Understanding Long-Term Japanese Government Bonds' Low Nominal Yields

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Abstract

During the past two decades chronic fiscal deficits have led to elevated and rising ratios of government debt to nominal GDP in Japan. Nevertheless long-term Japanese government bonds' (JGBs) nominal yields initially declined and since then have stayed remarkably low and stable. This is contrary to the received wisdom of the existing literature which holds that higher government deficits and indebtedness shall exert upward pressures on nominal yields. This paper examines the relationship between JGBs' nominal yields and short-term interest rates and other factors, such as low inflation and persistent deflationary pressures and tepid growth. It is also argued that Japan has monetary sovereignty, which gives the Government of Japan the ability to service its debt and enables the Bank of Japan (BOJ) to keep JGBs' nominal yields low by ensuring that short-term interest rates are low and by using various other tools of monetary policy. The argument that short-term interest rates and monetary policy are the primarily drivers of long-term interest rates follows Keynes's (1930) insights.

JEL Classification: E43, E50, E60

Keywords: Japanese government bonds, nominal bond yields, long-term interest rates, short-term interest rates, monetary sovereignty

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Introduction

Japanese government bonds (JGBs) nominal yields have stayed exceptionally low since the mid-1990s (see Figure [1]), even though the country experienced chronic fiscal deficits, the government's net and gross debt ratios rose sharply, and credit rating agencies announced downgrades. This is contrary to the conventional wisdom that higher government deficits and indebtedness shall result in upward pressures on nominal yields (Baldacci and Kumar 2010, Lam and Tokuoka 2011, Tokuoka 2012, Gruber and Kamin 2012, and Poghosyan 2012). Why did JGBs'nominal yields initially decline and have since then stayed remarkably low and stable? Keynes (1930) held that fundamental uncertainty about the future and the effect of short-term realization on long-term expectations can keep long-term interest rates largely in harmony with short-term interest rates and that monetary policy is the primary driver of long-term government bonds' nominal yields. In that spirit it is argued here that JGBs' nominal yields stayed low primarily because of the Bank of Japan's (BOJ) monetary policy which resulted in low short-term interest rates. Other factors, such as low inflation and persistent deflationary pressure and tepid growth, also contributed. The econometric results obtained here vindicate Keynes' (1930) conjectures.

This paper provides an explanation of JGBs' low nominal yields based on the following: (1) an analysis the economics of Japan's lost decades and the BOJ's monetary policy, (2) Keynes's (1930) insights on the fundamental uncertainty under which long-term government bonds' nominal yields primarily respond to monetary policy, and (3) modern money theory and recent mainstream understanding of money and central banking.

<Insert Figure [1] here>

Section I: The Economics of Japan's Lost Decades and the BOJ's monetary policy

The Japanese economy has been mired in subdued growth and deflation which in turn has resulted in large and chronic fiscal deficits that have led to elevated and rising ratios of government debt to national income. Japan's gross financial liabilities and net

financial liabilities, as a share of nominal GDP, have risen from less than 75% and 25% respectively in 1990 to more than 200% and 125% in 2012. Its ratio of general government net debt to nominal GDP is the highest among G-7 countries.

Japan's economy has stagnated for more than two decades following the collapse of its asset bubbles in the early 1990s. Between 1991 and 2011 Japan experienced the slowest growth in per capita real GDP among the G-7 countries. Since 1990, growth in real GDP per capita has fallen well short of the pace set by the U.S. Meantime Japan's industrial production has stagnated. Japan's growth faltered during the lost decades due to both the slowdown of labor force growth and lower labor productivity growth, as evident in Table [1] below.

<Insert Table [1] here>

The Japanese economy has been suffering from low inflation and has been under deflationary pressure since the mid-1990s in terms of CPI, core CPI and various implied price deflators despite accommodative monetary policy. The severity of deflationary pressure abated somewhat since early 2011, but the deflationary pressures resumed its force again by late 2012. Headline inflation picked up in 2013 but core CPI has remained stubbornly deflationary.

