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It Takes More than Two to Tango: Understanding the Dynamics behind Multiple Bank Lending and its Implications

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Abstract

In this paper we investigate the matching process between banks and large borrowers that switch from single to multiple bank lending relationships in the corporate loan market. Using a unique dataset on all large credit exposures (about 214,000) of all Israeli commercial banks in the period between 2005 and 2015, we highlight the systemic externalities of micro-prudential regulation. We find, *inter alia*, that regulatory limits on credit exposures aimed at limiting an individual bank's concentration risk lead large borrowers to turn to multiple lending. This increases the level of asset commonality among banks, and the systemic risk arising from this indirect contagion channel. We find that large borrowers are more likely to establish a new lending relationship with big banks and with the banks that are familiar with the borrower's business profile, whether through existing loans to a group of borrowers to which the borrower belongs, or through acquaintance with the industry in which the borrower operates. Furthermore, we find that borrowers tend to establish a new lending relationship with banks whose asset portfolio is correlated with that of their original lender. This result may possibly be related to the tendency of banks to become more similar in their credit portfolios in order to benefit from a "too many to fail" implicit guarantee.

Keywords: Bank Lending; Firm-Bank Relationship; Portfolio Choice; Diversification; Interconnectedness; Bank Regulation; Overlapping Portfolios

JEL codes: G11, G21, G28

צריך יותר משניים לטנגו: היווצרותה של תופעת ריבוי מלווים והשלכותיה

קונסטנטין קוסנקו ונועם מיכלסון

תקציר

במחקר זה אנו בוחנים את תהליך ההתאמה (matching) בין בנקים לבין נוטלי אשראי עסקי גדולים שעוברים ממערכת יחסים עם בנק אחד (single-bank lending relationship) למערכת יחסים עם כמה בנקים (multiple-bank lending relationship). אנו משתמשים במסד נתונים ייחודי – הוא כולל את כל חשיפות האשראי הגדולות במערכת הבנקאית בישראל (כ-214,000 חשיפות) בין 2005 ל-2015 – ותחילה מזהים את ההשפעות החיצוניות של הגישה הרגולטורית המיקרו-יציבותית: אנו מוצאים בין היתר כי כאשר מטילים מגבלות רגולטוריות על חשיפות האשראי כדי להקטין את סיכון הריכוזיות של תיק האשראי בבנק הבודד, הדבר מאלץ את הלווים הגדולים לעבור מבנק מלווה אחד לכמה בנקים מלווים; תהליך זה מגדיל את הסיכון המערכתי הטמון בהדבקה (contagion) בערוץ הבלתי ישיר – ערוץ שנוצר עקב חשיפה של מוסדות פיננסיים (בנקים) לנכסים חופפים. בשלב הבא אנו בודקים את תהליך ההתאמה (matching) ומוצאים כי לווים גדולים נוטים ליצור מערכות יחסים חדשות עם בנקים גדולים ועם בנקים שיש להם היכרות מוקדמת עם פעילות הלווה – בזכות חשיפה קיימת לקבוצת לווים שהלווה נמנה עימה ו/ או בזכות חשיפה לענף פעילותו. זאת ועוד, הלווים נוטים ליצור מערכת יחסים חדשה עם בנקים שלתיק נכסיהם יש מתאם גבוה עם תיק הנכסים של הבנק המלווה המקורי; את התוצאה הזו אפשר לייחס לנטיית הבנקים להחזיק תיקי אשראי דומים על מנת ליהנות מהערבות המשתמעת הנובעת ממצב של "רבים מכדי ליפול" (too many to fail).

1. Introduction

The literature on systemic risk and contagion in the financial system points to two types of channels through which an idiosyncratic shock turns into a systemic one. The first type is a direct contagion channel, arising from contractual obligations such as interbank loans, swap agreements or other bilateral exposures between two (or more) financial institutions; and the second is an indirect contagion channel, through which financial institutions are exposed to mark-to-market losses due to common asset holdings. While there is substantial theoretical—as well as empirical—evidence exploring the origins and the dynamics of the former (Rochet and Tirole, 1996; Allen and Gale, 2000; Allen et al., 2012; Duffie, 2013; Kallestrup et al., 2016; Diebold and Yilmaz, 2014; Gorton and Metric, 2012; and Giglio, 2011), the indirect contagion channel remains less explored. The aim of this paper is to contribute to a better understanding of the empirical realities associated with this topic.

Surprisingly, it is only relatively recently that academics and policymakers have started to pay close attention to the risk posed by indirect connections associated with asset commonality. What is even more surprising in this context, especially with respect to perspectives regarding the financial and banking stability, is that simulations based on actual interbank exposures (loan data) suggest that so-called "domino defaults" arising from contractual violations are highly unlikely[1], though they can be very destructive if they do materialize.[2] In contrast, models incorporating indirect channels of contagion can explain a distinct class of systemic crises that occur even in the absence of contractual linkages.[3] Indeed, evidence suggests that the losses

[1] Representative papers in this literature are Furfine (2003) for the US; Elsinger et al. (2006) for Austria; Upper and Worms (2004) for Germany; Mistrulli (2007) for Italy; Degryse and Nguyen (2007) for Belgium; and van Lelyveld and Liedorp (2006) for the Netherlands. Alves, et al. (2013) provide cross-country analysis and study contagion within a network of large EU banks. Upper (2011) surveys and critically assesses the direct contagion literature.

[2] Gai and Kapadia (2010) elucidate this common feature of financial (and more generally complex) systems: these tend to be generally robust, but fragile to targeted attacks on specific (systemically important) nodes.

[3] Luck and Schempp (2015) develop a model in which an idiosyncratic run leads to a systemic run through inducing an overall scarcity of liquid funds via the fire sale channel. This is even in the absence of direct contractual linkages. Anand, Gauthier and Souissi (2015) develop a model-based stress-testing framework that integrates fundamental solvency risk with funding liquidity risk and information asymmetries.

deriving from indirect contagion during systemic crises dwarf direct losses[4] (Lopez, 2015).

The risk arising from common asset holding (portfolio overlap) is described in many theoretical, but few empirical, works (Acharya and Yorulmazer, 2008; Acharya, 2009; Allen et al., 2012; Wagner, 2010; Wagner, 2011; Caccioli et al., 2014 and Greenwood et al., 2015). These studies highlight the role of "fire sale" dynamics (Coval and Stafford, 2007; Duffie, 2013; Shleifer and Vishny, 2011; Ellul et al., 2011) as a mechanism through which the overlapping portfolios phenomenon amplifies financial contagion.[5] According to the studies, the indirect connections provide a contagion channel for the propagation of mark-to-market portfolio losses (Ellul et al., 2014) to one or more financial institutions due to depression in asset prices resulting from fire sales by a distressed institution holding the same assets. In some cases, as occurred in the 2007–08 financial crisis, for example, these losses may be sufficient to cause additional financial institutions to become distressed, thereby resulting in more rounds of asset fire sales and further depression in asset prices. Nevertheless, the empirical evidence on the overlapping portfolios phenomenon, its origins and the implications for financial stability remains scarce.[6] In this study we try to shed light on these issues and, more specifically, to explore the determinants behind the emergence of asset commonality in banks' loan portfolios.

In general, asset commonality results from either unintentional or intentional actions or causes. It can arise unintentionally if the methodology used by financial institutions (banks, for example) to diversify their asset portfolios and to reduce financial risk is similar, or if they are provided with just a few of the investment alternatives/opportunities in the markets (Wagner, 2011; Ibragimov et al., 2011) - especially in the presence of home bias[7]. In contrast, financial institutions might

[4] In an application of the Greenwood et al. (2015) "vulnerable banks" framework to EBA stress test data, Lopez (2015) shows that the second round effects owing to fire sale externalities tend to be greater in magnitude than an initial shock by a factor of approximately five.

[5] The intensity of this dynamic depends on many factors, among which are the extent of overlapping, the amount of each asset each institution holds, asset liquidity in the markets, and capital requirements.

[6] The existing, few studies (see Greenwood et al., 2015, for example), focus on the specific segments of financial institutions' activity or the specific assets classes (e.g., government bonds and syndication loans).

[7] The existence of home bias in investment/asset portfolios can be explained by informational advantages for domestic, biases arising from familiarity considerations (Giannetti and Laeven, 2012) or by transaction costs involved in cross-border lending and borrowing (French and Poterba, 1991; Wagner, 2011).

intentionally increase their common exposures when they jointly finance different projects—through syndicated loans, for example (Jain and Gupta, 1987). Usually, these loans take two major forms: in one case a loan is structured, arranged and exercised by one bank (or several)—known as the lead arranger—which holds explanatory meetings, invites other banks to participate, arranges a contractual agreement among them, etc. This case represents "formal" loan syndication. According to a Thomson Reuters report (2017:Q4)[8] the share of syndications loans granted in 2017 out of total outstanding credit to the nonfinancial corporations[9] in the EU is 6 percent, in Japan—5 percent, the UK—8 percent and in the US—19 percent.[10] In the other case, each bank independently and non-cooperatively determines the extent of its loans to a firm, which results in *multiple lending*. This type of syndication represents "de facto"[11] or "implicit" loan syndication. Despite the fact that research data and empirical evidence show large variation across countries in the average number of bank relationships per firm, multiple-bank relationships seem to be the common and the most prevalent characteristic of credit markets in nearly all countries (Degryse et al., 2009). [12]

From the theoretical point of view, at least, the difference between "formal" and "de facto" syndication is clear: in "formal" syndication, banks can agree on their terms of lending before the contract is signed and can make a cooperative contract. This type of collaboration is a kind of "cartel" in which banks maximize their joint profit and distribute it later to the satisfaction of all the participants of syndicate. In "de facto" syndication, in contrast, each bank tries to maximize its own profit non-cooperatively, while conjecturing the action of the other banks.[13] As such, two distinct types of loans

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[8] Available at: https://www.thomsonreuters.co.jp/content/dam/openweb/.../2017/loan-4q-2017-e.pdf

[9] The figures for total outstanding credit to the nonfinancial corporates are taken from the BIS website: https://www.bis.org/statistics/totcredit.htm.

[10] The comparable figure for Israel is 0.9 percent (Bank of Israel Banking Supervision Department and BIS).

[11] The term "de facto" loan syndication means a syndication in which banks lend non-cooperatively, while the term "formal" loan syndication implies the case in which the banks make agreements before the contract is signed and lend as if they were joint profit maximizers.

[12] Notwithstanding, the systematic evidence on the extent (credit amount) of multiple lending is lacking as the measuring of cross and mutual exposures between different lenders is quite challenging. A few examples of such evidence include: Jimenez et al., (2011) who report that in Spain 80 percent of overall bank credit is due to multiple lending; and Cappelletti and Mistrulli (2017) who argue that in Italy, where syndication loans account for about 5 percent of total outstanding credit, multiple credit supply is estimated at 65 percent.

[13] In this vein, a contract between a borrower and a lender cannot be made contingent on other lenders and in particular on future lenders who have not yet lent to the borrower. Contractual terms could help

exist and are practiced in Nash equilibrium and thus must be distinguished. Moreover, with respect to financial stability issues, these types of syndication incorporate different implications for financial risk. While in the case of formal syndication the risks, when they exist,[14] are often shared, monitored and moderated by the participants of the loan contract (Simons, 1993; Dennis and Mullineaux, 2000; Sufi, 2007; Ivashina and Scharfstein, 2010), a "de facto" syndication, which arises from multiple lending, can be harmful to market developments and liquidity, and can suffer from coordination failure. First, multiple lending may induce both borrowers and lenders to behave opportunistically and can lead to credit rationing and high interest rates (Bennardo et al., 2015). Second, while in normal times, multiple banking may well be beneficial as it alleviates the hold-up risk inherent in single-source bank financing (Rajan, 1992), and protects the debtor against a sudden deterioration of the liquidity position of the bank (Detragiache et al., 2000), in other times —when the borrower himself is in distress—multiple bank lending is likely to be a disadvantage; and, due to non-exclusivity of credit contracts and the lack of coordination mechanisms,[15] may generate important negative contractual externalities (Degryse et al., 2016)[16]. Finally, when the typical markets for liquidity are impaired, multiple lending, especially if the credit lines to borrowers are granted, may give rise to liquidity hoarding, and, thus, may amplify and propagate liquidity shock throughout the banking system.[17]

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enforce exclusivity or mitigate the negative externalities from non-exclusivity—the extent and efficiency with which this can be achieved depends on the institutional framework (Degryse et al., 2016). Bennardo et al. (2015) show how this setting affects the contractual terms of the first lender.

[14] Cai et al. (2014) find a positive correlation between interconnectedness (measured by being a member of the same loan syndicate) and standard bank-level systemic risk measures including SRISK, CoVaR, and DIP, during recessions.

[15] A large body of literature focuses on the difficulties experienced by multiple lenders attempting to coordinate their actions. For example, Gertner and Scharfstein (1991) analyze the free-rider problem in corporate distress, and Morris and Shin (2004) emphasize the associated welfare loss of a creditor run.

