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An Empirical Analysis of Swedish Government Bond Yields

by

Tanweer Akram*
Citi Bank

and

Mahima Yadav**
Independent Scholar

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****Corresponding author*. **Email**: tanweer.akram@gmail.com **ORCID**: https://orcid.org/0000-0002-6646-0902
** **Email:** mahima9yadav@gmail.com, **ORCID**: https://orcid.org/0009-0008-5995-637X
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Levy Economics Institute
P.O. Box 5000
Annandale-on-Hudson, NY 12504-5000
http://www.levyinstitute.org

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ABSTRACT

This paper econometrically models the dynamics of Swedish government bond (SGB) yields. It examines whether the short-term interest rate has a decisive influence on long-term SGB yields, after controlling for other macroeconomic and financial variables, such as consumer price inflation, the growth of industrial production, the stock price index, the exchange rate of the Swedish krona, and the balance sheet of Sweden's central bank, Sveriges Riksbank. It applies an autoregressive distributive lag (ARDL) approach using monthly data to model SGB yields across the Treasury yield curve. The results of the estimated models show that the short-term interest rate has a marked influence on the long-term SGB yield. Such findings reaffirm John Maynard Keynes's view that the central bank's monetary policy affects long-term government bond yields through the current short-term interest rate. It also shows that the interest rate behavior observed in Sweden is in concordance with empirical patterns discerned in previous studies related to government bond yields in both advanced countries and emerging markets.

KEYWORDS: Swedish Government Bonds; Bond Yields; Short-term Interest Rate; Inflation; Sveriges Riksbank; Sweden

JEL CLASSIFICATIONS: E43; E50; E58; E60; G10; G12

SECTION I: INTRODUCTION

This paper econometrically models the dynamics of Swedish government bond (SGB) yields, examining whether the short-term interest rate has a decisive influence on long-term SGB yields after controlling for several key macroeconomic and financial variables. Recently there has been a revival of empirical research, such as Akram and Li (2020) and Akram and Uddin (2022), based on the Keynesian perspective on long-term government bond yields. However, interest rate dynamics in Sweden have not yet been analyzed from a Keynesian perspective, even though the country's monetary system and the mechanics of the Swedish government's fiscal operations have been the subject of an incisive and insightful inquiry into balance sheet relations, a study that has reinforced the chartalist perspective (Ehnts and Ora 2024).

John Maynard Keynes (1930) claimed that the central bank's monetary policy actions exert a substantial influence on long-term interest rates, mainly through its policy rates' effects on short-term interest rates. Keynes's (1930) views on interest rate dynamics were based on his analysis of the ontological uncertainty regarding economic and social phenomena, liquidity preference, investor behavior in the financial markets (including herding and animal spirits), institutional features of financial markets, and knowledge of financial institutions' operations for both central banks and private financial institutions. He supported his claims by citing the statistical studies that Riefler (1930) conducted with data from US financial markets in the 1920s.

A wide body of recent empirical research has shown that there is consistent regularity in the strong ties between short-term interest rates and long-term government bond yields in key advanced countries/regions, such as the United States, the United Kingdom, the eurozone, Japan, and Canada, as well as selected emerging markets such as China, India, Brazil, and Mexico. Lavoie (2014, 186–88, 232–34) renders a summary of selected empirical literature on interest rate dynamics from a Keynesian perspective. More recently, Akram and Mamun (2024) have critically reviewed both mainstream and Keynesian empirical studies of long-term interest rate dynamics and they maintain that a plethora of studies support the Keynesian perspective. In the post–Bretton Woods era, Kim and Tymoigne (2024) evince that, for countries with monetary sovereignty, it is the short-term interest rate—rather than the fiscal balance or debt ratios—that exerts the most important influence on the long-term government bond yield. Based on an interpretation of Keynes's writings on interest rate dynamics, Akram (2022a, b) has developed several quantitative models that connect long-term government bond yields to the central bank's policy rate via its effect on the short-term interest rate.

The examination and econometrical modeling of SGB yields is undoubtedly useful for many reasons. Crucially, it can reveal whether the empirical patterns that tether the short-term interest rate and long-term government bond yields, as hypothesized by Keynes (1930), also hold in Sweden. Furthermore, empirically modeling SGB yields can provide insights about the effectiveness of the monetary transmission mechanism of Sveriges Riksbank, Sweden's central bank. It can also provide valuable insights into the workings of the country's financial system, sovereign debt management, and operational aspects of fiscal policy. The findings from the econometric models of SGBs may also lead to actionable strategies for private investors and portfolio managers when considering strategic and tactical asset allocation and risk management.

This paper is arranged as follows. Section II provides a background to the evolution of SGB yields during the study period. Section III describes the data and undertakes unit root and stationarity tests to understand the nature of the time series data. Section IV presents the econometric models and discusses the findings of the estimated models. Section V examines the policy implications of the findings. Section VI concludes.

SECTION II: A BACKGROUND TO THE EVOLUTION OF SGB YIELDS

It is useful to examine the macroeconomic backdrop to the evolution of SGB yields, prior to partaking in the econometric modeling of their dynamics.

Figure 1 displays the evolution of SGB yields during the study period. From the start of the study period in 2000 until mid-2005, SGB yields steadily declined. Between mid-2005 and mid-2008, SGB yields rose, but—with the onset of the global financial crisis—SGB yields fell sharply. After the sharp decline at the start of financial crisis, SGB yields stayed stable between early 2009 and late 2010. Beginning in early 2011, SGB yields rose until late 2013, after which point they again declined until late 2014. Between 2015 and early 2022, SGB yields remained low, ranging between –1 percent to 1 percent. During this period, the Riksbank's main policy rate (the repo rate) was lowered to –0.1 percent in February. It was further reduced to –0.5 percent in 2016, a level it maintained until January 2019, when it raised the policy rate to –0.25 percent and kept it unchanged until mid-December 2019. The negative policy rate resulted in low and negative SGB yields, especially in the front end of the Treasury yield curve. However, once the Riksbank began hiking its policy rate in May 2022, SGB yields rose sharply. The SGB yields declined a bit in late 2023 as the Riksbank kept its policy rate on hold when inflation pressures began to gradually abate with improvements in the global supply chain.

