Price discovery in Indian government securities market, monetary management and the cost of government borrowing

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Email(corresponding author): ashima@igidr.ac.in

Abstract

Over 2017-18 there was a sharp rise in Indian government securities (G-Secs) interest rates unrelated to fundamentals. Examining each of the standard explanatory variables shows them to be inadequate to account for the rise in bond yields in this period. Turning to aspects of Indian structure the reason is found to be the narrow focus of monetary operating procedures, with excessive reliance on making up liquidity shortfalls with short-term liquidity, which was inadequate given large exogenous durable liquidity shocks including foreign inflows. The composition of liquidity, share of reserve money and its sources all matter. Open market operations (OMOs) have a significant impact on yields. Large foreign debt inflows induce OMOs sales as G-Secs are swapped for foreign securities to sterilize the effect of inflows on the money supply. G-Secs yields are then found to rise.

Keywords: Government securities market; yields; open market operations; debt inflows; price discovery

JEL Code: G12, F34, H63

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1. Introduction

The government securities (G-Secs) market is little understood yet has substantial effects on other markets as the producer of risk-free interest rates that serve as benchmarks for bonds more generally. Price discovery in the longer term G-Secs gives an estimate of macroeconomic variables such as expected inflation and growth. It has a major role in monetary management. The RBI conducts open market operations (OMOs) in G-Secs, that is, sale to or purchase from the market in order to adjust long-term or durable rupee liquidity. Sale of securities aims to suck out rupee liquidity when it is in excess; while buying securities from the market releases liquidity into the market when liquidity conditions are tight. Finally, it also determines the price of market borrowing for government. It can be argued that the RBI should not worry about this and focus only on monetary management. But G-Secs rates are becoming more important in monetary transmission as the share of bank credit goes down and that of market borrowings goes up. Market interest rate spreads affect monetary transmission.

Second, 10 year G-Secs threw up an interesting puzzle last year. There was a sharp rise in yields unrelated to fundamentals. Exploring its causes sheds light of the working of G-Secs markets in India, and on pitfalls of monetary management in an emerging market.

The following figures give a quick overview of the G-Secs market and put the sources of government financing in context. On December 17, 2018 all G-Secs totaled to Rs 54.43 tr. Commercial banks were the major holders with 26 tr in 2016. In end November 2018 the RBI held only7.85 tr of this, which itself was up from 4.74 tr in end March, while foreign institutional investors held Rs 1.91 tr. Other holders and players include insurance companies-- provident and pension funds, co-operative banks, regional rural banks, mutual funds and corporates. Retail at present has a minor share, although there are continuing attempts to develop the retail market. Stock exchanges have launched debt trading platforms (G-Secs as well as corporate bonds) for retail investors, with access through broker banks.

At present the main players in the G-Secs market are commercial banks. Some of these as well as a few non-banking financial companies (NBFCs) function as primary dealers. These are market makers providing both buy and sell executable quotes. There are sustained improvements in market microstructure, such as the development of transparent electronic trading and reporting platforms.

The 10-year G-Secs is the most traded. Average daily turnover over 2015-18 was about rupees 4tr (7% of the stock) but ranged from a low of 1.5 to a high of 15tr. We will focus on these G-Secs from now on.

After the August 2017 cut in Repo rate from 6.25% to 6%, the monetary policy stance hardened and the cost of government paper rose sharply. The historical spread between the Repo and the 10 year G-Secs since 2011 was about 60 basis points, but the yield on the 10-year benchmark paper rose from 6.4% to peak at 8.18% on 11 September 2018 before coming down towards 7. At the shorter end also G-Secs yields rose. Over the same period the rise in policy Repo rates was only 0.5%. Why did G-Secs yields then rise[1] by almost 2%?

Under the expectations theory of interest rates long-rates are the sum of expected short-rates, plus a time varying term risk premium that depends on investor preferences. Real components and inflation components underlie the nominal yields, the nominal term premium and the path for nominal expected short rates[2]. The standard explanation for a rise in long-term bond yields is market expectations of rising inflation and growth. Underlying this could be factors that push-up demand like rising fiscal deficits, or supply shocks like rising crude prices that affect inflation. In such conditions policy rates would be expected to rise over time. Demand and supply of securities affect price, but are themselves linked to fundamental factors. Policy rates directly affect short rates.

But examining each of the standard variables shows them to be inadequate to explain the rise in Indian bond yields in this period. Therefore, we turn to special features of Indian G-Secs markets. RBI provision of short-term liquidity is automatic under the liquidity adjustment

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[1] This raises the share of interest payments to be paid out of scarce revenue resources. Interest payments as a ratio of GDP went up to 3.2 in the revised estimates for 2018-19 compared to 3 in budget estimates. See Kanagasabapathy et. al (2018) for an assessment of rising interest burden.
[2] There is a large literature on term premia and their estimation. See Li and Wei (2013) and Wright (2011). Krishna and Nag (2018) estimate Indian sovereign bond yields.

facility (LAF). But large persistent deficits indicate a shortage of durable liquidity. An emerging market (EM) like India with a sizable informal sector is subject to major autonomous shocks in durable liquidity from fluctuations in foreign inflows as well as from the demand for cash. These affect banks demand for G-Secs, which goes down as liquidity dries up. Sources of durable liquidity can be the RBI's holdings of G-Secs, which also raise demand for G-Secs, or its holdings of foreign securities acquired through buying foreign exchange and then investing in foreign securities. We find that in addition to policy rates, the provision of durable liquidity and its sources also affect G-Secs yields.

Over the period there was a large swing in RBI positions from selling G-Secs to sterilize acquisition of foreign currency to buying above 60 per cent of net government borrowing through OMOs. Durable liquidity was largely in deficit. In the Indian system where only commercial banks can access the LAF window sustained periods of liquidity deficit increase the leakage of cash, as informal rates of interest rise, thus making the deficit worse. These features along with other regulatory actions offer more satisfactory explanations for distortions in yields that also distorted markets ability to successfully discover price, so that G-Secs yields deviated from fundamentals. Finally, implications for policy are drawn out.

