Staff memo

Estimating the effect of Riksbank government bond purchases on bond term premia and yields

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Contents

Summary

We find that Swedish government bond term premia covary significantly with the supply of government bonds available to market participants, both during periods when the central bank has purchased bonds and when it has not. This finding is in line with the portfolio-balance effect of large-scale asset purchases suggested by Tobin (1963). As the stock of bonds available to market participants shrinks and investors rebalance their portfolios, pricing adjusts to offer less compensation for holding interest-rate risk.

Using time-series regression analysis, we find that term premia on Swedish government bonds declined noticeably as the supply of bonds declined. Even after controlling for the state of the business cycle and international financial conditions, our estimates indicate that the Riksbank's purchases of government bonds between 2015 and 2021 depressed term premia by a total of somewhere between 0.4 to 1.0 percentage points. Pandemic purchases of government bonds during 2020 and 2021 were relatively small and explain about 0.1 to 0.2 percentage points.

The uncertainty surrounding these estimates is considerable, but the full specification including foreign and domestic financial conditions yields estimates that are roughly in line with the international consensus. Robustness tests indicate that the simple regression model estimated up until the global financial crisis in 2008 performs reasonably well out-of-sample. Similar regressions for bond yields indicate that yields are also sensitive to the supply of bonds but that other variables dominate.

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1 Term premia and bond purchases

Starting in 2015 the Riksbank made large-scale government bond purchases as a complement to traditional policy interest rate cuts when countering persistently low inflation.[2] During the corona pandemic in 2020 and 2021, bond purchases were broadened to several other asset types and complemented with a variety of different measures to provide liquidity. The policy measures during the pandemic were intended to ease the supply of credit, support low interest rates for households and companies and improve the functioning of key financing markets.

Did central bank bond purchases lower interest rates and ease financial market strains? Several methods have been proposed to assess this question. Event studies that utilise information from a short window around policy announcements are one common method to identify the effect of asset purchases on market interest rates. Event studies have found sizeable announcement effects of the Riksbank's asset purchases on bond yields (see Gustafsson 2022, Melander 2021 and De Rezende et al 2015). However, event studies can underestimate or overestimate the effects of asset purchases. To the extent that purchases are anticipated, prices adjust outside of the measurement window so that the measured effects are underestimated. But if bond yields overreact during the measurement window, unwinding much of the move in the following days and weeks, then effects will be overestimated (Hanson et al, 2021).

Alternative approaches model market interest rates at a lower frequency. Methods used in the literature include time-series regressions, yield-curve models, and dynamic-stochastic general equilibrium models of yields, premia and the macroeconomy. In this memo, we perform a two-stage analysis. We generate time-series of bond term premia and yields from a standard yield-curve model and regress these term premia and yields on plausible determinants. Our particular focus is the relationship with the supply of government bonds available for trading in the marketplace, the so-called *free float*.

Our approach is similar to that of Backus and Wright (2007) and Gagnon et al. (2011) for the U.S. and is motivated by the portfolio-rebalancing channel of large-scale asset purchases. Central bank purchases reduce the supply of government bonds available to investors and increase the supply of central bank reserves. To the extent that investors treat these reserves and government bonds as imperfect substitutes, for example due to regulatory requirements, investors bid up the price and down the yield on the remaining bonds in the marketplace. According to this channel, central bank purchases which reduce the *free float* drive a decline in the term premium – the premium for holding interest-rate risk – which lowers bond yields all else equal.

Assessing the impact of the pandemic policy measures on bond yields and premia is further complicated by the fact that bond purchases were announced and implemented in an environment of financial market stress when other policy measures

[2] See Andersson et al. (2022) for a thorough discussion of the Riksbank's asset purchases.

were also being implemented. Our estimate of the effect of bond supply may be inflated if simultaneous policy measures such as interest-rate cuts or liquidity provision also depressed risk premia.[3]

2 Method and data

This memo follows the method in Gagnon et al. (2011) by regressing Swedish government bond term premia and yields on variables that represent the business cycle, financial market conditions and the *free float* of government bonds.

We estimate equations of the following type with monthly data:

$$tp_t^j = \alpha^{tp} + \beta^{tp} Z_t + \gamma^{tp} S_t + \varepsilon^{tp}{}_t$$

$$y_t^j = \alpha + \beta Z_t + \gamma S_t + \varepsilon_t$$

where tp_t^j and y_t^j are the bond term premium and yield respectively on nominal bonds with maturity j-years. Z_t consists of variables that control for the Swedish business cycle (inflation, unemployment, and the Riksbank's policy rate), foreign financial conditions (US and German government bond term premia and yields) and an indicator of domestic financial market stress. To control for the policy expectations component of bond yields, we augment the yield regressions with the slope of monetary-policy expectations one-to-two years ahead. S_t is the *free float* of government bonds. The effect of the change in bond supply on bond term premia and yields is indicated by the parameters γ^{tp} and γ.

