Risk Sharing in Supply Chains of Business Groups: Evidence from Trade Credit *

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Abstract

This paper examines customer-supplier relationships and trade financing within a business group. Our analysis reveals that business group firms actively trade among themselves and utilize trade financing to assist their affiliates in mitigating operating risks. Compared to stand-alone peers, group firms trading with suppliers from the same group receive greater trade credit, especially when facing difficult sales conditions and cash shortages. Trade financing is a substitute for direct investment as a way to allocate internal capital within a group, except for the most capital-dependent (bottom-of-pyramid) affiliates, where both channels matter. An identification strategy based on major natural disasters strengthens the causal interpretation of our main results.

Keywords: Business Groups, supply chain, trade credit, liquidity

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1 Introduction

Business groups, characterized by more than two listed firms sharing the same controlling shareholder, are a ubiquitous structure in many countries, where they have been shown to have important implications for economic and institutional development (e.g. Morck et al., 2005; Khanna and Yafeh, 2007; Hamdani et al., 2020; Dau et al., 2021). It is well established in the literature that business groups gain this predominance in their financing advantages in accessing internal capital.[1] More than an ownership network, a business group is often strategically organized around a supply chain. Along the supply chain, trade credit plays an important role in sharing demand risk between customer and supplier firms (Petersen and Rajan, 1997; Yang and Birge, 2018).

The supply chain network allows affiliated firms to share liquidity through the extension of trade credit. Drawing from a large literature on trade credit, this is a critical financing advantage as trade credit is now widely considered to be the most significant source of funding on a firm's balance sheet.[2] Business groups have the incentive to maximize overall group welfare, which includes sharing risk among affiliates and leveraging the advantages to overcome liquidity constraints by allowing group firms to pool resources.

Despite the important role trade credit plays, our understanding of the internal structure of supply chains within business groups remains limited. Specifically, there is little research on supplier-customer networks and trade financing relationships for supply chains within business groups. Research questions on whether and how business groups use trade credit as a way to

[1]For example, business groups can leverage their group structure to finance through intra-group loans, intra-group dividend payments, cross-firm equity investments, initial public offerings of group firms, etc. (e.g. Gopalan et al., 2007, 2014; Buchuk et al., 2014; Almeida et al., 2011, 2015; Masulis et al., 2020).

[2]For example, Emery (1984) shows that accounts receivable constitute 26.5 percent of the total assets of manufacturing firms in 1981, and Murfin and Njoroge (2015) highlights that trade payables represent the second largest liability on the aggregate balance sheet of nonfinancial businesses in the United States as of 2009. Recent evidence from Levine et al. (2018) highlights the international importance of trade credit by showing that it accounts for a substantial portion (24%) of debt financing by listed firms across 34 countries.

provide liquidity are unexplored. This is surprising given the economic power of business groups in many economies, as well as the prevalence of trade financing in major business models. For example, in their study of Belgian firms, Deloof (1995); Deloof and Jegers (1996) find that, 23% of the account receivables are from affiliated firms, while total trade credit constitutes about 80% of these receivables.

This study aims to help fill the above-mentioned gap in the literature by examining the dynamics of supplier-customer relationships within business groups and exploring the extent to which these groups strategically allocate operational and capital resources to their affiliated firms through these within-group supply chains. Literature on the bright side of business groups highlights a group's advantages in financial markets, labor markets, and product markets (Khanna and Palepu, 1999). One of these significant advantages lies in a business group's ability to leverage its internal network of firms and establish efficient supply chains to enhance its profitability and competitiveness in the product market. In particular, sharing a supply chain facilitates a group's ability to share financial and operational liquidity among affiliated firms through extensions of trade credit.

The extension of trade credit is determined by a supplier's ability and willingness to lend credit to customers to meet their liquidity needs, which in part is going to be determined by customer creditworthiness (Petersen and Rajan, 1997). The supplier's willingness to offer trade credit depends on their financial strength and ability to take on more credit exposure. With the presence of a controlling shareholder at the helm of business groups who has substantial power over affiliated firms and the ability to make group-level decisions, groups are able to strategically utilize their trade financing to meet the liquidity needs of downstream member firms. From the supplier's perspective, business group member customers, tend to exhibit relatively low default risk compared to standalone firms. This can be partially attributed to the presence of internal capital and labor markets within business groups, which serve to alleviate resource constraints

and provide financial backup to group firms, thereby reducing their default risk (Masulis et al., 2011; Buchuk et al., 2014; Almeida et al., 2015). Hence, our first hypothesis is that when business group firms request more trade credit, their suppliers are more inclined to extend it.

