Staff memo

What drives variable mortgage rates?

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SVERIGES RIKSBANK

Contents

Summary

In comparison to other advanced economics, Swedish households on average have large loans in relation to their incomes, with mortgages representing over 80 percent of the loan volume. In addition to high indebtedness, the interest rate fixation of these mortgages are short. Approximately 65 percent of these mortgages have a fixation period of up to 3-months. These conditions together imply a strong cash-flow channel of monetary policy to the extent that changes in the Riksbank's policy rate corresponds to changes in the so called variable or 3-month mortgage rate.

In this memo, we discuss the pass-through of the Riksbank policy rate to the variable mortgage rate by using an analytical framework. The framework shows that the pass-through from the policy rate to the mortgage rate is conditional on the funding structure of banks. This have changed overtime.

One main prediction of the framework is that if the amount of deposit financing that banks use to provide mortgages increases, the pass-through is lower. This prediction is consistent with the actual pass-through of the policy rate to the mortgage rate in various periods over the last two decades where the Riksbank have increased or decreased its policy rate.

Other than actual changes in the policy rate, the framework shows that risk premia of covered bonds and bank interest margin requirements could also drive the variable mortgage rate.

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1 Introduction

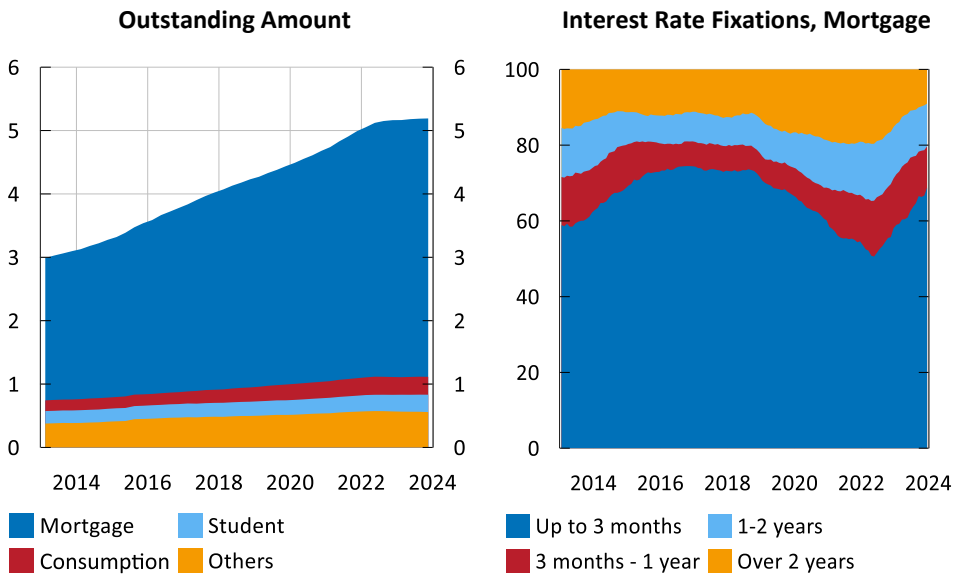
The surge in inflation after the Covid-19 pandemic has led many central banks, including the Riksbank, to pivot from an extended period of ultra-loose monetary policy to the most contractionary tightening cycle since the Global Financial Crisis. This tightening of monetary policy impacts the economy through various channels, including the so called interest rate and cash-flow channels – that is through the borrowing rates and debt service costs that households and firms are exposed to.

The cash-flow channel and particularly the borrowing costs faced by households is important for the Riksbank's monetary policy transmission. This is because the main policy instrument of the Riksbank is the policy rate and given that; **(i)** households in Sweden are relatively highly indebted and **(ii)** a significant portion of this debt have short and variable rate mortgages; the ability for the Riksbank to steer the variable mortgage rate through its policy rate is crucial for slowing demand, which then translates to cooling inflationary pressures.

This paper focuses on the first stage of the Riksbank's monetary policy transmission – that is how the policy rate impacts the borrowing costs faced by households, with exclusive focus on the 3-month or so called variable mortgage rate that more than half of all Swedish household debt is based on (see figure 1).

Figure 1. Household debt

1,000 billion SEK (right) and percent (left)



Notes: The figure shows stock of outstanding loans from monetary and financial institutions (MFI) and student loans from the Swedish Board of Student Finance (CSN). The right panel shows total outstanding loan amounts by type. The left panel shows the distribution of housing loans by interest rate fixations. Data until December 2023.

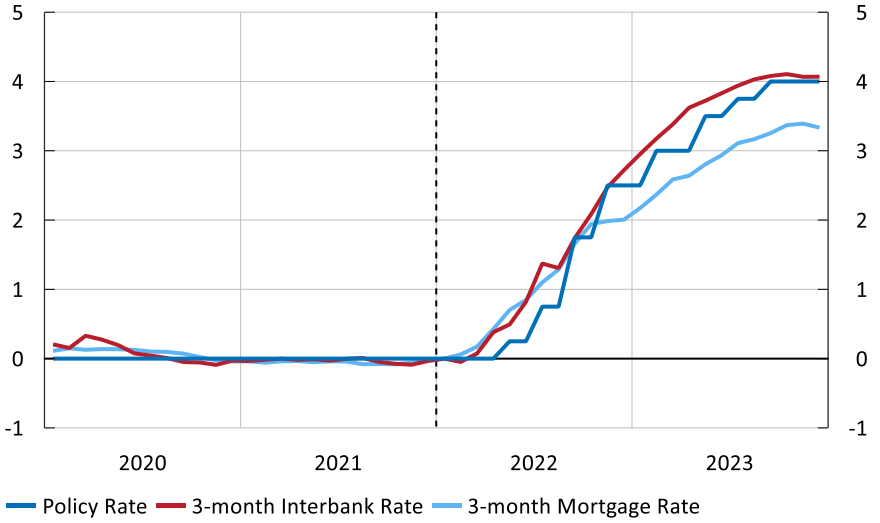
Sources: Statistics Sweden (Financial Market Statistics)

The relationship between policy rates and lending rates is not straightforward. For example, Illes, Lombadi and Mizen (2015) argue that it is misleading to directly compare policy rates to lending rates since banks do not obtain all of their funding at the policy rate. This implies that results in banking models (see, for example, Monti, 1971; Klein, 1972; Freixas and Rochet, 2008) where lending rates follow the marginal interest rate in the economy (for example the policy rate) one-to-one are not applicable in an environment where bank funding is diverse.

Consequently, we develop an analytical framework based on Eidestedt, Forsman and Ünlü (2020) where the variable mortgage rate is a function of the overall funding cost of banks rather than the marginal interest rate, which is usually the policy rate or interbank rate in traditional banking models. We use the framework to **(i)** decompose and operationalize various factors that influence the variable mortgage rate and **(ii)** understand the monetary policy transmission mechanism.

