The Long-Run Determinants of Indian Government Bond Yields

Tanweer Akram, PhD
Thrivent Financial
Anupam Das, PhD
Mount Royal University
IMPORTANT DISCLAIMER AND DISCLOSURE

• **Disclaimer:** The authors’ institutional affiliation is provided solely for identification purposes. Views expressed are solely those of the author and are not necessarily those of Thrivent Financial, Thrivent Asset Management, or any affiliates. This is for information purposes only and should not be construed as an offer to buy or sell any investment product or service.

• **Disclosure:** Tanweer Akram’s employer, Thrivent Financial, invests in a wide range of securities. Asset management services provided by Thrivent Asset Management, LLC, a wholly owned subsidiary of Thrivent Financial, the marketing name for Thrivent Financial for Lutherans, Appleton, WI. Securities and investment advisory services are offered through Thrivent Investment Management Inc., 625 Fourth Ave. S., Minneapolis, MN 55415, a FINRA and SIPC member and a wholly owned subsidiary of Thrivent Financial, the marketing name for Thrivent Financial for Lutherans, Appleton, WI. For additional important information, visit Thrivent.com/disclosures.

• **Compliance Tracking # 2012552-013118**
Motivation

• Does Keynes’s (1930) supposition that the short-term interest rate is the key driver of long-term government bonds’ yields?

• Does the government finance variable have an adverse effect on government bond yields?
Key Findings

• In India the short-term interest rates is the key driver of long-term government bond yields over the long-run.

• The government finance variable does not have any discernible adverse effect on government bond yields over the long-run.
Central Bank and its Policy Rate

• “The efficacy of the Bank-rate for the management of managed money was a great discovery and also a most novel one... but,... its precise modus operandi were not clearly understood - and have not been clearly understood... down to this day.” (Keynes, 1930, p. 17)

• Monetary policy through the short-term interest rate drives the long-term interest rate.
Determinants of LT Bond Yields

• “[T]he influence of short-term rate of interest on the long-term rate is much greater than anyone ... would have expected.” (Keynes 1930, vol. II, p.315).

• “[T]here is no reason to doubt the ability of a central bank to make its short-term rate of interest effective in the [government bond] market.” (Keynes 1930, vol. II, p.324).

• Current conditions provide the basis of the investor’s future outlook, and thus the forward rates.
Reserve Bank of India

- The **Reserve Bank of India (RBI)** is the country’s central bank.
- The RBI has **monetary sovereignty**
  - India issues its own currency, the Indian rupee.
  - Monetary sovereignty gives the RBI the ability to control the short-term interest rates.
  - Government of India can service its sovereign debt issued in Indian rupees.
- The RBI is the **lender of last resort**.
- The RBI conducts “**independent”** monetary policy.
A Keynesian Model on Bond Yields

• A two-period model of long-term interest rates on government bonds sets the framework for this empirical study.
Data

- Monthly Data (1999M1 to 2015M10) and Quarterly Data (1999Q1-2015Q3)
  - Short-term interest rates
  - Indian government bond yields
  - Inflation
  - Economic Activity: Industrial Production
  - Government Finance (quarterly only)
Evolution of Bond Yields
Evolution of ST Interest Rates

![Graph showing the evolution of interest rates](image_url)
Evolution of Fiscal Variables
### Table 2: Unit Root Tests for Monthly Variables

| Variable       | DFGLS  | ADF       | PP         |
|----------------|--------|-----------|------------|
| IGB2YR         | -1.29  | -1.72     | -1.86      |
| ΔIGB2YR        | -1.76* | -11.57*** | -11.57***  |
| IGB3YR         | -1.26  | -1.81     | -1.97      |
| ΔIGB3YR        | -2.01**| -7.60***  | -11.54***  |
| IGB5YR         | -1.26  | -1.95     | -2.03      |
| ΔIGB5YR        | -2.44**| -7.87***  | -11.38***  |
| IGB7YR         | -1.27  | -2.06     | -2.06      |
| ΔIGB7YR        | -2.74***| -7.96***  | -11.18***  |
| TB3M           | -1.57  | -2.57     | -2.58      |
| ΔTB3M          | -2.15**| -17.09*** | -17.13***  |
| TCPIY0Y        | -1.63* | -1.89     | -1.99      |
| ΔTCPIY0Y       | -9.47***| -9.51***  | -9.48***   |
| IPY0Y          | -1.92* | -4.67***  | -13.66***  |
| ΔIPY0Y         | -0.97  | -9.73***  | -47.57***  |
| CREDIT         | 0.30   | -1.54     | -1.64      |
| ΔCREDIT        | -0.98  | -2.48     | -6.99***   |
| NEER           | 0.48   | -0.52     | -0.27      |
| ΔNEER          | -0.79* | -11.21*** | -11.04***  |
| RISK           | -4.95***| -4.93***  | -4.86***   |
| ΔRISK          | -0.97  | -17.18*** | -19.01***  |