Figure 1. The Evolution of Swedish Government Bond Yields, 2000M01–2023M12

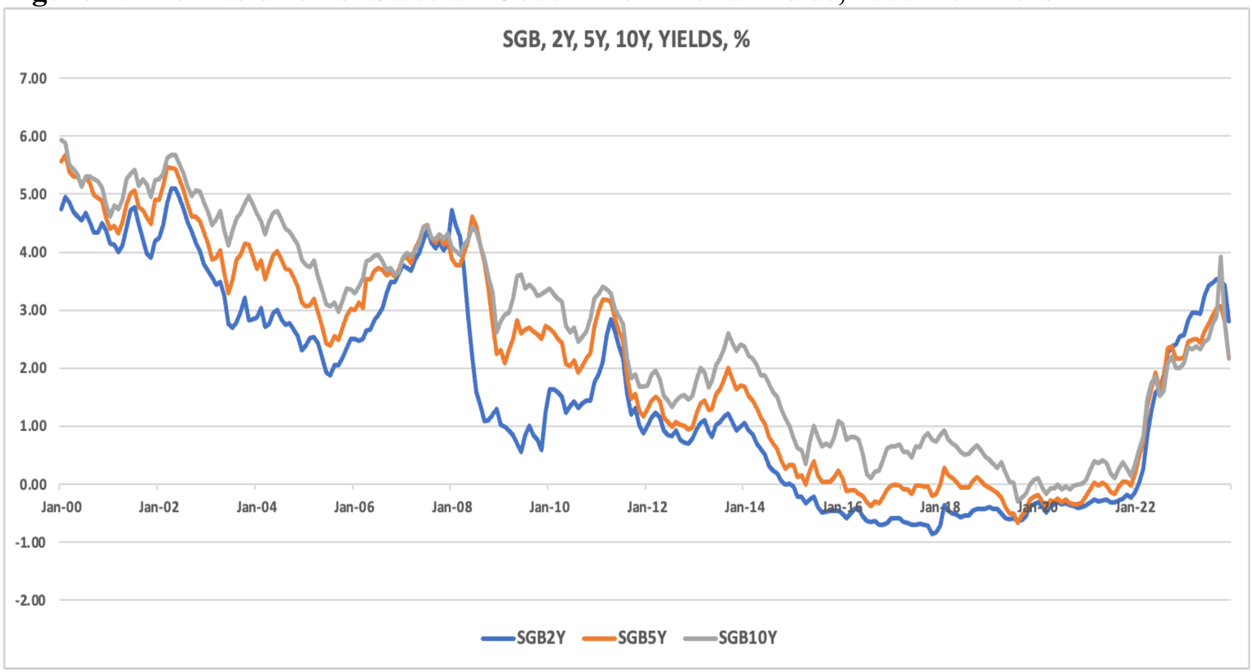


Figure 2 displays the coevolution of the 5-year SGB yield and 3-month Treasury bill rate. Usually, the long-term SGB yield and the short-term interest rate move in lockstep and thus are highly correlated. However, from time to time, the SGB yield may lead or lag the 3-month Treasury bill rate.

Figure 2. The Coevolution of 5-year Swedish Government Bond Yields and 3-month Treasury Bill Rates, 2000M01–2023M12

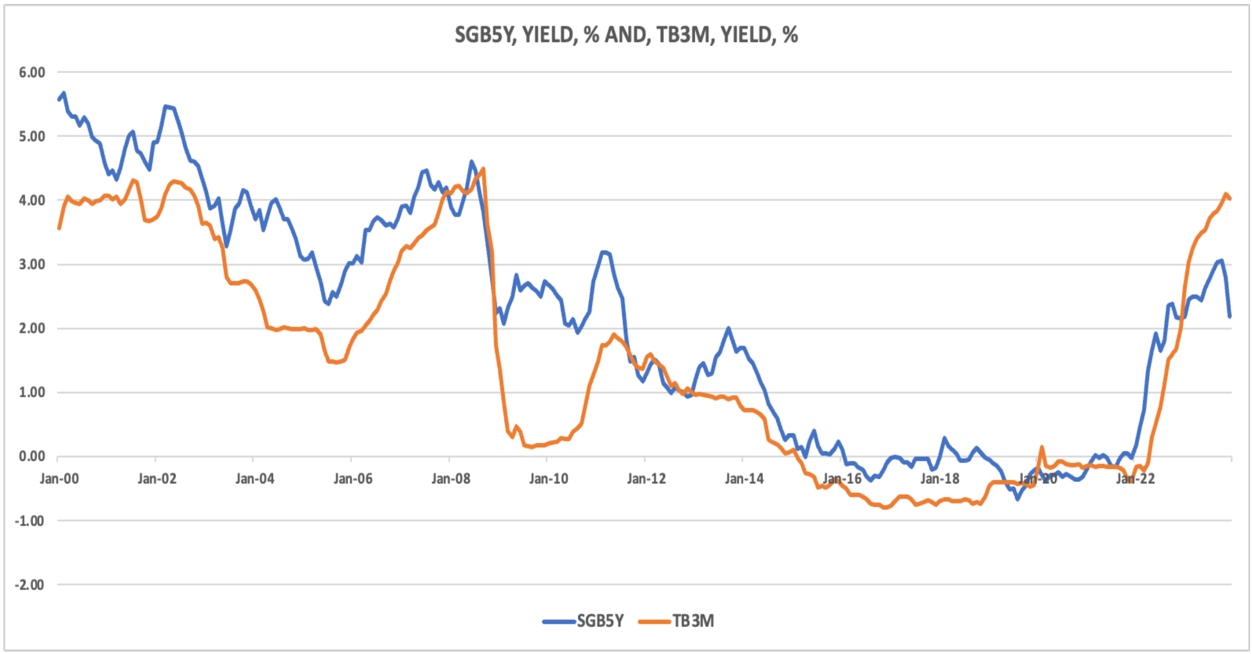


Figure 3 shows the coevolution of the 5-year SGB yield and a measure of core inflation in Sweden during the study period. As can be ascertained from the figure, the correlation between SGB yields and core inflation is positive but not particularly strong. There are times when inflation rises (declines) but SGB yields remains low (high) or decline (rise). For example, core inflation rose from late 2015 to mid-2022, but SGB yields stayed largely unchanged.