Figure 2. The variable mortgage rate and marginal interest rates

Percentage points



Notes: The figure shows the change in various interest rates relative to their level in January 2022.

Sources: The Riksbank, Statistics Sweden, Macrobond

The framework implies that three factors determine the variable mortgage rate: a policy rate factor, a risk premium factor and a loan mark-up. The policy rate factor is used to understand the transmission of monetary policy to the mortgage rate and our findings show that the strength of transmission is conditional on the **(i)** amount of deposit financing that banks use to provide mortgages and **(ii)** sensitivity of the deposit rate to the policy rate.[2] The framework analytically shows that if all bank funding was done at

[2] These predictions are similar to Drechesler, Savov and Schnabl (2007) who find that the deposits channel can account for the entire transmission of the Fed's monetary policy through bank balance sheets.

the policy rate, then the transmission would be one-to-one as would be predicted in traditional banking models.[3]

In addition to showcasing the analytical implications of the framework, it is used to discuss the actual pass-through of the Riksbank's policy rate to the variable mortgage rate across various policy cycles over the past two decades. Compared to previous cycles, we find the pass-through to be slightly weaker in the cycle between April 2022 to October 2023 where the Riksbank increased its policy rate from 0 to 4 percent. In the 2022 cycle, the pass-through was computed to be around 0.8 while it was on average 0.93 in prior cycles. We show that the pass-through predicted by the analytical framework is consistent with the actual pass-through across cycles. We argue that the relatively weak pass-through observed in the 2022 cycle can be explained by the significant increase in banks' deposit financing over the past decade.

Our work contributes to the extensive literature studying the so called pass-through of policy rates to household lending rates.[4] Estimates from a cross-country meta-analysis conducted by Gregora, Meleky and Meleky (2019) find that on average, a 1 percentage point increase in policy rates lead to a 0.8 percentage point contemporaneous increase in lending rates across a panel of countries. The analysis also discusses the various factors that could impact this pass-through and finds that when controlling for country-specific macro-financial and institutional factors, the estimate declines to 0.6 percentage points.

Beyer et. al (2024) study the pass-through of policy rates to lending rates in 30 European countries. They find the pass-through to mortgage rates to be weaker during the post-pandemic hiking cycle compared to previous cycles across countries. For Sweden in particular, the paper found the pass-through to the average mortgage rate on new loans to have decreased from 0.88 in previous periods to 0.77 in the post-pandemic hiking cycle. We find similar results in terms of the pass-through to the variable mortgage rate, but we take an additional step by providing an explanation for why this have been the case.

The rest of the memo is structured as follows: Section 2 resents the analytical framework. Section 3 operationalizes the factors in the framework. Section 4 discusses the monetary policy transmission mechanism according to the framework, and the section 6 concludes.

2 An analytical framework for the variable mortgage rate

The analytical framework departs from standard results in bank intermediation models where the lending rate set by a profit maximizing bank is a function of its funding

[3] This is based on the assumption that risk premia does not systematically move as a result of changes in the policy rate. See page 8 for this discussion.

[4] The term pass-through refers to how sensitive lending rates are to the policy rates. In the literature, this is often measured as the relative change/elasticities between lending rates on new loans to policy rates. We use a narrower definition of the pass through where we the study the relative changes between the variable mortgage rate to the policy rate.

cost and a mark-up. One key difference between this framework and standard theoretical models, for example, Monti-Klein, is that we assume this cost to be a composite rather than a single marginal rate. The so called composite rate is the weighted average cost of deposits and market debt funding, with respective outstanding amounts on the bank's balance sheet used as weights.

In the absence of financial market frictions, our framework stipulates that the mortgage rate set by a bank follows

$$M_t = \omega_t F_t^{Depo} + (1-\omega_t) F_t^{Market} + \alpha_t \,, \tag{1}$$

where $0 \geq \omega_t \geq 1$ is the share of deposits on the bank's balance sheet, F_t^{Depo} and F_t^{Market} are the cost, expressed as an interest rate, of obtaining funds through deposits and the financial markets respectively, and α_t is a margin.

The bank obtains deposits by providing term and on-demand deposit accounts to its customers and it receives market funding through covered bonds issued to investors in the capital markets. Compared to deposits, covered bonds usually have longer maturities to ensure a stable funding source for the bank. We assume that the return demanded by investors for providing the bank with funding through a covered bond with a $i \in I$ maturity is

$$F_t^i \equiv E_t^i + \rho_t^i \,, \tag{2}$$

where E_t^i is the average expected short rate over the maturity of the bond and ρ_t^i is the risk premium, also called the spread, demanded by the investor to compensate for credit, term and other risks involved in investing in the bond.

Following Eidestedt, Forsman and Ünlü (2020), we assume that banks match the duration between the covered bonds issued and the mortgage provided in order to manage interest rate risk.[5] For the 3-month mortgage, this implies that banks swap the covered bonds to a 3-month rate through derivative contracts. Let E_t^3 be the 3-month rate and assume that the banks incur no hedging costs, we use equation (2) and our hedging assumption to reformulate equation (1)

$$\begin{aligned} M_t = {} & \omega_t F_t^{Depo} + \cdots \\ & (1-\omega_t)\left[\sum_{i \in I} w_t^i \left(E_t^i + \rho_t^i + \underbrace{\left[E_t^3 - E_t^i\right]}_{swap} \right)\right] + \cdots \\ & \alpha_t . \end{aligned} \tag{3}$$

[5]The interest rate and payments of a variable mortgage loan is reset at various periods implying that all the future cash-flows from this loan are not known in advance by the bank. To reduce this risk, the bank hedges its funding so that the loan it provides is exposed to the same interest rate risk as its funding to ensure that the inflows from the loans with the outflows from financing the loans are matched. If it was the case that the bank provided a fixed rate mortgage loan where the interest rate and payments are all known in advance, then it would not be necessary to hedge.

We introduce the policy rate E_t^{Policy} in the framework by establishing the relationship that the deposit rate set by banks follows $F_t^{Depo} = E_t^{Policy}\mu_t$ where the sensitivity of the deposit rate to the policy rate $0 \geq \mu_t > 1$.[6] By adding and subtracting the policy rate E_t^{Policy} from equation (3), we have that

$$\begin{aligned} M_t \quad = \quad & [1 + \omega_t(\mu_t - 1)]E_t^{Policy} + \cdots \\ & (1 - \omega_t)\left(\tau_t + \sum_{i \in I} w_t^i \rho_t^i\right) + \cdots \\ & \alpha \quad , \end{aligned} \tag{4}$$

where $\tau_t = E_t^3 - E_t^{Policy}$ is the spread (risk premia) between the policy rate and the 3-month market rate.