**Notes:** ****, ***, and * indicate statistical significance at the 1%, 5%, and 10% level respectively. Null hypothesis of all three tests is that the series contains unit root.
# Unit Root Tests

## Table 3: Unit Root Tests for Quarterly Variables

| Variable          | DFGLS | ADF   | PP    |
|-------------------|-------|-------|-------|
| IGB2YR_Q          | -1.51 | -2.05 | -2.05 |
| ΔIGB2YR_Q         | -6.10*** | -7.47*** | -7.48*** |
| IGB3YR_Q          | -1.60 | -2.27 | -2.14 |
| ΔIGB3YR_Q         | -6.36*** | -8.06*** | -8.36*** |
| IGB5YR_Q          | -1.72* | -2.54 | -2.30 |
| ΔIGB5YR_Q         | -6.58*** | -8.51*** | -9.59*** |
| IGB7YR_Q          | -1.81* | -2.72 | -2.47 |
| ΔIGB7YR_Q         | -6.77*** | -6.81*** | -10.14*** |
| TB3M_Q            | -1.59 | -2.16 | -2.57 |
| ΔTB3M_Q           | -1.87* | -8.52*** | -8.60*** |
| TCPIYQY_Q         | -1.93* | -2.36 | -2.44 |
| ΔTCPIYQY_Q        | -6.46*** | -6.56*** | -6.65*** |
| IPIYOY_Q          | -1.70* | -4.64*** | -4.58*** |
| ΔIPIYOY_Q         | -6.55*** | -6.53*** | -14.18*** |
| DRATIO_Q          | -1.27 | -2.21 | -4.00*** |
| ΔDRATIO_Q         | -0.87 | -2.60* | -11.21*** |

**Notes:** *** and ** indicate statistical significance at the 1% and 5% level respectively. Null hypothesis of all three tests is that the series contains unit root.
Empirics: An ARDL Approach

• Proposed by Pesaran and Shin (1998) and Pesaran et al (2001)

• **ARDL** (Auto Regressive Distributive Lags) has a number of advantages over standard cointegration:
  - allows regressors to take different optimal numbers of lags
  - produces consistent estimates of the long-run coefficients irrespective of the level of integration of the regressors
  - provides both long-run and short-run dynamics
Empirical Results: 3Yrs IGBs

Table 5: ARDL Bounds Test Results for IGB3YR (Monthly Data)

| Equation | $F$-statistics |
|----------|----------------|
| 4.7) IGB3YR = $\beta_{16} + \beta_{17}$TB3M | 4.60 |
| 4.8) IGB3YR = $\beta_{18} + \beta_{19}$TCPIYOY | 2.64 |
| 4.9) IGB3YR = $\beta_{20} + \beta_{21}$PIYOY | 2.03 |
| 4.10) IGB3YR = $\beta_{22} + \beta_{23}$TB3M + $\beta_{24}$TCPIYOY | 8.37*** |
| 4.11) IGB3YR = $\beta_{25} + \beta_{26}$TB3M + $\beta_{27}$PIYOY | 3.70 |
| 4.12) IGB3YR = $\beta_{28} + \beta_{29}$TB3M + $\beta_{30}$TCPIYOY + $\beta_{31}$PIYOY | 6.20** |

Long-Run Relationships

| Variable | Equation 4.10 | Equation 4.12 |
|----------|---------------|---------------|
| TB3M     | 0.39***       | 0.38***       |
|          | (0.04)        | (0.05)        |
| TCPIYOY  | -0.01         | -0.01         |
|          | (0.04)        | (0.04)        |
| PIYOY    | -             | -0.01         |
|          |               | (0.01)        |
| Constant | 4.74***       | 4.81***       |
|          | (0.47)        | (0.55)        |

