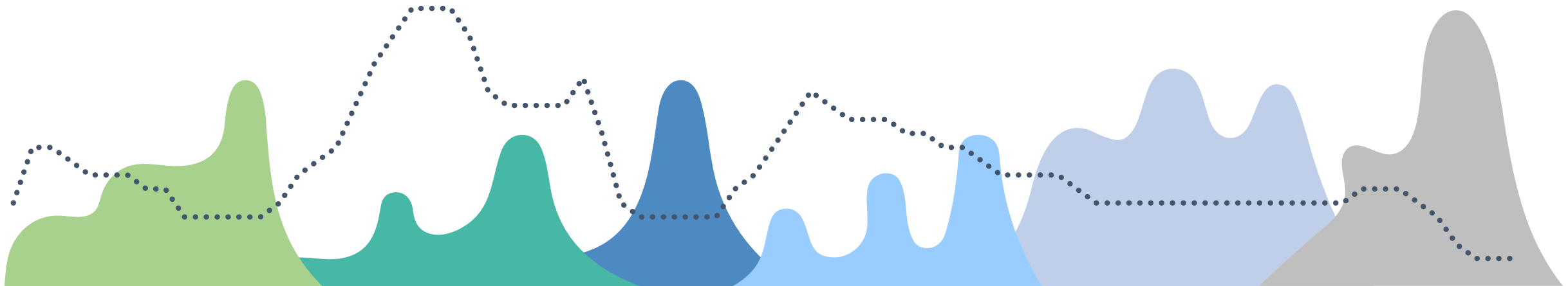


Monetary Policy and Risk-taking: Evidence from Thai Corporate Bond Markets

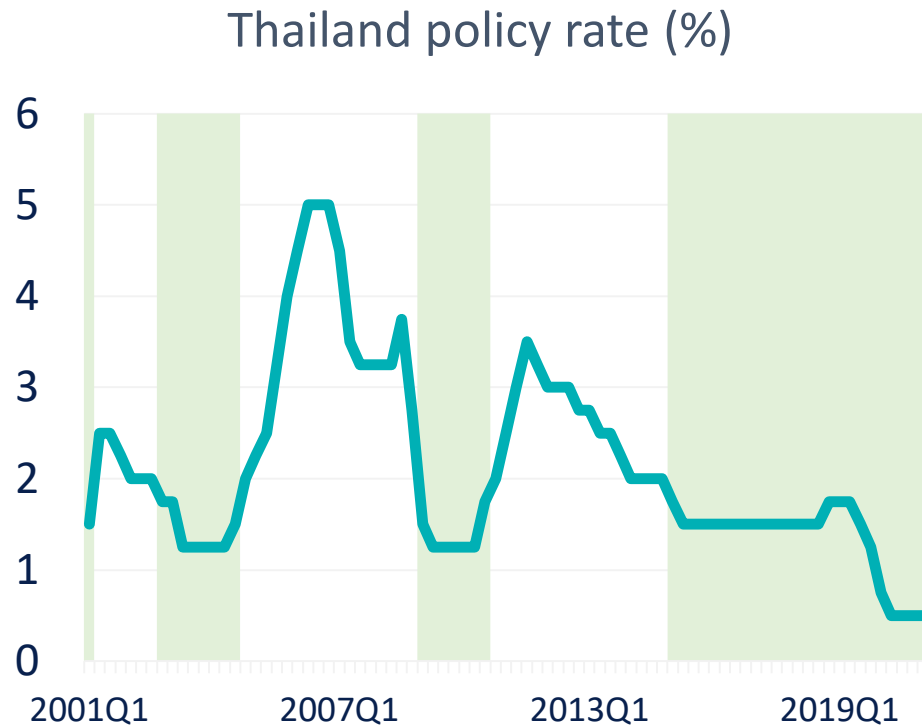
Warinthip Worasak, Nuwat Nookhwun, and Pongpitch Amatayakul

PIER Research Exchange

22 April 2021



Motivations



Source: Bank of Thailand

- Right after the GFC in 2008-09, the risk-taking channel was described as the missing link of monetary policy transmissions
 - Risk-taking channel: the notion that monetary policy affects not only quantity, but quality of credit extensions
 - The link is particularly important for central banks with FS mandate.
- The “low-for-long” interest rates to address COVID-19 may encourage the “search-for-yield” behavior going forward.
- This paper explores...
 - (1) the impact of monetary policy on risky bond issuance
 - (2) the search for yield behavior of Thai bond investors
 - (3) how low interest rates affect pricing of risks

Related Literature

- Literature on the risk-taking channel is abundant but mainly focuses on banks' risk-taking behavior
 - There is conclusive evidence that low interest rates incentivize banks to take on higher risks to their portfolio.
- For bond markets, Becker and Ivashina (2013) show that insurance companies reach for yield in choosing their investments.

