

RETAIL CREDIT PREMIUMS AND MACROECONOMIC DEVELOPMENTS

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This article sets out to contribute to the understanding of the dynamics of retail credit premiums (i.e. the difference between reference interest rates and rates on retail loans with comparable maturities) in the Czech economy. The text documents the history of the credit premium. A model that investigates the relationship between this premium and the business cycle is then proposed, and it is shown that the current premium level can be explained to a large extent by the cyclical position of the economy. This model can be used not only as a tool for explaining the observed premium, but also to forecast the future premium, as it is linked to the variables used in the CNB's core forecasting model.

1. MOTIVATION

Money market interest rates started to fall at the start of 2009, while retail rates on loans provided by banks to households and non-financial corporations were either flat or falling more slowly than money market rates. This sparked interest in the analysis of the retail credit premium, i.e. the difference between reference interest rates (money market interest rates for the purposes of this text, and IRS rates for longer horizons) and rates on retail loans with comparable maturities. There are numerous reasons for paying attention to credit premiums.

First, the credit premium is an important part of the monetary policy transmission mechanism, which can be characterised as follows: monetary policy rate → money market rates → retail rates.¹ As the credit premium has been growing since 2009, questions are being asked about how sensitive the second link in the transmission mechanism, i.e. from money market rates to retail rates, is to the current business cycle.

Second, the retail credit premium is connected to financial stability for several reasons. The size of the client premium, for example, affects bank profits, and modelling bank profits is a key element of stress testing. Consequently, it is vital to understand the dynamics of the retail credit premium, i.e. whether it reflects changes in loan risk over the business cycle or one-off factors such as a frozen credit channel or institutional rigidities. These different explanations can have different implications for the estimation of investment risk and bank profits.²

Third, in both the academic literature and central banking practice, attention is devoted to whether financial variables (interest rates and their spreads, and aggregate statistics on financial variables such as NPLs or corporate financial indicators) have non-trivial predictive power for macroeconomic aggregates (economic activity and inflation). If they do, the toolkit used in central banks for short-term forecasting can be expanded.

However, the empirical relationship between macroeconomic and financial variables also has implications for macroeconomic models with a financial sector. This is because the different theoretical mechanisms describing the interaction between macroeconomic dynamics and the financial sector generally have different empirical implications regarding the forecastability of macroeconomic aggregates using financial variables. As macroeconomic models with a financial sector are starting to become very popular in central banks and economic policy-making institutions, it is important to have a tool for assessing these competing mechanisms. These competing mechanisms can have different implications for the desirable monetary policy settings, which should take into account interactions between the real economy and the financial sector, and for financial stability.

That there is (currently) no consensus on how to model macro-financial mechanisms correctly can be illustrated by the fact that different authors attach different levels of importance to different mechanisms in the interaction between macroeconomic dynamics and the financial system. One section of the literature concentrates on

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1 This is because most economic agents (households and firms) do not come into direct contact with the interest rates of the monetary authority or with the money market, but do come into contact with the interest rates of commercial banks.

2 Gambacorta (2009) argues that a low interest rate environment can cause an increase in investors' risk-taking for the following possible reasons: money illusion of the part of investors, the use of nominal returns in management decision-making, or increasing collateral values.

the “demand” side, whereas Adrian et al. (2010), for example, argue in favour of “supply-side” effects. The uncertainty regarding the correct modelling of these interactions can also be illustrated by the evolution of the work of individual authors; for example, in a series of articles Woodford and Curdia (2009a,b; 2010) investigate the spreads between deposit and loan rates. This series of articles demonstrates the evolution of their model, with its different empirical implications and therefore also different economic policy implications. This implies that further knowledge in this field will be vital for normative assessment of monetary and macroprudential policy, especially at times of economic and financial instability.

Fourth, attention must be devoted not only to the question of whether financial variables can contribute to macroeconomic forecasting, but also to the related question of whether macroeconomic developments can contribute to the forecasting of selected aggregate financial variables. In this article, attention will be focused on non-performing loans (NPLs). If it turns out that macroeconomic developments can predict future NPL dynamics, this will have a clear significance for financial stability, as it may facilitate more accurate construction of stress tests scenarios.

This article contributes to the debate by explaining the factors underlying the retail credit premium on the basis of macroeconomic dynamics. It also examines whether the premium can contribute to the forecasting of macroeconomic variables (economic activity and inflation) or variables relevant to financial stability (e.g. NPLs).