The results in equation (4) shows that the mortgage rate is driven by a:

i. **Policy rate factor:** $[1 + \omega_t(\mu_t - 1)]E_t^{Policy}$,
ii. **Risk premium factor:** $(1 - \omega_t)\left(\tau_t + \sum_{i \in I} w_t^i \rho_t^i\right)$,
iii. **Margin factor:** α_t.[7]

For simplicity, we assume that the risk premium and margin factors are idiosyncratic to the policy rate E_t^{Policy}.[8] With this simplifying assumption, we define the pass-through of the policy rate to the mortgage rate as

$$\frac{dM_t}{dE_t^{Policy}} = 1 + \omega_t(\mu_t - 1) \tag{5}$$

The result in equation (5) contains three analytical propositions:

1. The pass-through from the policy rate to mortgages rate is unity when banks only use market funding to provide mortgages. The share of deposits $\omega_t = 0$ when banks only use market (covered bond) funding and this implies that the pass-through is 1 ;

2. the pass-through of the policy rate to the mortgage rate increases when the sensitivity of the deposit rate to the policy rate increases. The sensitivity of

[6] The deposit rate banks charge to households cannot be less than 0 but the policy rate can be negative. We set a zero lower bound restriction $E_t^{Policy} = \max(0, E_t^{Policy})$ when using this rule to ensure this.

[7] The policy rate and policy rate factor should not be confused. The policy rate refers to the actual Riksbank policy rate while the policy rate factor is a confounding factor in the relationship between the policy rate and mortgage rates.

[8] This follows from our definition of risk premia: the portion of the covered bond yield and 3-month market rate that is beyond the current and expected short interest rate (i.e. policy rate) (see equation 2). Although risk premia could systematically move with expected levels of the policy rate, we assume credit market perfection and that the so called credit channel of monetary policy is shut down. If we assumed otherwise, then a tightening in monetary policy for example, would increase both expectations in the short rate and external financing (risk) premium due to tighter financial constraints (see, for example, Bernanke and Gertler 1995; Bernanke, Gertler and Gilchrist, 1999). However, theories of the credit channel differ on the precise way central bank interest rate shifts influence credit constraints (see, for example, Gertler and Karadi, 2015)

the deposit rate to the policy rate is given by $0 \geq \mu_t > 1$ and when this increase, then $\omega_t(\mu_t - 1)$ increases, implying that the pass-through in equation (5) also increases;

3. the pass-through of the policy rate to the mortgage rate decreases when the share of deposit funding (market) increases (decreases) given that $0 \geq \mu_t > 1$.

The subsequent section of this paper operationalizes the components in the framework and uses equation (5) to study the transmission of the policy rate to the mortgage rate.

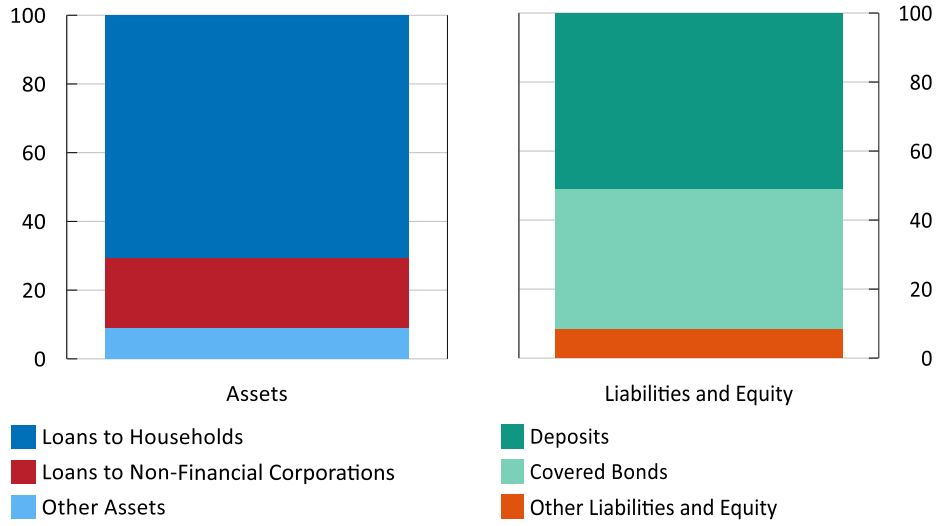
3 How do banks fund mortgages?

This section provides a brief overview of how Swedish banks fund mortgages and the cost of funding through different sources. These are used to operationalize the policy rate, risk premium and margin factors discussed in the previous section. For a more detailed overview of the Swedish mortgage market and bank funding of mortgage loans, see Sveriges Riksbank (2014).

As mentioned, banks fund mortgages loans through two main sources: deposits and covered bonds. The share of funding through deposits have almost doubled over the last decade and as of December 2023, they represent around 51 percent of total funding (see figure 1).

Figure 3. The balance sheet of a sample of mortgage institutions as of December 2023

Percent

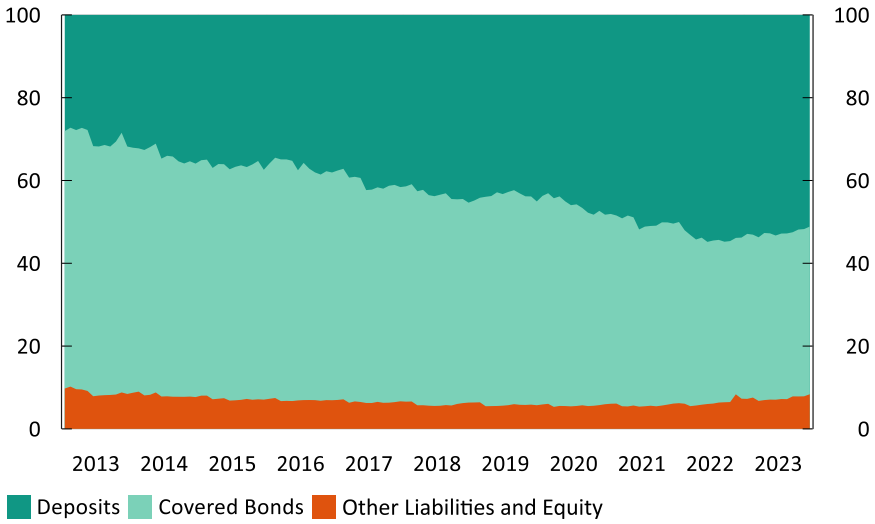


Notes: The mortgage institutions in our sample have, between 2002 and 2023, in aggregate provided roughly 62 percent of all outstanding mortgages in Sweden.