The BOJ's Monetary Policy, Low Short-Term interest Rates and Its Effect of JGBs' Nominal Yields

The BOJ has kept the policy rates, especially the uncollateralized (overnight) call rate and the discount rate, exceptionally low in response to economic stagnation and deflation since the early 1990s. This in turn has resulted in very low short-term interest rates. Low short-term interest rates have led to low forward interest rates. Low short-term rates and low forward rates have been the drivers of low long-term bonds' nominal yields.

The BOJ has been using a variety of tools, both conventional and unconventional, in its monetary policy (Institute for Monetary and Economic Studies 2012, Maeda *et al* 2005, and Okina 1993). It pursued a Zero Interest Rate Policy (ZIRP) from April 1999 to March 2001, quantitative easing from March 2001 to March 2006 and Asset Purchase program from October 2010 to March 2013.

Abnenomics is the new policy package introduced by the government of Prime Minister Abe. It consists of three "arrows", namely (1) expansive monetary policy, (2) current fiscal stimulus to be followed by fiscal consolidation, and (3) various initiatives to raise productivity. As part of Abenomics, in early April 2013 the BOJ announced a new program of Quantitative and Qualitative Monetary Easing (QQME), a series of measures to achieve its target of 2.0% year over year inflation with a time horizon of about two years. The BOJ's balance sheet was bloated even before the 2008 global recession. Its balance sheet has continued to rise since then and more so after the announcement of QQME.

The BOJ's monetary policy has the ability to affect long-term government bonds' nominal yields and keep them low for a variety of reasons. First, the BOJ directly controls the policy rates, in particular it sets the target for the uncollateralized (overnight) call rate, and other policy rates, which results in low short-term interest rates and low forward interest rates. Second, the BOJ can influence government bonds' nominal yields through asset purchases and forward guidance about its policy rates. Thirdly, Japan benefits from monetary sovereignty as the BOJ controls the nation's monetary policy and the government bonds are issued in its own currency. Fourthly, low inflation and deflationary pressures keep long-term interest rates low, since the BOJ keeps its policy rates low in response to economic stagnation, low inflation and deflationary pressures. Fifthly, the slow pace of economic activity results in the containment of nominal government bond yields. Last but not the least, Japan's deflationary environment is another reason both short- and long-term interest rates have stayed low, as low inflation tends to beget low interest rates. Low inflation and deflationary pressures have resulted in positive real yields even amid long-term JGBs' nominal yields being unusually low for a long time. In a deflationary environment investors are willing to hold what is generally deemed as safe assets even if nominal yields are low, while shunning risky assets. Hence, the combination of accommodative monetary policy and sustained deflationary pressures has contrived to keep JGBs' nominal yields very low since the mid-1990s.

Section II: A Simple Framework for Understanding Long-Term JGBs' Low Nominal Yields

The theoretical reasons for long-term JGBs' nominal yields are simple: (1) The Government of Japan exercises monetary sovereignty and Japan's government debt is

issued in its own currency, (2) the BOJ largely controls short-term interest rates by setting the policy rate and it influences JGBs' nominal yields though asset purchases, forward guidance, and communication tools, and (3) low inflation and deflationary pressures have also contributed to keeping government bonds' nominal yields low in Japan. These reasons are elaborated below after a short primer that decomposes long-term bond yields into the two key components: (i) short-term interest rates and (ii) forward interest rates.

A framework for understanding government bonds' nominal yields

The long-term government bond yield can be understood as a function of short-term interest rates and forward interest rates. The yield of a long-term (LT) bond, r_{LT}, depends on short-term (ST) interest rate, r_{ST}, and an appropriate forward interest rate, $f_{ST,LT-ST}$:

$$(1 + r_{LT})^{LT} = (1 + r_{ST})^{ST}(1 + f_{ST,LT-ST})^{LT-ST} \quad \textbf{(1)}$$

A long-term bond and long-term interest rate are here defined in relative terms, such that a long-term bond is of longer maturity than a short-term bond, i.e., $LT - ST > 0$. The standard market practice is to define short-term interest rate as yields of bonds with maturity of 12 months or less, and long-term interest rates as yields of bonds with maturity higher than 12 months.

