An Empirical Analysis on Information Aggregation of Inflation-Indexed Bonds

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ABSTRACT. We test a hypothesis whether inflation-indexed bonds are informative for professional forecasters and central banks in UK and US, using the GMM estimator of Keane and Runkle (1990,1998). Estimating the equations where forecast errors in real-time inflation rates are the dependent variable, we find that both a UK private forecaster and the Bank of England extract the inflation expectations from the indexed bond pricing, while the US Federal Reserve does not. The contrast between UK and US proves noises à la Grossman and Stiglitz(1976, 1980) from low liquidity in the US market partly because of the US government’s reluctance to issue the costly indexed bonds. A US private forecaster also turns out to be concerned with the indexed bond pricing only when it predicts the longer-term forecasts of inflation. As the US evidence suggests, the Japanese data does not indicate the informativeness of the indexed bond prices at present.

JEL classification: G14.
Keywords: inflation-indexed bond, information aggregation, covariance-matrix estimator.

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1. Introduction A financial device of inflation-indexed bonds has drawn attention to its role of information aggregation à la Grossman and Stiglitz(1976, 1980). In an informationally efficient market, pricing of inflation-indexed bonds could aggregate private information of market participants on future inflation, so that investors would not acquire private information from the market-pricing signal. However, depending on costs and benefits of information acquisition, the market equilibrium is associated with noises in prices. An empirical study of Huberman and Schwert(1985) shows significant responses of indexed bond prices prior to announcements of the Consumer Price Index in Israel, which suggests the informational role of indexed bonds for market participants.

As well as investors affiliated with professional forecasters, it is central banks that are attentive to market-based inflation expectations. Indexed bond pricing as a market signal is a good example for testing informational advantage of either private agents or central bank. Romer and Romer(2000) addresses private information in the US Federal Reserve, showing considerable information on inflation beyond what is known to some commercial forecasters. Central bank in general, however, should be careful in that accommodating itself to public’s expectations could lead to a sunspot equilibrium(Woodford, 1994; Bernanke and Woodford, 1997), or imprecision of public signals could deteriorate social welfare via the beauty contest mechanism of Keynes(Morris and Shin, 2002).

Motivated by these issues, we test a hypothesis whether inflation-indexed bonds are informative for professional forecasters and central banks in UK and US, where the indexed government bonds have been issued since 1981 in UK and since 1997 in US. As Figure 1 and 2 show, the shares of the indexed bonds in the UK and US government securities have ever been increasing. Especially, as Campbell and Shiller(1996) made a historical remark, the UK indexed bonds account for higher market-liquidity than the US ones do. Since high market-liquidity reduces liquidity premium, it is expected that the UK yield differential between nominal and indexed bonds would be a more accurate proxy for inflation expectations than the US ones(Barr and Campbell, 1997; Sack, 2000).

Data we use in estimations below consists of i)the real-time data of inflation; ii)inflation
forecasts by professional forecasters (National Institute of Economic and Social Research (NIESR), and Data Resources, Inc. (DRI)) and the central banks (the Bank of England (BoE), and the Federal Reserve (FRB)); and iii) yield differentials between nominal and indexed bonds, a proxy for market-based inflation expectations. In order to take advantage of our data rich in the length of prediction horizons, we stack the forecast observations into a $T(k+1) \times 1$ column vector, where $T$ is the number of time-series observations and $k$ the length of prediction horizons. To the constructed data with covariance structures of $k-$periods ahead forecast errors, we apply the GMM estimator of Keane and Runkle (1990, 1998) considering MA forecast error structures.

In the estimated equations where differentials between real-time inflation rate and each forecast are the dependent variable, we test significance of coefficients on the market-based inflation expectations. We found that either the NIESR or the BoE extracts the inflation expectations from the indexed bond pricing, while the FRB does not. The US DRI also turns out to be concerned with the indexed bond pricing only when it predicts the longer-term forecasts of inflation. As the market shares in Figure 1 and 2 indicate, the contrasts between UK and US probably prove noises in the US prices, due to low market-liquidity partly because of government’s reluctance to issue the indexed bonds (Shen and Corning, 2001; Sack and Elsasser, 2004).

