the expected values of the nominal interest rate, the nominal growth rate, and the ratio of the primary surplus to GDP to be equal to the International Monetary Fund's October 2015 *World Economic Outlook* (WEO) forecasts up to 2020 and extrapolate at the same values from then on. The three steps differ in how we formalize uncertainty.

In the first step, we focus on the uncertainty associated with r and g through the term $(r - g)d_{-1}$ only and, to do so, assume that the ratio of the primary surplus to GDP, s, is not stochastic (equal to the WEO forecast until 2020 and constant thereafter).

■ In the simulation showing debt dynamics when nominal bonds are used, we assume the distribution of shocks for r and g is a normal distribution, with a covariance matrix given by the empirical covariance matrix estimated over 1999–2014, a period that includes the global economic and financial crisis. It might be argued that the crisis evidence should be left out, as the probability of its reoccurrence during the next decade or so is hopefully small. On the other hand, including this evidence illustrates the value of growth indexation during severe downturns. It turns out that, for Spain, the correlation between the interest rate and the growth rate is nearly the same, namely a large and

negative –0.76, for the whole period, 1999–2014, and for the crisis period, 2007–14. (As shown below, the benefits of growth indexation remain sizable for Italy, where the correlation is positive.) The shocks are assumed to be independently and identically distributed over time, that is, shocks occurring this year have no implications for the distribution of the shocks next year.[5]

■ In the simulation showing debt dynamics when growth-indexed bonds are used, we assume the bonds pay $r_i = g + k$, (where the subscript i stands for "indexed"), i.e., the growth rate plus a constant k. By implication, $(r_i - g)$ is now constant. Given our additional assumption that the primary surplus is nonstochastic, the debt dynamics are also nonstochastic. We choose the constant k so that the expected return on growth-indexed bonds is the same as the expected return on nominal bonds in the first simulation. In other words, following on the earlier discussion, we assume for the moment that the risk premium on growth-indexed bonds is zero and that the debt dynamics absent uncertainty are the same under nominal and under growth-indexed bonds. (We return to this assumption later.)

Debt dynamics, up to 2035, are then generated through random draws from the distribution of r and g in the case of nominal bonds, and from the distribution of g in the case of growth-indexed bonds. They are reported in figure 1.

Figure 1a shows the fan chart for the debt-to-GDP ratio when nominal bonds are used. By 2035, the 98 percent interval for the debt ratio (i.e., leaving out the top and bottom 1 percent of the distribution) ranges from 44 to 117 percent. Figure 1b shows the evolution of the debt-to-GDP ratio under growth-indexed bonds: With full growth indexation and a nonstochastic primary surplus, the debt ratio is nonstochastic and declines to 72 percent at the end of the projection period. This first set of simulations is overly simplistic, but it conveys the message clearly: Growth-indexed bonds can substantially decrease uncertainty and, by implication, decrease the worrisome upper tail of the distribution of the debt ratio.

By assuming a nonstochastic primary surplus, the first step understates the debt uncertainty that stems from changes in the stance of fiscal policy as well as from the link between growth and the primary surplus. Thus, in the second step, we allow for uncertainty in the primary surplus.

For the case of nominal bonds, the covariance matrix of r, g, and now s is again estimated over 1999 to 2014. In the case of Spain, the correlation between growth and the primary

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5. A possible extension would relax this assumption and estimate a vector autoregression to establish a distribution of the shocks in which past shocks affect the future distribution.