The remainder of the paper is structured as follows: Section 2 assesses the standard explanations; section 3 discusses the Indian context; section 4 estimates G-Secs yields; section 5 estimates the effect of debt inflows on interest rates while section 6 draws out policy implications and concludes the paper.

2. The standard explanations
Inflation and growth expectations
In the 2016-18 period inflation remained within the inflation targeting band, first undershooting then briefly overshooting and finally again undershooting RBI projections. Thus inflation was low in the beginning of the period, rose and then fell again.

Low oil and food prices kept inflation low in 2016. Retail inflation quickened to 5.21% in December a 17-month high, as food and fuel inflation rose. In its December 2017 policy review, RBI raised the projection of inflation in the second half of the fiscal year by 10 basis

points—from a range of 4.2-4.6% to 4.3-4.7%[3]. In the October 2018 policy, however, this projection had to be revised downwards to 3.9-4.5% as despite a rise in MSP food inflation remained soft. A rise in oil prices also did not have the expected effect on inflation and oil prices fell sharply in November. October 2018 headline consumer price inflation (CPI) inflation came in at 3.3% and continued to fall.

Similarly, growth rates were first low then rose and then fell again. In October 2017 RBI reduced its gross value added (GVA) growth projection to 6.7 from 7.3 after economic growth slumped to a three-year low of 5.7% in the June 2017 quarter. But growth bounced back to 6.3% in the July-September quarter after deceleration in the past five consecutive quarters. In the December 2017 policy, RBI kept the growth projection unchanged at 6.7% for fiscal year 2018, expecting 7% growth in the December quarter and 7.8% in March quarter. Gross domestic product (GDP) growth was 6.6 in 2017-18. RBI projection for 2018-19 in April 2018 was 7.4. A strong growth recovery to 8.2% took place in Q1 2018-19, but it moderated to 7.1% in Q2 and was expected to moderate further as credit conditions tightened, although RBI did not change its growth projections.

Since both growth and inflation showed soft patches, and their expected values were reflected in Repo rates rises, it is unlikely they were responsible for the extent to which yields hardened above Repo rates. These were not our culprits.

Fiscal Deficit
Mild fiscal slippages compared to the Fiscal Responsibility and Budget Management (FRBM) path announced occurred in both the 2017 and 2018 budgets (3.5% versus 3.2% and 3.3% versus 3%). The FRBM path itself, however, allowed some deviation from the path in a year of major tax reform such as GST. While the number of tax payers and direct tax payments went up, GST itself was running slightly below target, although the longer term potential remains excellent.

The 2018 budget had a proposal to ensure minimum support price of kharif crops 50% higher than cost of production, as well as a partially funded health scheme. On 2 February, a day after the 2018 budget, the 10-year paper yield fluctuated between 7.48% and 7.68%, 10 times

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[3] Source: various monetary policy committee (MPC) statements available at www.rbi.org.in.

the normal market volatility, as the market worried about managing government's Rs 6.06 trillion gross market borrowing with the additional schemes in 2018-19. It welcomed a later announcement of cuts in borrowing with a softening of yields.

But again, the rise in government borrowing was not sufficient to warrant a 2% rise in G-Secs yields.

US Federal Fund Rate

Bond yields rose in most developed markets during this period as monetary policy moved towards normalization after the global financial crisis (GFC) stimulus. Even so, since inflation itself did not rise, and neither did long-term sustainable growth, the bear market in bonds was not expected to intensify.

As Trump tax cuts over-stimulated the economy near the top of its growth cycle and the US Fed raised rates, US 10 year yields rose to touch 3% from 1.5% in mid- 2016. Even so, short-term yields rose more than the long rate. The flattening yield curve suggested markets were pricing earlier monetary tightening, rather than a greater overall amount of tightening by the end of the cycle. The term premium increased as the end of global quantitative easing was fully priced in. But it was mostly due to the inflation component. As the recovery in real output growth in early 2016 reduced a fear of future deflation markets had priced into bonds, the inflation risk premium returned to a normal level of about zero, raising yields and explaining market pressure to sell bonds.

As commodity prices soften and the US growth shows signs of peaking, further sharp rise in global bond markets yields is unlikely. An escalating bond bear market requires either a continued upward adjustment in the expected path of Fed rate hikes, or an increase in the term risk premium on long bonds. The US Fed Chairman also indicated in November 2018 that real Fed rates were approaching neutral. Traders slashed bets on Fed interest rate rises. Futures had priced in the US central bank move in December but indicated it might pause in 2019.

Moreover, Indian policy rates had not remained low commensurately with US interest rates, after the GFC. They had been raised substantially on the inflation targeting path after 2013,

so the differential between Indian and US rates was high enough not to require a further sharp rise in Indian rates.

Since none of these standard explanations are satisfactory we next turn to special Indian features.

3. The Indian context

3.1 Special features of Indian markets

Large volatility in bond prices led to extremely thin markets in 2018 where the volume of trading was less than one-fourth of the previous year. On several days after February it was below Rs 2 tr. There were few buyers and RBI had to cancel or devolve bond auctions[4]. The sharp fall in yields, led to large treasury losses. Banks and fixed income funds did not want to buy government paper for fear of such losses. But by November 2018 rates were falling. Turnover was back at a respectable 6 tr in December.

3.1.1 Liquidity

Banks meet the funding needs of households, corporates, and NBFCs through primary liquidity (deposits) and by accessing funding liquidity (collateralised and uncollateralised from the money market), market liquidity (using liquid assets in their portfolio to raise funds) and central bank liquidity. Liquidity mismatch is fully accommodated through banks' exclusive access to the RBI's LAF. Autonomous liquidity shocks (such as currency demand of households, liquidity impact of forex market interventions of the RBI, and changes in government's cash balances maintained with the RBI) as well as non-LAF discretionary liquidity management operations (such as the Open Market Operations (OMOs), use of Market Stabilisation Scheme (MSS) securities/cash management bills, and changes in the cash reserve ratio), which are targeted to meet the durable liquidity needs of a growing economy, affect the LAF demand (Kavediya and Pattanaik, 2016).

