# Bond Markets Help Lower Inflation

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 "I used to think if there was reincarnation, I wanted to come back as the president or the pope or a .400 baseball hitter. But now I want to come back as the bond market. You can intimidate everybody."
- James Carville, *Wall Street Journal* (February 25, 1993, p. A1)

## 1. Introduction

The government benefits when inflation is high; inflation is a tax on money-holders.  But inflation reduces the real value of all government liabilities that are fixed in nominal terms, not just money.  Since many governments carry high debt loads, it has long been recognized (e.g., Barro and Gordon, 1983) that the government benefits in a big way from inflation since the real value of the public debt falls.  Of course bond-holders are aware of this fact, and act accordingly.

Debt is issued in many varieties: public and private, long- and short-maturity, nominal and real, and so forth.  Since most countries do not have a complete set of bond markets, new ones are sometimes added.  For instance, Poland introduced 10-year fixed rate government bonds in 1999; Korea followed in 2000.  In recent research, I ask the question: does the very existence of such bond markets help keep inflation low and stable?  One might imagine so, since bond vigilantes are a potentially formidable political force who benefit from low stable inflation.  My research shows empirically for an important set of countries, those with inflation-targeting monetary regimes, that the presence of a long, nominal, local-currency bond market is indeed associated with inflation that

is approximately three-four percentage points lower.  That is, bond markets provide institutional support for low inflation.

This finding seems intuitive.  Financing government spending by printing money is usually regressive.  Money creation causes an inflation tax which is paid more by the poor, since they disproportionately tend to hold money instead of assets that earn interest or are otherwise protected from inflation.  If a government begins to finance its deficit by issuing bonds to the rich instead of money to the poor, it creates a powerful constituency for low inflation.  The consequences of inflation become more concentrated when they are borne by the rich rather than the poor.  The logic of collective action implies that the free-rider problem is reduced, and anti-inflation measures are more likely to be pursued.  Hence the public good of low inflation is likely to be more prevalent when bonds are held, as they are owned by a relatively small powerful interest group necessarily opposed to the redistributionary consequences of inflation.  That is, inflation is likely to be lower when the consequences of inflation tax are borne more by bond-holders and less by money-holders.  This effect can also operate without any growth in bonds relative to money, if the nature of debt is transformed.  Debt which is short-maturity, indexed, and/or foreign-currency denominated does not provide the anti-inflationary bulwark/incentives of long, nominal, local-currency bonds.

## 2.  A Peek at the Data

My focus is on countries with inflation targeting (IT) regimes.  Four IT countries do not have bond markets during the sample (Albania, Ghana, Guatemala, and Romania).  The bond markets of a number of countries began long before IT (including Australia, Canada, New Zealand, Norway, South Africa, Sweden, Switzerland, and the UK).  Finally, a number of bond markets came into being after IT, including those for: Armenia, Brazil, Chile, Colombia, Czech Republic, Iceland, Indonesia, Israel,

Korea, Mexico, Peru, Romania, and Turkey. This variation provides the identification required for my empirical approach. Details on the data set, methodology, and results are available in Rose (2014).

Table 1 provides some descriptive statistics on inflation across bond markets and monetary regimes. Panel A examines countries with bond markets, and shows that within this class, inflation targeters experience inflation that is lower and more stable than hard fixers or other countries. Panel B is an analogue for countries without bond markets; here average inflation is similar for inflation targeters and hard fixers, though inflation is more stable with IT. Finally, Panel C compares inflation moments within a given monetary regime, for countries with and without bond markets. The top left t-test is significantly different from zero at all conventional confidence levels, indicating that the average CPI inflation rate is higher for inflation targeters *without* bond markets than for inflation targeters *with* bond markets. The F-test immediately to the right is also large, indicating that inflation volatility is also higher for IT countries without bond markets than IT countries with bond markets. Analogues for GDP inflation, hard fixers, and the sloppy centre are tabulated in the remainder of the panel.