Sources: Statistics Sweden

Figure 4. The share of funding through deposits has increased

Percent



Sources: Statistics Sweden

In addition to deposits, banks also issue covered bonds and the amount of bonds outstanding is estimated to make up 41 percent of funding. Aside from these two funding sources, banks are required to hold some equity and they also assume other liabilities through for instance, unsecured bonds. These other funding sources have been stable over time and represent around 8 percent of total funding

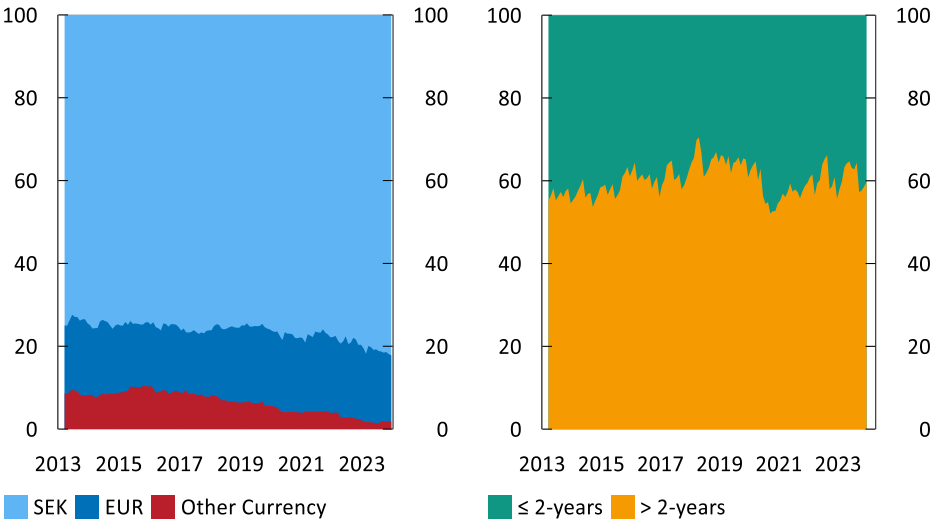
The banks issue covered bonds in SEK as well as in foreign currencies, predominantly in EUR.[9] The majority of covered bonds issued are denominated in SEK and as of December 2023, SEK covered bonds represent around 82 percent of the outstanding issuance from the institutions in our sample (see figure 5). Since 2013, the amount of SEK funding has increased relative to foreign currencies other than EUR (see figure 5). However, it should be noted that regardless of the currency that covered bonds are issued, banks could swap the borrowed foreign currency back to SEK using for example, FX swaps or cross currency basis swaps. In practice, this implies that all liabilities from covered bond issuances can be considered to be in SEK.

With regards to the current maturity structure, around 60 percent of the outstanding covered bonds issued by the mortgage institutions in our sample have maturities of more than 2-years. The majority of which mature between 4 and 5-years (see figure 5).

[9] Since most covered bonds issued in foreign currencies are in EUR, we simply refer to these as EUR bonds.

Figure 5. The outstanding stock of covered bonds

Percent



Notes: The aggregated maturity structure from a sample of mortgage institutions.

Sources: The Riksbank (SVDB Database)

The cost of funding in terms of interest rate via each source is shown in figure 6. The deposit rate is the average interest rate that banks pay to households and non-financial corporations on all deposit accounts. Compared to covered bonds, bank deposits have very short maturity. For example, between 2005 and 2023, roughly 75 percent of all household deposits where on-demand deposits while 67 percent of the remaining term deposits had an agreed maturity period of 3-months. [10]

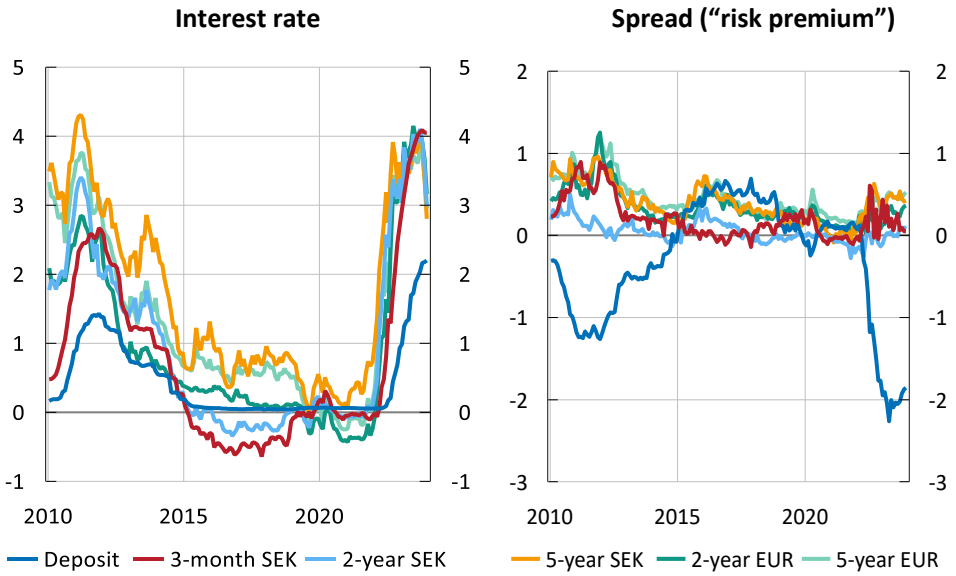
The 2-year and 5-year SEK rates are zero coupon covered bond yields computed using Nelson-Siegel-Svensson (NSS) (Nelson and Siegel, 1987; Svensson, 1994). The estimation is based on bonds issued by Stadshypotek.[11] The 2 and 5-year EUR bonds are zero coupon Pfandbriefe yields, which are triple-A German covered bond rates calculated by the Bundesbank. The Pfandbriefe usually have the similar credit quality as the SEK covered bonds and as a result, we use this to proxy for EUR funding rates of Swedish banks.[12] The EUR rates are then converted to SEK using EUR-SEK (3m vs 3m) cross-currency basis swaps over a tenure of 2- and 5-years, respectively. The 3-month SEK rate is the 3-month interbank (Stibor) rate and this is relevant for bank funding of the 3-month mortgage due to the hedging assumption in the framework.

[10] See Statistics Sweden's Financial Market Statistics

[11] Covered bond issued by Stadshypotek, but is should be noted that covered bond rates might vary between intuitions.

[12] Pfandbriefe rates are used since we do not have data on EUR denominated zero coupon covered yields of Swedish mortgage institutions.

Figure 6. The cost of funding through various sources
Percent (left) and percentage points (right)



Notes: The 2- and 5-year SEK (EUR) are cost of funding through covered bonds originally issued in SEK (EUR). The spread for covered bonds are imputed as the difference between the yields and a so called swap rates with an equivalent maturity (ρ_t in the framework). The spread for the deposit rate and the 3-month SEK are over the Riksbank policy rate (τ_t in the framework)