From 2011 it was decided to keep the LAF in deficit even in easing cycles, as is the practice in many advanced economies (AEs), as this was thought to aid monetary transmission. But

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[4] On 22 December 2017 a Rs. 30 crore floating rate bond auction devolved on the primary dealers who buy and sell such securities. A week later, on 29 December, RBI cancelled Rs110 bn of a Rs150bn auction. On 5 January, a Rs. 40bn long-bond auction (of 40 years and 16 years) was cancelled. On 19 January, yet another Rs. 40 bn auction of 6 and 28 year papers got cancelled. Finally, a day after the budget, Rs. 110 bn auction was cancelled as there were no takers. News reports.

given major autonomous shocks in the Indian system this led to large recurring liquidity deficits. Although the call money rate (CMR), which is the operational target, remained within the LAF band, spreads rose for other rates (Figure 1), and there were periodic complaints from markets. Repos and term repos work well to smooth transient liquidity shocks but are inadequate to address durable shortages. In the absence of clear benchmarks, banks were not confident about rates in the interbank market. They were also reluctant to finance longer-term investments through short-term funding. In 2016, therefore, it was decided to keep liquidity in neutral. Yet 2017 again saw complaints of liquidity shortages from markets.
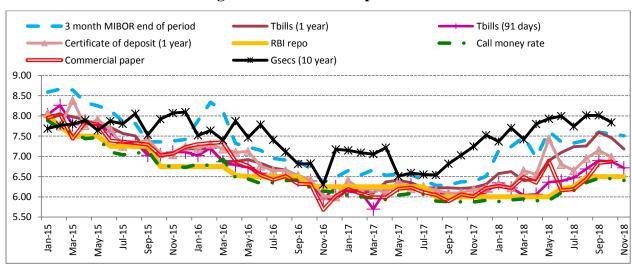
Figure 1: Interest rate spreads

Following excess liquidity as cash flooded the banking system after the 2016 demonetization, the RBI was in a liquidity absorption mode. In the first half of 2017, bonds yields were low because of adequate liquidity in the system. The RBI sought to absorb not only demonetization related excess liquidity[5] but also that from acquisition of excess foreign inflows that came in through 2017. The markets blamed this absorption of durable liquidity for a shortage of liquidity. Banks that were lending began to face liquidity deficit. State Bank of India raised bulk deposit rates by 50-140 basis points and a few banks raised loan rates, even before Repo rates were raised.

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[5] Of this, Rs 900 bn was from OMOs and 1 trillion from long-term treasury bills under the market stabilization scheme in April and May (RBI 2017 December 6, MPC statement).

Although the RBI's stated aim since 2016 was to keep liquidity neutral, its MPC statements record that ever since December 2017 liquidity fluctuated between surplus and deficit. RBI preferred to use overnight and term repos to inject short-run liquidity rather than provide long term liquidity[6], choosing to fine-tune variable rate auctions of both repos and reverse repos, in addition to the regular operations.

The situation worsened in mid-October 2018 when the cash deficit or net core liquidity (availability of cash in the system considering Government cash balance auctions) deficit in financial markets reached 1.4 Rs tr compared to a small surplus in the first week, and was expected to reach 2.5 tr by March 2019 (Das, 2018). In the 5 months between April and August the RBI sold $18.6 bn in the currency market as foreign portfolio investments began to exit. This further reduced rupee cash in the system. There was also the festival demand for cash.

Currency in circulation had risen by 6tr in 2017 and 3.3 tr in 2018. Goyal and Kumar (2018) argue when liquidity is tight, informal rates rise and as a result there is more cash leakage from the banking to the informal sector further constraining liquidity. Liquidity was tight over 2017 and 2018. They also find in an estimated DSGE model for India that money significantly affects demand in addition to interest rates, unlike in AEs. The income elasticity of narrow money is three times that of broad money. Therefore both money supply and its composition matter for an economy like India. It is not enough just to target Repo or CMR[7].

The components of reserve money are liabilities of the RBI. These are currency in circulation, bankers' deposits and other deposits with the RBI. The main sources of this reserve money[8] are net RBI credit to Government and its net holdings of FX reserves. RBI holding of treasury bills and dated securities constitute the major part of RBI credit to Central Government while government cash balances with the RBI are deducted from it. FX

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[6] In March 2018 one tr was released through the redemption of the MSS Treasury bills.

[7] Dr. Rangarajan, visiting IGIDR for a book release function in December 2018, remarked in private conversation that the MPC should rather be called RPC (rate policy committee), since they do not assess monetary aggregates at all. It is a common view among those with practical experience of Indian monetary policy making that the composition of money supply matters.

[8] Exactly they are net RBI credit to Government, to banks and the commercial sector, RBIs net holdings of FX reserves, Government's currency liabilities to the public – RBI's net non-monetary liabilities. The last are all those liabilities which do not create any monetary impact. They include RBI capital, various reserves, provisions etc. minus the other assets of RBI. Net RBI credit to Central Government = Loans and advances to the Centre + holding of Treasury Bills + Dated securities + Rupee coins + Small coins - Net of Centre's cash balances with the Reserve Bank.

intervention such as purchase of dollars adds to reserve money, unless sterilized by a sale of G-Secs held on the RBI balance sheet.

3.1.2 FX Intervention

India followed a carefully sequenced process of capital account convertibility. Equity inflows, which are risk-sharing, were liberalized earlier, while caps remained on debt inflows these were lifted slowly[9]. Equity inflows dominated because of caps on debt, but imperatives of financing the current account deficit (CAD) lead to faster relaxations in debt flows, after 2011[10]. India could absorb larger absolute amounts now as its GDP had risen. As caps on debt were lifted up to $19 billion flowed in over 2017-2018, taking up all space available, because they gained both from India's much higher interest rates and from currency appreciation.

Despite being an additional source of demand for G-Secs these inflows did not reduce the cost of government borrowing since the RBI was forced to buy US treasuries at zero interest from the excess inflows it accumulated as reserves thus decreasing its holdings of Indian G-Secs[11]. For example, as OMOs that had injected Rs 1783 billion in 2016 withdrew long-term liquidity of 900 bn in 2017, Indian G-Secs yields shot up to 8 per cent. Therefore the composition of durable liquidity also seems to matter. If its source is foreign or domestic G-Secs held on the RBI balance sheet makes a difference. The RBI also earns much lower interest rates on foreign securities. Table 1 shows the share of G-Secs to foreign securities in the RBI balance sheet became negative in periods of large inflows, and these were also periods when G-Secs yields rose. The ratio reached a low of 0.15 on 23 February 2018 while G-Secs yield rose.

