

# The market for large bank deposits: Evidence from a new fintech platform.

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## Abstract

We study a new and unique online business-to-bank deposit platform and provide insights to the understudied research topic of *bank* or *firm deposits*. On this platform, potential depositors can choose where to deposit large quantities of money among offers posted by banks. Banks determine the characteristics of their own offers, such as the interest rate, withdrawal notice period/deposit maturity, minimum transaction volume, etc. We find that depositors care about bank risk and they make a trade-off between risk and promised returns, and that banks offer a positive term premium on their deposits. We also empirically show that depositors diversify risk by making transaction clusters and their likelihood to select an offer greatly depends on the availability and attractiveness of recent offers. This studied platform provides a transparent marketplace for depositors — a rare event when it comes to large deposits — and it gets more competitive and efficient over time.

## 1 Introduction

For firms and organizations, a crucial task in cash management is to improve liquidity positions, which often involves depositing large amounts of money over short periods of time. Although deposit rates for retail customers are readily available on banks' websites, deposit rates for larger deposits are typically not. To obtain information on these rates, firms and organizations must contact and negotiate with one or more banks. Due to the informationally opaque environment for large deposits, this task can be slow and tedious, and it becomes costly both in terms of time and money. In this paper, we analyze a unique data set on an innovative fintech platform — one that provides a transparent marketplace for large deposits with a full overview of deposit rates offered by the platform's member banks.

The platform we analyze is Fixrate, a Norwegian fintech company established in late 2017. The purpose of this online platform is to make the process of depositing large deposits in banks more transparent and less daunting, while at the same time helping banks reach out to new and potential depositors. Fixrate creates a bridge connecting banks and depositors (firms and organizations) in Norway. Banks join the platform and make advertisements for large deposits with detailed terms and conditions. Potential depositors have access to these offers and pick what suits them best just by a simple click. Since Fixrate operates

in Norway, a country that is highly financially-developed,<sup>1</sup> this online deposit platform can introduce fundamental changes in the Norwegian large-deposit markets. First, as Thakor (2020) points out, financially-developed countries offer the greatest chances for fintech firms to thrive. Second, the innovative features of Fixrate — a straightforward path addressing depositors’ needs and a business model allowing easy access and quick resolution — make the platform attain all pillars that constitute *the Fintech Revolution*, as described in Gomber et al. (2018).

We use the data on this platform to address the following three research questions:

*Q1:* How does such a marketplace work in terms of risk and return trade-off?

*Q2:* How do depositors allocate their cash to banks?

*Q3:* Is such a market in fact competitive and efficient?

To answer our research questions, we first study the relationship between the interest rates offered by banks and bank risks (measured by banks’ credit spreads), terms of the offered deposits, and other prevailing (money) market conditions. The studied platform provides a marketplace that does not disguise risk. We find depositors to care about bank risks and they make a trade-off between risk and promised returns. Second, we analyze the variables that can influence the likelihood of an offer to be chosen and the transactions specific to each depositor. By running these analyses, we are able to detect the pattern of deposit activities as well as deposit allocation and uncover any common preference shared on this marketplace. We empirically confirm that the daily number of transactions is strongly associated with the availability and attractiveness of the offers and this number reduces when the money market rate is high. We also find that depositors diversify risk by making transaction clusters. Finally, we examine the platform’s efficiency and competitiveness by investigating different aspects: the potential existence of bank-firm relationships, the waiting time for an offer to get its first deposit and the ratio of transactions to offers over time, and the competitiveness of the offered interest rates. We conclude that the marketplace is becoming more efficient over time and banks on the platform offer competitive interest rates.

Technological innovation and transparency are particularly relevant to our study. Technology changes in the financial markets are important for the overall economy. Banks generally have the upper hand due to the information asymmetry in the markets they operate in, especially when it comes to the market for larger deposits. Vishwanath and Kaufmann (2001) argue that transparency is absolutely essential to the financial sector and bring up the interrelation between “information imperfections, macroeconomic policy, and questions of risk”. They conclude that transparency, along with responsible governance and credible mechanisms, helps reduce risks and fortify stability. Similarly, Borgogno and Colangelo (2020) propose that properly implemented technological innovation can stimulate competition within the banking sector and mitigate information asymmetry problems.<sup>2</sup> The setup of the studied platform and the findings in our

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<sup>1</sup>According to the Global Competitiveness Report from World Economic Forum by Schwab et al. (2019), Norway is ranked number 1 in *macroeconomic stability*, number 5 in *stability of financial system*, and number 17 in overall *global competitiveness*.

<sup>2</sup>An evidence of such technology that enhances transparency and efficiency in financial markets, particularly in the banking industry, is the growing adoption of peer-to-peer (P2P) lending and open banking platforms worldwide. According to Statista (2021), there are over

paper are in strong support of these arguments. We also suspect that Fixrate has the potential to be a game-changer for the large bank deposit market in Norway. As pointed out in Broby (2021), the increasing digital transformation and innovative services from fintech gradually lessen information asymmetry, and they can therefore alter the nature of bank deposits.

We have other grounds to believe that such a platform like Fixrate has a strong prospect to expand and high potential to improve the Norwegian deposit market efficiency. Deposits and covered bonds make up the most significant and stable sources of funding for Norwegian banks. With the Norwegian Banks' Guarantee Fund providing a coverage level of NOK 2 million per depositor per bank (including accrued interest payments),<sup>3</sup> retail bank deposits in Norway are insured and the Norwegian banking sector is generally considered highly secure. We expect that even for very large deposits (partly or wholly uninsured), large depositors in Norwegian banks, i.e., firms and organizations, have little reason to hesitate if they encounter a (new or small) bank with a very attractive offer. There are two reasons: 1) The Norwegian economy is secure and resilient;<sup>4</sup> 2) The trust level in Norway is high.<sup>5</sup>

In our paper, we focus on a sub-area in the four broad categories of the fintech services as listed by Thakor (2020), i.e., the deposit sector: (i) *credit, deposits, and capital-raising services*; (ii) *payments, clearing, and settlement services*; (iii) *investment management services*; and (iv) *insurance*. Thakor (2020) expresses the existential threat to traditional financial intermediation due to the rapid development of these fintech advancements. Regarding the deposit sector, the author concludes that banks will eventually either build their own platform that is similar to P2P platforms or acquire such a platform for customer retention and acquisition. This conjecture, to some extent, is validated by the establishment and progression of the platform studied in this paper — despite the fact that joining such a platform would reduce the information asymmetry advantage, around 40% of banks operating in Norway have decided to do so.

Marketplaces for digital deposits are relatively new and originated in Europe. The pioneers are Deposit Solutions and Raisin, both founded in Germany in 2011 and 2012, respectively. One of the core services of these fintech firms is allowing customers to easily receive services from a third-party bank with better rates than their main bank offers. This service is operated via open banking. Both platforms connect European partner banks and are backed by renowned investors. In June 2021, shortly after having launched the platforms in the U.S. markets, the two rivals merged to create Raisin DS, forming a fintech giant with global ambitions of providing innovative services in the savings and investment

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26,000 fintech startups by November 2021 globally, up from 12,000 in 2019.

<sup>3</sup>In accordance with the Norwegian Banks' Guarantee Fund (Bankenes sikringsfond), most types of deposits are covered by the Norwegian deposit guarantee scheme, such as those on savings, current accounts, share savings accounts, credit cards, and other credits, where the depositors are individuals, corporations, and associations. Depositors from credit and financial situations like other banks, insurance companies, or public authorities are non-eligible for this scheme.

<sup>4</sup>Norges Bank (2021), the central bank of Norway, reports that “The Norwegian banking sector is solvent and well-equipped to withstand shocks. Bank profitability is solid, and banks' have ample access to funding”.

<sup>5</sup>Norway is ranked number 3 in *social capital*, which is a pillar representing *institutional trust* among others. See Schwab et al. (2019). Broby (2021) argues that trust is and will continue to be the key element of banking, no matter how the future of banking is in a world of financial technology revolution.

market. There are key differences between Fixrate, the platform studied in this paper, and these other two providers (which are now one pan-European firm). First, customers of Fixrate are strictly firms and organizations, while customers of the other two can be both individuals and businesses. Second, customers on Fixrate are not tied to one main bank. They come and go as pleased, free of charge. Therefore, while the platform Fixrate provides is not unique, it has an original approach with potentially major contributions to the Norwegian deposit market.

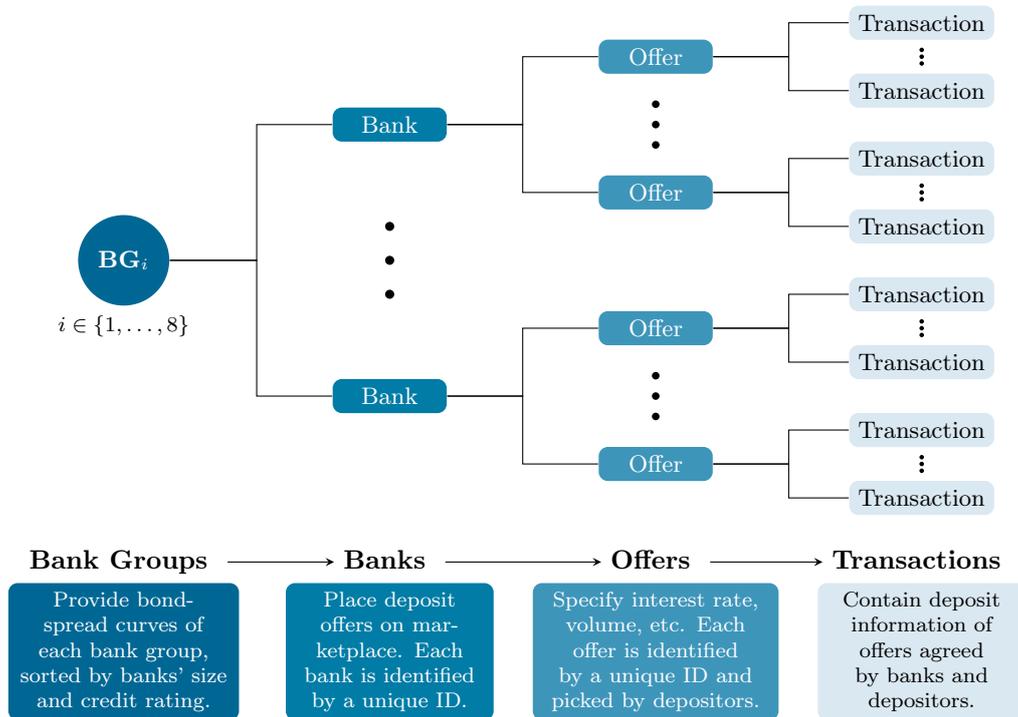
With the access to a unique data set, we are able to shed light on the workings of large deposits in the literature. *Firm or bank deposits*, i.e., firms lending money to banks — the focus of this paper — is an understudied research area. We are only aware of one working paper that investigates bank-firm relationship on these deposits. Friedmann et al. (2017) study an auction platform where banks bid for deposits placed by firms and firms then select a bid and deposit money to the corresponding bank. The authors conclude that firms disregard bank risk and there exists a certain loyalty that evidently helps banks get easier access to funds at lower rates. Besides, the literature have found that paying higher interest rates is an effective way for both depositor discipline (Martinez Peria and Schmukler, 2001; Maechler and McDill, 2006) and depositor attraction (Acharya and Mora, 2015).