Figure 3. The Coevolution of 5-year Swedish Government Bond Yields and Core Inflation in Sweden, 2000M01–2023M12

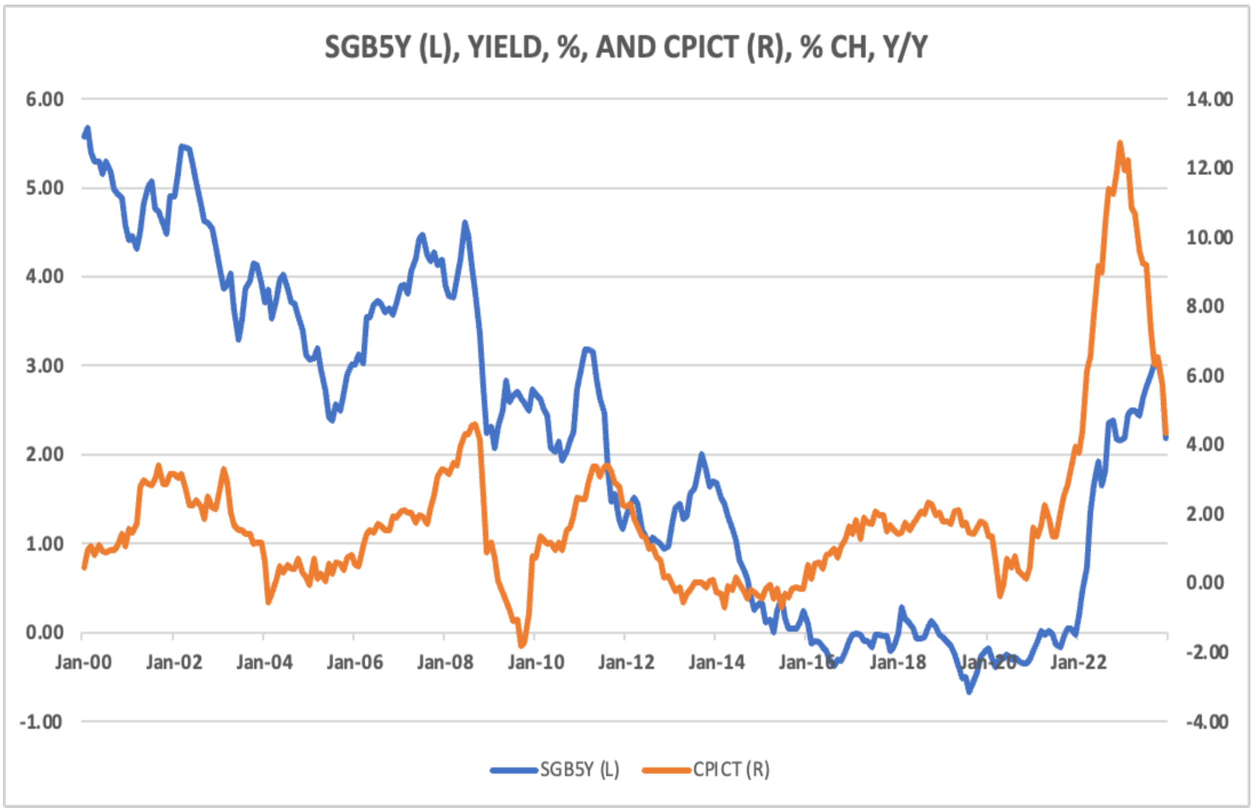


Figure 4 shows the growth of industrial production in Sweden during the study period. The growth of industrial production is represented by its year-over-year percentage change. During the study period, the growth of industrial produced averaged 1 percent year over year. The growth of industrial production can vary notably due to the economic fluctuations of the business cycle; its standard deviation is 6.3 percent. Recessionary periods are associated with a marked decline in the growth of industrial production, while recovery periods are associated with strong growth in industrial production. Thus, the growth of industrial production is a useful indicator of overall economic activity and the state of the business cycle.

