# Does Long-Term Cross-Currency Basis Swap Have an Impact on Japanese Government Bond ?: Analysis of Different Monetary Policy Regimes

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Abstract

Foreign investors have more incentives to buy long term JGBs by funding yen in the market of long term basis swap under the regime of comprehensive easing policy. The purchase of JGBs by foreign investors using a cheaper yen funded on a negative basis in the long term basis swap market contributes to the declining yield of JGBs under the regime of "comprehensive easing policy". While the BOJ introduced "the quantitative and qualitative easing policy", and negative interest rate policy, the trend observed under comprehensive easing policy changed. This is because the yield curve of long term basis swap rate tend not to decline under the regime of quantitative and qualitative easing policy, and negative interest rate policy in comparison with in the regime of comprehensive easing.

Keywords: Long Term Basis Swap, Japanese Government Bond, Monetary Policy
JEL Classifications: E43, G15

## 1. Introduction

Overseas investors fund Japanese yen in exchange for US dollar in the cross currency basis swap market on a negative basis because the demand for US dollar is very high. Japanese financial institutions have difficulty in funding US dollar. US financial institutions are reluctant to lend US dollars because they are supervised by regulatory authorities to downsize the size of their balance sheet. This study investigates whether negative funding cost of yen is an incentive for foreign investors to buy JGBs under different monetary policy regimes. None of the related literatures cited below focus on the long-term basis swap and JGB markets. Ito (2019) analyzes short term basis swap and JGB markets, not the long term basis swap market. Thus, this paper has a great originality.

Arai et al. (2016) point out that " three factors affecting the cross-currency basis swap market:

(1) the increased demand for US dollars in Japan or Europe against the backdrop of monetary policy divergence among advanced countries is thought to be a USD demand-side factor; (2) the reduced appetite of global banks for market-making or arbitrage-trading activities due to the effects of regulatory reforms and (3) the possible decrease in USD supply from foreign reserve managers and sovereign wealth funds are thought to be USD supply-side factors".

The number of related literatures analyzing basis swap market is small. Baba et al. (2008) find that "the use of swap markets by non-US financial institutions to overcome US dollar funding shortages resulted in marked deviations from covered interest parity (CIP) conditions and the impairment of liquidity in these markets". Baba and Packer (2009) investigate "the spillover effects of money market turbulence in 2007–08 on the short-term CIP condition between the US dollar and the euro through the FX swap market". Baba et al. (2008) conclude that "the failure of Lehman Brothers stressed global interbank and foreign exchange markets because it led to a run on money market funds, the largest suppliers of dollar funding to non-US banks. Policy stopped the run and replaced private funding with public funding".

Fanelli (2016) develops a credit risk model to price basis swaps in a multi-curve condition. Arai et al. (2016) indicate that "careful attention should be continuously paid to how concerns regarding advanced economies' monetary policies impact USD funding demand and that it is important to pay attention to the trading stances of global banks as they are affected by regulatory reforms". Wenxin et al. (2017) find that "deviations from the CIP condition imply large, persistent, and systematic arbitrage opportunities in one of the largest asset markets in the world".

Ito (2019) concludes that "the five-, 10-, and 20-year yields of Japanese government bonds (JGBs) co-move with the six- and 12-month basis swap rates under the quantitative and qualitative easing policy regime introduced by the Bank of Japan (BOJ)". "A cheaper yen gives foreign investors strong incentives to buy 10- and 20-year JGBs under the quantitative and qualitative easing policy". "On the other hand, JGB yield does not co-move with basis swap rate under the negative interest rate policy". "After the BOJ introduced the negative interest rate policy, the trend observed under the quantitative and qualitative easing policy regime changed".

## 2. Data

Basis swap rates of 2, 5 and 10 year and 5- and 10-year JGB yields are used. The daily data of basis swap rate are provided by Datastream. JGB yields are provided by Japan Bond Trading.

Basis swap rates moved in the negative range. This means that foreign investors could fund Japanese yen by negative rate.

The entire sample period is from June 11, 2008 to March 31, 2021. It is divided into three. Sample period from June 11, 2008 to April 3, 2013 is Sample A. The BOJ adopted comprehensive easing policy. Sample period from April 4, 2013 to January 28, 2016 is Sample B. The BOJ adopted “a quantitative and qualitative easing policy” during this period. Sample period from January 29, 2016 to March 31, 2021 is Sample C. The BOJ adopted “a negative interest rate policy”.

