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The Determinants of Long-Term Japanese Government Bonds' Low Nominal Yields*

by

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Abstract

During the past two decades of economic stagnation and persistent deflation in Japan, chronic fiscal deficits have led to elevated and rising ratios of government debt to nominal GDP. Nevertheless, long-term Japanese government bonds' (JGBs) nominal yields initially declined and have stayed remarkably low and stable since then. This is contrary to the received wisdom of the existing literature, which holds that higher government deficits and indebtedness shall exert upward pressures on government bonds' nominal yields. This paper seeks to understand the determinants of JGBs' nominal yields. It examines the relationship between JGBs' nominal yields and short-term interest rates and other relevant factors, such as low inflation and persistent deflationary pressures and tepid growth. Low short-term interest rates, induced by monetary policy, have been the main reason for JGBs' low nominal yields. It is also argued that Japan has monetary sovereignty, which gives the government of Japan the ability to meet its debt obligations. It enables the Bank of Japan to exert downward pressure on JGBs' nominal yields by allowing it to keep short-term interest rates low and to use other tools of monetary policy. The argument that current short-term interest rates and monetary policy are the primary drivers of long-term interest rates follows Keynes's (1930) insights.

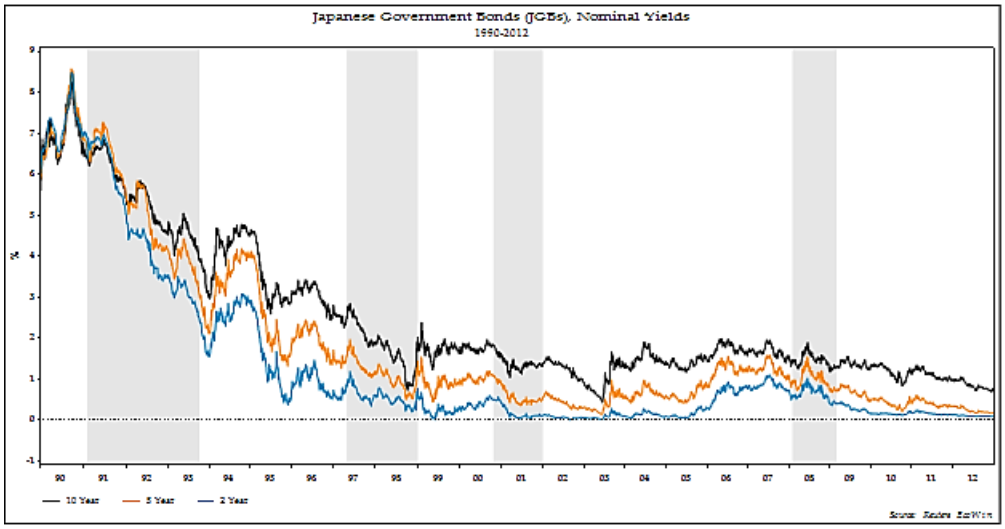
Keywords: Japanese Government Bonds (JGBs); Long-Term Interest Rates; Monetary Sovereignty; Nominal Bond Yields

JEL Classifications: E43, E50, E60

INTRODUCTION

Japanese government bonds' (JGBs') nominal yields have stayed exceptionally low since the mid 1990s (see Figure 1), and even though the country experienced chronic fiscal deficits, the government's net and gross debt ratios rose sharply and remained elevated, and international credit rating agencies have downgraded its yen-denominated sovereign debt several times. This is contrary to the conventional wisdom which holds that higher government deficits and indebtedness lead to upward pressures on government bonds' nominal yields (Baldacci and Kumar 2010; Lam and Tokuoka 2011; Gruber and Kamin 2012; Tokuoka 2012; and Poghosyan 2012). Why did JGBs' nominal yields initially decline and have since then stayed remarkably low and stable? What are the key determinants of JGBs' nominal yields? 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 current 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 have stayed low primarily because of the Bank of Japan's (BOJ) accommodative monetary policy. The BOJ's accommodative monetary policy has resulted in low short-term interest rates, which in turn have kept JGBs' nominal yields low. Other relevant factors, such as low inflation and persistent deflationary pressure and tepid growth, have also contributed to the persistence of low nominal yields. The BOJ has kept its 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, both of which have been the critical drivers of long-term JGBs' low nominal yields.

Figure 1 JGBs' Nominal Yields Initially Declined and Since then have Stayed Remarkably Low and Stable in the Past Two Decades



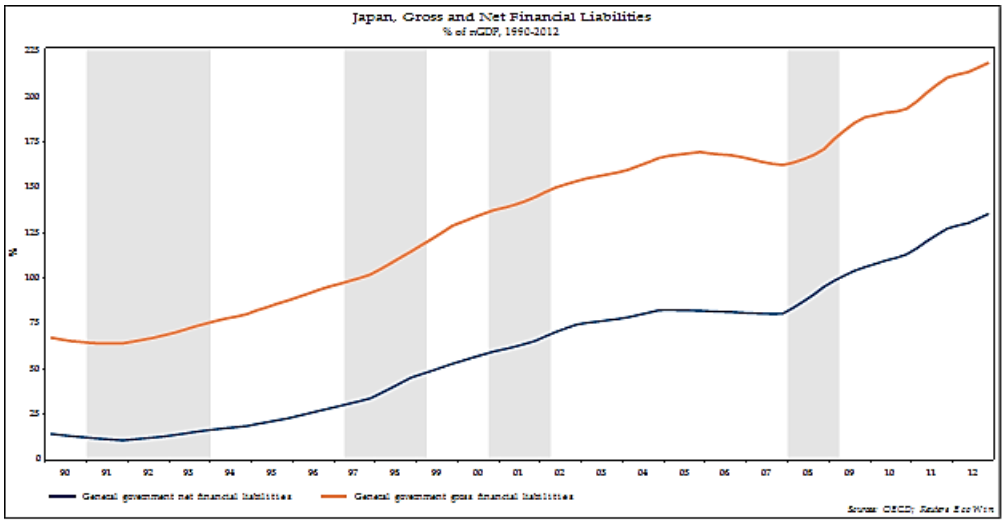
This paper investigates what are the empirical determinants of JGBs' low nominal bond yields. This is an extended version of the authors' earlier paper (Akram and Das 2014). It seeks an explanation based on (1) an analysis of the economics of Japan's lost decades, (2) Keynes's (1930) insights on the fundamental uncertainty under which long-term government bonds' nominal yields primarily respond to monetary policy, and (3) modern theoretical understanding of paper money (Sims 2013b; Woodford 2000; Wray 2003 and 2012) and central banking (Bindseil 2004; Fullwiler 2008). The econometric analysis undertaken here vindicates Keynes's (1930) conjectures and is in concordance with modern theoretical understanding of paper money, monetary sovereignty and central banking.

Section I provides a brief background on the economics of Japan's lost decades characterized by slow growth and persistent deflationary pressures. Section II articulates a simple framework for understanding government bonds' nominal yields under monetary sovereignty in light of modern theoretical analysis of paper money and central banking. Section III reviews Keynes's (1930) insights on the fundamental uncertainty under which long-term government bonds' nominal yields primarily respond to monetary policy. Section IV describes the empirics of different behavioral equations, in the spirit of modern theoretical analysis of paper money and the Keynesian framework, that are estimated to calibrate the effects of short-term interest rates and other relevant variables on long-term JGB's nominal yields. Section V concludes.