Figure 4. The Growth of Industrial Production in Sweden, 2000M01–2023M12

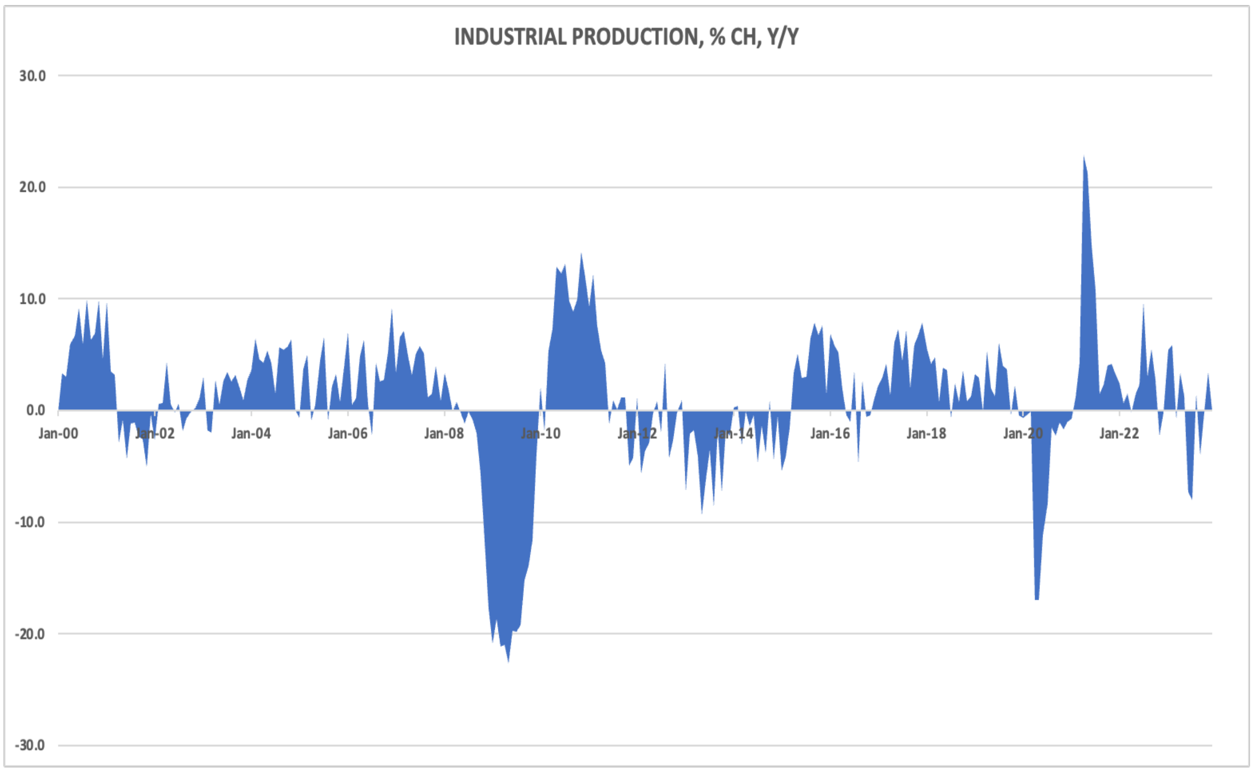


Figure 5 depicts the evolution of two different stock market indexes during the study period, namely the OMX Stockholm 30 and the Stockholm Affarsvariden stock price indexes. The two indexes were highly correlated during the study period, implying the gains and losses in these two indexes almost always occur in tandem.

Figure 5. The Evolution of the Stock Market Indexes, 2000M01–2023M12

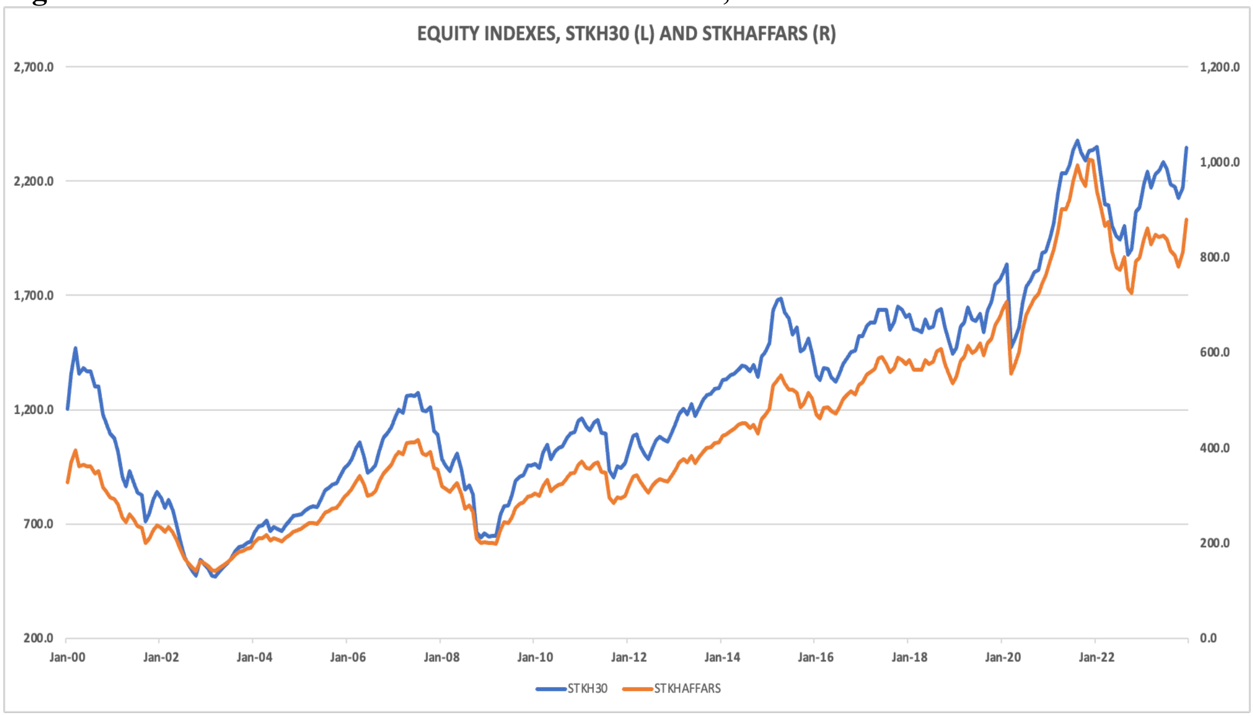
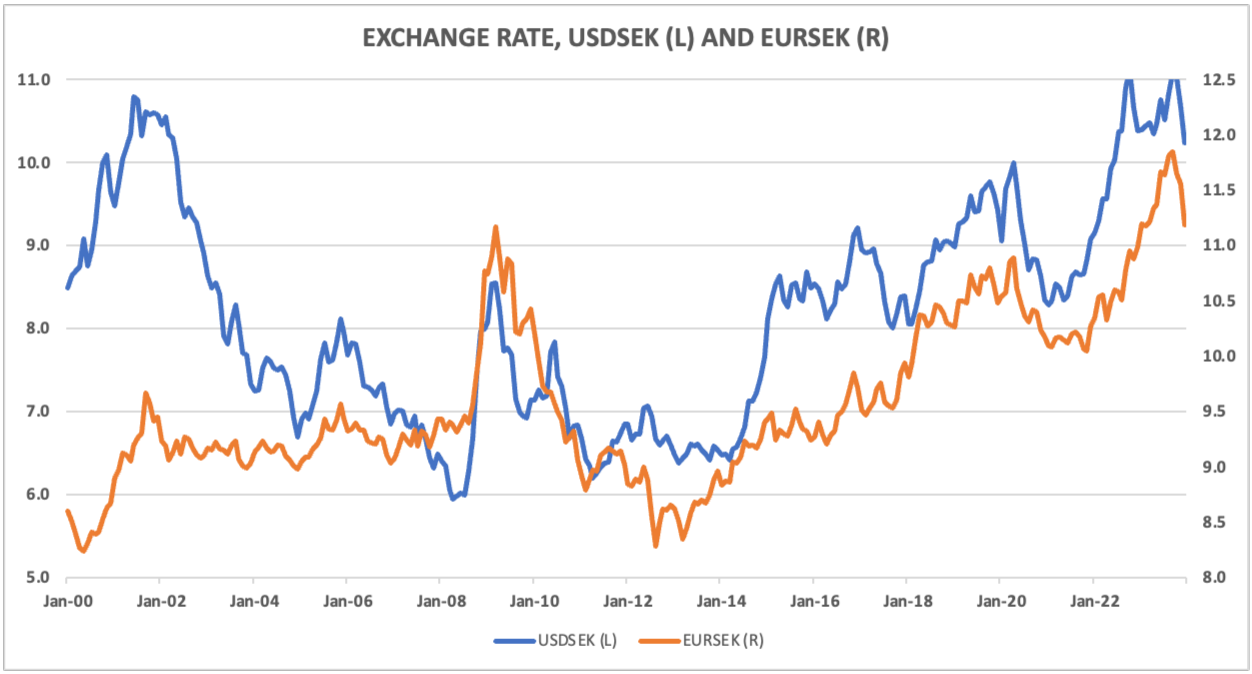