[16] The common-pool problem, in which creditors race to the courthouse to collect their loans, occurs because creditors do not internalize the costs and benefits that their actions impose on other creditors. A creditor that chooses to pursue its individual, state law collection rights may be causing the premature liquidation of a viable firm, and this may hurt all creditors. The common-pool problem persists because creditors act in their self-interest.

[17] Cappelletti and Mistrulli (2017) find that this channel of contagion may have a significant impact on the stability of the banking system, especially when it interacts with other channels for contagion related to direct interbank exposures. All in all, there is a the trade-off between the benefits of diversification of the liquidity risk that borrowers may pursue by establishing multiple lending relationships, especially when they are granted credit lines, and the cost of propagating liquidity shocks within the banking system. This trade-off depends on the structure of the network and the severity of the liquidity shock that hits a bank or part of the banking system. Multiple lending, in line with Detragiache, at al. (2000), may mitigate the impact of banks' liquidity shocks on the economic activity

In this study, we focus on "de facto" syndication which stems from the pool of large corporate loans. This population is probably the most important and intriguing empirical platform to test the origins and the dynamics of overlapping portfolios. Among the variety of risks under consideration of bank regulators around the world, the large credit exposure of a bank to an individual borrower, or a group of related borrowers, is significant. The BIS clearly indicates that a "significant proportion of major bank failures have been due to credit risk concentration of one kind or another" and "it is important for supervisors to consider measures limiting banks exposures to concentrated forms of credit risk" in general, and "large borrowers" in particular.[18] And indeed, to control the risk of credit concentration, regulators have established policies for lending limits or large exposures, which set a maximum exposure as a share of a bank's capital that can be extended to a single borrower or a group of related borrowers.[19] It should be noted, however, that regulatory limits, while targeting the idiosyncratic risk of banks, by lowering the level of credit concentration, force borrowers with large credit needs to borrow from other sources—either capital markets or other banks—and thus create one of the potentially most insecure platforms for risk expansion.[20] Overall, large borrowers, due to their high credit demand, have a higher impact on the emergence of asset commonality, and the propagation of shocks within the system, should they be in distress, is expected to be more severe.[21]

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of borrowers. However, this holds in normal times when the market for liquidity works smoothly. In contrast, in a crisis, when the interbank market is impaired, a dark side of multiple lending may emerge since it may give rise to contagion and financial instability.

[18] See "Measuring and Controlling Large Credit Exposures", January 1991 (Basel Committee) and "Supervisory framework for measuring and controlling large exposures", April 2014 (BIS).

[19] The limit of large exposure represents a direct limit on banks' risk taking (Schooner and Taylor, 2010). According to the Global Macroprudential Policy Instruments survey taken by the IMF (IMF, 2013), 86 out of 97 countries surveyed have limits on large exposures. The limits vary in the scope of the borrowers to which they are applied, the limit itself and in benchmark used to calculate the maximum exposure. The most common limit used is 25 percent of the lender's own capital. Basel I and II key principles focus on risk-adjusted capital requirements.

[20] In contrast to domino contagion interconnectedness through common assets mentioned above, large exposures does not necessary reflect whether banks are sequentially affected or not. In fact, if shocks are large enough, banks with large common exposures to these shocks might default simultaneously even before a domino effect sets in.

[21] It is hard to assume that the classical fire sale dynamics explanation is presumable in this case—the process of selling the existed loans is complicated, but theoretically possible. It should be noted, however, that in contrast with typical loan syndications, the secondary loan sales market is dominated by leveraged, risky loans and the majority of loans are purchased by nonbank, institutional investors (Yago and McCarty, 2004).

These settings of multiple lending raise various questions: Which kind of (large) borrowers prefer to borrow from more than one bank? What are their incentives? How do they choose the additional (second, third, etc.) bank to borrow from and why; what are the incentives of the additional bank to lend to this borrower? Is the decision to grant a loan affected by the borrower having already established lending relationships with another bank? And, finally—do the decisions by the borrower and the new lender to establish lending relationship depend on the economic profile of the original lender, and in what manner? The existing literature on multiple lending describes the borrowers' motives and the perspectives of borrowing from more than one bank and banks' motivation to lend them, separately. To the best of our knowledge, however, no study to date has tested the determinants of the lending match between a borrower and an additional new lender as a function of an existing single loan relationship.

In attempting to answer these questions, we rely on the most recent literature on multiple bank lending and derive several testable empirical predictions regarding the determinants of matching between a borrower and a new lending bank—given the characteristics of the potential lending banks, borrowing firm, the original lending bank and the distance between them in the asset space. We test these predictions empirically by using a novel dataset consisting of firm-bank loan data on about 213,453 large credit exposures of the seven largest banks in the Israeli banking system over the period 2005 to 2015 (around 4,800 loans per quarter to 9,577 unique borrowers), reported to the Bank of Israel's Banking Supervision Department (hereinafter, BSD). This database accounts for over 70 percent of total nonfinancial corporate business sector credit supplied by Israeli commercial banks.[22] Based on these data we identify 2,197 large corporate borrowers that added another bank as a lender during the sample period, and derive 1,250 cases of large corporate borrowers that replaced a single relationship with multiple-bank relationships.

The narrative underlying our analysis is close to that described in Acharya (2009) who argues that banks, while reducing their own idiosyncratic default risk, can increase systemic risk by adopting similar investment strategies. This can be done

[22] This is a first study in Israel to be based on large credits register data. The database is very helpful as it exhibits a panel data structure for three levels: lenders, borrowers and the groups of borrowers. In general, the data are confidential and may only be used with the BSD's permission and is subject to restrictions.

strategically[23] to increase the likelihood for regulatory intervention (in the form of bail-outs or recapitalization) in the case of joint failure (by creating a state of "too many to fail"); or to reflect the tension between market characteristics (e.g., small number of assets to invest, home bias, etc.) and banking regulation that limits banks' investment opportunities. Basel III directives regarding large exposures are possible examples of such tension.

Due to these motives, we examine two important factors with potential implications for policymaking. First, we test whether a new lender's decision to grant a loan could be explained by banks' intentional choice to undertake correlated investments (which are, in our case, equivalent to lending to the same borrowers). This is in order to maximize the likelihood of a joint bailout in case of joint default (Acharya and Yorulmazer, 2007; Acharya, 2009 and Ibragimov et al., 2011).[24] The difference between our work and other studies which focus on "formal" syndication loans (Gong and Wagner, 2016; Cai et al., 2014), is that we test this decision by exploring the pool of syndicated loans that emerged "de facto".

Second, we include regulatory limits on large exposures and test how these limits affect lenders' decisions. Since these limits, suggested by Basel III to mitigate concentration risk, are implemented in various countries, it is crucial to revise their unintended externalities. Moreover, it is also important to understand whether and how policymakers' micro-prudential and macro-prudential goals in the banking sector conflict with one another and how micro-prudential tools mitigate and diminish idiosyncratic risk at the expense of an increase in systemic risk[25].

We find evidence that the Israeli banking system does not have a significant volume of intentional overlap (syndication transactions), with most of the loans portfolio overlap being unintentional (through "de-facto" syndication). Such overlap and asset commonality are created, inter alia, due to the regulatory restrictions on a single

[23]According to Hanson et al. (2011), a micro-prudential approach is one in which regulation is partial equilibrium in its conception and aimed at preventing the costly failure of individual financial institutions. In contrast, a "macro-prudential" approach recognizes the importance of general equilibrium effects and seeks to safeguard the financial system as a whole. Hanson et. al. (2011) argue that in the aftermath of the crisis, there seems to be agreement among both academics and policymakers that financial regulation needs to move in a macro-prudential direction.

[24] In the presence of public guarantees (implicit or explicit) for bailout, joint defaults often result in joint bailouts. In line with this prediction, Brown and Dinç (2009) show that the ex-post effect of "too-many-to-fail" is that when a banking system is weak, it is less likely that a government will close or take over a failed bank.

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bank's exposure (restricted exposure to a single borrower, group of borrowers, or industry) that do improve the diversification of loan portfolios in each bank, but that also force large borrowers to seek alternative sources of financing. We find that the likelihood of providing new credit to a borrower, who already has a single-bank relationship, increases with the size of the potential lender (bank) but also with: (a) the bank's familiarity with the borrower's business, whether through existing loans to a group of borrowers to which the borrower belongs, or through acquaintance with the industry in which the borrower operates (i.e., lender specialization and credit exposure to the industry with which the potential borrower is affiliated); and (b) it increases with the level of similarity in equity returns movements and asset-portfolio composition between the candidate (potential) lender and the original lending bank. This result, similar to evidence from studies on "formal" syndications, may possibly be related to a "too-many-to-fail" guarantee and the associated collective moral hazard of "love for correlation" among the lenders (banks). We argue, however, that in case of "de-facto" syndication, and due to potential coordination failure, the negative impact of such (herding) behavior among different lenders on the stability of the financial system and banking system in particular is significantly higher.

The outline of the paper is as follows: in Section 2 we review the existing literature and derive testable empirical predictions regarding the relation between a borrower, first lender and second lender; in Section 3 we present the data and estimations used to test our predictions; and in Section 4 we discuss our results and their policy implications; Section 5 concludes.

2. Literature Review and Empirical Predictions

The literature on multiple-bank relationships (and the systemic risk) addresses three major questions: (a) who borrows from multiple banks, (b) why do firms borrow from more than one bank, and (c) why do banks lend to firms that already borrow from other banks?

According to Degryse et al. (2009), who summarize findings from different studies on multiple-bank lending, borrowers (companies) who borrow from more than one bank are (on average) bigger, older, less profitable, distressed, low-cash flow, intangible and highly leveraged. In addition, Farinha and Santos (2002) show that the probability

for multiple-bank lending increases for firms with high growth opportunities which require high (re)investments or for firms facing financial difficulties and/or experiencing poor performance.

Another strand of the literature emphasizes the incentives of borrowing from multiple banks. One possible explanation of this phenomenon is that the borrower tries to diversify his credit portfolio to avoid the hold-up problem and to eliminate any potential rents that can be extracted by an exclusive lender[26] (Farinha and Santos, 2002). Other studies emphasize the role of confidential information in a firm's choice of the number of lenders (Bhattacharya and Chiesa, 1995; Von Rheinbaben and Ruckes, 1998). According to these, the firm trades off the benefits from competition against the costs of information leakage to its competitors when it chooses the number of lenders. Yosha (1995) focuses on the signal that the choice of lenders sends to competition. Thus, borrowing from a single lender avoids the disclosure of information that occurs when the firm borrows from multiple lenders, but it leads the firm's competitors to infer that the firm is concealing information and react accordingly. Therefore, firms with the most to lose, if private information is disclosed, borrow from a single lender. Bolton and Scharfstein (1996) in their study emphasize the negotiation costs and predict that low-default risk firms, those with strong asset complementarities, and those in noncyclical businesses will tend to borrow from more creditors.

From the lender's point of view, there is also a variety of motives to become an additional source of funding. First, the incentive to become an additional lender and to create the de facto syndication can reflect a desire to reduce the costs of monitoring (Carletti et al., 2007). In addition, Acharya and Yorulmazer (2007), Acharya (2009) and Ibragimov et al. (2011) argue that—given a specific setting of the market or the banking system—banks strategically choose to become an additional lender and tend to herd into loans (asset classes) in order to create, de-facto, a "too many to fail" guarantee[27]. Such a strategy is beneficial when assuming the potential severe shock to

[26] Thus, for example, in the case of relatively small or young firms, whose access to external, non-banking financing is quite limited, such firms will try to find another source to fund its activity.

[27] According to Ibragimov et al. (2011), this happens only when the risk's distribution is moderately heavy-tailed and when the uncertainty about correlations between a large number of thin-tailed risks is high. It also depends on the number of distinct asset classes in the economy, the discount rate, and the time to recover after a massive intermediary default. Acharya's (2009) result arises if banks are large, essential and unique in their business.

the banking system. Gong and Wagner (2016) show empirically, through the market of syndicated loans that banks, especially smaller ones, underestimate the systemic risk that borrowers bear, and explain this result by the increased expectations of banks to be bailed out in a case of a systemic event. Uchida (1999), by applying the theory of common agency, formally explains the fact that there are two forms of loan syndication, "de facto" and "formal". He shows that banks may choose both forms and that the key to the choice is a free rider problem among banks in giving the borrowing firm an incentive to take appropriate actions (moral hazard).