Note that the modelling strategy assumes that changes in the available supply of government bonds – whether because of changes in supply by the Swedish National Debt Office or because of purchases by the Riksbank – have the same effect on bond yields and premia.[4] This assumption allows us to estimate regressions on data prior to Riksbank's government bond purchases and then use the parameters to calculate the effect of the purchases on term premia and yields with the help of scenarios for the free float. Any effects on term premia or yields related to the signalling channel of asset purchases will not be captured in our estimates.

A further assumption necessary to avoid downward bias in our estimated parameters is that our measure of the government bond supply is exogenous with respect to the term premium and yield. In other words, the government is assumed not to respond to a lower term premium or yield by issuing more debt.

Specifically, we compare forecasts from the models for three scenarios for the free float: i) the actual path of the free float, ii) the counterfactual scenario in which the

[3] In Sweden, the Riksbank announced changes in both the policy rate and/or the policy rate forecast and asset purchases simultaneously on several occasions during the period 2015-2017. During the pandemic outbreak in March 2020, central banks and governments in Sweden and abroad introduced numerous different measures during a very short time span.

[4] Recent empirical evidence supports the existence of supply-induced portfolio balance effects, see Christensen et al. (2023).

Riksbank did not purchase bonds from 2015 onwards and iii) the counterfactual scenario in which the Riksbank did not purchase government bonds during the pandemic (see Figure 1). Comparing the term premia forecasts in these scenarios gives an indication of the effect of the Riksbank's purchases.

Regarding the free float variable, we estimate regressions with two different measures of the free float: nominal bonds only, and a combined measure of nominal and index-linked bonds. Because our analysis focuses on nominal bond term premia and yields, the nominal bond free float is the natural measure. However, changes in the total stock of Swedish government bonds may still exert some pressure on nominal yields. The measures are scaled by GDP to aid interpretation and comparability.

In the analysis that follows, we focus on the effects of government bond purchases on 10-year maturity bond term premia and yields. Yields are measured as constant-maturity zero-coupon yields. Bond term premia for Sweden, Germany and the US are derived from a Bayesian estimation of the no-arbitrage model for the yield curve presented in Adrian et al (2013). The term premia are highly correlated and illustrated in Figure 2.[5] Inflation is measured as the year-on-year change in CPIF while unemployment is the total unemployment rate (16-64 years). The measure of domestic financial market stress is calculated as the difference between the 3-month STIBOR (interbank) rate and the yield on a 3-month government bond (see Figure 3). An increase in this variable indicates greater stress in money markets and correlates with periods of financial strain.

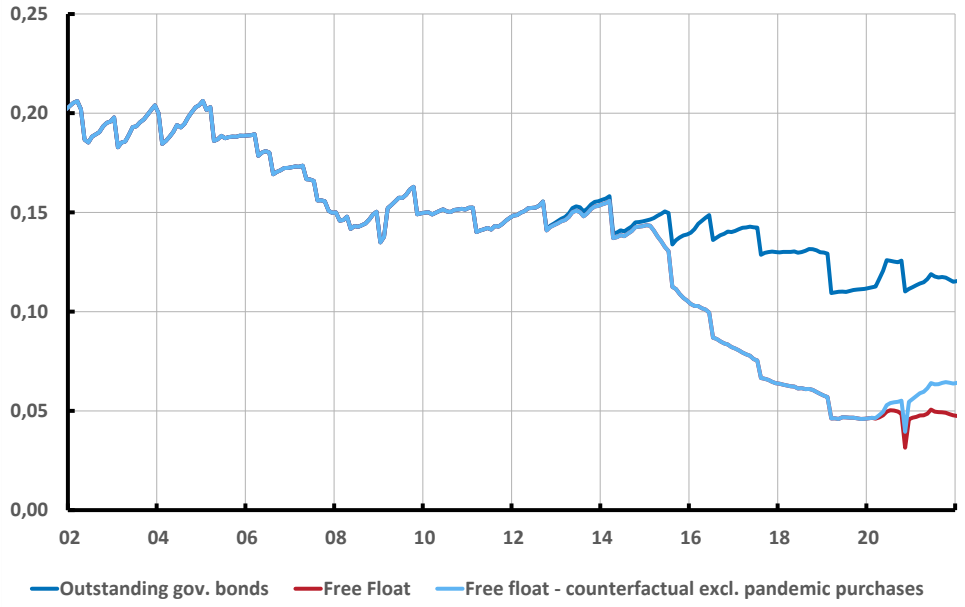
Our variable for monetary-policy expectations is the slope of instantaneous forward rates from 1 to 2 years, computed from the derivatives forward rate curve.[6] The free float of government bonds is measured as the outstanding stock of Swedish government bonds issued in Swedish kronor less the Riksbank's government bond holdings, all measured at face value. As can be seen in Figure 2, the free float as a share of GDP has trended down since the early 2000's, not because of central bank purchases but due to reduction in debt relative to GDP. The free float declined steeply from 2015 until 2019, the period during which the Riksbank purchased government bonds on a large scale.

[5] The correlation between the term premia in Sweden and Germany is 0.89 for the period 1994-2021. The corresponding correlation between Sweden and the US is 0.76. The international co-movement of term premia likely reflects global factors driving investors' required compensation for risk; see for example Jotikasthira et al. (2015).