Figure 6 traces the evolution of the exchange rates of the Swedish krona against the US dollar and the euro. The value of Sweden's currency varied substantially during the study period against the dollar and the euro. While the exchange of krona against the dollar and the euro has been strongly correlated, it is not perfectly correlated. Hence, there were occasions during the study period when the krona appreciated against the US dollar but depreciated against the euro.

Figure 6. The Evolution of the Exchange Rate of the Krona, 2000M01–2023M12



SECTION III: DATA DESCRIPTION AND UNIT ROOT AND STATIONARITY TESTS

Table 1, below, summarizes the data. The first column lists the variables used in the study. The second column provides the data description and the date range of the time series. The third column indicates the frequency and whether a high-frequency series has been converted to a monthly series. The final column displays the primary source of the data.

Short-term interest rates are based on Treasury bills of 3-month and 6-month tenors. The long-term government bond yields are obtained for SGBs of 2-, 5-, and 10-year tenors. Two measures of inflation are used. The first is based on the year-over-year change in the consumer price index

(CPI) excluding energy and unprocessed food. The second is based on the year-over-year change in the CPI at constant tax rates. Economic activity is based on the year-over-year change in industrial production. Several financial variables are also used in the study, including two variables for the exchange rate (the exchange rate of the Swedish krona against the US dollar and the euro) and two different stock price indexes (the OMX Stockholm 30 and the Stockholm Affarsvariden). The Riksbank's total assets provide a measure of the balance sheet. The first difference of the natural logarithm of several variables is used when the relevant driver is the percentage change of that variable. The time series data in the study period are from January 2000 to December 2023, covering 24 years (except for the growth of industrial production, which ends in November 2023). There are 288 monthly observations for each variable, except the growth of industrial production which has 287 monthly observations.

Table 1. Summary of the Data

Variables	Data description, date range	Frequency	Source
Short-term interest rates			
TB3M	Treasury bill, 3-month, yield, %, January 2000–December 2023	Daily; converted to monthly	Sveriges Riksbank
TB6M	Treasury bill, 6-month, yield, %, January 2000–December 2023	Daily; converted to monthly	Sveriges Riksbank
Long-term government bond yields			
SGB2Y	Swedish government bond, 2-year, yield, %, January 2000–December 2023	Daily; converted to monthly	Sveriges Riksbank
SGB5Y	Swedish government bond, 5-year, yield, %, January 2000–December 2023	Daily; converted to monthly	Sveriges Riksbank
SGB10Y	Swedish government bond, 10-year, yield, %, January 2000–December 2023	Daily; converted to monthly	Sveriges Riksbank
Inflation			
CCPIF	Consumer price index, all items, excluding energy and unprocessed food, not seasonally adjusted, % change, y/y, January 2000–December 2023	Monthly	Statistica Centralbyran
CPICT	Consumer price index at constant tax rates, not seasonally adjusted, % change, y/y, January 2000–December 2023	Monthly	Sveriges Riksbank
Economic activity			
IP	Production of total industry, seasonally adjusted, % change, y/y January 2000–November 2023 [To be updated to December 2023, when data are available]	Monthly	OECD
Financial variables and stock indexes			
USDSEK	Spot exchange rate, krona per US dollar, USDSEK, January 2000–December 2023	Daily; converted to monthly	Refinitiv
EURSEK	Spot exchange rate, krona per euro, EURSEK, January 2000–December 2023	Daily; converted to monthly	Sveriges Riksbank
STKH30	OMX Stockholm 30, stock price index, September 30, 1986 = 125, January 2000–December 2023	Daily; converted to monthly	OMX Nordic Exchange
STKHAFFARS	Stockholm Affarsvariden, stock price index, December 29, 1995 = 100, January 2000–December 2023	Daily; converted to monthly	OMX Nordic Exchange
Central bank balance sheet			
RIKSBANK	Sveriges Riksbank, balance sheet, total assets, End of period, not seasonally adjusted, million krona, January 2000–December 2023	Monthly	Sveriges Riksbank

Note: LNUSDSEK = LN(USDSEK); LNEURSEK = LN(EURSEK); LNSTKH30 = LN(STKH30); LNSTKHAFFARS = LN(STKHAFFARS); LNRIKSBANK = LN(RIKSBANK); where LN = natural logarithm = $\log_e(.)$.

Summary Statistics

Tables 2A and 2B provide the summary statistics of the variables in their levels and first differences, respectively. It is evident that the mean of the swap yield increases from lower maturity (2Y) to higher maturity (10Y) due to higher risk premia at longer durations. Similarly, the mean of the 6-month T-bill rate is slightly higher than the mean of the 3-month T-bill rate. There is negative skewness in swap yields and the short-term rates in the first difference series, meaning that the data exhibit a fatter tail toward the left. In the level series, the kurtosis values for swap yields and short-term rates are less than three, implying that the distributions are platykurtic with infrequent outliers. There is high kurtosis for the month-on-month percentage change in the Riksbank's balance sheet (△LNRIKSBANK), implying that the data heavily reside in the tail of the distribution. The Jarque-Bera statistics indicate that none of the variables are normally distributed in their levels or first differences.