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 have resulted in large and chronic general government net borrowing (fiscal deficits) that have led to elevated and rising ratios of government financial liabilities (debt) to national income. Japan has extremely elevated ratios of general government financial liabilities—both net and gross—to its nominal GDP. Japan's gross financial liabilities and net financial liabilities, as a share of its nominal GDP, have risen from less than 75% and 25% respectively in 1990 to more than 200% and 125% in 2012 (see Figure 2). Its ratio of general government net debt to nominal GDP is the highest among G-7 countries, and is substantially higher than that of other advanced countries.

Figure 2 Japan has Extremely Elevated Ratios of Government Financial Liabilities to Nominal GDP



Japan's economy has stagnated for more than two decades following the collapse of its asset bubbles in the early 1990s. Between 1990 and 2012, Japan experienced the slowest growth in per capita real GDP, measured in 2005 constant US dollars, among the G-7 countries (see Table 1). This is in sharp contrast to the strong growth in per capita real GDP the country experienced during the 1960s, 1970s, and 1980s. Since 1990, growth in real GDP per capita in Japan has fallen well short of the pace set by the US. Not only did the gap in per capita real GDP between the US and Japan increase in absolute terms, but Japanese real GDP per capita deteriorated in relative terms compared to the US, from nearly 80% in 1990 to around 70% in 2012.

Table 1 Per Capita Real GDP Growth in Japan During the Lost Decades has been the Slowest Among G-7 Countries

G7 Per Capita Real GDP Trend Growth Rates, 1960-2012							
US$ at Constant 2005 Prices, % change							
	1960-1970	1970-1980	1980-1990	1990-2000	2000-2010	2010-2012	1990-2012
CAN	3.5	2.6	2.0	2.1	0.9	1.0	1.7
DEU	n/a	2.8	2.2	1.3	1.1	1.9	1.3
FRA	4.3	2.9	1.8	1.5	0.6	0.5	1.2
GBR	2.3	1.9	3.0	3.1	1.3	-0.1	2.2
ITA	4.6	3.3	2.5	1.5	-0.2	-1.4	0.7
JPN	8.1	3.0	3.9	0.7	0.8	0.6	0.7
USA	3.5	2.2	2.7	2.3	0.9	1.5	1.7
Sources: World Bank, Reuters EcoWin; ING Investment Management							

The vicissitudes of industrial production convey cyclical business conditions in Japan fairly well. For the past two decades Japan's industrial production has stagnated, as shown in Figure 3 below. The growth in the country's industrial production, calibrated year over year, is strongly correlated with its real GDP growth (see Figure 4).

Figure 3 The Evolution of Industrial Production in Japan

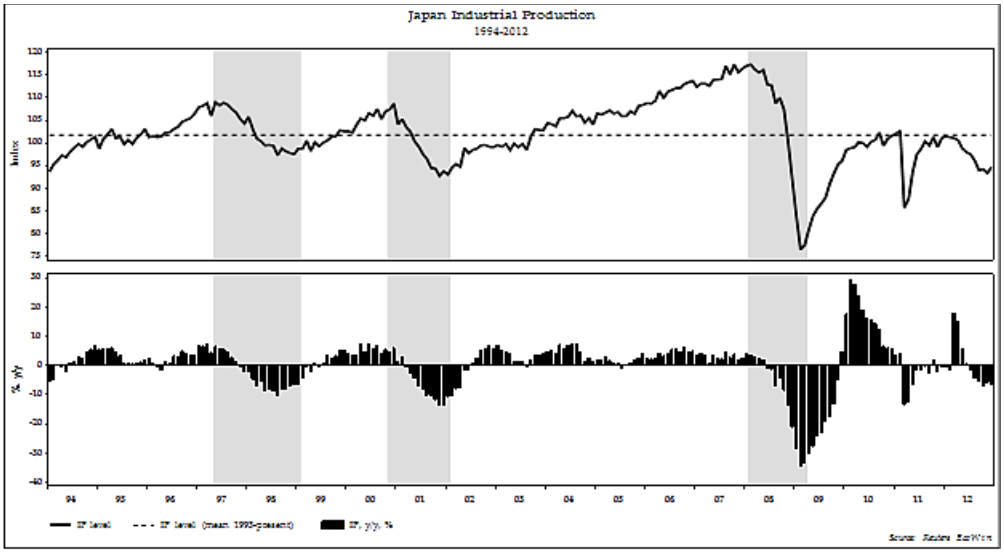
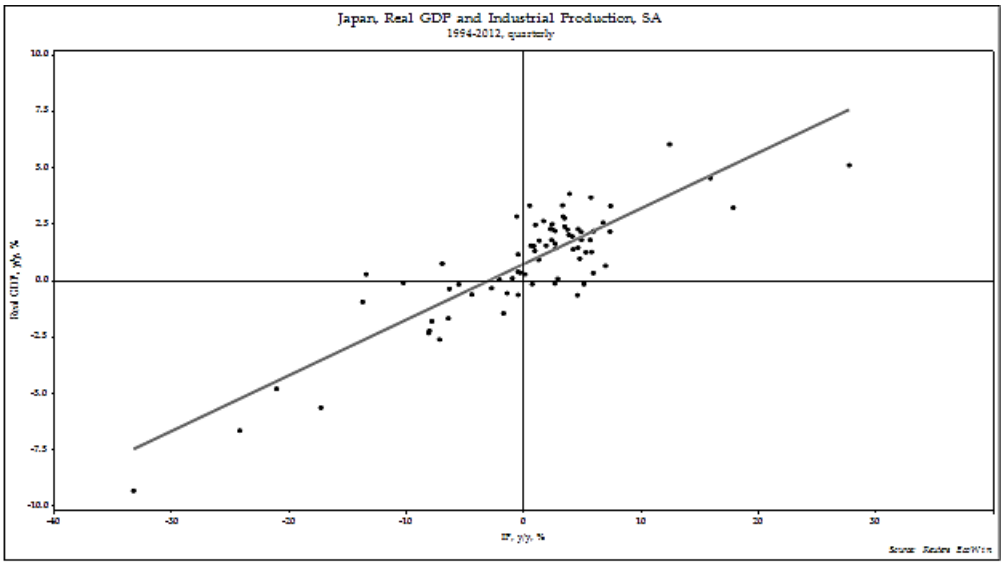


Figure 4 The Pace of Industrial Production, which is Strongly Correlated with real GDP Growth, Conveys Cyclical Business Conditions in Japan Fairly Well



Japan's economic stagnation during the last two decades is due to both the slowdown of its labor force growth and the retardation of its labor productivity growth, as shown in tables 2 and 3 below. The tepid pace of productivity growth in Japan has been noted—for example, in Hayashi and Prescott (2002)—but it must be placed in the context of weak effective demand, declining real wages and stagnant real disposable income.

