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The effects of two-way lending between financial conglomerates in bilateral repo markets

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Abstract

We examine how market structure, market power, and systemic risk respond to close and intense lending relationships between financial conglomerates (FCs) in non-centrally cleared bilateral repo. Using transaction-level data from Mexico, we document persistent and stable funding relationships between FC-affiliated banks and funds with two distinctive features: first, funding transactions are *two-way*, that is, a given pair of rival FCs provide lending to one another on the same day; second, two-way transactions are executed at lower average rates than one-way transactions. We show that two-way lending between FCs favours both market concentration and market power of FC-affiliated funds, and worsens the terms of trade of independent banks' and funds' lending. Furthermore, we find that the bank-level contribution to systemic risk increases with two-way lending.

Keywords: Repo market, Financial conglomerates, Relationship lending, two-way lending, Competition, Concentration, Market power, Financial stability.

JEL Codes: G1, G23, G28, L4, L22.

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Los efectos del crédito bidireccional entre conglomerados financieros en mercados repo bilaterales

Carlos Cañón Jorge Florez-Acosta Karoll Gómez*

Resumen

Examinamos cómo la estructura del mercado, el poder de mercado y el riesgo sistémico responden a relaciones de financiamiento estrechas e intensas entre conglomerados financieros (CF) en mercados de repos bilaterales descentralizados. Usando datos a nivel transaccional de México, documentamos relaciones de financiamiento persistentes y estables entre bancos y fondos afiliados a CF con dos características distintivas: primero, las transacciones de financiamiento son *bidireccionales*, es decir, un par dado de CF rivales proporciona financiamiento mutuo en el mismo día; segundo, las transacciones bidireccionales se ejecutan a tasas promedio más bajas en comparación con las transacciones unidireccionales. Mostramos que los préstamos bidireccionales entre los CF favorecen la concentración del mercado, aumentan el poder de mercado de los fondos afiliados a los CF y empeoran los términos de intercambio de las transacciones de crédito de bancos y fondos independientes. Además, encontramos que la contribución individual a nivel de banco al riesgo sistémico aumenta con los préstamos bidireccionales.

Palabras clave: mercado repo, conglomerados financieros, relación de financiamiento, financiamiento bidireccional, competencia, concentración, poder de mercado, estabilidad financiera.

Códigos JEL: G1, G23, G28, L4, L22.

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1 Introduction

Repo markets are a crucial source of collateralised funding for financial systems. Also, they have the potential to give rise to systemic crises due to three main reasons:[1] first, collateralised financing is more pro-cyclical than traditional unsecured wholesale funding (see ICMA (2019)); second, financial institutions tend to rely excessively on short-term funding (see Grill et al. (2017); Schaffner et al. (2019)); last, non-centrally cleared bilateral repo (NCCBR) segments are usually the largest (or even the only) components of the repo, and are often opaque to both market participants and regulators (Hu et al., 2019; OFR, 2023a,b). In effect, due to their nature—over the counter (OTC), and without the intervention of a central clearing house or custodian—NCCBR transactions are not registered by central counterparties and, in most cases, are not reported to the authorities. Two remarkable examples are the U.S. and the European repo markets, where the total outstanding volume traded in the NCCBR segment accounted, respectively, for 60% and 57% of the total volume traded by primary dealers in each market in 2022 (Hempel et al., 2022; OFR, 2023a; ICMA, 2023), and which are almost fully opaque to authorities and market participants.[2,3]

Furthermore, the increasing concentration of financial markets in a few large institutions with market power is raising new concerns about the functioning of repo markets and the effects on interest rates, the transmission of monetary policy, and financial stability.[4] However, despite its importance, the effects of imperfect competition in the functioning of NCCBR markets and their contribution to financial fragility remain understudied. Precisely

[1] Previous literature has referred to the role that both excessive reliance on and disruptions in repo markets played in the 2007-2009 Great Financial Crisis. See, for example, Grill et al. (2017); Schaffner et al. (2019) and Hu et al. (2019).

[2] In 2023, the Office of Financial Research presented a proposed rule that would require institutions highly exposed to the NCCBR to submit transaction-level data on their repo activity in that segment on a daily basis. The aims would be to make the market more transparent for all participants, and to provide regulators with useful information on how the market works (see OFR (2023b)).

[3] Due to the lack of data, the European market size is an estimate of the true market size, based on survey responses. The survey was conducted by the ICMA in December 2022 among a sample of 61 financial institutions across Europe— including EU countries, the UK, Norway, and Switzerland—(ICMA, 2023). Previously, the market size was estimated to be between 30% and 50% of the total trading volume (see, for example, Baklanova et al. (2019); ECB (2018); Julliard et al. (2022)).

[4] For instance, Eisenschmidt et al. (2023) show that dealer banks' market power in the European OTC repo segment introduces substantial dispersion in interest rates, weakens their link with policy rates, and distorts the transmission of monetary policy. Huber (2023) shows that dealers' market power in the tri-party repo market is a key friction causing funding spreads.

due to the lack of official data about this segment in advanced economies, the existing literature has mainly focused on centrally cleared or tri-party repo segments.[5] We fill this gap by examining how market structure, market power, and systemic risk respond to close and intense lending relationships between financial conglomerates (FCs) in NCCBR markets.

Using detailed transaction-level data from the Mexican repo market between 2006 and 2018, we start by documenting that FC-affiliated banks and funds establish repeat and stable lending (borrowing) relationships with very few counterparties. Next, we provide evidence that FCs are increasingly engaging in an unusual type of relationship lending that is characterized by two features: first, short-term secured loan transactions are two-way; that is, the investment funds affiliated to a given FC provide liquidity to the bank of a rival FC, and, on the same day, a similar transaction occurs between the same pair of FCs but in the reverse direction.[6] Second, two-way transactions are executed at lower average rates than one-way (i.e., regular) transactions. We then focus on two-way lending transactions and examine the potential effects of this type of relationship on both FCs' market power and competition in the repo market, and banks' contribution to systemic risk.

The Mexican repo market is particularly well suited to an analysis of the effects of close and intense lending relationships between FCs in imperfectly competitive short-term money markets, for several reasons. First, it fully operates under non-centrally cleared bilateral OTC trades, negotiated directly between cash borrowers and investment funds as the dominant cash lenders; that is, Mexican repo transactions are only made directly between parties, and there is no intervention of a match-making platform or intermediary institution. Therefore, each participant has the ability to choose its counterpart in every transaction. This feature of the Mexican repo market implies both an advantage and a challenge for our purposes: an advantage because the ability of market participants to observe the identity of their potential counterparts and choose among them removes the possibility that two-way transactions are

[5] Two notable exceptions are Baklanova et al. (2019), who use a unique data set of repo transactions made by a few large players in the U.S. DBR in the first quarter of 2015 to study the use of collateral in non-centrally cleared bilateral repo transactions; and Eisenschmidt et al. (2023), who use data on OTC repo transactions made between 2017 and 2020 by 38 large dealer banks in Europe and collected by the European Central Bank.

[6] In Mexico, money market funds were legally included in the General Provisions Applicable to Mutual Funds (Circular on Mutual Funds) in 2009. With the financial reform of 2014, "investment corporations" or mutual funds were formally renamed investment funds; however, they are essentially the same.

the result of random or exogenous matching; on the other hand, it poses an identification challenge, as we have to deal with selection bias in our econometric exercises.

Second, its regulatory framework makes it an almost ideal environment for our purposes, because investment funds are allowed to lend money to banks and brokerage firms only; furthermore, investment funds are not allowed to act as borrowers, implying that reverse repo—a channel that, in developed countries such as the U.S., the UK and the EU, is commonly used by lenders to look for specific collateral—is not active in this market; this means that banks' motivations for establishing lending relationships with funds are mainly driven by the need for liquidity; this, in turn, is convenient in terms of the identification of our causal effects of interest, as long as the potential source of bias generated by reverse repo is not present in our setting.[7]

Third, the seven largest FCs owning a bank in Mexico (so-called Group of seven or G7)[8] also own investment fund management companies (AMs) that are among the largest in the Mexican market.[9] Last, evidence shows that, between 2006 and 2018, G7 banks obtained funding mainly from funds affiliated to G7 FCs. Furthermore, 30% of the daily transactions between funds and banks affiliated to rival FCs were made in a two-way fashion; this corresponds to 52% of the average daily volume traded in the repo market.

We follow recent literature on one- and two-way relationship lending (Brauning and Fecht, 2017; Li, 2021; He, 2021) and compute measures of the intensity and depth of the existing relationship between FC-affiliated funds and banks. Further, we compute a two-way lending indicator variable, which equals one if we observe both that FC-affiliated funds provide liquidity to a bank of a rival FC and that the transaction in the opposite direction occurs contemporaneously; and zero otherwise.[10] Using these metrics as our main indicators of two-way lending between rival FCs, we examine the effects of two-way lending on two fronts:

[7] See point 2.2 in DOF-19-2020

[8] The G7 includes Banamex, BBVA Bancomer, Banco Santander Mexico, Banorte, HSBC Mexico, Scotiabank Inverlat, and Banco Inbursa.

[9] Of 33 AMs in the market in 2017, the five leading ones were affiliated to G7 FCs. They were managing nearly 46% of the funds in operation, and at year-end 2015, they held a combined market share of 70% of assets under management.

[10] We also compute traditional metrics of the intensity and depth of the existing relationship between bank and funds, but these account for only part of the relationships that we observe in our data.

First, we look at the effect on the competitiveness of the fund sector in the repo market; to this end, we explore both the direct effects on market concentration and market power, and the spillover effects on funding volume and terms of trade provided (received) by independent funds (banks), using regressions of several outcome variables on our measures of depth and intensity. Second, we look at the effect on systemic risk; to this end, we carry out separate regression analyses of a bank-level measure of the bank's contribution to systemic risk on our two-way lending measures.

Our main threat to identification comes from the fact that banks and funds are allowed to observe and choose their counterparts in each repo transaction. This could potentially cause selection bias in our estimates. To deal with this threat, we use an instrumental variables approach. Given that all of our regressions require some degree of aggregation, our general identification strategy consists of exploiting the granularity of our original data to compute granular instrumental variables (GIVs, Gabaix and Koijen (2022)), and isolate the effect that two-way lending has on our outcome variables. Following Gabaix and Koijen (2022), for each of our regressions and endogenous variables, we perform principal component analysis to obtain factors that explain the observed variation of the endogenous variable well; then, we carry out a regression of the endogenous variable on the factors and obtain the residuals of the regression. By construction, these residuals are correlated with the endogenous variable, orthogonal to the regressors, and plausibly uncorrelated with the error term of the main regression. Next, we aggregate those residuals to the level of aggregation of the regression of interest, using bank or fund market shares as weights. As a result, we obtain a valid, share-weighted instrumental variable for each endogenous variable in the regression of interest. In some cases, we combine the GIVs with other instruments to improve the strength of the identification.

Our first set of results shows that two-way lending leads to a more concentrated market. That is, whenever lending happens mostly between FC-affiliated banks and funds in a bidirectional fashion—which we interpret as a greater preference of FCs to lend to each other through their affiliated funds—market concentration increases. This benefits FCs as long as their affiliated funds' market shares and market power increase. We also find a negative effect on market shares and market power for big FCs if their dependence on their counterpart increases. However, the net effect is positive, which implies that this kind of relationship between big institutions in the market always favours market concentration and market power. Finally, our results indicate that higher levels of two-way lending in the repo market deteriorate the terms of trade of both independent banks and independent funds; that is, independent banks obtain less funding at higher average rates, and independent funds provide less funding to any bank.

Our second set of results shows that two-way lending transactions increase commercial banks' contribution to systemic risk. Specifically, we find that, at the individual level, the more two-way lending there is, the higher is the contribution of a bank to systemic risk, measured as the industry-level equity loss that would be created by the institution's default. This result suggests that two-way lending reduces funding costs to banks, thus potentially improving the efficiency of the whole financial system, and increasing their contribution to systemic risk through higher contagion in the case of default.[11] This result suggests that two-way lending transactions might have an ambiguous impact on the aggregate metrics of systemic risk as, on the one hand, it increases through commercial banks, but on the other hand, efficiency gains in the overall financial system help to reduce it.

This paper is organized as follows. Section 2 takes stock of the related literature. Section 3 describes the data and our empirical strategy. Section 3.4 provides the institutional context in which banks' and funds' two-way lending transactions occur in the Mexican repo market. Moreover, we provide some motivating evidence of the potential mechanism behind two-way transactions. Section 4 studies the effect of two-way lending on the competition for investment funds in the repo market. Section 5 studies the effect of two-way lending on the contribution of commercial banks to systemic risk, and on an overall metric of systemic risk. Finally, Section 6 concludes.

[11] We employ *DebtRank* as a metric of the potential contagion risk that an institution poses to the system, see Battiston et al. (2012). Téllez-León et al. (2021) have already shown its relevance for the empirical analysis of the Mexican money markets.

2 Related literature

This paper adds to a nascent literature that studies particular forms of two-way lending relationships in shadow banking; a common feature of this literature is the emphasis on the so-called reciprocal nature of lending relationships (Li, 2021; He, 2021). Specifically, Li (2021) provides empirical evidence on what she calls cross-market reciprocal lending between banks and prime money market funds (MMFs), which appear to circumvent the tight post-crisis regulations by establishing bundling arrangements between the two parties that include multiple markets and both short- and long-term financial products. On the other hand, He (2021) documents a reciprocal cross-holding relation (CHR) between U.S. and European FCs, and explores the influence of such a relation on portfolio management and the lending spillover derived from it. We contribute to this literature by providing an assessment of the implications of two-way lending between FCs in domestic shadow banking, for the competitiveness of the fund sector and systemic risk, in a relatively small and very concentrated market.

Further, this paper contributes to a strand of literature that studies the determinants of systemic risk from several perspectives: first, the role of size, market power, VaR, leverage, and maturity mismatches of commercial banks (Anginer et al., 2014; Black et al., 2016; Irresberger et al., 2017; Laeven et al., 2016; Varotto and Zhao, 2018; Buch et al., 2019; Carlson et al., 2022); second, banks' dependence on short-term wholesale funding (Karim et al., 2013; Lopez-Espinosa et al., 2013; Mayordomo et al., 2014); third, the relevance of non-interest-rate income (De Jonghe, 2010; De Jonghe et al., 2015; Bostandzic and Weiss, 2018; Kamani, 2019); and last, the role of interconnections between financial institutions, which is an important channel for the propagation of shocks (Allen and Gale, 2000; Markose et al., 2012; Battiston et al., 2012; Gorton and Metrick, 2012; Acemoglu et al., 2016; Tasca et al., 2017; Cai et al., 2018; Roukny et al., 2018; Kanno, 2018; Téllez-León et al., 2021; Batiz-Zuk and Lara-Sanchez, 2021). Our paper adds to this literature by providing new empirical evidence on the relationship between two-way lending, its strength and depth, and systemic risk; in particular, we show that two-way lending yields efficiency gains in terms of stable sources of cheap funding, relative to one-way lending, that reduce the fragility of financial markets.