**Table 1: Descriptive Statistics**

A: Inflation across monetary regimes in the presence of bond markets

| Inflation | Inflation Targeting | | | Hard Fix | | | Neither | | |
|---|---|---|---|---|---|---|---|---|---|
| | Mean | Std Dev | Obs | Mean | Std Dev | Obs | Mean | Std Dev | Obs |
| CPI | 3.2 | 2.2 | 277 | 5.9 | 54. | 381 | 6.6 | 10.4 | 412 |
| GDP | 3.6 | 2.9 | 294 | 6.1 | 50. | 383 | 6.6 | 9.5 | 4211 |

B: Inflation across monetary regimes without a bond market

| Inflation | Inflation Targeting | | | Hard Fix | | | Neither | | |
|---|---|---|---|---|---|---|---|---|---|
| | Mean | Std Dev | Obs | Mean | Std Dev | Obs | Mean | Std Dev | Obs |
| CPI | 7.2 | 4.0 | 69. | 6.6 | 22. | 999 | 95. | 951. | 1,489 |
| GDP | 8.9 | 5.7 | 71. | 13.1 | 169. | 1,229 | 114. | 933. | 1,596 |

C: Tests for Equality of Inflation in the absence/presence of bond markets

| | Inflation Targeting | | Hard Fix | | Neither | |
|---|---|---|---|---|---|---|
| | Mean (t) | Std Dev (F) | Mean (t) | Std Dev (F) | Mean (t) | Std Dev (F) |
| CPI | 11.4** | 3.4** | .3 | .2 | 1.9 | 8300** |
| GDP | 11.0** | 3.9** | .8 | 11.** | 2.4* | 9600** |

The tests are t/F tests for equality of means/standard deviations across observations without/with bond markets. One (two) asterisk(s) indicate rejection of equality at the .05 (.01) significance level.

Together, the panels of Table 1 paint a suggestive picture.  IT countries with bond markets seem to have lower and more stable inflation than those without bonds, while results for other monetary regimes are less clear.  This impression is bolstered by the evidence in Figure 1, which provide graphical evidence for inflation targeters with and without bond markets.  In the pair of histograms at the left of the figure, I plot CPI inflation for IT countries with (below) and without (above) bond markets.  The histograms give the impression that inflation is typically lower for inflation targeters with bond markets.  The same view emerges from the analogous histograms for GDP inflation in the middle column.  The top-right chart graphs the quantiles of CPI inflation for inflation targeters with bond markets (on the y-axis) against inflation quantiles for those without bond markets (on the x-axis).[i]  A diagonal line is provided for reference; if inflation were similarly distributed across inflation targeters with and without bond markets, the data would be plotted along the diagonal.  In fact, the data are below the diagonal; IT countries without bond markets have systematically higher inflation than those with bonds.  The quantile plot for GDP inflation in the lower-right delivers the same message.

**Inflation with and without Bond Markets**
Inflation Targeters: Histograms and Quantile Plots
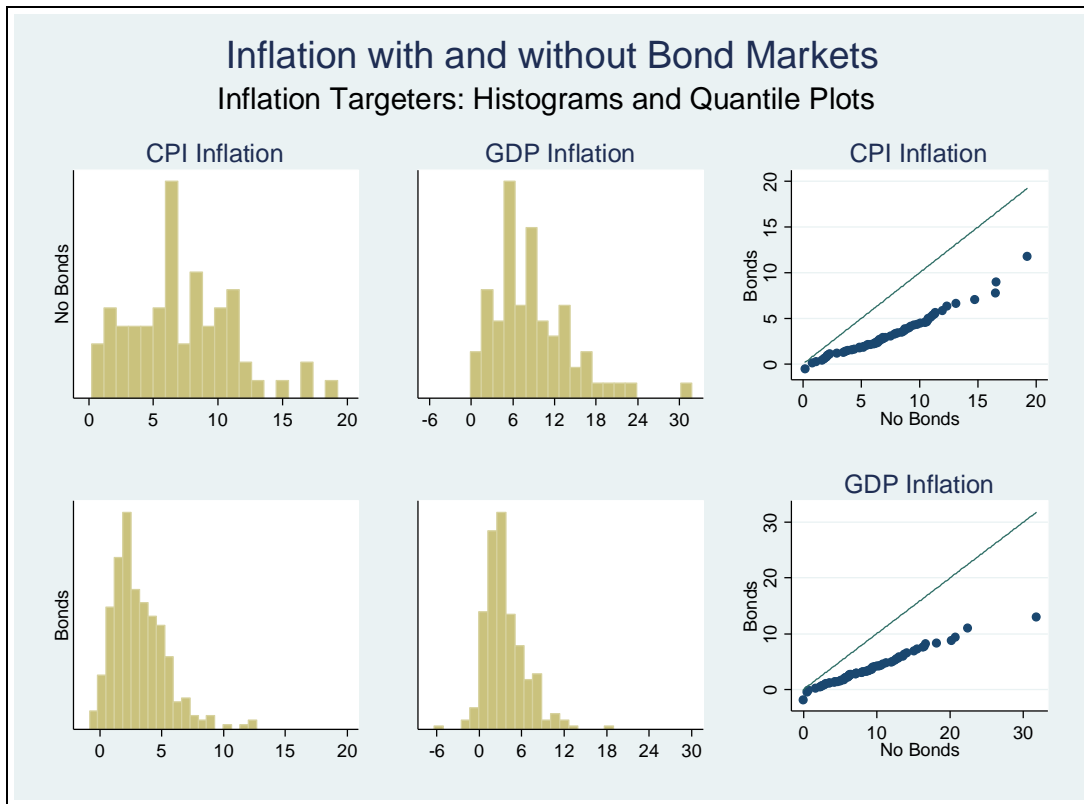
**Figure 1**