Table 2 Trend Growth rate in Real GDP in Japan has Declined Due to Tepid Growth in Employed Labor Input and Slower Labor Productivity Growth Compared to the United States

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 3 Labor Productivity Growth in Japanese Manufacturing has Slowed Notably

Trend Growth in Manufacturing Labor Productivity: Comparison of JPN and USA				
	Output Per Hours Worked (%)		Output Per Employee (%)	
	JPN	USA	JPN	USA
1950-1959	8.1	1.8	8.8	1.6
1960-1969	9.4	3.4	9.6	3.6
1970-1979	5.3	2.9	4.6	2.8
1980-1989	3.5	3.7	3.6	4.2
1990-1999	3.2	3.8	2.6	4.1
2000-2011	3.7	5.1	3.5	5.2
Sources: Bureau of Labor Statistics; ING Investment Management				

Since the mid 1990s, the Japanese economy has experienced persistent deflationary trends despite accommodative monetary policy. The implicit price deflators for GDP, domestic demand, public demand, and private demand have declined notably (see Figure 5). The evolution of headline and core consumer price index (CPI) confirm persistent deflationary trends (see Figure 6). For the most part, inflation remained low throughout the period except in years in which either taxes were raised or energy prices rose.

Figure 5 The Japanese Economy has Experienced Persistent Deflationary Trends

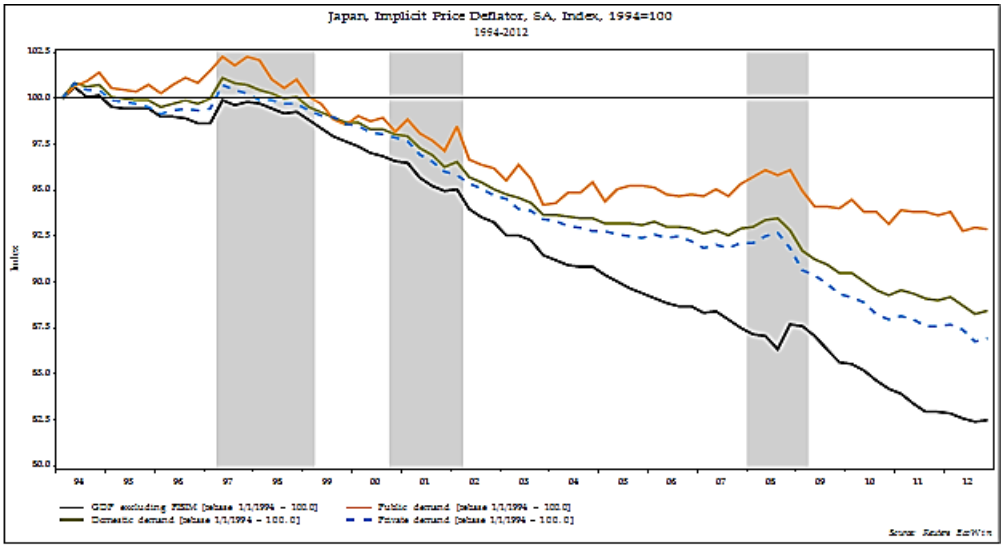
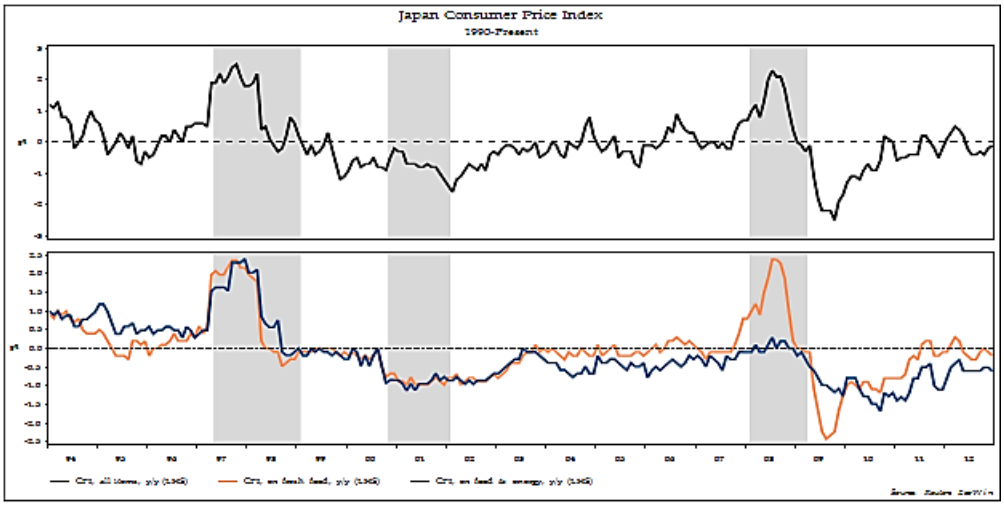


Figure 6 The Evolution of Consumer Price Index in Japan also Confirms the Persistence of Deflationary Trends

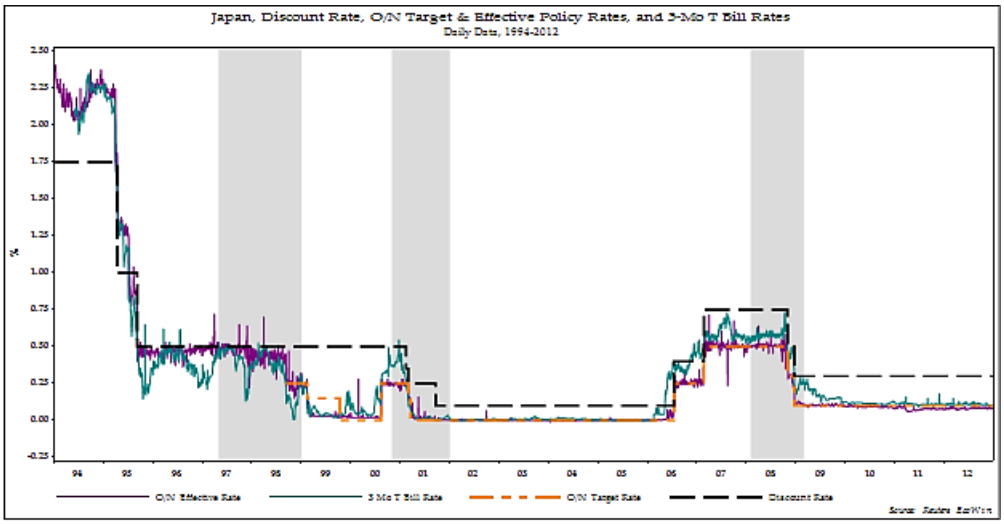


The deflationary dynamics have resulted in deleveraging, tepid growth in private non-residential investment, decline in residential investment, and slowdown in the growth of private consumption. The stagnant real disposable income has been a fundamental cause of the weakness of effective demand and the persistence of deflationary trend. Weak and declining average monthly cash earnings of Japanese employees have enabled the perpetuation of the deflationary trend. Real wage growth started slowing in the early and the mid 1990s. In the late 1990s, real wages began declining, and this has continued since the beginning of this century.