[6] The Riksbank uses the Nelson-Siegel method to estimate the derivatives forward rate curve on a daily basis.

Figure 1. Free float of Swedish nominal government bonds

Share of GDP

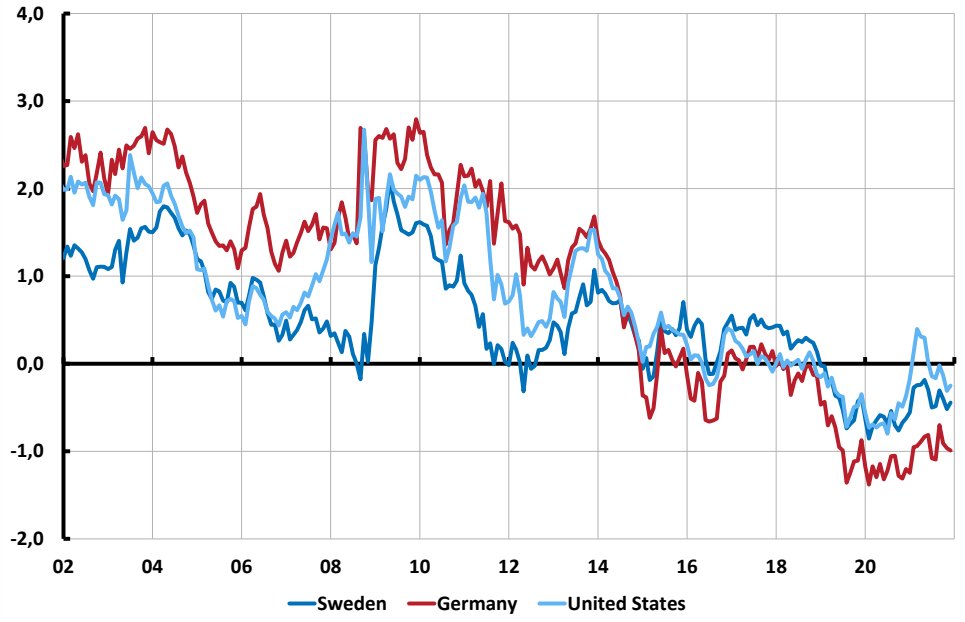


Note. The monthly series are calculated as the ratio of the outstanding nominal value of Swedish government bonds to annual nominal GDP (interpolated quarterly data scaled up to an annual rate)

Source: Swedish National Debt Office, Statistics Sweden and the Riksbank.

Figure 2. 10-year bond term premia for Sweden, Germany and the United States

Per cent

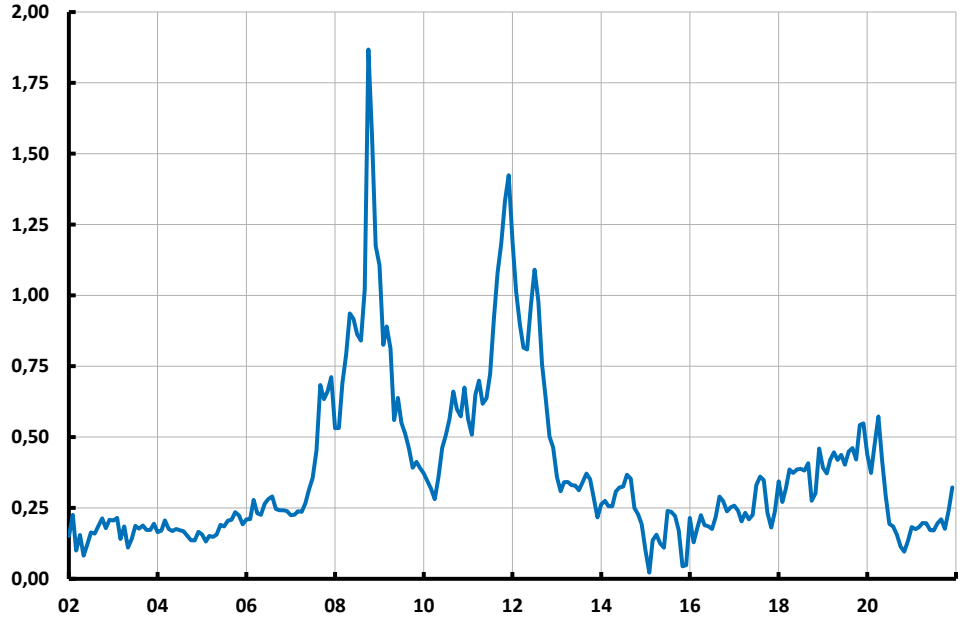


Note: Derived from a Bayesian estimation of the no-arbitrage model for the yield curve presented in Adrian et al (2013).

Source: The Riksbank.

Figure 3. Indicator of financial stress in Sweden

Percentage points



Note: The measure of domestic financial market stress is calculated as the difference between the 3-month STIBOR (interbank) rate and the yield on a 3-month government bond.

Source: The Riksbank.