Figure 2 provides a different take. This provides a pair of event studies (one for each measure of inflation) that characterize inflation around the creation of bond markets, again restricting attention to IT countries. I show average inflation starting three years before bond market creation (at the extreme left) and continuing until three years afterward (at the extreme right); a confidence interval is provided by the empirical (5%, 95%) quantiles. This exercise is limited, since there are only 14 cases where inflation targeters introduced a bond market during my sample. Still, the introduction of a long bond market seems associated with lower inflation.

**Inflation around Year of Bond Market Introductions**
14 Inflation Targeters: mean, (5%, 95%) band
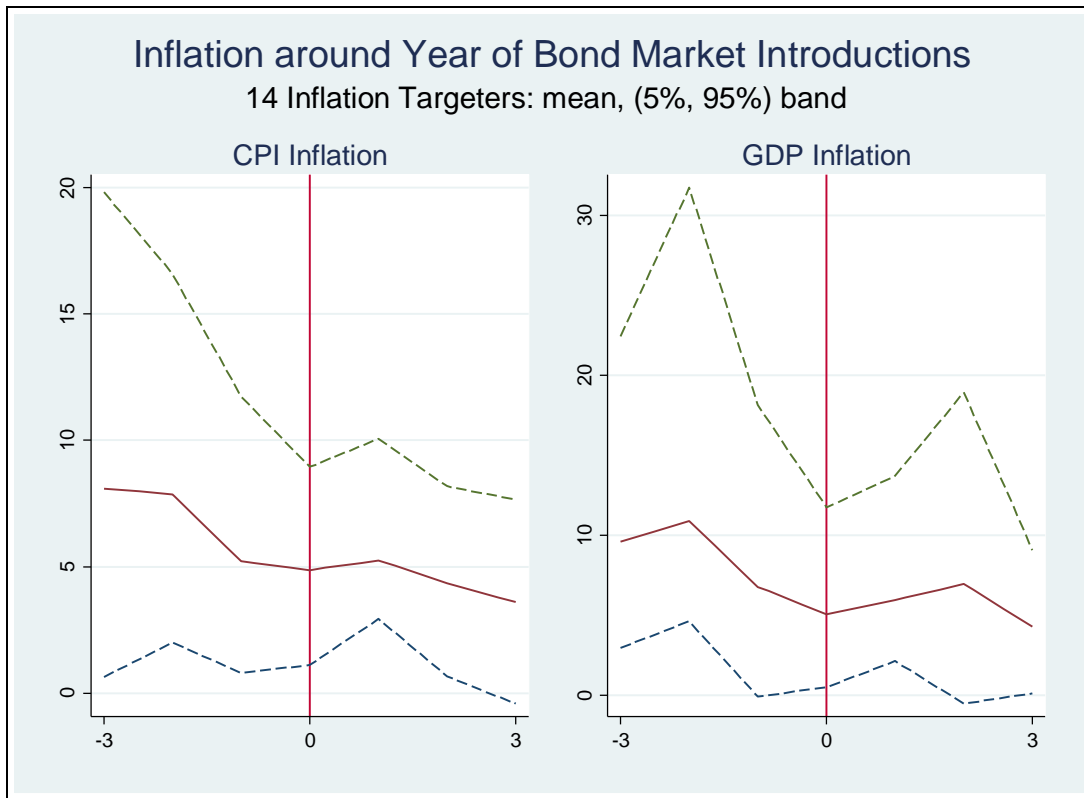
**Figure 2**