The long-term rate, r_{LT}, is a function of short-term interest rate, r_{ST}, and an appropriate forward interest rate, $f_{ST,LT-ST}$. That is,

$$r_{LT} = \Phi(r_{ST}, f_{ST,LT-ST}) \quad \textbf{(2)}$$

The forward rate, $f_{ST,LT-ST}$, depends on the short-term interest rates, r_{ST}, expectation of the rate of inflation, π^E, and expectations about the rate of economic activity, $\dot{y}^E$. However, if one holds that near-term views almost always affect investors' long-term economic and investment outlook, then the current rate of inflation, π, and the current rate of economic activity, $\dot{y}$, would respectively influence investors' expectation of inflation and expectations of economic activity. Hence,

$$f_{ST,LT-ST} = g(r_{ST}, \pi^E, \dot{y}^E) = g(r_{ST}, \pi, \dot{y}) \quad \textbf{(3)}$$

The forward rate is a function of the short-term interest rate, the current rate of inflation, and the current rate of growth, under "Keynesian" assumptions, discussed in

Section III. As a result the long-term rate, r_{LT}, is a function of short-term interest rate, r_{ST}, the current rate of inflation, π, and the current rate of economic activity, $\dot{y}$.

$$r_{LT} = \Phi\big(r_{ST}, g(r_{ST}, \pi, \dot{y})\big) = \vartheta(r_{ST}, \pi, \dot{y}) \quad \textbf{(4)}$$

Monetary sovereignty

Monetary sovereignty belongs to a government that has the following characteristics, per Tymoigne's (2013) definition: It (1) sets its own unit of account, (2) issues liabilities mostly denominated in that unit of account, (3) is a monopoly issuer of unconvertible final means of payment denominated in that unit of account, and (4) has the authority to tax and to determine what is accepted in payment of the taxes it imposes. The Government of Japan definitely has monetary sovereignty.

Following Michael Woodford (2001, p. 31), as cited in Tcherneva (2010, p.15), it can be paraphrased that for any sovereign government that issues debts in its own currency, such as Japan, its debt is merely a promise to deliver more of its own liabilities in the future. What is the liability obligation on the Government of Japan resulting from its issuance of JGBs? A JGB is simply a promise to pay yens — which are merely additional government liabilities that happen to be non-interest bearing — at various future dates. It could perhaps be argued that a higher ratio of government debt to nominal GDP might, under certain circumstances, lead to inflation and a depreciation of the Japanese yen, but these do not impose any *operational* barriers for the Government of Japan to service its debt.

In similar vein Christopher Sims (2013a, pp.20-21 and 2013b, pp. 11-15) observes that the government bonds' nominal yields of currency issuers, such as U.S., U.K., and Japan, are much lower than those of euro zone periphery countries which are merely currency users, such as Italy and Spain. He states that "since nominal debt promises to pay only costless paper, it is never necessary for it to default," and "a central bank with the fiscal backing from a Treasury that can issue nominal debt is the most powerful form of a lender of last resort" (Sims 2013a, p. 19 and p. 23). This understanding of modern money renders clear that the liabilities of governments that retain monetary sovereignty and are currency issuers are fundamentally different from that of households, businesses, and governments that do not possess sovereignty and hence are currency users.

Woodford's and Sims's understanding of government debt of currency issuers and the contemporary analysis of the principles of modern central banking and the lender of last resort with sovereign money, such as Bindseil (2004) and Fullwiler (2008), support Keynes's insights.

Section III: Keynes' Insights on Monetary Policy and Long-Term Government Bonds' Nominal Yields

Kregel (2011) has aptly documented that Keynes (1930) contended that short-term interest rates and long-term interest rates have a close relationship that is principally driven by monetary policy and fundamental uncertainty. Keynes observed that "experience shows that, as a rule, the influence of the short-term rate of interest on the long-term rate is much greater than anyone … would have expected." Keynes's conjectures on long-term interest rates were based on his speculations in financial assets, his astute observations of contemporary financial markets and his reading of the history financial markets and financial speculations, and his *interpretation* of the empirical research of Reifler (1930). He noted that generally it is profitable to borrow short and lend long. The quest for yields and herding are other factors that keep long-term interest rates aligned with short-term interest rates.