This paper also relates to a strand of literature that studies relationship lending, according to which, financial institutions develop close and stable relationships with borrowers over time in order to circumvent information asymmetries, reduce search, screening, and monitoring costs, and mitigate uncertainty about counterparty credit quality (Furfine, 1999; Cocco et al., 2009; Presbitero and Zazzaro, 2011; Craig et al., 2015; López-Espinosa et al., 2016; Brauning and Fecht, 2017; Han et al., 2022). We complement earlier studies showing that two-way lending is a way to overcomes the tightness that come with stressed market conditions. Moreover, this paper relates to a strand of literature studying the effects of imperfect competition in lending markets (Huber, 2023; Eisenschmidt et al., 2023; Altunbas et al., 2022; Carlson et al., 2022; Cruz-García et al., 2021; Crawford et al., 2018).

Finally, this paper is also linked to a strand of literature that studies FC-affiliated funds (Ritter and Zhang, 2007; Massa and Rehman, 2008; Golez and Marin, 2015; Franzoni and Giannetti, 2017, 2019); and, from a broader perspective, our paper relates to a vast literature that studies the economics of the mutual fund industry (see, for example, Sirri and Tufano (1998); Hortaşu and Syverson (2004); Stein (2005), and many others).

3 Background and preliminary evidence on two-way lending

3.1 Overview of the data

We use transaction-level data of lending supplied by investment funds to commercial banks in the Mexican repo market between January 1, 2006, and February 8, 2018. Our data set comes from reports sent by market participants to the Mexican Central Bank (the regulator of financial markets in Mexico). An observation of our data set consists of a funding transaction that took place in the repo market on a given day between an individual fund (the lender) and a bank (the borrower); for each transaction, we observe the amount, interest rate, maturity, collateral, haircut and whether the collateral has been used in other lending transactions (and the characteristics of those collateral chains). We provide a description of these variables and summary statistics in Tables A.1 and A.2 of the Appendix.

Further, we observe fund and bank individual characteristics, such as total assets, liquid assets for funds and all funding sources for banks. Moreover, we observe ownership: whether a bank is owned by a FC or not, and whether a fund's assets are managed by an FC-affiliated asset manager; with this information, we are able to link funds and banks that are commonly "owned" by a particular FC and build networks on both supply and demand sides at the owner level. Overall, we observe 666,796 transactions over 3,040 trading days.

3.2 Two-way lending: measurement and descriptive evidence

Two-way lending is a concept with a precise meaning in the context of our paper. It is defined as a set of transactions between FC-affiliated fund-bank pairs that are two-sided in nature and happen contemporaneously. That is, all of the transactions that occur between banks and funds owned by a given pair of rival FCs, in which one or several individual funds (i.e., fund share classes) affiliated to a FC provide liquidity to the bank of a rival FC and, within the same day, a similar transaction occurs in the reverse direction.[12] Accordingly, we refer to all other transactions as one-way lending transactions. Figure 1 offers an illustration of this point.

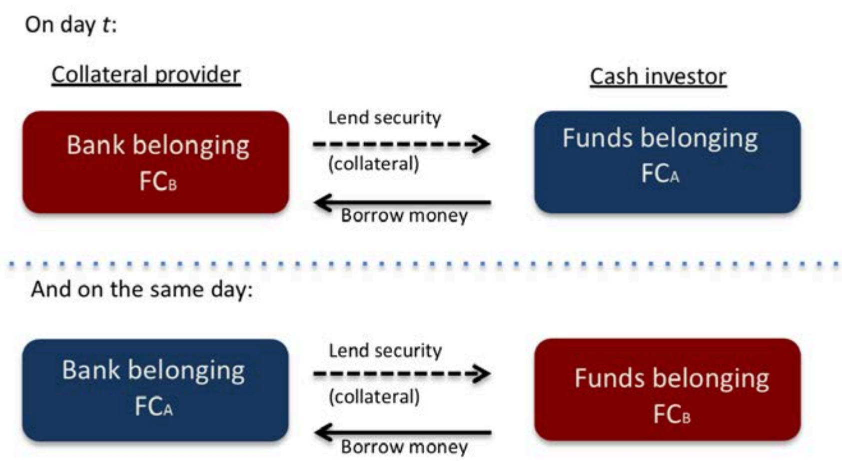
Let $f, l = 1, \ldots, G$ index FCs. To account for two-way lending in our empirical exercises, we construct a dummy variable, denoted D_{flt}, that takes on one whenever we observe that two transactions happen in the same day t as follows: one between FC-affiliated fund f and FC-affiliated bank l, and another between fund l and bank f, regardless of the amount of the two transactions; our dummy takes on zero otherwise.

Further, we measure the depth and intensity of the two-way connections between fund-bank pairs in each period. Specifically, we follow Brauning and Fecht (2017) and construct two measures of the concentration of lending and borrowing portfolios between pairs of rival FCs—the *depth* of the two-way relationship—and one measure of the *intensity* of the interactions,

[12] In our data, 90% of the two-way lending transactions between pairs of FCs happen on the same day, whereas 10% happen in a two-day window, which is why we restrict attention to contemporaneous transactions only.

Figure 1. Lending transactions between FCs in Repo Market

This figure describes the two types of lending transactions in the Mexican repo market. One-way transactions correspond to the relationship depicted on the superior part of the diagram. Two-way lending involves two bilateral repo transactions (the one depicted on the superior part of the diagram plus the one depicted on the inferior part) happening the same day. Note that the diagram only shows what happens in the opening leg of the repo. In the closing leg, these flows are reversed, the cash investor returns the securities to the collateral provider in exchange for cash.



Source: Authors' diagram.

based on the mutual number of loans between the two parties. To measure *depth*, we compute the share of mutual business between two rival FCs relative to the total value of business combined of that pair with all of their counterparts; we do this from both the viewpoint of the lender and the borrower, which yields two different and complementary measures of intensity. In fact, we compute a "lender relationship index", LRI_{flt}, as the share of money lent by funds affiliated to FC f to banks owned by FC l, m_{flt}, plus the money lent by funds affiliated to FC l to banks owned by FC f, m_{lft}, in a given day t on the total money lent by both FCs' funds combined in that day; moreover, we compute a "borrower relationship index", denoted BRI_{flt}, as the share of money borrowed by banks owned by FC f from funds affiliated to FC l, n_{flt}, plus the money borrowed by banks owned by FC l from funds affiliated to FC f, n_{lft}, at t on the total money borrowed by both FCs' banks combined at

t. Formally, the LRI and BRI are given by:

$$LRI_{flt} = \frac{m_{flt} + m_{lft}}{\sum_{k \neq f} m_{fkt} + \sum_{h \neq l} m_{lht}}, \qquad \text{and} \qquad BRI_{flt} = \frac{n_{flt} + n_{lft}}{\sum_{k \neq f} n_{fkt} + \sum_{h \neq l} n_{lht}}, \tag{1}$$

$k, h = 1, \ldots, G$.

We interpret our LRI as a measure of the concentration of credit risk exposure between the two FCs involved in the two-way lending relationship. Similarly, we interpret our BRI as a measure of the preference of FCs to lend to each other through their affiliated funds.

On the other hand, we measure *intensity* of interactions between trading pairs, which we denote SI_{flt}, as the log of the number of loans of that pair combined, in the two directions, over the last 22 trading days. Formally,

$$SI_{flt} = \log \left[1 + \sum_{t}^{t-22} (loan_{flt} + loan_{lft}) \right] \tag{2}$$

where $loan_{flt}$ (respectively, $loan_{lft}$) is a dummy taking on 1 if a loan was granted by f (resp. l) to l (resp. f) at t, and zero otherwise.

Table 1 reports summary statistics and pairwise correlations of our two-way lending measures. All of the correlations are significant at the 1% level. The variables reported capture different aspects of the cross-funding activity between FC-affiliated funds and banks. Our relationship indexes, LRI and BRI, are moderately related with a correlation coefficient of 0.44. The strength of the interactions is less correlated with the cross-funding concentration measures, with correlations of 0.19 and 0.07, respectively.

3.3 Empirical strategy and identification

Our goal is to empirically explore the effects of the intensity and depth of the two-way lending relationship between FCs on fund competition and systemic risk. To do that, we carry out several econometric exercises in which we hope to estimate the differential effects of two-way lending relative to one-way transactions on several outcome variables.

Table 1. Two-way measures: summary statistics and pairwise correlations

The table reports the summary statistics for our two-way lending measures, and their correlations. Our data set covers the period from January 1, 2006 through February 8, 2018.

Variable	Mean	Stand. dev	Min	Max	# Obs
LRI_{flt}	0.27	0.22	0	1	666,796
BRI_{flt}	0.28	0.22	0	1	666,796
SI_{flt}	4.58	0.67	1.10	5.80	666,796

Variable	LRI_{flt}	BRI_{flt}	SI_{flt}
LRI_{flt}	1		
BRI_{flt}	0.44	1	
SI_{flt}	0.19	0.07	1

Source: Banco de México. Authors' calculations.

We face two main challenges to identification: first, a potential selection bias derived from the fact that transaction parties observe market participants, select their counterparts and self-select into one- or two-way lending transactions; and second, reverse causality problems in some of our regressions. We deal with these concerns using instrumental variables in all of our regressions.

Our general identification strategy consists of exploiting the granularity of our original data and the fact that all of our regressions require some degree of aggregation. We compute GIVs (Gabaix and Koijen, 2022), and isolate the effect that two-way lending has on our outcome variables. Following Gabaix and Koijen (2022), for each of our regressions and endogenous variables, we perform principal components analysis (PCA) to obtain factors that explain well the observed variation of the endogenous variable; in the PCAs, we use fund/bank characteristics that may vary with time—such as total fund/bank assets and asset manager assets—variables that explain fund lending and bank borrowing behaviour —such as the number of counterparties of the fund/bank and the frequency of interactions between each fund-bank pair—and market level information.[13] With the factors in hand, we carry out a regression of the endogenous variable on the factors and obtain the residuals of the regression; by construction, these residuals are correlated with the endogenous variable, orthogonal to the regressors, and plausibly uncorrelated to the error term of the main regression. Next, we

[13] See Appendix A for a description and some summary statistics of all of our variables.

aggregate those residuals to the level of aggregation of the regression of interest using bank or fund market shares as weights. As a result, we obtain valid, share-weighted instrumental variables, one for each endogenous variable in the regression of interest.[14,15]

3.4 Background

The Mexican repo market has several features that make it unique relative to repo markets in advanced economies. First, it operates under a bilaterally-cleared OTC trades negotiated directly between cash borrowers and lenders; there is no intermediary and the parties to a transaction know their identities. Second, banks and brokerage houses are allowed to act both as cash borrowers (security seller or collateral provider) and as lenders (security buyer or collateral receiver); while investment funds and other financial institutions can only participate as money lenders (security buyer or collateral receiver) and perform reverse repo transactions (López et al., 2017). Furthermore, funds can only provide liquidity through the repo market.[16]

At year-end 2017, there were 33 asset management companies (AMs) managing 521 mutual funds and 3,521 share classes. Table 2 shows the ownership structure of the AMs, the number of funds and fund classes they managed, and the share of assets under management on the total mutual fund assets in 2017. Seven of the leading AMs are owned by the leading FCs of Mexico which are also owners of the largest commercial banks. These FCs are part of the so-called "Group of Seven" (G7) and concentrate a significant share of the fund sector: they manage 52% of the total funds available with a combined share of 77% of total assets under management.

This evidence suggests that the mutual fund sector is concentrated in a few AMs that belong to large FCs. Table 3 presents a set of characteristics of assets under management by AMs in Mexico at the end of 2017. Even though the Herfindahl-Hirshman index (HHI) indicates that the market was competitive according to the US Department of Justice's

[14]For a formal exposition of the construction of the GIVs and proofs of why they are valid IVs, see Gabaix and Koijen (2022).

[15]In some cases, we combine GIVs with other instruments to improve the strength of identification. We give details of the additional instrumental variables in the corresponding section.

[16]See 2.2 DOF-19-2020.

Table 2. Mexican Investment Funds Industry and Asset Management companies in 2017

The table reports characteristics of Mexican mutual fund management companies (AM) ordered by their share of assets under management (AUM) at year-end 2017. The first two columns show the ownership structure of asset managers: whether or not they belong to a financial conglomerate (FC) and whether or not they are part of the group of seven (G7). The G7 group is composed of Banamex, BBVA Bancomer, Banco Santander Mexico, Banorte, HSBC Mexico, Scotiabank Inverlat, and Banco Inbursa. The columns labelled "Number of funds" and "Number of fund classes" show the number of funds and fund classes managed by each AM. The column "Share on total AUM" shows the percentage share of assets under management of that particular AM on the total value of assets in the fund industry in Mexico.

	Ownership		Number of	Number of	Share on
Asset manager	FC (=1 if Yes)	G7 (=1 if Yes)	individual funds	fund classes	total AUM (%)
AM1	1	1	53	315	24
AM2	1	1	59	463	20
AM3	1	1	65	306	12
AM14	1	0	36	217	7
AM5	1	1	9	29	6
AM11	1	1	29	301	6
AM8	1	1	34	358	5
AM23	0	0	37	161	4
AM4	1	1	20	101	4
AM21	0	0	35	389	2
AM24	0	0	12	131	1
Other	—	0	132	750	8

Source: CNBV. Authors' calculations.

thresholds,[17] other market concentration measures indicate that the market was rather concentrated. In effect, according to concentration ratios, the three leading asset managers accounted for 56.4% of the total assets in the market, and the leading five accounted for 70% of the total assets held by funds. All five belong to G7 FCs. Moreover, there is a considerable dispersion in assets managed by different operators. The 75th percentile AM had 14 times more assets under management than the 25th percentile AM. The dispersion is higher if we compare assets of the 90th percentile AM and the 10th percentile AM: the former had 66 times more assets than the latter.

Figure 2 presents the total repo funding received by commercial banks, discriminating G7 banks from the others. G7 funds were the main funding source of G7 banks. Between

[17] The HHI is a widely-accepted measure of market concentration. It is calculated as the sum of the squares of the individual firms market shares. It ranges between near zero and 10,000. The US Department of Justice interprets the HHI as follows: if HHI$<$ 1500, the market is considered to be unconcentrated; if $1500 \leqslant$ HHI < 2500, the market is considered to be moderately concentrated; finally, if HHI$\geqslant$ 2500 then the market is considered to be highly concentrated (see Department of Justice (2010)).

Table 3. Characteristics of the investment funds' asset management sector, end of 2017

This table reports summary statistics related to asset values, market concentration and dispersion of assets under management in Mexico by the end of 2017. Asset information corresponds to the balance sheets of investment funds, not management companies. The row *Financial conglomerate* (= 1 *if yes*) corresponds to a dummy that takes the value of one whenever an asset manager belongs to a Financial Conglomerate; HHI stands for the Herfindahl-Hirshman index; $C5$ corresponds to the concentration ratio, calculated as the total assets of the five largest asset managers, divided by the value of the total assets in the market; $C1$ and $C3$ correspond to concentration ratios for the largest and the three largest asset managers, respectively. The row 75th to 25th percentile ratio is calculated as the asset value of the asset manager in the 75th percentile, divided by the assets of the asset manager in the 25th percentile; 90th to 10th percentile ratio is calculated as the asset value of the asset manager in the 90th percentile, divided by the assets of the asset manager in the 10th percentile.