Data availability restricts the estimation sample period to November 2000 to January 2015. This period ends just before the Riksbank began large-scale government bond purchases in February 2015. Estimates using the sample period November 2000 to December 2021 are qualitatively similar and are shown in the appendix.

3 Results and robustness

We focus initially on the relationship between the term premia and free float, as in Gagnon et al (2011). Table 1 reports the estimation results for several specifications and for the two different measures of the free float. Overall, the results indicate that the available supply of government bonds plays a sizeable and significant role for Swedish 10-year bond term premia, even after controlling for the business cycle and foreign and domestic financial conditions. The coefficients on the free float, marked in bold in the table, are positive, strongly significant, and economically meaningful. Having controlled for foreign financial conditions, a decline in the free float by one percentage point of GDP is associated with a decline in term premia ranging from 6 to 14 basis points (point estimates).

Tabell 1. OLS regression of 10-year nominal bond term premium

	Nominal free float			Nominal and Index-linked free float		
Specification	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	tp_t^{10}	tp_t^{10}	tp_t^{10}	tp_t^{10}	tp_t^{10}	tp_t^{10}
Constant	-2.37*	-0.44	0.85*	-2.40*	-0.50	0.65
Inflation	0.35***	+0.00	-0.01	0.34***	-0.03	-0.02
Unemployment	0.03	-0.16**	-0.18***	-0.01	-0.21***	-0.19***
Riksbank policy rate	-0.26**	-0.32***	-0.29***	-0.29**	-0.36***	-0.30***
US 10y term premium		0.62***	0.27***		0.67***	0.33***
German 10y term premium			0.46***			0.41***
Swedish 3m Treasury-bill-to-Stibor spread			-0.48***			-0.47***
Free float share of GDP, γ^{tp}	**0.18*** (0.02)**	**0.14*** (0.01)**	**0.06*** (0.01)**	**0.15*** (0.03)**	**0.12*** (0.01)**	**0.06*** (0.01)**
Adjusted R^2	0.56	0.84	0.90	0.51	0.85	0.90
S.E. of regression	0.36	0.21	0.17	0.37	0.20	0.17
Augmented Dickey-Fuller test	-3.29***	-5.08***	-6.32***	-3.03***	-5.56***	-6.39***
Number of observations	159	159	159	159	159	159

Note. Sample is November 2001 to January 2015. Newey-West standard errors in parentheses. ***, ** and * denote significance at the 1, 5 and 10 percent levels respectively.

These coefficients are economically meaningful in the sense that they imply that the Riksbank's purchases of government bonds between 2015 and 2021 (approximately 7 percent of GDP) lowered the 10-year term premium by 0.4 to 1.00 percentage points. Purchases during the pandemic were relatively small (about 1.5 percent of GDP) and lowered term premium by 0.10 to 0.20 percentage points according to the point estimates.[7]

Recall that the regressions are estimated over a sample before the Riksbank began its large-scale government bond purchases. As such, the parameters on the free float ($\boldsymbol{\gamma^{tp}}$) are estimated on changes in the supply of government bonds owing to the debt management of the Swedish National Debt Office. In Section 3.5 we test whether the relationship of term premia and yields with the free float differs since 2015.

[7] In addition to buying government bonds, the Riksbank bought significant volumes of covered bonds and municipal bonds during the pandemic. To the extent that investors viewed these bonds as close but not perfect substitutes to government bonds, portfolio rebalancing following these purchases might also have affected government bond term premia and yields.

3.1 Baseline specification

Specifications (1) and (4) represent the most scaled down version of the model, with controls for the Swedish business cycle, monetary-policy expectations and the free float. The term premium tends to rise as inflation rises, possibly reflecting higher inflation uncertainty. Term premia are found to covary inversely with the policy rate, consistent with the typical countercyclical behaviour of term premium – when the economic activity is strong and the policy rate is rising, term premia tend to decline. The coefficient on the free float is strongly significant, positive and relatively large.

3.2 Controlling for foreign and domestic financial conditions

As a small open economy with open financial markets, Swedish bond yields and term premia are strongly correlated with movements in other countries (see Figure 2). To the extent that large-scale asset purchases in other jurisdictions such as the US and euro area depressed yields and term premia abroad, this is likely to have spilled over to Swedish interest rate markets. Because of this, we control for US and German term premia in our regressions and introduce our measure of domestic financial stress.

US term premia

US 10-year bond term premia are internationally influential. They are widely thought to have been depressed somewhat by the Fed's bond purchases and likely contain a cyclical component related to the US or global business cycle. Columns (2) and (5) report the regressions augmented with this variable.

The Swedish term premium varies strongly with the US term premium – a one percentage point decline in the US 10-year term premium is associated with more than half a percentage point decline in the Swedish term premium. Despite controlling for this international factor, the coefficient on the free float is still significant and positive. The signs of the coefficients on the Swedish business cycle variables do change – inflation becomes insignificant while unemployment becomes significantly negative – but the coefficient on the policy rate is still strongly and significantly negative.