Although foreign institutional investors (FIIs) are an additional source of finance and contribute to developing markets they add volatility especially in thin markets. In September

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[9] In 2011, for example, an FII could invest up to 10% of the total issued capital of an Indian company. The cap on aggregate debt flows from all FIIs together was only 1.55 billion USD.

[10] By 2013 caps on government debt for foreign investors had been raised to USD 30 billion (overall debt limit including corporate bonds at 81 billion). In October 2015 bi-annual increases in limits were announced to reach up to 5 percent of government bonds by March 2108. This cap was fully utilized at 1.91 lakh crores by that date. In April it was raised to 5.5 per cent in two tranches and to go up to 6 per cent in 2019-20. The limit in corporate bonds was raised to 9 per cent of the stock
(https://www.rbi.org.in/Scripts/NotificationUser.aspx?Id=10059&Mode=0)

[11] Its absorption of durable liquidity in the 2017-18 financial year till November was Rs 1.9 trillion. G-Secs holdings of FIIs, which fully utilized the cap, were also 1.91 tr in 2018.

2013, even after relaxation in debt caps, the share of debt securities was still small at 36 per cent of equity securities and 6 per cent of total liabilities. The rise in yields that year (Table 1) was driven more by unnecessary policy tightening, not the debt outflows, in the Indian context[12]. But in March 2018 these numbers had increased to 75.5 per cent and 11 per cent respectively. Debt security liabilities now totaled USD 117 bn compared to reserves at USD 425 bn. Thus a low cap of 5 per cent of domestic debt leads to debt stocks being too large a share of foreign liabilities. This share should also be capped (Goyal, 2018).

There were also periods of sudden stops and outflows due to global factors to which debt flows are more susceptible. Sustained outflows in 2013 and slowdowns in late 2017 were largely in the debt component due to global risk-off. In both periods Indian market positions were largely long in government debt as interest rates were in a downward phase. As policy raised rates or did not lower them partly out of concern for possible debt outflows, bond values fell creating large domestic market losses, and shrinking domestic institutional and retail participation in debt, further raising G-Secs rates. Moreover, if the policy Repo rate is forced to more closely follow the rise in US Fed rates, it can hurt the domestic cycle. Capital flow management, such as caps on debt, prudential regulation, a more flexible exchange rate, and reserve accumulation and use are ways to retain some policy independence[13].

The US Treasury, however, would like all EM adjustment to be in exchange rates since local currency appreciation will help expand US exports. It dislikes market interventions and threatens to label a country as a 'currency manipulator' and pressurize it to appreciate its currency. A prior step is putting it on a watch-list based on 3 criteria: a bilateral trade surplus with US of at least $20bn; CA surplus of at least 3% of GDP; persistent one-sided FX intervention of at least 2% of GDP over 12 months. These grounds are flimsy since bilateral surpluses are inadequate measures of trade distortion—they could be arising from multi-country value-added chains. Intervention must also be seen in the context of excess volatility of capital flows.

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[12] Debt outflows over May 22-August 26th in 2013 were 868 USD million for Indonesia, where foreign funding of domestic currency sovereign bonds had been liberalized considerably, compared to 35 USD million for India. So Indonesia had to raise policy rates 175 basis posts post taper-on. The share of foreign bond investors in Indonesia's bond markets was 38% in 2014 compared to 4% for India.

[13] While Rey (2018) argues that flexible exchange rates are not adequate to protect EMs from global shocks and they need capital controls, Aizenman (2018) believes a balanced combination of policies can work.

	Table: 1		
	Turnover in G-Secs (Rs billion)	G-Secs (10 yr) yield	Ratio of G-Secs to foreign securities in RBI balance sheet
2000	162.99	11.08	
2001	396.74	9.38	0.73
2002	485.20	7.19	0.45
2003	619.07	5.65	0.24
2004	378.66	5.93	0.04
2005	260.59	6.97	-0.01
2006	95.65	7.66	0.02
2007	134.41	7.95	-0.04
2008	725.16	7.86	-0.07
2009	1035.73	7.02	0.03
2010	999.78	7.83	0.17
2011	995.57	8.38	0.27
2012	1768.80	8.31	0.35
2013	3342.03	8.22	0.39
2014	3249.18	8.58	0.32
2015	3340.73	7.84	0.20
2016	5630.71	7.28	0.23
2017	4004.32	6.94	0.22
2018	3017.23	7.83	0.21

It has not yet named any country a currency manipulator although among its major trading partners six countries were on the April 2018 Monitoring List: China, Japan, Korea, Germany, and Switzerland with India as a new addition. In 2017 Indian purchase of foreign exchange was USD 56 bn coming to 2.2 per cent of India's GDP. US Treasury (2018) pointed to this and the bilateral goods trade surplus of USD 23 bn. But it also noted India's overall CAD and that its currency was not deemed under-valued by the IMF. In Treasury's view, however, India did not need more foreign exchange reserves since it still had some capital controls. But India needed to intervene more precisely because it relaxed capital controls such as debt caps (Goyal, 2018). All the more reason, therefore, for India to go slow in relaxing such controls.

3.1.3 Open market operations in G-Secs

The surge in debt flows in 2016 because of relaxing debt caps and keeping interest differentials high necessitated sales of G-Secs by the RBI in order to sterilize the effect of large dollar purchases on the money supply. As a result, G-Secs yields began to rise. Tight liquidity encouraged cash leakages further reducing durable liquidity. Then in mid-2018 a rise in oil prices and global instability led to a reversal of foreign portfolio flows. RBI's estimated sale of US$ 22-25 bn in the spot market further reduced reserve money. Therefore it began to do OMO G-Secs purchases. Beginning in May, (Table 2) these amounted to ₹500 billion during H1:2018-19. In end September it began a practice of announcing a calendar of future OMOs for every month.