In reference to the UK and US results, assessing the Japanese data on the indexed bond market since 2004 indicates low liquidity and high yields on the indexed bonds relative to nominal Treasury. As the US evidence suggests, pricing on the Japanese indexed bond is not informative for both the Bank of Japan and private forecasters, at least for the present.

The structure of this paper is as follows. Section 2 describes our data and estimation method. Section 3 provides the estimation results. In Section 4, we take a casual look at the Japanese case where the indexed government bonds have been issued since 2004. Finally, we conclude in Section 5.

2. Data and Econometric method
2.1. **Data set** We construct each data set of UK or US, directing our attention to the timing of data announcements. Data consists of i) the real-time data of inflation; ii) inflation forecasts by professional forecasters and the central banks; and iii) the market-based inflation expectations, defined by yield differentials between nominal and indexed bonds.

We use as actual inflation rates ”the real-time data”, which is initial data available when forecasters make predictions, not later revised data, since forecasters are concerned with the former. Throughout this paper, the inflation rate is measured with Retail Prices index (RPIX, all items excluding mortgage interest payments, percentage change on a year earlier) for UK, while with Consumer Price Index (CPI, all urban consumers, all items, percent changes, seasonally adjusted annual rate) for US. Note that there was a change in the base period of the UK inflation data in 1993, so that our UK observations start in August, 1993.

We choose as professional forecasters two representative enterprises, National Institute of Economic and Social Research (NIESR) and Data Resources, Inc. (DRI), since both are acknowledged with reputation¹. The UK NIESR has published *National Institute Economic Review* each quarter, though it has made only annual projections since July, 2003. The US DRI publishes the quarterly forecast data of CPI each month, while the alternative commercial forecaster, the Survey of Professional Forecasters (SPF) does the prediction only with quarterly frequency.

Since adopting the inflation targeting regime in 1992, the Bank of England (BoE) has published its inflation forecasts with the quarterly *Inflation Report*. Among a variety of the predictions following each scenario, we choose the mean values of the inflation forecasts. In December 2003, the Bank announced its switch of inflation target measure from RPIX to HICP (Harmonized Index of Consumer Prices). The US Federal Reserve (FRB) also releases the inflation forecasts with the *Greenbook*, which is submitted as a material for the FOMC meetings. The release has been done in months only when the FOMC meeting was held.

¹ Websites are useful for the changes of these enterprises, http://www.niesr.ac.uk/niesr/about.htm and http://www.globalinsight.com/About/.
The projections are made available to the public after a lag of five years, so that at present we have data up to December, 1999. Details of these forecast data are listed in Table 1. Note that all the predictions range in quarters from the current period. We will take advantage of the length of prediction horizons, for a purpose of increasing the number of observations in our estimation below.

Finally, we describe our proxy for the market-based inflation expectations. We measure the proxy with yield differentials between nominal and indexed bonds. For both the nominal and indexed bonds in the UK, the zero-coupon yields (10-year gilt, monthly average, BoE) are available, while for the US the yields on actively traded non-inflation-indexed issues and Treasury inflation protected securities (TIPS) adjusted to constant maturities (10-years, monthly average, FRB) are used. The time-series of the yields is in Figure 3 and 4. Note that we adjust months of the indexed bond data to when each of professional forecaster or central bank announced its quarters-ahead forecasts.

2.2. Efficiency test We test a hypothesis whether the indexed bond pricing is informative for forecasters, private ones and central banks. In order to do so, we perform an efficiency test for rationality. Under a rational expectations hypothesis,

$$t\pi_{t+k} = E(\pi_{t+k}|I_t)$$

where $t\pi_{t+k}$ is $k$ period-ahead inflation expectations formed at period $t$. Then, the forecast errors $\varepsilon_{t,k} = \pi_{t+k} - t\pi_{t+k}$ are uncorrelated with any variables included in the information set $I_t$. We test the implication in the following equation,

$$\pi_{t+k} - t\pi_{t+k} = \alpha_0 + \alpha_1 X_{t,k} + \varepsilon_{t,k}$$

where a variable $X_{t,k}$ included in information set $I_t$ is used for forecasting $k$ period-ahead inflation.