The 5-year basis swap rate and the yields of JGBs with maturities of 5 and and10 years are indicated in Figure 1, and the descriptive statistics are shown in Table 1.

Figure 1

Table 1

## 3.Methodology and Results

### 3.1 Unit Root Test

The augmented Dickey-Fuller (ADF) test and the Kwiatowski-Phillips-Schmidt-Shin (KPSS) test are used. Dickey and Fuller (1979), and Dickey and Fuller (1981) define “the null hypothesis as unit roots exist and the alternative hypothesis as unit roots do not exist.” Fuller (1976) provides a table for the ADF test. According to Kwiatkowski et al (1992), the KPSS test defines “the null hypothesis as unit roots do not exist and the alternative hypothesis as unit roots exist.” Unit root tests are conducted both on original data and first differenced data. The results show that three variables are found to be non-stationary I (1) variables by two unit root tests.

Table 1

Table 2

Table 3

Table 4

### 3.2 Cointegration Test

Cointegration is used to analyze the relationship between JGB yield and basis swap rate. In the test of cointegration between JGB yield and basis swap rate, equation (1) is estimated by ordinary

least squares (OLS) to find out whether unit roots are contained in the residual.

$$JGB_t = \alpha + \beta\, basis_t + u_t \qquad (1)$$

$JGB_t$ = JGB yield $basis_t$ = basis swap rate

When $JGB_t$ and $basis_t$ are both non-stationary I (1), they are defined to be in a cointegratio when their linear combination is stationary I (0). The cointegration between $JGB_t$ and $basis_t$ indicates that JGB yield and basis swap rate move together in the long-run equilibrium. If JGB yield is found to co-moves with basis swap rate, it is considered that JGB yield gets lower when the funding cost of Japanese yen declines. In other words, foreign investors are inclined to buy JGBs.

Cointegration relationship is only found in the combination of basis swap rate of 2 years and JGB of 5 and 10 years, and basis swap rate of 10 years and JGB of 10 years in Sample A. None of the cointegration relationship is found in Samples B and C.

## 4. Conclusion

This study investigates whether negative funding cost of yen is an incentive for foreign investors to buy JGBs under different monetary policy regimes. Cointegration relationship is only found in the combination of basis swap rate of 2 years and JGB of 5 and 10 years, and basis swap rate of 10 years and JGB of 10 years under the regime of "comprehensive easing policy". None of the cointegration relationship is found in the regimes of "quantitative and qualitative easing policy" and "negative interest rate policy".

Ito (2019) concludes that the five-, 10-, and 20-year yields of JGBs co-move with the six- and 12-month basis swap rates under the quantitative and qualitative easing, but the result of this paper shows that long term basis swap rates are not in the relationship of cointegration with 5 year and 10 year JGB yields.

Foreign investors have more incentives to buy long term JGBs by funding yen in the market of long term basis swap under the regime of comprehensive easing policy. On the other hand, they have more incentives to buy long term JGBs by funding yen in the market of short term basis swap market under the quantitative and qualitative easing as shown in Ito (2019). They have less incentives to buy long term JGBs either in short term or long term basis swap market under the regime of negative interest rate policy.

The purchase of JGBs by foreign investors using a cheaper yen funded on a negative basis in

the long term basis swap market contributed to the declining yield of JGBs in the regime of "comprehensive easing policy". While the BOJ introduced "the quantitative and qualitative easing policy", and negative interest rate policy, the trend observed under comprehensive easing policy changed. This is because the long term basis swap rate tend not to decline under the regime of quantitative and qualitative easing policy, and negative interest rate policy in comparison with under the regime of comprehensive easing.