OMOs restored the confidence of banks and brought them back to the bond market. Treasury gains were once more on the horizon. 10Y G-Secs yields began to fall in November and were 7.45% in early December. The abnormal term premium was still elevated (above the average since 2011 of 60 bps) but was coming back to normal as durable liquidity outflow was compensated.

By end December RBI 2018-19 OMO purchases of Rs 1.76tn were 69% of the Rs 2.55 tn net central government issuance. Critics regard this as a form of financing government deficits that distorts markets, hurting their price discovery (Narayan, 2018). For example, RBI (2014) suggested large OMO purchases amounting to 20%-40% of the net government market borrowings over 2008-13 may have aimed to reduce G-Secs yields. But these OMOs were necessitated by global risk-off led outflows in this post global financial crisis period. And yields remained high because inflation was high.

OMOs do not amount to automatic financing of government deficits since the RBI now has freedom on when and how to do OMOs unlike with the earlier ad-hoc Treasury bills. The latter involved automatic financing of government deficits and were discontinued in the nineties.

Moreover, Deuskar and Johnson (2016) present evidence that the market trading liquidity effects of large CB quantitative interventions are small, although yields are affected. They conclude market distortions from quantitative easing operations such as OMOs may be minimal.

3.2 Regulatory features

As we saw investments by commercial banks in G-Secs is the largest amounting to more than half the stock. Prior to the nineties reform the Statutory Liquidity Ratio (SLR) forced banks to hold 38.5% of Net Demand and Time Liabilities (NDTL) in G-Secs. Reforms aimed to reduce this financial repression and the SLR was steadily brought down. It was 25 for much of the 2000s and in 2018 was 19.5, moving towards convergence with the minimum Liquidity Coverage Ratio (LCR) required under Basel rules. LCR ensures banks have sufficient high-quality liquid assets to survive any stress for 30 days. In order to complete this alignment SLR is to reduce further by 25 basis points every calendar quarter until it reaches 18 per cent of NDTL, with the first reduction of 25 basis points in the January 2019 quarter.

But since 2000 banks generally chose to hold more than the statutory minimum, as market determined returns were attractive while credit growth was slow. Private and foreign banks sometimes held more than public sector banks (PSBs). Foreign banks held 44% in 2015, which had come down to 33% in 2017. In 2018 the average level held was 29.5%.

As rates rise banks make capital losses on the longer duration bonds. But banks can opt to hold about 50% of SLR in a Held to Maturity (HTM) category, which protects from valuation changes, since mark to market (MTM) is not required. The limit of 25% of total investments under HTM category could be exceeded, if held in SLR securities when total SLR securities under HTM category are not more than 20.5% of NDTL. As SLR was reduced, this ceiling was also reduced to 19.5% over October, 2017 to March 31, 2018[14]. Unfortunately this was just the period when rates rose, inflicting heavy losses on sales and transfers from the HTM category. In the past, during such periods, regulatory forbearance had been forthcoming in the form of a rise in the HTM category, deferment of recognition of MTM valuation losses, or OMO operations that reduced yields.

This time, however, a speech by a RBI deputy governor (Acharya, 2018) told banks not to expect help with interest rate risks. The aim was to encourage banks to hedge risks but it increased banks reluctance to hold long-duration G-Secs. In India the interest rates swap market is still underdeveloped and most PSBs lack the skills and expertise to use it.

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[14] https://www.rbi.org.in/scripts/NotificationUser.aspx?Id=11136&Mode=0

Moreover, banks are still on the path of reducing holdings of G-Secs away from financial repression. Pushing banks towards better managing interest rate risks is a laudable objective but is better done in good times not in bad. The RBI later[15] (June 15) did allow them to stagger the provisioning for their MTM losses.

Banks had to maintain 90% LCR from January 2018, to reach 100 % by January 1, 2019, in line with Basel norms. A broader range of high quality liquid assets could now be computed for LCR. Apart from G-Secs in excess of and within the mandatory SLR requirement, these included the 2% of NDTL allowed under the Marginal Standing Facility and a Facility to Avail Liquidity for LCR created, which was increased from 13 to 15% of the bank's NDTL from October 1, 2018. This broader range and reduction in SLR did not yet dent banks demand for G-Secs, although the HTM reduction and capital losses made them reluctant to add to their stocks.

The rise in LCR, however, contributed to the liquidity issue for some banks. Although banks could use almost 50% of their SLR holdings (9% of 19.5%) for LCR, some new private banks had to rush to buy money for maintaining LCR raising rates in the term money market. One-year certificate of deposits rose above 7.5% even though the overnight call money market did not rise.

Thus poorly thought through announcements, over strict regulations, and regulatory flip-flops contributed to raising market yield spreads.

3.3 Impact of Events

Table 2 summarizes the impact of major events in the period of analysis that are expected to impact G-Secs yields. It gives the basis points change in the yield one week before and one week after the event. Although the MPC was on hold in a neutral stance through much of 2018, Figure 2 shows the steady rise in yields. The withdrawal of long-term liquidity through OMOs, as well as announcements of greater government borrowing, all raised yields.

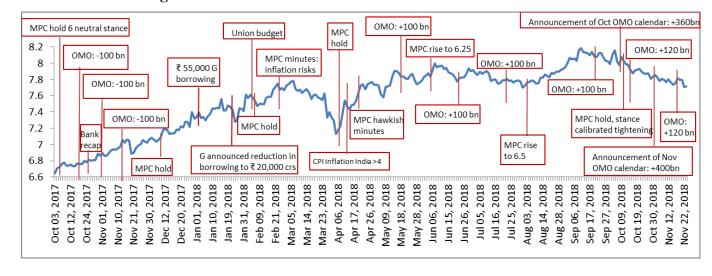[15] https://rbi.org.in/scripts/NotificationUser.aspx?Id=11304&Mode=0

Figure 2: India 10-Year Bond Yield Historical Data

Perhaps the one tr released through the redemption of the MSS Treasury bills explains the softening of yields in March (Figure 2). Announcements of reduction in government borrowing and the Union budget that did not increase borrowing requirement also reduced yields. The bank recap announcement of Oct 24, 2017, temporarily raised yields by 3bps as markets digested its impact on government borrowings. The DG's speech (Jan 15, 2018) on no regulatory remission raised yields to 7.56 on Jan 16 from 7.44 by 12 basis points although the government's announcement of reducing borrowing reduced yields soon after.