Variable	Statistic
Number of asset managers (AMs)	33
Assets: summary statistics (Million dollar)	
Share in total assets (%)	12,7
Min	0.15
Mean	3,957
Median	1,140
Standard Deviation	6,668
Max	27,906
Market concentration	
Financial conglomerate (=1 if yes)	0.57
HHI	1,335
C1	25.18
C3	56.43
C5	69.82
Dispersion of assets under management	
Coefficient of variation	168.50
75th to 25th percentile ratio	14.14
90th to 10th percentile ratio	66.27

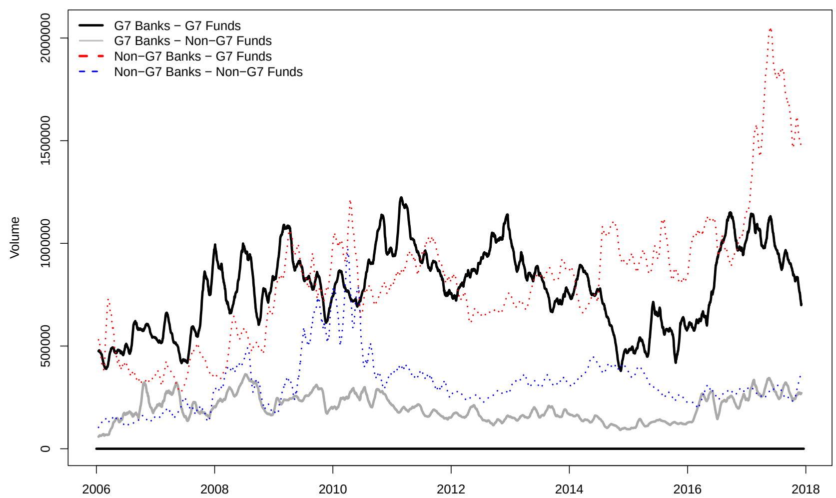
Source: CNBV. Authors' calculations.

2006 and 2018, 36.8% of loan volume received by G7 banks was provided by G7 funds; in terms of lending transactions, we observed that 48.6% involved G7 banks and funds.

Figure 3 presents the evolution of the number of repo transactions by type (one-way/two-way). The figure shows that there is a considerable number of two-way transactions that take place in each day. Both two-way and one-way transactions show similar behaviour between 2006 and 2011; however, since 2012, two-way loans remarkably exceed one-sided transactions. On average, 30% of the daily transactions between FC-affiliated funds and banks were made two-way, representing about 52% of the average total amount daily traded in the repo market (see Table 4).

Figure 2. Liquidity sources of commercial banks in the repo market

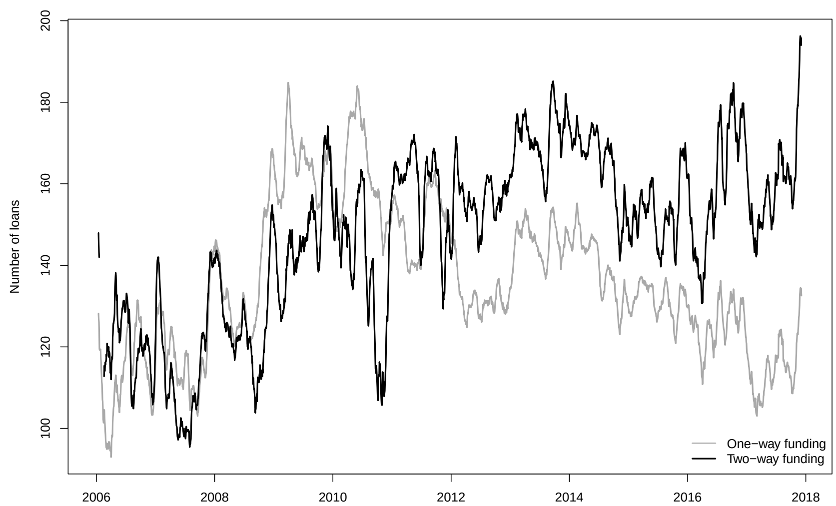
The figure shows the daily loan volume of the repo funding received by commercial banks from investment funds discriminating by G7 group. The dataset covers the period from January 1, 2006 to February 8, 2018.



Source: Banco de Mexico. Authors' calculations.

Figure 3. Number of lending transactions by type: two-way vs. one-way transactions

This figure depicts the 20-day moving average of the daily total number of loans, both one- and two-way. The dataset covers the period from January 1, 2006, to February 8, 2018.



Source: Banco de Mexico. Authors' calculations.

Table 4 presents the number of transactions, and average amount, interest rate and haircut for one- and two-way lending transactions made by FC-affiliated banks in the Mexican repo market between 2006 and 2018. Most transactions are one-way: 70.9% of the total bank-fund repo transactions, which account for 43.9% of the yearly traded volume. A distinctive feature of the Mexican market relative to the U.S. and Europe, is that internal capital markets are not banned, yet, they are not a common source of one-way liquidity for banks. Of all of the bank-fund repo transactions, only 0.4% are executed by funds and banks affiliated to the same FC; two banks perform these transactions and account for 0.8% of the annual volume traded in the repo market, on average.[18] According to the industry's conventional wisdom, obtaining liquidity through internal capital markets can considerably harm a bank's reputation. Therefore, in practice, internal funding is not an option in Mexico.

Two-way lending is concentrated by the three biggest commercial banks in Mexico (identified as B1, B2 and B3 in Table 4), concentrating 81% of the two-way lending transactions between 2006 and 2018. Likewise, the funds managed by the leading three FCs (identified as AM1, AM2 and AM3 in Table 2) concentrate 88.8% of the total two-way lending transactions observed between 2006 and 2018.

3.5 Preliminary evidence on two-way lending

Why FCs engage in two-way lending transactions? A first look at the data suggests that cheap funding is one of the salient features of this type of transactions. In effect, Table 4 shows that average interest rates of two-way lending transactions are lower than the average rates of most one-way transactions. In particular, the three leading banks in the market, B1, B2, and B3, obtained cheaper liquidity through two-way lending compared to the average rates of their respective one-way transactions; average rates are, respectively, 35, 8 and 36 basis points lower relative to rates of their own one-way transactions. Furthermore, this behaviour is persistent over time. The left panel of Figure 4 presents the difference between the daily average interest rate between two-way and one-way transactions for FC-affiliated banks and funds. We observe that the difference has been mainly positive, which means that two-way lending transactions were cheaper. Moreover, the right panel of Figure 4 presents the daily average volume weighted haircuts of one-way and two-way transactions. Haircuts

[18]In some cases, banks are explicitly allowed to obtain liquidity from funding sources owned by the same FC as long as they use certain asset classes approved by the National Banking and Securities Commission (CNBV) (see point 2.1 in DOF-19-2020). Securities must have the minimum rating from at least two rating agencies, including Standard and Poors and Moodys and Fitch (López et al. (2017)).

Table 4. Lending transactions by FC-affiliated banks in the Mexican repo market, 2006-2018

Table shows the number and the average rate, haircut and amount of lending transactions in the Mexican repo market by type. Average values cover the period from January 1, 2006 to February 8, 2018.

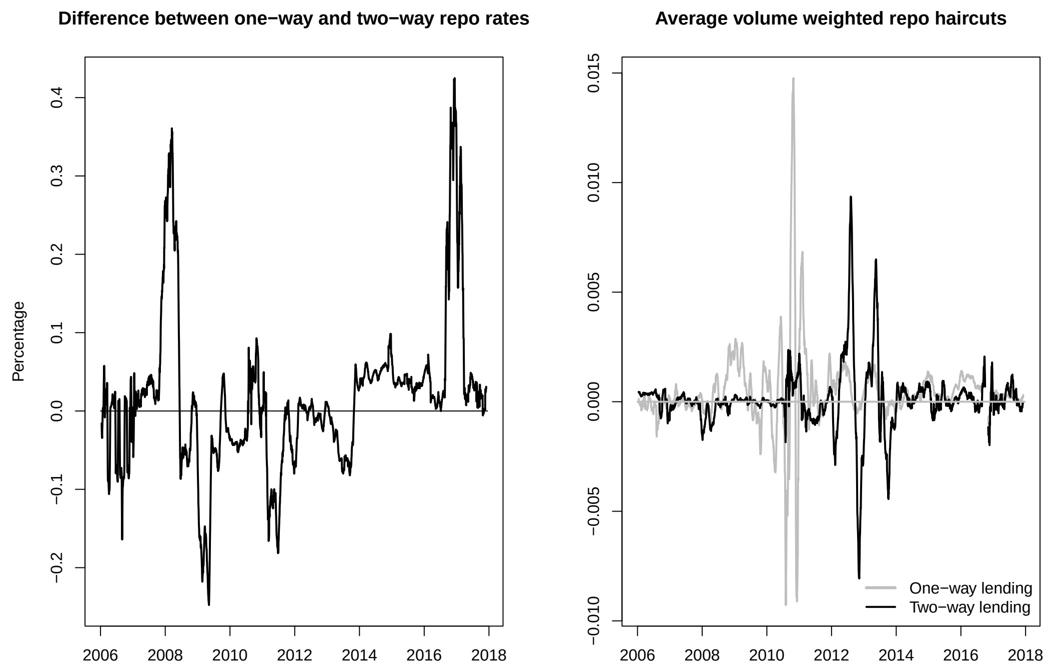
	Two-way lending				One-way lending							
					Between FCs				Within FC			
Banks	Number of transactions	Average repo rate	Average amount	Average haircut	Number of transactions	Average repo rate	Average amount	Average haircut	Number of transactions	Average repo rate	Average amount	Average haircut
B1	67,897	4.72	982,998	-0.000013	198,067	5.07	404,614	-0.0000005	2,886	5.13	69,025	-0.000034
B4	9,367	5.14	658,537	-0.00033	51,743	5.22	666,471	0.000064				
B2	67,016	4.78	678,269	0.000019	22,397	5.14	791,178	0.000149				
B9	3,128	5.22	431,864	0.000354	8,860	5.59	689,784	0.0014363				
B7	3,606	4.50	755,186	-0.000355	25,482	4.31	557,706	0.0028794				
B9	38	4.55	331,578	-0.001308	7,448	5.59	180,609	0.0010182				
B6	1,296	4.43	243,079	0.000121	17,698	4.79	346,535	-0.0000105				
B5	3,279	6.14	679,347	0.000113	10,342	6.32	377,408	0.0004655				
B3	21,507	5.14	1,386,643	0.000016	11,354	5.26	375,278	0.0004604				
B8	16,618	5.54	595,778	0.000216	33,265	5.33	515,230	0.0001654				
B10					750	3.66	385,137	0.0007869	96	4.48	35,986	-0.00028
OtherTwo					82,656	6.16	333,492					
Total	193,752		6,743,279		470,062		5,623,442		2,982		105,011	
% share	29.1%		51.7%		70.5%		43.1%		0.4%		0.8%	

Source: Banco de México. Authors' calculations.

from two-way lending transactions appear to be smaller, which suggests that the discount applied to the initial market value of the collateral in two-way transactions was smaller than in one-sided transactions.

Figure 4. Average daily interest repo rate and haircuts transactions

The left panel depicts the spread between the daily average volume weighted interest rate and the repo rate. The right panel shows the daily average volume weighted haircuts, for both two-way lending and total lending. The dataset covers the period from January 1, 2006 to February 8, 2018.



Source: Banco de Mexico. Authors' calculations.

Previous literature shows that, in a context of one-way lending relationships, close ties between the borrower and the lender often leads to lower funding costs (see, for example, Petersen and Rajan (1994)). We explore if this is the case in the context of two-way lending relationships. We estimate the probability that a two-way lending transaction takes place as a function of prices (haircuts), and traditional measures of dependence and intensity. Considering lending transaction between banks and funds, we estimate the following binary choice model:

$$D_{flt} = \mathbb{1}(\beta_1 DoF_{flt} + \beta_2 DoB_{flt} + \beta_4 Vol.22_{flt} + \beta_5 HC_{flt} + \lambda_{fm} + \xi_{lm} + \phi_m + \epsilon_{flt} \geq 0), \quad (3)$$

where D_{flt} is the two-way lending dummy previously defined.[19] DoF_{flt} and DoB_{flt} are two measures of dependence that we compute following Li (2021). DoF_{flt} measures the dependence of a bank affiliated to FC l on the funds affiliated to FC f; alternatively, DoB_{flt} measures the dependence of FC l's funds on its borrowers (i.e., FC l's banks). $Vol.22_{flt}$ measures intensity as the total lending amount between fund-bank pairs during the last 22 days. HC_{flt} is the haircut of the transaction. λ_{fm}, ξ_{lm} are fund and bank fixed effects that vary over time, and ϕ_m are month-of-the-year fixed-effects. Finally, ϵ_{flt} is a zero-mean logistic error; we assume that it is independently and identically distributed Type 1 Extreme Value.

To capture the how crises and market tightness shape two-way lending, we estimate two alternative specifications to equation (3): first, we add interactions between our measures of depth and intensity and haircut with a dummy variable for last global financial crisis, from August 2007 through June 2010;[20] and second, we include an indicator variable for market tightness interacted with the dependence variables.[21]

Dependence measures between parties and the intensity of the bilateral relationships are endogenous. We deal with this issue by computing GIVs and estimating the model using a control function approach. Table 5 presents the results in three columns. Column (1) shows that the estimated coefficients on the two dependence measures are both positive and significant.[22] Thus the probability to engage in a two-way lending transaction increases with the relative importance of the fund and bank to each other. We also find that an increase in haircuts implies a lower probability for a two-way lending transaction.

Columns (2) and (3) show that the probability of FCs to engage in two-way transactions is preserved under stress conditions. In effect, results in column (2) indicate that a higher market uncertainty barely reduces the effect of bank dependence on their fund suppliers,

[19] The $\mathbb{1}(\cdot)$ is an indicator function taking on 1 if the condition inside the parentheses is satisfied and zero otherwise.

[20] This period was characterized by high uncertainty in the markets worldwide; hence, private information about counterparty risk became more important for the allocation and pricing of liquidity.

[21] We compute the tightness dummy variable $Tight.dt$ as follows: we compute the ratio of the number of lenders on the number of borrowers participating in the repo market on day t; second, if the market is tight (i.e., if the value of the ratio for a given day is in the lowest quantile of its distribution of the whole period, we assign a value of 1 for our dummy of market tightness, and zero otherwise.

[22] Table B.1 in the Appendix reports first-stage regression results. Notice that the Angrist-Pischke F-tests are highly rejected, suggesting that our instruments are strong.

while it reinforces the effect of fund dependence on their bank counterparts. This result is consistent with the expected behaviour of funds, which tend to seek particular safer securities as collateral. Also with previous evidence according to which banks tend to restrict their liquidity funding to those counterparties with which they have stable and frequent interactions. By contrast, the effect of haircuts on the probability of engaging in two-way lending drops considerably during higher market uncertainty, even though the net effect is still negative.

Finally, the coefficients of the interactions of dependence measures with the market tightness variable are not statistically significant. This suggests that when the market is tight, either because funds suffered significant net outflows or the market was driven by investors in search of specific collateral rather than investors seeking funding, banks and funds are equally likely to engage in two-way lending in the overnight market. This is in line with previous literature showing that search frictions lead to relationship formation (Han et al., 2022). Again, market tightness reduces the impact of haircuts, meaning that for a given value of the collateral, parties are more likely to engage in two-way if the market is tight, compared to less stressful periods.