German term premia and domestic financial stress

Specifications (3) and (6) in Table 1 further augment the regressions with the estimated 10-year term premium on German government bonds and with our indicator of domestic financial stress – the spread between 3-month Stibor and the yield on the 3-month Treasury bill. Despite their tight correlation, both German and US term premia appear to play an important role for Swedish term premia. The estimated coefficient on the US term premia shrinks somewhat after adding the German data but remains positive and significant.

When the Treasury-bill-to-Stibor spread rises, Swedish bond term premia decline and the estimated effect is quite large. This may reflect flight-to-safety behaviour at times of heightened financial stress, characterised by flows away from riskier assets and into

government bonds, which depress the bond risk premium.[8] The estimated free-float coefficients are somewhat smaller having controlled for US and German bond term premia and domestic money-market stress but remain significant and meaningfully large nonetheless.

3.3 Comparison with estimates for other countries

There are many estimates in the literature of the effects of large-scale asset purchases spanning several countries but a consensus rule-of-thumb has emerged that purchases of government bond yields equivalent to 1 percent of GDP are associated with a decline of government bond yields by about 0.05 percentage points.[9]

The coefficient estimates reported in Table 1 of the effect of the free float on term premia in Sweden ($\boldsymbol{\gamma^{tp}}$) span 0.06 to 0.18 percentage points. The higher end of the results is somewhat larger than the estimates reported in Gagnon et al (2011) but the lower range of estimates based on the full specification in equations (3) and (6) are similar in magnitude to the rule-of-thumb mentioned above.

3.4 Counterfactual scenarios to illustrate the effect of the Riksbank's purchases

In this section we illustrate the effect of the Riksbank's government bond purchases on term premia with the help of counterfactual scenarios. We use the coefficients in the full specification including foreign and domestic financial conditions (column 3, Table 1) estimated up to January 2015 and compare the out-of-sample forecast conditioned on the three alternative paths illustrated in Figure 1.

a) the actual path of the free float given the Riksbank's purchases,
b) the free float, assuming that the Riksbank made no purchases of government bonds from 2015 onwards, and
c) the free float if the Riksbank made no purchases of government bonds during the pandemic and instead followed the path of bond holdings published in in Monetary policy report in February 2020.

The deviation of the forecasted term premia in scenario (b) and (c) from the baseline scenario (a) give an indication of the effect of the Riksbank's bond purchases via the free float. These are shown in Figure 4.

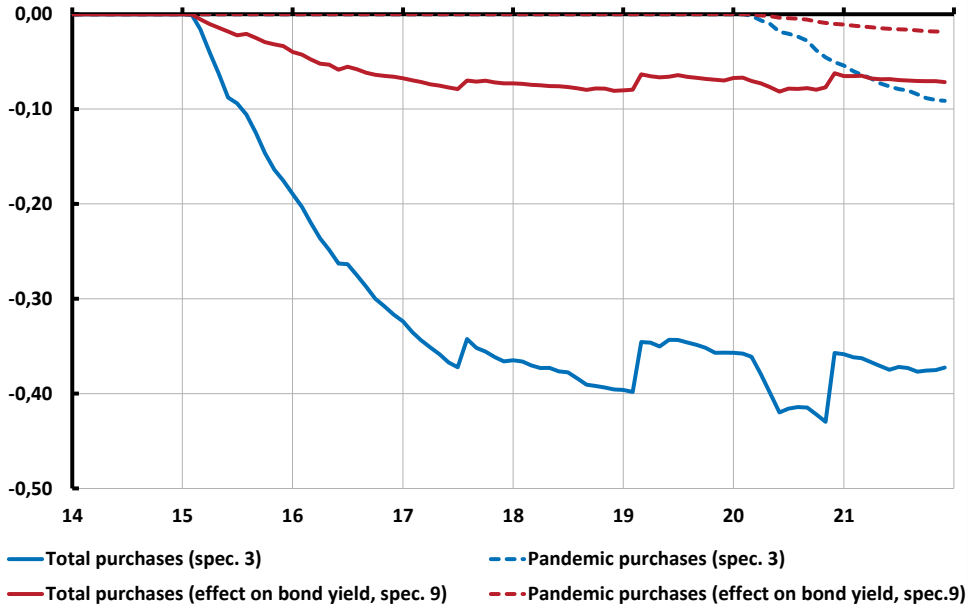
The Riksbank's purchases government bond purchases since 2015 are estimated to have reduced the 10-year term premium by about almost 0.4 percentage points while the Riksbank's bond purchases during the pandemic, which were modest in size, contributed to a 0.1 percentage point reduction in the 10-year bond premium.

[8] Coefficients are qualitatively similar for other measures of money market stress.

[9] See for example Gagnon (2016).

Figure 4. Implied effects on 10-year term premium and government bond yield of the increase in the Riksbank government bond holdings

Percentage points



Source: The Riksbank.

3.5 Robustness

To check the robustness of our results we perform some standard diagnostic tests and repeat the regression analysis using bond yields instead of term premia as the dependent variable.