Investors live in a world of uncertainty where short-term realizations have a profound impact on long-term expectations and the animal spirits of investors. They are usually affected by the present conditions, which color their outlook (Keynes 2007 [1936], pp. 152-153). The long-term economic and investment outlook is quite uncertain, according to Keynes (2007 [1936], p. 149): "The outstanding fact is the extreme precariousness of the basis of knowledge on which our estimates of prospective yield have to be made. Our knowledge of the factors which will govern the yield of an investment some years hence is usually very slight and often negligible."

The fundamental uncertainty that affects investors' economic and investment outlook also colors their rates outlook. Fundamental uncertainty about the future and the effect of short-term realization on long-term expectations can keep long-term interest rates largely in harmony with short-term interest rates, whereas those factors that can cause fluctuations in short-term interest rates also drive investors' long-term outlook, and thus long-term interest rates, according to Keynes. Similarly those factors that affect the current rate of inflation generally also color investors' long-term inflation expectations and the drivers that shift the current rate of economic activity also impel

investors' expected rate of economic activity. With this Keynesian framework different behavioral equations are estimated to calibrate the effects of short-term interest rates on long-term JGBs' nominal yields.

Section IV: Data and Empirics of Long-Term Government Bond Yields

Time series data on interest rates, core inflation, industrial production, and general government finance from mid-1994 to end of 2012 are used here for the econometric models. Interest rates data cover short-term interest rates, such as yields on T-bills of 3 month and 12 month maturities; and long-term government bonds' nominal yields, such as yields on JGBs of 2 year, 3 year, 5 year, 7 year, 10 year, and 20 year maturities. Inflation data cover core inflation, that is, CPI for all items excluding food and energy items, measured as percentage change year over year. Industrial production data is a seasonally adjusted index of industrial activity, measured as percentage change year over year. Government finance data cover net general government financial liabilities, gross general government financial liabilities, and general government net lending/borrowing, all measured as percentage of nominal GDP. Table [2] below summarizes the variables and the data.

<Insert Table [2] here>

The data used in the econometric models are largely stationary, as shown in Table [3] below, using both Augmented Dickey Fuller and Phillips-Perron tests. However, government debt ratios and government balance (deficit) ratios are not stationary, based on the same tests, though not shown here but available upon request.

<Insert Table [3] here>

This paper implements an instrumental variable approach in modeling JGBs' nominal yields. The two-step feasible and efficient generalized method of moments (GMM) technique is used here. To instrument for the short-term interest rate and the rate of core inflation, their second and third period lags are used in both cases. The Hansen J test of the over identifying restrictions is used to check for the validity and relevance of the instruments.

Table [4] reports the results from the GMM estimation of JGBs' nominal yields using T-bills of 3 months. The dependent variables are JGBs' nominal yields for different maturities. The coefficients of short-term interest rates are positive and always

statistically significant. It implies that JGBs' nominal yields are extremely sensitive to short-term interest rates. The coefficients of the rates of core inflation are positive and statistically significant but moderate in magnitude. It implies that as core inflation picks up JGBs' nominal yields rise. The coefficients of the growth of industrial production are positive but low and statistically insignificant, implying that JGBs' nominal yields are fairly insensitive to the growth of economic activity.

<Insert Table [4] here>

Similar estimations are obtained using T-bills of 12 month maturities and the same control variables. The results, which not shown here but are available upon request, are fairly similar. In order to check the robustness of the above findings, Two Stage Least Squares (2SLS) technique is applied to the same regression models of JGBs' nominal yields. It reveals similar results, available upon request, which reinforce the soundness of these findings. Furthermore econometric models that incorporate several measures of government finances, after controlling for the effects of short-term interest rates, core inflation, and industrial production, show that debt ratios and deficit ratios do *not* exert any upward pressure on JGBs' nominal yields. However, since government finance variables are not stationary these results would have to be treated with due caution. These results are also are available upon request.