Additionally, the default risk of group firms for the same-group suppliers is further reduced, due to the decreased information asymmetry associated with transactions between affiliated firms and the more intense monitoring under a common controlling shareholder. This lower default risk within the same-group customer-supplier relationships leads us to hypothesize that group firms receive more trade credit when they have same-group suppliers. It is also possible that group suppliers may allocate less trade credit to their standalone customer firms to manage their overall trade credit exposure when it is providing increased credit to some of the group's affiliated customers. This becomes particularly relevant for a group's strategic behavior during periods of sales growth stagnation or when disruptions in operations and production occur due to exogenous shocks. Based on these hypotheses, in this study, we examine whether group firms receive more trade credit when they have same-group trading partners and explore the dynamics of trade credit adjustments when group-affiliated customers face increased credit needs and when their default risk is rising.

To examine these questions, we assemble a dataset by combining the supplier-customer linkage data from the Factset Revere Supply Chain database with data on business group affiliation for 45 countries. To identify whether a firm is affiliated with a business group, we rely on the international business group affiliation dataset compiled by Masulis and Mobbs (2011); Masulis et al. (2020, 2023). We then merge the combined sample of listed firms with the Thomson Reuters Worldscope database for financial and accounting information. Following Petersen and Rajan (1997), we exclude firms in the financial industry (SIC code 6000 – 6999) and services industry (SIC code 7000 – 8999) in our main sample. We also conduct our analysis on a subsample of firms in manufacturing industries (SIC code 2000 - 3999), following Levine

et al. (2018); Li et al. (2021). The final sample comprises 10,386 unique firms in 45 economies covering the period 2013-2021.

As a starting point, we document the extent to which business group firms rely on other same-group affiliates to form their supply chains. We find that same-group suppliers and customers constitute a substantial portion of a group's supplier networks and its customer base. Among the group firms that disclosed their customers and suppliers, 36.8% (36.4%) of group firms have at least one same-group customer (supplier), and these proportions are higher for family business group firms. Family business groups are defined as business groups in which ultimate controlling shareholders are individuals or families, whereas non-family groups are typically controlled by widely-held corporations, governments, or institutional investors (Masulis and Mobbs, 2011). Compared with non-family business groups, family business groups exert stronger centralized control over members' decision-making processes, particularly regarding resource allocation within member firms. Consequently, the presence of a controlling family within a business group may facilitate internal transactions among group affiliates to achieve cost efficiency and economies of scale for the group as a whole.

The aforementioned observations could in part be attributed to the industry dominance of business groups or the different financial characteristics between group firms and standalone firms. To alleviate this concern and provide insights into the probability of group firms forming same-group supply chain relationships, we construct "pseudo" business groups. We match standalone firms with each of the (actual) business group firms in our sample. For each group firm, the matched standalone firm is constrained to be in the same country and industry based on nearest neighbor matching[3]. This matching procedure allows us to create pseudo-groups that mimic the composition and group structure of the actual business groups to which they are matched. The comparison shows that, with the presence of a controlling shareholder,

[3]The matching covariates include size, age, sales growth, leverage, cash holdings, and tangibility.

actual group firms are more likely to have same-group suppliers and customers, and these same-group suppliers and customers are on average more important than unaffiliated suppliers and customers.

After establishing the importance of same-group supplier-customer relationships, we next investigate the association between a firm's relationship with its suppliers and the level of trade credit the firm receives from them. Following Petersen and Rajan (1997); Levine et al. (2018); Li et al. (2021); Gofman and Wu (2022); Ersahin et al. (2024), we use accounts payable divided by the cost of goods sold, as well as accounts payable scaled by sales, to capture trade credit a firm receives. To capture the business group supply chain relationship, we classified the firms in our sample into four categories based on their business group affiliation and their relationship with their suppliers. The first category denotes firms affiliated with a business group with same-group suppliers. Firms in the second category are affiliated with a business group, but they lack any same-group suppliers. The last two categories consist of standalone firms, with the third category having group-affiliated suppliers, while the fourth category has none. We also use alternative measures to capture the relative importance of same-group suppliers relative to all of the suppliers. For each group firm, this measure is derived by dividing the total sales of the firm's same-group suppliers by the total sales of all suppliers associated with the firm.

