

The Long-Run Determinants of Indian Government Bond Yields

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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.

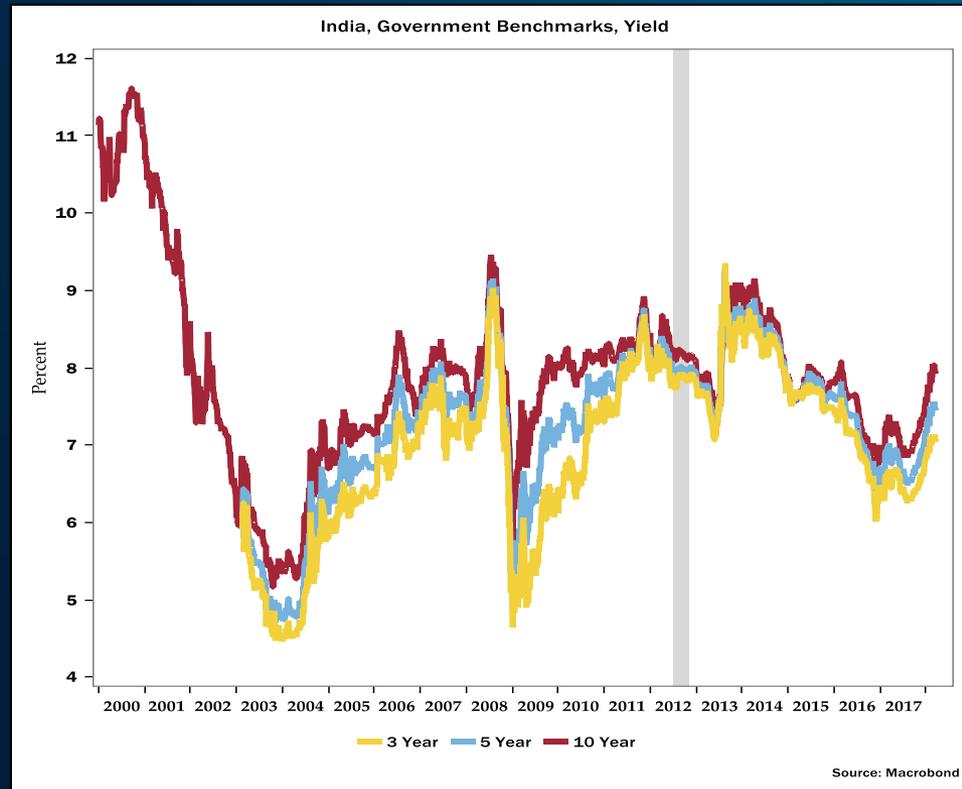


Data

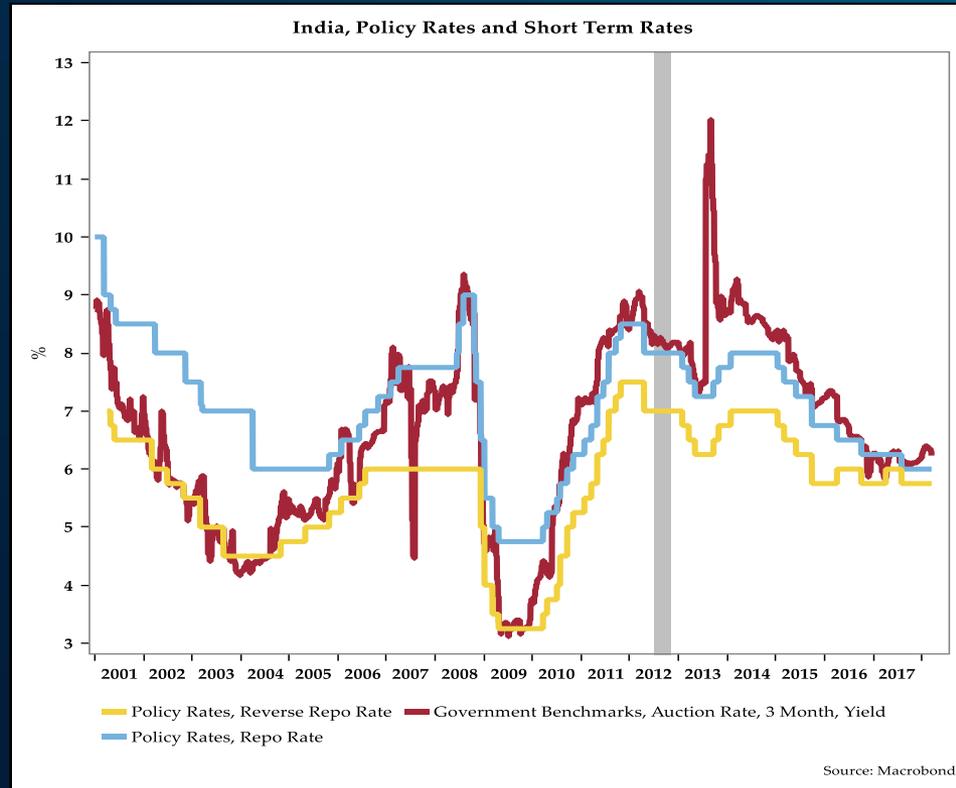
- Monthly Data (1999M1 to 2015M10) and Quarterly Data (1999Q1-2015Q3)
 - Short-term interest rates
 - Indian government bond yields
 - Inflation
 - Economic Activity: Industrial Production
 - Government Finance (quarterly only)