Table 2A: Summary Statistics of the Variables

	Mean	Max	Min	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Probability	Obs.
SGB10Y	2.547	5.930	-0.290	1.761	0.081	1.710	20.28	0.0000	288
SGB5Y	2.118	5.670	-0.670	1.824	0.110	1.709	20.56	0.0000	288
SGB2Y	1.622	5.100	-0.860	1.788	0.270	1.758	22.02	0.0000	288
TB3M	1.461	4.490	-0.790	1.708	0.318	1.678	25.83	0.0000	288
TB6M	1.488	4.480	-0.780	1.731	0.315	1.674	25.87	0.0000	288
CCPIF	1.751	8.580	0.220	1.569	2.910	11.161	1205.67	0.0000	288
CPICT	1.934	12.740	-1.820	2.468	2.332	9.216	724.68	0.0000	288
IP	1.037	22.610	-22.550	6.349	-1.023	6.349	184.20	0.0000	287
LNEURSEK	2.258	2.472	2.108	0.077	0.604	2.753	18.27	0.0001	288
LNRIKSBANK	13.194	14.279	12.081	0.710	-0.153	1.745	16.68	0.0002	240
LNSTKAFFARS	5.965	6.913	4.948	0.481	0.028	2.223	7.28	0.0263	288
LNSTKH30	7.072	7.774	6.153	0.392	-0.244	2.411	7.03	0.0297	288
LNUSDSEK	2.090	2.408	1.783	0.160	0.078	1.961	13.26	0.0013	288

Table 2B: Summary Statistics of the Variables in their First Difference

	Mean	Max	Min	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Probability	Obs.
ΔSGB10Y	-0.0131	1.0300	-1.1600	0.199	-0.248	9.081	445.08	0.0000	287
ΔSGB5Y	-0.0118	0.6200	-0.6300	0.185	-0.046	4.035	12.92	0.0016	287
ΔSGB2Y	-0.0067	0.6600	-0.8000	0.187	-0.340	5.921	107.59	0.0000	287
ΔTB3M	0.0016	0.6300	-1.4600	0.167	-2.732	26.001	6683.23	0.0000	287
ΔTB6M	0.0005	0.5800	-1.5300	0.170	-2.788	28.358	8061.19	0.0000	287
ΔCCPIF	0.0152	0.8600	-0.8700	0.264	0.173	4.591	31.69	0.0000	287
ΔCPICT	0.0136	1.7400	-1.8900	0.462	-0.170	6.173	121.79	0.0000	287
ΔIP	0.0126	18.5200	-16.5000	3.738	-0.043	5.513	75.37	0.0000	286
ΔLNEURSEK	0.0009	0.0616	-0.0590	0.013	-0.085	5.294	63.28	0.0000	287
ΔLNRIKSBANK	0.0078	0.7942	-0.2953	0.072	5.299	62.953	36912.01	0.0000	239
ΔLNSTKAFFARS	0.0034	0.1360	-0.2404	0.048	-1.248	7.410	307.03	0.0000	287
ΔLNSTKH30	0.0023	0.1391	-0.2269	0.047	-1.125	6.814	234.51	0.0000	287
ΔLNUSDSEK	0.0007	0.1079	-0.0708	0.026	0.190	3.647	6.74	0.0345	287

Unit Root Tests

Tables 3A and 3B provide the unit root test results for the variables in their levels and first differences, respectively. The augmented Dickey–Fuller (ADF) test (Dickey and Fuller 1979, 1981) and Phillips–Perron (PP) test (Phillips and Perron 1988) are used to check the unit root of the time series. The null hypothesis in both unit root tests is that the series has a unit root.

The p-value statistics, as per the ADF and PP tests, indicate that none of the series, barring industrial production (IP), have a unit root in the levels. In the first differences, none of the series have a unit root.

On first differencing, all variables have a unit root. Granger causality tests were also undertaken, revealing a unidirectional causal relationship from swap yields to short-term T-bill rates.

Given that all the variables are either stationary, I(0), or integrated of first order, I(1), the autoregressive distributed lag (ARDL) approach is deemed the most appropriate for modeling the dynamics of SGB yields. The ARDL approach allows the econometric modeling of long- and short-run relationships between different time series variables. The presence of ARCH effects in the model is also tested using the ARCH LM test. These tests reveal that there were no ARCH effects in the model. Hence, the ARDL approach is germane for the econometric modeling of SGB yields.

Table 3A: Unit Root Tests and Stationarity Tests of the Variables

	ADF Test			PP Test		
	None	Intercept & Trend	Intercept	None	Intercept & Trend	Intercept
SGB10Y	-1.868*	-1.910	-1.943	-1.916*	-1.537	-1.932
SGB5Y	-1.985**	-1.783	-2.057	-1.888*	-1.066	-1.921
SGB2Y	-1.972**	-1.748	-2.169	-1.627*	-0.871	-1.829
TB3M	-1.587	-1.261	-2.013	-1.134	-0.453	-1.560
TB6M	-1.509	-1.057	-1.921	-1.176	-0.379	-1.571
CCPIF	-0.319	-2.137	-1.759	-0.551	-2.066	-1.604
CPICT	-0.738	-1.916	-1.676	-1.791*	-2.705	-2.518
IP	-3.872***	-3.954**	-3.941***	-4.974***	-5.055***	-5.064***
LNEURSEK	1.159	-2.298	-1.583	1.021	-2.080	-1.281
LNRIKSBANK	1.279	-2.536	-1.162	1.272	-2.638	-1.162
LNSTKAFFARS	0.821	-3.636**	-0.319	0.893	-3.136	-0.472
LNSTKH30	0.508	-3.723**	-0.632	0.598	-3.151*	-0.756
LNUSDSEK	0.100	-1.974	-1.718	0.199	-1.809	-1.577

Note: Significance level indicated at the: *** 1 percent level, ** 5 percent level, and * 10 percent level

Table 3B: Unit Root Tests and Stationarity Tests of First Differences

	ADF Test			PP Test		
	None	Intercept & Trend	Intercept	None	Intercept & Trend	Intercept
ΔSGB10Y	-13.406***	-13.491***	-13.433***	-13.184***	-13.165***	-13.173***
ΔSGB5Y	-11.233***	-11.339***	-11.256***	-11.155***	-11.089***	-11.167***
ΔSGB2Y	-9.608***	-9.71***	-9.607***	-9.605***	-9.616***	-9.603***
ΔTB3M	-6.604***	-6.791***	-6.592***	-9.458***	-9.642***	-9.441***
ΔTB6M	-6.903***	-7.103***	-6.891***	-9.41***	-9.50***	-9.394***
ΔCCPIF	-5.579***	-5.612***	-5.567***	-16.468***	-16.385***	-16.429***
ΔCPICT	-6.262***	-6.303***	-6.271***	-15.186***	-15.139***	-15.164***
ΔIP	-7.439***	-7.420***	-7.427***	-21.813***	-21.734***	-21.773***
ΔLNEURSEK	-12.157***	-12.199***	-12.226***	-13.886***	-13.758***	-13.786***
ΔLNRIKSBANK	-12.299***	-12.371***	-12.393***	-12.421***	-12.474***	-12.496***
ΔLNSTKAFFARS	-13.395***	-13.505***	-13.415***	-13.665***	-13.657***	-13.668***
ΔLNSTKH30	-13.599***	-13.712***	-13.593***	-13.825***	-13.869***	-13.815***
ΔLNUSDSEK	-12.051***	-12.053***	-12.032***	-12.049***	-11.975***	-12.029***