Our baseline results suggest that group firms are associated with approximately 10% higher trade credit compared to standalone firms. More importantly, group firms with same-group suppliers receive nearly twice the amount of trade credit as group firms without same-group suppliers. This is consistent with our default risk hypothesis that the business group customers receive more trade credit from their suppliers in part due to their lower default risk. While group suppliers extend more trade credit to their same-group customers, it appears that they may reduce the trade credit provided to standalone customers, possibly due to the relatively higher default risk associated with these standalone customers combined with the total level

of credit exposure they are willing to bear. The results using the group relative importance measure also indicate that the firm receives greater trade credit when the same-group suppliers are more important relative to all their suppliers.

Next, we delve into the strategic trade financing of business groups by examining the circumstances under which group firms receive more trade credit if their suppliers are in the same group. The regression results show that if group firms experience a decline in their sales growth, they tend to receive more trade credit when they have same-group suppliers. This finding suggests that business groups utilize internal trade financing to support their affiliated firms during periods of declining sales growth. In contrast, we did not observe a similar pattern of standalone firms receiving more trade credit when they have group suppliers. This preference is likely in part to be driven by the relatively lower default risk of group firms compared to standalone firms, although the default risk of both group firms and standalone firms is likely to rise given their negative sales growth. Importantly, this positive relationship is specific to emerging markets and not observed in developed capital markets. This result aligns with the theory of financing advantages, as in developed markets, external financing tends to be less costly, and the comparative financial advantages of business group firms in supplying it are relatively lower.

We also examine the role of trade credit and other internal capital mechanisms within business groups for reallocating funds. We construct a measure for investments received by the group firm from other affiliated firms within the same group as a proxy to gauge the extent of intragroup capital reallocation. This identification strategy allows us to investigate how this reallocation differs from other documented internal capital channels, including intra-group loans and equity investments. The results suggest that, except for financially weaker affiliates, trade credit can substitute for other forms of internal capital in pyramidal group firms. Focal firms with same-group suppliers receive more supplier trade credit, but less when alternative

group capital is provided. There is a complementary relationship between trade credit and internal capital transfers for firms at the bottom of the pyramid, indicating varied internal capital market support mechanisms across different group affiliates.

We rely on major natural disasters as an exogenous shock to supply chain operations, which allows us to assess the impact of having same-group supply chain relationships and using trade financing to provide internal capital. We use major natural disasters for two reasons. Trade credit plays a pivotal role in hedging volatility in operation and sharing risk along the supply chain, which motivates why the prior literature (e.g. Barrot and Sauvagnat, 2016) uses natural disasters as shocks to supply chain continuity. In addition, one crucial feature of business groups documented in the extant literature is their resilience during both economic downturns and negative economic shocks (e.g. Masulis et al., 2023; Faccio and O'Brien, 2021). For example, the strategic value of group affiliation may be incrementally more important during the global financial crisis when credit was in short supply Masulis et al. (2023). If business groups strategically utilize trade financing from their internal supply chains, then we expect to observe that group firms with same-group suppliers receive more trade credit after experiencing negative operating shocks. To examine this hypothesis, we use the international natural disaster database from EM-DAT[4]. We use a difference-in-differences analysis to compare the trade credit response experienced by group firms compared to standalone firms following major natural disasters. We focus on the interaction term of the customer-supplier relationship classification and the indicator of firms hit by major natural disasters. To mitigate potential issues associated with a staggered difference-in-differences (DiD) approach (Gormley and Matsa, 2011, 2016), we also employ a stacked-cohort DiD methodology for robustness. This alternative approach alleviates concern that our baseline results are confounded by a mix of a supplier's

[4]EM-DAT is a global database that records at the country level both the human and economic losses associated with major natural disasters. EM-DAT, CRED / UCLouvain, Brussels, Belgium – www.emdat.be

ability or willingness to extend more trade credit and a customer's demand for more trade credits, by providing a setting where customers should demand more trade credit after they are hit by severe disasters.

Our results show greater trade credit is given to group firms having same-group suppliers when they are hit by natural disasters. Unanticipated natural disasters, such as floods and earthquakes, can result in substantial economic damage and may temporarily disrupt the production and business operations of firms located in an area hit by these disaster events. As a consequence, these firms may experience a decline in sales growth and a reduction in cash flow generated through their regular transactions. Consequently, there is an increased demand for trade credit among the affected firms, as they seek additional liquidity and financing to cope with the aftermath of the natural disaster. As credit demand increases, the group supplier may be pushed by their controlling shareholder to extend more trade credit. This credit risk exposure is less of a concern for group suppliers since the relative default risk of group firms remains lower than that of standalone firms also hit by natural disasters.