Findings from loan markets	Papers
1. Increases in riskier loans to borrowers with worse credit history or a higher probability of default in periods of low interest rates.	Jimenez et al (2008); Ioannidou et al (2012); Dell'Ariccia et al (2013); Ananchotikul and Ratanavararak (2018)
2. Loan pricing discount for riskier borrowers in periods of low interest rates.	Paligorova and Santos (2012); Bonfim and Soares (2018)
Findings from bond markets	Papers
1. Conditional on credit ratings, insurance portfolios are systematically biased toward higher yield, higher CDS bonds.	Becker and Ivashina (2013)

Data - Focus on fixed-coupon corporate bonds issued by non-financial firms

ThaiBMA [Supply side]

- **Periods: 2001Q1 to 2020Q3**
- **Detailed issue/issuer characteristics:** credit rating, bond types, maturity, issue size, coupon rate, issuer's business sector
- **We obtain more issuer characteristics from Bloomberg, and macroeconomic variables from CEIC**

Debt Securities Holding Database [Demand side]

- **Periods: 2013Q1 to 2020Q3**
- **Information on debt securities holding by 24 groups of bondholders** – we combine them into 8 groups:

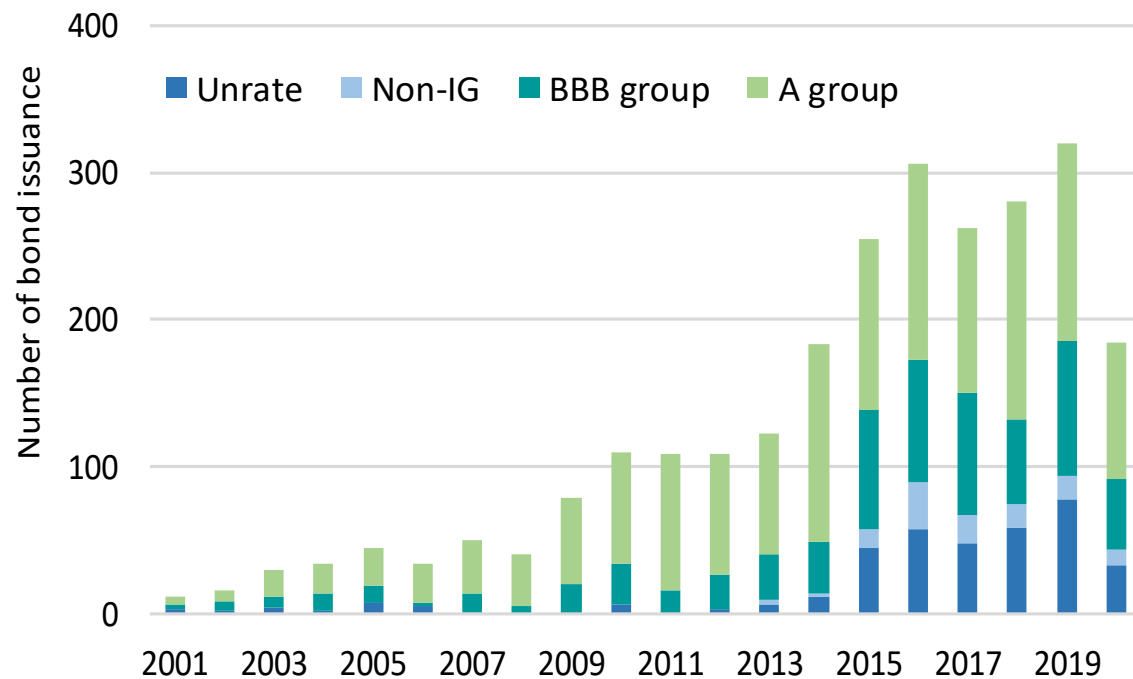
1. Pension funds & provident funds	5. Other depository FIs (e.g. cooperatives & MMFs)
2. Mutual funds (except for MMFs)	6. Corporates
3. Insurances	7. Individuals
4. Commercial banks & SFIs	8. Government agencies & others

- **Focus on holding at par value in the first month of each bond issuance**
- **Missing data:** Sep-Dec, 2016

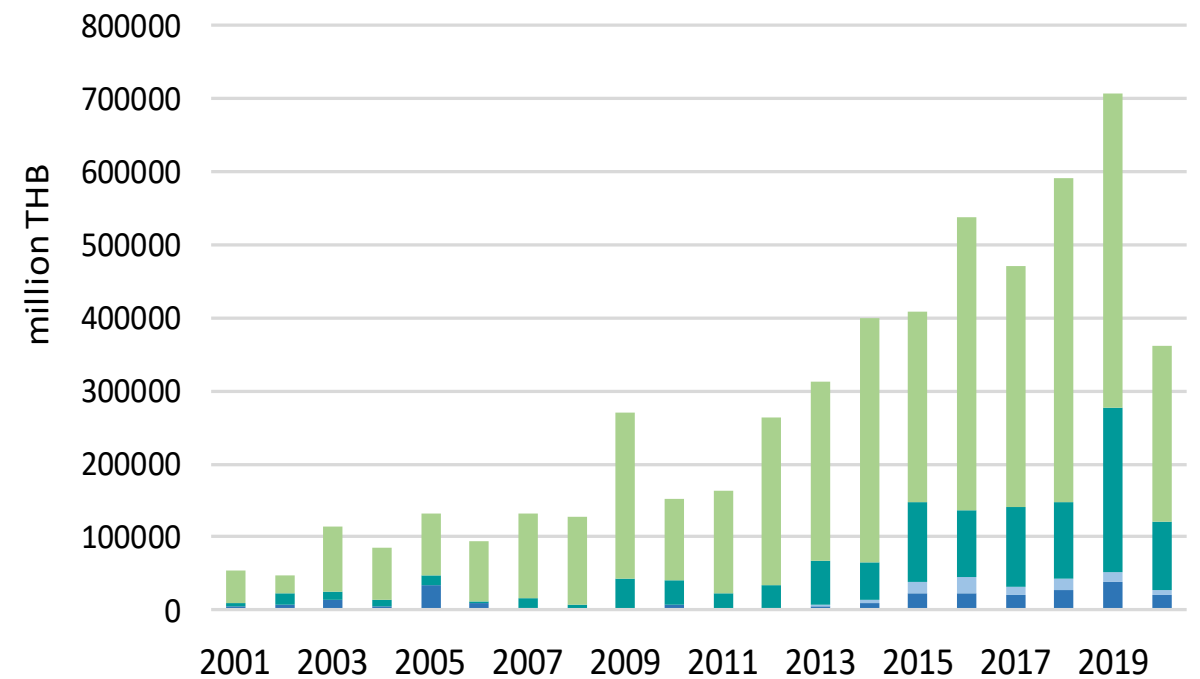
Stylized facts [ThaiBMA]