Another important aspect that is relevant to our study is the effect of regulation on banks' lending decisions and activities. Laeven and Levin (2009), in a cross-country analysis, include several regulatory tools and examine their effect on risk taking. More specifically, they test the impact of capital requirements, deposit insurance and restrictions on non-banking activities. The closest regulation to one whose impact we examine in our study—"limits on large exposures"—is the restriction on a bank's activities. They find this tool to have a positive effect on risk-taking when the bank has a sufficiently powerful owner. Agoraki et al. (2011) find that the same regulatory tool, in combination with high market power, reduces both credit risk and the risk of default in the banking system. Anginer et al. (2014) show that regulatory restrictions on a bank's asset diversification—a class of regulations that also include limits on large exposures—are efficient in reducing systemic risk, but only in less competitive markets. More broadly, an earlier study Barth et al. (2004) examines the correlation between various regulations and measures of banking-sector development, efficiency and fragility and finds that government policies that rely excessively on direct government supervision and regulation of bank activities are not sufficient and, sometimes, even not/less efficient. Barth et al. (2004) stress the importance of accurate information disclosure and the private sector corporate control of banks in achieving stability, development and performance.

In addition to the aforementioned literature, our paper also relates to the literature on the matching process between borrowers and lenders (Cole et al., 2004; Chen and Song, 2013) in loan markets. However, those studies focused on the initial match between a borrower and a lender, explaining why a certain firm borrows from a certain bank, while in our study we try to reveal the determinants of a new lending match conditional on existing lender-borrower match characteristics.

Despite extensive literature and the existing analysis of different aspects of multiple-bank lending, there is no study, to the best of our knowledge, that formulates testable empirical predictions regarding the determinants of new banking relationship formation. To explore the incentives behind the establishing of multiple lending, and thus the characteristics of the new lender, given the existing (single) relationship, we rely on Berger et al. (2008) who summarize major motives for firms to replace single banking relationship with multiple one[28]. Below, we present these motives and derive empirical predictions regarding banks' and borrowers' characteristics determining the establishment of multiple banking relationships:

1) ***"Availability motive"*: Multiple relationships arise when one bank is not able to provide all of the firms' funding needs.**

Prediction 1: According to this motive, we expect the new lender to have much available capital, relative to other, potential lenders. Since big firms need more funds to maintain and expand their activity, we also expect bigger firms to establish new lending relationships with banks with larger funding availability. In addition, given the fact that banks face regulatory limits on total exposure to a single borrower, a group of borrowers and the borrower's industry, we expect these limits to be less binding for the new lender. In other words, we expect its actual overall credit exposure to group and borrower's industry to be significantly lower than the maximum exposure allowed in comparison with other potential lenders.

2) ***"Hold-up motive"*: New banking relationship mitigates the hold-up problem.**

Prediction 2: According to this motive and following Elsas et al. (2004), we expect a borrower to establish a new relationship with a smaller bank, relatively to the original one, and by that to diversify its funding sources (debt portfolio) and to diminish the potential for the hold-up problem. This incentive may be greater when banking markets are less competitive, offering fewer potential alternatives in the future event that their main bank tightens contract terms dramatically.

3) ***"Diversification motive"*: Multiple relationships insure a firm against distortion with the relationship bank services due to its distress.**

[28] Berger et al. (2008) provide 5 motives.

Prediction 3: By establishing new relationships, the firm can increase the likelihood that at least one informed bank would be able to continue providing services, reducing the costs of bankruptcy or financial distress for the firm. Hence, according to the diversification motive, we expect new lending relationships to emerge with less risky banks, compared to the original one. In addition, establishing multiple relationships with less correlated banks can reach the same diversification purpose.

4) *"Familiarity motive"*: Multiple banking relationships lead to enhanced bank monitoring.

The choice between single and multiple banking relationships depends on optimization by firms weighing the costs and benefits of the additional monitoring. Monitoring duplication benefits the firm by increasing the success probability of the project, but, at the same time, it reduces the firm's expected private return and increases total monitoring costs (Carletti, 2004). Thus, establishing multiple-banking relationships implies that firms' benefits outweigh the costs. Carletti et al. (2007) predict greater use of multiple-bank lending when banks have lower equity, when firms are less profitable, and monitoring costs are high due to poor financial integration, strict regulation, and inefficient judicial systems.

Prediction 4: When firms are opaque and less transparent, monitoring costs are higher, but they can be reduced if the bank has some prior knowledge on the firm. Hence, we expect firms to establish a new relationship with a bank that has prior credit relationships with a borrowing firm, or, which is familiar with borrower's industry, or which lends to another firm from the group of borrowers to which the firm belongs.

In the next section we test these predictions empirically.

3. Data and Estimation

3.1 The Israeli Banking System

The Israeli banking system is made up of 16 commercial banks, 12 of which are domestic.[29] Five banking groups are quite dominating: these holding groups hold 94 percent of total assets, while two additional banks/bank groups hold together another 5 percent (Figure 1): The Herfindahl-Hirschman Index[30] of banking system, calculated based on the total assets, is 0.2—which is a relatively high number in comparison with the EU average of 0.11. Indeed, Israel is a small country with a high level of concentration in almost all other sectors of the economy. Nonetheless, it can be said that the level of concentration in Israel's banking sector is not out of line in comparison to other (similar) economies, and to other sectors.

Banks are the main players in the Israeli financial system. They supply 64.2 percent of all credit in the private sector and almost 50 percent of the credit in the business sector. The rest of the credit for the business sector is provided through tradeable bonds, foreign lenders and institutional investors who started granting credit relatively recently, in 2009. These alternative sources, however, are practically available for very large firms, especially public firms, while for the rest of the firms the banking system has been and continues to be the most exclusive source of credit supply. Finally, Israeli banks are well-capitalized with a capital to assets ratio of 6.9 (the total capital in system is approximately NIS 100 billion) and the profitability, as measured by ROE, is similar to the OECD average and stands on 9.1 percent.

3.2 Large Borrowers' Exposures Data

In order to monitor the risk in credit portfolios of banks based in Israel, the Banking Supervision Department (BSD) maintains a credit register for credit exposure exceeding a threshold that is considered as significant for the solvency of banks. The threshold is applied to single borrower and to groups of borrowers alike in order to account for contagion. Each quarter, banks report to the Banking Supervision Department their overall current (stock) exposure to each large borrower.[31] The

[29] The data and description of the Israeli banking system is for 2015 and is based on "Israel's Banking System – Annual Survey, 2015", published by the Banking Supervision Division.

[30] The index is calculated as: $HHI = \sum_{i=1}^{N} s_i^2$, where N is number of banks in the system and s_i is the share of bank i assets in the total assets of the system.

[31] Except for the borrower's size, there are other criteria for which exposures are to be reported. For example, most banks must confirm that their total reported exposure does not fall short of 25 percent of

dataset we use consists of all "large borrower" reports from the seven largest Israeli banks in the period between 2005 and 2015. The definition of "large" borrower is based upon the amount of a bank's credit exposure to a given borrower relative to the bank's equity capital: according to banks' balance sheets, the equity capital of the six largest banks in Israel is above 5 billion NIS (~$1.3 billion). This fact and the Banking Supervisor directive in particular requires Israeli banks to report credit exposures equal to or exceeding NIS 20 million (~$5 million) [32]. The smallest bank out of seven largest Israeli banks is obligated to report every exposure of NIS 4 million (~$1 million) or higher. In general, and in line with these definitions, over the sample period our comprehensive database includes detailed information of banking system exposure to large borrowers which, in its turn, accounts for 73.6 percent of total nonfinancial corporate business sector credit supplied by Israeli commercial banks (Figure 2).

The data reported by Israeli banks to the BSD are divided into three categories[33]:

1) Borrower data—these include a borrower's unique identifying number, legal status (e.g., firm, individual, foreign firm, citizen), industry affiliation and its affiliation to group of borrowers, if such exists.[34]
2) Banks credit exposure data—a full, detailed, credit exposure composition that includes total and specific banks' balance sheet and off-balance sheet exposure, net exposure[35], deductions, provisions, amount of non-performing loans, etc.
3) Collateral data—type of collateral, value and value for the bank

The full database on large exposures consists of 304,843 loans (around 7,000 loans per quarter) to 19,273 unique borrowers. (Figure 3 and Table 1 preset the distribution of sample by different populations of borrowers). In this study, however, we focus on exposures to local nonfinancial corporates only (including government-owned corporates). This subsample consists of 72 percent (NIS 270 billon) of total credit

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total bank's credit risk. In addition, if a reported borrower belongs to a group of borrowers, the bank must report all other, existing, exposures to that group.

[32] More precisely, every exposure above NIS 20 million should be reported, while every exposure over NIS 200 million should be reported with enhanced details regarding the structure of the exposure.

[33] A full description of the variables is in Table 1A in the Appendix.

[34] In addition, we include the public legal status of borrower - whether the borrower is a public/listed company, and also an indicator on borrower's exposure (if it exists) to the corporate bonds market.

[35] Net exposure is calculated as a sum of balance and off-balance credit, after subtracting deductible items (e.g., the borrower's deposit in the lending bank) and all kinds of non-preforming loans.

exposures (NIS 375 billion) included in full "large borrowers" database and of 213,453 loans (4,800 loans per quarter) to 9,577 unique borrowers. The average credit exposure of borrowers is NIS 81 million out of total indebtedness and the median is NIS 37.4 million. The distribution of loans to large borrowers is concentrated and has a heavy right tail, reflected by the fact that the sum of exposure of the first 50 percent of all borrowers (ordered by the size of the exposure) consists of only 12.5 percent of total exposure (Figure 4).

As noted above, Israeli banks are also obligated to report their aggregate credit exposure to "groups of borrowers". The number of unique groups of borrowers reported throughout the sample period is 786. Descriptive statistics of borrowing group (for 2015:Q4) are presented in Table 1 and Table 2. However, since the borrowing groups' exposures include most of the single borrowers' exposures (consisting of individually reported exposures by single borrowers), we exclude the observations related to "group of borrowers" from our sample. This allows us to avoid the double counting bias.

According to simple descriptive statistics, during the sample period about 75.5 percent of large borrowing corporates reported to BSD have a single banking relationship[36], while their share in total large corporate exposures is 39.2 percent (NIS 115 billion), on average (Figure 5).[37] Borrowing corporates with multiple relationships (24.5 percent of large borrowing corporates reported to BSD) account for 60.8 percent (NIS 154 billion) of large corporate exposures. This figure consists of 39.2 percent of total nonfinancial corporate business sector credit supplied by Israeli commercial banks.[38] The median (mean) number of banking relationship maintained by nonfinancial corporates is 1 (1.4), and is quite stable throughout the sample.[39] Given this background, we do find that many borrowers replace single relationships with multiple relationships. About 1 percent to 2 percent of firms in our sample match

[36] Qian and Strahan (2007) found that the median number of banking relationships in Israel between 1994 and 2003 is 3, but their sample is very small and limited only to syndicated loans, which by definition involve more than one lending bank.

[37] The numbers refer to the last data point in our dataset - 2015:Q4, but these numbers are quite stable over the full period considered.

[38] The total outstanding volume of syndication loans in Israel, for comparison, is NIS 46.9 billion. This includes all the existing syndications: between banks and between banks and the institutional investors as well.

[39] In comparison to other markets/countries: firms in the UK, Norway, Sweden and US maintain relatively few bank relationships – fewer than three on average – while for firms in Italy, Portugal, Spain and Belgium, for example, the average is 10 or more bank relationships.

this pattern on quarterly basis. We identify these borrowers by tracking the changes in borrower's status between two consecutive reports. Thus, a borrower who is identified as a "large borrower" in a quarterly report of a single bank, and who appears in the reports of the same bank and in another bank's report in the following quarter, is defined as a borrower who has established multiple bank relationships. Since excluding or including the borrower from the large borrowers report might be merely a technical result of exceeding the minimum exposure threshold, we use different constraints to avoid this problem. More precisely, the treatment group in this study consists only of those borrowers who are included in four consecutive reports on large borrowers of the same bank and in the last two reports of both the original lender and new one. This feature, of course, cannot rule out the possibility that the firm has already had a historical relationship with so-called "a new lender". The fact that borrower's exposure is not marked as "large" for the specific bank simply means that his/her exposure is not sufficient to exceed the threshold required by BSD directive for reporting the credit exposure as a "large" one.[40] The categorization of a borrower into the "large borrower" niche is not just a technical nuance: by changing its status, such borrower becomes more significant to the bank and thus so does its bargaining power. The costs of monitoring its activity are higher and therefore banks' chief loan officers, rather than loan officers, are always in charge of approving and dealing with the exposures to these borrowers. Hence, in this study, we do not cover *all* newly emerged bank-lender relationships, but rather the *new significant* relationships. According to these constraints and the definitions used in this study, we identify 2,197 cases of corporates that added a lending bank,[41] but in our study we focus on 1,250 cases of corporates that replace single relationship by multiple-bank relationships. Another 78,508 observations of corporates that did not add a lending bank make up the control group. Due to the fact that our data is an unbalanced panel, firms can appear more than one time, both in the treatment and the control group.

3.3 Regulatory framework on large exposures

The regulatory framework on banking activity in Israel, in general, and the exposure to large borrowers in particular, is in line with Basel III principles and guidelines (see

[40] In addition, due to the high switching costs in banking services (Kim et al., 2003), large borrowers do not usually eliminate their entire relationship with one bank and move to another.