Section V: Conclusion

The findings of the paper explain why JGBs' nominal yields have stayed low despite large and persistence fiscal deficits and elevated government debt ratios. Long-term JGBs' nominal yields have stayed low because of policy-induced low short-term interest rates, low observed inflation and indeed persistent deflationary pressures, tepid growth, and monetary sovereignty. Monetary sovereignty in particular gives the Government of Japan the ability to always service its yen-denominated JGBs. Low short-term interest rates, which are really the outcomes of the BOJ's monetary policy, are the primary drivers of long-term JGBs' low nominal yields. This is in concordance with Keynes's insight as articulated in his *Treatise*, modern money theory and recent mainstream understanding of money and central banking.

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Tables and Figures

Figure [1]: JGBs' nominal yields declined in the early 1990s and since then have stayed remarkable low and stable

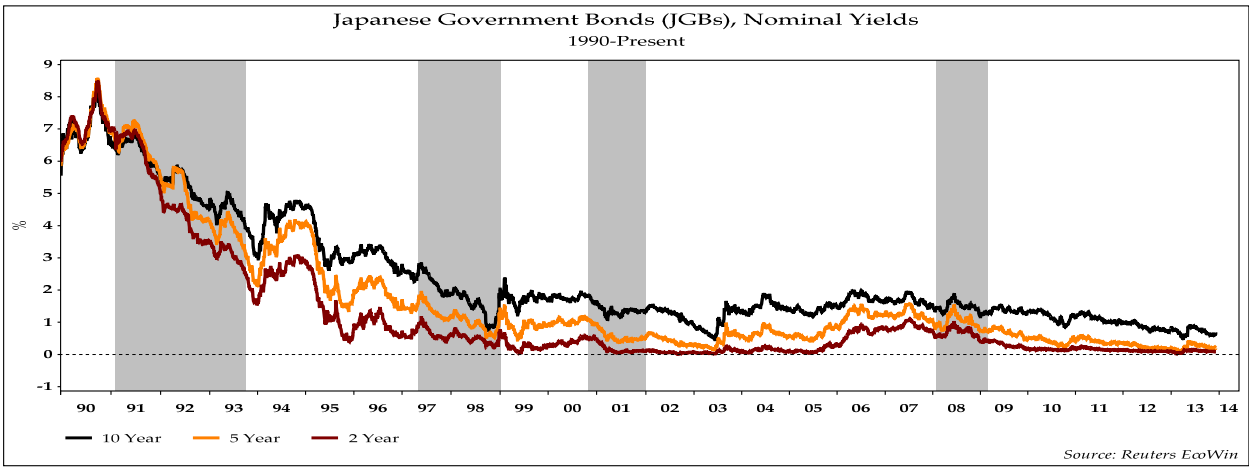

Table [1]: Trend growth rates in real GDP in Japan slowed due to slower growth of both employed labor input and labor productivity

Trend Growth Rates of Real GDP, Employed Labor, and Labor Productivity						
	Real GDP Growth (%)		Labor Growth (%)		Labor Productivity Growth (%)	
	JPN	USA	JPN	USA	JPN	USA
1980-1989	4.4	3.6	1.1	2.0	3.3	1.6
1990-1999	1.1	3.4	0.3	1.5	0.8	2.9
2000-2011	0.7	1.6	0.0	0.3	0.7	1.3
Sources: Reuters EcoWin; ING Investment Management						

Table [2]: Summary of the data and the variables

Variable Labels	Data Description	Frequency	Sources (Primary & Secondary Sources)
Treasury Bill Rates and Government Bond Yields			
TB3M	T-bills, 3 month, bid, % yield, close	Daily; Converted to Monthly	Reuters; Reuters EcoWin
TB12M	T-bills, 12 month, bid, yield, close	Daily; Converted to Monthly	Reuters; Reuters EcoWin
JGB2YR	Government bonds, 2 year,	Daily; Converted	Reuters; Reuters EcoWin