### 3. More Rigor

My objective is to investigate whether the presence of a (long, nominal, local-currency) bond market is correlated with inflation. There are obviously other determinants of inflation, especially in the short run. As a consequence, my methodology is relatively low-frequency, relying on annual data for a broad panel of countries. As a default, I use a conventional least-squares panel estimator:

$$\pi_{it} = \beta \text{Bond}_{it} + \gamma X_{it} + \{\delta_i\} + \{\varepsilon_t\} + \eta_{it} \tag{1}$$

where $\pi_{it}$ is the inflation rate for country i at time t, $\text{Bond}_{it}$ is a binary variable (1 if country i has a bond market at time t, 0 otherwise), {X} is a vector of controls linked to inflation via a set of nuisance parameters γ, {δ} and {ε} are respectively country- and time-specific fixed effects, and η is a residual

to represent all other influences on inflation.  The coefficient of interest to me is β, the partial-correlation between a bond market and inflation.

Why and when do bond markets get created?  It is natural to think that low and stable inflation is a necessary prerequisite for the existence of a long, nominal, local-currency bond market.[ii]  Perhaps then the presence of a bond market cannot be treated as exogenous for inflation; perhaps some common cause creates the conditions for both a fall in inflation and the creation of a bond market?  I try to handle this potential simultaneity problem in a few ways.  First, I estimate (1) only for inflation-targeting regimes (hereafter "IT").  I also try two econometric strategies to deal with potential simultaneity.  I use a variety of different treatment estimators to estimate β.  These may be useful to handle any selection issue, since countries may choose in principle to create a bond market when the conditions are ripe, because of an actual or expected fall in inflation.  I also estimate (1) with instrumental variables, relying on fiscal and political variables to construct instruments for bond market existence.   I use the size of government spending in the economy and the age of the country as my instrumental variables, and show that my results are insensitive.

My benchmark results for (1) are recorded in Panel A of Table 2.  This presents estimates of β from (1), along with robust standard errors (clustered by country).  IT countries with a bond market experience CPI inflation that is 2.9% lower than those without bond markets, holding a variety of other features constant.  The robust t-ratio is -2.9, significantly different from zero at the 1% significance level.  The estimate for GDP inflation is over four percentage points, again economically and statistically large.  That is, the null hypothesis that the bond market is *not* associated with lower inflation, is grossly inconsistent with the data.  Rather, inflation targeting countries have inflation that is three to four percentage points lower when a (long nominal local-currency) bond market exists.  The same is not true of different monetary regimes, as can be seen in Panel B; while countries with bond markets seem to have *higher* inflation, the coefficients are imprecisely estimated for both hard fixers and countries in the sloppy centre.

The remaining panels of Table 2 consist of self-explanatory sensitivity analysis intended to show that the default estimate in Panel A is not a fluke that can be easily dismissed.

**Table 2: Effect of Presence of Long Bond Market on Inflation, for Inflation Targeters**

A: Default

|  | CPI Inflation | GDP Inflation |
|---|---|---|
| Inflation Targeters | -2.9** | -4.4** |
|  | (1.0) | (1.1) |

B: Different Monetary Regimes

|  | CPI Inflation | GDP Inflation |
|---|---|---|
| Analogue for Hard Fixers | 7.3 | .6 |
|  | (7.7) | (13.7) |
| Analogue for Other Monetary Regimes | 74. | 136. |
|  | (53.) | (83.) |