In order to take advantage of our data rich in the length of prediction-horizon, we stack
the forecast observations into a $T(k + 1) \times 1$ column vector, where $T$ is the number of time-series observations and $k$ the length of prediction horizons,

$$(1 \pi_1, \cdots, t \pi_t, \cdots, T \pi_T, 1 \pi_2, \cdots, t \pi_{t+1}, \cdots, T \pi_{T+1}, \cdots, 1 \pi_{1+k}, \cdots, t \pi_{t+k}, \cdots, T \pi_{T+k})'$.$

For example, in a case of $k = 4$, we have a $5T \times 5T$ covariance matrix of the error term $\varepsilon$, 

$$\Omega = \begin{pmatrix}
\Omega_{00} & \Omega_{01} & \Omega_{02} & \Omega_{03} & \Omega_{04} \\
\Omega_{10} & \Omega_{11} & \Omega_{12} & \Omega_{13} & \Omega_{14} \\
\Omega_{20} & \Omega_{21} & \Omega_{22} & \Omega_{23} & \Omega_{24} \\
\Omega_{30} & \Omega_{31} & \Omega_{32} & \Omega_{33} & \Omega_{34} \\
\Omega_{40} & \Omega_{41} & \Omega_{42} & \Omega_{43} & \Omega_{44}
\end{pmatrix}$$

consisting of symmetric $T \times T$ ones $\Omega_{ij} = \Omega_{ji}$,

$$\Omega_{ij} = \begin{pmatrix}
E(\varepsilon_{1,i} \varepsilon_{1,j}) & E(\varepsilon_{1,i} \varepsilon_{2,j}) & \cdots & E(\varepsilon_{1,i} \varepsilon_{T,j}) \\
E(\varepsilon_{2,i} \varepsilon_{1,j}) & E(\varepsilon_{2,i} \varepsilon_{2,j}) & \cdots & E(\varepsilon_{2,i} \varepsilon_{T,j}) \\
\cdots & \cdots & \cdots & \cdots \\
E(\varepsilon_{T,i} \varepsilon_{1,j}) & E(\varepsilon_{T,i} \varepsilon_{2,j}) & \cdots & E(\varepsilon_{T,i} \varepsilon_{T,j})
\end{pmatrix}.$$

2.3. Covariance-matrix estimator  We apply the GMM estimator of Keane and Runkle (1990, 1998) to our constructed data where covariance structures of $k$-period-ahead forecast errors are implied under a null hypothesis of rational expectations.

We will construct the weighting matrix in the GMM estimator from residuals estimated under the null hypothesis below. It is important to notice that information of $\pi_t$ is not known to the forecasters at period $t$, so that their information set $I_t$ does not include $\pi_t$. Rational expectations hypothesis implies the following restrictions on our variance-
covariance matrix of forecast errors.

\[
E(\varepsilon_{t+l,k}\varepsilon_{t+m,k}) = \begin{cases} 
\sigma_{l-m}, & \text{if } |l - m| \leq k, \ k = 0, 1, 2, 3, 4; \\
0, & \text{otherwise.}
\end{cases} \tag{3}
\]

\[
E(\varepsilon_{t+l,k_1}\varepsilon_{t+m,k_2}) = 0, \quad \text{if } l < m \text{ and } l + k_1 < m, \text{ or } m < l \text{ and } m + k_2 < l. \tag{4}
\]

for \(k_1 \neq k_2 = 0, 1, 2, 3, 4\). For instance, one covariance \(E(\varepsilon_{1,2}\varepsilon_{3,2})\) is not zero because inflation rate \(\pi_3\) is not announced at period \(t = 3\), while another covariance \(E(\varepsilon_{1,2}\varepsilon_{4,2})\) is zero because \(\pi_3\) has already been in forecasters’ information sets.