Action by AE central banks (CBs) did not necessarily affect Indian G-Secs yields in the expected direction. While Indian CPI inflation rising above the MPC target raised yields in April, yields fell in May under similar conditions. But MPC warnings on inflation risks and hawkish minutes raised yields. MPC raising rates in June and August also raised yields. Active OMO purchases starting in May that injected durable liquidity reduced yields temporarily and on a durable basis by September. OMO calendars for the following months announced in end September and October also reduced yields. Thus liquidity injection and announcement through OMOs had the greatest impact on yields.

4. Estimating G-Secs yields

The stylized facts above strongly support the importance of liquidity and its composition for G-Secs yields. We next turn to formal regressions of 10 year G-Secs yields on short rates and a number of control variables, which also support the hypothesis, since OMOs as a ratio of

narrow money are found to have the largest effect while FX intervention as a similar ratio is insignificant.

4.1 Data and Methodology

Monthly data was obtained over the period May 2002 to Feb 2018 by taking monthly averages of daily data for 10-Year, 91-Day T Bills and US Fed Rate rates. All other variables OMOM1, CPIIR_1m, IIPGR_1m and FX were already monthly. First differences were taken from the previous month so for market rates the first observation starts from May' 2004.The data on FD was quarterly and that on SLR was annual. Therefore the same value was taken over 3 and 12 months respectively. The variables were all tested for stationarity. To include the dummy for the period after October 2017, insignificant variables ending in 2017, such as the quarterly fiscal deficit data were excluded since otherwise Stata dropped the dummy. One month ahead annualized growth and inflation rates derived from CPI and IIP were taken as proxies for inflation and growth expectations, rather than 1 year ahead variables because of this problem. Absorption (dollar sales) is negative for FX and OMO since it decreases money supply, injection is positive.

OMO injections normally occur when long-run liquidity is tight. The net injection or purchase of FX creates domestic money. It implies an exchange of G-Secs for foreign securities in the RBI's balance sheet.

OLS and GMM regressions of change in monthly ten year G-Secs yields (D10 Y) were run on change in the policy rate (DRepo), change in 91 day treasury rates (D91Y) since under the term structure theory of interest rates short rates affect long rates; change in the US Fed Rate rates (DFF) since the differential affects foreign inflows; change in the FD ratio as a proxy for G borrowing requirements; the one -month ahead inflation and one-period ahead growth rate as a proxy for inflation (CPIIR_1m) and growth expectation (IIPGR_1m) effect on G-Secs; banks' actual or excess SLR (actual - regulatory mandate) as a ratio to their NDTL as a proxy for their demand for G-Secs; RBI OMOs as a ratio of narrow money (their balance sheet) as a proxy for their demand for G-Secs; and RBI net purchase of FX divided by narrow money, which reduced demand for G-Secs. A dummy variable was also added for the period after October 2017, which saw a sharp rise in G-Secs rates. The dummy tests for factors other than the above explanatory variables as affecting G-Secs rates in this period. OLS results are not reported since the residuals show signs of non-normality. GMM regressions correct for simultaneity and their diagnostics are satisfactory.

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4.2 Results

Yields change significantly with change in US fed rates and 91D yields supporting the rational expectations theory of interest rates (Table 2). That DRepo is insignificant in GMM but significant in OLS (not reported) suggests that policy rates respond to market rates. Variables such as expected inflation, the fiscal deficit and SLR holdings are insignificant. The latter two variables are not adequately measured since the monthly variables are derived from quarterly and annual figures available. The results show the large impact of OMO operations on 10 Year G-Secs even after including the standard determinants. Tight long-run liquidity when OMOs occur raises G-Secs rates. Therefore OMOs can still counter variables like DFF that are not in the control of domestic authorities. The dummy variable is also significant, suggesting that the special regulatory and other variables, perhaps such as the announcement effects highlighted in the event table, had a role.

5. Estimating the effect of debt inflows on interest rates

Regressions were also run to estimate the impact of portfolio debt flows on short and long term Indian interest rates. The results show the debt inflows affect short-term rates probably because of policy over-reaction, but not long rates implying policy still has degrees of freedom to respond to the domestic cycle. Repo has a larger effect on short compared to long-rates. Domestic long-rates still have some protection from global volatility and appropriate policy action can increase that protection.

5.1 Data and Methodology

Quarterly data for 2006-Q2 to 2017-Q1 was obtained for portfolio debt inflows: external debt securities and cross-border loans; short-term interest rates (inter-bank CMR); long-term interest rates (10-year G-Secs bond yield) and other domestic macroeconomic variables – CPI-IW inflation, IIP growth rate, Repo rate and nominal effective exchange rate (NEER). A post-crisis time dummy is added to capture a possible structural break in the post-crisis period (2009-Q1 onwards) and the volatility index (VIX) to capture risk perception and uncertainty in the United States and the global economy. Data sources are BIS, Thomson Reuters and RBI time series database.

External debt security is defined as the outstanding amount of bond issuance in the international market for all maturities and denominated in foreign currency. The residence

approach is followed where data is provided on an immediate risk basis and the residence of the borrowing firm. Immediate risk basis uses the country of residence of the immediate borrower. In other words, it means that if a firm residing in India issues a bond it would come under this category regardless of the actual nationality/headquarter of the firm. This is in line with the balance of payment and the system of national accounts principles. Cross-border loans are defined as total claims by BIS reporting countries on India in form of loans and deposits and denominated in the foreign currency.

Software R was used for data cleaning and estimation. Before the estimation, seasonality and Unit root tests were conducted. X-13 ARIMA package was used to remove seasonality and Augmented Dickey-Fuller tests were used to check for unit roots in the dataset. Except for IIP and cross-border loans, all variables were found to be I(1) so first differences were taken to convert these non-stationary series into stationary I(0) processes. OLS regressions were used given the small sample of the dataset, but tests show endogeneity is not an issue.