[41] Out of the remaining 947 cases, 476 are cases in which a borrower switched from 2 to 3 lending banks, 219 cases from 3 to 4 banks, 122 from 4 to 5 and the rest are other cases (including rare cases in which a borrower added more than one lender in a quarter).

"Supervisory framework for measuring and controlling large exposures", April 2014). Starting already at 1991, the Basel Committee suggests that to prevent credit risk concentration, limits should be set on large exposures. The final standard (BIS, 2014) is recommended for national implementation to the exclusion of conflicting rules by January 1, 2019. The term "large exposure" includes the exposures to a single large borrower, affiliated/group of borrowers and industry credit exposure. Following such definition, the Banking Supervision Department—Israel's banks regulating authority—has already imposed limits on different kinds of exposures. The limits are set on:

1) Exposure to a single borrower: a single borrower's indebtedness must not exceed 15 percent of bank's capital.
2) Exposure to a group of borrowers[42]: The total indebtedness limit to a group of borrowers before 2012 was set on 30 percent of bank's capital and changed to 25 percent afterward. Group of borrowers is defined as a group of individuals, corporates etc. that are controlled by the same entity, have strong economic affiliation to each other, have significant interests in each other, or which are dependent on each other.
3) Exposure to an industry: bank's credit exposure to a particular industry cannot exceed 20 percent of credit total supply.

3.4 Estimation

3.4.1 The probability of establishing a multiple banking relationship

We start our analysis by estimating the probability of replacing a single relationship with multiple relationships (see Ongena and Smith, 2000; Farinha and Santos, 2002; Berger et al. 2005; Gopalan, 2011). Specifically, we estimate a logit model of the following form:

$$\Pr\left(new\ lending\ relationship = 1\right)_{i,q} = \alpha + \beta' borrower_{i,q-1} + \gamma' exposure_{i,q-1} + \delta' bank_{i,q-1} + \theta' borrower\_bank_{i,q-1} + \varepsilon$$

where the dependent variable takes 1 if firm i replaced in quarter q a single with multiple bank relationship, and 0 otherwise. To satisfy the assumptions and the

[42] See Proper Conduct of Banking Business Directive #313 on "Limitations on the indebtedness of a borrower and a group of borrowers", Banking Supervision Department, Bank of Israel.

empirical predictions, in the regressions mode we use four sets of following independent variables:

Borrower variables—most borrowers in BSD data are not required to report their financial statements, thus classic size indicators (e.g., total assets or revenue) are available only for insignificant pool of (mostly listed) corporates in our sample. Therefore, we calculate the natural log of borrowers' net gross exposure (L_TOT_DEBT) as a proxy for borrower size. We expect the size effect to be positive; PUBLIC is a dummy variable taking the value of 1 when the borrower is a public firm and 0 otherwise. After controlling for the size, this variable accounts for the potential transparency of the borrower. The dummy variable BONDS takes the value of 1 if the borrower's corporate bonds are tradable and 0 otherwise. We assume that bonds are an alternative/substitute source of financing that can affect a borrower's decision to borrow from an additional lender (another bank), and to affect the preference of "de facto" type of syndication to "formal" one[43].

Exposure variables—NET_GROSS_SHARE variable measures the share of borrower (firm) net exposure out of gross exposure. The difference between net and gross exposure is the amount of deductions the banks considers (deposits the borrower holds in the lending bank, for example); COLL_DEBT_SHARE is the share of exposure secured by collaterals. We assume that a high share of debt secured by collateral has a positive effect on the probability of replacing a single relation with multiple-bank relationships (Booth and Booth, 2006)[44]; BALANCE_DEBT is the share of the balance of credit to the borrower out of its total exposure (which consists of both balance sheet items and off-balance sheet items). We explain the motivation to include this variable by the fact that according to Basel directives, on-balance and off-balance credit imply different capital allocations and therefore affect the price of the

[43] If a firm can raise funds from capital markets, it has some power in the loan market by threating banks "not to borrow". Once the borrower offers terms of contracts, no externalities can occur. Therefore, "de facto" syndication strictly dominates the "formal" by the amount of cooperation costs (Uchida, 2002).

[44] Booth and Booth (2006) examine the relation between borrowing costs and the presence of loan collateral. They find that the presence of collateral increases with default risk, which is consistent with low quality borrowers trying to reduce their risks and borrowing costs through the use of collateral. By explicitly controlling for the interdependence between the decision to pledge collateral and borrowing costs, the researchers find that secured loans have predicted spreads substantially lower than if they had been made on an unsecured basis. Alternatively, loans made on an unsecured basis have spreads that are not substantially different than if they had been secured. The evidence suggests that collateral pledging decisions are generally consistent with borrowing cost minimization.

credit (BIS, 2004)[45]. Finally, we include a dummy variable, PROBLEM, that takes the value of 1 if any, even negligible, amount of the borrower's credit exposure is defined as either impaired, substandard, special mention or problem debt, and 0 otherwise.

Original lender (Bank) variables—We include the original bank's total assets (BANK_SIZE), share of the credit portfolio in total assets (BANK_CREDIT) and capital-assets ratio (BANK_CAPITAL).

Borrower-bank relation variables—One of the main motives for extending or not extending the credit lines to an existing borrower is regulatory limits. We find three relevant limits in the Israeli banking regulation: 1) "Industry limit" – according to which a bank's credit exposure to a particular industry cannot exceed 20 percent of credit total supply. Since the definition of the relevant limited exposure has changed through the sample period and so have the limits, we define IND_CREDIT to be the share of the on-balance sheet credit of the borrower's industry in the bank's credit portfolio. We expect this variable to have a positive effect on the probability of switching from a single bank relationship to a multiple banking relationships. We add IND_CREDIT_SQ - the square term of IND_CREDIT - to control for any potential non-linear effects; 2) "Single Borrower Limit" – according to banking regulation, net credit exposure to single borrower must not exceed 15 percent of bank's capital. Following this regulatory limit, we calculate GAP_SINGLE as the difference between the "Single Borrower Limit" and the borrower actual (net) exposure as a share of capital. We expect a negative sign of the estimated coefficient; 3) "Group of borrowers" limit – in addition to the single borrower limit, the banks' net exposure to a group of borrowers cannot exceed 25 percent of bank's capital (30 percent until 2012). GAP_GROUP is the difference between this limit and the actual exposure of the "group of borrowers" to which the borrower belongs.[46] Finally, we define the duration of relationship between the borrower and the original lender—TIME—as the number of quarters for which the bank includes the borrower in its reports on large borrowers' exposures.

[45] In Basel II, which governed for most of the period included in our study, for capital allocation means, off-balance sheet items were converted into credit exposure equivalents through the use of credit conversion factors. Some of these factors were changed in Basel III (BIS, 2010).

[46] When the borrower is not a part of borrowing group, the variable takes the value of 0.25 (or 0.3 before 2012).

Table 3 presents the descriptive statistics[47] of all variables for both categories of borrowers—those who replaced single relationship by multiple relationships and those that did not. The t-tests show that the means of most variables are significantly different between these groups, except for the "original lender" set of variables.

We estimate the probability of switching to a multiple banking relationship using a classical logit model where the dependent variable takes the value of 1 if the borrower switched to multiple relationships in time *t*, and the independent variables are the set of lagged (*t-1*) variables described above. All the financial/accounting variables are in thousands of NIS and in 2015 prices. The results are presented in Table 4.

The full specification, including all four groups/categories of variables (borrower, exposure, bank and borrower-bank relationship), is in Column 5. Most of the results are in accord with the expected sign. Some of the variables related to "exposure" and "borrower-bank relationship" sets of variables are found to be significant. The share of balance sheet credit out of total exposure (BALANCE_DEBT) and the PROBLEM variable negatively and significantly affect the decision to form multiple relationships. While the interpretation of the first result is less clear, the second result can be explained by unwillingness of a new lender to lend to a distressed borrower. Although the fact that part of the exposure is a problematic loan is the original lending bank's private information, it is reasonable that other non-private soft or hard information, which is also available for the bank that is interested in providing a loan to the borrower, also point to the fact that this borrower is in some type of distress. However, this result contradicts the findings of Farinha and Santos (2002).

The set of borrower-bank relationship variables indicates that regulatory limits are binding. These limits are set to enhance diversification in each bank, but they also force the large borrowers to seek additional credit in other banks, as the gap between the maximum allowed credit line and de facto exposure decreases, and by that contribute to the emergence of overlapping portfolios. In other words, a potential byproduct of regulatory limits used to decrease banks' idiosyncratic risk is an increasing of the systemic risk posed by overlapping portfolios (Acharya, 2009; Haiss, 2010; Wagner, 2011). This may be a good example of microprudential tool

[47] Correlations between the variables are reported in Table 2A in the Appendix.

deficiency, which should be completed by a macroprudential one (Hanson et al., 2011).

3.4.2 With whom does the borrower match? A mixed logit approach

In this section we focus on the treatment group which consists of 1,250 cases in which a borrower that had only one banking relationship establishes a new one. We adopt the discrete choice analysis approach to understand what affects the identity of the new lending bank. For such purpose, we use a conditional logit model with the following mixed logit specification[48]:

$$Pr\left(\mu_{ij}^{t}=1\middle|\mu_{ij}^{t-1}=0\right)=\frac{\exp(\beta_{j}X_{ji}^{t-1}+\gamma D_{ji}^{t-1})}{\sum_{k\epsilon B}\exp(\beta_{j}X_{j}^{t-1}+\gamma D_{kj}^{t-1})}$$

The new loan matching between bank *i* and firm *j* in time *t* (μ_{ij}^{t}) is characterized by the set of lagged firm variables, X_{j}^{t-1} such as its size, debt, legal status and industry affiliation, and the distance D_{ji}^{t-1} between the borrower and the new lender in the asset space. This includes the gap between the actual exposure and regulatory limits on credit lines, as well as the interactions between the financial and accounting characteristics of the original lender and the potential lender.

The data are organized as follows: Each one of the 1,250 cases of borrowers that had a single banking relationship in time *t-1* appears six times, for each one of the six potential lenders (banks) the borrower has the potential to create a new lending relationship by time *t*. The dependent variable, MATCHED, takes the value of 1 if the match is realized in time *t*. Since borrowers' characteristics are fixed for all possible combinations (the one that is realized and the 5 other alternative combinations) they are eliminated through the (econometric) estimation process. Therefore, we use only candidate banks' characteristics and variables that interact with their characteristics, including borrowers' and the original bank's characteristics.

The explanatory variables are grouped according to empirical predictions. Thus, following "Availability" motive we include different measures of credit availability: C_RATIO - the capital to assets ratio of the candidate bank; IND_CREDIT- the candidate bank's credit exposure (the share of total credit) to the industry to which the

[48] This specification is more general and does not rely on the independence of irrelevant alternatives (IIA) assumption and allows for random taste variation, unrestricted substitution patterns and correlation in unobserved factors over time (Train, 2009).

borrower belongs; and GAP_GROUP - the difference between the maximum exposure limit to a single group of borrowers and the actual exposure of the candidate bank to the group of borrowers to which the borrower belongs. We expect C_RATIO and GAP_GROUP to have a positive effect on the probability of matching and the IND_CREDIT to have a negative effect.

We also include a set of size variables: CAND_BANK_SIZE is the log assets of the candidate bank and BOR_BANK_SIZE is the interaction (product) between the size of the borrower and the size of the candidate bank, assuming that bigger borrowers need large loans and, therefore, try to match with large banks.

The "Hold up" hypothesis implies that the larger the original lender (bank), the smaller the new lender should be - in order to mitigate the potential hold-up problem. We define CAND_ORG_BANK_SIZE as the interaction (product) between the size, measured by log total assets, of the original and the candidate bank, assuming a negative effect: a relationship with two big banks is less likely to emerge than a relationship with a larger and smaller bank in the presence of hold-up externalities.

The "Diversification" motive implies that the new lending bank should be different in various terms from the first lending bank, especially in its asset portfolio risk. We reflect banks' diversity in several ways: in order to reflect the difference in risk levels we calculate the difference between the candidate and the original banks' equity volatility within the last 90 days (EQ_VOL_90D_DIF). Given that the equity volatility reflects the market perception of each bank's level of risk, we assume a negative effect, implying that borrowers are reluctant to borrow from a riskier bank, relative to their current lending bank. As an alternative measure for relative risk we use the difference between candidate and original traded bonds spread[49] (BOND_DIF), assuming again a negative effect.