Unlike firm/bank deposits, *firm or bank loans* — banks lending money to firms — is an area with a rich literature, of which *bank-firm relationship* has been found to be a critical factor. Specifically, Petersen and Rajan (1994), Boot and Thakor (1994), Berlin and Mester (1999), and López-Espinosa et al. (2017) find that banks offer lower loan rates and are more ready to loan out to their loyal firms than to other customers. Schwert (2018) also find that “bank-dependent firms borrow from well-capitalized banks, while firms with access to the bond market borrow from banks with less capital”. Several papers argue that bank-firm relationship has a strong influence on a firm’s cash holding, and this influence depends on the power of banks, their primary lenders (Hubbard et al., 2002; Pinkowitz and Williamson, 2015; Nakajima and Sasaki, 2016; Cui et al., 2020).

## 2 Data

**The platform** Fixrate offers an online platform for large deposits. The users of this platform include *banks*, who initiate offers to receive deposits, and *private firms and public organizations*, who look for attractive offers for depositing money. By using this platform, banks can easily reach out to new customers and new deposits, while the customers, i.e., the depositors, can get the most attractive deal available through a simple process. Fixrate charges banks an annual fee of 8 bps for deposits brokered through their platform in addition to a fixed monthly fee. For depositors, however, usage is free of charge. In a sense, Fixrate is like Uber and Airbnb for financing — they all depart from the traditional market structure and make profits from a shared marketplace without owning the offered services.

On the platform, banks announce the terms and conditions of their offers, which consist of the interest rate on the deposits, total offer size, minimum and maximum sizes for individual deposits, and withdrawal notice period or



**Figure 1: Data visualization** This figure visualizes the interrelationship between observations in the data set. *Banks*, *Offers*, and *Transactions* are data types from the platform, and *Bank Groups* are market-wide consensus of bank categorizations.

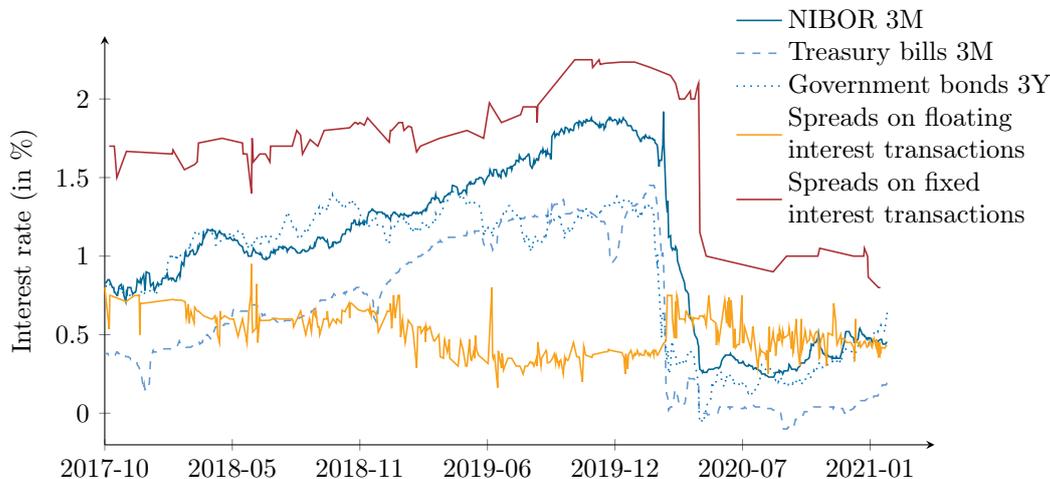
the deposit maturity. The interest rate is either an *interest spread* over the three-month NIBOR<sup>6</sup> (NIBOR 3M), hence, a *floating interest rate*, or a nominal *fixed interest rate*. The floating-interest deposits are time unlimited with the withdrawal notice period of 31 or 90 days, and the maturities of the fixed-interest deposits are three, six, or twelve months. The minimum deposit amount was originally set at NOK 5 million<sup>7</sup> and was then changed to NOK 1 million in 2020 as the company received inquiries from potential customers to lower this number.

When potential depositors decide on an online offer, they can accept the offer unless it has expired, i.e., if the total offer size has been fulfilled or the offering bank has withdrawn the offer. This acceptance from the depositors creates a binding relationship that banks cannot reject.<sup>8</sup> Banks and potential depositors must agree on the terms before they enter into a contract. The process of entering into a contract and transferring the money can take less than 10 minutes.

<sup>6</sup>NIBOR is short for Norwegian Interbank Offer Rate and corresponds to the more well-known LIBOR and EURIBOR. It is adjusted at noon every weekday by Norske Finansielle Referanser, the responsible administrator for NIBOR.

<sup>7</sup>At the time of writing, NOK 5 million is about USD/€500,000.

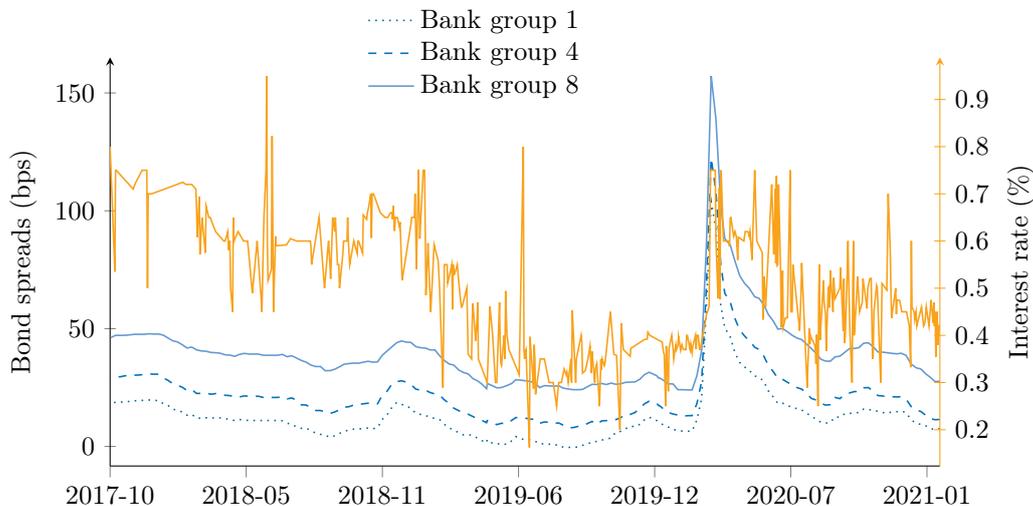
<sup>8</sup>According to Fixrate, there have been two extreme cases where banks rejected entries to contract. However, these rejections are not due to how banks perceive the potential customers.



**Figure 2: Daily interest rates** This figure illustrates daily interest rates of the Norwegian money market (NIBOR 3M), treasury bills (3 month maturity), government bonds (3 year maturity), and the spreads on both floating-interest transactions and fixed-interest transactions on the Fixrate platform.

From data on the offers and actual transactions on this platform, we obtain a data set built from four main data types: bank groups, banks, offers, and transactions. Figure 1 helps demonstrate the hierarchy of the data set and the function of each data type. The smallest element in the data is a transaction, which is made from an offer placed on the platform by a bank. Banks are grouped into eight different groups based on their size and their credit ratings. This sorting and the bond spread curves, i.e., *credit spreads*, of these bank groups serve as a market-wide consensus for banks in the Norwegian bond market, according to Nordic Bond Pricing (NBP). We obtain data on the bond spreads from NBP. These credit spreads, which represent the differences to the NIBOR (3M), are based on broker quotes with possible adjustments when necessary (trade, new issues, or discretion adjustments). The biggest and highest rated banks are in Bank Group 1, and the ratings follow the groups in descending order.

**The Norwegian Money Market and The Bank Sector** As a link between the Norwegian central bank’s key rate and the interest rates that customers of Norwegian banks face, the NIBOR (3M) is considered to be a good basis for pricing financial instruments, and we choose it as the Norwegian representative money market rate. As shown in Figure 2, the yields on the government securities with different maturities — treasury bills and bonds — generally share a similar trend with the NIBOR. The peak of the Covid-19 financial crisis is reflected clearly by the sharp drop of these rates in early 2020. Figure 2 also shows the volume-weighted average interest spreads on the floating-interest transactions on the platform for comparison. When depositors enter a floating-interest transaction contract, they have accepted the money market rate as a basis for their deposits, with a margin rate, i.e., spread, on top of that. Figure 2 shows that the spreads are relatively stable over time and in fact increase during the

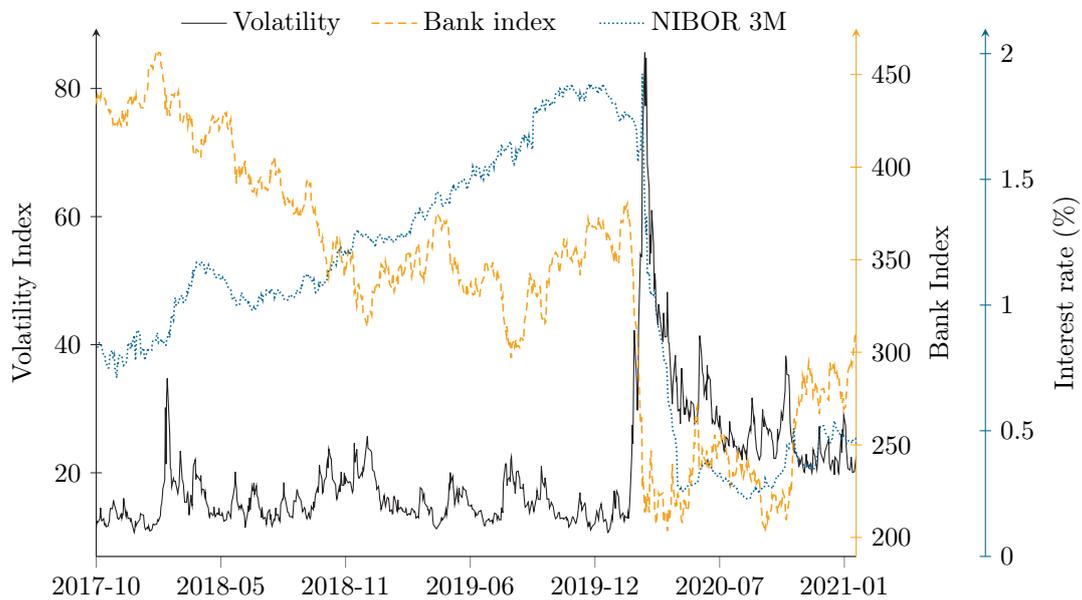


**Figure 3: Bank spreads** This figure depicts weekly average credit spreads with one year maturity bonds of three representative bank groups and daily spreads on floating-interest transactions on the platform.