4 Effects of two-way lending on the fund industry

This section explores the effects of two-way transactions between FCs on market concentration and market power of funds in the repo market. To do this, we first carry out an analysis of the effects on market shares and market structure and, second, we estimate a stylized structural model of demand and supply to back out a Lerner index for funds in order to disentangle the contribution of such transactions on fund market power. Finally, we examine the potential spillover effects on independent banks and funds.

4.1 Two-way transactions, market shares and market structure

In order to explore the effects of two-way lending on individual outcomes, we perform a regression of the fund level market shares as the dependent variable on our two-way lending

Table 5. Determinants of two-way lending transactions

This table reports the second-stage estimates of the logit model presented in (3). Robust standard errors are given in parentheses. The dependent variable is a dummy that equals one if two-way lending took place between FCs f and l at t, and zero otherwise. In Appendix A of the paper, we provide a description of all of our variables. Our data set consists of daily transactions between pairs of FCs; it covers the period from January 1, 2006 through February 8, 2018. The symbols *,**,*** denote statistical significance at the 10%, 5% and 1% level, respectively. Table B.1 of the Appendix presents the corresponding first-stage estimates and diagnostics.

	Dependent variable: D_{flt}		
Variable	(1)	(2)	(3)
Constant	-2.86***	-2.89***	-2.85***
	(0.10)	(0.10)	(0.10)
DoB_{flt}	6.28***	6.11***	6.28***
	(0.10)	(0.10)	(0.10)
DoF_{flt}	0.20*	0.10	0.13
	(0.09)	(0.09)	(0.09)
$Vol.22_{flt}$	0.00***	0.00***	0.00***
	(0.00)	(0.00)	(0.00)
HC_{flt}	-40.45***	-83.84***	-44.30***
	(2.68)	(3.93)	(2.89)
$DoB_{flt} \times crisis_t$		-0.61***	
		(0.10)	
$DoF_{flt} \times crisis_t$		0.51***	
		(0.09)	
$HC_{flt} \times crisis_t$		66.38***	
		(4.41)	
$DoB_{flt} \times tight.d_t$			0.26
			(0.18)
$DoF_{flt} \times tight.d_t$			0.17
			(0.18)
$HC_{flt} \times tight.d_t$			19.18***
			(5.36)
Fund × Month FE	Yes	Yes	Yes
Bank × Month FE	Yes	Yes	Yes
Month FE	Yes	Yes	Yes
Observations	108.649	108.649	108.649
R-squared	0,4889	0,4901	0,4892
Average Angrist-Pischke F-statistic	234.8	233.6	229.1
Average F-statistic	754.4	746.6	718.3

Source: Banco de México. Authors' calculations.

measures. We compute market shares as the amount of money lent by fund f to banks at day t on the overall amount of money lent by all of the funds that are active in the market at t. In the case of FC-affiliated funds, we aggregate the loans granted by all of the funds affiliated to a given FC at date t and compute the share at the FC level. In this regression, we control for both observed and unobserved fund characteristics by including fund fixed effects λ_f, and market-level time shocks through month fixed effects, θ_m. Formally, we estimate:[23]

$$s_{ft} = \beta_0 + \beta_1 r_{ft} + \beta_2 BRI_{ft} + \beta_3 LRI_{ft} + \beta_4 SI_{ft} + \lambda_f + \theta_m + \nu_{ft}, \quad (4)$$

where s_{ft} is the market share of fund (FC) f on the total amount of money lent to banks in the repo market at date t; r_{ft} is the average interest rate charged by fund f to borrowers at date t; BRI_{ft} is the across-counterparties average borrower relationship index of funds-affiliated to fund (FC) f on day t; LRI_{ft} is the lender relationship index of funds affiliated to FC f, averaged across transactions made with counterparties on day t; SI_{ft} is the log of the number of transactions made between fund-bank pairs, averaged across all fund f counterparties; and ν_{ft} is a zero-mean random term.

We address the endogeneity issues of our relationship measures by following a similar strategy as in previous regressions, namely, using GIVs (Gabaix and Koijen, 2022). Further, we follow the recent Industrial Organization literature and compute an additional set of instruments that exploit the differences between observed characteristics of the products available to consumers to generate exogenous variation that is useful for identification; these instruments, known as "differentiation IVs"—DIVs—(Gandhi and Houde, 2020), are computed as the sum, across products, of the distances between a given observed product attribute and the value for that attribute of each of the competing products existing in the market. Finally, we use interactions between some of our IVs. The identifying assumption is, therefore, that after controlling for fund-time and time (market) shocks along with an exogenous variation that is correlated with our endogenous variables, we are able to isolate the effect of two-way lending on fund market shares.

We report the results in Table 6 (Table B.2 of the Appendix presents the corresponding first-stage estimates and diagnostics). Column (1) presents OLS estimates and column (2) displays results for our preferred specification estimated by 2SLS. As expected, the interest rate has a negative and significant coefficient meaning that, on average, cheaper funding

[23] We abuse notation and use the same index f to index both an independent fund and a group of funds affiliated to a FC.

leads to higher market share. Concerning our two-way lending measures we find that a higher dependence of banks on a given fund (measured by the average BRI) leads to a higher market share; alternatively, a higher dependence of a fund on its counterparties (measured by average LRI) leads to a lower market share; finally, a greater intensity in two-way relationships between pairs of institutions leads, on average, to higher market shares. Overall, these results suggest that there is a positive and significant effect of deeper, two-way relationships between FCs, measured from the standpoint of the borrower; that is, FC-affiliated funds have the ability to concentrate a larger share of the market through two-way lending transactions.

Table 6. Regression results for funds' market shares

This table reports second-stage estimates. Standard errors clustered at the fund-month level are given in parentheses. The dependent variable is the daily market share of fund f on the total amount of money lent by funds to banks on the repo market in a given day t. Control variables include daily averages of the borrower relationship index and the lender relationship index. In Appendix A of the paper, we provide a description of all of our variables. The second column of the table presents first-stage tests for weak identification. We aggregate our data at the fund-day level; it covers the period from January 1, 2006 through February 8, 2018. The symbols *,**,*** denote statistical significance at the 10%, 5% and 1% level, respectively. Table B.2 of the Appendix presents the corresponding first-stage estimates and diagnostics.

	Dependent variable: market share	
	OLS	IV
Variable	(1)	(2)
Average interest rate	-0.0006	-0.006*
	(0.0022)	(0.004)
BRI_{ft}	0.246***	0.183***
	(0.035)	(0.045)
LRI_{ft}	-0.148***	-0.117***
	(0.022)	(0.027)
SI_{ft}	0.02***	0.018***
	(0.001)	(0.002)
Constant	Yes	Yes
Factors as controls	Yes	Yes
Fund FE	Yes	Yes
Month FE	Yes	Yes
Kleibergen-Paap F-statistic		51.69
Angrist-Pischke average F-statistic		2391.5
Kleibergen-Paap rk LM-statistic		316.55
P-value		0
Observations	114279	114279

Source: Banco de México. Authors' calculations.

Next, we explore whether two-way lending reinforces market concentration on the few large FCs that already concentrate a large share of the market. To do that, we compute a daily Herfindahl-Hirschman Index (HHI) for the repo lending supplied by funds to banks as the sum of the squares of the fund-level market shares on the total volume of money lent by funds in a day in the Mexican repo market. The daily HHI measures the level of concentration of the lending supplied by investment funds to banks in the repo market in one day. Given that our HHI is a market-level measure—meaning that it is common to all of the transactions observed at t—we aggregate our data up to the daily level by taking averages across transactions and fund-bank pairs. We regress our HHI on measures of depth (BRI_t and LRI_t) and intensity (SI_t) of the relationships between FC-affiliated banks and funds. Finally, we account for market-level and seasonal shocks by including week-of-the-year fixed effects ϕ_w and year fixed effects γ_y. Our specification is as follows:

$$HHI_t = \beta_0 + \beta_1 BRI_t + \beta_2 LRI_t + \beta_3 SI_t + \phi_w + \gamma_y + \varepsilon_t, \tag{5}$$

where ε_t is a zero-mean random term.

Our two-way lending measures are potentially endogenous as long as a shock to the market concentration index may shift the nature, depth and intensity of the lending relationships between a pair of institutions. We address these issues by instrumenting our variables with GIVs (Gabaix and Koijen, 2022).

We report the results in Table 7 (Table B.3 of the Appendix presents the corresponding first-stage estimates and diagnostics), in which our HHI is measured between zero and one. Column (1) presents OLS estimates and column (2) displays results for our preferred specification estimated by 2SLS. Results show a positive and significant effect of two-way lending measured by BRI, which suggests that an increase in banks dependence on funds leads to a more concentrated market: an increase in 1 unit in our borrower index leads to an increase in 0.184 units of the sector HHI. By contrast, the coefficient of our relationship lending measure from the lender's perspective, LRI_t which measures dependence of funds on banks, is negative and significant: an increase in 1 unit in our borrower index leads to a decrease in 0.169 units of the sector HHI. This suggests that the concentration of fund lending by a few FC-affiliated banks contributes to a less concentrated market. Overall, our results indicate that two-way lending relationships favor market concentration if banks become, on average, more dependent on their fund counterparts than funds on their bank counterparts. Last, the intensity of the two-way relationships is positive and significant, which indicates that repeated interactions between the same fund-bank pairs leads to more concentrated markets.

Table 7. Regression results for Herfindahl-Hirschman Index (HHI)

This table reports second-stage estimates. Robust standard errors are given in parentheses. The dependent variable is a daily Herfindahl-Hirschman Index (HHI) for the repo market in which funds supply liquidity to banks. Controls include the average borrower relationship index, the average lender reciprocity index, and factors obtained from a principal component analysis. In Appendix A of the paper, we provide a description of all of our variables. The second column of the table presents first-stage tests for weak identification. We aggregate our data at the daily level; it covers the period from January 1, 2006 through February 8, 2018. The symbols *,**,*** denote statistical significance at the 10%, 5% and 1% level, respectively. Table B.3 of the Appendix presents the corresponding first-stage estimates and diagnostics.

	Dependent variable: HHI_t	
Variable	OLS (1)	IV (2)
BRI_t	0.203***	0.184**
	(0.031)	(0.085)
LRI_t	-0.084***	-0.169***
	(0.021)	(0.042)
SI_t	0.048***	0.016*
	(0.005)	(0.009)
Constant	Yes	Yes
Factors as controls	Yes	Yes
Week-of-the-year FE	Yes	Yes
Year FE	Yes	Yes
Kleibergen-Paap F-statistic		76.11
Angrist-Pischke average F-statistic		520.87
Kleibergen-Paap rk LM-statistic		237.51
P-value		0
Observations	3039	3039

Source: Banco de México. Authors' calculations.

4.2 Effects on the market power of funds affiliated to financial conglomerates

Bearing the last results in mind, now we explore wheater two-way lending also increases the market power of FC-affiliated funds. To check this empirically, we back out a fund-level

Lerner index as a measure of market power and use it as our outcome variable. According to theory, the Lerner index is a function of the marginal cost of production, which is not observed in our data. However, in the context of Bertrand competition with differentiated products, the optimal pricing rule of a firm in a symmetric equilibrium equals the Lerner index to the inverse of the elasticity of demand. Our strategy to back out the fund-level Lerner index is to develop a simple structural model of supply and demand, following the standard literature of demand estimation in empirical Industrial Organization.

Our focus is on the repo market for lending services, in which banks (the demand side), have short-term liquidity needs, whereas investment funds supply lending products to banks at an interest rate. The fund sector consists of a number of single product firms that set the interest rates of their lending products, according to the Bertrand competition conduct. We perform our estimation in two steps. First, we set out supply and demand models for the repo market of short-term funding and estimate the demand coefficients using our data set of fund-bank transactions. With the demand coefficients in hand, we compute own-price elasticities of demand, and then apply the price-cost markups formula derived from the supply model to back out product level markups and compute a fund-level Lerner index. Second, we regress our estimated Lerner index on our relationship measures, an HHI to account for industry structure, and other controls.

4.2.1 A stylized structural model to back out a fund Lerner index

Supply side. Suppose that there are F funds in the Repo market, indexed by $f = 1, \ldots, F$ each of which supplies liquidity through lending services. For the sake of simplicity, we assume that funds are single-product firms; that is, each fund supplies lending with fixed characteristics (e.g., interest rate, maturity and haircut) to banks looking for liquidity in the repo market. Accordingly, datawise, we aggregate all credits made by a given fund in a single product indexed by the same index of the fund; the characteristics of that lending product correspond to averages of the observed lending terms across banks that borrowed from the same fund in period t.[24] The variable profit of fund f derived from its lending activities in

[24]This is a restrictive assumption relative to how the market works in reality, in which a given fund-bank pair may agree on several loans in the same day, each of them characterized by a particular amount of money, a

the repo market is given by:

$$\Pi_{ft} = (r_{ft} - c_{ft}) M_t s_f(\mathbf{r}_t),$$

where r_{ft} is the weighted average interest rate of the lending given by f at time t, c_{ft} is the fund's marginal cost, s_{ft} is the market share of fund f at time t, $\mathbf{r}_t$ is the $F \times 1$ vector of interest rates of all of the funds in the market, and M_t is the size of the lending market, which we take as all of the money borrowed by banks in the repo market from any firm providing wholesale liquidity at time t, including investment funds.[25] We assume that funds compete in setting interest rates and that a pure-strategy Bertrand-Nash equilibrium in prices exist. Therefore, the interest rate of the lending supplied by fund f must satisfy the first order condition:

$$s_f(\mathbf{r}_t) + (r_{ft} - c_{ft}) \frac{\partial s_f(\mathbf{r}_t)}{\partial r_{ft}} = 0.$$

We have, therefore, a system of F equations, one for each of the funds (products) existing in the market. Solving fund f's equation for its interest rate-cost margin yields, for $f = 1, \ldots, F$:

$$r_{ft} - c_{ft} = \frac{1}{-\frac{\partial s_f(\mathbf{r}_t)}{\partial r_{ft}}} s_f(\mathbf{r}_t). \tag{6}$$

This optimal pricing rule allows us to back out a Lerner index for each fund at each period t. Dividing the two sides of equation (6) by f's interest rate yields:

$$LI_t \equiv \frac{r_{ft} - c_{ft}}{r_{ft}} = \frac{1}{\eta_{ft}}, \qquad \text{with} \qquad \eta_{ft} = -\frac{\partial s_f(\mathbf{r}_t)}{\partial r_{ft}} \frac{r_{ft}}{s_f(\mathbf{r}_t)}, \tag{7}$$

being the positive own price elasticity of demand. The Lerner index being a function of the the demand elasticity implies that we do not need to observe the marginal costs of investment funds to estimate the Lerner index, but to have a good estimate of the own price elasticity of demand.

given interest rate, a given maturity, and a given collateral. Lending products provided by the same fund to the same borrower may, therefore, be heterogeneous; we, therefore, obtain an average measure of the true market power of each fund, which can vary across banks.

[25] For simplicity, we assume that funds expect the full repayment of each loan from banks and that banks actually do the full repayment of their loans; this implies that there is no loss of profits due to default. For a model that explicitly accounts for default in the lender's problem, see Crawford et al. (2018).