The retail credit premium is investigated for the following types of loans: loans to households for house purchase, loans to non-financial corporations of up to CZK 30 million (“small corporate loans”) and loans to non-financial corporations of over CZK 30 million (“large corporate loans”). Consumer credit is not analysed, as its credit premium is far higher than those for the aforementioned three types of loan and displays low sensitivity to the business cycle. It can also be argued that consumer

credit does not play such an important role in economic activity as loans to non-financial corporations and loans for house purchase (consumer loans account for around one-fifth of all loans to households).

The article is structured as follows. Section 2 defines the theoretical framework of the analysis. Section 3 describes the data and the econometric model used to analyse the relationship between macroeconomic dynamics and credit premiums. The final section concludes.

2. THEORETICAL FRAMEWORK

The theoretical framework of the credit premium model is characterised by the following three properties.

First, the model compares interest rates of comparable maturities and therefore allows us to derive the retail credit premium directly. This contrasts with some earlier studies, whether applied to the Czech Republic or applied to other countries, which compare interest rates on retail loans with a rate fixation of more than one year with money market rates. Such studies therefore implicitly confuse retail credit premiums with changes in the slope of the yield curve. This means, however, that when the financial market is expecting long-term interest rates to fall (rise), such studies overstate (understate) the retail credit premium.³ Second, the empirical model used is derived directly from asset pricing theory, which means that the results are easy to interpret structurally. Third, the model is formulated in stock form, which allows us, among other things, to conduct a historical decomposition of shocks, to make an estimate that is robust to high-frequency noise, and to formulate (conditional) forecasts.

Finally, another important factor is the existence of risk. The risks of the money market and IRS market are very low compared to those of retail loans and often have the character of operational risks, which are not closely linked to the business cycle. In the case of retail loans, by contrast, the risk is higher and its cycle can be expected to

³ This is the case with Horvath and Podpiera (2009), who analyse the pass-through from money market interest rates to bank interest rates using Czech data. However, there are also studies which work explicitly with the time structure of interest rates. For example, an interesting study by Banerjee et al. (2010) examines the effect of money market rates on retail rates in a theoretical model in which financial intermediaries incur fixed menu costs if they change the retail rate. This implies that there will be occasional changes in the retail rate and the timing of these changes will depend not only on the current difference between the retail rate and the reference rate, but also on expectations about future changes in the reference rate. The authors then use this theoretical model to construct an error correction model and show that pass-through is underestimated if expected future money market rates are neglected.

be closely linked to the business cycle. Consequently, it is not unreasonable to assume that the dynamics of the client premium can be explained by the change in the risk level of loans over the business cycle. Unfortunately, few studies have analysed this relationship in any detail.

In this article, the relationship between the retail credit premium and macroeconomic risk is analysed using the arbitrage theory of asset pricing. Let us formally describe the implications of this theory. Let y_t^k be the retail rate at time t with maturity (or fixation) k . The theory then implies (see, for example, Cochrane, 2001) that if there are no arbitrage opportunities in the markets:

$$y_t^k = -k^{-1} \log E_t [\exp(m_t^{t+k}) / \exp(\pi_t)] \quad (1)$$

where E_t is the mean conditional on the information at time t , m_t^{t+k} is the rate of intertemporal substitution of a representative investor, and π_t is the objective level of risk of a financial contract. The risk-free interest rate is given (if we set $\pi_t = 0$) by: $i_t^k = -k^{-1} \log E_t [\exp(m_t^{t+k})]$. If we adopt the usual assumption that the rate of intertemporal substitution is log-normally distributed and if we make the same assumption about the risk π_t , the retail credit premium can be written in the form:

$$y_t^k - i_t^k = k^{-1} \left[E_t \pi_t + \frac{1}{2} V_t \pi_t \right] + COV_t(\pi_t, m_t^{t+k}) \quad (2)$$

where V_t and COV_t are, respectively, the conditional variance and conditional covariance between the risk and the rate of intertemporal substitution. This equation has a clear interpretation: it says that the credit premium can be split into two parts, the first part measuring the objective risk and its variance, and the second pricing that risk. Given that in a typical market economy both the risk and the rate of intertemporal substitution are countercyclical (e.g. Cochrane and Piazzesi, 2005), we can expect the covariance between the risk and the rate

of substitution to be positive. This means that at times of recession the market demands a higher premium for risky instruments.