Variable Labels	Data Description	Frequency	Sources (Primary & Secondary Sources)
	bid, % yield, close	to Monthly	
JGB3YR	Government bonds, 3 year, bid, % yield, close	Daily; Converted to Monthly	Reuters; Reuters EcoWin
JGB5YR	Government bonds, 5 year, bid, % yield, close	Daily; Converted to Monthly	Reuters; Reuters EcoWin
JGB7YR	Government bonds, 7 year, bid, % yield, close	Daily; Converted to Monthly	Reuters; Reuters EcoWin
JGB10YR	Government bonds, 10 year, bid, % yield, close	Daily; Converted to Monthly	Reuters; Reuters EcoWin
JGB20YR	Government bonds, 20 year, bid, % yield, close	Daily; Converted to Monthly	Reuters; Reuters EcoWin
Inflation			
CINF	Consumer prices, nationwide, all items excluding food & energy, % change, y/y	Monthly	Statistics Bureau, Ministry of Internal Affairs and Communication; Reuters EcoWin
Industrial Production			
IP	Industrial production, Seasonally adjusted, Index, % change, y/y	Monthly	Ministry of Economy, Trade, and Industry (METI); Reuters EcoWin
Public Finance			
NETDEBT	General government net financial liabilities, % of nominal GDP	Quarterly	OECD; Reuters Ecowin
GROSSDEBT	General government gross financial liabilities, % of nominal GDP	Quarterly	OECD; Reuters Ecowin
BALANCE	General government net lending, annualized rate, % of nominal GDP	Quarterly	OECD; Reuters Ecowin

Table [3]: Unit root tests reveal most variables are stationary

Table: Unit Root Tests for Monthly Variables

Variables	Augmented Dickey Fuller Test			Phillips-Perron Test		
	No Constant and Trend	With Constant	With Constant and Trend	No Constant and Trend	With Constant	With Constant and Trend
JGB2YR	-5.262***	-6.122***	-5750***	-3.613***	-3.625***	-3.268*
JGB3YR	-3.067***	-3.310**	-3.256*	-3.199***	-3.254**	-3.040
JGB5YR	-2.992***	-3.291**	-3.302*	-3.039***	-3.101**	-2.965
JGB7YR	-2.846***	-3.927***	-4.281***	-3.687***	-4.781***	-4.908***
JGB0YR	-2.517**	-3.047**	-3.222*	-2.743***	-2.829*	-2.683
JGB20YR	-2.216**	-3.287**	-3.247*	-2.641***	-3.403**	-2.891
TB3M	-3.804***	-3.791***	-3.432**	-3.933***	-3.864***	-3.437**
TB12M	-5.626***	-6.438***	-6.129***	-5.556***	-6.132***	-5.707***
CINF	-2.531**	-2.565	-2.618	-3.142***	-3.155**	-3.179*
IP	-3.153***	-3.143**	-3.165*	-3.760***	-3.755***	-3.774**

Notes: ***, ** and * indicate statistical significance at the 1 percent, 5 percent and 10 percent level respectively. Null hypothesis of both ADF and PP tests is that the series contains unit root.

Table [4]: Results of GMM estimation of long-term JGBs' nominal yields using 3 month T-bills and other control variables

Table: GMM Estimations of Long Term Government Bond Yields Equation with T-bills of 3 Months (1994M6-2012M12)

Variables	JGB2YR	JGB3YR	JGB5YR	JGB7YR	JGB10YR	JGB20YR
$TB3M_{-1}$	1.091***	1.229***	1.268***	1.049***	1.132***	1.060***
	(0.055)	(0.081)	(0.095)	(0.127)	(0.127)	(0.129)
$CINF_{-1}$	0.054*	0.100**	0.169**	0.284***	0.270***	0.224***
	(0.032)	(0.050)	(0.069)	(0.104)	(0.096)	(0.082)
IP_{-1}	0.002	0.002	0.004	0.007	0.007	0.005
	(0.002)	(0.002)	(0.003)	(0.004)	(0.004)	(0.004)
Const.	0.148***	0.294***	0.591***	1.025***	1.409***	2.026***
	(0.034)	(0.054)	(0.077)	(0.092)	(0.120)	(0.111)
Hansen Test	2.040	1.793	1.798	0.136	0.274	1.045
	(P=0.361)	(P=0.408)	(P=0.407)	(P=0.934)	(P=0.872)	(P=0.593)
Obs.	220	220	220	215	220	220

Notes: ***, ** and * indicate statistical significance at the 1 percent, 5 percent and 10 percent level respectively. Standard errors are in parenthesis.
Instrument Variables: Second and third lag of t-bills of 3 month, second and third lag of rate of core inflation.

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