The BOJ's Monetary Policy

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; Okina 1993) and has kept its policy rates low, resulting in low short-term interest rates (see Figure 7). Besides using the traditional tools of setting the policy rates—viz., the discount rate and announcing a policy target for the overnight uncollateralized call rate, lowering the interest of excess reserve —the BOJ has used numerous other tools and has created a policy framework that has enabled it to foster a financial environment in which long-term JGBs' nominal yields remain low.

Figure 7 Short-term Interest Rates, as Reflected in T-bills Rates, Tend to Closely Follow the BOJ's Policy Rates



The BOJ pursued a Zero Interest Rate Policy (ZIRP) from April 1999 to March 2001, quantitative easing from March 2001 to March 2006 and an Asset Purchase Program between October 2010 and March 2013. These policy measures have included lowered policy target rates, purchases of government bonds, purchases of Japanese Treasury bills, and risk assets, such as commercial papers, corporate bonds, Exchange Trade Funds (ETFs), and Japanese Real Estate Investment Trusts (J-REITs). The central bank authorities had also extended the tenor of JGBs purchases, from maturities of three years or less to more extended maturities. In late 2012 the BOJ established an inflation target of 2.0% year over year in headline CPI. The BOJ has also been using forward guidance since January 2013, conditionally committing itself to ZIRP and purchases of government bonds and other securities as long as it deems that it is appropriate to continue each of its policy measures as warranted by economic and financial conditions.

In December 2012 the government of Prime Minister Shinzo Abe, who returned to power, introduced a new comprehensive policy package, dubbed "Abnenomics." 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 main official operating target for the BOJ's money market operation was changed from uncollateralized overnight call rate to the monetary base. The monetary base is expected to double within two years, rising to ¥270 trillion by the end of

2014 compared to ¥138 trillion at the end of 2012. The BOJ also announced that it will increase its JGB purchases and extend the maturity of its JGB holdings with the aim to reduce interest rates across the yield curve. The BOJ will increase the purchase of JGBs by about ¥50 trillion per year. Hence, the BOJ's holding of JGBs is expected to slightly more than double within a span of two years, rising to ¥190 trillion by the end of 2014, markedly up from its holding of nearly ¥90 trillion at the end of 2012. It will also more than double its holding of ETFs within two years, while increasing its purchase of J-REITs to about ¥30 billion per year. The BOJ has stated that it will continue its QQME program as long as it is necessary for achieving its target of 2.0% year over year inflation.

SECTION II: A SIMPLE FRAMEWORK FOR UNDERSTANDING LONG-TERM JGBS' LOW NOMINAL YIELDS

The theoretical reasons for long-term JGBs' low 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 also influences JGBs' nominal yields though asset purchases, forward guidance, and communication tools, (3) low inflation and deflationary pressures have also contributed to keeping JGBs' nominal yields low in Japan, and (4) the demand for government debt remains strong, as the country's domestic financial institutions hold the bulk of it.

These reasons are elaborated below after a short primer that decomposes long-term bond yields into two key components: (i) short-term interest rates and (ii) forward interest rates.

Long-term 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 the short-term (ST) interest rate, r_{ST}, and an appropriate forward interest rate, $f_{ST,LT-ST}$:

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

A long-term bond and long-term interest rate are defined in relative terms here, such that a long-term bond is of longer maturity than a short-term bond, that is, $LT - ST > 0$. The standard market practice is to define short-term interest rate as yields of bills and securities 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,

$$r_{LT} = \Phi\left(r_{ST}, f_{ST,LT-ST}\right) \tag{2}$$

The forward rate, $f_{ST,LT-ST}$, depends on the future short-term interest rate, r_F, and the term premium, z. However, the future short-term interest rate and the term premium are determined by the expected rate of inflation, π^E, and the expected 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, the current rate of inflation, π, and the current rate of economic activity, $\dot{y}$, would respectively influence the investors' expected rate of inflation and the expected rate of economic activity. That is, $\pi^E = \lambda(\pi)$ and $\dot{y}^E = \kappa(\dot{y})$. Hence,

$$f_{ST,LT-ST} = \tau(r_F, z) = \gamma(\pi^E, \dot{y}^E) = \gamma\left(\lambda(\pi), \kappa(\dot{y})\right) \tag{3}$$

The forward rate is a function of the current rate of inflation, and the current rate of economic activity, under the Keynesian assumption that the near-term view is almost always the key determinant. As a result, the long-term interest rate, r_{LT}, is a function of the short-term interest rate, r_{ST}, the current rate of inflation, π, and the current rate of economic activity, $\dot{y}$.

$$r_{LT} = \Phi\left(r_{ST}, \gamma\left(\lambda(\pi), \kappa(\dot{y})\right)\right) = \vartheta(r_{ST}, \pi, \dot{y}) \tag{4}$$

Monetary Sovereignty

Monetary sovereignty belongs to a government that has the following characteristics, per Tymoigne's (2013) definition, which articulates the concept of monetary sovereignty as defined in Wray (2012, 30): A government with monetary sovereignty (1) sets its own unit of account, (2) issues liabilities primarily denominated in that unit of account, (3) acts as a monopoly issuer of unconvertible final means of payment denominated in that unit of account, and (4) exercises the authority to tax and to determine what is accepted in payment of the taxes it imposes.

The government of Japan clearly has monetary sovereignty. It meets all the above criteria for monetary sovereignty because it (1) sets yen as the country's unit of account, (2) issues liabilities only in yens, (3) act as the monopoly issuer of unconvertible final means of payment denominated solely in yen, and (4) exercises the authority to tax individuals, firms, and other institutions domiciled in Japan and accepts only yens in payments of the taxes that it

imposes. Monetary sovereignty entails that the denomination of central government debt is in its own currency. Monetary sovereignty is crucial because it gives the Government of Japan and the BOJ the operational capability to contain JGBs' nominal yields low in spite of elevated deficits and rising ratios of government debt to nominal GDP.

Following Woodford (2000, 31), as cited in Tcherneva (2010, 15), it can be paraphrased that for any sovereign government, such as the government of Japan, that issues debts in its own currency, 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 government bond is simply a liability that promises to pay yens—which are merely additional government liabilities that happen to be non-interest bearing—at various future dates. However, the BOJ can always produce yens either in the forms of cash or reserves. Hence there are no operational or financial barriers for the government of Japan to service its debt.

In similar vein Sims (2013a, 11-15; 2013b, 563-584) observed that the government bonds' nominal yields of currency issuers (such as the US, the UK, and Japan) have generally been much lower than the mere currency users (such as euro zone periphery countries like Italy and Spain) because currency issuers can always service their debts. He states that "nominal sovereign debt promises only future payments of government paper, which is always available," "obviously outright default on nominal debt is much less likely than default on real debt." (Sims 2013b, 567). He notes the following: (1) "a central bank can 'print money' — offer deposits as payment for its bills. It will not be subject to the usual sort of run, then, in which creditors fear not being paid and hence demand immediate payment. Its liabilities are denominated in government paper, which it can produce at will." (Sims 2013b, 566), (2) "Nominal sovereign debt promise only future payments of government paper, which is always available." (Sims 2013b, 567), (3) "Nominal debt is a cushion, like equity." (Sims, 2013b, 568), and (4) "Nominal debt is (almost) non-defaultable, hence important to the lender of the last resort." (Sims 2013b, 569). This understanding of modern paper money renders clear that the liabilities of governments which retain monetary sovereignty and hence are currency issuers are fundamentally different from that of households, businesses, and governments that do not possess monetary sovereignty and hence are currency users.