There are several ways of applying the aforementioned relation for data analysis. One way is to derive an assumption about the dynamics of intertemporal substitution and risk. One can then derive the yield curve for risk-free instruments as well as for risky retail loans. This approach is theoretically advantageous, since it allows us to test both the yield curve and the retail credit premium model.

From the empirical perspective, however, this approach is less advantageous, since an erroneous yield curve model can render analysis of the retail credit premium worthless.⁴ In this article, therefore, we use a model in which the credit premium is tested separately for different instruments and maturities/rate fixations. The empirical model derived from the aforementioned relation is presented in section 3.2. This model will then be used to analyse the retail credit premium.

3. DATA AND ECONOMETRIC MODEL

3.1 Data

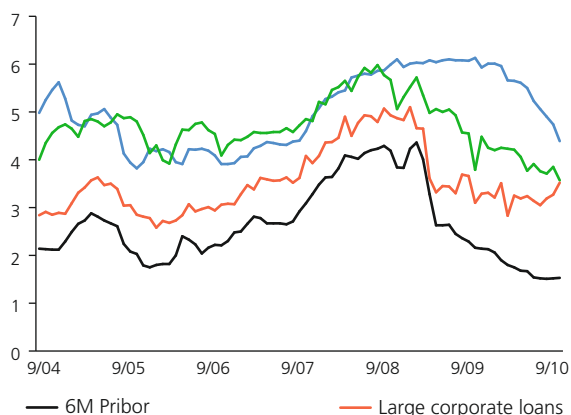
Data from the ARAD time series database are used to formulate and estimate the model. This database contains, among other things, retail interest rates on new business at monthly frequency from January 2004 to the present, which are used in the analysis. This determines the time frame of the analysis. The following retail rates are investigated in the model: loans for house purchase (with a rate fixation of up to 1 year, 1–5 years and 5–10 years) and loans to corporations (small loans of up to CZK 30 million and large loans of over CZK 30 million) with similar maturities.

4 This is important given that there is no generally accepted yield curve model for macroeconomic analyses. For example, the model proposed in Ang and Piazzesi (2003) is convincingly criticised by Atkeson and Kehoe (2008). Similarly, the Nelson-Siegel (1987) model, popular among financial market practitioners, has the unfortunate property that arbitrage cannot be excluded.

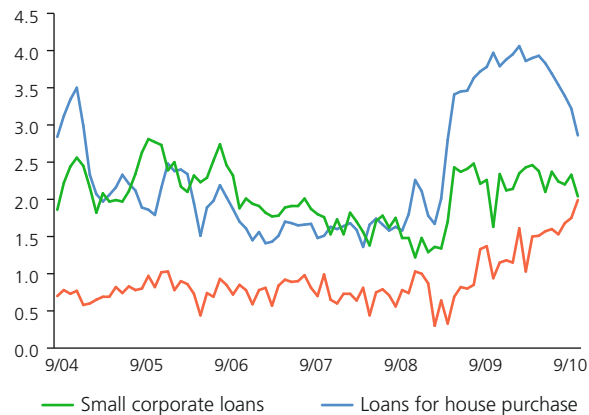
FIGURE 1

RETAIL CREDIT PREMIUM FOR LOANS WITH A RATE FIXATION OF LESS THAN 1 YEAR

a) Interest rates



b) Spreads vis-à-vis 6M Pribor



Source: ARAD

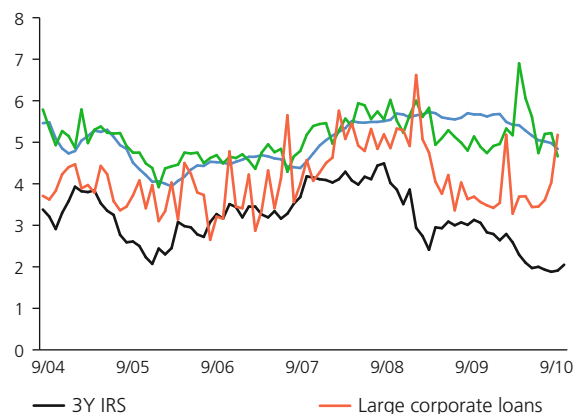
The figure shows that the retail credit premium for loans for house purchase reached a historical high of four percentage points in the second half of 2009. This is a rather higher value than in 2004, when it reached 3.5 p.p. Since the start of 2010, however, this premium has

been falling. Since 2008, the premium for small corporate loans has been below the historical highs recorded in 2005 and 2006. In mid-2009, the premium for large corporate loans exceeded 1 p.p., which is higher than in pre-2009 period, when it was below 1 p.p.