Demand model. The demand model presented in this section builds on the standard techniques of the empirical Industrial Organization literature (in particular, Berry (1994) and Nevo (2000)). Banks, indexed by $l = 1, 2, \dots, L$ face a multiple-choice decision among F funds in each period. Assume that the conditional indirect utility of bank l from choosing to borrow money from fund f at time t is given by:

$$u_{lft} = \mathbf{x}_f \boldsymbol{\beta} - \alpha r_{ft} + \gamma SI_{ft} + \phi_t + \xi_f + \Delta\xi_{ft} + \varepsilon_{lft} \tag{8}$$

where $\mathbf{x}_f$ is a (row) vector of observable product (fund) characteristics that do not vary with time; r_{ft} is the mean interest rate of the lending granted by fund f to banks at t; SI_{ft} is the mean intensity, across banks, of fund f's lending relationships at t; ϕ_t accounts for time shocks that are common to all of the transactions observed at t in the market; ξ_f captures the mean valuation of the unobserved fund characteristics that do not vary with time; $\Delta\xi_{ft}$ are unobserved fund characteristics that vary with time; and ε_{lft} is an additively separable mean-zero random shock that captures idiosyncratic bank preferences.

We assume that banks' choice set includes an "outside good", which may capture all other liquidity sources not considered in this analysis (such as lenders other than funds in the repo market and so on). Normalizing its mean utility to zero, the indirect utility derived by bank l from the outside option writes as $u_{l0t} = \varepsilon_{l0t}$. Another key assumption of this model is that banks choose at most one lending product (i.e., fund) at each period t. The product (fund) chosen is the one giving the highest utility. For given unobserved demand shocks, $\boldsymbol{\varepsilon}_{lft}$, bank l will choose product f if:

$$u_{lft} \geqslant u_{lkt}, \text{ for all } \; k = 0, 1, \dots, F.$$

Assuming that the shocks to utility ε_{lft} are independent of the product characteristics and of each other (i.i.d.), and drawn from a Type 1 Extreme Value distribution, the market share of fund f at time t is given by:

$$s_f(\mathbf{X}, \mathbf{r}_t) = \frac{\exp(\mathbf{x}_f \boldsymbol{\beta} - \alpha r_{ft} + \gamma SI_{ft} + \phi_t + \xi_f + \Delta\xi_{ft})}{1 + \sum_k \exp(\mathbf{x}_k \boldsymbol{\beta} - \alpha r_{kt} + \gamma SI_{kt} + \phi_t + \xi_k + \Delta\xi_{kt})}, \tag{9}$$

where $\mathbf{X}$ is the matrix of observed characteristics of all of the included funds, that do not vary with time.

Demand elasticities. The bank-level own- and cross-price elasticities are given by:

$$\eta_{lfkt} = \frac{\partial s_{ft}}{\partial r_{kt}} \frac{r_{kt}}{s_{ft}} = \begin{cases} -\alpha(1 - s_{ft}) r_{ft} & \text{if} \quad f = k, \\ \alpha s_{kt} r_{kt} & \text{if} \quad f \neq k. \end{cases} \tag{10}$$

Estimation and results. We follow Berry (1994) and use the equality between predicted shares, given by by equation (9), and observed market shares S_{ft} to transform our non-linear model in a linear one. Formally, the model we obtain is given by:

$$\ln S_{ft} - \ln S_{0t} = \mathbf{x}_f \boldsymbol{\beta} - \alpha r_{ft} + \gamma SI_{ft} + \phi_t + \xi_f + \Delta\xi_{ft}. \tag{11}$$

Notice that our demand model allows for unobserved factors at both the time level, ϕ_t, and the fund level, ξ_f. We account for those unobservables by including time and fund dummies, respectively. The latter capture also all of the observed fund attributes that do not vary with time, $\mathbf{x}_f \boldsymbol{\beta}$. We do not account for fund-time unobserved factors, $\Delta\xi_{ft}$; thus, we leave it as the error term of the model.

We have two potentially endogenous variables. Both the interest rates and intensity are under a fund's control. Fund f may have incentives to adjust those two variables in response to changes in banks' need for funding or preferences for time-varying product (i.e., fund) characteristics, $\Delta\xi_{ft}$, that are unobserved to the econometrician. To correct the potential bias in our estimates, we exploit both the granularity and panel structure of our data to generate three instrumental variables: one GIV for each endogenous variable, and one DIV for the interest rate. The identifying assumption is, therefore, that after controlling for market-level aggregate shocks and fund-level observed and unobserved characteristics, our instrumental variables are not correlated with demand shocks.

We estimate model (11) using two-stage least squares. We report the estimation results in Table 8 (Table B.4 of the Appendix presents the corresponding first-stage estimates and diagnostics). Columns (1) shows the demand model estimated without correcting the endogeneity issues. Column (2) is analogous to column (1) but uses IVs. As expected, the coefficient of the interest rate is negative and statistically significant, which means that the demand for liquidity is downward sloping. Further, the coefficient of the mean intensity is positive and significant, suggesting that a higher intensity of the relationship between a fund and its counterparties implies a higher probability of a fund of being chosen by any bank, on average.

Table 8 also shows mean own-price elasticities implied from the demand model. Results show that demand for lending from funds is elastic to changes in interest rates, which is consistent with evidence: first, there are multiple funding alternatives in the repo market; and second, our outside option captures other funding sources that banks can use to meet their liquidity needs. In effect, the mean own-price elasticity is -5.78. Moreover, FC-affiliated funds face a more sensitive demand compared to independent funds: on average, the mean own-price elasticity for the subgroup of FC-affiliated funds is 0.54 units higher than the corresponding elasticity for the subgroup of independent funds (see Table C.1 of the Appendix for details of the distribution of elasticities).

4.2.2 Fund market power and two-way lending

With the demand estimates in hand, we are able to compute a daily product-level Lerner index according to equation (7) which we use as our outcome variable to explore the role of two-way lending on the market power of FC-affiliated funds. Our specification is as follows:

$$\widehat{LI}_{ft} = \beta_1 HHI_t + \beta_2 BRI_{ft} + \beta_3 LRI_{ft} + \beta_4 SI_{ft} + Maturity_{ft} + \alpha_f + \phi_m + \nu_{ft}, \tag{12}$$

where HHI_t is a Herfindahl-Hirschman index that measures concentration of the fund sector in the repo market; BRI_{ft} (LRI_{ft}) is the borrower (lender) relationship index of fund f averaged across bank counterparties at t; SI_{ft} is the mean intensity of bilateral relationships; $Maturity_{ft}$ stands for the average maturity of all of the loans granted by fund f to its bank counterparties at t; α_f are fund fixed effects; ϕ_m are month fixed effects; last, ν_{ft} is a zero-mean disturbance.

Table 8. Demand model results

This table reports second-stage estimates of the demand model. Standard errors clustered at the fund-year level are given in parentheses. All regressions include fund and week fixed effects and factors obtained from a factor model with the granular data for each of our regressors. The table also displays mean implied own-price elasticities by fund ownership and statistics for weak identification. In Appendix A of the paper, we provide a description of all of our variables. We aggregate our data at the fund-daily level; it covers the period from January 1, 2006 through February 8, 2018. The symbols *,**,*** denote statistical significance at the 10%, 5% and 1% level, respectively. Table B.4 of the Appendix presents the corresponding first-stage estimates and diagnostics.

Variable	OLS (1)	IV (2)
Average interest rate	-0.347	-1.182*
	(0.234)	(0.649)
SI_{ft}	0.406***	0.459***
	(0.077)	(0.092)
Constant	Yes	Yes
Factors as controls	Yes	Yes
Fund FE	Yes	Yes
Week FE	Yes	Yes
Mean implied own-price elasticities		
Independent funds		-5.48
FC-affiliated funds		-6.02
Kleibergen-Paap F-statistic		54.53
Angrist-Pischke average F-statistic		135.3
Kleibergen-Paap rk LM-statistic		99.837
P-value		0
Observations	55662	55662

Source: Banco de México. Authors' calculations.

In this regression, the HHI and two-way lending measures are potentially endogenous. To deal with these problems, we use instrumental variables and estimate the model (12) by two-stage least squares. Specifically, we instrument the HHI with a DIV based on funds' total assets; moreover, we instrument our two-way lending measures with GIVs, one for each of them; finally, we include interactions between instruments. Overall, we have eight instruments.

We report the results in Table 9 (Table B.5 of the Appendix presents the corresponding first-stage estimates and diagnostics). Column (2) shows results for our preferred specification, which was estimated by 2SLS. The estimates associated to the depth of the two-way relationships are statistically significant and of the expected sign. The coefficient of the borrowers relationship index (BRI) is positive, suggesting that the higher the dependence of FC-affiliated banks on FC-affiliated funds, the higher the market power of funds. Alternatively, the lender relationship index (LRI) suggests that a higher dependence of FC-affiliated funds on FC-affiliated banks imply a lower market power for funds; notice, however, that the impact of BRI is considerably larger that the impact of LRI, meaning that the net effect of deep two-way lending relationships tend to favor fund market power. In line with previous literature on relationship lending, which shows that long and stable relationships between financial institutions are associated to cheaper funding, frequent (i.e., intense) two-way transactions leads to lower fund market power.

Table 9. Regression results for the fund-level Lerner index

This table reports second-stage estimates. Robust standard errors are given in parentheses. The dependent variable is a daily fund-bank level Lerner index. All regressions include fund, bank, collateral and month fixed-effects. In Appendix A of the paper, we provide a description of all of our variables. The second column of the table presents the Kleibergen-Paap F statistic for weak identification and the average Angrist and Pischke partial F statistic, which are both greater than 10, the widely used rule of thumb. We aggregate our data at the fund-daily level; it covers the period from January 1, 2006 through February 8, 2018. The symbols *,**,*** denote statistical significance at the 10%, 5% and 1% level, respectively. Table B.5 of the Appendix presents the corresponding first-stage estimates and diagnostics.

Variable	OLS (1)	IV (2)
HHI_t (of funds in repo)	-0.011***	0.124***
	(0.003)	(0.030)
BRI_{ft}	0.007***	0.022***
	(0.003)	(0.004)
LRI_{ft}	0.002	-0.006**
	(0.002)	(0.003)
SI_{ft}	-0.001***	-0.001*
	(0.0002)	(0.0004)
$Maturity_{ft}$	-0.002***	-0.003***
	(0.001)	(0.001)
Constant	Yes	Yes
Factors as controls	Yes	Yes
Fund FE	Yes	Yes
Month FE	Yes	Yes
Kleibergen-Paap F-statistic		35.96
Angrist-Pischke average F-statistic		2897.1
Kleibergen-Paap rk LM-statistic		304.075
P-value		0
Observations	55662	55662

Source: Banco de México. Authors' calculations.

4.3 The impact of two-way lending between FCs on independent banks and funds

Does two-way lending affect the terms of trade of independent institutions (i.e., banks and funds that are not affiliated to FCs)? At first glance, our data suggest that independent institutions have considerable lower number of transactions and volume shares in the market; moreover, we observe very few repo transactions between independent funds and banks. This may be partly explained by the fact that the number of independent banks in Mexico is low. However, the question of whether this is caused in part by two-way lending or not remains open. Specifically, we explore whether independent institutions are indirectly affected or not by higher levels of two-way lending in terms of restricted liquidity supply, higher interest rates or less advantageous haircuts. To do this, we execute two analyses: first, we focus on independent banks and explore their borrowing transactions with all funds (both FC-affiliated and independent). Second, we focus on independent funds and explore their lending transactions with all banks (both FC-affiliated and independent).

To check whether two-way lending is associated with a drop in liquidity supply to independent banks and worse terms of trade, we regress the total volume traded between all independent banks (IB) and all active funds combined in each day, Vol_t^{IB}, average interest rates, $Rate_t^{IB}$, and average haircuts, HC_t^{IB}, that funds (both independent and FC-affiliated) charge to independent banks, on our measures of two-way lending, averaged across all FC-affiliated fund-bank pairs that day. Formally, we estimate the following model,

$$y_t = \beta_1 BRI_t + \beta_2 LRI_t + \beta_3 SI_t + \phi_w + \phi_y + \epsilon_t, \tag{13}$$

where y_t stands for Vol_t^{IB}, $Rate_t^{IB}$ or HC_t^{IB}; and ϕ_w and ϕ_y are weak-of-the-year and year fixed-effects, respectively.

Next, we execute similar exercises but for independent funds (IF). That is, we explore whether the total volume of liquidity supplied by independent funds, Vol_t^{IF}, average interest rates, $Rate_t^{IF}$, and average haircuts, HC_t^{IF}, of their transactions with banks (both FC-affiliated and independent) are indirectly affected by two-way lending relationships between

FCs. To do this, we use the same specification of equation (13) and change our outcome variable in turn.

In all of our regressions, we deal with the potential endogeneity of BRI, LRI and SI by computing GIVs, one for each of our endogenous variables and estimate the coefficients of our regressions by two-stage least squares.

Table 10 presents the results in two panels (See Table B.6 in the Appendix for first-stage results). Panel A displays the estimates for independent banks, while Panel B shows the estimates for independent funds. Our results are similar in the direction of the effects. We find that higher levels of two-way lending relates to both a lower liquidity obtained by independent banks from any fund and a lower liquidity supplied by independent funds. Furthermore, higher levels of two-way lending is associated with higher average interest rates for one-way transactions in which independent funds or banks are involved. These results are consistent with our previous results in which we showed that two-way lending leads to more concentrated industries and favors FCs market power. Overall, our results indicate that higher levels of two-way lending in the repo market deteriorate the terms of trade of both independent banks and independent funds.

Table 10. Impact of two-way lending on independent banks and fund

This table reports second-stage estimates. Robust standard errors are given in parentheses. The dependent variables are the aggregate volume, average interest rate and haircuts of the transactions executed either by independent banks and funds (Panel A), or by any banks and independent funds (Panel B). Variables of interest are BRI, LRI and SI. Controls include bank level covariates. In Appendix A of the paper, we provide a description of all of our variables. The bottom panel of the Table presents first-stage diagnostics for weak identification. We aggregate our data at the daily level; it covers the period from January 1, 2006 through February 8, 2018. The symbols *,**,*** denote statistical significance at the 10%, 5% and 1% level, respectively. Table B.6 of the Internet Appendix presents the corresponding first-stage estimates and diagnostics.

	Panel A: Indep. banks, all funds			Panel B: All banks, Indep. funds		
Variable	Vol_t^{IB}	$Rate_t^{IB}$	HC_t^{IB}	Vol_t^{IF}	$Rate_t^{IF}$	HC_t^{IF}
BRI_t	-2.14***	0.18***	-0.00	-1.39***	0.08*	0.00
	(0.69)	(0.05)	(0.00)	(0.36)	(0.05)	(0.00)
LRI_t	0.73*	0.11***	0.00***	-0.15	0.02	-0.00
	(0.42)	(0.03)	(0.00)	(0.26)	(0.03)	(0.00)
SI_t	-1.01***	0.07**	-0.00	-0.45**	0.01	0.00
	(0.36)	(0.03)	(0.00)	(0.19)	(0.02)	(0.00)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Week-of-the-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,366	1,366	1,320	1,783	1,783	1,742
R-squared	0.33	0.75	0.33	0.39	0.81	0.20
K-P F-stat	296.54	296.54	283.98	526.73	526.73	509.11
K-P LM-stat	316.79	316.79	305.81	395.95	395.95	383.61

Source: Banco de México. Authors' calculations.