Note: Significance level indicated at the: *** 1 percent level, ** 5 percent level, and * 10 percent level

ARDL Results: Specification 1

Table 4, below, provides the estimation outputs for ARDL models using the yields of swaps of 2-, 5-, and 10-year tenors as the dependent variable in column 2, 3, and 4, respectively. After estimating the ARDL model, heteroscedasticity and autocorrelation are respectively checked using the Breusch-Pagan-Godfrey test and Breusch-Godfrey serial correlation LM test. Since the data are heteroscedastic, heteroskedasticity- and autocorrelation-consistent (HAC) estimators are used for calculating the standard errors.

Upon estimating the ARDL model, cointegration in the level series is checked using the long-run form and bounds test. If the variables are found to be cointegrated, both short- and long-run models (error correction form) are specified.

Cointegration Test

The null hypothesis of the cointegration test is that there are no integrating equations, while the alternative hypothesis is a cointegrating equation.

If the F-statistic calculated from the bounds test is greater than I(1) [the upper bound], the null hypothesis of no integration is rejected and the long-run error correction form is estimated; if the F-statistic is less than I(0) [the lower bound], the null hypothesis is not rejected. However, for F-statistic values between I(0) and I(1), the test is inconclusive.

Table 4: ARDL Models of Swap Yields

	SWAP2Y	SWAP5Y	SWAP10Y
Main equation			
AR(1)	1.435***	1.205***	1.029***
	(0.096)	(0.072)	(0.157)
AR(2)	-0.490***	-0.305***	-0.175
	(0.091)	(0.069)	(0.135)
TB3M	0.014	0.249***	0.303***
	(0.027)	(0.080)	(0.078)
TB3M(-1)	-	-0.216***	-0.273***
		(0.077)	(0.077)
CCPIF	0.040***	0.046***	0.061***
	(0.011)	(0.012)	(0.020)
IP	0.003**	-0.001	-0.003
	(0.001)	(0.002)	(0.002)
ΔLNRIKSBANK	0.198	-0.020	0.031
	(0.191)	(0.154)	(0.132)
ΔLNEURSEK	-1.124*	-2.055***	-2.422**
	(0.658)	(0.741)	(0.980)
ΔLNSTKH30	0.497	0.521	0.197
	(0.387)	(0.399)	(0.457)
Intercept	0.111*	0.333***	0.622***
	(0.057)	(0.086)	(0.193)
@TREND	-0.001**	-0.002***	-0.003***
	(0.000)	(0.000)	(0.001)
Cointegrating equation			
Long-term coefficient	0.252	0.332***	0.204**
	(0.379)	(0.124)	(0.098)
Rate of adjustment		-.100***	-0.145***
		(0.000)	(0.030)
Model information			
Obs.	238	238	238
Adj. R^2	0.99	0.99	0.98
AIC	-0.89	-0.89	-0.55

	SWAP2Y	SWAP5Y	SWAP10Y
Diagnostic tests			
Joint significance	2517.178***	2401.115***	1546.963***
F-test	(0.000)	(0.000)	(0.000)
Serial correlation			
Durbin-Watson statistic	1.99	1.94	1.77
Breusch-Godfrey LM test	0.114	1.871	2.177
	(0.892)	(0.156)	(0.116)
Heteroscedasticity			
Breusch-Pagan-Godfrey test	3.092***	2.957***	8.092***
	(0.002)	(0.002)	(0.000)
Normality test	162.854***	16.395***	979.312***
Jarque-Bera statistic	(0.000)	(0.000)	(0.000)
Stability diagnostic			
Ramsey RESET test	0.261	0.163	0.184
	(0.771)	(0.849)	(0.832)

Note: Significance level indicated at the: *** 1 percent level, ** 5 percent level, and * 10 percent level

The maximum number of lags for the dependent variable and dynamic regressor (3-month T-bill rate) is specified as 3. A 100–basis point increase in the 3-month T-bill rate increases the 10-year swap yield by 30 basis points and the 5-year swap yield by about 25 basis points. However, the 3-month T-bill rate is not found to have a statistically significant impact on the 2-year swap yield. The impact attenuates from higher-tenor to lower-tenor swaps.

In addition to the 3-month T-bill rate, the inflation rate and euro–krona exchange rate are also found to be statistically significant. A higher level of inflation is associated with a higher swap yield, and a higher exchange rate (weaker krona) is associated with a lower swap yield.

However, the lagged impact of the 3-month T-bill rate on the swap yield is found to be negative. This impact is smaller in magnitude compared to the contemporaneous impact and is indicative of a reversion to the trend.

The coefficients in the long-run error correction model are slightly different from those in the short-run model. The results of the long-run form and bounds test reveal that there is no cointegration for the model when using the 2-year SGB yield as the dependent variable.

The Breusch-Godfrey serial correlation LM test indicates that the residuals are not autocorrelated (which means a failure to reject the null hypothesis of zero autocorrelation). The results of the Breusch-Pagan-Godfrey test reveal that the residual terms are heteroscedastic (p-values are less than the significance level, hence we reject the null hypothesis of homoscedasticity). Therefore, HAC standard errors and covariances are used. The Jarque-Bera test statistics indicate that the residuals are not normally distributed (as p-values are less than the significance level, the null hypothesis—that the error terms are normally distributed—is rejected).

The results of the Ramsey RESET test indicate that, for the estimated models, the null hypothesis of correct specification cannot be rejected.