Another aspect of diversification we test is the extent to which the original and candidate banks are correlated in their business. In order to control for this effect, we include the correlation between lenders' equity returns (EQ_CORR). In line with the "Diversification" hypothesis, we assume this variable to have a decreasing effect. Since the equity correlation is market based, we include as well a more robust book-based measure of business correlation—the distance between the original and the

[49] All banks have for most of the period traded bonds. The spread is calculated as the difference between the bond's yield to maturity and a matching government bond (matching is based on duration).

candidate banks loan portfolios (DISTANCE). We calculate this measure as the Euclidean distance between a candidate and the original lender (bank) loan portfolios:

$$Distance_{ii'} = \sqrt{\sum_{n=1}^{N} \left(w_{n,i} - w_{n,i'}\right)^2},$$

where $w_{n,i}$ and $w_{n,i'}$ are the shares of credit to industry n in bank i (the original bank) credit portfolio and in bank i' (the candidate bank) credit portfolio respectively. The higher the index (distance), the more divergent the lenders are.[50] Thus, we assume this variable to have a positive effect: borrowers prefer their lender's portfolio to be diversified.

Finally, to examine the "Familiarity" hypothesis, we define variables that reflect the level of bank's acquaintance (expertise) with the borrowers' field of operations. We define the dummy variable NEW_BORROWER, which takes the value of 1 in a case where there is no historical evidence on candidate-borrower lending relationships in the past. We expect this coefficient to be negative. In addition, the variable IN_GROUP takes the value of 1 if the candidate bank has an exposure to one of the entities in the borrower's group of borrowers and 0 otherwise. Through this variable, we control for any previous information/experience the bank has with the group of borrowers to which the borrower belongs, and we expect this variable to have a positive effect. We also use GAP_GROUP and IND_CREDIT variables, used to support the "Availability" hypothesis. According to the "Familiarity" hypothesis, however, we expect these variables to have the opposite sign: the higher the gap between the actual borrower's group exposure to the regulatory limit, the lower is the experience the bank has with him, and therefore the lower the probability to observe a match (negative effect); for the same reason we expect IND_CREDIT to have a positive effect.

The descriptive statistics of the explanatory variables included in the final specifications can be found in Table 5.

We first run partial specifications according to four major hypotheses and then the full multiple regression model. Due to the absence of data for one of the banks (the smallest one) in the period 2005–07, we define two subsamples: the first subsample

[50] See Cai et al. (2014) for a similar use of the index.

(Table 6, hereafter: sample 1) includes all years (2005–15) but excludes the bank with the missing data. Since this bank is the smallest banks and its activity in corporate lending is negligible, this does not change much—neither the size of the control group nor of the treatment group. In the second subsample (Table 7, hereafter: sample 2) we include the bank with the missing data but limit the sample only for those years the data are available, i.e., for 2008–15.

In line with the "Availability" hypothesis, we find that the large size of the candidate bank and its capital to assets ratio (CAND_BANK_SIZE and C_RATIO respectively) are associated with higher probability of observing a match between a borrower and a new lending bank. However, potential lender exposure to the borrower's industry (IND_CREDIT) and group of borrowers (GAP_GROUP) has a positive and negative effect (respectively), in contradiction to the predictions derived from this hypothesis.

The "Hold-up" hypothesis's predictions are partly supported by our tests. Thus, we find that the candidate bank's size is negatively correlated with the probability of observing a match with a borrower. The interaction between the size of the original and the candidate bank is positively correlated with the probability of observing a match, which implies that holding the size of the candidate bank fixed, the bigger the original bank is, the higher the probability of observing a match.

In order to test the "Diversification" hypothesis we use several measures to control for the risk gap and the magnitude of diversity between the lenders (the original and the candidate). The difference in risk variable (EQ_VOL_90D_DIF) implies that the riskier the candidate bank is relative to the original one, the lower the probability for a match with a borrower. In other words, borrowers diversify their funding sources (debt portfolios) and search for a less risky lender. After controlling for risk differences, the correlation measure's (EQ_CORR) positive effect implies that borrowers establish multiple relationships with more correlated banks. Similarly, we find that the DISTANCE between the candidate and original banks is associated with lower probability of observing a match. These two results are in contradiction with the assumptions derived from the "Diversification" hypothesis.

The predictions we derive from the "Familiarity" hypothesis are also partly supported by the empirical results. Thus, the familiarity with the industry and borrowers group of the borrower through credit exposure to borrower's industry (IND_CREDIT) or

group (GAP_GROUP) have the expected sign, although the effect of both variables is not statistically significant. However, the dummy variables controlling for any current or previous lending relationships with the group of borrowers (IN_GROUP) and with the borrower (NEW_BORROWER) both show that familiarity with the borrower significantly increases the probability of observing a match.

In the last column of Table 6 we present the results from estimating the mixed logit model when including all explanatory variables. A candidate bank's credit availability, as measured by its capital to asset ratio, increases the probability of observing a match, as well as its current exposure to the borrower's industry. The bank's exposure to the borrower's group of borrowers or its industry also increases matching probability. The positive effect of these two variables (GAP_GROUP and IND_CREDIT) supports the "familiarity" hypothesis and not the "availability" one, according to which the effect should have been negative. One potential explanation for this result is that given the exposure of banks to a group of borrowers and industry throughout the period, the restrictions on total exposure were not effectively binding, and therefore the "availability" motive is less relevant.

Another result is that excess risk of the candidate bank over the original bank lowers the probability of a match. In other words, if the candidate bank is less risky (and therefore the value of EQ_VOL_90D_DIF is negative), the probability of matching increases.[51] The level of correlation between the original and the candidate banks, as measured by the correlation in their equity returns (EQ_CORR) and the distance between their loan portfolios (DISTANCE), however, is found to significantly increase the probability of observing a match, at least by the measure of correlation in equity returns.

Re-estimating the model within sample 2 (which includes all banks but shorter period) provides results that are somewhat similar but that differ in the effects of bank's size variables—either original or candidate. The reason for this is, as mentioned above, that the omitted bank in sample 1 is the smallest (in terms of assets/size) lender, with only a few large borrowers who borrow from it and from the other bank. In contrast, the specification that includes all the explanatory variables (the 5th column in Table

[51] In another specification (not shown) we replace the measure of relative risk with BOND_DIF. Due to data limitations, we need to leave out the first 5 quarters of the period. Nevertheless, the results remain the same with very few effects becoming non-significant.

7) implies that other, non-size related, variables significantly affect the probability of observing a match in the expected direction. Specifically, we find that candidate bank's credit availability (capital to asset ratio), familiarity with borrower group lending history or the industry in which it is active, relatively lower riskiness[52], and higher similarity with the original bank in terms of equity returns correlation—all increase the probability of observing a match.

In terms of goodness of fit, there is no single measure that best represents this statistical parameter under a mixed logit model. Based on the likelihood ratio, we calculate seven different measures to reflect the goodness of fit. Six of these provide us with very similar (within the narrow range) results.[53] Following these results, we infer three main conclusions. First, estimating all specifications within sample 2 produces better fit. Second, ordering the hypotheses by goodness of fit shows that *Familiarity* has the best value, followed by the *Availability*, *Hold-up* and *Diversification* hypotheses.[54] Finally, when we test a full specification, we get a high measure that ranges between 0.53 and 0.74.[55]

4. Discussion and policy implications

Syndication loans, either formal or "de-facto", increase the overlap of bank loan portfolios and therefore overall asset commonality. This makes the banking system, and the financial system as a whole, more vulnerable to contagious effects. Using a novel database on large exposures in the Israeli banking system, we find that interconnectedness of banks is explained by both the behavior of large borrowers and by the strategic choices of lenders (banks) providing the credit supply.

The results presented in our study highlight several important factors determining the emergence of overlapping portfolios through "de-facto" syndication in the banking system, and they have several important implications for regulators. First, the results of the analysis of the probability of switching from single to multiple lending

[52] Using the BOND_DIF as a measure of the relative risk does not change the results.
[53] The seventh – McFadden's Likelihood-Ratio Index – is much lower, but according to McFadden (1974), an index higher than 0.2 maps into an R-square of 0.4, which more or less are the levels of the other measures.
[54] The ranking of the explanatory power does not change even when we look at the only measure that explicitly include the number of the regressors, and by that controlling for the different number of explanatory variables each thesis-related regression contains.
[55] And a McFadden's LRI of 0.31 which is comparable to approximately 0.6.

relationships confirm some of the findings of earlier studies: the likelihood of a firm to substitute a single bank relationship with multiple relationships increases with its size and transparency level. Second, we find that regulatory limits on large exposures are binding both in the case of overall industry exposure and in the case of banks' overall exposure to a group of borrowers. These limits lead borrowers, especially the large ones, to seek alternative sources of funding, thus increasing the probability for observing high asset commonality. Regulation and the gradual development of capital markets provide these borrowers both with the demand for new credit sources and with the variety of financing sources. While existing regulation is important and supposed to diversify the concentration risk of a single bank, it also reduces the level of actual systemic diversification, because banks, and financial institutions in general, become more similar to one another through multiple lending and form so-called, "de-facto" syndication. Despite the fact that the issue of choice between two forms of syndication—formal and "de-facto"—is beyond the scope of this study, we do find the latter phenomenon to be prevalent and argue that the key to the choice is explained by the "free-rider" problem among banks and high bargaining power of large borrowers.

The empirical results partly confirm the conjectures explaining the incentives and determinants that lead the borrowers to establish multiple banking relationships. In addition, they also confirm the motives for a bank to lend to a borrower in a single bank relationship. From the borrower's point of view, the two most empirically supported rationales are the "availability" and "familiarity" motives, suggesting that a borrower turns to borrow from a bank that has more funding availability and that is more familiar with the borrower's economic activity. We find this feature to be especially relevant for borrowers who do not have access to capital markets, e.g., relatively small and medium corporates.

Another important result arises from testing the "diversification" hypothesis. In line with its predictions, we find that a borrower is more likely to establish multiple relationships with a bank less risky than the original one. In addition, after controlling for risk difference, we find that the similarity in the composition of banks' assets portfolio has a positive effect on the matching probability.

In our assessment, this result reflects the candidate banks' motives: by lending to a borrower that has a single bank relationship with a lender similar to the candidate

bank, the latter maintains and even increases the level of similarity between them. Interestingly, while Gong and Wagner (2016) find the same behavior in the loan syndication market, where banks deliberately form a loan syndicate that increases their level of similarity, we find that the new lending bank acts in the same way when establishing a "de-facto" syndication via multiple lending.

What do banks gain from imitating other banks? According to the theoretical literature mentioned above, several explanations exist. First, an existing banking relationship provides a signal of the borrower's creditworthiness and eliminates at least some of the asymmetric information embedded in granting a loan. Second, the existence of a credit relationship with another bank ensures that the borrower is already monitored, so the monitoring costs for the new lender can be reduced. Last, a higher level of credit portfolio similarity implies a higher level of credit risk similarity. Given that governments are more likely to act in order to rescue the system as a whole than in a case where there is a risk for a single bank, such herding behavior creates the potential of a "too many to fail" guarantee and ensures the stability of the single bank.

This study focuses on the Israeli banking system, but its implications are relevant for other, similar, financial systems. That is, it is particularly relevant for financial systems in which banks are the dominant funding source, the banking system is concentrated and where the investment opportunities are limited (strong home bias effect).

The findings of this study emphasize not only the effect regulatory limits have on the distribution of credit in the banking system but also the byproducts that, probably, less or not fully considered when setting these regulations. Since banks do not internalize the risks they create for the financial system through asset commonality, a complete and comprehensive regulatory approach when developing regulatory tools should take into account not only the idiosyncratic risk of each bank but also the potential externalities of regulations that might increase systemic risk. The importance of regulatory limits on large and concentrated exposures is clear, but it should be completed with better monitoring, at least by the regulator, of the outcomes, i.e. - the extent to which banks are becoming similar to each other in their asset portfolio composition. Since our results show that similarity is probably not an unintentional consequence arising out of full diversification of loan portfolios, which is likely to

increase the level of similarity among banks, but rather a strategic choice - regulators should adopt measures to reduce such behavioral patterns in their individual supervision directives.[56]

5. Conclusions

In this study we explore the determinants behind the emergence of asset commonality in banks' loan portfolios. We focus on the multiple lending channel, which, for simplicity, we define as a "de-facto" syndication, and examine the incentives of both lenders and borrowers to establish multiple lending relationships. In particular, we are the first to document the effect that regulatory limits on total exposures have on the motivation to establish new relationships and thus on the systemic risk arising from asset commonality. In addition, we go a step further from the existing literature on multiple bank lending and analyze the determinants of the lending process between a borrower and an additional lender as a function of existing single loan relationship. We find that the likelihood of providing new credit to a borrower, who already has single bank relationship, increases with the size of the potential lender (bank) but also with the bank's familiarity with the borrower's business, whether through existing loans to a group of borrowers to which the borrower belongs, or through acquaintance with the industry in which the borrower operates (i.e., lender specialization and credit exposure to the industry the potential borrower is affiliated with). It also grows with the level of similarity in asset portfolio composition between the candidate (potential) lender and the original lending bank. This result may possibly be related to the "too-many-to-fail" guarantee and the associated collective moral hazard of "love for correlation" among the lenders (banks). We argue, however, that in case of large exposures' "de-facto" syndication, and due to the coordination problem, the negative impact of such (herding) behavior among different lenders on the stability of the financial system, and the banking system in particular, is significantly higher.