Cointegration

While term premia are theoretically stationary, they do trend down persistently during the sample, as do several of the regressors. This raises the spectre of spurious regressions if the variables are not cointegrated. For each regression, we perform an Engle-Granger test of the null hypothesis that the series are not cointegrated and calculate the Augmented Dickey-Fuller statistic (shown in the tables). The null hypothesis can be rejected in all specifications.

Sample length, out-of-sample forecasting and coefficient stability

We explore the choice of the sample in three ways. Overall, we find that the regressions perform reasonably well out of sample, even after the global financial crisis of 2008; that there is little evidence of a changed relationship between term premium and the free float in the period before and during the Riksbank's asset purchases; but that the coefficient estimates tend to decline as the sample grows towards 2021.

First, we estimate the model from January 2001 to August 2008 and produce out-of-sample forecasts of bond yields and term premia. These are shown in the Diagram A1

in the Appendix. The full specification does well at capturing the development of term premia, although somewhat underestimating it in the latter parts of the sample.

We also calculate recursive coefficients on the free float (γ^{tp}) for samples beginning in November 2001 and growing to November 2021, shown in Diagram A2. The coefficient on the free float tends to decline somewhat as the sample grows beyond 2016, most notably for the specification in equation 3 with the most control variables. For the full sample up to November 2021, estimates of γ^{tp} span 0.01 to 0.15.

Finally, we estimate the equations over the full sample November 2001 to December 2021 and test whether γ^{tp} differs significantly between periods when the Riksbank did, and did not, purchase government bonds. Specifically, we interact the free float variable with a dummy variable for February 2015 to December 2021. As shown in table A1 in the appendix, the coefficients on the dummy variable are insignificant, thus rejecting the hypothesis that the relationship between the term premia and the free float differed during the period when the Riksbank purchased government bonds.

Estimating the relationship of bond yields to the free float

We repeat the regressions above with the ten-year nominal bond yield as the dependent variable and adapt the regressors in two ways. Because yields are likely to incorporate some aspect of policy expectations as well as term premia, we include the slope of 1-to-2 year monetary-policy expectations in the estimation. In place of the measures of foreign term premia, we substitute US and German bond yields as regressors. Results are shown in Table 2.

In contrast to the term premium regressions, the sign on the policy rate in the yield regressions is positive, with yields tending to rise as the policy rate rises. This likely reflects the policy-expectations component of yields. Similarly, the coefficient on the slope of policy expectations is positive and strongly significant in all specifications. The other variables controlling for the business cycle – unemployment and inflation – have a mixed relationship with yields. Higher inflation is associated with higher yields in the narrowest specification, but inflation and unemployment lose their significance when foreign bond yields are included.

Swedish bond yields exhibit a strong covariation with German bond yields, as is expected given the internationally integrated nature of Swedish financial markets. Indeed, the coefficient on German yields is larger than the coefficient on German term premia shown in Table 1, indicating that the covariation in yields is driven by additional factors than the term premia, such as covariation in the policy-rate cycle.

Covariation with US bond yields is less pronounced. The coefficient on the Swedish 3-month Treasury bill to STIBOR-spread is still large and significant, indicating that at times of financial stress, bond yields do tend to decline. Again, the coefficients are larger for the yield regressions than the term premia regressions, suggesting that declining policy expectations during periods of stress play an additional role for yield movements. The coefficients on the free float are smaller than in the term premium regressions, with point estimates spanning from zero to 0.14. As more regressors are included the significance of the free float on bond yields vanishes.

Tabell 2. OLS regression of 10-year bond yield

	Nominal free float			Nominal and Index-linked free float		
Specification	(7)	(8)	(9)	(10)	(11)	(12)
Dependent variable	y_t^{10}	y_t^{10}	y_t^{10}	y_t^{10}	y_t^{10}	y_t^{10}
Constant	0.37	-0.94	1.06	0.19	-0.66	1.31**
Inflation	0.21**	0.15**	0.06*	0.21**	0.13*	0.05
Unemployment	-0.18	0.01	-0.04	-0.22*	+0.00	-0.02
Riksbank policy rate	0.53***	0.52***	0.18**	0.51***	0.54***	0.21***
Slope of policy expectations	1.29***	1.0 ***	0.38***	1.30***	1.06***	0.42***
US 10y bond yield		0.43***	-0.15*		0.45***	-0.13*
German 10y bond yield			0.82***			0.82***
Treasury-bill-to-Stibor spread			-0.69***			-0.75***
Free float share of GDP, γ	**0.14*** (0.03)**	**0.05** (0.03)**	**0.01 (0.02)**	**0.12*** (0.03)**	**0.02 (0.03)**	**-0.01 (0.02)**
Adjusted R^2	0.90	0.95	0.98	0.90	0.95	0.98
S.E. of regression	0.37	0.27	0.17	0.37	0.28	0.16
Augmented Dickey-Fuller test	-4,22***	-4,23***	-5,42***	-4.19***	-4,10***	-5,52***
Number of observations	159	159	159	159	159	159

Note Sample is November 2001 to January 2015. Newey-West standard errors in parentheses.
***, ** and * denote significance at the 1, 5 and 10 percent levels respectively.