ARDL Results: Specification 2

In the second specification, the independent variables are replaced as follows: 3-month T-bill rate with 6-month T-bill rate, CCPIF with CPICT as a measure of inflation, EURSEK with USDSEK, and STKH30 with STKAFFARS, while other variables are kept unchanged.

The 6-month T-bill rate is found to have a statistically significant positive impact on the swap yields for the 10-year and 5-year maturity tenors. However, the measure of inflation no longer remains significant in the 10-year swap yield specification. The euro–krona exchange rate has a negative effect on the swap yield; it is statistically significant for the 10- and 5-year swaps but not for the 2-year swap. Furthermore, the long-run form and bounds test indicates that there is no cointegration among the variables since the F-statistic was found to be less than I(0) [the lower bound]. Therefore, only the short-run ARDL model is specified. The results are provided in Table 5, below.

Table 5: ARDL Models of the Swap Yield with Alternative Variables

	SWAP2Y	SWAP5Y	SWAP10Y
Main equation			
AR(1)	1.438***	1.203***	1.054***
	(0.111)	(0.071)	(0.173)
AR(2)	-0.483***	-0.269***	-0.141
	(0.101)	(0.071)	(0.162)
TB6M	0.116	0.385***	0.483***
	(0.103)	(0.081)	(0.089)
TB6M(-1)	-0.109	-0.485***	-0.637***
	(0.085)	(0.109)	(0.140)
TB6M (-2)		0.119*	0.174*
		(0.064)	(0.103)
CPICT	0.019***	0.019*	0.019
	(0.006)	(0.009)	(0.012)
IP	0.001	-0.002	-0.004*
	(0.001)	(0.002)	(0.002)
ΔLNRIKSBANK	0.265	0.118	0.165
	(0.190)	(0.172)	(0.185)
ΔLNUSDSEK	-0.516	-1.150**	-0.956*
	(0.408)	(0.541)	(0.556)
ΔLNSTKHAFFARS	0.495	0.581	0.293
	(0.353)	(0.378)	(0.442)
Intercept	0.107*	0.221**	0.352*
	(0.061)	(0.088)	(0.186)
@TREND	-0.000**	-0.001**	-0.001*
	(0.000)	(0.000)	(0.001)
Model information			
Obs.	238	238	238
Adj. R^2	0.99	0.99	0.98
AIC	-0.87	-0.90	-0.53
Diagnostic tests			
Joint significance	2224.813***	2224.707***	1382.654***
F-test	(0.000)	(0.000)	(0.000)
Serial correlation			
Durbin-Watson statistic	1.99	1.96	1.83
Breusch-Godfrey LM test	0.129	1.064	0.082
	(0.879)	(0.347)	(0.921)
Heteroscedasticity			
Breusch-Pagan-Godfrey test	2.980***	3.943***	8.461***
	(0.002)	(0.000)	(0.000)
Normality test			
Jarque-Bera statistic	211.197***	18.054***	1270.87***
	(0.000)	(0.000)	(0.000)
Stability diagnostic			
Ramsey RESET test	0.650	0.315	0.473
	(0.523)	(0.730)	(0.624)

Note: Significance level indicated at the: *** 1 percent level, ** 5 percent level, and * 10 percent level

CUSUM and CUSUMSQ Tests

The CUSUM test and CUSUMSQ test (Brown, Durbin, and Evans 1975) provide, respectively, an assessment of instability in the estimated equations and the variance of the regression errors. These models are stable as per the CUSUM test. There is, however, a structural break observed as per the CUSUMSQ test. Hence, the swap yields of the three maturities have been modeled using the breakpoint least-squares approach; these results are available upon request.

SECTION V: IMPLICATIONS

The results of the estimated ARDL models show that the Riksbank's monetary policy actions can sway long-term government bond yields of different maturity tenors. The Riksbank primarily uses its main policy rate to steer the overnight rate. It also uses other complementary rates in conjunction with the overnight rate to affect the short-term interest rate, such as: (1) the deposit rate, that is, the rate on its deposit facility; (2) the loan rate, that is, the rate on its loan facility; and (3) the liquidity facility rate, that is, the rate on its supplementary liquidity facility.

While the Riksbank's main objective is to attain its inflation target, the overnight rate and other assorted policy rates affect the short-term interest rate. In turn, the short-term interest rate has a pronounced effect on long-term SGB yields of different maturity tenors. This means that the Riksbank has substantial sway over the country's financial system and the value of financial assets denominated in the Swedish krone, as long-term SGB yields affect the borrowing costs and lending rates for agents in the Swedish economy, including households, businesses and corporations, local and regional governments, and the central government. It also means that the Riksbank can have notable influence on financial stability through its overnight rate, as changes in the overnight rate affect the long-term yields of SGBs' different maturity tenors.

The estimated models, however, also suggest that the current policy rate is not the sole factor that affects long-term interest rates. Other factors, such as the exchange rate, are relevant and usually have a statistically significant effect. A depreciation (appreciation) of the krona, whether with respect to the US dollar or the euro, is associated with lower (higher) SGB yields; the effects are often statistically significant. The lagged values of SGB yields also have an effect on current SGB yields, implying persistence in government bond yields.

SECTION VI: CONCLUSION

The estimated models show that the short-term interest rate has a statistically significant and economically meaningful effect on SGB yields in the middle and the back end of the yield curve. The short-term interest rate has a positive effect on SGB yield in the front end, but it is not statistically significant. The two different specifications show similar results. Alternative independent variables serve to confirm that the results obtained in the estimated models are robust and invariant to the choice of specific variables for a particular concept. The results show that the Riksbank's monetary policy has a material effect on SGB yields, implying that the Riksbank can sway borrowing and lending costs and can influence the borrowing and lending rates that are crucial to both the private and public sectors. The findings also strengthen the case for Keynes's insight about the relationship between long-term government bond yields and short-term interest rates by showing that this pattern also holds for SGBs. Previous research has revealed similar patterns for government bond yields denominated in major advanced currencies, such as the US dollar, British pound, Japanese yen, Canadian dollar, and the euro, as well as key emerging market currencies, such as the Indian rupee, Chinese yen, Brazilian real, and Mexican peso. While additional studies including more currencies, more data, and more advanced econometric methods would still be warranted, the fact that the dynamics of SGB yields are similar to those observed in most other financial markets, as revealed in previous studies, is propitious.

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