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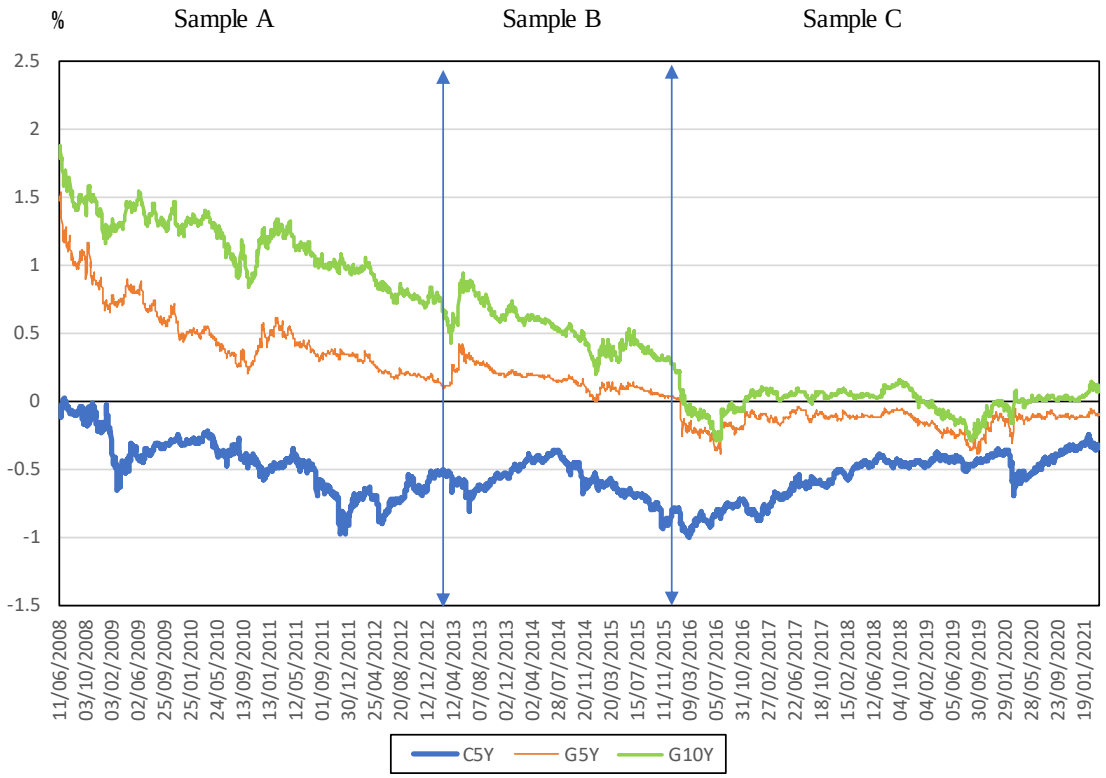


Figure 1 Movement of three Series

Notes: C5Y = Basis Swap Rate 5 Years,G5Y =Japanese Government Bond 5 year
G10Y = Japanese Government Bond 10 year
Data sourece of basis swap rate is datastream.
Data sourece of japanese Government Bond is Datastream.
Sample period from A is from June 11, 2008 to April 3, 2013.
Sample period from B is from April 4, 2013 to January 28, 2016.
Sample period from C is from January 29, 2016 to March 31, 2021.

Table 1

Descriptive Statistics of Data for Analysis

| Variable | Average | SD | Min | Max | Median |
|---|---|---|---|---|---|
| Sample A | | | | | |
| Y2 | -0.341 | 0.127 | -0.852 | 0.010 | -0.328 |
| Y5 | -0.455 | 0.211 | -0.981 | 0.030 | -0.443 |
| Y10 | -0.386 | 0.207 | -0.771 | 0.120 | -0.366 |
| JGB5Y | 0.235 | 0.195 | 0.030 | 1.010 | 0.155 |
| JGB10Y | 0.492 | 0.274 | 0.095 | 1.535 | 0.425 |
| Sample B | 1.141 | 0.256 | 0.510 | 1.875 | 1.175 |
| Y2 | -0.371 | 0.138 | -0.783 | -0.187 | -0.335 |
| Y5 | -0.593 | 0.131 | -0.935 | -0.354 | -0.598 |
| Y10 | -0.642 | 0.085 | -0.865 | -0.473 | -0.653 |
| JGB5Y | 0.154 | 0.086 | 0.00 | 0.42 | 0.155 |
| JGB10Y | 0.517 | 0.168 | 0.200 | 0.940 | 0.520 |
| Sample C | | | | | |
| Y2 | -0.442 | 0.167 | -0.821 | -0.184 | -0.381 |
| Y5 | -0.554 | 0.175 | -1.004 | -0.244 | -0.480 |
| Y10 | -0.590 | 0.141 | -0.971 | -0.291 | -0.540 |
| JGB5Y | -0.148 | 0.070 | -0.385 | -0.035 | -0.120 |
| JGB10Y | -0.006 | 0.090 | -0.295 | 0.155 | 0.020 |

Notes:

Sample period from A is from June 11, 2008 to April 3, 2013.

Sample period from B is from April 4, 2013 to January 28, 2016.

Sample period from C is from January 29, 2016 to March 31, 2021.