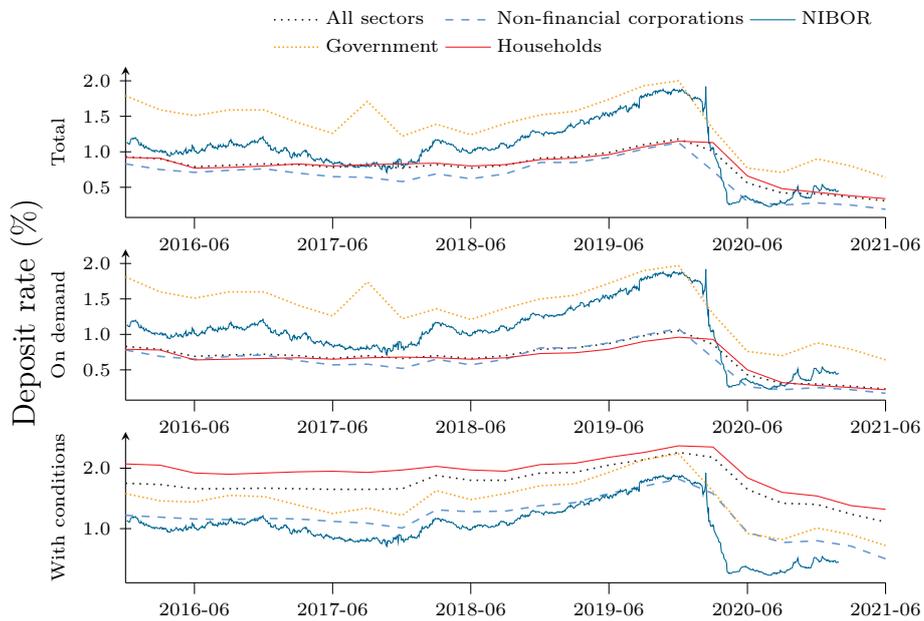
Covid-19 crisis. The volume-weighted average interest rate on the fixed-interest transactions moves similarly to the money market rate with an extra margin. This margin is thinner in two periods, February 2019 – September 2019 and March 2020 – June 2020.

Figure 3 depicts the weekly average credit spreads (one-year term bond spreads) of three representative bank groups and the volume-weighted average spreads on the floating-interest transactions on the platform. The shown bank groups are the highest, intermediately, and lowest rated banks. Figure 3 shows that the average spreads of different groups have a parallel trend, with lower spreads for better-rated groups. These spreads clearly reflect the peak of the Covid-19 financial crisis and are otherwise steady. In comparison, the spreads on the floating-interest transactions on the Fixrate market vary markedly over time, but they do not fluctuate noticeably more during the crisis than during other periods.

We also compare the NIBOR (3M) with the European market. The EURO STOXX 50 Volatility Index, or “the European VIX”, indicates the market expectations of market volatility by referencing to the implied variance across all options of 50 blue chip European stocks. In Figure 4, we plot this volatility index against the STOXX Europe 600 Banks Index, which reflects the European bank sector. The changes in the volatility index are generally in the opposite direction to the changes in the bank index. This contrary shows best during the Covid-19 crisis. To compare with the Norwegian money market, we also plot the NIBOR (3M) in the figure. Before late 2019, the plot shows a near-inverse relationship between the NIBOR (3M) and the bank index, however, they move in similar trends after this period. There is no clear relation from the plots between the NIBOR (3M) and the European market volatility.



**Figure 4: Bank index and volatility** This figure illustrates the EURO STOXX 50 Volatility Index, STOXX Europe 600 Banks Index, and the daily interests of the Norwegian money market (NIBOR 3M).



**Figure 5: Overview of deposit rates in Norway** This figure provides an overview of quarterly deposit interest rates in financial institutions in Norway since the last quarter of 2015 to the second quarter of 2021. The plots are based on different types of deposits and deposit sectors.

**Data Sample** We examine data from Fixrate from its establishment in October 2017 to February 2021. We have data on all offers made by the member banks. All current member banks are fairly small, local, or regional banks. In our data set, the banks are anonymized, with each bank only identified by a unique ID. However, Fixrate publishes the name of its member banks. We thus do not know the exact banks for each offer and transaction, but we know which banks are in our data set. The identities of the depositors are also anonymized by unique IDs.

For each offer, whether it is for a floating-interest and fixed-interest product, we know the consequent transactions connected to it. In Table 1, we provide descriptive statistics of the data sample. Panel A reports characteristics of the data set, and Panel B provides transaction characteristics. We sort both panels by year. Up until February 26th, 2021, there have been 1,111 unique transactions from 653 offers placed on Fixrate since its formation. There are 52 different banks that have registered and placed an offer on the platform, and 47 that have successfully received deposits.

As we have seen from earlier figures, the money market rate, i.e., NIBOR (3M), fluctuates during our sample period, and this fluctuation is shown by the average NIBOR (3M) by year reported in Table 1. We also average the *interest spread* on top of the NIBOR (3M) basis for floating-interest offers by year in Table 1. These average spreads vary from 0.38% to 0.61%, with an overall average spread of 0.46%. Combining the NIBOR (3M) with the spreads, we find that the combined average interest rates are slightly lower than the interest rate on the fixed-interest offers, except for in 2019. There are however no big differences.

The total deposit volume from both floating-interest and fixed-interest transactions is roughly NOK 21 billion, with the floating interest transactions accounting for 80% of the deposit volume. However, as Panel A shows, there are only twice as many floating-interest offers as fixed-interest offers. Compared to the fixed-interest transactions, the volume per transaction for the floating-interest type is higher in 2017 and 2018, and it is much lower in the years after. We have a total of 174 unique depositors for the floating-interest transactions, and 69 depositors for the fixed-interest transactions.

In Table 2, we report bank characteristics for banks that have placed an offer on the platform. The variables are sorted by the total assets of banks. Most of the banks have assets of NOK 2–5 billion or NOK 10+ billion. With bank group counts, we confirm that bigger banks are rated more highly. However, Bank Group 5 seems to include banks of various sizes. The table also shows the weighted average bond spreads (bps) with one year maturity over the whole time span of the data sample, with weights corresponding to the bank group counts. As expected, larger banks bear lower bond spreads. The reason why we choose bonds with one year maturity is because this duration is similar to the average transaction duration on the platform, as shown in the table. We also provide the number of offers and transactions for the banks in each asset category. Banks in the NOK 2–5 billion category make the most offers and transactions and the highest ratio between transactions to offers falls into the biggest bank category.

**Table 1: Descriptive Statistics of Data Sample**

The table shows descriptive statistics of data from October 2017 to February 2021. Panel A reports data set characteristics with two types of offers: *Floating interest* with interest rates specified by a *spread* on top of the concurrent NIBOR 3M, and *Fixed interest* with nominal interest rates. We also report the ratio between transactions and offers per bank for banks with at least one offer. Panel B provides transaction characteristics categorized by the two types of transactions. We also report the average deposit volume per transaction and the number of unique depositors in each year.

<b>PANEL A: DATA SET CHARACTERISTICS</b>						
	2017	2018	2019	2020	2021	Total
Banks making offers	12	27	39	38	12	52
Banks making transactions	7	25	37	38	19	47
Offers	49	172	204	208	20	653
Type I: Floating interest	18	89	137	180	11	435
Type II: Fixed interest	31	83	67	28	9	218
Total asked volume (NOK mil.)	2,735	9,270	25,952	21,766	1,231	60,954
Type I: Floating interest	1,425	5,455	16,413	19,251	791	43,335
Type II: Fixed interest	1,310	3,815	9,539	2,515	440	17,619
Transactions $t$	20	238	346	445	62	1,111
From offers $t$	20	212	306	398	31	–
From offers $t-1$	0	26	37	47	31	–
From offers $t-2$	0	0	3	0	0	–
Average interest rates (%):						
NIBOR 3M	0.81	1.06	1.55	0.70	0.47	1.05*
Spreads on Type I offers	0.61	0.58	0.38	0.45	0.42	0.56*
Interest on Type II offers	1.56	1.67	1.84	1.58	0.91	1.67*
<b>PANEL B: TRANSACTION CHARACTERISTICS</b>						
	2017	2018	2019	2020	2021	Total
<b>Floating interest trans.</b>	15	189	297	402	52	955
31 day notice	12	168	280	399	51	910
90 day notice	3	21	17	3	1	45
Average spreads (%)	0.71	0.63	0.43	0.48	0.43	0.50*
Volume/tran. (NOK mil.)	16.6	15.43	17.72	18.34	16.63	17.45*
Volume (NOK mil.)	249	2,917	5,263	7,371	865	16,665
Tran./Asked Volume (%)	17.47	53.47	32.07	38.29	109.36	43.49*
Depositors	9	39	83	94	29	174
<b>Fixed interest trans.</b>	5	49	49	43	10	156
3 month notice	1	9	1	0	1	12
6 month notice	0	8	16	16	3	43
12 month notice	4	32	32	27	3	98
Permanent interest	0	0	0	0	3	3
Average interest rate (%)	1.65	1.72	1.94	1.7	0.94	1.67*
Volume/tran. (NOK mil.)	13.4	12.78	38.92	24.53	41.5	26.09*
Volume (NOK mil.)	67	626	1,907	1,055	415	4,070
Tran./Asked Volume (%)	5.11	16.41	19.99	41.95	94.32	28.48*
Depositors	3	13	9	17	2	69

Note: \* shows the weighted average with weights as lengths of time, measured by the number of months in a year the analysis period.