Woodford's (2000), Sims's (2013a; 2013b) and Wray's (2003; 2012) 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 those of Bindseil (2004) and Fullwiler (2008), support Keynes's (1930) insights.

The fear that bond market vigilantes or increased levels of government debt would cause JGBs to sell off suddenly and yields to spike sharply have so far proven to be spurious. International credit rating agencies, such as Moody's, have downgraded Japan's government debt many times since the late 1990s (see Table 4) based on the view that increased ratios of government deficits and debt to GDP entail increased credit risk. However, the evolution of JGBs' nominal yields reveals that the downgrades of Japan's sovereign ratings issued by Moody's and other credit rating agencies have had no detectable effect on government bonds' nominal yields.

Table 4 Credit Rating Agencies have been Downgrading JGBs Since the Late 1990s

Moody's Investor Service Rating for Japan			
Local Currency Long-Term Debt			
Effective Date	**Rating**	**Watch**	**Rating Change**
03-May-93	Aaa		
23-Jul-98	Aaa	-	Down
17-Nov-98	Aa1		Down
17-Feb-00	Aa1	-	Down
09-Sep-00	Aa2		Down
06-Sep-01	Aa2	-	Down
04-Dec-01	Aa3		Down
13-Feb-02	Aa3		Down
31-May-02	A2		Down
04-Jul-07	A2	+	Up
11-Oct-07	A1		Up
30-Jun-08	Aa3		Up
18-May-09	Aa2		Up
31-May-11	Aa2	-	Down
24-Aug-11	Aa3		Down
Source: Bloomberg (Oct 2012)			

The rating agencies seem unwilling to acknowledge that the credit risk profile of a government that issues debt in its own currency—such as Japan and the US federal government—is very different from the credit risk profile of a government that issues debt in a currency that it does not control, such as the peripheral countries of the euro zone and US state and local governments. Importantly, a sovereign government issuing bonds in its own currency can keep nominal yields low for as long as its central bank chooses to cooperate and coordinate its monetary policy with the fiscal authorities to keep long-term interest rates low.

The BOJ has the ability to control long-term JGBs' nominal yields and keep them low for a variety of reasons. First, the BOJ directly controls the policy rates, and 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 JGBs' nominal yields through asset purchases and conditional or even unconditional forward guidance on the path of its policy rates. Third, Japan benefits from monetary sovereignty as the BOJ controls the nation's monetary policy and the government bonds are issued in its own currency. Fourth, 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. Fifth, the slow pace of economic activity, as measured by the year over year growth of industrial production, results in the containment of government bonds' nominal yields. Sixth, the demand for government debt securities remains strong as the country's domestic private financial institutions hold the bulk of it. Seventh, in Japan, the Ministry of Finance and the BOJ have the institutional and legal framework to collaborate to ensure the smooth operation of Japan's monetary and financial system, including the government securities market. 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 JGBs' nominal yields are low, while shunning risky assets. Hence, the combination of low policy rates, sustained deflationary pressures and tepid economic activity, and above all, the country's monetary sovereignty, has contrived to keep JGBs' nominal yields exceptionally low since the mid 1990s.

In countries with sovereign currencies, such as Japan, long-term interest rates are strongly associated with short-term interest rates, and the changes in long-term interest rates are also fairly tightly correlated with changes in short-term interest rates. Thus, long-term interest rates generally stay low (high) when short-term interest rates are low (high) and long-term interest rates rise (decline) when short-term interest rates rise (fall). Moreover, when observed headline inflation, core inflation, and inflationary expectations are low (high), both short-term interest rates and long-term interest rates tend to stay low (high). Long-term interest rates are also driven by persistence, implying that long-term interest rates tend to stay low once they become low and stay high once they turn high.

Japan's experience since the turn of the century validates the contemporary understanding of monetary policy and central banking, which holds that the expansion of the

central bank's balance sheet does not necessarily lead to higher inflation. Increases in reserves are merely outcomes of the expansion of the central bank's balance sheet. The central bank's asset purchases are financed by the issuances of its reserves. The amount of reserves may not directly affect banks' lending or credit growth, while in the absence of a supply shock, inflationary pressures may not arise unless credit growth fuels economic activity. This is particularly true when an economy is characterized by excess slack and spare capacity, as is Japan's. It could perhaps be argued that, under certain circumstances, a higher ratio of government debt to nominal GDP may lead to inflation and a depreciation of the Japanese yen, but these do not impose any operational barriers on the government of Japan to service its debt, that is, the interest obligations and principal repayments entailed by its issuance of JGBs.

SECTION III: KEYNES' INSIGHTS ON MONETARY POLICY AND LONG-TERM GOVERNMENT BONDS' NOMINAL YIELDS

The close relationship between short-term rates, which are principally driven by monetary policy, and long-term interest rates was well understood by John Maynard Keynes (1930), as cited and carefully documented in Kregel (2011). Keynes (1930, 353) 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. … [T]here are some sound reasons, based on the technical character of the market, why it is not unnatural that this should be so.

Keynes's conjectures on long-term interest rates were based on his investments in financial assets and involvement in financial matters, both as advisor to the government and as a private investor, his astute observations of contemporary financial markets and his reading of the history of financial markets and financial speculations, and his interpretation of the empirical research of Riefler (1930). He noted that it is generally 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.

Keynes's (1930, 235-362; 2007 [1936], 147-164) observations, about the behavior of long-term interest rates and the state of investors' long-term expectations, made more than 75-85 years ago, are still valid and have proved to be prescient. The econometric results obtained here and the past two decades of Japan's experience mostly vindicate Keynes' (1930)

conjectures about the trajectory of interest rates, even amid large and chronic fiscal deficits (net government borrowing) leading to elevated and rising government debt ratios.

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 for the future. The long-term economic and investment outlook is quite uncertain, according to Keynes (2007 [1936], 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. If we speak frankly, we have to admit that our basis of knowledge for estimating the yield ten years hence of a railway, a copper mine, a textile factory, the goodwill of a patent medicine, an Atlantic liner, a building in the City of London amounts to little and sometimes to nothing; or even five years hence.

The fundamental uncertainty that affects investors' economic and investment outlook also colors their rates outlook. Keynes (2007 [1936], 152-153) maintained that the near-term views affect the long-term economic and investment outlook. Moreover, changes in current economic and financial conditions and changes in investors' near-term views affect changes in the long-term outlook:

> For if there exist organized investment markets and if we can rely on the maintenance of the convention, an investor can legitimately encourage himself with the idea that the only risk he runs is that of a genuine change in the news *over the near future*, as to the likelihood of which he can attempt to form his own judgment, and which is unlikely to be very large. For, assuming that the convention holds good, it is only these changes which can affect the value of his investment, and he need not lose his sleep merely because he has not any notion what his investment will be worth ten years hence. Thus investment becomes reasonably 'safe' for the individual investor over short periods, and hence over a succession of short periods however many, if he can fairly rely on there being no breakdown in the convention and on his therefore having an opportunity to revise his judgment and change his investment, before there has been time for much to happen. [Keynes 2007 (1936), 152-153] (emphasis is in the original).