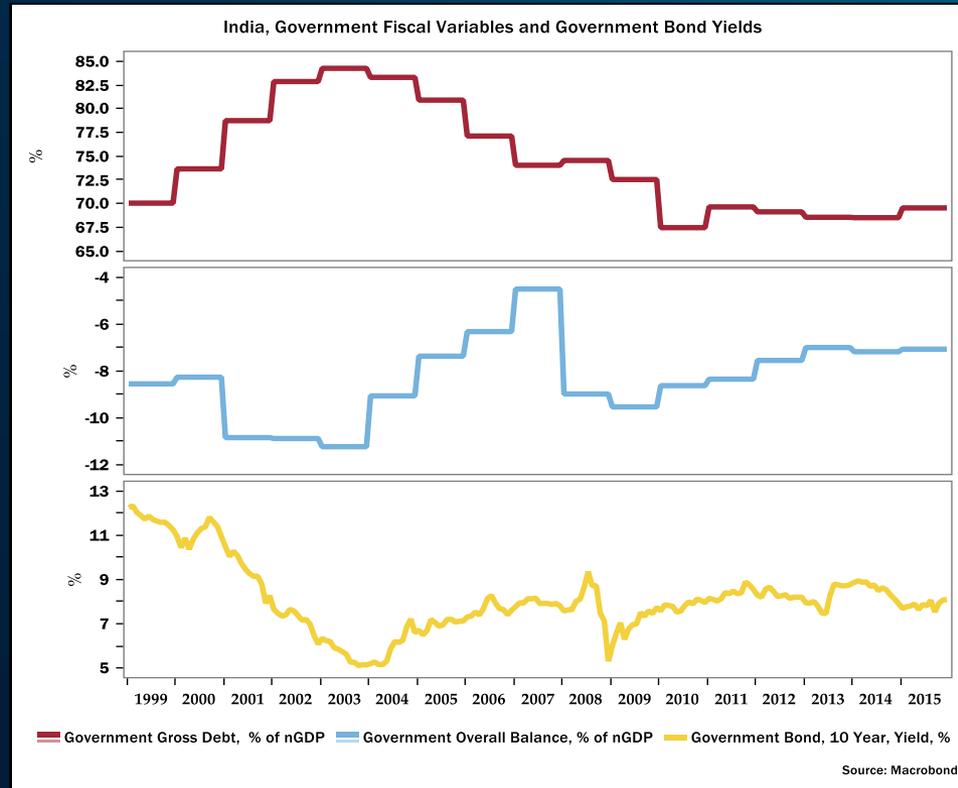
Evolution of Bond Yields



Evolution of ST Interest Rates



Evolution of Fiscal Variables



Unit Root Tests

Table 2: Unit Root Tests for Monthly Variables

Variable	DFGLS	ADF	PP
IGB2YR	-1.29	-1.72	-1.86
Δ IGB2YR	-1.76*	-11.57***	-11.57***
IGB3YR	-1.26	-1.81	-1.97
Δ IGB3YR	-2.01**	-7.60***	-11.54***
IGB5YR	-1.26	-1.95	-2.03
Δ IGB5YR	-2.44**	-7.87***	-11.38***
IGB7YR	-1.27	-2.06	-2.06
Δ IGB7YR	-2.74***	-7.96***	-11.18***
TB3M	-1.57	-2.57	-2.58
Δ TB3M	-2.15**	-17.09***	-17.13***
TCPIYOY	-1.63*	-1.89	-1.99
Δ TCPIYOY	-9.47***	-9.51***	-9.48***
IPIYOY	-1.92*	-4.67***	-13.66***
Δ IPIYOY	-0.97	-9.73***	-47.57***
CREDIT	0.30	-1.54	-1.64
Δ CREDIT	-0.98	-2.48	-6.99***
NEER	0.48	-0.52	-0.27
Δ NEER	-0.79*	-11.21***	-11.04***
RISK	-4.93***	-4.93***	-4.86***
Δ RISK	-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
Δ IGB2YR_Q	-6.10***	-7.47***	-7.48***
IGB3YR_Q	-1.60	-2.27	-2.14
Δ IGB3YR_Q	-6.36***	-8.06***	-8.36***
IGB5YR_Q	-1.72*	-2.54	-2.30
Δ IGB5YR_Q	-6.58***	-8.51***	-9.59***
IGB7YR_Q	-1.81*	-2.72	-2.47
Δ IGB7YR_Q	-6.77***	-6.81***	-10.14***
TB3M_Q	-1.59	-2.16	-2.57
Δ TB3M_Q	-1.87*	-8.52***	-8.60***
TCPIYOY_Q	-1.93*	-2.36	-2.44
Δ TCPIYOY_Q	-6.46***	-6.56***	-6.65***
IPIYOY_Q	-1.70*	-4.64***	-4.58***
Δ IPIYOY_Q	-6.55***	-6.53***	-14.18***
DRATIO_Q	-1.27	-2.21	-4.00***
Δ DRATIO_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) $IGB3YR = \beta_{20} + \beta_{21}IPIYOY$	2.03	
4.10) $IGB3YR = \beta_{22} + \beta_{23}TB3M + \beta_{24}TCPIYOY$	8.37***	
4.11) $IGB3YR = \beta_{25} + \beta_{26}TB3M + \beta_{27}IPIYOY$	3.70	
4.12) $IGB3YR = \beta_{28} + \beta_{29}TB3M + \beta_{30}TCPIYOY + \beta_{31}IPIYOY$	6.20**	
Long-Run Relationships		
Variable	Equation 4.10	Equation 4.12
TB3M	0.39*** (0.04)	0.38*** (0.05)
TCPIYOY	-0.01 (0.04)	-0.01 (0.04)
IPIYOY	- (0.01)	-0.01 (0.01)
Constant	4.74*** (0.47)	4.81*** (0.55)
Number of Observations	107	105
<p>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.</p>		