Y2=basis swap 2 year, Y5=basis swap 5 year, Y10=basis swap 10 year

JGB5Y=Japanese Government Bond 5 year, JGB10Y=Japanese Government Bond 10 year

Table 2

ADF unit root test (Original Series)

| Variable | Without Trend | With Trend |
|---|---|---|
| Sample A | | |
| Y2 | -0.893 | -3.789* |
| Y5 | -0.226 | -2.511 |
| Y10 | -0.123 | -2.663 |
| JGB5Y | -3.639* | -3.801* |
| JGB10Y | -2.048 | -3.720* |
| Sample B | | |
| Y2 | 0.626 | -2.160 |
| Y5 | 0.534 | -1.559 |
| Y10 | 0.501 | -1.904 |
| JGB5Y | -1.028 | -4.316* |
| JGB10Y | -0.724 | -4.272* |
| Sample C | | |
| Y2 | -1.352 | -3.104 |
| Y5 | -1.786 | -2.731 |
| Y10 | -1.479 | -2.827 |
| JGB5Y | -1.477 | -3.429* |
| JGB10Y | -2.840 | -2.789 |

Notes:

* indicates significance at the 5% level.

5% critical values are −2.864 (without trend) and −3.415 (with trend).

1% critical values are −3.437 (without trend) and −3.964 (with trend).

Sample period from A is from June 11, 2008 to April 3, 2013.

Sample period from B is from April 4, 2013 to January 28, 2016.

Sample period from C is from January 29, 2016 to March 31, 2021.

Y2=basis swap 2 year, Y5=basis swap 5 year, Y10=basis swap 10 year

JGB5Y=Japanese Government Bond 5 year, JGB10Y=Japanese Government Bond 10 year

Table 3

KPSS unit root test (Original Series)

| Variable | Lag = 4 | | Lag = 12 | |
|---|---|---|---|---|
| | Level Stationary | Trend Stationary | Level Stationary | Trend Stationary |
| Sample A | | | | |
| Y2 | 11.263* | 1.110* | 4.529* | 0.460* |
| Y5 | 16.866* | 0.987* | 6.580* | 0.394* |
| Y10 | 17.984* | 0.850* | 7.006* | 0.340* |
| JGB5Y | 18.862* | 2.755* | 7.418* | 1.122* |
| JGB10Y | 32.715* | 0.752* | 7.788* | 0.314* |
| Sample B | | | | |
| Y2 | 9.974* | 2.833* | 3.891* | 1.121* |
| Y5 | 6.033 | 2.985* | 2.362 | 1.173* |
| Y10 | 3.769* | 2.702* | 1.505* | 1.080* |
| JGB5Y | 11.739* | 0.574* | 4.628* | 0.252* |
| JGB10Y | 11.666* | 0.404* | 4.582* | 0.173* |
| Sample C | | | | |
| Y2 | 19.944* | 3.134* | 7.771* | 1.251* |
| Y5 | 16.568* | 19.853* | 7.728* | 7.728* |
| Y10 | 16.072* | 3.707* | 6.285* | 1.465* |
| JGB5Y | 1.777* | 1.740* | 0.716* | 0.700* |
| JGB10Y | 1.804* | 1.911* | 0.714* | 0.756* |

Notes:
* indicates significance at the 5% level.
5% critical values are 0.463 ( level stationary) and 0.146 ( trend stationary).
Sample period from A is from June 11, 2008 to April 3, 2013.
Sample period from B is from April 4, 2013 to January 28, 2016.
Sample period from C is from January 29, 2016 to March 31, 2021.
Y2=basis swap 2 year, Y5=basis swap 5 year, Y10=basis swap 10 year
JGB5Y=Japanese Government Bond 5 year, JGB10Y=Japanese Government Bond 10 year

Table 4

ADF unit root test (First Differenced Series)

| Variable | Without Trend | With Trend |
|---|---|---|
| Sample A | | |
| ⊿Y2 | -28.768* | -28.673* |
| ⊿Y5 | -39.953* | -28.006* |
| ⊿Y10 | -43.147* | -43.085* |
| ⊿JGB5Y | -34.805* | -34.825* |
| ⊿JGB10Y | -35.703* | -35.640* |
| Sample B | | |
| ⊿Y2 | -29.146* | -28.992* |
| ⊿Y5 | -26.166* | -26.413* |
| ⊿Y10 | -26.786* | -26.921* |
| ⊿JGB5Y | -16.724* | -17.577* |
| ⊿JGB10Y | -17.433* | -18.025* |
| Sample C | | |
| ⊿Y2 | -38.289* | -38.115* |
| ⊿Y5 | -40.583* | -40.500* |
| ⊿Y10 | -41.375* | -41.107* |
| ⊿JGB5Y | -36.427* | -36.644* |
| ⊿JGB10Y | -38.349* | -38.165* |

Notes:

* indicates significance at the 5% level.