Source: The Riksbank, Statistics Sweden, Macrobond and Bloomberg

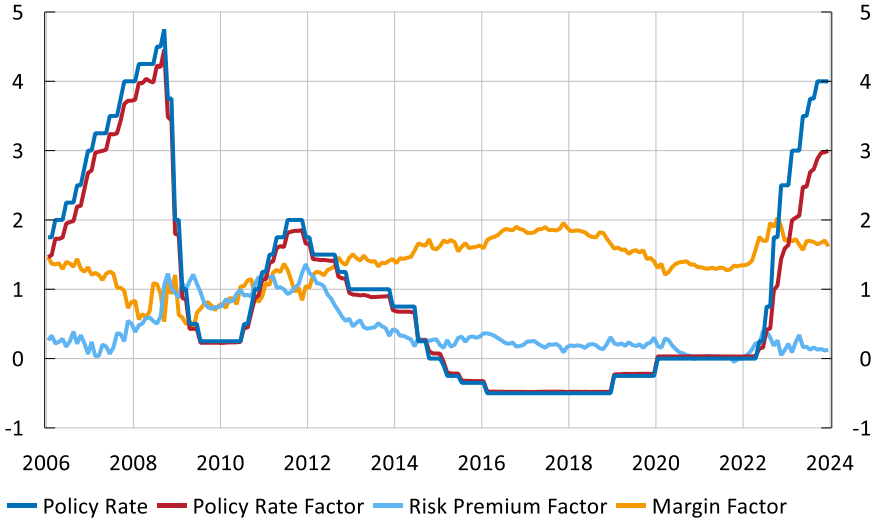
We compute swap spreads for each covered bond to get an idea of the risk premium associated with the bond. The swap spreads for the SEK bonds are computed by taking the difference between the SEK yields and so called swap rate with an equivalent maturity. The swap rates used are the market implied expected average level of the 3-month Stibor rate over various future time horizons.[13] For the covered bonds originally issued in EUR, we use swaps that reflect the average expected 3-month Euribor.

The data presented in figures 4 – 6 are used to operationalize the policy rate and risk premium factors. These are computed using the first two components of equation (4), respectively (see figure 7). The margin factor is unobserved and we compute it as the difference between the variable mortgage rate and banks funding cost, i.e. sum of the policy rate factor and risk premium factors. This is an accounting based approach of computing the margin and it is both used by Eidestedt, Forsman and Ünlü (2020) and Finansinspektionen, the Swedish FSA[14]. The loan margin is around 1.5 percent on average (see figure 7).

[13] See the article "What is a swap rate?" in Monetary Policy Report, February 2023, Sveriges Riksbank
[14] See "Bankernas bruttomarginal på bolån", Finansinspektionen

Figure 7. The policy rate, risk premium factor and margin factors

Percentage points



Sources: The Riksbank, Statistics Sweden, authors' calculations

Table 1. The underlying drivers of the factors

Factor	Underlying driver	Impact on mortgage rate
Policy rate factor	Policy rate, E_t^{Policy}	+
	Share of banks' deposit funding, ω_t	-
	Sensitivity of deposit rate to policy rate, μ_t	+
Risk premium	Risk of 3-month money market rate, τ_t	+
	Risk of covered bonds, ρ_t^i	+
Loan margin	Banks' return on equity requirements	+
	Competition	-

Notes: The last column shows how an increase in the underlying drivers would impact of the mortgage holding all else equal. A positive (+) sign means that the mortgage rate would increase and a negative (-) sign means that it would decrease.

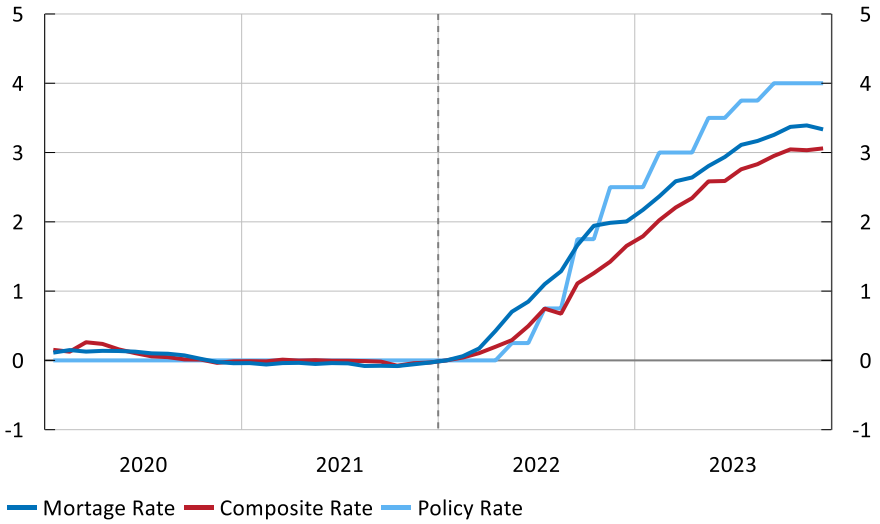
The analytical framework shows that each factor has underlying drivers. For example, the policy rate factor is dependent on the actual policy rate but also **(i)** the proportion of deposit funding that banks use to provide mortgages ω_t and **(ii)** the sensitivity of the deposit rate to the policy rate μ_t.

The risk premium factor is primarily driven by stress in credit markets and premia captured by τ_t and ρ_t^i. Moreover, it could also be the case that policy rate's level has an impact on risk premia. For example, a high interest rate environment could lead banks to devalue their assets and book higher credit losses, which in turn increases the perceived risk on their credit worthiness. In this paper, we disregard the impact of the level of the policy rate on the risk premia factor as discussed in section 2. Unlike the

policy rate and risk premium factors, the margin factor, which is an estimate of the mark-up that banks earn for providing a variable mortgage loan, is driven by structural factors, for example, regulation, return on equity requirements and competition.

Figure 8. What is driving the variable mortgage rate?

Percentage points



Notes: The figure shows the change in interest rates relative to their level in January 2022. The composite rate is sum of the policy rate factor and risk premium factor, i.e. the right hand side of equation (4) excluding the margin.

Sources: The Riksbank, Statistics Sweden, authors' calculations

Among all factors, we observe that the policy rate factor has a higher variation (in the long run) as the risk premium factor is stable over time and the margin factor moves around an average (see figure 7). Therefore, the variation in the composite rate and as a result mortgage rates is primarily due to the policy rate factor.

The remaining parts of this paper focuses on this factor and seeks to answer questions related to the pass-through of the policy rate to the mortgage rate.

4 What is the actual and predicted pass-through?

In the analytical framework, we define the pass-through of the policy rate to the mortgage rate as

$$\frac{dM_t}{dE_t^{Policy}} = 1 + \omega_t(\mu_t - 1) \qquad (6)$$

where ω_t is the share of deposit funding that banks utilize to provide mortgages loans and μ_t is the sensitivity of the deposit rate to the policy rate. The pass-through quantifies the change in the mortgage rate given a change in the policy rate and equation (6) shows that this is dependent on ω_t and μ_t.