**Table 2: Bank characteristics**

The table reports characteristics of banks that have placed an offer on the platform. We sort the banks by the size of their total assets. For each asset group, we report the number of banks, corresponding bank groups (categorized by banks' creding ratings), weighted average bond spreads (bps) with one year maturity over the time span of the data, number of offers placed, number of transactions made, and average duration of transactions.

<b>Asset size</b>	<b>0–5 NOK bil.</b>	<b>5–10 NOK bil.</b>	<b>10+ NOK bil.</b>
No. of banks	23	11	18
Bank group counts	B5: 1; B6: 3 B7: 9; B8: 10	B4: 1; B5: 6 B6: 3; B7: 1	B2: 3; B3: 6 B4: 4; B5: 5
Weighted average bank group	B7	B5	B4
Weighted average bond spread (bps)	42.37	33.81	27.55
Average transaction duration (days)	299	363	280
No. of offers	268	203	182
No. of transactions	463	247	401

### 3 Analyses and Results

Before starting the analyses, we make a clear distinction between the two types of offers. For floating-interest offers, banks offer an *interest spread*, the interest rate on top of the floating money market rate NIBOR (3M). These offers come with a condition on the withdrawal notice period of either 31 or 90 days, among other conditions. For fixed-interest offers, banks offer a *fixed interest rate*. This interest is unchanged during the whole maturity of this type of deposits, which is either three months, six months, or twelve months. In the analyses, we measure bank risk by *credit spreads* of banks. Credit spreads is the difference between the yield of a one-year term bond of banks and the NIBOR (3M).

#### 3.1 Risk and Return Trade-off

The regression of the offered interests on a set of control variables provides the analysis for risk and return trade-off.<sup>9</sup> The regressor set includes conditions of the deposit offers (asked volume and withdrawal notice period/deposit maturity), the offered banks (assets, one-year maturity bond's credit spreads), and the market (bank index return and NIBOR (3M)). Prior to the analysis, we have run tests for homoskedasticity, autocorrelation, and endogeneity checks, and conclude that the random effects model (RE) is the most suitable model for our data. We, however, present the results of all models for a general overview and comparisons: pooled OLS (POLS) and RE models with robust standard errors clustered at the bank level, fixed effects (FE) model with clustered stan-

<sup>9</sup>The interest rates on transactions are the same as the offered interest rates for all transactions.

dard errors and bank fixed effects.<sup>10</sup> We also run an additional RE model with a different market variable (volatility index return) as a robustness check for our reported results. Furthermore, the separation of the analysis for offers from transactions enables us to find any differences in preferences between banks and depositors.

We first analyze the floating interests and report the results in Table 3. For both offers and transactions, bank risks (credit spreads used as a proxy), the money market rate (NIBOR (3M)), bank assets, and the length of withdrawal notice period are strongly significant factors for the floating interest on top of the given money market rate. In particular, the higher magnitude of bank risks coefficient for transactions than for offers demonstrates that depositors want a higher compensation for bank risks than what banks generally offer. We also find large banks (those with assets of NOK 10+ billion) to have a clear advantage of paying lower interest rates than smaller banks — this finding is consistent with the fact that larger banks are often less risky: depositors receive lower return when transacting with larger banks for bearing less risk. Besides bank risks, banks compensate depositors for longer withdrawal notice period (90 days instead of 31 days). Depositors also tend to choose offers that give a higher compensation than the average given in offers. Further, when the money market rate increases, banks tend to offer a lower floating interest to reduce financing costs. For every one percentage point increase in the NIBOR (3M), banks reduce the offered interest spread by 0.06 percentage points (we base on the RE model’s results). Therefore, if we consider the total offered interest rate, one percentage point in the NIBOR (3M) is equivalent to 0.94 percentage points in the total offered interest.<sup>11</sup>

Table 4 reports the results of regressing the interest rates of fixed-interest offers and transactions on the same set of variables. The results are quite similar to the findings for floating interest rates. Bank risks and the money market rate are strongly relevant for the fixed interest rate. Additionally, banks also offer a lower interest rate for offers with shorter maturities (three and six months versus 12 months in the base models). Therefore, they seem to offer a positive term premium to depositors.

The differences in the cost transfer of bank risks and the money market rate into the offered interest rates between the floating-interest deposits and fixed-interest deposits are noteworthy. Let us write simplified versions of the interest rate regressions with only consistently significant factors (based on the RE models) in terms of the total interest rate:

$$\begin{aligned} r_{\text{float-type offer}} &= 0.48 + 0.16 \cdot \text{Credit spreads} + 0.94 \cdot \text{NIBOR (3M)}; \\ r_{\text{fixed-type offer}} &= 0.60 + 0.70 \cdot \text{Credit spreads} + 0.77 \cdot \text{NIBOR (3M)}. \end{aligned}$$

As shown, the structures of the cost transfer into interest rates for the two types of deposits are different. For floating-interest offers, a lot more weight is put towards the money market rate and the base offered interest is 0.12 percentage points lower. However, for fixed-interest offers, a much higher weight is put

<sup>10</sup>Covariance estimators are no longer robust against entity effects, so FE models require clustered standard errors.

<sup>11</sup>For floating-interest offers, banks offer a floating interest on top of the NIBOR (3M). Therefore: *Offered interest rate* = NIBOR (3M) + *Offered interest spread*. Hence, if *Offered interest spread* corresponds to  $-0.06 \cdot \text{NIBOR (3M)}$ , then *Offered interest rate* corresponds to  $0.94 \cdot \text{NIBOR (3M)}$ .

**Table 3: Determinants of floating-interest rates**

In this table, we report the regression results of the floating-interest rates on top of NIBOR (3M) offered by banks on a set of control variables. The data is from floating-interest offers (models (I) to (III)) and floating-interest transactions (models (IV) to (VI)) from October 2017 to February 2021. The control variables include characteristics of: the deposit offer (asked volume and withdrawal notice period), the offered bank (assets, one-year maturity bond's credit spreads), and the market (bank index return, NIBOR (3M)). Model (I) and (IV) represent the POLS model, model (II) and (V) RE model, and model (III) and (VI) FE model. Models (II\*) and (V\*) are robustness checks for Model (II) and Model (V), respectively, using volatility index instead of bank index. Clustered standard errors are at the bank level. This table uses the base model with banks of the NOK 0–5 billion asset group and with the withdrawal notice period of 31 days.

	Dependent variable: <i>Interest rates (%)</i>							
	Offers			Transactions				
	(I)	(II)	(II*)	(III)	(IV)	(V)	(V*)	(VI)
Constant	0.525*** (0.019)	0.482*** (0.019)	0.482*** (0.019)	0.479*** (0.017)	0.483*** (0.013)	0.447*** (0.014)	0.449*** (0.014)	0.465*** (0.010)
Asked volume								
Total	-8.6e-05 (8.5e-05)	-1.8e-04** (8.1e-05)	-1.8e-04** (8.1e-05)	-1.1e-04 (8.8e-05)	-5.4e-05 (5.1e-05)	-2.4e-05 (5.6e-05)	-2.1e-05 (5.6e-05)	2.8e-05 (6.2e-05)
Min	-4.4e-05 (1.5e-04)	-1.8e-04 (1.5e-04)	-1.8e-04 (1.5e-04)	3.0e-04 (2.8e-04)	-1.2e-04 (1.7e-04)	2.3e-04 (2.4e-04)	2.2e-04 (2.4e-04)	4.8e-04* (2.7e-04)
Max	-1.7e-04 (1.6e-04)	7.2e-05 (1.6e-04)	7.3e-05 (1.6e-04)	1.5e-04 (1.8e-04)	-1.6e-04 (1.0e-04)	-1.2e-04 (1.2e-04)	-1.1e-04 (1.2e-04)	-1.1e-04 (1.3e-04)
Credit spreads (%)	0.147*** (0.028)	0.162*** (0.027)	0.162*** (0.027)	0.141*** (0.024)	0.283*** (0.024)	0.253*** (0.021)	0.246*** (0.021)	0.237*** (0.022)
Bank index return (%)	-2.5e-04 (0.002)	2.8e-05 (0.002)	2.8e-05 (0.002)	-2.9e-06 (0.002)	0.003*** (0.001)	0.002* (0.001)	0.002 (0.001)	0.002 (0.001)
Volatility index return (%)			-1.9e-04 (5.9e-04)				-5.8e-04 (4.2e-04)	
NIBOR (3M) (%)	-0.066*** (0.010)	-0.060*** (0.009)	-0.060*** (0.009)	-0.060*** (0.010)	-0.044*** (0.006)	-0.043*** (0.005)	-0.045*** (0.005)	-0.046*** (0.005)
Bank assets (NOK)								
10+ bil.	-0.063*** (0.014)				-0.045*** (0.009)			
5–10 bil.	-0.023 (0.012)				-0.016 (0.010)			
90-day notice period	0.053** (0.026)	0.044* (0.026)	0.044* (0.026)	0.034 (0.025)	0.169*** (0.023)	0.135*** (0.020)	0.134*** (0.020)	0.129*** (0.019)
Bank Fixed Effects				Yes				Yes
Number of observations	435	435	435	435	955	955	955	955
Adjusted $R^2$	0.347	0.359	0.360	0.181	0.447	0.372	0.365	0.288
Standard Error	Robust	Robust	Robust	Clustered	Robust	Robust	Robust	Clustered

**Table 4: Determinants of fixed-interest rates**

In this table, we report the regression results of the interest rates offered by banks on a set of control variables. The data is from fixed-interest offers (models (I) to (III)) and fixed-interest transactions (models (IV) to (VI)) from October 2017 to February 2021. The control variables include characteristics of: the deposit offer (asked volume and withdrawal notice period), the offered bank (assets, one-year maturity bond's credit spreads), and the market (bank index return, NIBOR (3M)). Model (I) and (IV) represent the POLS model, model (II) and (V) RE model, and model (III) and (VI) FE model. Models (II\*) and (V\*) are robustness checks for Model (II) and Model (V), respectively, using volatility index instead of bank index. Clustered standard errors are at the bank level. This table uses the base model with banks of the NOK 0-5 billion asset group and with the withdrawal notice period of 12 months.