5.2 Results

Table 4 gives the results for short term rates and Table 5 for long-term rates, as a function of external debt securities, Repo rates and other macroeconomic controls[16]. Change in external debt securities significantly and positively changes short term interest rates but not long term. Among other variables change in repo rates positively and significantly changes both short and long term rates, but its effect on short term rates is more than double that on the latter. Nominal exchange rate appreciation reduces both interest rates. An interesting result is that a rise in global volatility has no effect on short rates and significantly reduces change in long-term rates, again suggesting some protection of the domestic cycle from global shocks, as does the absence of significant effects of debt flows on long-term interest rates. India's caps on capital flows may still be mitigating the impact of short-term global market volatility. The negative coefficient for long-rates suggests Indian market risks may be negatively correlated with US risks.

The small sample limits us to OLS, but the diagnostics are satisfactory, implying results are credible. We fail to reject the Breusch-Pagan test null hypothesis (H0) of constant variance or residuals are homoscedastic, the Ramsey test null that the model has no omitted variable,

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[16] External debt securities are larger than cross border loans. The latter do not significantly affect domestic interest rates and therefore regressions with the loans are not reported.

the Link test null (H0) of no specification error, and the Shapiro-Wilk (SW) test null that the distribution of residuals is normal.

6. Conclusions

The regressions as well as the event summary show the large impact of OMOs on 10-year G-Secs, while that of world interest rates is still limited. The analysis identifies the reason for the puzzle of the sharp rise in G-Secs yields as the narrow focus of monetary operating procedures, which was inappropriate for many aspects of Indian structure. For example, large exogenous durable liquidity shocks require a more rapid adjustment of durable liquidity. Adjustment just through short-term liquidity as occurs at present is inadequate. The composition of liquidity, share of reserve money and its sources all matter. OMOs must not be viewed as only a residual durable liquidity management tool, but as affecting the spread of interest rates and therefore the transmission of monetary policy. They should not be entirely replaced by RBI's acquisition of foreign securities. If large foreign debt inflows reduce OMOs, as sterilization takes place, they can raise yields. While development, deepening and stability of financial markets must remain a major objective, tightening of regulations should avoid being pro-cyclical.

The price discovery function of G-Secs markets is impeded both by too little and too much of OMOs, so balance is required. Both distort G-Secs yields away from fundamentals.

Many implications follow for policy. As SLR reduces and banks are encouraged to hold different kinds of securities and lend more to the private sector, the RBI will have to hold more G-Secs on its balance sheet. A threshold ratio of G-Secs to foreign securities should be worked out in terms of its impact on the market rate spreads and the ratio should not fall below that. Debt inflows do help to deepen debt markets but lifting of caps on debt inflows should be calibrated to the reserve accumulation and sterilization it would entail, as well as to the impact on the country's net international investment position, not only as a share of domestic debt markets. The size of debt market is large but the turnover is still small. Alternatively, if inflows and reserve holdings have to rise, in the longer term the RBI can consider issuing its own bonds for sterilization, as the People's Bank of China does.

More widespread holding of G-Secs is also required and will happen as markets deepen. The retail share should rise as NSE and other stock exchanges provide platforms reducing transaction costs and raising awareness.

If government debt becomes more widely held and high GDP growth aids the FRBM path of debt reduction to East Asian levels there should be no problem in finding holders for G-Secs. But in transition holders are needed for net borrowings. If foreign inflows remain restricted, the RBI will be able to hold much of this.

A public debate needs to take place on whether there should be an independent debt office or government debt management should remain with the RBI. The international debate that had earlier favoured independence in view of possible conflicts of interest has swung around to seeing CBs as the best debt managers after the GFC. Huge expansion in the balance sheets of AE CBs has made them large holders of debt. They have the advantage of strategic timing of placements and use of market intelligence. OMOs help them enhance monetary transmission by acting on interest rate spreads. But if a CB is a government debt manager OMOs cannot be narrowly seen as only a residual monetary tool. The AE experience also suggests that large expansion in CB's balance sheet need not disrupt market trading.

Reducing the cost of government borrowing is a function of the debt manager but need not imply automatic funding of deficits. The critical difference of freedom in use of OMOs remains, unlike the automatic ad-hoc treasury bills, which were discontinued in the nineties. Economists are used to working out optimal trade-offs between multiple objectives. Reducing elevated excess SLR holdings and rates risk in the banking system will require good management of public debt and strategic OMOs that reduce yields on G-Secs.

The MPC should expand its operational targets to consider reserve money and its sources. This would be consistent with flexible inflation targeting, since everything that affects the inflation target can be considered in the decision. More sensitivity is required to the role that good communication can play.

Attention should be paid to making micro and macro regulations more counter-cyclical and context based.

Although some protection is still there given India's gradual path to capital account convertibility, the path should be calibrated further, and together with the other measures will help insulate domestic interest rates from global shocks.

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Appendix

Date	Basis point change (Week before)	Basis point change (Week after)	Policy action
		Table 2: Event window	
Oct 04, 2017		0.05	MPC hold 6 neutral stance
Oct 12, 2017	0.05	0.05	OMO: -100 bn
Oct 24, 2017	0.04	0.08	Bank recap announcement
Oct 26, 2017	0.03	0.06	OMO: -100 bn
Nov 09, 2017	0.04	0.11	OMO: -100 bn
Dec 05, 2017	0.06	0.11	MPC hold
Dec 27, 2017	0.04	0.12	Rs 55,000 G borrowing
Jan 04, 2018	0.12	0.12	FOMC minutes: Hawkish
Jan 15, 2018	0.15	-0.03	DG speech no regulatory remission for bank interest rate risk
Jan 17, 2018	0.05	-0.11	G announced reduction in borrowing to ₹ 20,000 crs
Jan 31, 2018	-0.05	0.06	FOMC hold
Feb 01, 2018	0.20	-0.12	Union Budget
Feb 06, 2018	0.13	0.00	MPC hold
Feb 21, 2018	0.21	0.03	MPC minutes: inflation risks
Mar 08, 2018	0.00	-0.11	European Central Bank hold
Mar 21, 2018	-0.08	-0.25	FOMC raise
Apr 05, 2018	-0.42	0.30	MPC hold
Apr 11, 2018	0.20	0.10	FOMC Minutes hawkish
Apr 12, 2018	0.17	0.25	CPI Inflation India > 4
Apr 19, 2018	0.10	0.14	MPC hawkish minutes
Apr 26, 2018	0.22	-0.18	ECB Policy decision dovish hold
May 02, 2018	0.01	-0.02	FOMC Policy decision dovish hold
May 15, 2018	0.28	-0.09	CPI Inflation India > 4%
May 17, 2018	0.17	-0.01	OMO: +100 bn
May 23, 2018	-0.05	-0.02	FOMC Minutes hawkish
Jun 06, 2018	0.16	0.03	MPC rise to 6.25
Jun 13, 2018	0.10	-0.16	FOMC rise
Jun 21, 2018	-0.16	0.13	OMO: +100 bn
Jul 19, 2018	-0.09	0.00	OMO: +100 bn
Aug 01, 2018	-0.08	0.04	MPC rise to 6.5
Sep 19, 2018	-0.11	-0.05	OMO: +100 bn
Sep 27, 2018	-0.11	-0.05	OMO: +100 bn
Oct 01, 2018	-0.09	0.04	Announcement of Oct OMO calendar: +360bn
Oct 04, 2018	0.03	-0.17	MPC hold, stance calibrated tightening
Oct 26, 2018	-0.03	-0.07	Announcement of Nov OMO calendar: +400bn
Nov 01, 2018	-0.05	-0.06	OMO: +100.02 bn
Nov 06, 2018	-0.01	0.02	OMO: +100 bn
Nov 15, 2018	-0.05	-0.04	OMO: +120 bn
Nov 22, 2018	-0.02	-0.02	OMO: +80 bn