4 Concluding remarks

The literature contains several different approaches to evaluating the effects of large-scale government bond purchases on financial prices, economic activity and inflation. In this memo, we take a two-stage approach to investigate the empirical relationship between the government bond term premium and the volume of government bonds available to private investors, the *free float*.

We combine factor-model based estimates of Swedish and international bond premia with monthly-frequency regression analysis, exploiting variation in the *free float* both before and during large-scale asset purchases. Controlling for the state of the Swedish business cycle, monetary-policy expectations, foreign financial conditions and domestic financial stress we find significant effects of the free float on Swedish bond premia. Our range of estimates spans the international consensus rule of thumb and slightly larger.

The results lend support to the view that by reducing the available supply of government bonds, the Riksbank initiated a rebalancing of private investor portfolios, depressing the premia required to hold interest-rate risk. Our estimates indicate that, once we have controlled for foreign financial conditions the Riksbank's government bond purchases during the period 2015−2021 lowered term premia by somewhere

between 0.4 to 1.0 percentage points. The estimated parameters appear robust, having performed standard checks.

We identify these effects using variation in the supply of government bonds by the Swedish National Debt Office. Assuming that bond supply prior to 2015 was independent of the level, or expected level, of the policy rate, our coefficient estimates should reflect the portfolio-balancing channel of bond purchases and not the signalling channel.

It is important to note that this regression analysis does not control for the possibility that the Riksbank's government bond purchases eased financial-market stress and prevented escalation of yields and term premia during the pandemic years of 2020 and 2021. As such, the calculated effect of the pandemic government bond purchases on term premia via the free float may be an underestimate of the total effect considering all channels.

Further analysis could give additional insight. Model-based estimates of the term premia as the dependent variable in our analysis introduces uncertainty. Further robustness tests would include different estimation methods and samples for calculating term premia. Similarly, other plausible measures of financial market stress such as bond or equity market volatility could be incorporated. Given the relative short average duration of the outstanding stock of Swedish government bonds (compared to other countries), it would be worth investigating whether the portfolio-balancing channel was similarly effective for bonds with shorter maturities.

References

Adrian, T., R. Crump and E. Moench (2013), "Pricing the Term Structure with Linear Regressions," Journal of Financial Economics 110, no. 1 (October 2013): 110-138.

Andersson, B., M. Beechey Österholm and P. Gustafsson (2022), “The Riksbank's asset purchases 2015–2022”, Riksbank study, No 2, 2022.

Backus, D. and J. Wright (2007), “Cracking the conundrum” Brookings papers on Economic Activity (2007-1): 293-329.

Christensen, J. H. E., and S. Thinggaard Hetland (2023), "Passive Quantitative Easing: Bond Supply Effects through a Halt to Debt Issuance", Federal Reserve Bank of San Francisco Working Paper 2023-24.

De Rezende, R., D. Kjellberg and O. Tysklind (2015), “Effects of the Riksbank’s government bond purchases on financial prices”, Sveriges Riksbank Economic Commentary no. 13, 2015.

Gagnon, J. M. Rasking, J. Remache and B. Sack (2011), “The Financial Market Effects of the Federal Reserve’s Large-Scale Asset Purchases”, International Journal of Central Banking 7(1): 3-43.

Gagnon, J. (2016), "Quantitative easing: An underappreciated success", Policy Brief, PB16-4, Peterson Institute for International Economics.

Gustafsson, P. (2022), "An event study of the effects of asset purchases on financial prices during the pandemic", Staff Memo, Sveriges Riksbank.

Hanson, S., D. Lucca and J. Wright (2021), “Rate-amplifying demand and the excess sensitivity of long-term rates”, Quarterly Journal of Economics, 1719-1781.

Jotikasthira, C., A. Le and C. Lundblad (2015), "Why do term structures in different currencies co-move?", Journal of Financial Economics, vol 115, no 1, pp 58-83.