C: Sample Sensitivity

|  | CPI Inflation | GDP Inflation |
|---|---|---|
| Drop pre-1995 | -2.6** | -4.1** |
|  | (1.0) | (1.1) |
| Drop post-2006 | -4.7** | -6.4** |
|  | (1.2) | (1.3) |
| Drop Poor (real GDP p/c < $10k) | -5.4** | -6.5** |
|  | (1.0) | (1.2) |
| Drop Rich (real GDP p/c > $40k) | -2.9** | -4.5** |
|  | (1.0) | (1.1) |
| Drop Small (population <10m) | -2.8* | -4.5** |
|  | (1.0) | (1.5) |
| Drop Large (population > 100m) | -1.8 | -4.8** |
|  | (1.2) | (1.6) |
| Drop >\|2.5σ\| outliers | -2.8** | -4.4** |
|  | (.6) | (.6) |

D: Estimator Sensitivity

|  | CPI Inflation | GDP Inflation |
|---|---|---|
| Conventional standard errors | -2.9** | -4.4** |
|  | (.5) | (.7) |
| Random (not fixed) country effects | -3.2** | -4.5** |
|  | (1.0) | (1.0) |
| Drop country effects | -3.2** | -3.8** |
|  | (.9) | (1.0) |
| Drop time effects | -2.6** | -4.6** |
|  | (.9) | (1.2) |
| Drop covariates | -2.8* | -4.5** |
|  | (1.1) | (1.3) |

E: Robustness of Bond Market Measure

|  | CPI Inflation | GDP Inflation |
|---|---|---|
| 5-year lag of bond market, not contemporaneous | -1.9** | -3.4** |
|  | (.5) | (.8) |
| 5-9 year maturity bonds instead of ≥10 years maturity | -4.7** | -4.2* |
|  | (1.0) | (1.7) |
| Indexed/Adjusted instead of nominal long bonds | -1.6 | -2.7 |
|  | (1.3) | (1.9) |
| Bonds denominated in foreign exchange, not LCU | 1.1 | 1.4 |
|  | (.6) | (.8) |

Coefficients for dummy variable (=1 if bond market exists, =0 otherwise). Robust standard errors (clustered by country) recorded parenthetically unless otherwise indicated; coefficients significantly different from zero at .05 (.01) level marked with one (two) asterisk(s). Sample restricted to inflation targeters unless otherwise indicated. Each cell is the result of a single panel regression of inflation on bond market presence with comprehensive time- and country-specific fixed effects unless otherwise indicated. Control covariates included: a) polity; b) log real GDP per capita; c) log population; d) trade, %GDP; and e) demeaned real GDP growth. Default includes annual data for up to 32 IT countries, 1991-2012 (up to 116 hard fixers, 1987-2012; up to 129 others, 1987-2012)

**4. Conclusion**

Does the existence of a long nominal local bond market affect inflation? My recent research is unabashedly empirical and delivers a clear answer: yes, the very existence of a market for long maturity, nominal bonds denominated in local currency seems to lower inflation by three to four percentage points (bonds that are either indexed to inflation or denominated in foreign currency do not have a similar effect). This result is striking because it holds for countries with inflation-targeting regimes, countries which already seem disposed to low and stable inflation. Other monetary regimes, such as those dedicated to maintaining hard fixed exchange rates, do not have the same reaction. And the effect is intuitive; countries with bond markets have a powerful interest group opposed to inflation, one that often has considerable influence.

I conclude that bond markets constitute an effective bulwark in the defence of an inflation-targeting regime.

**References**

Barro, Robert J., and David B. Gordon (1983) "Rules, Discretion and Reputation in a Model of Monetary Policy*" Journal of Monetary Economics* 12, 101-121.

Rose, Andrew K. (2014) "The Bond Market: An Inflation-Targeter's Best Friend" *CEPR Discussion Paper No. 10,124.*

**Endnotes**

[i] Quantiles are points taken at regular intervals from the cumulative distribution function of a random variable. Dividing ordered data into q essentially equal-sized data subsets is the motivation for q-quantiles; the quantiles are the data values marking the boundaries between consecutive subsets (http://en.wikipedia.org/wiki/Quantile).

[ii] Natural, but perhaps mistaken. Even restricting attention to the OECD, a number of countries have experienced high inflation in the presence of a bond market; indeed, that is the norm. In the mid-1970s, Australia, Canada, and Denmark all experienced bouts of inflation of 15% or more while maintaining long bond markets; such inflationary episodes were more extended for Greece, Ireland, Italy, New Zealand, Spain, and the UK.