5 Effects of two-way lending on systemic risk

In this section we evaluate if two-way lending between FCs affects the overall fragility of the financial system. The concentration of financial markets in a few large and powerful FCs is a main concern of regulators, not only for its potential implications in terms of efficiency and competition, but also on the stability of the system. The literature on the determinants of systemic risk is extensive but the impact of two-way lending between FCs has not been studied (see Qin and Zhou (2019)). However, a related strand discusses the interconnectedness between financial institutions. Allen and Gale (2000) argue that higher levels of interconnectedness can turn financial systems more fragile due to contagion risk (see also Brauning and Fecht (2017); Gorton and Metrick (2012)). Acemoglu et al. (2016) argue that interconnectedness between financial institutions is more subtle as higher levels are beneficial, but only up to the point at which the downside of higher contagion outweighs the benefits (see also Acemoglu et al. (2012, 2017); Kanno (2018)).

We analyze if two-way lending affects the individual contribution of FC-affiliated banks to systemic risk. We use institution l's debt rank, denoted DB_{lt} as a proxy. This network-based metric, introduced by Battiston et al. (2012) and already used for the Mexican case in Téllez-León et al. (2021), quantifies the monetary equity loss (in Mexican pesos) on the entire financial system due to a *distress* on institution l.[26] We interpret this metric as the contribution of individual financial institutions to systemic risk.

We regress the bank-level debt rank on a dummy for two-way lending, and our measures of depth and intensity of two-way lending. The econometric specification is the following:

$$\begin{aligned} DB_{lt} = & \beta_1 D_{lt} + \beta_2 BRI_{lt} + \beta_3 LRI_{lt} + \beta_4 SI_{lt} + \mathbf{B}_{lt}\boldsymbol{\beta}_5 + \mathbf{M}_t\boldsymbol{\beta}_6 \\ & + \xi_{lm} + \phi_y + \phi_m + \epsilon_{lt} \end{aligned} \tag{14}$$

where D_{lt} is the share of two-way transactions for bank l at day t respect to the total number of transactions in that day; BRI_{lt} and LRI_{lt} are the two-way lending concentration measures for bank l, averaged across counterparts, at time t; SI_{lt} is the average intensity of bank l's interactions; $\mathbf{B}_{lt}$ is a row vector of bank-specific characteristics that may vary on a daily basis; $\mathbf{M}_t$ are market-level observed characteristics that vary with time; ξ_{lm}, are bank fixed-effects interacted with month-of-the-year dummies, and ϕ_y, ϕ_m are year and month-of-the-year fixed-effects, respectively.

We correct the potential endogeneity of BRI, LRI and SI in the two regressions with GIVs. The identifying assumption is that once we control for bank-time and time (market) shocks, along with exogenous variation that may correlate with the endogenous variables, we are able to isolate the effect of two-way lending on our outcome variables. Table 11 presents

[26] Its calculation requires the positions (e.g., assets and bonds, derivatives, and call money) of each bank and fund, and potentially any other financial institution, respect to all other banks and funds. Also, it requires balance sheet information at each point in time. All information is provided from the Mexican Central Bank.

the results corresponding to the specification in equation (14). We present the estimates without correcting for endogeneity using standard OLS, and the corrected estimates obtained with GIVs (see Table B.7 of the Appendix presents the corresponding first-stage results).

We observe that as two-way lending increases also does individual bank's contribution to systemic risk. Respect to BRI and LRI, just like with our previous analysis of two-way lending and market power, while higher exposure of funds to banks (LRI) reduce the contribution, higher levels of banks' dependence on fund (BRI) outweigh the latter effect. Additionally, higher intensity of interactions increase banks' contribution to systemic risk, measured as the equity loss of the entire financial system.[27] These results confirm that two-way lending help FCs create reliable short-term funding channels, allowing banks from FCs to operate with lower funding cost, so in the case they (the banks) default the equity loss on the entire financial system will be higher vis-a-vis a situation with lower two-way lending levels.

6 Conclusions

This paper examines how market structure, market power, and systemic risk are affected by two-way lending between FCs in repo markets characterized by non-centrally cleared bilateral transactions. Using transaction-level data from Mexico between 2006 and 2018, we first shed light on a special way of relationship lending that occurs between FCs, characterized by contemporaneous mutual funding transactions between pairs of FCs and lower average interest rates, relative to regular one-way transactions. The Mexican case provides a natural experiment in which to study the effects of two-way lending relationships because market participants only use OTC bilateral trading; mutual funds are bound to supply liquidity to banks and brokerage firms only, which makes banks their main counterpart; and reverse repo is not possible, essentially because funds are not allowed to act as borrowers, which implies that fund-bank relationships are mainly motivated by liquidity rather than collateral needs.

We exploit this unique setting to show that two-way lending allows FC-affiliated funds

[27] *DebtRank* in our example calculates equity losses due to defaults on all relevant financial markets in Mexico rather than focusing on the impact on particular markets (e.g., Téllez-León et al. (2021); Batiz-Zuk and Lara-Sanchez (2021)).

Table 11. Two-way lending and systemic risk

This table reports second-stage estimates. Robust standard errors are given in parentheses. The dependent variable is the bank-level contribution to systemic risk, $DebtRank_{lt}$. Variables of interest are BRI, LRI and SI. Controls include bank-level covariates. In Appendix A of the paper, we provide a description of all of our variables. The bottom panel of the Table presents first-stage diagnostics for weak identification. We aggregate our data at the bank-daily level; it covers the period from January 1, 2006 through February 8, 2018. The symbols *,**,*** denote statistical significance at the 10%, 5% and 1% level, respectively. Table B.7 of the Appendix presents the corresponding first-stage estimates and diagnostics.

	$DebtRank_{lt}$	
Variable	OLS	IV
D	-0.002***	-0.001***
	(0.000)	(0.00)
BRI	0.004***	0.008***
	(0.000)	(0.001)
LRI	0.004***	-0.004***
	(0.000)	(0.001)
SI	0.004***	0.002***
	(0.000)	(0.00)
Year FE	Yes	Yes
Month FE	Yes	Yes
Bank × Month FE	No	Yes
Controls	Yes	Yes
Observations	15,353	15,102
R-squared	0.244	0.283
Kleibergen-Paap F-statistic		913.63
Kleibergen-Paap rk LM-stat		685.14
Angrist-Pischke average F-stat		5389.64

Source: Banco de México. Authors' calculations.

to increase their market shares and markups, favours the concentration of lending in FC-affiliated funds and banks, worsens independent institutions' access to funding and terms of trade, and increases the individual contributions of banks to systemic risk. We also find that, at the aggregate level, the country-level systemic risk decreases, which suggests that potential efficiency gains from two-way lending spill over into the entire financial system, and potentially to the real economy, and outweigh the banks' higher contribution to systemic risk. Explicitly measuring the efficiency gains from two-way lending, and understanding how they extend to the system so that two-way lending implies a lower overall systemic risk, is a relevant topic for future research.

Our results have important implications for understanding the role of financial conglomerates, concentration, and market power in the functioning of wholesale money markets in developing economies. Likewise, our work provides valuable insights for thinking about the role imperfect competition in NCCBR segments play in the overall functioning and contribution to systemic risk of more complex repo markets, which include centrally cleared repo and tri-party repo segments (usually in developed economies). For instance, Hempel et al. (2022) consider that the bilateral nature of the non-centrally cleared bilateral segment of the U.S. repo market has made it an almost unknown market and a "blind spot" for regulators. This paper suggests an interesting area researchers, market analysts, and regulators should look at when data is available.

In terms of financial stability, our findings suggest that two-way lending increases the individual contribution of banks to systemic risk. Alternatively, we show that two-way lending is partly driven by the possibility to secure stable and cheap funding (relative to one-way lending); the stable financing at lower costs may potentially lead to efficiency gains (see, e.g., Nguyen (2018); Harris et al. (2013)) that spill over into the rest of the system (see, e.g., Shamshur and Weill (2019)). Furthermore, two-way lending increases FC-affiliated funds' market power, turns independent funds into a more expensive funding source, and leads independent banks to obtain less (and more expensive) funding. Given that independent banks and funds represent a small fraction of the repo market in the Mexican financial industry (see Section 3), it could happen that two-way lending efficiency gains in FC-affiliated banks will spread to the rest of the financial industry, thereby reducing financial fragility. Empirically testing the efficiency-gains mechanism will require both additional balance sheet information (see, e.g., Shamshur and Weill (2019); Isik and Uygur (2021)) that we are not able to observe, and the use of methodologies to measure those efficiencies that explicitly incorporate the role of multiple regulatory reforms that can affect bank efficiency (see, e.g., Chen et al. (2022)). Understanding the efficiency gains that individual banks derive from engaging in two-way lending transactions, and the risk-efficiency net effects on the stability of the entire system, is an important topic for future research.

Finally, our results highlight the importance of understanding the scope for public policy intervention in setting limits on the potential harm two-way lending could cause, and stress the need for a broader study of the effects of financial conglomeration on the functioning of financial markets, as a promising area for future research, as Franzoni and Giannetti (2019) have already pointed out. In this avenue, there are two main questions that we leave for future research. Concerning the competition policy of financial markets, a first question would be to fully understand whether two-way lending is motivated mainly by market forces (cheap and stable funding) or is rather used as a strategy to exclude competition from smaller non-FC-affiliated rivals. A structural model of the demand and supply of short-term secured funding would help answer this question. Concerning regulation, while intra-group transactions and exposures within FCs are usually regulated, exposures between FCs are not. Therefore, a second question would be to determine the optimal regulatory design of two-way lending practices that would balance out the benefits and costs for the stability of the financial system.

References

D. Acemoglu, V. M. Carvalho, A. Ozdaglar, and A. Tahbaz-Salehi. The network origins of aggregate fluctuations. *Econometrica*, 80(5):1977–2016, 2012.

D. Acemoglu, A. Ozdaglar, and A. Tahbaz-Salehi. Networks, shocks, and systemic risk. *The Oxford Handbook of the Economics of Networks*, Oxford University Press, 2016. DOI: 10.1093/oxfordhb/9780199948277.013.17.

D. Acemoglu, A. Ozdaglar, and A. Tahbaz-Salehi. Microeconomic origins of macroeconomic tail risks. *American Economic Review*, 107(1):54–108, 2017.

F. Allen and D. Gale. Financial contagion. *Journal of Political Economy*, 108:1–33, 2000.

Y. Altunbas, D. Marques-Ibanez, M. van Leuvensteijn, and T. Zhao. Market power and bank systemic risk: Role of securitization and bank capital. *Journal of Banking and Finance*, 138:1–15, 2022.

D. Anginer, A. Demirguc-Kunt, and M. Zhu. How does competition affect bank systemic risk. *Journal of Financial Intermediation*, 23:1–26, 2014.

V. Baklanova, C. Caglio, M. Cipriani, and A. Copeland. The use of collateral in bilateral repurchase and securities lending agreements. *Review of Economic Dynamics*, 33:228–249, 2019. URL https://www.sciencedirect.com/science/article/pii/S1094202518303119.

E. Batiz-Zuk and J. L. Lara-Sanchez. Revisiting the link between systemic riks and competition based on network theory and interbank exposures. *Banco de Mexico Working Paper*, (2021-26), 2021.

S. Battiston, M. Puliga, R. Kaushik, P. Tasca, and G. Caldarelli. Debtrank: Too central to fail? financial networks, the fed and the systemic risk. *Nature - Scientific Reports*, 2(541), 2012.

S. Berry. Estimating discrete-choice models of product differentiation. *The RAND Journal of Economics*, 25(2):242–262, 1994.

L. Black, R. Correa, X. Huang, and H. Zhou. The systemic risk of european banks during the financial and sovereign debt crises. *Journal of Banking and Finance*, 63:107–125, 2016.

D. Bostandzic and G. Weiss. Why do some banks contribute more to global systemic risk. *Journal of Financial Intermediation*, 35((Part A)):17–40, 2018.

F. Brauning and F. Fecht. Relationship lending in the interbank market and the price of liquidity. *Review of Finance*, 21(1):33–75, 2017.

C. Buch, T. Krause, and L. Tonzer. Drivers of systemic risk: Do national and european perspectives differ? *Journal of International Money and Finance*, 91:160–176, 2019.

J. Cai, S. A. Eidam, Frederik, and S. Steffen. Syndication, interconnectedness, and systemic risk. *Journal of Financial Stability*, pages 105–120, 2018.

M. Carlson, S. Correia, and S. Luck. The effects of banking competition on growth and financial stability: Evidence from the national banking era. *Journal of Political Economy*, 130(2), 02 2022.

M. Chen, Q. Kang, J. Wu, and B. N. Jeon. Do macroprudential policies affect bank efficiency? evidence from emerging economies. *Journal of International Financial Markets, Institutions and Money*, 77:101529, 2022.

J. Cocco, F. Gomes, and N. Martins. Lending relationships in the interbank market. *Journal of Financial Intermediation*, (18):24–48, 2009.

B. Craig, F. Fecht, and G. Tümer-Alkan. The role of interbank relationships and liquidity needs. *Journal of Banking and Finance*, (53):99–111, 2015.

G. Crawford, N. Pavanini, and F. Schivardi. Asymmetric information and imperfect competition in lending markets. *American Economic Review*, 108(7):1659–1701, 2018.

P. Cruz-García, J. Fernández de Guevara, N. Maudos, Joaquín, and F. Schivardi. Bank competition and multimarket contact intensity. *Journal of International Money and Finance*, 113:1–23, 2021.

O. De Jonghe. Back to the basics in banking? a micro-analysis of banking system stability. *Journal of Financial Intermediation*, 19:387–417, 2010.

O. De Jonghe, M. Diepstraten, and G. Schepens. Banks size, scope and systemic risk: what role for conicts of interest? *Journal of Banking and Finance*, 61:3–13, 2015.

U. S. Department of Justice. Horizontal merger guidelines, 2010. URL https://www.justice.gov/sites/default/files/atr/legacy/2010/08/19/hmg-2010.pdf. Accessed October 13, 2017.

DOF-19-2020. Circular 19/2020. URL https://www.dof.gob.mx/nota_detalle.php?codigo=5594245&fecha=02/06/2020.

E. C. B. ECB. Euro money market study 2018, 2018.

J. Eisenschmidt, Y. Ma, and A. Lee Zhang. Monetary policy transmission in segmented markets. *Unpublished Working Paper*, 2023.

F. Franzoni and M. Giannetti. Financial conglomerate affiliated hedge funds: Risk taking behavior and liquidity provision. *CEPR Discussion Papers*, (12040), 2017.

F. Franzoni and M. Giannetti. Costs and benefits of financial conglomerate affiliation: Evidence from hedge funds. *Journal of Financial Economics*, 134(2):355–380, 2019.

C. Furfine. The microstructure of the federal funds market. *Financial markets, Institutions and Instruments*, 8(5):24–44, 1999.