- Bond markets become a more popular source of funding for Thai corporates
- Greater bond issuance by risky firms, but issuing size rather small

Number of corporate bonds' issuance



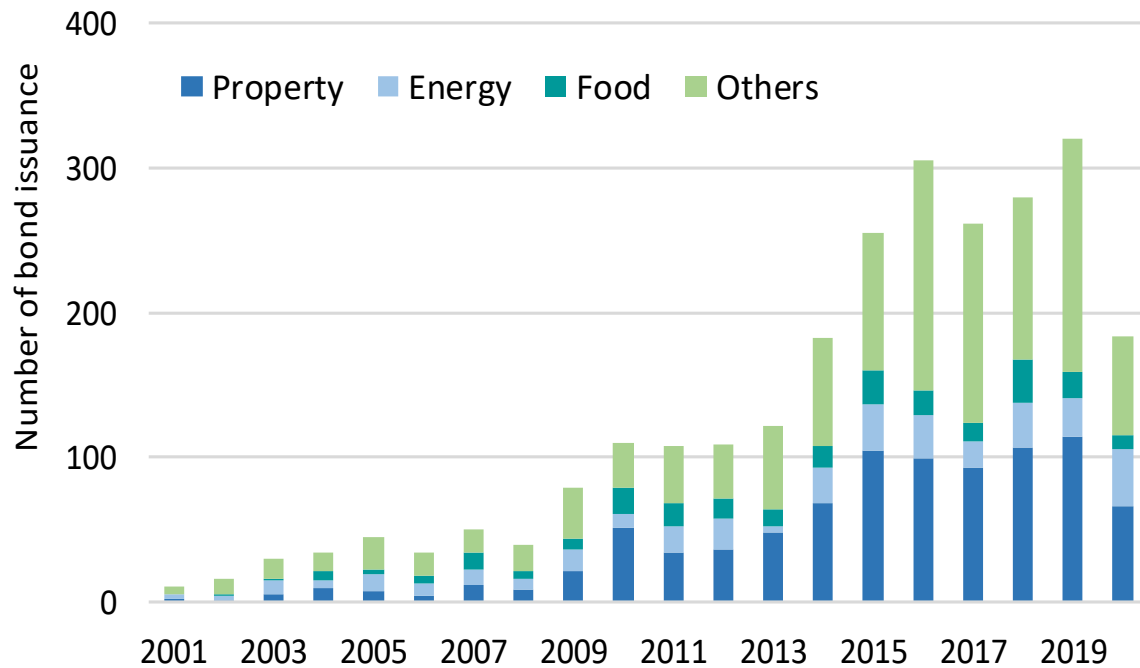
Total value of corporate bonds' issuance



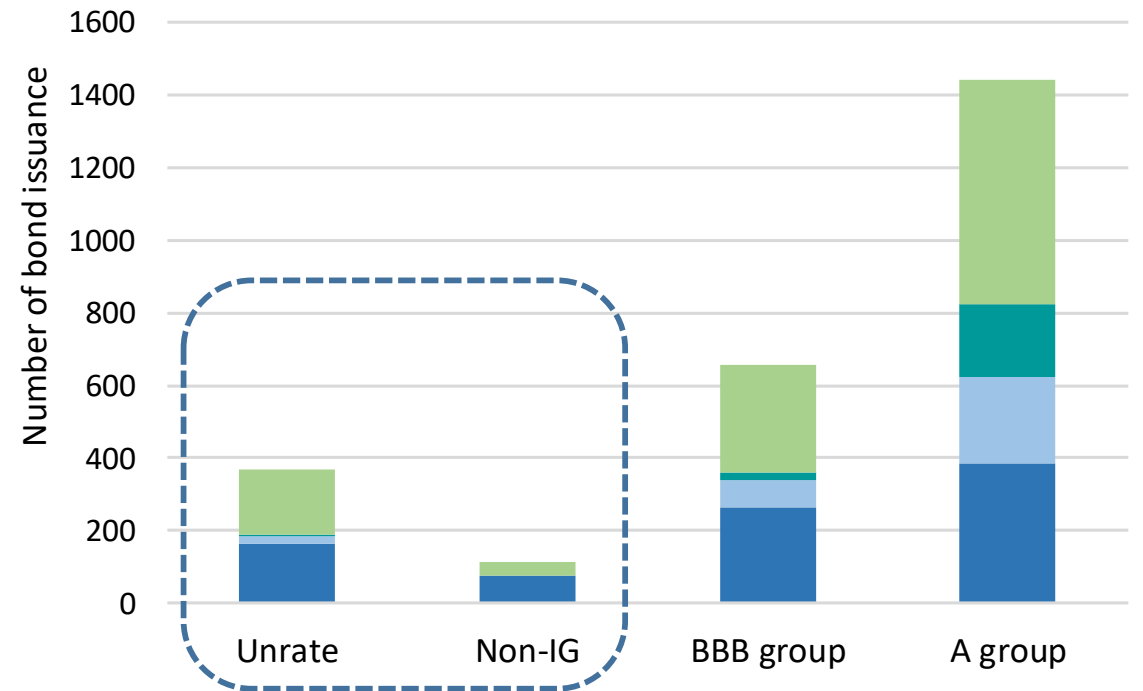
Stylized facts [ThaiBMA]

Firms in the property sector are the main issuer of Thai corp bonds, particularly the risky ones.