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 (1930, 352-362, cited in Kregel 2011). On similar lines, it can be argued that 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 in the future.

Different behavioral equations are estimated here to calibrate the effects of short-term interest rates and other control variables on long-term JGBs' nominal yields based on this Keynesian framework.

Section IV: Data and Empirics of Long-Term JGBs' Nominal Yields

Time series data on interest rates, various indices of inflation and core inflation, industrial production, and general government finance from mid-1994 to the end of 2012 are used here for the econometric models. Interest rate data cover short-term interest rates, such as nominal 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, the Consumer Price Index (CPI) for all items excluding food and energy items, measured as a percentage change year over year, as well as total (headline) CPI inflation and CPI inflation excluding fresh food, measured similarly. Industrial production data are a seasonally adjusted index of industrial activity, also measured as a 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 a percentage of nominal Gross Domestic Product (GDP). Net general government financial liabilities and gross general government financial liabilities are stock variables, whereas general government net lending/borrowing is a flow variable.

Table 5 below summarizes the variables and the data used in the models. The first column provides the variable labels. The second column provides the variable description and the date range for the data. The third column gives the original frequency and indicates if it has also been converted to a lower frequency. The fourth column lists both the primary sources and the secondary sources. The final column lists Reuters EcoWin's, that is, the data provider's mnemonic code for the time series of the variables.

Table 5 Summary of the Data and the Variables

Variable Labels	Data Description, Date Range	Frequency	Sources (Primary & Secondary Sources)	Reuters EcoWin Mnemonic Code
Japanese Treasury Bill Rates and Japanese Government Bond Yields				
TB3M	T-bills, 3 month, bid, % yield, close; Jun 1, 1994-Dec 31, 2012	Daily; Converted to Monthly (M)	Reuters; Reuters EcoWin	ew:jpn14200
TB12M	T-bills, 12 month, bid, % yield, close; Dec 9, 1994-Dec 12, 2012	Daily ; Converted to Monthly (M)	Reuters; Reuters EcoWin	ew:jpn14220
JGB2YR	Government bonds, 2 year, bid, % yield, close; Jan 1, 1990-Dec 31, 2012	Daily; Converted to Monthly (M)	Reuters; Reuters EcoWin	ew:jpn14110
JGB3YR	Government bonds, 3 year, bid, % yield, close; Jan 1, 1990-Dec 31, 2012	Daily; Converted to Monthly	Reuters; Reuters EcoWin	ew:jpn14113
JGB5YR	Government bonds, 5 year, bid, % yield, close; Jan 1, 1996-Dec 31, 2012	Daily; Converted to Monthly	Reuters; Reuters EcoWin	ew:jpn14120
JGB7YR	Government bonds, 7 year, bid, % yield, close; Feb 20, 1995-Dec 31, 2012	Daily; Converted to Monthly	Reuters; Reuters EcoWin	ew:jpn14117
JGB10YR	Government bonds, 10 year, bid, % yield, close; Jan 1, 1990-Dec 31, 2012	Daily; Converted to Monthly	Reuters; Reuters EcoWin	ew:jpn14130
JGB20YR	Government bonds, 20 year, bid, % yield, close; Jan 1, 1990-Dec 31, 2012	Daily; Converted to Monthly	Reuters; Reuters EcoWin	ew:jpn14145
Inflation				
CINF	Consumer prices,	Monthly	Statistics	ew:jpn11977

Variable Labels	Data Description, Date Range	Frequency	Sources (Primary & Secondary Sources)	Reuters EcoWin Mnemonic Code
	nationwide, all items *excluding* food & energy, % change, y/y; Jan 1990 to Dec 2012		Bureau, Ministry of Internal Affairs and Communication; Reuters EcoWin	
INF	Consumer prices, nationwide, all items, % change, y/y; Jan 1990 to Dec 2012	Monthly	Statistics Bureau, Ministry of Internal Affairs and Communication; Reuters EcoWin	ew:jpn11899
CFINF	Consumer prices, nationwide, all items *excluding* fresh food, % change, y/y Jan 1990 to Dec 2012	Monthly	Statistics Bureau, Ministry of Internal Affairs and Communication; Reuters EcoWin	ew:jpn11890rty
Industrial Production				
IP	Industrial production, Seasonally adjusted, Index, % change, y/y; Jun 1994 to Dec 2012	Monthly	Ministry of Economy, Trade, and Industry (METI); Reuters EcoWin	ew:jpn02554
Public Finance				
NETDEBT	General government net financial liabilities, % of nominal GDP; 1Q1990-4Q2012	Quarterly	OECD; Reuters Ecowin	oe:jpn_gnflqq
GROSSDEBT	General government gross financial liabilities, % of nominal GDP; 1Q1990-4Q2012	Quarterly	OECD; Reuters Ecowin	oe:jpn_ggflqq
BALANCE	General government net lending, annualized rate, % of nominal GDP; 1Q1990-4Q2012	Quarterly	OECD; Reuters Ecowin	oe:jpn_nlgqq

The data used in the econometric models are largely stationary, as shown in Table 6 below, based on both Augmented Dickey Fuller (ADF) (1981) and Phillips and Perron (1988) tests. However, government financial liabilities (debt) ratios and government net borrowing (fiscal balance or deficit) ratios are non-stationary, based on the same tests, as shown in Table 7 below. Most tests show that the first differences of the government debt ratios and the government balance ratios are indeed stationary; these results are not shown here but they are available upon request.

Table 6 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***	-5.750***	-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 7 However, Debt Ratios and Deficit Ratios are Non-stationary Using the Same Unit Root Tests

Table: Unit Root Tests for Quarterly 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	-4.423***	-3.534***	-2.110	-4.125***	-3.339**	-2.095
JGB3YR	-4.966***	-4.486***	-3.389*	-1.901	-3.178**	-1.901
JGB5YR	-5.002***	-4.338***	-3.131	-3.899***	-2.771*	-1.655
JGB7YR	-3.592***	-4.426***	-4.454***	-3.784***	-4.419***	-4.426***
JGB10YR	-3.136***	-2.406	-1.964	-4.507***	-3.069*	-1.769
JGB20YR	-2.488**	-1.816	-1.316	-2.976***	-1.940	-1.114
TB3M	-6.969***	-8.223***	-7.758***	-4.323***	-4.207***	-3.517**
TB12M	-5.432***	-6.813***	-6.668***	-5.696***	-6.260***	-5.693***
CINF	-2.402**	-2.189	-2.732	-1.339	-0.842	-2.185
IP	-4.301***	-4.277***	-4.315***	-3.705***	-3.687***	-3.707**
GROSSDEBT	2.493	0.049	-2.428	5.260	0.732	-2.194
NETDEBT	2.338	0.974	-2.411	5.687	2.023	-1.944
BALANCE	-0.469	-2.456	-2.591	-0.411	-1.965	-2.221

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.