We use equation (6) to study the pass-through of the policy rate to the mortgage rate during the recent and previous monetary policy cycles (see figure 9) by comparing the actual pass-through and the pass-through that is predicted by the framework. We follow Beyer et. al (2024) and define the actual pass-through in each policy cycle as the relative change in the variable mortgage rate to the policy rate between the start and end of each cycle:

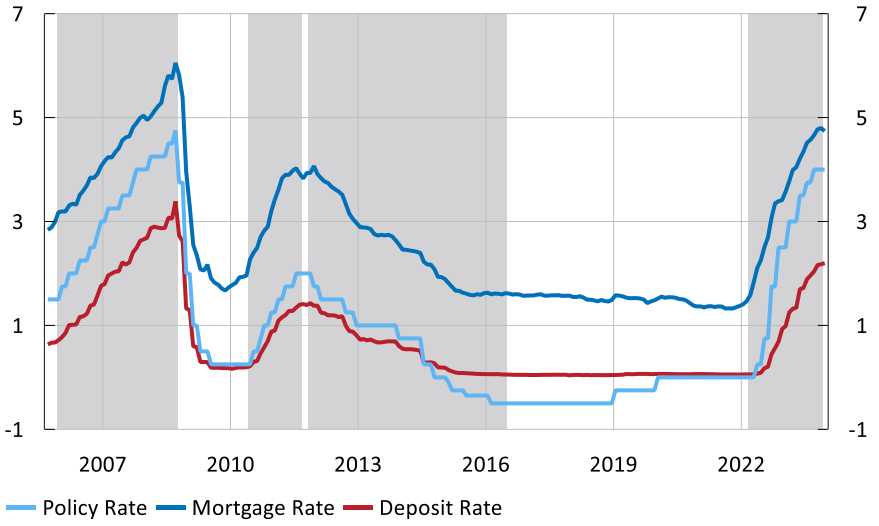
$$\frac{M_{t=cycle\ end} - M_{t=cycle\ start}}{E^{Policy}_{t=cycle\ end} - E^{Policy}_{t=cycle\ start}} \tag{7}$$

where the start of the cycle is the month before the first rate increase/decrease and the end of the cycle is the month after the most recent increase/decrease. For example, the start of the recent (2022-2023) monetary policy cycle was March 2022 as the first rate increase was in April 2022 and the end of the cycle was October 2023 given that the most recent increase, as communicated by the Rikbank in its January 2024 update, was September 2023.

The predicted pass-through in each cycle is based on equation (6) where we set ω_t as the average weight of deposit funding during the cycle (see figure 11) and μ_t the sensitivity of the deposit rate to the policy rate during the cycle (see figure 12). The sensitivity μ_t is computed using equation (7) but with the deposit rate in the numerator.

Figure 9. The Riksbank's monetary policy cycles since 2005

Percent

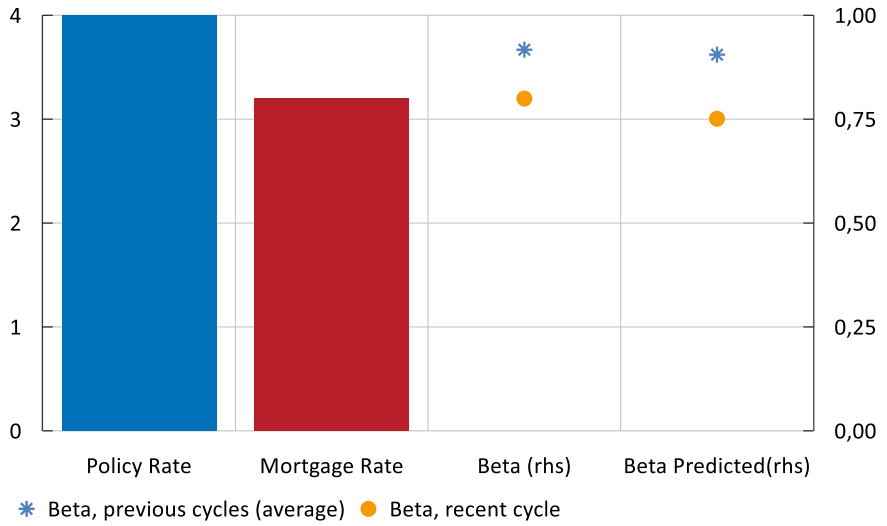


Notes: The shaded grey areas are monetary policy cycles. The analysis excludes the easing cycle that coincided with the global financial crises.

Source: The Riksbank and Statistics Sweden

Figure 10. The analytical framework can approximate the actual pass-through of the policy rate to the mortgage rate

Percentage points (lhs) and ratio (rhs)



Notes: The left axis shows change in the policy rate and mortgage rate in the recent cycle, i.e. between March 2022 and October 2023. The right axis shows both the actual and predict pass-through to the mortgage rate in the recent and previous (average) cycles. The pass-through in the previous cycles is the arithmetic average of the pre-2022 cycles.

Sources: The Riksbank, Statistics Sweden and authors' own calculations

We predict the pass-through of the policy rate to the mortgage rate using equation (6) and data on deposit funding shares and sensitivities. We find that in the recent cycle, the predicted pass-through is 0.75 while the actual pass-through is 0.80. In the past cycles, the predicted pass-through was 0.91 and the actual was 0.92.

The framework slightly underestimates the pass-through in the recent cycle and one reason for this could be that the risk premium factor is not entirely idiosyncratic to the policy rate as assumed. In practice, the risk premia on covered bonds and the 3-month market rate could systematically increase with the policy rate as mentioned. During the recent policy cycle for example, covered bond spreads increased as the policy rate was lifted from the zero lower bound (see appendix, figure 14) implying that the pass-through of the policy rate could have been slightly higher than predicted.

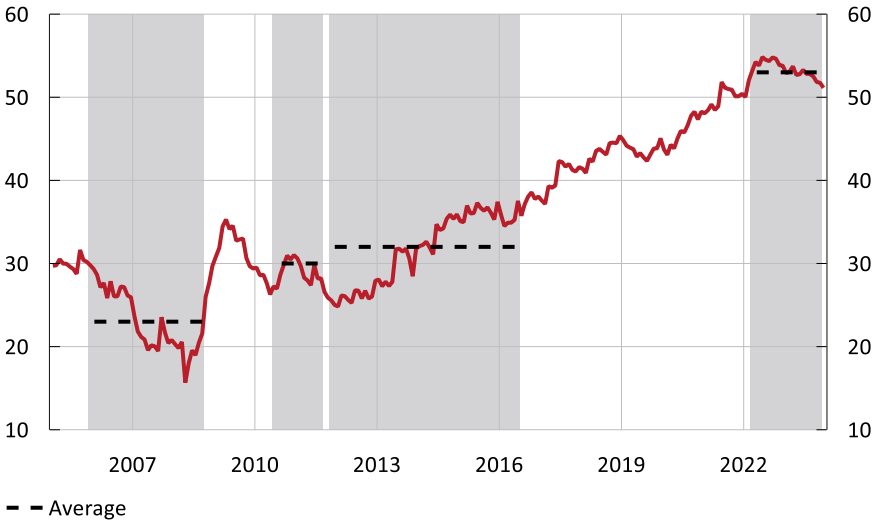
Nevertheless, the slight underestimation of the pass-through in the recent cycle does not contaminate the general message of this paper, that is: **(i)** the pass-through from the policy rate to the mortgage rate is not one-to-one and **(ii)** the financing structure of banks is an intermediate stage transmission mechanism. Most importantly, we also show that our simplied framework could approximate the pass-through of the policy rate to the most important interest rate for Swedish households.