X. Gabaix and R. Koijen. Granular instrumental variables. *National Bureau of Economic Research*, (28204):1–98, 2022.

A. Gandhi and J.-F. Houde. Measuring substitution patterns in differentiated products industries. *National Bureau of Economic Research*, (26375):1–71, 2020.

B. Golez and J. Marin. Price support by bank-affiliated mutual funds. *Journal of Financial Economics*, (115):614–638, 2015.

G. Gorton and A. Metrick. Securitized banking and the run on repo. *Journal of Financial Economics*, 104(3):425–451, 2012.

M. Grill, J. Jackovicka, C. Lambert, P. Nicoloso, L. Steininger, and M. Wedow. Recent developments in euro area repo markets, regulatory reforms and their impact on repo market functioning. *Financial Stability Review*, 2:158–171, 2017.

S. Han, K. Nikolaou, and M. Tase. Trading relationships in secured markets: Evidence from triparty repos. *Journal of Banking and Finance*, 139:1–42, 2022.

O. Harris, D. Huerta, and T. Ngo. The impact of tarp on bank efficiency. *Journal of International Financial Markets, Institutions and Money*, 24:85–104, 2013.

A. He. Reciprocity in shadow bank lending: Evidence from the cross-holding relation in money market funds. *Working paper*, 2021. URL https://ssrn.com/abstract=2826906.

S. Hempel, J. Kahn, V. Nguyen, and S. Ross. Non-centrally cleared bilateral repo, 2022. URL https://www.financialresearch.gov/the-ofr-blog/2022/08/24/non-centrally-cleared-bilateral-repo/. Accessed April 21, 2022.

A. Hortaşu and C. Syverson. Product differentiation, search costs and competition in the mutual fund industry: a case study of standard and poors 500 index funds. *The Quarterly Journal of Economics*, 119(2):403–456, 2004.

G. X. Hu, J. Pan, and J. Wang. Tri-party repo pricing. *Journal of Financial and Quantitative*

Analysis, pages 1–35, 2019.

A. Huber. Market power in wholesale funding: A structural perspective from the triparty repo market (january 30, 2023). *SSRN*, 2023. URL https://ssrn.com/abstract=4111327.

I. ICMA. What has been the regulatory response in the repo market to the great financial crisis? *Frequently asked questions on Repo*, pages 1–51, 2019.

I. ICMA. European repo market survey, 2023.

F. Irresberger, C. Bierth, and G. Weib. Size is everything: explaining sifi designations. *Review of Financial Economics*, 32:7–19, 2017.

I. Isik and O. Uygur. Financial crises, bank efficiency and survival: Theory, literature and emerging market evidence. *International Review of Economics and Finance*, 76:952–987, 2021.

C. Julliard, G. Pinter, K. Todorov, and K. Yuan. What drives repo haircuts? Evidence from the UK market. *Bank of England Staff Working Papers*, 985, 2022.

E. Kamani. The effect of non-traditional banking activities on systemic risk: Does bank size matter? *Finance Research Letters*, 30:297–305, 2019.

M. Kanno. Interconnectedness and systemic risk in the us cds market. *North American Journal of Economics and Finance*, 54:100837, 2018.

D. Karim, I. Liadze, R. Barrell, and E. Davis. Off-balance sheet exposures and banking crises in oecd countries. *Journal of Financial Stability*, 9:673–681, 2013.

L. Laeven, L. Ratnovski, and H. Tong. Bank size, capital, and systemic risk: some international evidence. *Journal of Banking and Finance*, 69:25–34, 2016.

Y. Li. Reciprocal lending relationships in shadow banking. *Journal of Financial Economics*, 141:600 – 619, 2021.

M. U. López, S. Martínez-Jaramillo, and F. Lopez-Gallo. The repo market in mexico: Empirics and stylized facts. *Neurocomputing*, 264:2–19, 2017.

G. Lopez-Espinosa, A. Rubia, L. Valderrama, and M. Antoon. Good for one, bad for all: Determinants of individual versus systemic risk. *Journal of Financial Stability*, 9:287–299, 2013.

G. López-Espinosa, S. Mayordomo, and A. Moreno. When does relationship lending starts to pay? *Journal of Financial Intermediation*, (31):16–29, 2016.

S. Markose, S. Giansante, and A. Shaghaghi. “too interconnected to fail” financial network of us cds market: Topological fragility and systemic risk. *Journal of Economic Behavior and Organizations*, 83:627–646, 2012.

M. Massa and Z. Rehman. Information flows within financial conglomerates: Evidence from the banks? mutual funds relation. *Journal of Financial Economics*, (89):288–306, 2008.

S. Mayordomo, M. Rodriguez-Moreno, and J. Peña. Derivatives holdings and systemic risk in the us banking sector. *Journal of Banking and Finance*, 45:84–104, 2014.

A. Nevo. A practitioner’s guide to estimation of random-coefficients logit models of demand. *Journal of Economics and Management Strategy*, 9(4):513–548, 2000.

T. L. A. Nguyen. Diversification and bank efficiency in six asean countries. *Global Finance Journal*, 37:57–78, 2018.

O. OFR. Non-centrally cleared bilateral repo data, 2023a. URL https://www.financialresearch.gov/data/non-centrally-cleared-bilateral-repo-data/. Accessed June 8, 2023.

O. OFR. Office of financial research releases proposal to collect data on certain repo transactions, 2023b. URL https://www.financialresearch.gov/press-releases/2023/01/05/office-of-financial-research-releases-proposal-to-collect-data-on-certain-repo-transa
Accessed June 8, 2023.

M. Petersen and R. Rajan. The benefits of lending relationships: evidence from small business data. *Journal of Finance*, 49(1):3–37, 1994.

A. Presbitero and A. Zazzaro. Competition and relationship lending: friends or foes? *Journal of Financial Intermediation*, (20):387–413, 2011.

X. Qin and C. Zhou. Financial structure and determinants of systemic risk contribution. *Pacific-Basin Finance Journal*, 57:101083, 2019.

J. Ritter and D. Zhang. Affiliated mutual funds and the allocation of initial public offerings. *Journal of Financial Economics*, (86):337–368, 2007.

T. Roukny, S. Battiston, and J. Stiglitz. Interconnectedness as a source of uncertainty in systemic risk. *Journal of Financial Stability*, 35:93–106, 2018.

P. Schaffner, A. Ranaldo, and K. Tsatsaronis. Euro repo market functioning: collateral is king. *BIS Quarterly Review*, December:69–101, 2019.

A. Shamshur and L. Weill. Does bank efficiency influence the cost of credit? *Journal of Banking and Finance*, 105:62–73, 2019.

E. Sirri and P. Tufano. Costly search and mutual fund flows. *The Journal of Finance*, 53(5): 1589–1622, 1998.

J. Stein. Why are most funds open-end? competition and the limit of arbitrage. *Quarterly Journal of Economics*, 120(1):247–272, 2005.

P. Tasca, S. Battistion, and A. Deghi. Portfolio diversification and systemic risk in interbank networks. *Journal of Economic Dynamics and Control*, 82:96–124, 2017.

I.-E. Téllez-León, S. Martínez-Jaramillo, L. O. L. Escobar-Farfán, and R. Hochreiter. How are network centrality metrics related to interest rates in the mexican secured and unsecured interbank markets? *Journal of Financial Stability*, 55:100893, 2021.

S. Varotto and L. Zhao. Systemic risk and bank size. *Journal International Money and Finance*, 82:45–70, 2018.

Appendix

A Control variables

Table A.1. Control variables description

	a) Individual fund-Bank repo transactions characteristics ($\mathbf{PT}_{iflt}$)
$InterestRate_{iflt}$	Overnight interest rate negotiated by fund i affiliated to FC f and bank affiliated to FC l at day t
HC_{iflt}	Haircut of the repo transaction between fund i affiliated to FC f and bank affiliated to FC l at day t
$Maturity_{iflt}$	Maturity of the repo transaction between fund i affiliated to FC f and bank affiliated to FC l at day t
$Coll_{iflt}$	Type of security sold (collateral) by bank affiliated to FC l to fund i affiliated to FC f at day t
Vol_{iflt}	Initial cash loan negotiated by find i affiliated to FC f and bank affiliated to FC l at day t
$Vol.22_{iflt}$	Cash loans negotiated by fund i affiliated to FC f and bank affiliated to FC l during the last 22 days preceding day t
$N.trans_{iflt}$	Number of loans granted from fund i affiliated to FC f to a bank affiliated to FC l at day t
$N.trans.22_{iflt}$	Number of loans granted from fund i affiliated to FC f and bank affiliated to FC l during the last 22 days preceding day t
$Freq.inter_{iflt}$	Frequency of interactions measure defines as logarithm of one plus the number of days a fund i affiliated to FC f has lent to bank affiliated to FC l over the last 22 days preceding day t
$d.s_{iflt}$	Dummy variable equals 1 if the repo rate of a particular lending transaction negotiated by fund i

	affiliated to FC f and bank affiliated to FC l is lower than the general repo rate at day t
DoF_{iflt}	Amount lent by fund i belonging financial conglomerate f to bank affiliated to FC l at day t divided by total lending of financial conglomerates funds f at day t
DoB_{lift}	Amount borrowed by banks affiliated to FC l from fund i affiliated to financial conglomerate f at day t, divided by total borrowing of bank affiliated to FC l at day t
b) Fund(Lender)-specific characteristics ($\mathbf{F}_{ift}$)	
$Assets.f_{ift}$	Total assets (in MNX millions) according to balance sheet record of month preceding day t.
$PR.f_{ift}$	Page.rank centrality network index for fund i affiliated to FC f at day t
$TP.Rank_{ift}$	Interest rate quantile of the fund i affiliated to FC f at day t
$HC.Rank_{ift}$	Haircut quantile value of the fund i affiliated to FC f at day t
$Flow_{ift}$	Funds Net flow of the fund i affiliated to FC f at day t
$Liq.f_{ift}$	Liquidity index for the fund i affiliated to FC f at day t
$G7.f_{if}$	Dummy variable that equals one if lender f belong to the 7 biggest financial conglomerates in Mexico
$d.f_f$	Dummy variable that equals one for a fund i belongs financial conglomerate f and zero in other case
c) Bank(Borrower)-specific characteristics ($\mathbf{B}_{lt}$)	
$DB.b_{lt}$	Debt Rank index for bank affiliated to FC l at day t preceding day t.
$Counter.b_{lt}$	Number of funds (counterparties) who lend to a bank affiliated to FC l at day t
$Assets.b_{lt}$	Total assets (in MNX millions) according to balance sheet record of month preceding day t.
$Liq.b_{lt}$	Liquidity index for bank affiliated to FC l at day t
$PR.b_{lt}$	Page.rank centrality network index for bank affiliated to FC l at day t
$Z.score.b_{lt}$	z-score measure proposed by Cheng et. al (2017) as a measure of default risk for bank affiliated to FC l at day t
$G7.b_{lt}$	Dummy variable that equals one if bank affiliated to FC l belong to one the 7 biggest financial conglomerates in Mexico
$d.b_l$	Dummy variable that equals one for bank belonging financial conglomerate l and zero in other case
d) Aggregate market characteristics ($\mathbf{M}_t$)	
$Repo.rate_t$	Repo rate at day t
$Repo.amount_t$	Total amount of financing provided in the Mexican repo market at day t
$Nf.repo_t$	Non-financial repo divided by total repo at day t
$TIIE_t$	Mexico 28 days equilibrium interbank interest rate at day t
$IESF_t$	Mexico financial stress index at day t
$Govt.rate_t$	Banco de Mexico's reference rate at day t
$Interbank.rate_t$	Mexico 28 days interbank interest rate at day t
$Target.rate.MX_t$	Mexico 28 days interbank interest rate at day t
$Target.rate.US_t$	United States federal funds target rate at day t
$Target.rate.EU_t$	European Central Bank interest rate at day t
$VIMEX_t$	Mexico volatility index at day t
$EMBI_t$	Emerging Market Bond Index at day t
$Exchange.rate_t$	Mexican exchange rate to US dollar (MNX/USD) at day t
IPC_t	It is an index of 35 stocks that trade on the Bolsa Mexicana de Valores at day t
$Market.tight_t$	Number of lenders divided by number of borrowers at day t
$Tight.d_t$	Dummy variable that equals one if day t is in lowest quantile of Market tight at day t, and zero otherwise.
$Trans_t$	Number of total overnight loans granted by funds to banks at day t
$Trans.d_t$	Dummy variable that equals one if day t is in lowest quantile of Market tight at day t, and zero otherwise.
$d.u_t$	Dummy variable that equals one if on a given day the IESF index is over their historical mean plus one standard deviation and zero otherwise. (This includes the financial crisis periods from 9 August 2007 to 30 June 2010)
e) Granular instrumental variables ($\mathbf{Z}_t$)	
z_t^{BRI} and $z_t^{BRI_2}$	GIVs for borrower relationship index.
z_t^{LRI} and $z_t^{LRI_2}$	GIVs for lender relationship index.
z_t^{SI} and $z_t^{SI_2}$	GIVs for intensity of the lending. interactions.

Source: Banco de México.