[56] Puzanova and Düllmann (2013), for example, provide a framework for capital surcharges from banks based on their contribution to systemic risk.

Figure 1: Distribution of the banking system's assets by banking groups (December 2015, total assets=NIS 1,469 billion)

This figure displays the distribution of assets between the Israeli commercial banks updated to December 2015.

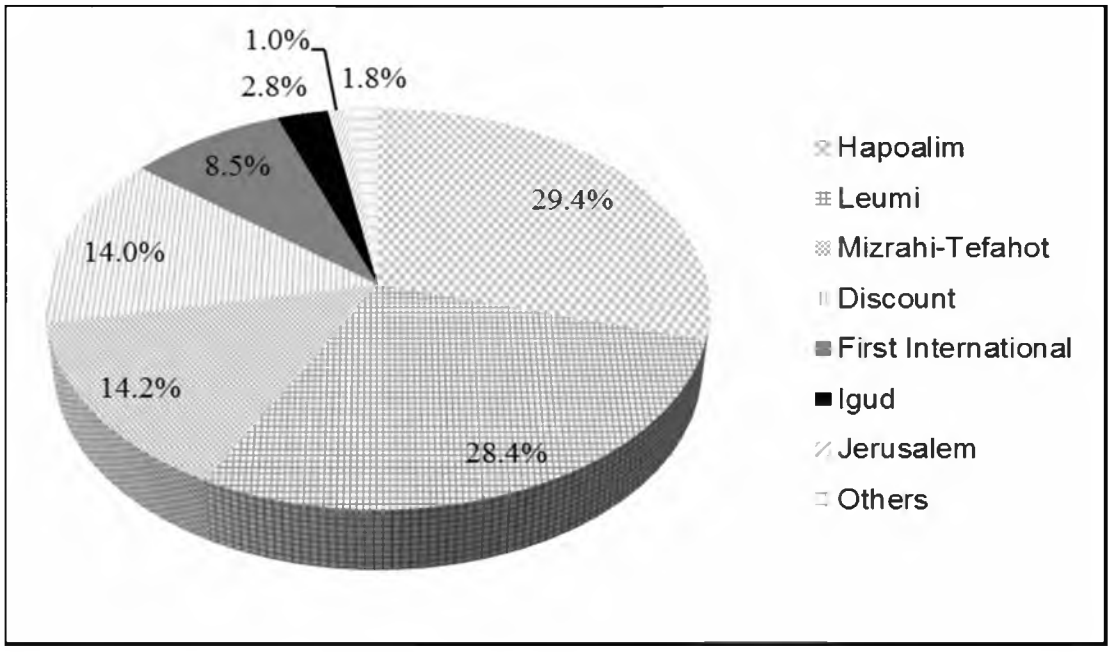

Figure 2: Composition of banks' balance sheet in Israel (NIS million, 2015:Q4)

The figure displays the breakdown of the banking system and the portion of credit covered in our detailed database. The figures are for 2015:Q4 but the same ratios hold throughout the whole period.

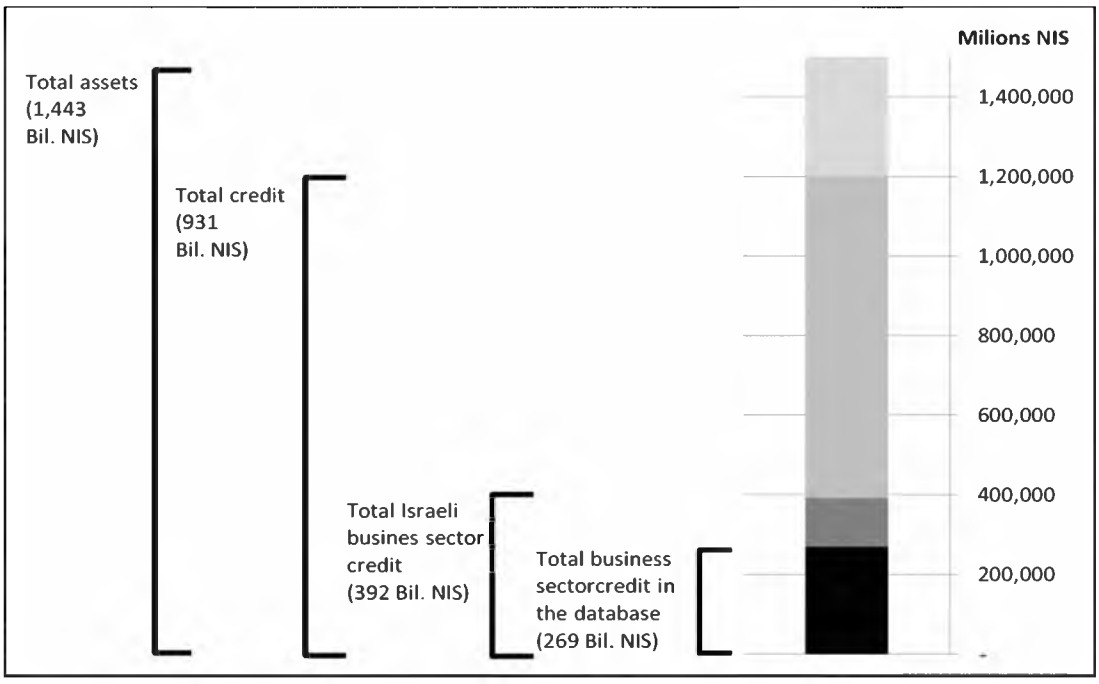

Figure 3: Composition of big borrowers' total exposure by borrower type (2015:Q4)

This figure displays the distribution of total indebtedness of large exposures by borrower type. The number of observations is in parenthesis. The figures are for 2015:Q4 but the same ratios hold throughout the whole period.

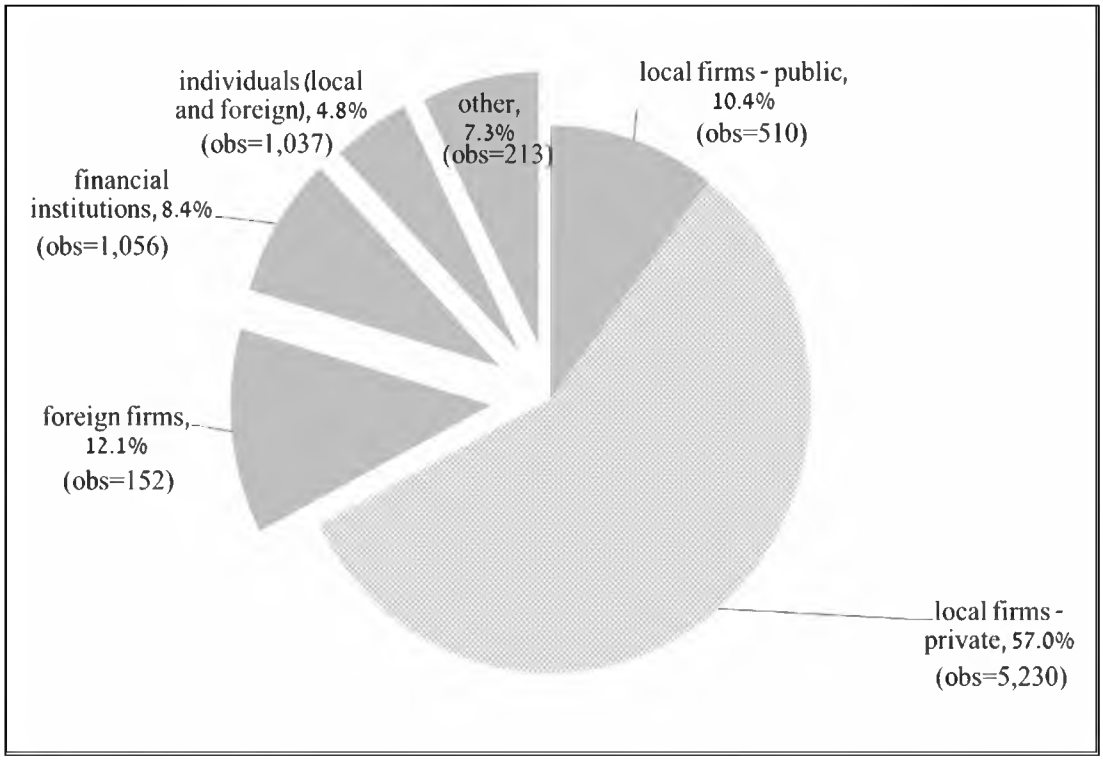

Figure 4: Cumulative distribution of total indebtedness by the number of borrowers (2015:Q4)

This figure displays the cumulative distribution of total indebtedness in the large borrowers dataset by the cumulative number of borrowers. Vertical lines are drawn in the 25, 50 and 75 percentiles. The figures are for 2015:Q4.

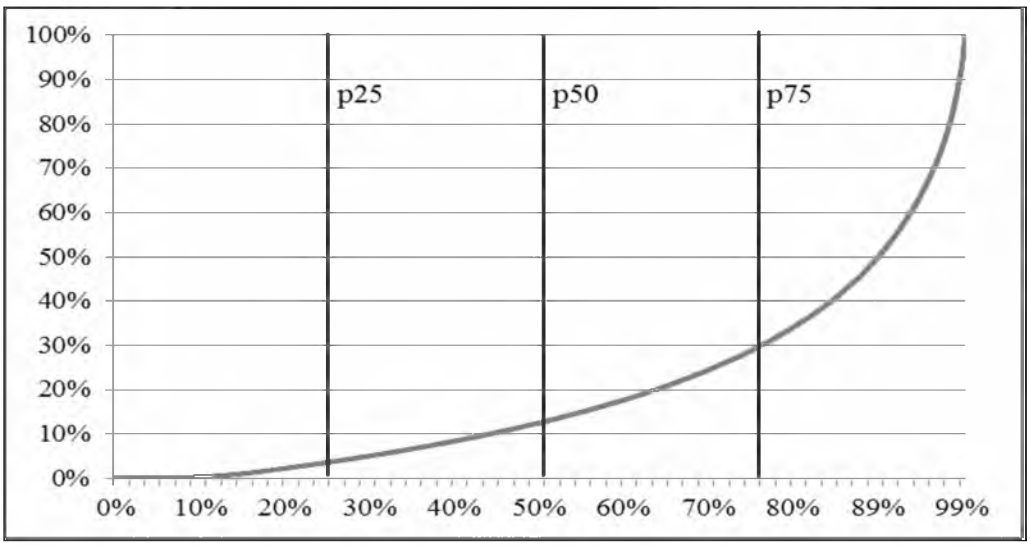

Figure 5: Number of borrowers by number of lending banks (2015:Q4)

This figure displays the distribution of borrowers by the number of lending banks and by their share in large total exposures. The share (number) of borrowers with only one lending bank is on the right axis. The figures are for 2015:Q4.

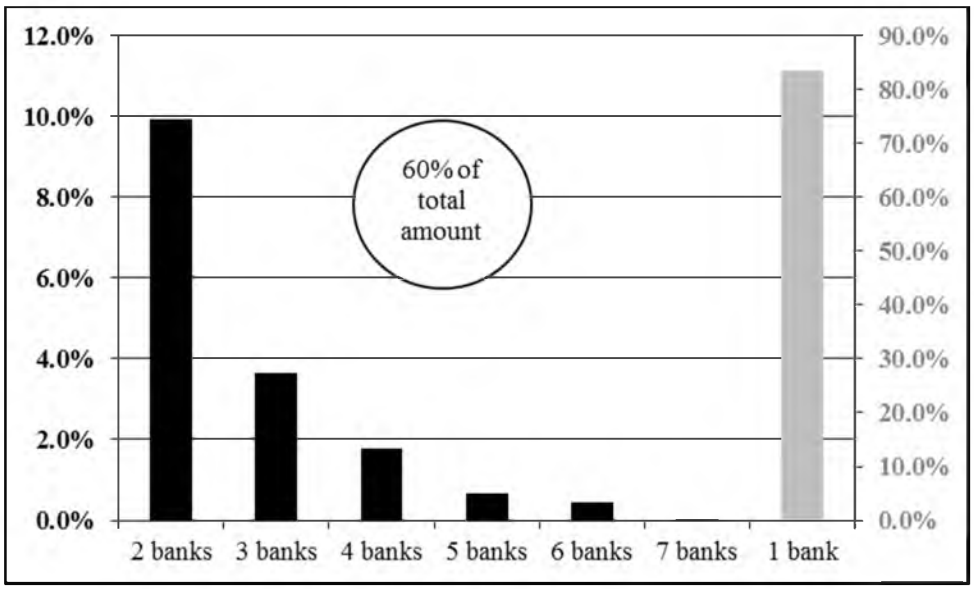

Table 1

Total exposure summary statistics by borrower type (2015:Q4, NIS million)

This table presents the descriptive statistics of large exposures net indebtedness by the borrower type as for 2015:Q4. Except for the number of firms, amounts are in NIS millions.