	Offers						Transactions		
	(I)	(II)	(II*)	(III)	(IV)	(V)	(V*)	(VI)	
Dependent variable: <i>Interest rates (%)</i>									
Constant	0.514*** (0.089)	0.603*** (0.087)	0.640*** (0.096)	0.652*** (0.097)	0.563*** (0.133)	0.722*** (0.100)	0.700*** (0.095)	0.912*** (0.167)	
Asked volume									
Total	1.8e-04 (1.2e-04)	7.5e-05 (9.2e-05)	7.8e-05 (8.8e-05)	-1.3e-05 (1.2e-04)	1.1e-03 (7.8e-04)	7.0e-04 (6.7e-04)	6.2e-04 (6.1e-04)	-4.0e-04 (1.2e-03)	
Min	-1.6e-04 (5.8e-04)	1.3e-04 (3.4e-04)	1.2e-04 (3.9e-04)	1.8e-04 (2.8e-04)	-9.5e-04 (9.4e-04)	-2.5e-04 (5.7e-04)	-3.5e-04 (5.7e-04)	-9.9e-04 (8.0e-04)	
Max	-3.0e-04 (1.9e-04)	-2.1e-04 (1.7e-04)	-2.4e-04 (1.6e-04)	-2.1e-04 (2.3e-04)	-1.7e-03** (7.2e-04)	-1.4e-03** (5.9e-04)	-1.2e-03** (5.3e-04)	-1.4e-03* (7.7e-04)	
Credit spreads (%)	0.889*** (0.180)	0.695*** (0.148)	0.636*** (0.173)	0.684*** (0.178)	0.942*** (0.272)	0.563*** (0.157)	0.629*** (0.146)	0.467** (0.200)	
Bank index return (%)	0.011 (0.014)	0.010 (0.012)	0.011 (0.012)	0.011 (0.011)	-0.012 (0.010)	-0.012 (0.007)		-0.014*** (0.005)	
Volatility index return (%)			-1.6e-04 (1.2e-03)				4.3e-03*** (1.6e-03)		
NIBOR (3M) (%)	0.804*** (0.039)	0.770*** (0.041)	0.753*** (0.043)	0.754*** (0.047)	0.758*** (0.049)	0.749*** (0.039)	0.752*** (0.038)	0.746*** (0.041)	
Bank assets (NOK)									
10+ bil.	0.052 (0.063)				0.247*** (0.063)				
5-10 bil.	0.040* (0.024)				0.005 (0.033)				
Shorter notice periods	-0.060*** (0.023)	-0.048** (0.023)	-0.046** (0.023)	-0.038 (0.024)	0.044 (0.032)	0.036 (0.030)	0.036 (0.029)	0.010 (0.048)	
Bank Fixed Effects				Yes				Yes	
Number of observations	218	218	218	218	156	156	156	156	
Adjusted $R^2$	0.788	0.877	0.876	0.779	0.769	0.873	0.876	0.855	
Standard Error	Robust	Robust	Robust	Clustered	Robust	Robust	Robust	Clustered	

on bank risks. However, since bank risks, measured by credit spreads, is of small magnitudes, the interest rates for the two types of deposits do not have a considerably big gap. Say, on a given arbitrary day, credit spreads is 0.3% and NIBOR (3M) is 1%, then the total interest rate that depositors would receive is 1.47% for floating-interest deposits, and 1.58% for fixed-interest deposits.

In conclusion, the returns that depositors receive are positively influenced by a number of conditions: bank risks, the money market rate, and the length of the withdrawal notice period. Depositors prefer a higher compensation for bank risks than what is given on average for floating-interest offers. The determinants of interest rates for the two types of offers are different: the interest rates of floating-interest offers follow the general market costs (NIBOR (3M)) closely, while the interest rates of fixed-interest offers compensate depositors more for bank risks. Overall, fixed-interest offers give a slightly higher interest rate and provide a positive term premium.

## 3.2 Deposit activities and allocation

**Determinants of deposit transactions** We first investigate the relationship between the daily number of transactions and factors that are closely tied to the platform, among others. On any given day, we collect data on the following variables: platform’s activities (number of new offers placed on the market the last 15 days, total number of transactions the last five days, average number of existing available offers the last five days,<sup>12</sup> and average offered interest rate), the money market (bank index return and NIBOR (3M)), offered banks (assets and credit spreads<sup>13</sup>), and depositors (the proportion of daily transactions from depositors who have made other transaction(s) in the previous 10 days). We provide descriptive statistics of daily activity on the platform in Table 5.

As we can see, the daily number of transactions on the platform is low, ranging mostly from 0 to 5 with a higher likelihood for floating-interest offers. Including only the days with transactions does not increase this number by much, so the platform’s activity is generally low. On most days, there are only 0–2 new offers placed on the platform, and there are fewer fixed-interest offers than floating-interest offers.

We report the investigation results of the activity of the platform, namely, the determinants of the daily number of transactions on the platform, from different model choices. Besides the conventional regression model choice as the OLS, we choose the following regression models: Poisson, Zero-inflated Poisson, Negative Binomial (NB), and Zero-inflated NB. These models are more appropriate because they handle count data — our dependent variable, the number of transactions on a given day, is always a non-negative integer, i.e., a count data. As we have seen earlier, the platform’s daily activity is low with the median of transactions and offers being zero. We therefore include the Zero-inflated

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<sup>12</sup>The average number of existing available offers the last five days is calculated as the weighted average of the number of available offers the last five days with heavier weights assigned to the more recent days. We define an offer to be expired if there has not been any new transaction in a one-year period or that its remaining asked volume is less than the required minimum volume per transaction. Otherwise, an offer is considered to be existing/available.

<sup>13</sup>We use the one-year term bond spreads of bank group 5 (B5) as the representative bank group for any given day.

**Table 5:** Descriptive Statistics of Daily Activity on the Platform

The table shows descriptive statistics of the data on the daily activities of the platform. The reported daily activities include: number of transactions, number of transactions conditioned on days with at least one transaction, number of new offers, and the average volume per transaction (in NOK million). We also report the floating-interest related activities separately from the fixed-interest related activities. The last statistic is the interval between the 5<sup>th</sup> percentile and 95<sup>th</sup> percentile.

	Mean	Median	Min	Max	St.Dev.	$[P_5, P_{95}]$
No. of transactions	0.90	0	0	14	1.69	[0, 5]
Floating-interest	0.78	0	0	13	1.55	[0, 4]
Fixed-interest	0.13	0	0	5	0.52	[0, 1]
No. of transactions (cond.)	2.45	2	1	14	1.99	[1, 6]
Floating-interest	2.31	2	1	13	1.89	[1, 6]
Fixed-interest	1.66	1	1	5	1.02	[1, 4]
No. of new offers	0.53	0	0	20	1.13	[0, 2]
Floating-interest	0.35	0	0	9	0.79	[0, 2]
Fixed-interest	0.18	0	0	11	0.60	[0, 1]
Avg. volume/tran	18.41	13.3	1	350	25.96	[3.6, 45]
Floating-interest	17.2	12	1	350	23.47	[2.5, 47.5]
Fixed-interest	23.99	20.6	5	300	32.56	[5, 53.5]

models.<sup>14</sup> Based on the Pseudo  $R^2$  and the AIC criterion, we choose the Zero-inflated Poisson regression model as our best model — column (II) in Tables 6 and 7.

In Tables 6 and 7, we show that the daily number of transactions, for both deposit types, is significantly and positively affected by the number of newly placed offers on the platform and the number of existing available offers. We take a closer look at each type of transactions. For floating-interest type, as shown in Table 6, we also see that higher offered floating interests also make it more likely for an offer to have transactions (columns (II) and (IV) in the table). The size of banks seems to influence the depositors' choice of offers — bigger banks are more likely to get transactions — even though we have seen in the previous subsection that larger banks tend to offer lower interest rates. The coefficients of the zero-inflate part of the models help us disentangle the excess zeros in the dependent variable: Fewer newly placed offers and existing available offers are likely to lead to a lower number of transactions. The zero-inflate part also suggests that if the number of transactions in the previous five days is high, then there is less chance for a transaction to be made on a given day. Perhaps a high number of transactions in the previous days means that more attractive offers have already been chosen and are no longer available. The NIBOR (3M) is also positively and strongly correlated with days that have no transactions. When the money market rate is high, banks might not likely to make new offers. For fixed-interest type in Table 7, we also find that higher offered interest rates is a strongly significant contributor for an offer to have

<sup>14</sup>In short, zero-inflated models deal with count data containing frequent zero-valued observations. These models are able to detect an underlying process (zero-inflate process) in the data that is likely to cause zeros in the observations. If a count data is recognized to not be in this zero-inflate process (whether its value is non-zero or not), the regular chosen process takes over to determine its value based on the choice of model (Poisson or Negative Binomial).

**Table 6: Determinants of daily number of floating-interest transactions**

In this table, we report the regression results of the daily number of *floating-interest* transactions on the platform (from October 2017 to February 2021) on a set of control variables on any given day: platform's activities (newly *floating-interest* placed offers, total number of floating-interest transactions the last five days, number of existing offers the last five days, and average newly offered interest spread), the market (bank index and NIBOR (3M)), the offered banks (assets, credit spreads), and the depositors (the proportion of daily transactions from depositors who have made other transaction(s) in the previous 10 days). We present the models as: (I) — Poisson regression model, (II) — Zero-inflated Poisson regression model, (III) — Negative Binomial (NB) regression model (based on the Poisson and auxiliary OLS to estimate the input parameters for the main NB model), (IV) — Zero-inflated NB regression model, and (V) — the OLS model.