Number of corporate bonds' issuance overtime
(by business sectors)

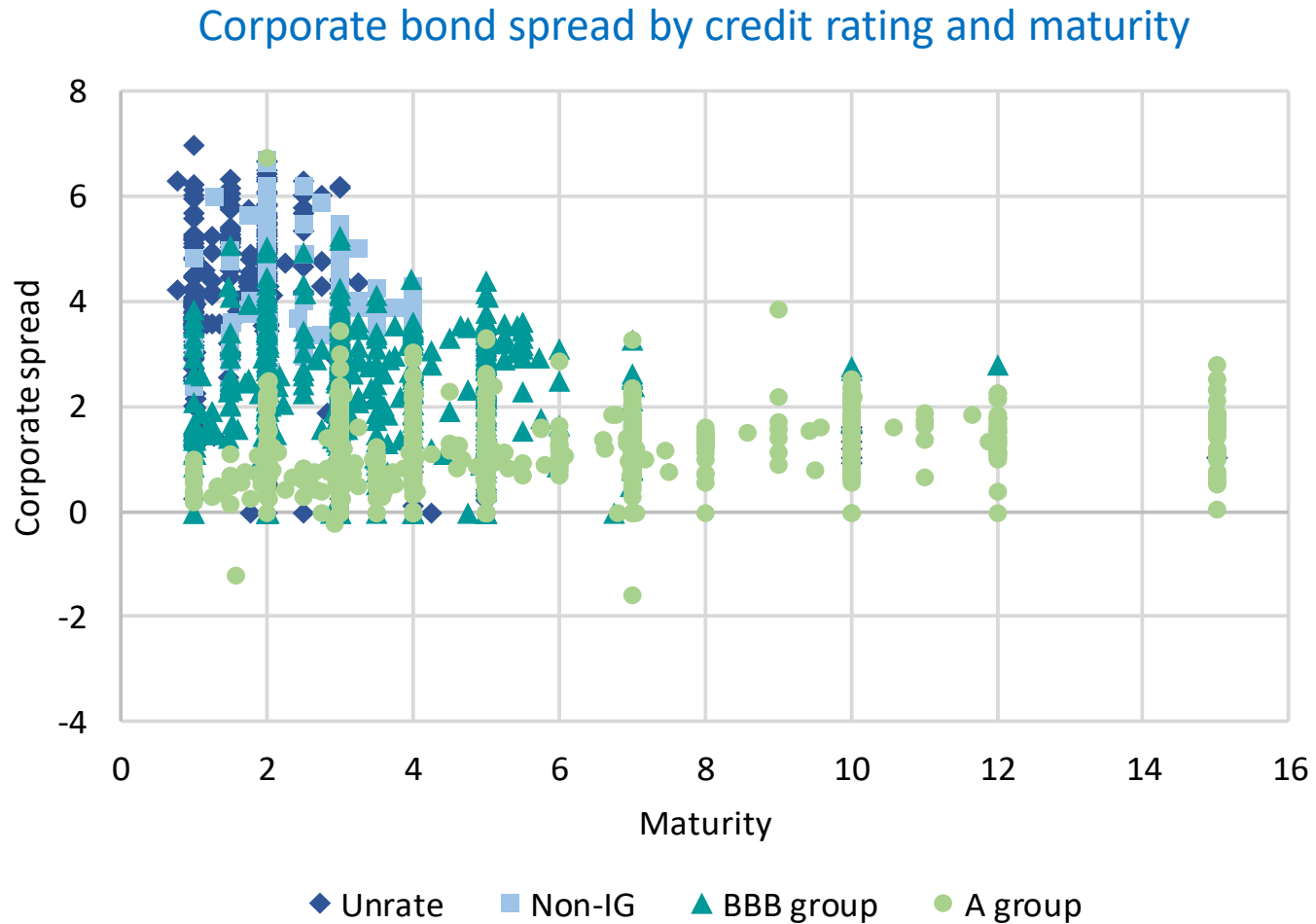


Number of corporate bonds' issuance in each credit rating



Stylized facts [ThaiBMA]

Corporate bond spread tends to vary with credit rating and bond maturity, thus offering a menu of bonds with differing yields for bond investors to shop.



Regression analysis 1: supply dimension

Impact of monetary policy on risky bond issuance

Credit Rating:
$$\ln \left(\frac{p(\text{rating}_{i,t}^S)}{1-p(\text{rating}_{i,t}^A)} \right) = c + \beta \text{Lowrate}_t + \theta \text{Bonds}_{i,t} + \delta \text{Issuers}_{i,t-1} + \mu \text{Macro}_t + \varepsilon_{i,t}$$

Bond Maturity:
$$\text{Maturity}_{i,t} = c + \beta \text{MonetaryPolicy}_t + \theta \text{Bonds}_{i,t} + \delta \text{Issuers}_{i,t-1} + \mu \text{Macro}_t + \varepsilon_{i,t}$$

Variables	Data
Key independent variable	
1. Monetary policy	<ul style="list-style-type: none"> - Dummy for periods of policy rates below median (low-rate indicator) - Policy interest rate
Dependent variables	
2. Risky bond issuance	<ul style="list-style-type: none"> - Credit rating (A, BBB, Non-IG, & Unrated) - Maturity