Figure 1   Debt-to-GDP ratio in Spain, primary balance as forecast
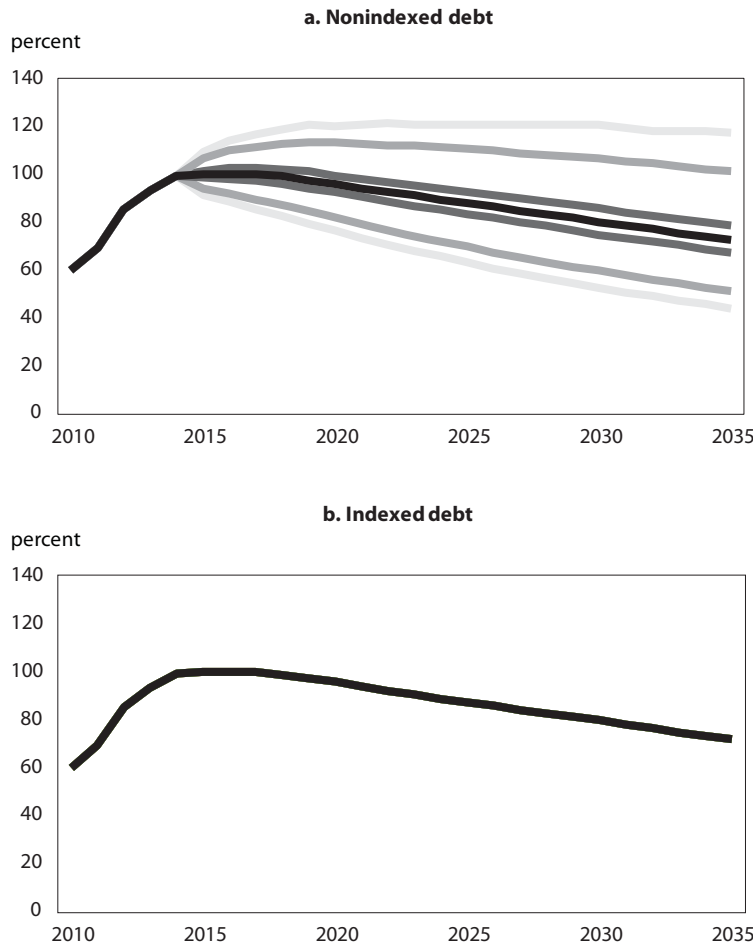
a. Nonindexed debt

percent

b. Indexed debt

percent

Note: The fan charts report the debt-to-GDP paths corresponding to the 1st, 5th, 35th, 50th (black line) 65th, 95th and 99th percentiles of the distribution.

Source: Authors' calculations.

surplus is large and positive, 0.93, and the correlation between the interest rate and the primary surplus is large and negative, –0.86. The signs of both correlations imply greater debt uncertainty than in the first step: Low growth is associated with a smaller primary surplus (a larger primary deficit) and a higher interest rate. For the case of growth-indexed bonds, we use the covariance matrix for *g* and *s*. As before, we start by assuming that growth-indexed bonds pay the growth rate plus a constant, and the value of the constant is set to equalize expected returns on nominal bonds and growth-indexed bonds.

Debt dynamics are reported in figures 2a and 2b. When nominal bonds are used, the 98 percent confidence band for the debt ratio now ranges from 7 to 168 percent. When growth-indexed bonds are used, the range is considerably narrower, between 27 and 117 percent. Focusing on the upper tail of the distribution, the probability that the debt exceeds, for example,

140 percent of GDP is about 4 percent with nominal bonds, but essentially zero with growth-indexed bonds.[6]

Our third step builds on the previous simulation but now focuses on the role of the premium in determining the dynamics of the debt ratio. As we discussed earlier, there are two effects at work, pulling in opposite directions. On the one hand, the decrease in default risk leads to a lower premium on public debt in general. On the other, the novelty, liquidity, and growth risks

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6. The ranges represented in figures 2a and 2b are very large. The reason is that our simulations do not take into account the fact that the primary surplus would likely respond to the debt level. Historical evidence suggests that, indeed, governments weaken the primary balance when the debt ratio is low and, conversely, strengthen it when the debt ratio is high (Bohn 1998, Mauro et al. 2015). Endogenizing the surplus as a function of debt would reduce the ranges reported in figure 2, under both nominal and growth bonds. It would not change our basic conclusions.