In relation to previous monetary policy cycles, it is observed from figure 10 that the pass-through is weaker in the recent cycle. According to the framework, the pass-

through can be weaker due to two reasons: **(i)** the funding share of deposits ω_t has increased **(ii)** the sensitivity of deposit rate to the policy rate has decreased μ_t. First, there is clear evidence that the funding share of deposits have significantly increased in the recent cycle compared to the past (see figure 11). In the previous cycles, around 30 percent of mortgage funding came from deposits whereas the proportion in the recent cycle is slightly over 50 percent. The reasons why deposit funding has increased in the past decade could be due to several factors including the Riksbank's quantitative easing, credit growth and weak preference for covered bond issuances. Exploring these are beyond the scope of this paper but discussed in Andersson and Kaplan (2024).

Figure 11. The funding share of deposits has increased

Percent



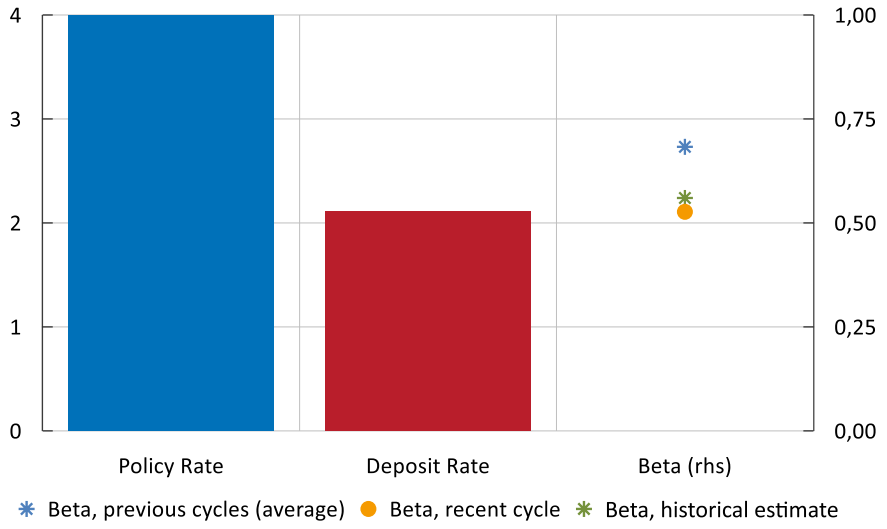
Notes: The figure shows the share of deposit funding in the balance sheet of a sample of mortgage institutions. The institutions in our sample have, between 2002 and 2023, in aggregate provided roughly 62 percent of all outstanding mortgages in Sweden.

Sources: Statistics Sweden

In addition to the increase in deposit funding, the sensitivity of the deposit rate to the policy rate has also decreased in the recent cycle compared to the previous cycles, but the sensitivity observed in the recent cycle is still in line with historical averages (see figure 12). The sensitivity of the deposit rate to the policy rate is computed to be 0.54 in the recent cycle, which is close to the historical average (0.56) that is estimated using a statistical model. The average sensitives in previous cycles is around 0.68, which is higher than the historical estimate. All in all, this reduced sensivity of the deposit rate contributed to the relatively lower pass-through of the policy rate to the mortgage rate as predicted by the framework.

Figure 12. The sensitivity of the deposit rate to the policy rate

Percentage points (lhs) and ratio (rhs)



Source: The Riksbank, Statistics Sweden and authors' own calculations

Notes: The left axis shows change in the policy rate and deposit rate in the recent cycle, i.e. between March 2022 and October 2023. The right axis shows the sensitivities of the deposit rate to the policy rate in the recent and previous cycles. The sensitivities in the previous cycles is the arithmetic average of the pre-2022 monetary policy cycles. The historical estimate of the sensitivity is based on an econometric model, see ANALYSIS BOX – The historical relationship between the policy rate and the deposit rate.

It is also important to note that the share of mortgage funding done through deposits ω_t may not be completely independent to the deposit rate and hence its sensitivity to the policy rate. For example, basic economic theory would predict that if the supply of deposits increase, then deposit rates should fall all else equal. In the cross section, we find that banks with large amounts of deposits tend to have lower deposit rates on average suggesting that the two are not entirely independent (see appendix, figure 15). One argument for why an increase in deposits could lead to lower deposit rates is that when banks have a large deposit base, it becomes more costly, in terms of interest expenses, to increase deposits rates compared to a situation where the deposit base is small.

On the other hand, it could also be argued that an increase in deposits could also lead to higher deposit rates if households and firms also increase the amount of funds that they place saving accounts which usually offer higher interest rates. This substitution channel could then offset the initial impact discussed.

ANALYSIS BOX – The historical relationship between the policy rate and the deposit rate

We estimate a linear regression in first differences using data between January 2006 to December 2023 to estimate the historical relationship between the policy rate R_t^{Policy} and the deposit rate F_t^{Depo}.

Our empirical specification is

$$\Delta F_t^{Depo} = \varphi + \hat{\mu}\Delta R_t^{Policy} + \varepsilon_t$$

where $\hat{\mu}$ is the estimate of the historical sensitivity between the deposit rate and the policy rate and ε_t is a residual term.

Table 2. The relationship between the policy rate and the deposit rate

	(1)
φ	0.00
	(0,00)
$\hat{\mu}$	0.56***
	(0,02)
Adj. R^2	0.8
Durbin-Watson	2.34
Observations	216

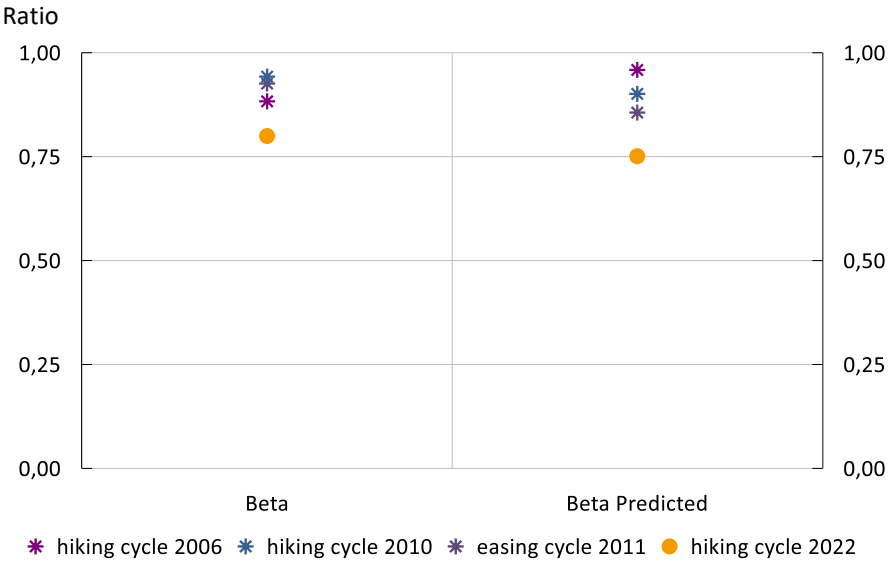
Notes: Standard deviations of the coefficients in parenthesis. * p < 0.1, ** p < 0.05, *** p < 0.01.