Variables	Data
Control variables	
4. Bond (or issue) characteristics	<ul style="list-style-type: none"> - Issue size - Dummy for callable bonds - Dummy for secured bonds - Maturity (in credit rating equations) - Credit rating (in maturity equations)
5. Issuer characteristics	<ul style="list-style-type: none"> - Firm size (dummy for large firms) - Profitability (return on assets) - Leverage (total debt to total assets)
6. Macroeconomic conditions	<ul style="list-style-type: none"> - GDP growth - Stock market volatility (SET index volatility) - Spread2Y5Y (in maturity equations)

Note: Focus on fixed-coupon corporate bonds issued by non-financial firms between 2001Q1 to 2020Q3

Result 1.1: Probability of risky bonds issuance

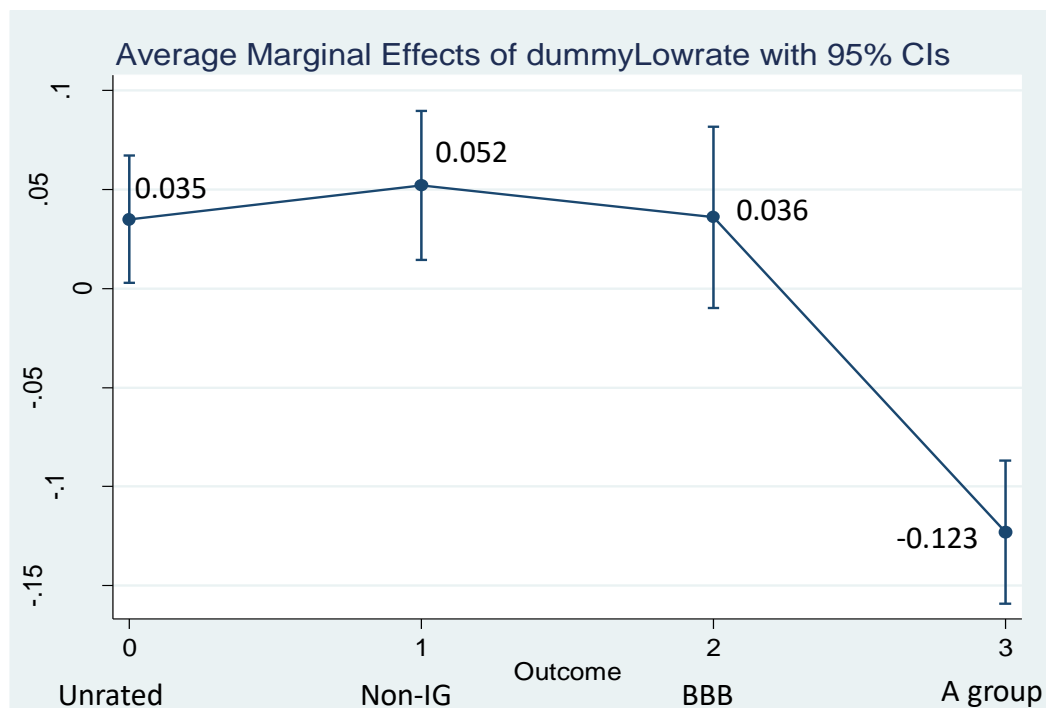
Q1: Do low interest rates lead to greater issuance of bond with low credit ratings?

- Using multinomial logistic regression

$$\ln \left(\frac{p(\text{rating}_{i,t}^S)}{1-p(\text{rating}_{i,t}^A)} \right) = c + \beta \text{Lowrate}_t + \theta \text{Bonds}_{i,t} + \delta \text{Issuers}_{i,t-1} + \mu \text{Macro}_t + \varepsilon_{i,t}$$

where $S = \{\text{BBB}, \text{Non-IG}, \text{Unrated}\}$

Result



Key takeaway:

- *Probability of risky bonds issuance is significantly higher in the low policy rate regime, whereas that of A rating bond falls.*

Result 1.2: Heterogeneity – Property sector v.s. others

Q2: in periods of low rates, is risky bond issuance greater in the property sector?

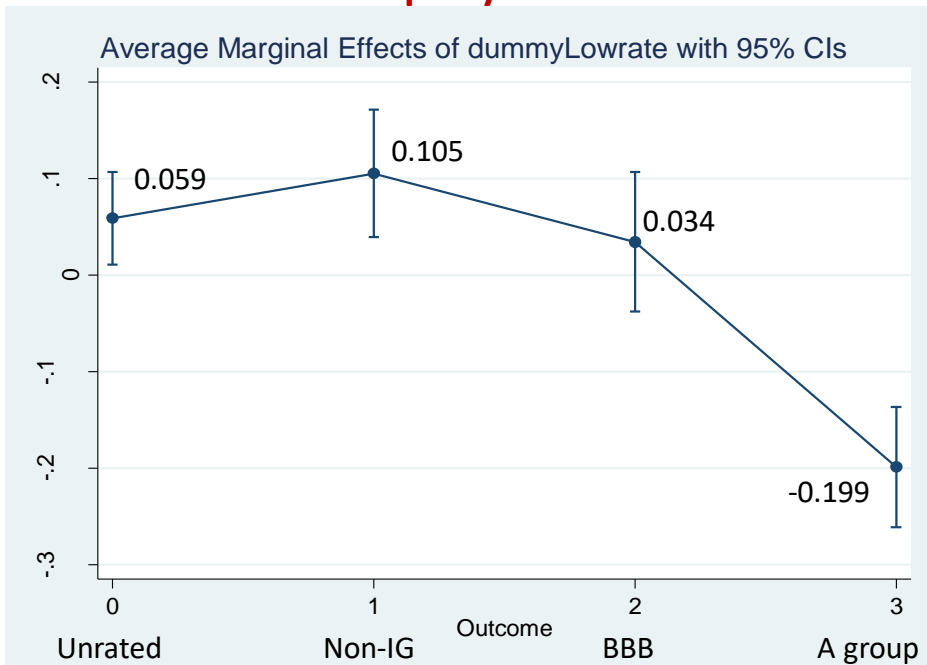
- Using multinomial logistic regression

$$\ln \left(\frac{p(\text{rating}_{i,t}^S)}{1-p(\text{rating}_{i,t}^A)} \right) = c + \beta \text{Lowrate}_t + \theta \text{Bonds}_{i,t} + \delta \text{Issuers}_{i,t-1} + \mu \text{Macro}_t + \varepsilon_{i,t}$$