Figure 2   Debt-to-GDP ratio in Spain, with stochastic primary balance
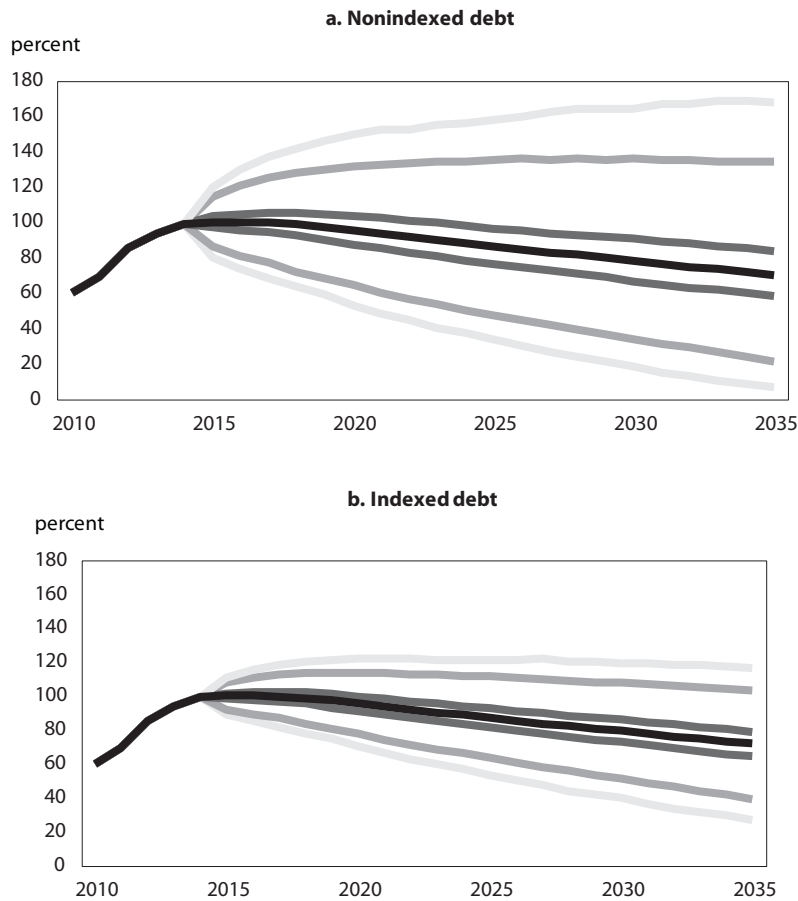
a. Nonindexed debt

percent

b. Indexed debt

percent

Note: The fan charts report the debt-to-GDP paths corresponding to the 1st, 5th, 35th, 50th (black line), 65th, 95th and 99th percentiles of the distribution.

Source: Author's calculations.

lead to a higher premium on growth-indexed bonds relative to nominal bonds.

To allow the default premium to depend on the debt ratio, we assume that the interest rate increases (decreases) by 2 basis points for every percentage point deviation of the debt-to-GDP ratio from the baseline and by 3 basis points per percentage point when the debt ratio exceeds 140 percent. The results are reported in figures 3a and 3b.

The results reinforce our earlier conclusions. The probability that the debt ratio exceeds 140 percent is now about 10 percent when nominal bonds are used and remains essentially zero with growth-indexed bonds.

This simulation, however, ignores the possibility of a positive premium stemming from liquidity, novelty, and growth risks. We believe, based on the existing evidence about inflation-indexed bonds and discussions with potential investors, that it is reasonable to expect, once the novelty and liquidity premia

stabilize, a premium substantially below 100 basis points. If we redo the simulations in figure 3, but now allowing for a premium of 100 basis points, the probability that under growth-indexed bonds, the debt ratio exceeds 140 percent increases from zero to 7 percent. The gain is smaller but remains relevant. The effect of the premium is, however, nonlinear: If we allow for a constant premium of 200 basis points, then the probability that the debt ratio exceeds 140 percent increases to 34 percent. Under those assumptions, nominal bonds dominate. The size of the premium is crucial to the case.

We focused on Spain as a representative illustration. Similar simulations for other countries, using the country-specific covariance matrix and initial debt ratio, show that growth-indexed bonds can substantially decrease the upper tail. They also show the relevance of individual country circumstances. In Germany, for example, the initial debt ratio is sufficiently low and the forecast primary surpluses are sufficiently large to reduce the