Overall, our analysis finds that groups strategically utilize trade financing from their internal supply chains. Group firms with same-group suppliers receive more trade credit generally and more trade credit when the same-group customers are in greater need of capital. Our study's main contributions are threefold. First, we provide empirical evidence on a new channel (trade financing) through which groups can support their affiliates. Second, we show that this channel can be a substitute for other previously documented internal capital reallocation mechanisms involving financially stronger firms and to be a complement for financially weaker firms. Third, this study utilizes major natural disasters as exogenous shocks to supply chain continuity, which allows for sharper inferences about the magnitude of the effect.

This study adds to the prior literature by highlighting the financial advantages that business groups can realize through intra-group loans, intra-group dividend payments, cross-firm equity

investments, starting up firms de novo or acquiring new group firms, and initial public offerings of group firms (Chang and Hong, 2000; Gopalan et al., 2007, 2014; Buchuk et al., 2014; Almeida et al., 2011, 2015; Masulis et al., 2020). While these studies highlight many of the group's financial advantages in supporting affiliates through internal capital markets, the operation relationships and the role of within-group supply chain networks are not well documented due to a lack of data. Our study expands the existing body of literature by using a comprehensive dataset of customer-supplier relationships.

Trade financing differs in two key aspects from other channels of business group internal capital transfers, such as intra-group loans and dividend payments. Firstly, trade financing offers greater flexibility, enabling quick or delayed cash payments in response to changing needs and business circumstances among group affiliates. In contrast, the transfer process through intra-group loans, dividends, and cross-equity investments may not address certain short-term financing needs promptly as it takes time to sign contracts and agreements. Secondly, trade financing is characterized by higher opacity since the supply contract and trade credit terms and conditions are subject to fewer disclosure requirements and are not extensively regulated by governments. This inherent opacity allows additional flexibility to the groups in their financial operations. Given the limited availability of inter-company transaction data, we examine in this study accounts payable as a proxy to investigate the trade financing among group firms.

Using a cross-country setting, this study is the first to show a broad picture of the supply chain relationship networks that exist within business groups. This contributes to our understanding of the inner workings of business group firm operations. There is very little evidence on the roles of affiliated firms within the supply chains of business groups. We present the frequencies of the affiliated firms with different roles based on their position within the group's internal supply chain. We also discuss some firm attributes related to these roles as key suppliers and customers involved in trade credit.

Our discussion is related more broadly to the trade credit literature. Prior literature suggests that negative economic shock can propagate through a supply chain Barrot and Sauvagnat (2016); Ersahin et al. (2024); Agca et al. (2022), we show that given such shocks, business groups provide advantages that can alleviate the impact of such shocks by providing support through trade financing. Our findings also provide additional evidence that business group members are more resilient during these shocks. This complements the literature on business groups that show how transfers of internal funds create value during economic shocks and crises (Almeida et al., 2015; Gopalan et al., 2007; Santioni et al., 2020; Buchuk et al., 2020).

2 Background

2.1 Financial Advantages of business groups

A substantial portion of the earlier literature on family business groups finds that controlling families often expropriate minority shareholders through resource tunneling activities (Johnson et al., 2000; Bertrand et al., 2002), especially in Korean chaebol context (Bae et al., 2002; Baek et al., 2004, 2006).[5]

On the other hand, other researchers argue that the prevalence of business groups in many emerging economies is a response to institutional underdevelopment, such as developing capital markets and institutions and weaker legal systems (Khanna and Yafeh, 2007; Morck, 2010). Chang and Hong (2000) show that group firms benefit from sharing intangible and financial resources with other affiliated firms. (Almeida and Wolfenzon, 2006a) model that business groups can better support new firms' funding requirements in underdeveloped external capital

[5]Other empirical work testing tunneling and expropriation hypothesis in business group literature includes Fisman and Wang (2010); Claessens et al. (2000); Lemmon and Lins (2003); La Porta et al. (1999, 2002); Siegel and Choudhury (2012).

markets. This echoes Hoshi et al. (1991)'s financing advantage explanation of the pyramidal structure of many business groups. Subsequent empirical research also documents evidence of internal transfers of group funds across affiliated firms consistent with internal financing motives for business group formation (Belenzon and Berkovitz, 2010; Fisman and Wang, 2010; Gopalan et al., 2007; Almeida et al., 2011, 2015; Buchuk et al., 2014; Masulis et al., 2011, 2020, 2023).