Table A.2. Summary statistics of control variables

The table Reports the statistic summary of variables used in the empirical analysis. The number of observations depends on the unit of observation of the respective variable. The data set covers the period from January 1, 2006 to February 8, 2018. Variables in billions of Mexican pesos (MNX)

Variable	Mean	Stand. dev	Min	Max	# Obs
Individual fund-Bank repo transactions characteristics ($\mathbf{PT}_{iflt}$)					
$InterestRate_{iflt}$	5.08	1.61	2.38	8.75	666,796
HC_{iflt}	0.00	0.006	-0.814	0.417	666,796
$Maturity_{iflt}$	1.03	0.16	1	24	666,796
Vol_{iflt}	0.587	1.308	0	24.423	666,796
$Vol.22_{iflt}$	11.148	25.522	0	421.95	666,796
$N.trans_{iflt}$	1.52	1.45	1	38	666,796
$N.trans.22_{iflt}$	18	5.98	1	22	666,796
$Freq.inter_{iflt}$	2.87	0.525	0.69	3.13	666,796
$d.s_{iflt}$	0.05	0.22	1	1	666,796
DoF_{iflt}	0.22	0.20	0	1	666,796
DoB_{lift}	0.32	0.25	0	1	666,796
Fund(Lender)-specific characteristics ($\mathbf{F}_{ift}$)					
$Assets.f_{ift}$	10129.7	14764.1	0.276	127914	57,760
$PR.f_{ift}$	0	0.0008	0	0.01	57,760
$TP.Rank_{ift}$	0.05	0.28	0	1	57,760
$HC.Rank_{ift}$	0.45	0.29	0	1	57,760
$Flow_{ift}$	-0.444	313.79	-3334.5	10901.6	57,760
$Liq.f_{ift}$	0.82	0.26	0	1	57,760
$G7.f_{ift}$	0.65	0.47	0	1	57,760
$d.f_{ift}$	0.05	0.21	0	1	57,760
Bank(Borrower)-specific characteristics ($\mathbf{B}_{lt}$)					
DB_{lt}					63,840
$Counter.b_{lt}$	51.5	40.15	1	139	63,840
$Assets.b_{lt}$	0.747	0.512	0.0014	2.027	63,840
$Liq.b_{lt}$	0.42	0.14	0.10	0.94	63,840
$PR.b_{lt}$	0.05	0.04	0	0.15	63,840
$Z.score.b_{lt}$	0.81	0.09	40.02	1	63,840
$G7.b_{lt}$	0.68	0.46	0	1	63,840
$d.b_{it}$	0.047	0.21	0	1	63,840
Aggregate market characteristics ($\mathbf{M}_t$)					
$Repo.rate_t$	4.75	1.51	2.93	8.21	2,657
$Repo.amount_t$	1614000	332544	900500	2258000	2,657
$Nf.repo_t$	0.82	0.03	0.72	0.91	2,657
$TIIE_t$	5.15	1.59	3.27	8.8	2,657
$IESF_t$	0.26	0.14	0.08	1	1,047
$Govt.rate_t$	4.79	1.48	2.99	8.24	2,657
$Interbank.rate_t$	4.82	1.53	2.96	8.34	2,657
$Target.rate.MX_t$	4.54	1.39	3.00	8.25	2,657
$Target.rate.US_t$	0.46	0.56	0.25	4.25	2,657
$Target.rate.EU_t$	0.32	0.44	0.00	1.50	2,657
$VIMEX_t$	21.23	9.361	10.14	68.12	1,047
$EMBI_t$	108.05	8.946	68.12	122.90	1,047
$Exchange.rate_t$	13.60	2.43	9.92	21.91	1,047
IPC_t	37160	7295.6	16869	49808	1,047
$Market.tight_t$	14.20	1.71	9.14	20.77	3,040
$Tight.d_t$	0.23	0.42	0	1	3,040
$Trans_t$	223.4	29.38	64	374	3,040
$Trans.d_t$	0.25	0.43	0	1	3,040
$d.u_t$	0.14	0.35	0	1	3,040

B First-stage regressions

Table B.1. First-stage for the determinants of two-way lending

This table reports the corresponding first-stage estimates for the model displayed in Table 5. It presents four separate regressions, each of which is displayed in a column. Robust standard errors are given in parentheses. The dependent variables are DoB_{flt}, DoF_{flt}, HC_{flt} and $Vol.22_{flt}$. Instrumental variables include granular IVs for each endogenous regressor. In the Appendix A of the paper, we provide a description of all of our variables. The bottom panel of the table reports Angrist and Pischke weak identification F-test. We use data on daily transactions between pairs of FCs and the data set covers the period from January 1, 2006 through February 8, 2018. The symbols *,**,*** indicate statistical significance at the 10%, 5% and 1% level, respectively.

Dependent variable:	DOB_{flt}	DOF_{flt}	$Vol.22_{flt}$	HC_{flt}
Constant	0.13***	0.25***	1.67***	0.000
	(0.006)	(0.005)	(0.004)	(0.000)
GIV_DoB_{flt}	1.29***	0.02***	4.19***	-0.000
	(0.005)	(0.004)	(0.480)	(0.000)
GIV_DoF_{flt}	0.20***	1.38***	1.30***	0.000
	(0.006)	(0.003)	(0.491)	(0.000)
GIV_$Vol.22_{flt}$	0.00***	-0.000***	0.59***	(-0.000)
	(0.000)	(0.000)	(0.004)	(0.000)
GIV_HC_{flt}	0.70 ***	-1.40	-2.71***	1.20***
	(0.18)	(0.122)	(0.14)	(0.002)
Fund × Month FE	Yes	Yes	Yes	Yes
Bank × Month FE	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes
Observations	108649	108649	108649	108649
R-squared	0.4853	0.6418	0.4124	0.644
F-test	442.5	841	169.9	442.2
Angrist-Pische F-test	317	1347	326.7	1027

Source: Banco de México. Authors' calculations.

Table B.2. First-stage for funds' market shares

This table reports the corresponding first-stage estimates for the model displayed in Table 6. It presents four separate regressions, each of which is displayed in a column. Clustered standard errors at the fund-month level are given in parentheses. The dependent variables are in column 1, the average interest rate charged by fund f in a given day t; in column 2, the average BRI; in column 3, the average LRI; and in column 4, the average SI. Instrumental variables include granular IVs for each endogenous regressor, differentiation IVs for interest rates and intensity (SI), and interactions between granular IVs and an interaction between a differentiation IV for total fund assets and the differentiation IV for interest rate. In the Appendix A of the paper, we provide a description of all of our variables. The bottom panel of the table presents partial F statistics for weak identification. We use data aggregated at the fund-daily level, covering the period from January 1, 2006 through February 8, 2018. The symbols *,**,*** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Variable	Average Interest rate	BRI_{ft}	LRI_{ft}	SI_{ft}
GIV_BRI	-0.240***	0.361***	-0.256***	-1.577***
	(0.031)	(0.021)	(0.004)	(0.074)
GIV_LRI	0.001	0.300***	0.939***	0.931***
	(0.0029)	(0.020)	(0.007)	(0.063)
GIV_rate	0.453***	-0.009***	0.002***	-0.151***
	(0.012)	(0.002)	(0.0004)	(0.011)
GIV_SI	-0.075***	-0.011***	0.004***	0.698***
	(0.005)	(0.001)	(0.0003)	(0.009)
DIV_rate	0.004***	0.0005***	0.0005***	0.004***
	(0.0006)	(0.0001)	(0.0001)	(0.001)
DIV_SI	0.012***	-0.0006	0.0014***	-0.012***
	(0.002)	(0.0004)	(0.0001)	(0.004)
GIV_BRI× GIV_LRI	-0.150	0.241***	0.220***	0.630***
	(0.103)	(0.042)	(0.081)	(0.184)
GIV_rate× GIV_SI	0.010***	-0.002**	-0.0002	-0.015**
	(0.004)	(0.001)	(0.0002)	(0.007)
DIV_FundAssets× DIV_rate	0.000***	0.000***	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Constant	Yes	Yes	Yes	Yes
Factors as controls	Yes	Yes	Yes	Yes
Fund FE	Yes	Yes	Yes	Yes
Week × Year FE	Yes	Yes	Yes	Yes
Angrist-Pischke average F-statistic	307.23	183.63	7999.10	1076.14
Sanderson-Windmeijer F-statistic	250.27	125.56	114.14	765.12
Observations	114279	114279	114279	114279

Source: Banco de México. Authors' calculations.

Table B.3. First-stage for HHI

This table reports the corresponding first-stage estimates for the model displayed in Table 7. It presents three separate regressions, each of which is displayed in a column. Robust standard errors are given in parentheses. The dependent variables are: in column 1, the market-level BRI; in column 2, the market-level LRI; and in column 3, the market level SI; all of these are averaged across transactions in the same period t. In the Appendix A of the paper, we provide a description of all of our variables. The bottom panel of the table presents partial F statistics for weak identification. We use data aggregated at the daily level, covering the period from January 1, 2006 through February 8, 2018. The symbols *,**,*** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Variable	BRI_t	LRI_t	SI_t
GIV_BRI	0.309***	-0.072***	-0.076
	(0.024)	(0.024)	(0.108)
GIV_LRI	0.090***	0.719***	0.238**
	(0.022)	(0.026)	(0.107)
GIV_SI	0.002	0.011*	0.824***
	(0.005)	(0.006)	(0.030)
Constant	Yes	Yes	Yes
Factors as controls	Yes	Yes	Yes
Week-of-the year FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Angrist-Pischke average F-statistic	187.94	624.58	750.10
Sanderson-Windmeijer F-statistic	220.17	527.32	810.93
Observations	3039	3039	3039

Source: Banco de México. Authors' calculations.

Table B.4. First-stage for the demand model

This table reports the corresponding first-stage estimates for the model displayed in Table 8. It presents two separate regressions, each of which is displayed in a column. Clustered standard errors at the fund-year level are given in parentheses. All regressions include fund and week-year fixed effects. In the Appendix A of the paper, we provide a description of all of our variables. The bottom panel of the table presents partial F statistics for weak identification. We use data aggregated at the fund-daily level, covering the period from January 1, 2006 through February 8, 2018. The symbols *,**,*** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Variable	Average interest rate	SI_t
GIV_rate	0.097***	0.001
	(0.008)	(0.018)
GIV_SI	-0.001	0.999***
	(0.009)	(0.042)
DIV_SI	-0.003	-0.092***
	(0.003)	(0.020)
Constant	Yes	Yes
Factors as controls	Yes	Yes
Week-of-the year FE	Yes	Yes
Year FE	Yes	Yes
Angrist-Pischke average F-statistic	79.65	190.94
Sanderson-Windmeijer F-statistic	85.86	285.94
Observations	55662	55662

Source: Banco de México. Authors' calculations.

Table B.5. First-stage for for funds' Lerner index

This table reports the corresponding first-stage estimates for the model displayed in Table 9. It presents four separate regressions, each of which is displayed in a column. Clustered standard errors at the fund-month level are given in parentheses. The dependent variables are: in column 1, the average interest rate charged by fund f in a given day t; in column 2, the average BRI; in column 3, the average LRI; and in column 4, the average SI. Instrumental variables include granular IVs for each endogenous regressor, differentiation IVs for total fund assets and interactions between granular IVs and the total fund assets differentiation IV. In the Appendix A of the paper, we provide a description of all of our variables. The bottom panel of the table presents partial F statistics for weak identification. We use data aggregated at the fund-daily level, covering the period from January 1, 2006 through February 8, 2018. The symbols *,**,*** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Variable	HHI_t	BRI_{ft}	LRI_{ft}	SI_{ft}
DIV_FundAssets	-0.0001***	0.0001***	-0.000012**	0.001***
	(0.0000)	(0.0000)	(0.000005)	(0.0001)
GIV_BRI	-0-013***	0.419***	-0.015***	-2.345***
	(0.0026)	(0.022)	(0.004)	(0.118)
GIV_LRI	0.011***	0.359***	0.995***	1.328***
	(0.002)	(0.017)	(0.004)	(0.095)
GIV_SI	-0.002***	-0.018***	0.002***	0.710***
	(0.001)	(0.002)	(0.001)	(0.022)
$(\text{GIV\_SI})^2$	-0.002***	0.001	0.001***	-0.085***
	(0.0004)	(0.001)	(0.0004)	(0.016)
GIV_BRI× DIV_FundAssets	-0.00001	0.0007***	0.00001	-0.008***
	(0.00002)	(0.0001)	(0.00003)	(0.001)
GIV_LRI× DIV_FundAssets	-0.0001***	-0.0007***	-0.0004***	-0.003***
	(0.0000)	(0.0001)	(0.0001)	(0.001)
GIV_SI× DIV_FundAssets	0.00002***	0.0001***	0.00001	0.00038
	(0.00000)	(0.0000)	(0.00000)	(0.00023)
Maturity	0.006***	-0.009**	-0.001	0.035
	(0.002)	(0.004)	(0.001)	(0.017)
Constant	Yes	Yes	Yes	Yes
Factors as controls	Yes	Yes	Yes	Yes
Fund FE	Yes	Yes	Yes	Yes
Week × Year FE	Yes	Yes	Yes	Yes
Angrist-Pischke average F-statistic	61.81	272.93	10649.06	604.73
Sanderson-Windmeijer F-statistic	60.15	139.49	147.30	349.75
Observations	55662	55662	55662	55662

Source: Banco de México. Authors' calculations.

Table B.6. First-stage for the effects of two-way lending on independent institutions

This table reports the corresponding first-stage estimates for the model displayed in Table 10. It presents four separate regressions, each of which is displayed in a column. Robust standard errors are given in parentheses. The dependent variables are in column 1, the average BRI; in column 2, the average LRI; in column 3, the average SI; in column 4, the bank-level BRI; in column 5, the bank-level LRI; in column 6, the bank-level SI. Instrumental variables include granular IVs for each endogenous regressor. In the Appendix A of the paper, we provide a description of all of our variables. The bottom panel of the table presents partial F statistics for weak identification. We use data aggregated at the daily level, covering the period from January 1, 2006 through February 8, 2018. The symbols *,**,*** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

	Independent Banks			Independent funds		
	BRI_t	LRI_t	SI_t	BRI_t	LRI_t	SI_t
GIV_BRI	0.872***	-0.122***	-0.152***	0.888***	-0.154***	-0.080***
	(0.019)	(0.025)	(0.037)	(0.018)	(0.025)	(0.020)
GIV_LRI	0.003	1.008***	-0.0106***	-0.038***	0.942***	-0.080***
	(0.014)	(0.018)	(0.028)	(0.014)	(0.020)	(0.015)
GIV_SI	-0.095***	-0.114***	0.829***	-0.118***	-0.174***	0.956***
	(0.009)	(0.015)	(0.026)	(0.007)	(0.012)	(0.011)
Constant	Yes	Yes	Yes	Yes	Yes	Yes
Factors as Controls	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Week FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1366	1366	1366	1783	1783	1783
F-test excluded instruments	1163.58	1312.58	794.36	1440.65	1178.52	3145.94
Angrist-Pischke F-stat	1875.686	3060.221	748.162	2626.392	2096.781	5191.957
Sanderson-Windmeije F-stat	1543.73	3035.75	795.38	2495.66	2264.13	2008.4

Source: Banco de México. Authors' calculations.

Table B.7. First-stage for systemic risk

This table reports the corresponding first-stage estimates for the model displayed in Table 11. It presents three separate regressions, each of which is displayed in a column. Robust standard errors are given in parentheses. The dependent variables are in column 1, the bank-level BRI; in column 2, the bank-level LRI; in column 3, the bank-level SI. Instrumental variables include granular IVs for each endogenous regressor. In the Appendix A of the paper, we provide a description of all of our variables. The bottom panel of the table presents partial F statistics for weak identification. We use data aggregated at bank-daily level, covering the period from January 1, 2006 through February 8, 2018. The symbols *,**,*** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

	$DebtRank_{lt}$		
	BRI_{lt}	LRI_{lt}	SI_{lt}
GIV_BRI	1.112***	-0.044***	0.000
	(0.000)	(0.000)	(0.662)
GIV_LRI	-0.181***	0.856***	-0.001
	(0.000)	(0.000)	(0.254)
GIV_SI	-0.165***	-0.018***	1.000***
	(0.000)	(0.000)	(0.000)
Observations	15099	15099	15099
Constant	Yes	Yes	Yes
Factors as Controls	Yes	Yes	Yes
Week FE	Yes	Yes	Yes
Bank × Week FE	Yes	Yes	Yes
F-test excluded instruments	2419.68	2372.49	4.40E+07
Angrist-Pischke F-stat	4135.811	6204.374	64658461
Sanderson-Windmeije F-stat	4277.92	4901.36	5221.79

Source: Banco de México. Authors' calculations.

C Demand elasticities

Table C.1 reports the distribution of the implied own-price elasticities backed out using equation (10) and the results of our preferred specification.

Table C.1. Distribution of estimated own price elasticities by fund affiliation

This table reports summary statistics of the distribution of estimated own price elasticities of funds' lending products according to whether a fund's asset manager is affiliated to a financial conglomerate or is independent.

Fund affiliation	Mean	SD	Percentile 10	Median	Percentile 90
Financial conglomerate	-6.02	1.89	-8.72	-5.32	-3.60
Independent	-5.48	1.68	-8.69	-5.30	-3.59
Total	-5.78	1.82	-8.71	-5.31	-3.59

Source: Banco de México. Authors' calculations.