FIGURE 2

RETAIL CREDIT PREMIUM FOR LOANS WITH A RATE FIXATION OF 1-5 YEARS

a) Interest rates



b) Spreads vis-à-vis 6M Pribor

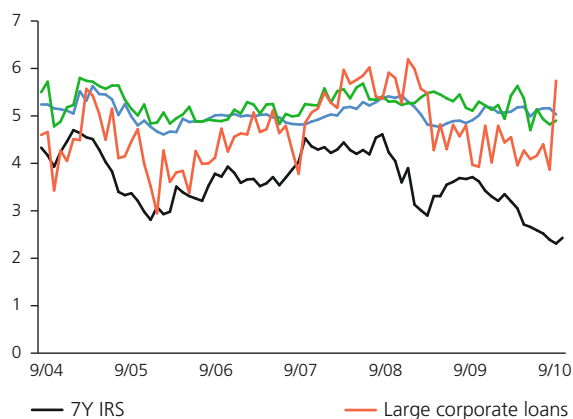


Source: ARAD

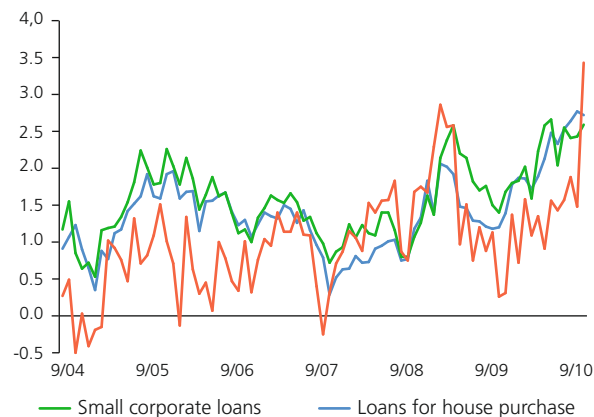
FIGURE 3

RETAIL CREDIT PREMIUM FOR LOANS WITH A RATE FIXATION OF MORE THAN 5 YEARS

a) Interest rates



b) Spreads vis-à-vis 6M Pribor



Source: ARAD

The retail credit premium for loans with a rate fixation of 1–5 years reached historical highs during the financial crisis in the cases of loans for house purchase and small corporate loans. In the case of large corporate loans, it did not show unusual values; it reached its historical maximum (above 3 p.p.) at the end of 2008 and fell back to its usual values of around 1 p.p. in the first half of 2009.

The retail credit premium for loans with a rate fixation of more than 5 years showed a similar pattern at the start of the crisis as that for loans with a rate fixation of 1–5 years. The premium increased in late 2008 and fell in the first half of 2009. In the case of large corporate loans, this premium then returned to its usual values, whereas for the remaining two types of loans it started to rise at the end of 2009 and is currently at historical highs.

As the economic crisis also implies a higher loan default risk, I focus on explaining this premium by means of growth in the risk level of loans in relation to the macroeconomic cycle. To do so, I use the following data: macroeconomic series (inflation, unemployment and industrial production) and the non-performing loan (NPL) ratio. These time series are available from the ARAD database.

It is difficult to find a suitable variable that reliably reflects the level of risk of the individual loan types. The NPL

ratio is not an optimal risk measure itself, because it is backward-looking, whereas it is reasonable to assume that financial intermediaries will tend to consider present or future risk when setting credit premiums. For this reason, the following variable π_{it} is derived from the NPLs using the methodology proposed in Geršl and Seidler (2010):

$$\pi_{i,t+1} = NPL_{i,t+1} - (1 - a)NPL_{i,t} \quad (3)$$

where a is an NPL outflow parameter. This parameter is set at 0.15 as recommended in Geršl and Seidler (2010).