**Figure 3   Debt-to-GDP ratio in Spain, with stochastic primary
balance and risk premium**
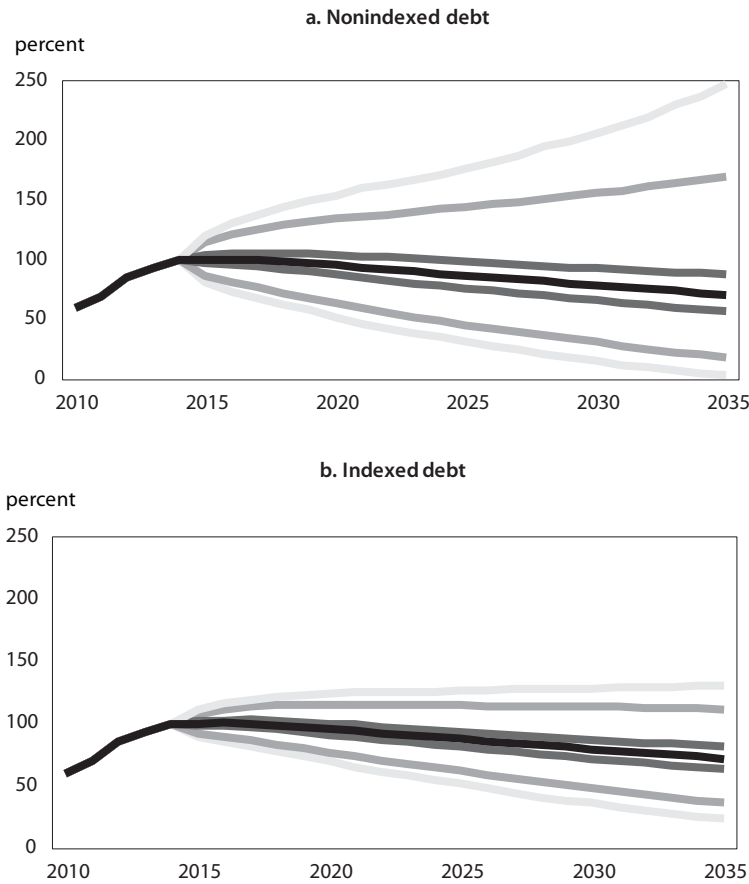
a. Nonindexed debt

percent

b. Indexed debt

percent

Note: The fan charts report the debt-to-GDP paths corresponding to the 1st, 5th, 35th,
50th (black line), 65th, 95th and 99th percentiles of the distribution.
Source: Author's calculations.

debt even without growth-indexed bonds for the vast majority of draws from the distribution of growth, interest rates, and the primary surplus. Using the same approach as in figure 3 for Spain, the 98 percent distribution of the German debt ratio in 2035 narrows from 4 to 54 percent with nominal bonds to 9 to 43 percent under growth-indexed bonds. The case for growth-indexed bonds is weaker for Germany than for Spain.

Italy differs from Spain in two ways: a higher initial debt ratio, which increases upper tail risk, but a positive correlation between r and g in the historical period, which decreases uncertainty under nominal bonds. The advantage of using growth-indexed bonds remains substantial: The 98 percent distribution of the debt ratio in 2035 shrinks from 42 to 147 percent with nominal bonds to 59 to 101 percent with growth-indexed bonds.

CONCLUSIONS

The quantitative exercises presented in this *Policy Brief* show that introducing growth-indexed bonds on a large scale in the advanced economies could substantially reduce "tail risks" associated with explosive debt paths starting from today's high ratios. And, while we have not focused on further macroeconomic implications in our simulations, they would also allow governments to pursue more countercyclical policies, and, by doing so, further stabilize growth and debt.

The exercises also show that a crucial issue is the size of the premium that such bonds would require, both initially and over time. The absence of the market suggests that, today, the implicit premium required by potential investors to buy the new instruments is too high for governments to find them desirable to issue. The question is whether there is another equilibrium with a sufficiently low premium that such bonds are attractive to both governments and investors.

We believe that there may well be, and this is the time to explore it. The novelty premium can be reduced by discussions between potential investors and governments, and by the type of constructive ground work spurred by the Bank of England. The liquidity premium can be lessened by the introduction of

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these bonds on a sufficiently large scale, and by the identification of potential investors willing to hold them to maturity. The growth risk premium may be limited if the bonds are largely held by foreign investors as part of a diversified international portfolio, or by investors whose liabilities are positively correlated with growth. If this ground work is brought to fruition, the introduction of growth-indexed bonds will benefit highly indebted advanced economies and, in the euro area, might provide a partial market-based solution to attain valuable insurance benefits well ahead of a formal fiscal union.

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