Dependent variable: <i>Number of transactions</i>	(I)	(II)	(III)	(IV)	(V)
Newly placed offers	0.057*** (0.015)	0.031*** (0.010)	0.052*** (0.015)	0.031** (0.013)	0.051*** (0.015)
Transactions last five days	0.003 (0.014)	0.037*** (0.009)	0.002 (0.016)	0.040*** (0.013)	0.007 (0.014)
Offers last five days	0.009*** (0.002)	0.003** (0.002)	0.010*** (0.002)	0.003 (0.002)	0.005*** (0.001)
Recent depositor	1.060*** (0.108)	-0.221** (0.091)	1.458*** (0.157)	-0.075 (0.129)	1.294*** (0.167)
Offered interest rate	0.939 (0.738)	1.622*** (0.489)	0.418 (0.761)	1.681** (0.660)	0.568 (0.489)
Bank index	-0.031 (0.044)	-0.025 (0.017)	-0.016 (0.031)	-0.021 (0.021)	-0.020 (0.042)
NIBOR (3M)	-0.154 (0.118)	0.033 (0.075)	-0.224* (0.122)	0.029 (0.101)	-0.125 (0.107)
Credit spreads	-0.435 (0.323)	-0.425* (0.239)	-0.324 (0.380)	-0.409 (0.335)	-0.270 (0.362)
Bank assets	0.416*** (0.141)	0.380*** (0.092)	0.386*** (0.136)	0.385*** (0.125)	0.309*** (0.009)
Zero-inflate:					
Newly placed offers		-0.068*** (0.024)		-0.068** (0.027)	
Transactions last five days		0.063*** (0.022)		0.073*** (0.024)	
Offers last five days		-0.009*** (0.003)		-0.009*** (0.004)	
Offered interest rate		1.988* (1.047)		2.328* (1.220)	
Bank index		-0.013 (0.044)		-0.014 (0.048)	
NIBOR (3M)		0.517*** (0.170)		0.560*** (0.198)	
Credit spreads		0.112 (0.570)		0.093 (0.655)	
Banks's assets		-0.061 (0.188)		-0.029 (0.217)	
Number of observations	1223	1223	1223	1223	1223
(Pseudo) R <sup>2</sup>	N/A	0.13	N/A	0.11	0.10
AIC	3288	2630	2747	2569	4417
Standard error	Robust	Robust	Robust	Robust	Robust

**Table 7: Determinants of daily number of fixed-interest transactions**

In this table, we report the regression results of the daily number of *fixed-interest* transactions on the platform (from October 2017 to February 2021) on a set of control variables on any given day: platform's activities (newly *fixed-interest* placed offers, total number of fixed-interest transactions the last five days, number of existing offers the last five days, and the average newly offered interest rate), the market (bank index and NIBOR (3M)), the offered banks (assets, credit spreads), and the depositors (the proportion of daily transactions from depositors who have made other transaction(s) in the previous 10 days). We present the models as: (I) — Poisson regression model, (II) — Zero-inflated Poisson regression model, (III) — Negative Binomial (NB) regression model (based on the Poisson and auxiliary OLS to estimate the input parameters for the main NB model), (IV) — Zero-inflated NB regression model, and (V) — the OLS model.

	(I)	(II)	(III)	(IV)	(V)
Dependent variable: <i>Number of transactions</i>					
Newly placed offers	0.244*** (0.042)	0.156*** (0.030)	0.292*** (0.059)	0.181*** (0.039)	0.039*** (0.010)
Transactions last five days	-0.160** (0.072)	0.046 (0.068)	-0.377*** (0.121)		-0.026* (0.015)
Offers last five days	0.013*** (0.003)	0.009*** (0.003)	0.015*** (0.005)	0.009** (0.004)	0.002*** (0.001)
Recent depositor	1.322*** (0.210)	-1.395*** (0.242)	2.122*** (0.405)	-1.243*** (0.297)	0.293*** (0.060)
Offered interest rate	3.529*** (0.805)	1.973*** (0.602)	3.680*** (0.853)	2.097*** (0.715)	0.497*** (0.153)
Bank index	0.075 (0.075)	0.103** (0.042)	0.034 (0.062)	0.119** (0.053)	0.008 (0.010)
NIBOR (3M)	-2.978*** (0.653)	-1.378** (0.539)	-3.372*** (0.743)	-1.439** (0.631)	-0.437*** (0.140)
Credit spreads	-1.989** (0.973)	-1.803* (1.002)	-2.167** (1.162)	-1.613 (1.185)	-0.268** (0.125)
Bank assets	-0.037 (0.231)	-0.122 (0.180)	-0.225 (0.245)	-0.167 (0.227)	0.025 (0.029)
Zero-inflate:					
Newly placed offers		-0.064 0.066		0.014 0.070	
Transactions last five days		0.598*** (0.218)			
Offers last five days		-0.002 (0.005)		0.002 (0.006)	
Offered interest rate		-2.917** (1.239)		-1.589 (1.230)	
Bank index		0.299** (0.118)		0.311** (0.128)	
NIBOR (3M)		2.769*** (1.072)		1.561 (1.055)	
Credit spreads		0.886 (1.606)		0.136 1.814	
Banks's assets		-0.092 0.321		-0.027 (0.363)	
Number of observations	1223	1223	1223	1223	1223
(Pseudo) R <sup>2</sup>	N/A	0.20	N/A	0.19	0.08
AIC	927	721	986	727	1813
Standard error	Robust	Robust	Robust	Robust	Robust

transactions. The NIBOR (3M) is also strongly negatively correlated with the number of transactions. This finding, once again, can be explained by the fact that banks are likely to not make more offers when the market rate is high (this claim is also supported by the opposite signs in the coefficients). The results in columns (II) and (IV) for the variable *recent depositor* indicate that if a depositor has made a transaction in the previous 10 days, it is less likely for them to make a transaction on a given day. However, we do not obtain a consistent sign of this variable in other model choices, so it is not definite that this is the case.

In short, it is challenging to capture the likelihood of an offer getting transactions. Via the regression models, we empirically confirm that the likelihood of depositors making transactions is strongly associated with the availability of new offers and the attractiveness of offered interest rates. While the number of existing offers is also a positive factor, its contribution is relatively small. We also find that depositors are more likely to select floating-interest offers made by larger banks.

**Depositor cash allocation** To further study depositors' cash allocation, we also investigate the transaction behavior of depositors. Figure 6 illustrates every transaction on the platform. Each horizontal gray line represents one unique depositor, and we depict every transaction made by a depositor as a transparent circle whose size is proportional to the transaction volume. Because of the transparent circles, darker shades along a depositor line indicates a cluster of transactions of that depositor.<sup>15</sup>

From the deposit activity illustration in Figure 6, we make several remarks: 1. a number of very large deposits (volume of at least NOK 200 million) happened within 2019 and then resumed from late May 2020;<sup>16</sup> 2. most depositors seem to be loyal customers of the marketplace — it is rare to see a depositor make one single transaction and quit the platform; 3. at least 51% of the depositors have at least one transaction cluster. Among these observations, the third finding is particularly interesting and we analyze these transaction clusters.

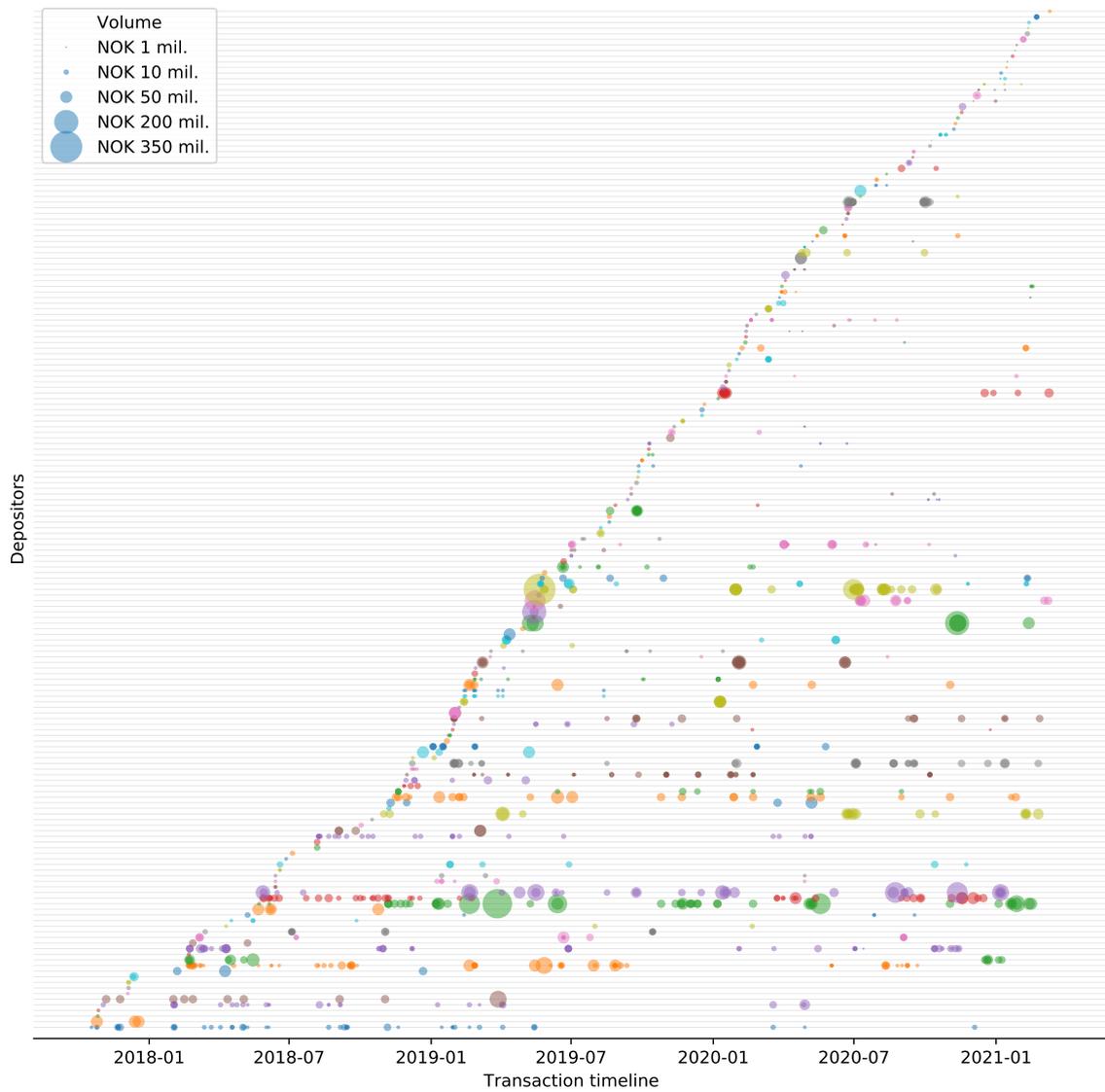
Let us define a cluster of transactions as one that contains at least two transactions within a seven calendar day period from one depositor. We find 232 transaction clusters in total in the analysis period. Among these clusters, 85 have the same volume and 28 have the same absolute total interest<sup>17</sup> on the creation date of the transactions. We now investigate the distribution of interest rates in these clusters.