3.2 Econometric model

The theoretical model is used to construct a model in a stock form for explaining the retail credit premium. The retail credit premium is explained by means of risk, which depends on the macroeconomic dynamics. The model has the following structural form:

$$i_{t+1} = \rho_i i_t + A_i X_t + e_t^i \quad (4)$$

$$\alpha_{t+1} = \rho_\alpha \alpha_t + [\lambda_1 \pi_t + \lambda_2 s_t] + e_t^\alpha \quad (5)$$

$$\pi_{t+1} = \rho_\pi \pi_t + A_\pi X_t + e_t^\pi \quad (6)$$

The interpretation of the equations is the following. The first stock equation says that the reference interest rate i_t depends on the macroeconomic variables X_t (matrix A_i transmits shocks from macroeconomic dynamics to the interest rate, so this equation can be regarded as an approximation of the monetary policy rule⁵). The second equation says that the retail credit premium α_t depends on the risk π_t and on an index of economic sentiment s_t ; economic sentiment is used as a forward-looking indicator of the risk level,⁶ so in other words $[\lambda_1 \pi_t + \lambda_2 s_t]$ models the future level of risk. The client interest rate is then given⁷ by $i_t + \alpha_t$. The third equation⁸ models the pass-through of the macroeconomic variables to the risk using matrix A_π . All three variables also depend on their lagged values through the autoregressive terms ρ_i , ρ_α and ρ_π . These terms model the slow transmission of structural shocks to endogenous variables owing, for example, to adjustment costs, bounded rationality or the slow process of aggregating information. e_t^i , e_t^α , e_t^π are random errors with the usual assumptions of regression analysis. The macroeconomic dynamics of vector X_t are modelled using a reduced VAR model.

Vector X_t contains unemployment, the household economic sentiment index and inflation for the models with loans for house purchase, and industrial production, the general economic sentiment index and inflation for the models with loans to corporations. This difference is motivated by the fact that unemployment is probably a more significant risk factor for households than is industrial production.⁹ We measure inflation using the consumer price index, as it is this inflation which enters equation (4), which approximates the monetary policy rule.

The aforementioned equations, together with the VAR model for the vector of macroeconomic variables X_t , are converted into a stock model with measurement noise and this model is estimated using the maximum likelihood method on the aforementioned data for nine types of retail loans at monthly frequency starting in 2004.

The model specified and estimated in this way can be used to determine the extent to which the dynamics of the retail credit premium can be explained by the business cycle.

TABLE 1

SIMULATION RESULTS

Type of loan	Rate fixation	Reference rate	Equilibrium premium (in p.p.)	Credit premium volatility (standard deviation)	Percentage of volatility explained by macro risk
Loans to households for house purchase	< 1 year	6M Pribor	2.36	0.86	88.1
	1–5 years	3Y IRS	1.80	0.74	76.0
	5–10 years	7Y IRS	1.11	0.46	49.9
Corporate loans up to CZK 30 million	< 1 year	6M Pribor	2.05	0.38	57.9
	1–5 years	3Y IRS	1.88	0.70	43.6
	5+ years	7Y IRS	1.55	0.50	30.2
Corporate loans over CZK 30 million	< 1 year	6M Pribor	0.87	0.29	13.6
	1–5 years	3Y IRS	0.33	0.54	51.7
	5+ years	7Y IRS	0.40	0.76	45.7

Source: ARAD

- 5 Strictly speaking, in an inflation-targeting economy, interest rates should depend on the expected values of macroeconomic variables, most notably inflation. However, equation (4) is not a structural relationship describing the monetary policy mechanism, but should be regarded as a reduced form of the monetary rule, hence the given formulation is statistically admissible.
- 6 The rationale for this is that the economic sentiment index is a leading indicator of NPLs, with a lead of around 12–15 months (depending on loan types). In reality, the correlation between the economic sentiment index and the NPL index lagged by 12 months is approximately 0.5 for loans to non-financial corporations and 0.9 for loans for house purchase, whereas the correlation of the present values is virtually zero for all types of loans.
- 7 Note that the retail credit premium depends on the other variables solely through the risk. It would be possible to formulate this equation in such a way that other macroeconomic variables also enter it, but in such case the model could not be used for the experiment described below.
- 8 What is the difference between the equation in the description of the model (6) and equation (3) in the preceding section? Equation (3) defines the risk index (and so is not being estimated), whereas equation (6) is a behavioural relation and its parameters are being estimated.
- 9 We also estimated models in which matrix X_t contained all the aforementioned variables, but the empirical results were very similar to the models whose results are presented in the following text. As a result, preference was given to the more parsimonious models.