	N	Sum	Mean	Median	Minimum	Maximum
Local firms	5,533	448,238.2	81.0	37.4	0	4,477.7
firms belonging to borrowers group	1,751	286,767.1	163.8	87.6	0	4,477.7
firms that do not belong to borrowers group	3,782	161,471.1	42.7	30.6	0	1,356.1
public firms	682	95,830.4	140.5	54.6	0	4,477.7
private firms	4,851	352,407.8	72.6	36.0	0	1,895.6
Foreign firms	966	80,548.9	83.4	52.7	0	1,693.6
Financial institutions	145	55,891.3	385.5	208.7	9.3	2,447.1
Individual (local and foreign)	1,191	31,965.3	26.8	21.6	0	354.3
Other	363	48,426.3	133.4	41.7	0	5,043.4
Total	8,198	665,070.0	81.1	36.4	0	5,043.4
Borrower's group						
groups	439	374,032	852.0	306.3	0	15,383.5

Table 2
Local firms distribution by belonging to a borrowers group (2015:Q4)

This table presents the distribution of local firms (row 1 in Table 1) by belonging to a borrowers group or not, and descriptive statistics of the number of firms within a borrowers group. Except for the number of firms, amounts are in NIS million.

	All local firms	Local firms not belonging to a borrowers group	Local firms belonging to a borrowers group
N of borrowers	**5,533**	**3,782**	**1,751**
(%)	(100%)	(68.4%)	(31.6%)
Sum	**448,238**	**161,471**	**286,767**
(%)	(100%)	(41.6%)	(58.4%)
Mean	**81.0**	**42.7**	**163.8**
Number of firms within a borrowers group			
Average			4.04
Median			2
Minimum			1
Maximum			47

Table 3

Descriptive statistics of the independent variables used to explain the probability of establishing multiple banking relationships

This table presents a descriptive statistics of the independent variables explaining the probability to establish multiple banking relationships, for the treatment group (borrower that added a bank as a lender) and the control group (borrower that didn't add a bank as a lender). Also included is the t-value for an equal mean between the two groups.

	Description	Mean			Standard Deviation		Median		Minimum		Maximum	
		didn't add bank	added bank	t-value (*H0: equal mean*)	didn't add bank	added bank	didn't add bank	added bank	didn't add bank	added bank	didn't add bank	added bank
Borrower												
L_TOT_DEBT	Natural log of borrower's total net exposure	10.345	10.757	-9.640	2.087	1.489	10.585	10.732	-0.007	0	14.6	13.98
PUB	Is it a public firm (0=no, 1=yes)	0.039	0.114	-8.340	0.194	0.318	0	0	0	0	1	1
BOND	Does the firm have tradeable bonds (0=no, 1=yes)	0.017	0.050	-5.400	0.129	0.219	0	0	0	0	1	1
Exposure												
NET_GROSS_SHARE	Net exposure / gross exposure	0.945	0.961	-3.850	0.184	0.139	1	1	0	0	1	1
COLL_DEBT_SHARE	Collateral value / net exposure	2.694	0.733	2.170	247.2	7.023	0.094	0.022	0	0	49,547.9	180.4
BALANCE_DEBT	On-balance credit / net exposure	0.627	0.571	5.140	0.405	0.383	0.838	0.667	0	0	1	1
PROBLEM	Does the borrower have any exposure defined as a problem loan? (0=no, 1=yes)	0.139	0.061	11.430	0.346	0.239	0	0	0	0	1	1
Bank												
L_BANK_SIZE	Natural log of bank's total assets	19.2	19.2	0.360	0.794	0.798	19.6	19.6	16.122	16.1	19.9	19.9
BANK_CREDIT	Bank's credit portfolio / total assets	0.661	0.662	-0.530	0.057	0.058	0.657	0.657	0.531	0.531	0.827	0.827
BANK_CAPITAL	Bank's capital / total assets	0.101	0.102	-0.760	0.016	0.017	0.098	0.098	0.064	0.064	0.131	0.131

(continued)

	Description	Mean			Standard Deviation		Median		Minimum		Maximum	
Bank-Borrower Relationship		didn't add bank	added bank	t-value (*H0: equal mean*)	didn't add bank	added bank	didn't add bank	added bank	didn't add bank	added bank	didn't add bank	added bank
IND_CREDIT	Borrower's industry credit in the bank / total credit	12.5	12.1	2.440	6.695	6.073	13.6	12.1	0.007	0.444	80.4	29.9
IND_CREDIT_SQ	(Borrower's industry credit in the bank / total credit)^2	201.764	183.355	4.350	220.0	146. 9	186.1	146.7	0	0.197	6,467.0	897.1
GAP_SINGLE	Single borrower regulatory gap – borrower's net exposure	0.146	0.145	4.980	0.006	0.008	0.148	0.148	0.003	0.061	0.150	0.150
GAP_GROUP	Borrowing group regulatory gap – borrower's borrowing group net exposure	0.238	0.233	4.330	0.037	0.045	0.250	0.250	-0.097	-0.042	0.250	0.250
TIME	Number of quarters in the bank	12.949	12.906	0.160	9.393	9.345	10.000	10.000	1	1	42	42

Table 4
The probability of adding a lending bank

	(1)		(2)		(3)		(4)		(5)	
	Point Estimate	Odds Ratio	Point Estimate	Odds Ratio	Point Estimate	Odds Ratio	Point Estimate	Odds Ratio	Point Estimate	Odds Ratio
Intercept	-5.612		-4.271***		-2.011		-0.662		-0.902	
Borrower										
L_TOT_DEBT	0.156***	1.169							0.112***	1.119
PUB	1.066***	2.904							1.003***	2.729
BOND	0.147	1.159							0.132	1.142
Exposure										
NET_GROSS_SHARE			0.487**	1.629					0.02	1.021
COLL_DEBT_SHARE			-0.001	1					-0.001	1
BALANCE_DEBT			-0.372***	0.69					-0.409***	0.664
PROBLEM			-0.874***	0.417					-0.621***	0.538
Bank										
BANK_SIZE					-0.188	0.829			-0.152	0.859
BANK_CREDIT					0.628	1.875			-0.431	0.65
BANK_CAPITAL					4.918	136.836			8.278	>999.999
Bank-Borrower Relationship										
IND_CREDIT							0.096***	1.101	0.078***	1.082
IND_CREDIT_SQ							-0.006***	0.995	-0.005***	0.996
GAP_SINGLE							-21.42***	<0.001	-8.898*	<0.001
GAP_GROUP							-2.482***	0.084	-2.056***	0.128
TIME							-0.002	0.999	-0.002	0.999
Quarters dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Banks dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cox-Snell R-squared	0.02984		0.0235		0.0144		0.0229		0.0409	

The dependent variable takes 1 if the the borrower added a lending bank in time *t* and 0 otherwise. L_TOT_DEBT is the natural log of borrower's total net exposure; PUB takes 1 if the borrower is a public company and 0 otherwise; BOND takes 1 if the firm has tradeable bonds and 0 otherwise; NET_GROSS_SHARE is the net exposure divided by the gross exposure; COLL_DEBT_SHARE is the collateral value divided by the net exposure; BALANCE_DEBT is the on-balance sheet credit divided by net exposure; PROBLEM takes 1 if the borrower has any exposure defined as a problem loan; BANK_SIZE is the natural log of bank's total assets; BANK_CREDIT is calculated as bank's credit portfolio divided by total assets; BANK_CAPITAL is calculated as bank's capital divided by total assets; IND_CREDIT is the borrower's industry credit in the bank divided by total credit and IND_CREDIT_SQ is the squared term; GAP_SINGLE is the difference between single borrower regulatory gap and borrower's net exposure; GAP_GROUP is the difference between borrowing group regulatory gap and borrower's borrowing group net exposure; TIME is the number of quarters the borrower-lender relationship exist. All independent variables are taken (lags) at *t-1*. Nominal variables are in log terms of their 2015 fixed value. All specifications include dummy variables for banks and quarter.

* - lower than 10 percent significance level; ** - lower than 5 percent significance level; *** - lower than 1 percent significance level.

Table 5. Descriptive statistics of the independent variables used to explain the matching between a borrower and a new lending bank

This table presents the descriptive statistics of the independent variables used to explain the matching between a borrower and a new lending bank, for matches that were realized and potential matches that were not realized. The analysis was made using two samples: sample 1 consists of all banks as candidates but for a shorter period (12 quarters are left out); sample 2 consists of all quarters but with one bank not included in the set of candidate banks.

	Description	Sample	Mean		t-value (*H0: equal mean*)	Standard Deviation		Median		Minimum		Maximum	
			matched	*non-matched*		*matched*	*non-matched*	*matched*	*non-matched*	*matched*	*non-matched*	*matched*	*non-matched*
CAND_BANK_SIZE	Natural log assets of the candidate bank	Sample 1	19.17	18.67	-21.59	0.71	0.77	19.61	18.67	17.22	17.22	19.88	19.88
		Sample 2	19.14	18.24	-28.88	0.84	1.18	19.63	18.53	16.13	16.12	19.88	19.88
C_RATIO	Capital to assets ratio the candidate bank holds	Sample 1	0.10	0.09	-14.21	0.02	0.01	0.10	0.09	0.06	0.06	0.13	0.13
		Sample 2	0.10	0.09	-19.24	0.02	0.01	0.10	0.09	0.07	0.07	0.13	0.13
IND_CREDIT	Share of credit to the borrower's industry in the candidate bank	Sample 1	11.76	11.48	-1.34	6.27	6.33	11.49	11.83	0.39	0.18	29.95	29.95
		Sample 2	11.70	10.55	-5.20	6.24	7.08	11.41	11.02	0.12	0.00	25.69	25.69
GAP_GROUP	Borrowing group regulatory gap – borrower's borrowing group net exposure, in the candidate bank	Sample 1	0.27	0.27	1.71	0.05	0.04	0.30	0.30	0.005	-0.004	0.30	0.30
		Sample 2	0.27	0.27	3.06	0.04	0.04	0.28	0.30	0.005	-0.004	0.30	0.30
BOR_BANK_SIZE	The product between the size of the borrower and the size of the candidate bank	Sample 1	206.28	200.87	-5.72	29.65	29.05	206.78	201.14	0	0	273.97	275.20
		Sample 2	204.59	195.02	-8.93	30.92	31.06	205.24	196.63	0	0	273.97	275.20
CAND_ORG_BANK_SIZE	The product between the original and the candidate bank's natural log total assets	Sample 1	369.10	359.33	-16.97	18.27	17.63	374.38	363.34	315.09	314.54	393.90	393.90
		Sample 2	367.28	349.91	-22.12	22.10	25.69	374.91	354.16	281.41	278.98	393.90	393.90

(continued)

	Description	Sample	Mean			Standard Deviation		Median		Minimum		Maximum	
			matched	*non-matched*	t-value (*H0: equal mean*)	*matched*	*non-matched*	*matched*	*non-matched*	*matched*	*non-matched*	*matched*	*non-matched*
IN_GROUP	Does the candidate bank supply credit to an entity that belongs to the borrower's borrowing group (0=no, 1=yes)	Sample 1	0.15	0.11	-3.55	0.36	0.31	0	0	0	0	1	1
		Sample 2	0.15	0.09	-5.05	0.36	0.28	0	0	0	0	1	1
NEW_ BORROWER	Did the candidate bank used to have any kind of exposure to the borrower in the past (0 = no, 1 = yes)	Sample 1	0.55	0.89	22.12	0.50	0.32	1	1	0	0	1	1
		Sample 2	0.51	0.89	23.33	0.50	0.31	1	1	0	0	1	1
EQ_VOL_90D_DIF	The difference between the original and the candidate bank 90-day equity volatility	Sample 1	0.002	0.18	1.53	3.57	3.76	0.00	0.01	-10.14	-10.14	10.14	10.14
		Sample 2	-0.11	-0.01	0.86	3.24	3.52	-0.01	-0.03	-9.28	-9.76	9.36	9.76
BOND_DIF	The difference between traded bond spread of a candidate and the original bank	Sample 1	-0.001	0.07	6.26	0.35	0.38	-0.001	0.07	-1.78	-1.78	1.78	1.78
		Sample 2	-0.02	0.12	10.36	0.37	0.42	-0.01	0.10	-1.78	-1.78	1.78	1.78
EQ_CORR	The correlation between the original and the candidate bank 90-day equity volatility	Sample 1	0.44	0.38	-10.45	0.19	0.17	0.45	0.39	-0.08	-0.08	0.84	0.84
		Sample 2	0.42	0.31	-15.78	0.20	0.21	0.44	0.33	-0.15	-0.25	0.79	0.79
DISTANCE	The Euclidean distance between a candidate and the original bank loan portfolios	Sample 1	0.13	0.16	11.45	0.09	0.09	0.11	0.13	0.03	0.03	0.46	0.46
		Sample 2	0.13	0.21	20.15	0.11	0.15	0.10	0.15	0.03	0.03	0.60	0.60

Table 6. With which bank does the borrower establish multiple relationships? Mixed logit estimation results – Sample 1

Estimation of the effect each dependent variable has on the choice of the additional bank. The sample includes the full period but excludes one bank as a candidate bank and all borrowers that established or had a banking relationship with it. CAND_BANK_SIZE is the natural log assets of the candidate bank; C_RATIO is the capital to assets ratio the candidate bank holds; IND_CREDIT is the share of credit to the borrower's industry in the candidate bank; GAP_GROUP is the difference between borrowing group regulatory gap and borrower's borrowing group net exposure; BOR_BANK_SIZE is the product between the size of the borrower and the size of the candidate bank; CAND_ORG_BANK_SIZE is the product between the original and the candidate bank's natural log total assets; IN_GROUP takes 1 if the candidate bank has an exposure to one of the entities in the borrower's borrowing group, and 0 otherwise; NEW_BORROWER takes 1 in case the candidate never used to have any kind of exposure to that borrower in the past, and 0 otherwise; EQ_VOL_90D_DIF is the difference between original and candidate bank's 90-day equity volatility; EQ_CORR is the correlation between original and candidate bank's equity returns; DISTANCE is the Euclidean distance between a candidate and the original bank loan portfolios.
* - lower than 10 percent significance level; ** - lower than 5 percent significance level; *** - lower than 1 percent significance level. The goodness-of-fit measures include 6 different measures based on the likelihood ratios of the full and empty model. Some use also the number of observations and/or regressors as inputs. The McFadden's LRI measure has different distribution so it is presented separately.