There are compelling reasons to believe that the long-term government bonds' nominal yields, short-term interest rates and the rate of inflation are strongly interrelated. However, it is unlikely that these variables are solely linked along a one-way causal chain. The rather complex nature of this relationship poses several challenges to empirical studies aimed at discerning the nature and strength of those links. Several statistically appropriate techniques have been used to address these issues but the most common, and least restrictive, approach is that of instrumental variables. Moreover, given the presence of lagged dependent variables as explanatory variables (a dynamic specification) in the behavioral equations, any estimation using least squares procedures would provide inconsistent estimates of the relevant coefficients. This paper applies an instrumental variable approach. The two-step feasible and efficient Generalized Method of Moments (GMM) technique is used here. This technique is an information-efficient means of obtaining consistent coefficient estimates and outperforms the two-stage least squares technique. The Hansen (1982) J test for overidentifying restrictions is used to check for the validity and relevance of instrumental variables. The Hansen's J statistic is insignificant in most cases, which means that the test does not reject the null hypothesis that the instrumental variables are uncorrelated with the error term.

Tables 8 and 9 report the results from the GMM estimations. The dependent variables are JGBs' nominal yields for different maturities. Lagged endogenous variables are commonly used as instrumental variables in time series studies. Hence, the second and third period lags of both short-term interest rate and the rate of core inflation are used as instrumental variables. Table 8 provides GMM estimates of long-term JGBs' nominal yields using T-bills of 3 months and other control variables, while Table 9 provides the same using T-bills of 12 months and the same control variables.

Table 8 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.

Table 9 Results of GMM Estimation of Long-term JGBs' Nominal Yields Using 12-month T-bills and Other Control Variables

Table: GMM Estimations of Long Term Government Bond Yields Equation with T-bills of 12 Months (1994M12-2012M12)

Variables	JGB2YR	JGB3YR	JGB5YR	JGB7YR	JGB10YR	JGB20YR
$TB12M_{-1}$	0.912***	1.030***	1.119***	1.170***	1.052***	1.016***
	(0.072)	(0.080)	(0.133)	(0.195)	(0.231)	(0.279)
$CINF_{-1}$	0.037	0.079*	0.139**	0.178**	0.215**	0.178**
	(0.028)	(0.047)	(0.067)	(0.085)	(0.087)	(0.078)
IP_{-1}	0.001	0.002	0.004	0.006	0.007*	0.005
	(0.001)	(0.002)	(0.003)	(0.004)	(0.004)	(0.004)
Const.	0.110***	0.251***	0.554***	0.880***	1.338***	1.969***
	(0.029)	(0.045)	(0.077)	(0.091)	(0.104)	(0.096)
Hansen Test	3.825	2.883	1.237	0.227	0.459	1.474
	(P=0.148)	(P=0.237)	(P=0.539)	(P=0.893)	(P=0.795)	(P=0.479)
Obs.	214	214	214	214	214	214

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 12 month, second and third lag of rate of core inflation.

In tables 8 and 9 the coefficients of short-term interest rates, whether using T-bills of 3 months or 12 months, 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. This implies that JGBs' nominal yields are fairly insensitive to the pace of economic activity.

In order to check the coherence of the above findings, another instrumental variable technique is applied to the same regression models of JGBs' nominal yields. Tables 10 and 11 report the results from Two Stage Least Squares (2SLS) estimations. Here to instrument for the short-term interest rate and the rate of core inflation, their second and third period lags are also used in both cases. Table 10 provides two-stage least squares estimates of long-term JGB's nominal yields using T-bills of 3 months and other control variables, while Table 11 provides the same respectively using T-bills of 12 months' maturity and the same control variables. The coefficients in tables 10 and 11 are similar in signs, magnitudes, and statistical significance to the earlier coefficients in tables 8 and 9. Thus, it reinforces the soundness of these findings.

Table 10 Results of 2SLS Estimation of Long-term JGBs' Nominal Yields Using 3-month T-bills and Other Control Variables

Table: 2SLS Estimations of Long Term Government Bond Yields Equation with T-bills of 3 Months (1994M6-2012M12)

Variables	JGB2YR	JGB3YR	JGB5YR	JGB7YR	JGB10YR	JGB20YR
$TB3M_{-1}$	1.052***	1.199***	1.235***	1.049***	1.116***	1.049***
	(0.063)	(0.085)	(0.108)	(0.133)	(0.149)	(0.140)
$CINF_{-1}$	0.065	0.138**	0.223**	0.290**	0.298*	0.281*
	(0.043)	(0.069)	(0.110)	(0.114)	(0.155)	(0.143)
IP_{-1}	0.002	0.002	0.004	0.007	0.008	0.006
	(0.002)	(0.002)	(0.004)	(0.004)	(0.005)	(0.004)
Const.	0.180***	0.339***	0.662***	1.025***	1.433***	2.79***
	(0.042)	(0.064)	(0.097)	(0.097)	(0.139)	(0.130)
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.

Table 11 Results of 2SLS Estimation of Long-term JGBs' Nominal Yields Using 12-month T-bills and Other Control Variables

Table: 2SLS Estimations of Long Term Government Bond Yields Equation with T-bills of 12 Months (1994M12-2012M12)

Variables	JGB2YR	JGB3YR	JGB5YR	JGB7YR	JGB10YR	JGB20YR
$TB12M._{-1}$	0.919***	1.045***	1.122***	1.149***	1.020***	0.992***
	(0.073)	(0.082)	(0.136)	(0.203)	(0.239)	(0.282)
$CINF._{-1}$	0.035	0.102**	0.173*	0.208*	0.250*	0.231*
	(0.029)	(0.051)	(0.088)	(0.114)	(0.130)	(0.122)
$IP._{-1}$	0.001	0.002	0.004	0.006	0.007*	0.006
	(0.001)	(0.002)	(0.003)	(0.004)	(0.004)	(0.004)
Const.	0.129***	0.281***	0.584***	0.895***	1.359***	2.000***
	(0.031)	(0.049)	(0.082)	(0.100)	(0.116)	(0.104)
Hansen Test	3.825	2.883	1.237	0.227	0.459	1.474
	(P=0.148)	(P=0.237)	(P=0.539)	(P=0.893)	(P=0.795)	(P=0.479)
Obs.	214	214	214	214	214	214

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 12 month, second and third lag of rate of core inflation.

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 government liabilities (debt) ratios and government net borrowing (budget balance) ratios do *not* exert any upward pressure on JGBs' nominal yields. However, since government finance variables are non-stationary the econometric results would have to be treated with due caution. Table 12, Table 13 and Table 14, respectively, report the results from GMM estimations of JGBs' nominal yields with T-bills of 3 months maturity, core inflation, and, respectively, the following measures of government finance: gross debt ratios, net debt ratios, and government budget balance. In all three cases the coefficients of T-bills of 3 months are positive and statistically significant. In all these case the coefficients of industrial production are positive but statistically insignificant. In tables 12 and 13 the coefficients of core inflation are usually positive but not statistically significant. In Table 14 the coefficients of core inflation are positive and statistically significant. Tables 12 and 13, respectively, show that the coefficients of gross debt ratios and net debt ratios are both negative while Table 14 shows that the coefficients of government balance ratios are positive. These coefficients are usually statistically significant. These findings are contrary to the conventional wisdom of the existing literature (such as Lam and Tokuoka 2011, and Tokuoka 2012) which holds that higher government indebtedness and/or government deficits would cause government bonds' nominal yields to rise. But it is consistent with the view that higher government spending leads to

excessive reserve positions, which in turn cause government bonds to rally, that is, it causes government bonds' nominal yields to decline, unless the central bank undertakes defensive actions to offset the effects of increased government spending on interest rates.