Number of Observations: 107, 105

Notes: *** and ** represent 1% and 5% levels of significance respectively. Standard errors are in the parenthesis. Lower bounds values are 6.84, 4.94 and 4.04 for 1%, 5% and 10% levels of significance respectively. Upper bounds values are 7.84, 5.73 and 4.78 for 1%, 5% and 10% levels of significance respectively.
Empirical Results: 3Yrs IGBs

Table 10: ARDL Bounds Test Results for IGB3YR_Q (Quarterly Data)

| Equation                                                                 | $F$-statistics |
|---------------------------------------------------------------------------|----------------|
| 4.37) IGB3YR_Q = $\gamma_{22} + \gamma_{23}TB3M_Q + \gamma_{24}DRAT1O_Q $ | 5.51**         |
| 4.38) IGB3YR_Q = $\gamma_{25} + \gamma_{26}TCP1Y0Y_Q + \gamma_{27}DRAT1O_Q $ | 2.19           |
| 4.39) IGB3YR_Q = $\gamma_{28} + \gamma_{29}PIY0Y_Q + \gamma_{30}DRAT1O_Q $ | 2.51           |
| 4.40) IGB3YR_Q = $\gamma_{31} + \gamma_{32}TB3M_Q + \gamma_{33}TCP1Y0Y_Q + \gamma_{34}DRAT1O_Q $ | 6.17**         |
| 4.41) IGB3YR_Q = $\gamma_{35} + \gamma_{36}TB3M_Q + \gamma_{37}PIY0Y_Q + \gamma_{38}DRAT1O_Q $ | 2.21           |
| 4.42) IGB3YR_Q = $\gamma_{39} + \gamma_{40}TB3M_Q + \gamma_{41}TCP1Y0Y_Q + \gamma_{42}PIY0Y_Q + \gamma_{43}DRAT1O_Q $ | 1.09           |

Long-Run Relationships

| Variable     | Equation 4.37 | Equation 4.40 |
|--------------|---------------|---------------|
| TB3M_Q       | 0.53***       | 0.44***       |
|              | (0.07)        | (0.03)        |
| TCP1Y0Y_Q    | -             | 0.00          |
|              |               | (0.03)        |
| PIY0Y_Q      | -             | -             |
| DRAT1O_Q     | -2.39***      | 0.69          |
|              | (0.82)        | (0.61)        |
| Constant     | 7.36***       | 3.21***       |
|              | (1.55)        | (0.85)        |

Number of Observations: 48

Notes: *** and ** represent 1% and 5% levels of significance respectively. Standard errors are in the parenthesis. Lower bounds values are 5.15, 3.79 and 3.17 for 1%, 5% and 10% levels of significance respectively. Upper bounds values are 6.36, 5.52 and 4.14 for 1%, 5% and 10% levels of significance respectively.
### Empirical Results: 10Yrs IGBs

#### Table 8: ARDL Bounds Test Results for IGB10YR (Monthly Data)

| Equation | $F$-statistics |
|----------|----------------|
| 4.25) $IGB_{10YR} = \beta_{64} + \beta_{65} TB3M$ | 4.73 |
| 4.26) $IGB_{10YR} = \beta_{66} + \beta_{67} TCIPIYOY$ | 7.51** |
| 4.27) $IGB_{10YR} = \beta_{68} + \beta_{69} IPIYOY$ | 3.60 |
| 4.28) $IGB_{10YR} = \beta_{70} + \beta_{71} TB3M + \beta_{72} TCIPIYOY$ | 9.42*** |
| 4.29) $IGB_{10YR} = \beta_{73} + \beta_{74} TB3M + \beta_{75} IPIYOY$ | 3.07 |
| 4.30) $IGB_{10YR} = \beta_{76} + \beta_{77} TB3M + \beta_{78} TCIPIYOY + \beta_{79} IPIYOY$ | 6.83** |