Trade credit in group-affiliated firms is closely linked to the available funds in internal capital markets. Fan et al. (2016) discuss the change in trade credit in business groups which can influence intra-group cash flows through normal transactions or implicit intra-group loans.

2.2 Supply chain and transaction costs in business groups

Business groups' advantages in production and operation have been discussed in the literature as well. Earlier research focusing on Japanese *keiretsu*, Yafeh (2003) discusses the reducing transaction costs incentive of business group formation. For manufacturing-centered business groups, joint development of new products and just-in-time supply of inputs are crucial. For example, Kawasaki and McMillan (1987); Asanuma (1989) provide evidence that Japanese manufacturer-centered groups strategically reduce hold-up problems through long-term relations without resorting to full vertical integration and Chang and Choi (1988) shows that Korean business groups are structured in a way to overcome transaction costs and market frictions. Khanna and Palepu (1999) document the product market advantages in Chilian and Indian business groups. A recent empirical study Masulis et al. (2023) shows that product market expansion is often achieved through internal capital flows, especially during a financial crisis.

2.3 Trade credit theories

The theoretical explanations for the existence of trade credit can be broadly categorized into three basic views as discussed below (Petersen and Rajan, 1997). Financing advantages theory argues that suppliers have financing advantages over traditional lenders (e.g. banks) in creditworthiness investigations and controls over their customers. This is because they have more information about their customers' businesses and financial performance. As a result, they are able to offer trade credit at a lower cost than banks. Schwartz (1974) first propose the financing advantages theory, and later work such as Mian and Smith (1992); Smith (1987); Biais and Gollier (1997); Wilner (2000); Cuñat (2007) discussed different theoretical mechanisms that underlie this advantage. Petersen and Rajan (1997); Amberg et al. (2021); Klapper et al. (2012); Murfin and Njoroge (2015); Gofman and Wu (2022) provide empirical evidence on the financing advantages theory.

Price discrimination theory argues that trade credit can be used as a strategic tool by suppliers with high margins to price discriminate among their customers. This is because trade credit reduces the effective price to low-quality borrowers when in most cases buyers with different creditworthiness receive the same trade credit terms (Petersen and Rajan, 1994, 1997). The earlier discussion on price discrimination theory includes Schwartz (1974); Brennan et al. (1988); Mian and Smith (1992); Petersen and Rajan (1997). Recent empirical work shows that trade credit can be used as a strategic tool by suppliers to acquire market power (Lehar et al., 2020; Gofman and Wu, 2022), and to price discriminate in favor of high-bargaining power customers (Klapper et al., 2012; Murfin and Njoroge, 2015; Giannetti et al., 2021).

The transaction costs theory of trade credit was first proposed by Ferris (1981). They argue that one incentive for the supplier to extend trade credit is to reduce the transaction costs of paying bills, which offers more flexibility to the firms by separating the payment cycle from

the delivery schedule. Some other discussions of these transaction costs including inventory costs due to seasonality in production and sales (Petersen and Rajan, 1997) and periodic tax liabilities (Desai et al., 2016).

3 Hypothesis Development

In many economies, business groups are known for having great economic power (Morck et al., 2005; Almeida and Wolfenzon, 2006a).[6] Transactions between affiliated firms within these groups can enhance the competitiveness of both suppliers and customers, acting as an alternative to external markets when such markets lack efficiency. At the same time, such transactions may involve implicit loans and wealth transfers from minority shareholders to controlling shareholders OECD (2020); Fan et al. (2016).

One important reason of diversification and the formation of vertically-integrated business groups arises from the challenge of sourcing qualified suppliers for essential parts and services, as documented in Kim (2010). This vertical-integration helps build internal supply chain networks inside business groups. Transactions between affiliated firms can also provide financial and operational liquidity to these affiliated firms. Affiliated firms may operate in different industries and have different capabilities, although still sharing the same group brand. By coordinating the activities of the affiliated firms, business groups can achieve economies of scale, create group synergies, reduce transaction costs, and improve the quality of their products and services. With these benefits, firms affiliated with the same business group are more likely to form supplier-customer relationships.