Figure 7 demonstrates histograms of deviations from the mean interest rate of each transaction cluster. There are more clusters in floating-interest transactions than in fixed-interest transactions. Most of the interest deviations are concentrated around 0, which means that depositors tend to choose similar offered interest rates in their transaction clusters. However, these deviations can

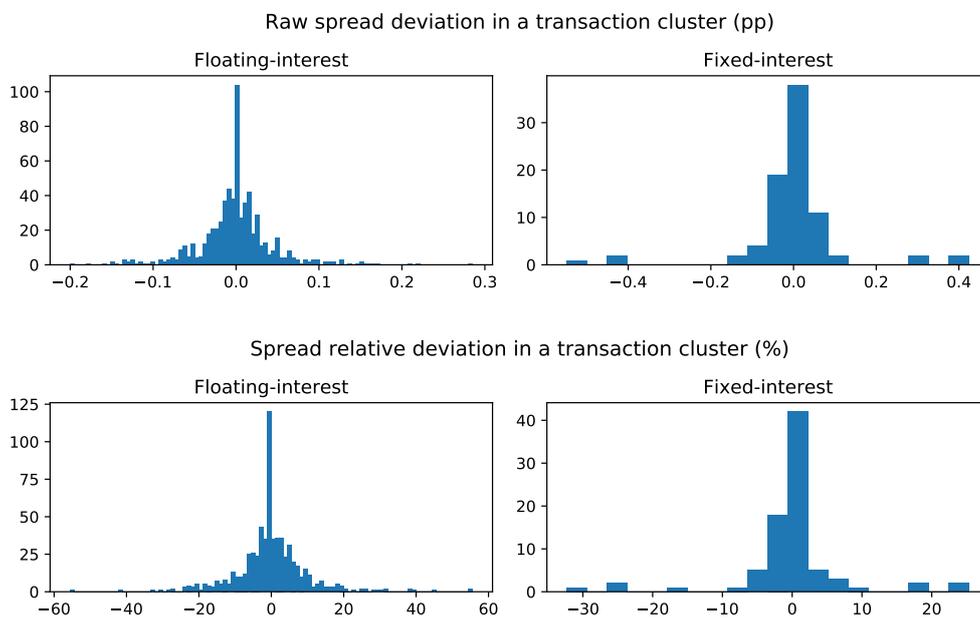
<sup>15</sup>In Figure 12 in the Appendix, we illustrate an additional piece of information: transaction duration to the figure.

<sup>16</sup>Perhaps up until 2019, Fixrate was perceived as an immature marketplace and the market participants were not willing to take such high risks. Then in early 2020, the world economy got hit by the COVID-19 pandemic, and the number of transactions with such large volumes reduced significantly. These large deposits happened once again after May 2020.

<sup>17</sup>For fixed-interest transactions, the absolute total interest is equal to the offered interest rate. For floating-interest deposits, the absolute total interest on a day is the sum of the offered interest spread and the NIBOR (3M) of that day.



**Figure 6: Timeline of the transactions of all depositors** Each of the 182 unique depositors on the platform is represented by a horizontal line, and each transaction is represented by a circle whose size is proportional to the transaction volume. As the circles are transparent, darker colors on one line represent a cluster of transactions of that depositor.



**Figure 7: Histograms of interest rate deviations in transaction clusters.** These histograms demonstrate the deviations from the mean interest rate of the transactions in a cluster of each depositor. We define each cluster as multiple transactions from a depositor in a period of seven days, and separate the cases into two different types of transactions. The top histograms are expressed in raw term (percentage points), while the bottom ones are expressed in relative term (percentage) with the mean interest rate of each transaction cluster.

be up to almost 55% of the mean cluster interest rate in the extreme cases for the floating-interest type, and 30% for the fixed-interest transaction type. These differences are possibly a consequence of different transaction volumes. Regarding banks in transaction clusters, we analyze the banks in terms of rating (bank groups) and asset size.<sup>18</sup> We find that most depositors make a transaction cluster to banks that are similarly rated (67% of the clusters have fewer or equal to 2 rated bank group jumps), but they also do not tend to stay in the same rated bank groups (only 19% of the clusters stay in the same bank group).

We, therefore, conclude that while depositors diversify potential risks by making transaction clusters, they have a certain preference of banks and return rates. Given how safe the banking environment generally is in Norway, depositors are yet reluctant to make a big jump in terms of the kind of banks they make transactions with. This finding suggests that lower rated banks might struggle more to get transactions unless they make very attractive offers.

### 3.3 Is this online deposit market competitive and efficient?

One of the unique features of this deposit marketplace is providing transparency. An examination into this marketplace’s competitiveness and efficiency can shed light on the operations of such a transparent deposit market. To empirically investigate these aspects, we check whether there exists a certain relationship between banks and depositors on the platform. If the marketplace is competitive and efficient, depositors should only seek for attractive offers (in terms of risk and return) instead of establishing a relationship with some specific banks. We also inspect the following aspects over time: the waiting time for an offer to get transactions, the offered interest rates, and the ratios of transactions to offers.

**Relationship transactions** Even though banks traditionally like to establish a long-lasting relationship with stable and secure depositors, on such a competitive platform where depositors are the ones to make decisions, we hypothesize that such a relationship is hard to establish and therefore unlikely.

We define a *relationship* in different ways depending on the minimum amount of transactions to the same bank by one depositor: 1. at least three transactions, 2. at least four transactions, and 3. more than four transactions. From here, we check whether such a relationship seems to exist among 182 depositors and 52 banks on the platform.

Table 8 summarizes our findings. Only 11% of the depositors make at least three transactions with the same bank, and 3% make more than five transactions. These *relationship* transactions lead to 26 relationship banks, and only 15% of the banks on the platform have received at least 5 transactions from a single depositor. Compared to the total number of transactions on the platform, the proportion of *relationship transactions* is low. Condition on relationship depositors, the average expected relationship transactions are 4, 5, and 7 for when a relationship is defined as at least 3, 4, and 5, respectively. Based on the numbers observed, we cannot conclude that such a bank-firm relationship exists on the platform.<sup>19</sup>

<sup>18</sup>An illustration of the results can be found in Figure 10 in the Appendix.

<sup>19</sup>We cannot verify whether a depositor makes a transaction to a bank on the platform and

**Table 8: Relationship between banks and depositors**

In this table, we report the proportions of depositors, banks, and transactions on the platform that have established a *bank-firm relationship*. We define a relationship as one where a depositor has made at least  $X$  transactions to the same bank.

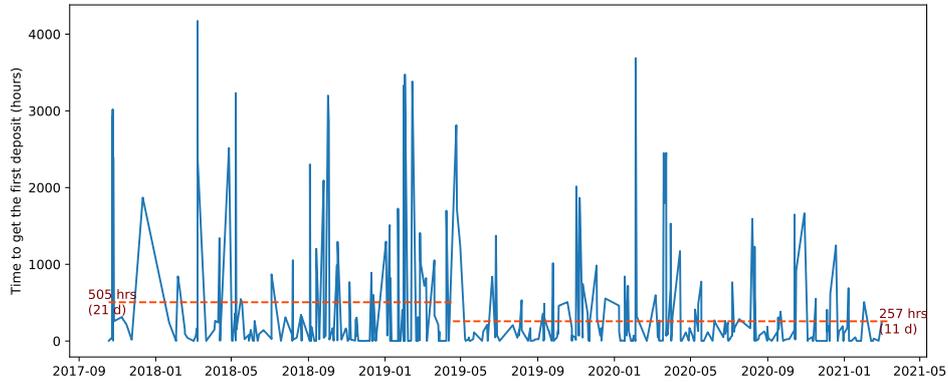
Relationship: <i>At least <math>X</math> transactions to the same bank by a depositor</i>			
	$X = 3$	$X = 4$	$X = 5$
Relationship transactions	70	24	11
Out of 182 depositors:			
Relationship depositors (%)	11	5	3
Out of 52 banks:			
Relationship banks: (%)	50	9	15
Out of 1111 transactions:			
Relationship transactions (%)	6	2	1
Avg. relationship transactions	4	5	7
Avg. days between transactions	184	153	142
Avg. volume per tran (NOK mill.)	21	23	29

**Efficiency and Competitiveness over time** To inspect the efficiency of the market overtime, we plot the waiting time for an offer to get its first deposit in Figure 8. We compare this variable in two different periods. In the first one and a half years after the marketplace establishment, the offers, on average, have to wait around 21 days to get their first deposits. However, in the subsequent period, this number reduces roughly by half, with only 11 days. This observation suggests that the platform becomes more efficient over time in terms of waiting time for a transaction. We also investigate the average ratio of transactions to offers per banks. At the start of the platform, on average, a bank must make two offers to receive a transaction, while in 2020, a bank is expected to receive more than two transactions for a placed offer.<sup>20</sup> We, therefore, conclude that not only it becomes faster for an offer to be selected, the expected number of transactions for a bank’s offer also increases as the market matures.