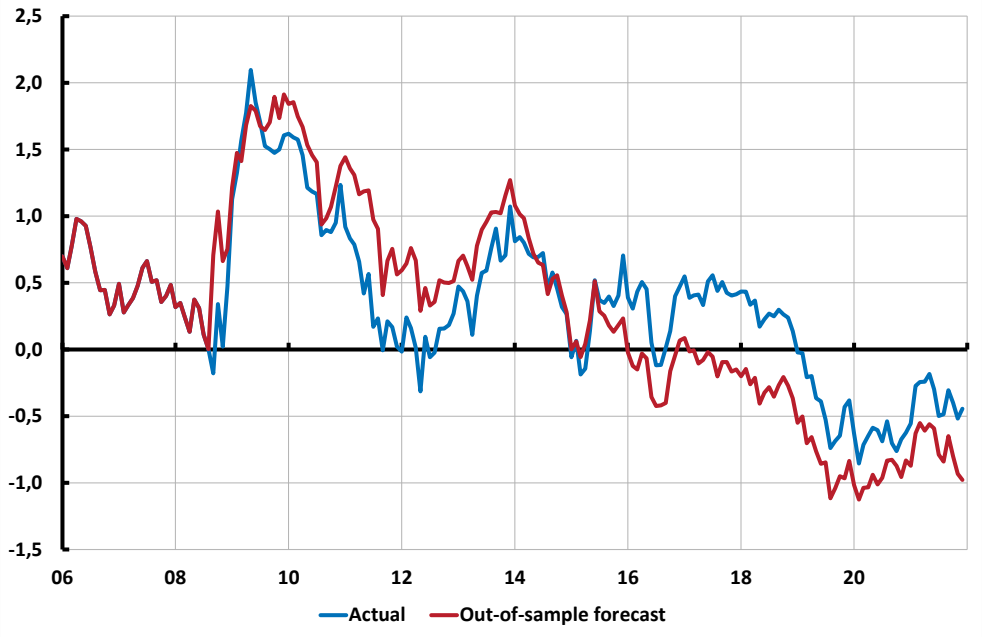
Melander, O. (2021), ”Effects on financial markets of the Riksbank’s government bond purchases 2015–2017”, Sveriges Riksbank Economic Review 2021:1.

Tobin, J. (1963), “An Essay on Principles of Debt Management”, Fiscal and Debt Management Policies, prepared for the Commission on Money and Credit, 143–218. Englewood Cliffs, NJ: Prentice-Hall.

APPENDIX – Sample length and coefficient stability

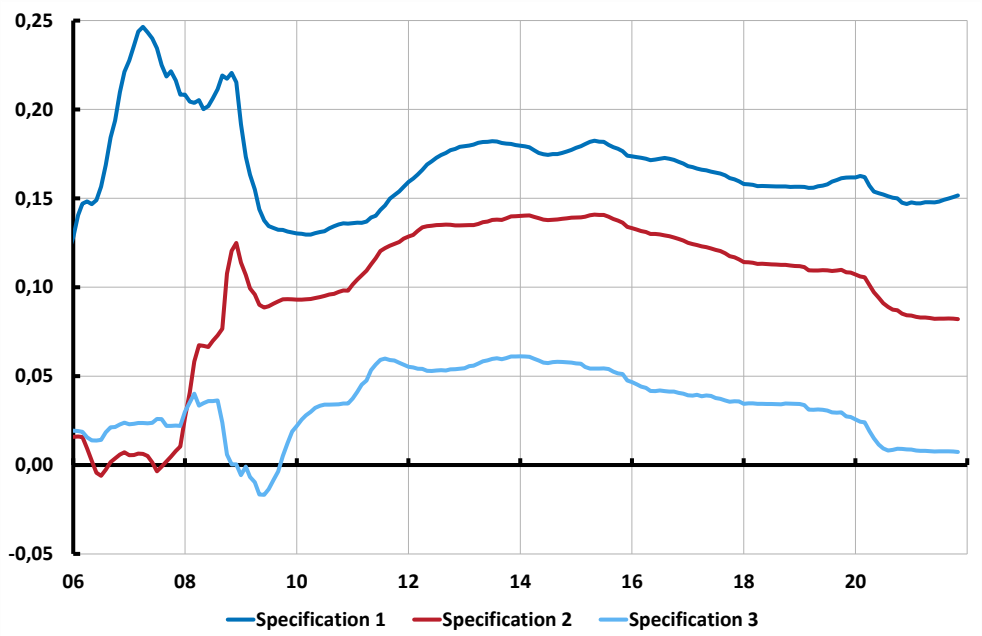
Figure A1. Out-of-sample forecast of Swedish 10-year term premium from September 2008

Per cent



Note. Specification 3, estimation sample is November 2001 to August 2008.

Figure A2. Recursive estimation of γ^{tp} in specifications 1, 2, and 3



Note. Estimation sample starts November 2001 to January 2006 and grows recursively.

Table A1. OLS regression of 10-year term premium, sample to December 2021.

	Nominal free float		
Specification	(13)	(14)	(15)
Dependent variable	tp_t^{10}	tp_t^{10}	tp_t^{10}
Constant	-0,95	0,05	0,74**
Inflation	0,30***	0,04	0,01
Unemployment	-0,06	-0,13***	-0,09***
Riksbank policy rate	-0,28***	-0,28***	-0,20***
US 10y term premium		0,58***	0,19**
German 10y term premium			0,53***
T-bill to Stibor spread			-0,67***
Free float as share of GDP, γ^{tp}	**0,14*** (0,02)**	**0,09*** (0,02)**	**0,01 (0,01)**
Dummy on γ^{tp} 2015 - 2021	**-0,19 (0,23)**	**0,14 (0,23)**	**0,17 (0,12)**
Adjusted R^2	0,73	0,86	0,94
S.E. of regression	0,34	0,24	0,16
Augmented Dicky-Fuller test	-4,11***	-4,85***	-7,77***
Number of observations	242	242	242

Note. Sample is November 2001 to December 2021. Newey-West standard errors in parentheses. ***, ** and * denote significance at the 1, 5 and 10 percent levels respectively.

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