Empirical Results: 3Yrs IGBs

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

Equation	<i>F</i> -statistics	
4.37) $IGB3YR_Q = \gamma_{22} + \gamma_{23}TB3M_Q + \gamma_{24}DRATIO_Q$	5.51**	
4.38) $IGB3YR_Q = \gamma_{25} + \gamma_{26}TCPIYOY_Q + \gamma_{27}DRATIO_Q$	2.19	
4.39) $IGB3YR_Q = \gamma_{28} + \gamma_{29}IPIYOY_Q + \gamma_{30}DRATIO_Q$	2.51	
4.40) $IGB3YR_Q = \gamma_{31} + \gamma_{32}TB3M_Q + \gamma_{33}TCPIYOY_Q + \gamma_{34}DRATIO_Q$	6.17**	
4.41) $IGB3YR_Q = \gamma_{35} + \gamma_{36}TB3M_Q + \gamma_{37}IPIYOY_Q + \gamma_{38}DRATIO_Q$	2.21	
4.42) $IGB3YR_Q = \gamma_{39} + \gamma_{40}TB3M_Q + \gamma_{41}TCPIYOY_Q + \gamma_{42}IPIYOY_Q + \gamma_{43}DRATIO_Q$	1.09	
Long-Run Relationships		
Variable	Equation 4.37	Equation 4.40
TB3M_Q	0.53*** (0.07)	0.44*** (0.03)
TCPIYOY_Q	-	0.00 (0.03)
IPIYOY_Q	-	-
DRATIO_Q	-2.39*** (0.82)	0.69 (0.61)
Constant	7.36*** (1.55)	3.21*** (0.85)
Number of Observations	48	34

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	<i>F</i> -statistics		
4.25) $IGB10YR = \beta_{64} + \beta_{65}TB3M$	4.73		
4.26) $IGB10YR = \beta_{66} + \beta_{67}TCPIYOY$	7.51**		
4.27) $IGB10YR = \beta_{68} + \beta_{69}IPIYOY$	3.60		
4.28) $IGB10YR = \beta_{70} + \beta_{71}TB3M + \beta_{72}TCPIYOY$	9.42***		
4.29) $IGB10YR = \beta_{73} + \beta_{74}TB3M + \beta_{75}IPIYOY$	3.07		
4.30) $IGB10YR = \beta_{76} + \beta_{77}TB3M + \beta_{78}TCPIYOY + \beta_{79}IPIYOY$	6.83**		
Long-Run Relationships			
Variable	Equation 4.26	Equation 4.28	Equation 4.30
TB3M	-	0.14*** (0.04)	0.13*** (0.04)
TCPIYOY	0.04 (0.05)	0.03 (0.04)	0.02 (0.04)
IPIYOY	-	-	-0.01 (0.01)
Constant	7.74*** (0.45)	6.87*** (0.44)	6.99*** (0.53)
Number of Observations	107	107	105
<p>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.</p>			

Empirical Results: 10Yrs IGBs

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

Equation	<i>F</i> -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 (0.20)	-	-	0.13** (0.05)
TCPIYOY_Q	-	0.03 (0.08)	-	-0.05 (0.06)
IPIYOY_Q	-	-	0.04 (0.07)	-
DRATIO_Q	-5.41*** (2.18)	1.53 (1.78)	-7.52*** (2.16)	1.75* (1.02)
Constant	14.67*** (4.42)	5.48* (2.90)	19.90*** (3.56)	4.85*** (1.48)
Number of Observations	64	34	64	34
<p>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.</p>				

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.



Conclusion (cont)

- 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)