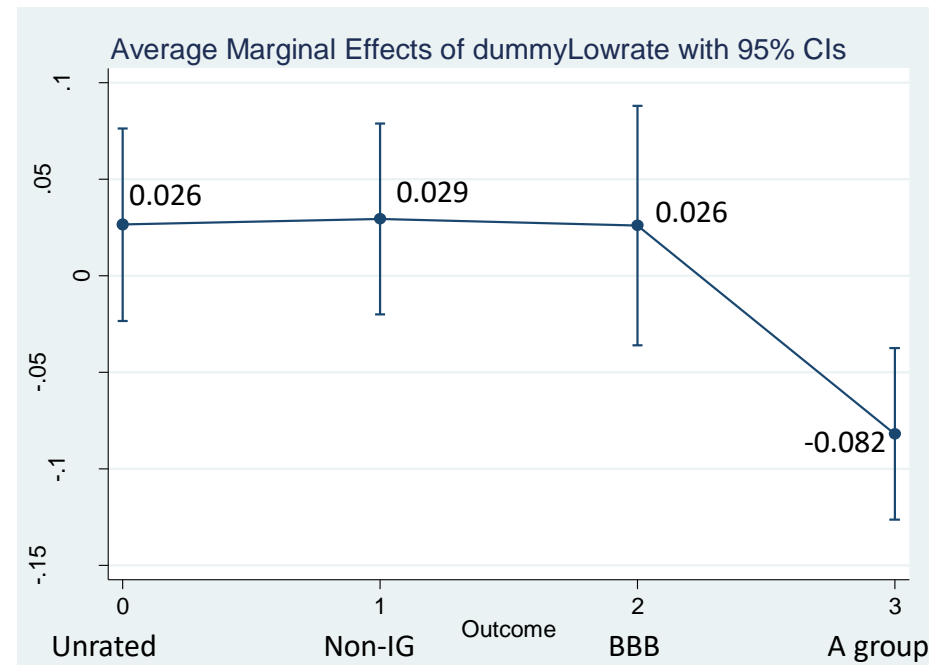
where $S = \{\text{BBB}, \text{Non-IG}, \text{Unrated}\}$

Result

Property sector



other sectors



Key takeaway:

Property sector has significantly higher probability of risky bond issuance in low rate regime than other sector.

Result 1.3: Bond maturity

Q3: Do low interest rates lead to greater issuance of bond with longer maturity?

- Using OLS regression

$$Maturity_{i,t} = c + \beta MonetaryPolicy_t + \theta Bonds_{i,t} + \delta Issuers_{i,t-1} + \mu Macro_t + \varepsilon_{i,t}$$

Result

Dependent variable: Maturity	(1)	(2)
Monetary policy		
dummyLowrate	0.0247	
PolicyRate		-0.0449
Bond characteristic		
BBB group	-0.422***	-0.426***
Non-investment grade	-0.567***	-0.573***
Unrated	-0.780***	-0.784***
Issue size (ln)	0.0588***	0.0598***
Dummy callable bonds	0.164**	0.161**
Dummy secured bonds	-0.0867	-0.0882
Issuer characteristic		
Firm size	0.139**	0.139**
Profitability (Lag 1)	0.00182	0.00235
Leverage (Lag1)	0.00167	0.00163
Macroeconomic condition		
GDP Growth	0.00475	0.00784***
SET volatility	0.00546**	0.00684***
2Y5Y spread	-0.0595*	-0.0989**
Constant	0.865***	0.941***
Observations	2,040	2,040
R-squared	0.371	0.373

*** p<0.01, ** p<0.05, * p<0.1

Key takeaway:

- Policy rates have an insignificant impact on bond maturity. Main determinants of bond maturity are bond and issuer characteristics

Regression analysis 2: demand dimension

Are any bondholders prone to search for yield?

Equation: $Bond\ demand_i^j = c^j + \alpha^j Return_i^j + \theta^j Bonds_i^j + \varepsilon_i^j$

Method: Tobit regression (due to a censoring issue)

Variables	Data
Dependent variable	
1. Bond demand	- Share of each bondholder j's holding amount of bond i to the size of holder j's portfolio
Key independent variables	
2. Bond returns	- Bond spread (over Government yield, median yield, and average yield) - Bond yield (i.e., coupon rate)
Control variables	
3. Bond characteristics	- Credit Rating (A, BBB, Non-IG, and Unrated) - Maturity - Issue size

Note: Using debt securities holding database between 2013Q1 to 2020Q3

Result 2.1: Baseline result

Key takeaway:

- Individuals and corporates are two bondholder types that tend to search for yield in their investment
 - Share of new bond holding significantly increases with bond spread.