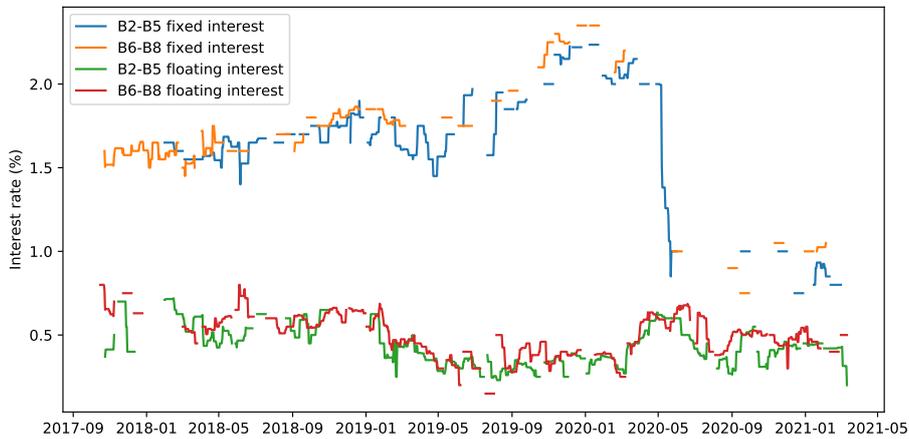
We examine the competitiveness of the platform in terms of the offered interest rates. Particularly, we observe the differences in the offered interest rates between two categories of banks based on their credit ratings: higher-rated banks (B2–B5) versus lower-rated banks (B6–B8). In Figure 9, we plot the rolling average of the offered interest rates categorized both by bank groups and by the types of offers. While the offered interest rates follow each other closely between the two bank groups, it is clear that, for either type of deposits, lower-rated banks offer higher interest rates. This observation suggests an evident risk and return trade-off on the platform — this finding is in line with what we have found earlier. Hence, we conclude that the platform is competitive. This transparent marketplace does not disguise risk: while the offered interest

tries to establish a relationship with the bank outside the platform. However, as we observed in Figure 6, depositors do not tend to quit the platform. Furthermore, one of the biggest advantages for banks to join this platform is to attract new potential depositors.

<sup>20</sup>There are only three months in 2017 and two months in 2019 in the analysis period. The rest of the years are full years in our data sample.



**Figure 8: Transaction waiting time** This figure illustrates the waiting time for an offer to get its first deposit. We divide the sample period into two subsamples, the division is at one and a half years after the platform’s establishment.



**Figure 9: Offered interest rates by bank group** This figure illustrates the rolling average of offered interest rates overtime by bank groups (categorized by credit ratings) and by types of offers. There are 26 banks on the platform that are rated between B2–B5 and 26 between B6–B8.

rates follow each other closely at any given time point, lower-rated banks reward customers with higher interest rates.

## 4 Conclusions

In this paper, we analyze a unique data set on an innovative and transparent deposit marketplace. Our paper provides insightful empirical findings to an understudied research area: *firm/bank deposits*. We investigate this platform under three perspectives: risk and return trade-off, deposit allocation, and competitiveness and efficiency.

First, we find that the offered deposit interest rates by banks are strongly influenced by banks own risk and the money market rate. Depositors indeed care about these bank risks and they make a trade-off between risk and promised returns. These deposit interest rates also reflect a positive term premium offered by banks. Second, we empirically observe that the availability and attractiveness of offers are the two biggest contributors to the daily number of transactions on the platform. We also find that depositors tend to make transaction clusters to diversify risk. Finally, we conclude that as this deposit marketplace matures, it becomes more competitive and efficient. This finding is reflected by the non-existence of bank-firm relationship on the platform, the shorter waiting period to get a transaction for an offer over time, the progressively higher ratio of transactions to offers, and the competitive offered interest rates.

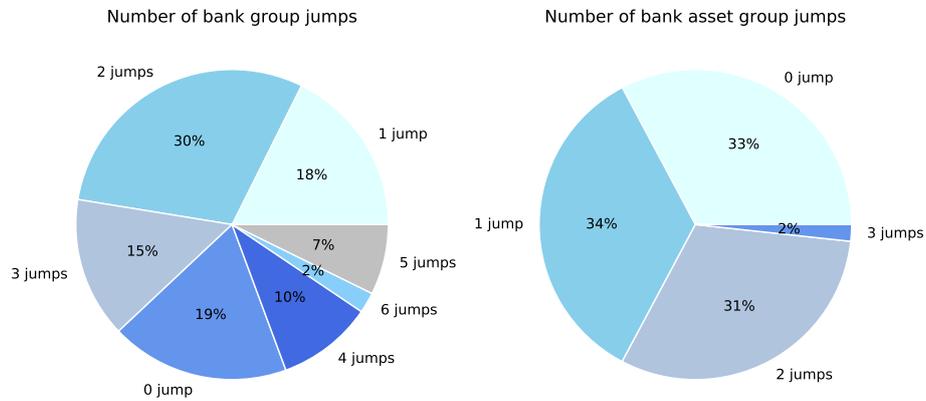
Through our findings, we believe that a novel and open deposit marketplace, such as the studied platform in our paper, can improve efficiency and lessen the gap of information asymmetry that banks often hold in the deposit markets. Therefore, such a platform can expand and gradually alter the nature of large deposits.

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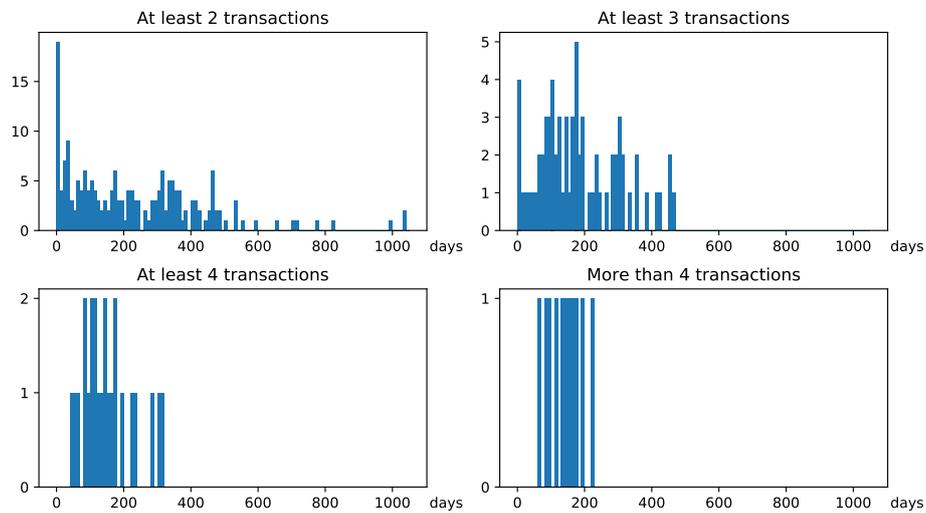
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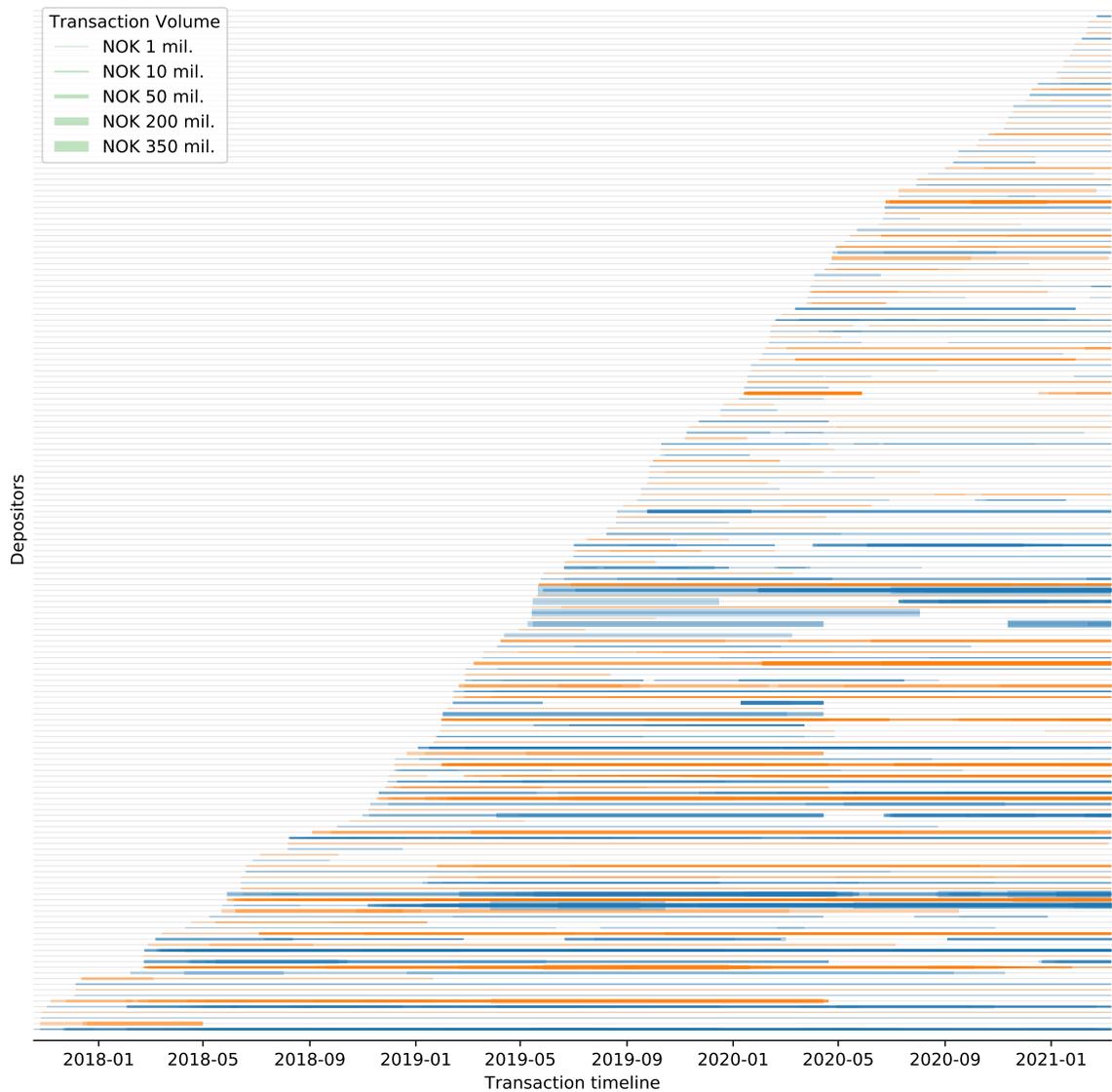
## Appendix



**Figure 10: Bank group jumps in a transaction cluster.** These pie charts illustrate the difference in bank groups (ranging from B1 to B8) and bank asset groups in transaction clusters of depositors.



**Figure 11: Average waiting time between relationship transactions** Depending on how a relationship is defined, we plot the average time between relationship transactions made by each depositor in days.



**Figure 12: Transaction and duration timeline of all depositors** Each of the 182 unique depositors on the platform is represented by a horizontal gray line, and each transaction is represented by a line with thickness corresponding to its volume and length corresponding to its duration. As the transaction lines are transparent, darker shades along one depositor line represent a cluster of transactions of that depositor. The colors alternate between each depositor for readability.