The estimate for μ shows that on average, a 1 percentage point increase in the policy rate leads to a 0.56 percentage point increase in the deposit rate.

The analysis presented in this section has implications for future monetary policy cycles and some issues to consider are **(i)** if the pass-through is symmetric in easing and hiking cycles **(ii)** how would deposit funding evolve as this is a key factor in the transmission mechanism.

For the first issue, we compare the 2010 – 2011 hiking cycle (2010) to the easing cycle that followed right after in November 2011 (2011). The pass-through to the variable mortgage rate during these policy cycles were qualitatively the same (0.93 and 0.94, respectively) and deposit funding were roughly the same (0.3 and 0.32, respectively) (see figure 13 and 10). If we base our assessment on this, we would argue that the pass-through is symmetric. However, this is uncertain since it is only based on two cases.

Figure 13. Is the pass-through to the variable mortgage rate symmetric in hiking and easing cycles?



Notes: Beta is actual pass-through across cycles computed using equation (7) and Beta Predicted predict pass-through is computed using equation (6).

Sources: The Riksbank, Statistics Sweden and authors' own calculations

With regards to the second question regarding bank deposit funding – one likely case is that the share of deposit funding would decrease. For example, continuation of the Riksbank's quantitative tightening and regulation could drive the supply of deposits down.[15] Given these developments, the pass-through is likely to increase in the medium and long term implying that the transmission will be relatively stronger for a given sensitivity of the deposit rate to the policy rate.

[15] See, for example, "What drove the major fluctuations in deposits between 2020 and 2023?", March 2024, Sveriges Riksbank

5 Conclusion

The transmission from policy rates to lending rates faced by households and firms in the economy is one of the channels through which central banks slow or increase demand to stabilize inflation at their desired target. The high indebtedness and degree to which Swedish households are exposed to the short and variable rate mortgage strongly argues for strength in the transmission mechanism. However, the relationship between the mortgage rate and the Riksbank policy rate is not obvious since banks do not fund mortgages at the policy rate. To gain insight of how the Riksbank's policy rate transmits to the variable mortgage rate, we develop a framework that takes various bank funding sources into consideration. We show that the mortgage rate is driven by three factors: the so called policy rate factor, risk premium factor and a margin. We have evidence that all explain movement in the mortgage rate but we observe that it is the policy rate factor that drives the variation.

We show that the transmission, quantified as the pass-through of the policy rate to the mortgage rate, is not one-to-one. The pass-through is dependent on the share of funding that banks obtain from deposits and the sensitivity of the deposit rate to the policy rate. In the recent decade, the funding structure of banks has changed with increased reliance on deposits. We show that this could explain the weaker pass-through of the policy rate to the mortgage rate in the recent monetary policy cycle in comparison to past cycles. Looking ahead, we expect the pass-through to relatively strengthen given that banks funding structure could change and our qualitative assessment that the pass-through is symmetric in hiking and easing cycles.

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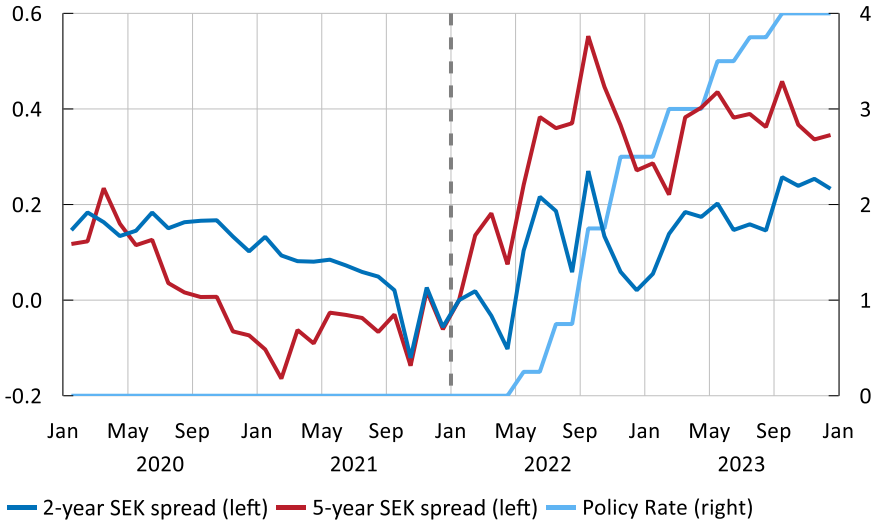
Appendix A – Additional Figures

Figure 14. The spread on covered bonds increased as the policy rate was lifted

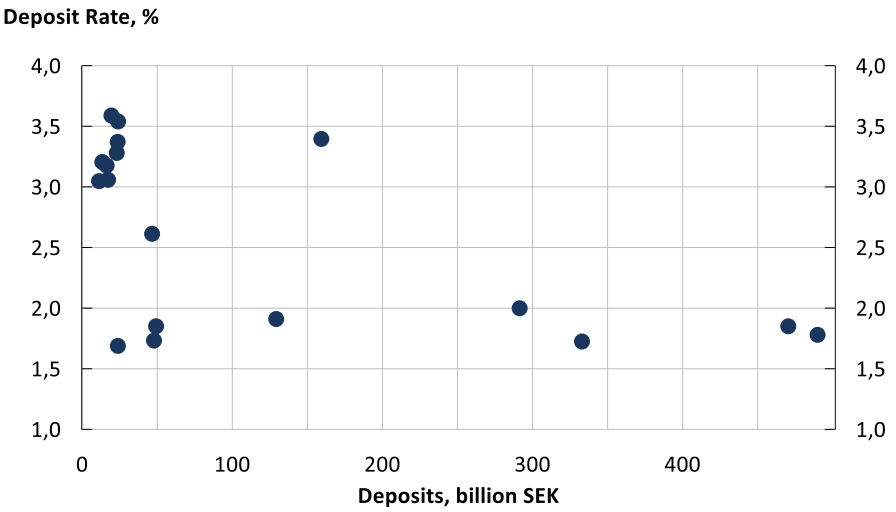
Normalized January 2022 = 0 (left) and percent (right)



Notes: The covered bond spreads are normalized so that they are 0 in January 2022.

Source: The Riksbank, Statistics Sweden, Macrobond

Figure 15. The banks with large deposit base have lower deposit rates on average



Source: The Riksbank and Statistics Sweden

Notes: The deposit rate and deposit base from cross section of banks in August 2023

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