Table 3: 10 year GOI GMM regression	
VARIABLES	_10Y
DRepo	0.248 (0.158)
DFF	0.301** (0.0164)
OMOM1	5.477*** (0.00854)
CPIIR_1m	0.000356 (0.985)
IIPGR_1m	0.00654 (0.133)
FX	0.153 (0.821)
Dum	0.212* (0.0610)
Dum_DFF	-0.450 (0.799)
_91D	0.193*** (8.28e-07)
Constant	-0.00918 (0.595)
Observations	188
R-squared	0.322
Sargan (over-identification test)	3.199 (0.0737)
LM (under-identification test)	43.739 (0.000)
pval in parenthesis; *** p<0.01, **p<0.05, *p<0.1	

Table 4: External effects on short term interest rates

	Dependent variable: Δ Short term interest rate					
	(1)	(2)	(3)	(4)	(5)	(6)
ΔExternal debt-Secs	0.275**	0.298**	0.348**	0.278**	0.296**	0.283**
	(2.74)	(2.84)	(3.49)	(3.29)	(3.43)	(3.10)
IIP growth	0.0531*	0.0578*	0.0836**	0.0266	0.0265	0.0211
	(2.07)	(2.10)	(3.04)	(1.10)	(1.09)	(0.78)
ΔInflation		-0.145	-0.229*			
		(-1.29)	(-2.09)			
ΔNEER			-0.172*	-0.0955	-0.0948	-0.0854
			(-2.67)	(-1.82)	(-1.80)	(-1.50)
ΔRepo rate				1.069***	1.139***	1.195***
				(4.24)	(4.36)	(4.13)
ΔRepo*Δ External debt-Secs					-0.216	-0.176
					(-1.01)	(-0.76)
Postcrs_dum	0.340	0.397	0.170	0.167	0.139	0.155
	(1.16)	(1.29)	(0.57)	(0.65)	(0.54)	(0.59)
ΔVIX						0.0111
						(0.47)
Constant	-0.404	-0.461	-0.590*	-0.238	-0.222	-0.193
	(-1.70)	(-1.86)	(-2.48)	(-1.14)	(-1.06)	(-0.88)
Obs	52	49	49	51	51	51
R square	0.191	0.216	0.327	0.471	0.483	0.485
Adj R square	0.141	0.145	0.249	0.412	0.412	0.402
F_statistic	3.782	3.028	4.186	8.012	6.847	5.796
BPheteroskedasticity test pval	0.148	0.141	0.129	0.703	0.875	0.721
Ramsey omittedvar test pval						0.210
Specification test pval						0.211
SW Normality test						0.421

t statistics in parentheses: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5: External effects on long term interest rates

	Dependent variable: Δ Long term interest rate					
	(1)	(2)	(3)	(4)	(5)	(6)
ΔExternal debt-secs	0.0132	0.0177	0.0449	0.0239	0.0239	0.0262
	(0.32)	(0.45)	(1.22)	(0.81)	(0.81)	(0.84)
IIP growth		0.0267*	0.0392***	0.0151	0.0151	0.0156
		(2.49)	(3.76)	(1.54)	(1.54)	(1.54)
ΔInflation		0.0501	0.0131			
		(1.19)	(0.33)			
ΔNEER			-0.0783**	-0.0520*	-0.0520*	-0.0527*
			(-3.22)	(-2.62)	(-2.62)	(-2.59)
ΔRepo rate				0.457***	0.457***	0.458***
				(4.58)	(4.58)	(4.54)
ΔRepo*Δ External debt-secs						-0.0191
						(-0.24)
Postcrs_dum	0.0293	0.00543	-0.0946	-0.0505	-0.0505	-0.0545
	(0.23)	(0.05)	(-0.86)	(-0.56)	(-0.56)	(-0.59)
ΔVIX	-0.029**	-0.0332***	-0.0402***	-0.0228**	-0.0228**	-0.0236**
	(-3.19)	(-3.87)	(-5.00)	(-3.02)	(-3.02)	(-2.86)
Constant	-0.0219	-0.147	-0.214*	-0.0971	-0.0971	-0.0978
	(-0.27)	(-1.56)	(-2.45)	(-1.31)	(-1.31)	(-1.30)
Obs	47	47	47	47	47	47
R square	0.193	0.334	0.471	0.652	0.652	0.652
Adj R square	0.136	0.252	0.391	0.600	0.600	0.590
F statistic	3.417	4.105	5.925	12.49	12.49	10.46
BP heteroskedasticity test pval	0.919	0.150	0.275	0.685	0.685	0.654
Ramsey omittedvar test pval						0.537
Specification test pval						0.500
SW Normality test						0.121

t statistics in parentheses: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$