Dependent variables = share of each bondholder's holding amount (at par value) to total amount of each bondholder's portfolio

VARIABLES	Bank & SFI	Corporate	Individual	Gov.Agency & Others
Spread (over government yield)	-0.00159***	0.000399**	0.000649***	-0.000362
A group	0.00227**	0.00180**	-0.00132***	0.00188*
BBB group	-0.000585	-0.000122	0.000193	-0.000155
Maturity (ln)	-0.00186***	-0.000793***	-0.000815***	-0.000683
Issue size (ln)	0.00350***	0.00263***	0.00244***	0.00386***
Constant	-0.0221***	-0.0196***	-0.0162***	-0.0283***
	/sigma	0.00803***	0.00588***	0.00423***
Observations	1,910	1,910	1,910	1,910
Pseudo-R:	-0.135	-0.0527	-0.0555	-0.1
Log-Likelihood:	2528	4278	5601	3026
Chi-squared	601.4	428.3	589.1	550.1
Prob Wald:	0	0	0	0

*** p<0.01, ** p<0.05, * p<0.1

Result 2.2: Only sample of investment-grade bonds

Key takeaway:

- *Though the sample is restricted to only IG bonds, the search-for-yield behavior still exist for individuals and corporates.*

Dependent variables = share of each bondholder's holding amount (at par value) to total amount of each bondholder's portfolio

VARIABLES	Bank & SFI	Corporate	Individual	Gov.Agency & Others
Spread (over government yield)	-0.00200***	0.000766**	0.00149***	-0.000682
BBB group	-0.00201**	-0.00235***	0.000644	-0.00156*
Maturity (ln)	-0.00146***	-0.000966***	-0.00114***	-0.000711
Issue size (ln)	0.00388***	0.00302***	0.00309***	0.00413***
Constant	-0.0230***	-0.0210***	-0.0230***	-0.0281***
/sigma	0.00829***	0.00647***	0.00473***	0.00822***
Observations	1,463	1,463	1,463	1,463
Pseudo-R:	-0.0919	-0.0474	-0.0695	-0.0732
Log-Likelihood:	2336	3408	4019	2671
Chi-squared	393.3	308.6	522.1	364.5
Prob Wald:	0	0	0	0

*** p<0.01, ** p<0.05, * p<0.1

Result 2.3: Robustness check (other bond return measures)

Key takeaway:

- Results are robust to different bond return measures.
- For coop. & MMF, we find significant “search for yield” behavior in 2 cases: (1) using coupon rate, (2) examining IG bond sample and using any yield measures

Dependent variables = share of each bondholder’s holding amount (at par value) to total amount of each bondholder’s portfolio

VARIABLES	Bank & SFI	Corporate	Individual	Gov.Agency & Others
Full sample				
Spread (over median yield)	-0.00117***	0.000750***	0.000722***	0.000116
Spread (over mean yield)	-0.00121***	0.000790***	0.000768***	5.69E-05
Coupon Rate	0.000476*	0.00117***	0.000841***	0.00159***
Only sample of IG bonds				
Spread (over median yield)	-0.00105***	0.00140***	0.00150***	0.00038
Spread (over mean yield)	-0.00109***	0.00148***	0.00158***	0.000275
Coupon Rate	0.00129***	0.00183***	0.00152***	0.00242***

*** p<0.01, ** p<0.05, * p<0.1

Result 2.4: Bond holding relative to other holders as a dependent variable

Dependent variables = share of each bondholder's holding amount (at par value) to total issuance amount

VARIABLES	Bank & SFI	Corporate	Individual	Gov.Agency & Others
Spread (over government yield)	-0.0651***	0.00742**	0.183***	-0.00994**
A group	0.125***	0.0648***	-0.268***	0.0585***
BBB group	0.0166	0.018	0.0444	0.0213
Maturity (ln)	-0.0635***	-0.000876	-0.0234	-0.00162
Issue size (ln)	0.0422***	0.0212***	0.1000***	0.0343***
Constant	-0.207***	-0.187***	-0.602***	-0.274***
/sigma	0.291***	0.124***	0.395***	0.150***
Observations	1,910	1,910	1,910	1,910
Pseudo-R:	0.197	-0.267	0.318	0.943
Log-Likelihood:	-694.4	393	-1101	-8.443
Chi-squared	341.7	165.8	1027	279.6
Prob Wald:	0	0	0	0

*** p<0.01, ** p<0.05, * p<0.1

Regression analysis 3: Pricing of risks

- Examining pricing of risks under low vs high interest rate regime
- Constructing excess bond premium (EBP) as a measure of underpricing of risks

Equation: $Spread_{i,t} = c + \alpha Rating_{i,t} + \beta Mpolicy_t + \rho(Rating_{i,t} \times Mpolicy_t) + \theta Bonds_{i,t} + \delta Issuers_{i,t-1} + \mu Macro_t + \varepsilon_{i,t}$

Method: OLS regression

Variables	Data
Key independent variable	
1. Monetary policy	<ul style="list-style-type: none"> - Dummy for periods of policy rates below median (low-rate indicator) - Policy interest rate
Dependent variables	
2. Pricing of risk in bond markets	- Bond spread (over government yield)

Variables	Data
Control variables	
4. Bond (or issue) characteristics	<ul style="list-style-type: none"> - Issue size - Dummy for callable bonds - Dummy for secured bonds - Maturity - Credit rating
5. Issuer characteristics	<ul style="list-style-type: none"> - Firm size (dummy for large firms) - Profitability (return on assets) - Leverage (total debt to total assets)
6. Macroeconomic conditions	<ul style="list-style-type: none"> - GDP growth - Stock market volatility (SET index volatility)

Result 3.1

Q: Do low interest rates lead to lower risk premium on risky bonds?

$$\begin{aligned}
 \text{Spread}_{i,t} = & \\
 & c + \alpha \text{Rating}_{i,t} + \beta \text{Mpolicy}_t + \rho (\text{Rating}_{i,t} \times \text{Mpolicy}_t) \\
 & + \theta \text{Bonds}_{i,t} + \delta \text{Issuers}_{i,t-1} + \mu \text{Macro}_t + \varepsilon_{i,t}
 \end{aligned}$$