5% critical values are −2.864 (without trend) and −3.415 (with trend).

1% critical values are −3.437 (without trend) and −3.964 (with trend).

Sample period from A is from June 11, 2008 to April 3, 2013.

Sample period from B is from April 4, 2013 to January 28, 2016.

Sample period from C is from January 29, 2016 to March 31, 2021.

Y2=basis swap 2 year, Y5=basis swap 5 year, Y10=basis swap 10 year

JGB5Y=Japanese Government Bond 5 year, JGB10Y=Japanese Government Bond 10 year

Table 5

KPSS unit root test (First Differenced Series)

| Variable | Lag = 4 | | Lag = 12 | |
|---|---|---|---|---|
| | Level Stationary | Trend Stationary | Level Stationary | Trend Stationary |
| Sample A | | | | |
| ⊿Y2 | 0.044 | 0.017 | 0.053 | 0.019 |
| ⊿Y5 | 0.092 | 0.040 | 0.098 | 0.043 |
| ⊿Y10 | 0.073 | 0.036 | 0.074 | 0.036 |
| ⊿JGB5Y | 0.3438 | 0.091 | 0.395 | 0.107 |
| ⊿JGB10Y | 0.058 | 0.055 | 0.060 | 0.058 |
| Sample B | | | | |
| ⊿Y2 | 0.040 | 0.176 | 0.044 | 0.198 |
| ⊿Y5 | 0.176 | 0.051 | 0.198 | 0.058 |
| ⊿Y10 | 0.077 | 0.060 | 0.092 | 0.072 |
| ⊿JGB5Y | 0.125 | 0.066 | 0.141 | 0.074 |
| ⊿JGB10Y | 0.222 | 0.099 | 0.228 | 0.103 |
| Sample C | | | | |
| ⊿Y2 | 0.034 | 0.030 | 0.033 | 0.029 |
| ⊿Y5 | 0.062 | 0.030 | 0.064 | 0.031 |
| ⊿Y10 | 0.052 | 0.031 | 0.061 | 0.035 |
| ⊿JGB5Y | 0.041 | 0.028 | 0.053 | 0.036 |
| ⊿JGB10Y | 0.093 | 0.053 | 0.115 | 0.066 |

Notes:

* indicates significance at the 5% level.

5% critical values are 0.463 ( level stationary) and 0.146 ( trend stationary).

Sample period from A is from June 11, 2008 to April 3, 2013.

Sample period from B is from April 4, 2013 to January 28, 2016.

Sample period from C is from January 29, 2016 to March 31, 2021.

Y2=basis swap 2 year, Y5=basis swap 5 year, Y10=basis swap 10 year

JGB5Y=Japanese Government Bond 5 year, JGB10Y=Japanese Government Bond 10 year

Table 6

Cointegration test

| Variable | Test Statistics | Variable | Test Statistics |
|---|---|---|---|
| Sample A | | Sample A | |
| Y2,JGB5Y | -3.474* | Y2,JGB10Y | -3.470* |
| Y5,JGB5Y | -2.930 | Y5,JGB10Y | -2.579 |
| Y10,JGB5Y | -3.015 | Y10,JGB10Y | -3.149* |
| Sample B | | Sample B | |
| Y2,JGB5Y | -1.873 | Y2,JGB10Y | -1.839 |
| Y5,JGB5Y | -1.559 | Y5,JGB10Y | -1.596 |
| Y10,JGB5Y | -2.074 | Y10,JGB10Y | -2.107 |
| Sample C | | Sample C | |
| Y2,JGB5Y | -1.841 | Y2,JGB10Y | -1.927 |
| Y5,JGB5Y | -2.012 | Y5,JGB10Y | -2.066 |
| Y10,JGB5Y | -2.345 | Y10,JGB10Y | -2.295 |

Notes:

*,** indicates significance at the 5% and 10% levels respectively.

5% critical value is −3.3377 from MacKinnon (1991).

10% critical value is −3.0462 from MacKinnon (1991).

Sample period from A is from June 11, 2008 to April 3, 2013.

Sample period from B is from April 4, 2013 to January 28, 2016.

Sample period from C is from January 29, 2016 to March 31, 2021.

Y2=basis swap 2 year, Y5=basis swap 5 year, Y10=basis swap 10 year

JGB5Y=Japanese Government Bond 5 year, JGB10Y=Japanese Government Bond 10 year