	(1)		(2)		(3)		(4)		(5)	
	Availability hypothesis		*Hold-up hypothesis*		*Diversification hypothesis*		*Familiarity hypothesis*		*Full specification*	
	Point estimate	p-value	Point estimate	p-value	Point estimate	p-value	Point estimate	p-value	Point estimate	p-value
CAND_BANK_SIZE	0.81**	0.0277	-4.936***	0.0003					-3.876**	0.0169
C_RATIO	5.275***	<.0001							6.786*	0.0897
IND_CREDIT	0.063***	<.0001					0.019	0.1062	0.05***	0.0002
GAP_GROUP	-8.633***	<.0001					-1.911	0.4395	-5.513**	0.033
BOR_BANK_SIZE	-0.014	0.6941							-0.035	0.3712
CAND_ORG_BANK_SIZE			0.299***	<.0001					0.247***	0.0032
IN_GROUP							1.224***	<.0001	0.943***	<.0001
NEW_BORROWER							-2.276***	<.0001	-2.067***	<.0001
EQ_VOL_90D_DIF					-0.034***	0.0067			-0.03**	0.0336
EQ_CORR					2.817***	<.0001			0.634*	0.0718
DISTANCE					-4.139***	<.0001			-0.098	0.8803
goodness-of-fit range	0.274 - 0.359		0.244 - 0.320		0.1968 - 0.2579		0.389 - 0.510		0.4558 - 0.6209	
McFadden's LRI	0.117		0.100		0.076		0.198		0.260	

Table 7. With which bank does the borrower establish multiple relationships? Mixed logit estimation results – Sample 2

Estimation of the effect each dependent variable has on the choice of the additional bank. The sample includes all 7 banks but for a shorter period due to lack of data for one bank in the first 12 quarters. CAND_BANK_SIZE is the natural log assets of the candidate bank; C_RATIO is the capital to assets ratio the candidate bank holds; IND_CREDIT is the share of credit to the borrower's industry in the candidate bank; GAP_GROUP is the difference between borrowing group regulatory gap and borrower's borrowing group net exposure; BOR_BANK_SIZE is the product between the size of the borrower and the size of the candidate bank; CAND_ORG_BANK_SIZE is the product between the original and the candidate bank's natural log total assets; IN_GROUP takes 1 if the candidate bank has an exposure to one of the entities in the borrower's borrowing group, and 0 otherwise; NEW_BORROWER takes 1 in case the candidate never had any kind of exposure to that borrower in the past, and 0 otherwise; EQ_VOL_90D_DIF is the difference between original and candidate bank's 90-day equity volatility; EQ_CORR is the correlation between original and candidate bank's equity returns; DISTANCE is the Euclidean distance between a candidate and the original bank loan portfolios.
* - lower than 10 percent significance level; ** - lower than 5 percent significance level; *** - lower than 1 percent significance level. The goodness-of-fit measures include 6 different measures based on the likelihood ratios of the full and empty model. Some use also the number of observation and/or regressors as inputs. The McFadden's LRI measure has different distribution so it is presented separately.

	(1)		(2)		(3)		(4)		(5)	
	Availability hypothesis		*Hold-up hypothesis*		*Diversification hypothesis*		*Familiarity hypothesis*		*Full specification*	
	Point estimate	p-value	Point estimate	p-value	Point estimate	p-value	Point estimate	p-value	Point estimate	p-value
CAND_BANK_SIZE	1.132***	0.0014	-1.548	0.1455					-0.517	0.6804
C_RATIO	17.531***	<.0001							10.516**	0.0119
IND_CREDIT	0.063***	<.0001					0.052***	<.0001	0.053***	0.0006
GAP_GROUP	-8.98***	<.0001					-3.564	0.1888	-6.912**	0.0124
BOR_BANK_SIZE	-0.048	0.1331							-0.068*	0.0661
CAND_ORG_BANK_SIZE			0.124**	0.0242					0.088	0.173
IN_GROUP							1.32***	<.0001	0.919***	0.0004
NEW_BORROWER							-2.444***	<.0001	-2.142***	<.0001
EQ_VOL_90D_DIF					-0.044***	0.004			-0.036**	0.0332
EQ_CORR					3.052***	<.0001			0.862**	0.0255
DISTANCE					-3.789***	<.0001			0.218	0.6886
goodness-of-fit range	0.380 - 0.489		0.348 - 0.445		0.3118 - 0.3988		0.463 - 0.628		0.5315 - 0.7443	
McFadden's LRI	0.171		0.149		0.126		0.241		0.317	

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Appendix

Table 1A. List of variables in the database

Variable	Note
Date	
Bank name	
Borrower identifier	
Borrower name	
Borrower type	Can be either an individual, a firm, partnership, financial institution, with distinction between local and foreign entities
Borrowing group name	
Borrowing group identifier	
Reason of inclusion in borrowing group	Controlled firm, held without control, guaranteed, financial dependency etc.
Industry classification	By main order, 2, 3 and 4 digits
Credit rating	Each bank has its own rating scales. We unified it to an eight level scale
Is it a public firm?	1 – yes, 0 – no
Does it have tradeable bonds?	1 – yes, 0 – no
Total credit before write-offs and provisions	on-balance items
Value of borrower's securities held by the bank	on-balance items
Commitment due to involvement in OTC derivatives	on-balance items
Total credit risk before write-offs and provisions	on-balance items
Write-offs	on-balance items
Total credit risk after write-offs and before provisions	on-balance items
Special mention credit risk	on-balance items
Substandard credit risk	on-balance items
Impaired credit risk	on-balance items
Total problematic credit risk	on-balance items
Indivudual credit risk loss provisions	on-balance items
Total credit risk after write-offs and provisions	on-balance items
Group provisions for credit loss	on-balance items
Additional provision	on-balance items
Non-indexed credit risk	on-balance items
Indexed credit risk	on-balance items
Foreign currency and foreign currency indexed credit risk	on-balance items
Nonrecourse credit	on-balance items
Total credit before write-	off-balance items

offs and provisions	
Write-offs	off-balance items
Total credit risk after write-offs and before provisions	off-balance items
Special mention credit risk	off-balance items
Substandard credit risk	off-balance items
impaired credit risk	off-balance items
Total problematic credit risk	off-balance items
Individual credit risk loss provisions	off-balance items
Total credit risk after write-offs and provisions	off-balance items
Group provisions for credit loss	off-balance items
Additional provision	off-balance items
On and off balance credit risk after write offs and provisions	
Gross exposure	
Total deductions	
Net exposure	
Bank deposits	Collateral. Appears in its original value and the value for collateral
Tradeable bonds	Collateral. Appears in its original value and the value for collateral
Other tradeable securities	Collateral. Appears in its original value and the value for collateral
Non-tradeable securities	Collateral. Appears in its original value and the value for collateral
Subordinated real-estate	Collateral. Appears in its original value and the value for collateral
State guarantee	
Tradeable documents	

Table 2A. Pearson correlations between the independent variables

	L_TOT_DEBT	PUB	BOND	NET_GROSS_SHARE	COLL_DEBT_SHARE	BALANCE_DEBT	PROBLEM	L_BANK_SIZE	BANK_CREDIT	BANK_CAPITAL
L_TOT_DEBT	1.0000	0.0259	0.0376	0.6943	-0.0069	0.0969	-0.4012	0.1806	0.0608	0.0513
PUB	0.0259	1.0000	0.5372	0.0098	-0.0019	0.0081	-0.0174	0.0389	0.0142	0.0133
BOND	0.0376	0.5372	1.0000	0.0142	-0.0013	0.0091	-0.0189	0.0135	0.0235	0.0202
NET_GROSS_SHARE	0.6943	0.0098	0.0142	1.0000	-0.0063	0.1549	-0.1875	0.0913	0.0312	0.0333
COLL_DEBT_SHARE	-0.0069	-0.0019	-0.0013	-0.0063	1.0000	-0.0070	-0.0010	-0.0020	-0.0061	-0.0064
BALANCE_DEBT	0.0969	0.0081	0.0091	0.1549	-0.0070	1.0000	0.0264	0.0190	-0.0499	-0.0087
PROBLEM	-0.4012	-0.0174	-0.0189	-0.1875	-0.0010	0.0264	1.0000	0.0026	-0.0139	-0.0142
L_BANK_SIZE	0.1806	0.0389	0.0135	0.0913	-0.0020	0.0190	0.0026	1.0000	0.1016	0.5793
BANK_CREDIT	0.0608	0.0142	0.0235	0.0312	-0.0061	-0.0499	-0.0139	0.1016	1.0000	0.2816
BANK_CAPITAL	0.0513	0.0133	0.0202	0.0333	-0.0064	-0.0087	-0.0142	0.5793	0.2816	1.0000
IND_CREDIT	0.0424	-0.0248	-0.0084	0.0047	-0.0037	-0.0719	-0.0255	-0.1274	-0.0732	-0.0043
IND_CREDIT_SQ	0.0098	-0.0309	-0.0125	0.0050	-0.0025	-0.0358	-0.0232	-0.1661	-0.0326	-0.0104
GAP_SINGLE	-0.2871	0.0014	-0.0366	-0.0852	0.0027	0.0396	0.1026	0.4394	-0.0307	0.2965
GAP_GROUP	-0.1453	-0.0291	-0.0378	-0.0284	0.0025	-0.0437	0.0848	-0.0452	-0.0277	-0.0226
TIME	0.0463	0.0027	0.0193	0.0242	0.0001	0.0454	0.0940	0.0762	-0.0212	0.3157

	IND_CREDIT	IND_CREDIT_SQ	IND_CREDIT	GAP_SINGLE	GAP_GROUP	TIME
L_TOT_DEBT	0.0424	0.0098	0.0424	-0.29	-0.15	0.05
PUB	-0.0248	-0.0309	-0.0248	0.00	-0.03	0.00
BOND	-0.0084	-0.0125	-0.0084	-0.04	-0.04	0.02
NET_GROSS_SHARE	0.0047	0.0050	0.0047	-0.09	-0.03	0.02
COLL_DEBT_SHARE	-0.0037	-0.0025	-0.0037	0.00	0.00	0.00
BALANCE_DEBT	-0.0719	-0.0358	-0.0719	0.04	-0.04	0.05
PROBLEM	-0.0255	-0.0232	-0.0255	0.10	0.08	0.09
L_BANK_SIZE	-0.1274	-0.1661	-0.1274	0.44	-0.05	0.08
BANK_CREDIT	-0.0732	-0.0326	-0.0732	-0.03	-0.03	-0.02
BANK_CAPITAL	-0.0043	-0.0104	-0.0043	0.30	-0.02	0.32
IND_CREDIT	1.0000	0.8361	1.0000	-0.13	0.01	-0.01
IND_CREDIT_SQ	0.8361	1.0000	0.8361	-0.11	0.01	-0.01
GAP_SINGLE	-0.1253	-0.1107	-0.1253	1.00	0.21	0.02
GAP_GROUP	0.0084	0.0139	0.0084	0.21	1.00	-0.03
TIME	-0.0132	-0.0074	-0.0132	0.02	-0.03	1.00

Published papers (in English)

R. Melnick and Y. Golan - Measurement of Business Fluctuations in Israel.	91.01
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