Assuming homoskedasticity in the time-series \(T\)

\[
E(\varepsilon_{t,k_1}\varepsilon_{t,k_2}) = \delta_{k_1,k_2}, \quad k_1 \leq k_2 = 0, 1, 2, 3, 4 \tag{5}
\]

the informational restrictions(Equation(3)) on the forecast errors, for example in a case of \(k = 4\), reduce the covariance matrix to the following forms. The \(T \times T\) sub-matrices \(\Omega_{00}, \Omega_{11}, \Omega_{22}, \Omega_{33}, \text{ and } \Omega_{44}\) are

\[
\Omega_{00} = \begin{pmatrix}
\sigma_0 & 0 \\
0 & \sigma_0 \\
0 & \sigma_0 \\
\end{pmatrix}
\]

\[
\Omega_{11} = \begin{pmatrix}
\sigma_0 & \sigma_1 & 0 \\
\sigma_1 & \sigma_0 & \sigma_1 \\
0 & \sigma_0 & \sigma_1 \\
\end{pmatrix}
\]
\[ \Omega_{22} = \begin{pmatrix}
\sigma_0 & \sigma_1 & \sigma_2 & & & 0 \\
\sigma_1 & \sigma_0 & \sigma_1 & \sigma_2 & & \\
\sigma_2 & \sigma_1 & \sigma_0 & \sigma_1 & \sigma_2 & \\
& & & & & \ddots \\
0 & & & \sigma_2 & \sigma_1 & \sigma_0
\end{pmatrix} \]

\[ \Omega_{33} = \begin{pmatrix}
\sigma_0 & \sigma_1 & \sigma_2 & \sigma_3 & & & 0 \\
\sigma_1 & \sigma_0 & \sigma_1 & \sigma_2 & \sigma_3 & & \\
\sigma_2 & \sigma_1 & \sigma_0 & \sigma_1 & \sigma_2 & \sigma_3 & \\
\sigma_3 & \sigma_2 & \sigma_1 & \sigma_0 & \sigma_1 & \sigma_2 & \sigma_3 & \\
& & & & & & \ddots \\
0 & & & \sigma_3 & \sigma_2 & \sigma_1 & \sigma_0 & \\
& & & & & & & \sigma_4 & \sigma_3 & \sigma_2 & \sigma_1 & \sigma_0
\end{pmatrix} \]

where we have five common parameters of the error covariances \( \sigma_0, \sigma_1, \sigma_2, \sigma_3 \) and \( \sigma_4 \). There are also obtained the sub-matrices of the covariance with zero restrictions from Equation (4), \( \Omega_{ij} \) for \( i, j = 0, 1, 2, 3, 4 \).

3. **Estimation results** Following Keane and Runkle (1990, 1998), we take steps as follows: i) to estimate Equation (2) using OLS; ii) to calculate the estimated covariance matrix of residuals; and iii) to take means of covariances to construct the estimates under the null hypothesis.

In the estimation, we take a first-difference of the market-based inflation expectations.
derived from indexed bonds rates for stationarity of the data (Bonham and Cohen, 1995). We also use as the explanatory variable the (first-differenced) expectation variable, either current or one month prior to each forecast date. The reason is that the real-time market information on indexed bond pricing might not be available when the forecasters draw up their predictions, since it takes enough time to prepare for them.

As obvious in Table 1, we cannot have balanced data spanning both time-series and prediction-horizons. Among the full sample, we have to choose observations so as to lose as few missing values as possible. In the UK case, we have no other choice else than the \( k \)-quarter-ahead predictions \((k = 0, 1, 2, 3, 4)\) from August, 1993-April, 2003 (40 quarters) without any missing values for both NIESR and BoE. For the US, it was in 1997 when the US TIPS was issued for the first time. The released Greenbook data is also updated to 1999. Consequently, we are given the observations of the \( k \)-quarter-ahead predictions \((k = 0, 1, 2, 3, 4, 5)\) from March, 1997-December, 1999 (23 months) with 11 missing months for FRB.