The following experiment was therefore performed. Structural shocks to the model described above were filtered out using the Kalman filter. The model was then simulated using these shocks with the exception of shocks to the client premium, which were set equal to zero. In other words, we simulated what retail credit premium the model would generate purely on the basis of macroeconomic risk.

The following table shows the results of the simulation. The table presents the equilibrium premium (i.e. the premium that would exist if the macroeconomic variables were at a steady state corresponding to their long-term averages), the premium volatility observed in the data, and the percentage of the volatility explained by the macroeconomic variables from the aforementioned experiment.

The model best explains the credit premium dynamics in the case of loans for house purchase. It shows the worst results for corporate loans of over CZK 30 million, which is the segment with the lowest equilibrium premium level. It is also clear from Charts 1–3 above that rates on large corporate loans are highly volatile and display low sensitivity to the business cycle. In fact, the premium for this type of loan (at least for a rate fixation of more than one year) did not record sustained growth during the crisis: interest rates rose at the end of 2008 and then fell back in the first half of 2009.

This result is probably due to this segment's market structure and smaller number of contracts, which means, among other things, that (1) the time series are more susceptible to outliers, and (2) banks do not want to lose major clients and so their rates display lower elasticity to current conditions. Both these factors mean intuitively that the premium will be less sensitive than for other loans and therefore less explainable by the business cycle.

3.3 Does the credit premium have forecasting potential?

As it is possible to link the macroeconomic series used in the model to the variables used in the forecasting process, it is also possible to use the model to forecast future credit

premiums. However, it is also possible to ask a related question, namely whether the observed credit premiums can help us forecast the other variables in the model, i.e. the macroeconomic variables or the NPL ratio.

A whole range of studies, based on various methodologies, deal with the question of whether financial variables have predictive power for the future evolution of the economy. Probably the most cited study on the empirical side (i.e. among studies based more on statistical analysis and less on economic theory) is Stock and Watson (2003).¹⁰ On the theoretical side we should mention Ang et al. (2006), who predict future GDP growth using a yield curve model. It is interesting that empirically oriented studies find (in the best case) a limited improvement in the predictive power of financial variables for macroeconomic dynamics, whereas the more theoretical studies find a non-trivial improvement in the forecasts. This is probably linked with the fact that restrictions based on economic theory increase the soundness and robustness of the estimates.

We conducted a comparison of the predictions of the presented model with a VAR model containing macroeconomic data only. The comparison generated interesting results. First, the presented model is relatively successful in predicting economic activity indicators (unemployment and industrial production). Second, the model has worse predictive power for inflation than the basic VAR model. This confirms the results of previous studies that interest rates can be a good variable for forecasting economic activity, but not inflation (e.g. Kotlán 1999a, 1999b).

Third, the model with the retail credit premium is able to satisfactorily predict the NPL ratio, which is used to define risk using equation (3). It turned out that compared to the simple VAR model, the credit premium model has a 20% smaller root mean square error (RMSE) of the prediction of the ratio of NPLs to house purchase loans for the 1–3 month horizon, whereas for the longer horizon (6–12 months) the RMSE is about 50% lower. The improvement in predictive power is not as great for the NPLs of non-financial corporations: 20% for the shorter horizon (1–5 months) and 30% for the longer horizon (6–12 months).

¹⁰ Havránek et al. (2010) conducted a similar analysis on Czech data.

4. CONCLUSION

This article presented a retail credit premium model that explains this premium on the basis of macroeconomic risk. The model turns out to be capable of explaining a large proportion of the premium – especially that on loans for house purchase – on the basis of the chosen risk level, as proxied by the NPL ratio. Based on the results of the analysis, we can also say that studies which do not take into account the time structure of interest rates or risk correlated with the business cycle will necessarily overstate the significance of retail credit premiums.

The article also investigated whether retail credit premiums can enhance short-term forecasts. The results reveal that the model with the retail credit premium can improve the forecasts of both real economic activity and the NPL ratio. For house purchase loans in particular, the predictive power of the model is considerably better than that of the VAR model for the 6–12 month horizon. This conclusion may be useful for stress testing and financial stability modelling.

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