Result

Key takeaway:

Low policy rates have a significant, positive impact on bond spread, more so for bonds with low credit rating. (i.e. greater pricing of risk for risky bonds)

- *Results contradict with banks' behavior, which tends to offer interest rate discount to risky borrowers*
- *Possibly reflect risk-aversion of Thai bond investors during the period of low rates.*

Dependent variable: Spread	(1)	(2)
Credit rating		
BBB group	1.158***	1.686***
Non-investment grade	2.008***	4.117***
Unrated	2.135***	4.254***
Monetary policy & interaction term		
Dummy low rate	0.0458	
BBB X Dummy low rate	0.210*	
NonIG X Dummy low rate	1.045***	
Unrated X Dummy low rate	1.111***	
Policy rate		-0.000229
BBB X Policy Rate		-0.243***
NonIG X Policy Rate		-0.872***
Unrated X Policy Rate		-0.859***
Bond characteristic		
Maturity (ln)	0.172***	0.173***
Issue size (ln)	-0.0063	-0.0085
Dummy callable bonds	0.325***	0.333***
Dummy secured bonds	0.115	0.12
Issuer characteristic		
Firm size	-0.243***	-0.239***
Profitability (Lag 1)	-0.0300***	-0.0300***
Leverage (Lag1)	0.00484***	0.00469***
Macroeconomic condition		
SET volatility	0.0036	0.000527
GDP Growth	-0.0353***	-0.0372***
BBB X GDP growth	-0.0280***	-0.0174**
NonIG X GDP growth	-0.0786***	-0.0324***
Unrated X GDP growth	-0.0640***	-0.0139
Constant	1.111***	1.220***
Observations	1,937	1,937
R-squared	0.803	0.802

*** p<0.01, ** p<0.05, * p<0.1

Result 3.2: Excess bond premium (EBP)

Q: How does EBP evolve during periods of low interest rates?

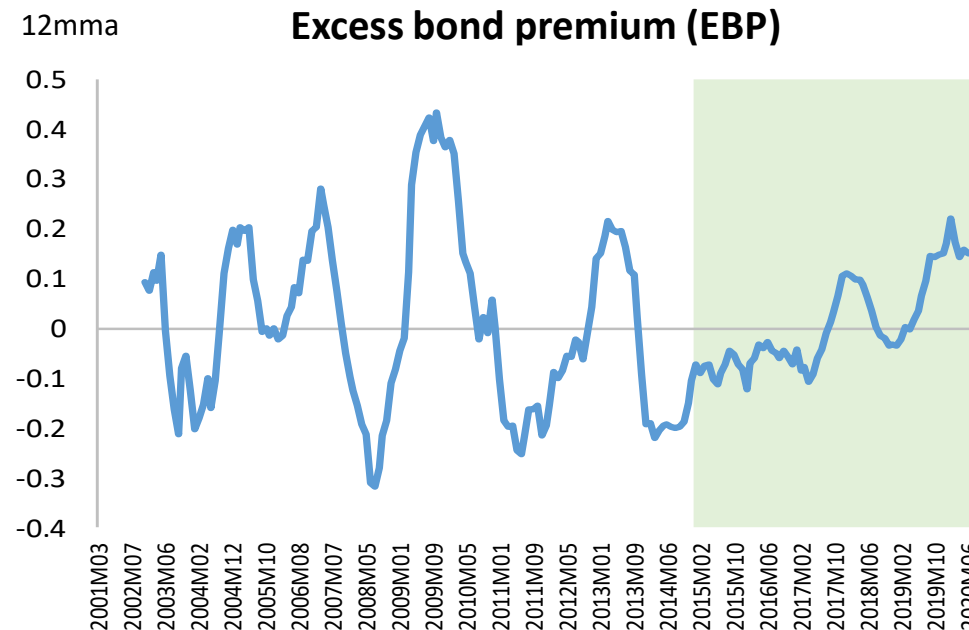
$$Spread_{i,t} = c + \alpha Rating_{i,t} + \theta Bonds_{i,t} + \delta Issuers_{i,t-1} + \mu Macro_t + \overset{EBP}{\varepsilon_{i,t}}$$

- Gilchrist & Zakrajsek, 2011 - Excess bond premium (EBP) reflects variation in the price of bearing exposure to credit risk, above and beyond the compensation for expected defaults.
- GFSR (Oct 2019) - ... reflects under (or over) -valuation of corporate bond spread

Result

Key takeaway:

The EBP has an increasing trend in the periods of low rates (2015-2020), hence showing no evidence of risk underpricing.



Dependent variable: Spread	
Credit rating	
BBB group	1.212***
Non-investment grade	2.681***
Unrated	3.015***
Bond characteristic	
Maturity (ln)	0.185***
Issue size (ln)	-0.00038
Issuer characteristic	
Firm size	-0.240***
Profitability (Lag 1)	-0.0299***
Leverage (Lag1)	0.00506***
Macroeconomic condition	
GDP Growth	-0.0498***
SET volatility	0.00107
Constant	1.198***
Observations	1,937
R-squared	0.783

Conclusions

- Low interest rates are associated with greater issuance of bonds with low credit ratings, particularly in the property sector.
 - ... but do not lead to bond issuance with long maturity.
- Individuals and corporates reach for yield in choosing their investments.
- Risky bond issuer has to pay higher risk premium in times of low rates.
 - Based on EBP, no evidence of risk underpricing over the recent period