For the US DRI, however, we can experiment with some patterns of observations. One is the \( k \)-quarter-ahead predictions \((k = 0, 1, 2, 3)\) from March, 1997-December, 1999 (30 months) with 4 missing months. The time-period covers that in the FRB case, being useful in comparison. Another pattern is the \( k \)-quarter-ahead predictions \((k = 0, \cdots, 17)\) from March, 1997-December, 1998 (22 months) without any missing values. The length of the prediction-period leads to an experiment for relationship between the market-based expectations and the forecaster’s horizons, as discussed later. The other is the \( k = 0, 1, 2, 3\)-quarter-ahead predictions (4 periods) from March, 1997-September, 2004 (78 months) with 13 missing months, which covers the recent period.

Table 2 indicates no significant cases of the market-based expectations in the UK forecast error equations. For either NIESR or BoE, the indexed bond pricing is in their information sets. The result is unaffected by whether data on the inflation expectations is current or one-period lagged. It suggests that the UK forecasters extract from the indexed bond rates information on the expected inflation, which is consistent with the empirical result of
Barr and Campbell (1997) that the extracted inflation expectations accurately forecast the actual future inflation in the UK.

On the other hand, the US results contrast with the UK ones. Table 3 shows significant cases in both FRB and DRI. In the case of FRB, the market-based expectations could have improved the forecasts, but never to be utilized. The indexed bonds are also underutilized by the DRI. The result holds true except for the longer-prediction-horizon case. The result of underutilization is consistent with inaccurate predictions of the US TIPS probably due to the low market liquidity, as shown by Sack (2000).

In the longer-prediction-horizon case, the market-based expectations are not significant in the equation. It suggests that, only when the private forecaster predicts the longer-term inflation, it is concerned with the indexed bond pricing.

4. The Japanese case  The Japanese government began to issue the inflation-indexed JGBs in March 2004. As of 2005 year end, there have been six issues (all 10-year bonds), the total amount of 2.4 trillion yen. For each of the six issues, Figures 5 to 10 plot the real yield of the inflation-indexed bond and the nominal yield of the 10-year JGB with the closest issue date\(^2\). For example, Figure 5 plots the daily yield of Issue No. 1 inflation-indexed JGB and Issue No. 258 10-year interest-bearing JGB from the March 2004 issue date to the present. The bold curve plots the differentials between the real and nominal yields. For the recent Issue No. 6 inflation-indexed bond issued in early December 2005, the expected inflation rate was approximately 0.6% at 2005 year end (Figure 10). It indicates that investors expect on average annual increases in CPI until the bond reaches maturity over the next decade.

However, the prevalent view is that due to the large fiscal deficits, the consumption tax rate will be raised by at least 5% within a decade at the latest. If this expectation is

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\(^2\) The source of the Japanese data is Bloomberg. As Kitamura (2004) makes clear, a method Bloomberg follows in calculating the indexed bond yields is a shortcut, in that it uses as the assumed inflation rate the average CPI rate for the year immediately preceding each issue of the indexed bonds, instead of the three-month-lagged rates. However, in the Japanese case the effect might be negligible due to the short period after the first issuance.
already priced into the bonds, then 0.5% of the expected inflation rate can be attributed to the consumption tax rate hike, and the remaining 0.1% to price inflation. We cannot help saying the figure would be unrealistic.

Further, the size of inflation-indexed bond market is still miniscule, comprising less than 1% of outstanding government securities (Table 4). Compared to another interest-bearing JGBs, a stricter tax rule on transfers of inflation-indexed bonds may limit the range of suitable investors. When inflation increases the bond’s principal and causes the redemption value to exceed par value, the additional principal falls under withholding tax as interest income. Also, since most investors including pension funds take a buy-and-hold investment strategy probably due to uncertainties in inflation depending on the course of the Bank of Japan’s monetary policy, the bond markets have extremely low liquidity.