#### Long-Run Relationships

| Variable | Equation 4.26 | Equation 4.28 | Equation 4.30 |
|----------|---------------|---------------|---------------|
| TB3M     | -             | 0.14***       | 0.13***       |
| TCIPIYOY | 0.04          | (0.04)        | (0.04)        |
| IPIYOY   | (0.05)        | 0.03          | 0.02          |
|          | -             | (0.04)        | (0.04)        |
| Constant | 7.74***       | 6.87***       | 6.99***       |
|          | (0.45)        | (0.44)        | (0.53)        |
| Number of Observations | 107 | 107 | 105 |

**Notes:** *** and ** represents 1% and 5% levels of significance respectively. Standard errors are in the parenthesis. Lower bounds values are 6.84, 4.94 and 4.04 for 1%, 5% and 10% levels of significance respectively. Upper bounds values are 7.84, 5.73 and 4.78 for 1%, 5% and 10% levels of significance respectively.
Empirical Results: 10Yrs IGBs

Table 13: ARDL Bounds Test Results for IGB10YR_Q (Quarterly Data)

| Equation | $F$-statistics |
|----------|----------------|
| 4.55) IGB10YR_Q = $\gamma_{88}$ + $\gamma_{89}$TB3M_Q + $\gamma_{90}$DRATIO_Q | $6.82^{***}$ |
| 4.56) IGB10YR_Q = $\gamma_{91}$ + $\gamma_{92}$TCPIYOY_Q + $\gamma_{93}$DRATIO_Q | $5.51^{**}$ |
| 4.57) IGB10YR_Q = $\gamma_{94}$ + $\gamma_{95}$IPIYOY_Q + $\gamma_{96}$DRATIO_Q | $7.88^{***}$ |
| 4.58) IGB10YR_Q = $\gamma_{97}$ + $\gamma_{98}$TB3M_Q + $\gamma_{99}$TCPIYOY_Q + $\gamma_{100}$DRATIO_Q | $10.66^{***}$ |
| 4.59) IGB10YR_Q = $\gamma_{101}$ + $\gamma_{102}$TB3M_Q + $\gamma_{103}$IPIYOY_Q + $\gamma_{104}$DRATIO_Q | 4.14 |
| 4.60) IGB10YR_Q = $\gamma_{105}$ + $\gamma_{106}$TB3M_Q + $\gamma_{107}$TCPIYOY_Q + $\gamma_{108}$IPIYOY_Q + $\gamma_{109}$DRATIO_Q | 3.93 |

Long-Run Relationships

| Variable     | Equation 4.55 | Equation 4.56 | Equation 4.57 | Equation 4.58 |
|--------------|---------------|---------------|---------------|---------------|
| TB3M_Q       | 0.29          | -             | -             | 0.13**        |
|               | (0.20)        |               |               | (0.05)        |
| TCPIYOY_Q    | -             | 0.03          | -             | -0.05         |
|               |               | (0.08)        |               | (0.06)        |
| IPIYOY_Q     | -             | -             | 0.04          | -             |
|               |               |               | (0.07)        |               |
| DRATIO_Q     | -5.41***      | 1.53          | -7.52***      | 1.75*         |
|               | (2.18)        | (1.78)        | (2.16)        | (1.02)        |
| Constant     | 14.67***      | 5.48*         | 19.90***      | 4.85***       |
|               | (4.42)        | (2.90)        | (3.56)        | (1.48)        |
| Number of Observations | 64 | 34 | 64 | 34 |

Notes: ***, **, and * represent 1%, 5%, and 10% levels of significance respectively. Standard errors are in the parenthesis. Lower bounds values are 5.15, 3.79 and 3.17 for 1%, 5% and 10% levels of significance respectively. Upper bounds values are 6.36, 5.52 and 4.14 for 1%, 5% and 10% levels of significance respectively.
Conclusion

- The empirical results support Keynes’s conjecture
  - The central bank’s actions, though its influence on the short-term interest rate and its use of monetary policy, are the main drivers of the long-term interest rate.

- The Reserve Bank of India (RBI) affects the long-term interest rate in the long-run.
  - Higher (lower) long-term interest rate on IGBs is associated with higher (lower) short-term interest rate.
Higher government indebtedness (the ratio of government debt to nominal GDP) does not have an adverse effect on IGBs’ nominal yields.

The findings concurs with earlier results:
- Akram and Das (2015a and 2015b)
- Chakraborty (2012)
- Vinod, Chakraborty, and Karun (2014)