Table 12 Results of GMM Estimation of Long-term JGBs' Nominal Yields Using 3-month T-bills, Gross Debt Ratios, and Other Control Variables

Table: GMM Estimations of Long Term Government Bond Yields Equation with T-bills of 3 Months and Gross Debt (1994Q4-2012Q4)						
Variables	**JGB2YR**	**JGB3YR**	**JGB5YR**	**JGB7YR**	**JGB10YR**	**JGB20YR**
$TB3M._{-1}$	0.688***	0.731***	0.768***	0.729***	0.656***	0.592***
	(0.105)	(0.094)	(0.090)	(0.059)	(0.087)	(0.070)
$CINF._{-1}$	-0.008	0.010	0.005	-0.006	0.025	0.100**
	(0.041)	(0.047)	(0.054)	(0.050)	(0.055)	(0.040)
$IP._{-1}$	0.002	0.002	0.001	0.001	0.003	0.001
	(0.002)	(0.003)	(0.004)	(0.004)	(0.004)	(0.003)
$GROSSDEBT._{-1}$	-0.003	-0.005*	-0.008***	-0.010***	-0.008***	-0.003
	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)
Const.	0.732*	1.130***	1.891***	2.490***	2.639***	2.514***
	(0.381)	(0.405)	(0.447)	(0.378)	(0.459)	(0.469)
Hansen Test	3.162	3.155	3.226	2.851	2.653	2.512
	(P=0.367)	(P=0.368)	(P=0.358)	(P=0.415)	(P=0.448)	(P=0.473)
Obs.	73	73	73	73	73	73

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.

Table 13 Results of GMM Estimation of Long-term JGBs' Nominal Yields Using 3-month T-bills, Net Debt Ratios, and Other Control Variables

Table: GMM Estimations of Long Term Government Bond Yields Equation with T-bills of 3 Months and Net Debt (1994Q4-2012Q4)						
Variables	**JGB 2YR**	**JGB3YR**	**JGB5YR**	**JGB7YR**	**JGB10YR**	**JGB20YR**
$TB3M._{-1}$	0.689***	0.742***	0.783***	0.761***	0.673***	0.599***
	(0.099)	(0.092)	(0.091)	(0.064)	(0.109)	(0.075)
$CINF._{-1}$	-0.010	0.011	0.010	0.005	0.028	0.097**
	(0.040)	(0.045)	(0.051)	(0.048)	(0.058)	(0.042)
$IP._{-1}$	0.001	0.001	0.001	0.001	0.003	0.002
	(0.002)	(0.003)	(0.004)	(0.003)	(0.004)	(0.002)
$NETDEBT._{-1}$	-0.004*	-0.005**	-0.009***	-0.011***	-0.010***	-0.004
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Const.	0.523***	0.794***	1.338***	1.783***	2.149***	2.407***
	(0.190)	(0.195)	(0.211)	(0.197)	(0.217)	(0.175)
Hansen Test	2.907	2.955	3.165	3.276	3.928	3.314
	(P=0.406)	(P=0.399)	(P=0.367)	(P=0.351)	(P=0.269)	(P=0.346)
Obs.	73	73	73	73	73	73

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.

Table 14 Results of GMM Estimation of Long-term JGBs' Nominal Yields Using 3-month T-bills, Government Balance, and Other Control Variables

Table: GMM Estimations of Long Term Government Bond Yields Equation with T-bills of 3 Months and Deficit (1994Q4-2012Q4)						
Variables	JGB2YR	JGB3YR	JGB5YR	JGB7YR	JGB10YR	JGB20YR
$TB3M._{-1}$	0.574***	0.593***	0.545***	0.445***	0.374***	0.418***
	(0.067)	(0.084)	(0.105)	(0.104)	(0.104)	(0.090)
$CINF._{-1}$	0.041***	0.078***	0.119***	0.149***	0.169***	0.174***
	(0.012)	(0.016)	(0.025)	(0.028)	(0.034)	(0.019)
$IP._{-1}$	0.001	0.001	0.001	0.000	0.001	-0.001
	(0.001)	(0.001)	(0.002)	(0.003)	(0.003)	(0.003)
$BALANCE._{-1}$	0.043***	0.052***	0.071***	0.064***	0.053***	0.015
	(0.008)	(0.009)	(0.013)	(0.017)	(0.016)	(0.023)
Const.	0.547***	0.784***	1.227***	1.525***	1.898***	2.309***
	(0.060)	(0.084)	(0.127)	(0.168)	(0.147)	(0.165)
Hansen Test	2.625	2.457	1.999	2.625	2.604	2.560
	(P=0.453)	(P=0.483)	(P=0.573)	(P=0.453)	(P=0.457)	(P=0.465)
Obs.	73	73	73	73	73	73

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.

The findings reported in the paper are robust to various measures of inflation. Other widely used measures of consumer price inflation, such as total consumer price inflation (INF), and consumer price inflation excluding fresh food (CFINF), are strongly correlated to core consumer price inflation excluding food and energy (CINF), as shown in Table 15 below. The use of these measures of inflation in either GMM or 2SLS estimations does not alter the key findings of the paper.

Table 15 Various Measures of Consumer Price Index (CPI) Inflation in Japan are Strongly Correlated

Correlation Matrix of Various Inflation Measures in Japan, 1994M6-2012M12			
	CPI *ex* fresh food,% change, y/y	CPI *ex* food and *ex* energy, % change, y/y	CPI, % change, y/y
	CFINF	CINF	INF
CFINF	1.00		
CINF	**0.90**	1.00	
INF	**0.95**	**0.85**	1.00
Sources: Reuters EcoWin; ING Investment Management			

SECTION V: CONCLUSION

The paper explained why JGBs' nominal yields have stayed low for the past two decades despite elevated government debt ratios and large and persistent fiscal deficits. It demonstrates that long-term JGBs' nominal yields have stayed low because of policy-induced low short-term interest rates, low observed core inflation and indeed persistent deflationary pressures, tepid growth, and monetary sovereignty. Monetary sovereignty gives the government of Japan (and other countries with monetary sovereignty) the operational ability to always service its yen-denominated (local currency-denominated) government bonds, that is, nominal debt issued in its own currency. Short-term interest rates, which are really the outcomes of monetary policy, are the primary drivers of long-term government bonds' nominal yield. Long-term JGBs' nominal yields have been low for the past two decades in spite of elevated government debt ratios and chronically high fiscal deficits because monetary policy has been highly accommodative and kept policy rates and short-term interest rates low, and inflationary pressures have also been subdued. This is very much in concordance with (i) Keynes's insights, as articulated in *A Treatise on Money* (1930), (ii) modern money theory (Wray 2003 and 2012), and (iii) the recent understanding of money (Sims 2013a and 2013b, and Woodford 2001) and central banking (Bindseil 2004; Fullwiler 2008).

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