Consequently, it is probable that pricing on the Japanese indexed bond is not informative for both the Bank of Japan and private forecasters, at least for the present. The public consensus is to withhold judgment of the inflation indexed bond’s predictive power until the market grows larger and participants have greater access to the data.

5. **Conclusion** We test a hypothesis whether inflation-indexed bonds are informative for professional forecasters and central banks in UK and US, using the GMM estimator of Keane and Runkle (1990,1998). Estimating the equations where real-time forecast errors are the dependent variable, we find that both a UK private forecaster and the Bank of England extract the inflation expectations from the indexed bond pricing, while the US Federal Reserve does not. The contrast between UK and US proves noises from low liquidity in the US market partly because of the US government’s reluctance to issue the indexed bonds. A US private forecaster turns out to be concerned with the indexed bond pricing only when it predicts the longer-term forecasts of inflation. Finally, it is probable that pricing on the Japanese indexed bond is not informative for both the Bank of Japan and private forecasters, at least for the present.
REFERENCES


<table>
<thead>
<tr>
<th>Forecasters</th>
<th>BoE</th>
<th>NIESR</th>
<th>FRB</th>
<th>DRI</th>
</tr>
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<tbody>
<tr>
<td>Source</td>
<td>Inflation Report</td>
<td>National Institute Economic Review</td>
<td>Greenbook</td>
<td>from Global Insight</td>
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<tr>
<td>Frequency</td>
<td>quarterly</td>
<td>quarterly</td>
<td>monthly</td>
<td>monthly</td>
</tr>
<tr>
<td>Observations prediction-horizons (quarters)</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>43</td>
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### Table 2: UK results of efficiency test

<table>
<thead>
<tr>
<th>Forecasters</th>
<th>Coefficients (standard errors)</th>
<th>Regressors</th>
<th># of observations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\alpha_0$ $\alpha_1$</td>
<td>1, $p_t - p_{t-1}$</td>
<td>40 $\times$ 5</td>
</tr>
<tr>
<td>NIESR</td>
<td>.0007 -.148 (.134) (.485)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>.009 .328 (.133) (.473)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-.036 -.225 (.088) (.295)</td>
<td>1, $p_t - p_{t-1}$</td>
<td>40 $\times$ 5</td>
</tr>
<tr>
<td></td>
<td>-.033 -.159 (.085) (.276)</td>
<td>1, $p_{t-1} - p_{t-2}$</td>
<td>40 $\times$ 5</td>
</tr>
</tbody>
</table>

Note: $p_t$ denotes the market-based inflation expectations, defined as yield differentials between nominal and indexed bonds.

### Table 3: US results of efficiency test

<table>
<thead>
<tr>
<th>Forecasters</th>
<th>Coefficients (standard errors)</th>
<th>Regressors</th>
<th># of observations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\alpha_0$ $\alpha_1$</td>
<td>1, $p_t - p_{t-1}$</td>
<td>30 $\times$ 4</td>
</tr>
<tr>
<td>DRI</td>
<td>-.147 1.723 (.209) (.586***)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-.156 1.094 (.235) (.597*)</td>
<td>1, $p_{t-1} - p_{t-2}$</td>
<td>30 $\times$ 4</td>
</tr>
<tr>
<td></td>
<td>-.329 .090 (.069***) (.146)</td>
<td>1, $p_t - p_{t-1}$</td>
<td>22 $\times$ 18</td>
</tr>
<tr>
<td></td>
<td>-.331 .072 (.069***) (.060)</td>
<td>1, $p_{t-1} - p_{t-2}$</td>
<td>22 $\times$ 18</td>
</tr>
<tr>
<td></td>
<td>.218 1.408 (.203) (.677***)</td>
<td></td>
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<td></td>
<td>.192 1.243 (.203) (.752*)</td>
<td>1, $p_{t-1} - p_{t-2}$</td>
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<tr>
<td></td>
<td>.136 1.155 (.289) (.617*)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>.143 1.147 (.285) (.573**)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FRB</td>
<td>.136 1.155 (.289) (.617*)</td>
<td>1, $p_t - p_{t-1}$</td>
<td>23 $\times$ 6</td>
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<tr>
<td></td>
<td>.143 1.147 (.285) (.573**)</td>
<td>1, $p_{t-1} - p_{t-2}$</td>
<td>23 $\times$ 6</td>
</tr>
</tbody>
</table>

Note: $p_t$ denotes the market-based inflation expectations, defined as yield differentials between nominal and indexed bonds. An asterisk *, ** or *** shows a rejection in a significance level 10%, 5% or 1%.
Table 4. Outstanding Government Bonds As of September 30, 2005 in Japan

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount (trillion yen)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Government Bonds</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General Bonds</td>
<td>518</td>
<td>79.7%</td>
</tr>
<tr>
<td>Long-term (10 years or more)</td>
<td>329</td>
<td>50.6%</td>
</tr>
<tr>
<td>Inflation-indexed Bonds</td>
<td>2</td>
<td>0.3%</td>
</tr>
<tr>
<td>Medium-term (from 2 to 6 years)</td>
<td>140</td>
<td>21.6%</td>
</tr>
<tr>
<td>Short-term (one year or less)</td>
<td>49</td>
<td>7.5%</td>
</tr>
<tr>
<td>Fiscal Loan Bonds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long-term (10 years or more)</td>
<td>61</td>
<td>9.4%</td>
</tr>
<tr>
<td>Medium-term (from 2 to 5 years)</td>
<td>66</td>
<td>10.2%</td>
</tr>
<tr>
<td>Subsidy Bonds</td>
<td>0.3</td>
<td>0.0%</td>
</tr>
<tr>
<td>Subscription / Contribution Bonds</td>
<td>2</td>
<td>0.3%</td>
</tr>
<tr>
<td>Government Bonds converted from Japanese National Railways Settlement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corporation Bonds</td>
<td>3</td>
<td>0.4%</td>
</tr>
</tbody>
</table>

(Note) Government Bonds do not include FB.
(Source) Ministry of Finance
Figure 1. Shares of inflation-indexed bonds in government securities issued in UK

(Source) the UK Debt Management Office (end of March)
Figure 2. Shares of inflation-indexed bonds in marketable government securities issued in US

(Source) US Treasury Department
Figure 3. Real and nominal yield of 10-year gilt in UK (%)

(Note) Monthly average yield from real and nominal zero coupon 10-year gilt
Calculated by the Bank of England using the Variable Roughness Penalty (VRP) model
(Source) Bank of England
Figure 4. Real and nominal yield of 10-year government bonds in US (%)

(Note) Yields on actively traded non-inflation-indexed issues and Treasury inflation protected securities (TIPS) adjusted to constant maturities.

(Source) Federal Reserve
Figure 5. Real and nominal yields (1)

- Real yield (Issue Number 1)
- Nominal yield (Issue Number 258)
- Yield differential of nominal and indexed bonds

(Source) Bloomberg (Y/M/D)
Figure 6. Real and nominal yields (2)

- Real yield (Issue Number 2)
- Nominal yield (Issue Number 260)
- Yield differential of nominal and indexed bonds

(Source) Bloomberg (Y/M/D)
Figure 7. Real and nominal yields (3)

- Real yield (Issue Number 3)
- Nominal yield (Issue Number 265)
- Yield differential of nominal and indexed bonds

(Source) Bloomberg (Y/M/D)
Figure 8. Real and nominal yields (4)

Real yield (Issue Number 4)
Nominal yield (Issue Number 270)
Yield differential of nominal and indexed bonds

(Source) Bloomberg (Y/M/D)
Figure 9. Real and nominal yields (5)

(Source) Bloomberg
Figure 10. Real and nominal yields (6)

Real yield (Issue Number 6)
Nominal yield (Issue Number 274)
Yield differential of nominal and indexed bonds

(Source) Bloomberg (Y/M/D)