The greater market power and frequent transactions between affiliated firms may in part

[6]For example, Boutin et al. (2013); Masulis et al. (2023) show that group's internal capital markets enhance group firm's competitive strength in the product market.

reflect the fact that in business transactions they can obtain better trade financing. One observable and testable metric in tracking trade financing is the level of trade credit extended by suppliers. Group members greater economic and market power may give rise to their having greater bargaining power with their suppliers. Additionally, business group firms are less likely to default, which increases their bargaining power in ordinary business transactions. Within a business group, affiliated firms often have access to shared financial resources through internal capital markets. This means that if one affiliated firm faces financial difficulties or defaults on payment, other affiliates of the group can step in to provide financial support Gopalan et al. (2007). This internal capital market reduces the default risk for a supplier when extending trade credit to group affiliated customers. Hence, we hypothesize that the business group firms, with greater bargaining power as customers, receive higher levels of trade credit than standalone firms.

H1. Group firms receive higher levels of trade credit than otherwise similar standalone firms.

There are a few reasons why a business group supplier faces much lower default risk when extending trade credit to affiliated customers. Firstly, the internal capital markets further reduce the default risk bearing of a group supplier when they trade with same-group customers. In fact, trade financing could be one way of supporting the affiliated firms.

Secondly, within a business group, there is usually a higher level of information sharing among affiliated companies. Based on the supplier's financial advantage theory of trade credit (Petersen and Rajan, 1997), the suppliers have a comparative advantage over banks and other creditors in terms of creditworthiness investigations and their influence over their customers as explained below. Petersen and Rajan (1997); Cuñat (2007) show that suppliers have comparative advantages over banks as lenders due to suppliers' ability to threaten to immediately stop supplying goods to ensure debt repayment. Jain (2001)'s model attributes the existence of

trade credit to the benefits of reduced monitoring costs due to a supplier's informational advantages.[7] When the supplier and customer are affiliated with the same business group, the group supplier can have access to detailed information about the financial health, creditworthiness, and performance of the same-group customers. This enhanced information allows the supplier to make more informed decisions when extending trade credit, reducing the risk of default.

Thirdly, business group suppliers may have tighter control and monitoring mechanisms in place compared to transactions with unrelated parties. The supplier can exercise greater control over the affiliated customers' operations, product development, and payment practices. Suppliers frequently play an active role in their customers' new product development processes and offer solutions to their technical challenges Ring and van de Ven (1992); Mahmood et al. (2011). This is particularly true in cases where there is a business group affiliation between the customer and supplier. For example, Helper and Sako (1995); Colpan et al. (2010) document how Japanese *keiretsu* suppliers assist their affiliated customers in product development. Another example is found in the context of Korean *chaebol* such as LG Group who sought for diversification due to difficulties in finding qualified suppliers as discussed in Kim (2010). These models of closely intertwined businesses allow the supplier to exert greater control over the operations and debt payments of their affiliated customers, particularly when they provide trade credit. The increased monitoring and control over affiliated customers help mitigate the risk of default by detecting early warning signs and taking proactive measures to address potential issues. With the lower default risk, we hypothesize that group suppliers are willing to extend more trade credit to same-group customers, compared to unaffiliated customers.

H2. Group firms having same-group suppliers receive higher levels of trade credit than otherwise similar standalone firms without group suppliers.

[7]Other theoretical discussions on a supplier's superior information advantage over financial institutions include Smith (1987); Brennan et al. (1988); Biais and Gollier (1997).

Natural questions arise when a group-affiliated supplier has both same-group customers as well as customers who are standalone firms: whether they favors their same-group customers by extending more trade credit, and whether this favoritism places standalone firms who also trade with the same group suppliers at disadvantage. Petersen and Rajan (1994, 1997); Smith (1980) suggest that trade credit terms tend to follow industry practice instead of being tailored for specific borrowers once the decision to extend trade credit is made. From the group-affiliated supplier's perspective, however, the informational advantages increase and monitoring costs decrease when they provide trade credit to customer of the same business group. Consequently, the default risk of trading with same-group customers is lower than with standalone customers. In some cases controlling family require the extension of trade credit to ensure the overall stability of the group's businesses. This is because the controlling family have greater incentive to maintain control and ensure the continuity of their business operations. Therefore, we hypothesize that same-group customers receive greater trade credit than otherwise similar standalone customers sharing the same suppliers. Moreover, the effects should primarily come from family business groups.

H3. Group firms receive greater trade credit from same-group suppliers than otherwise similar standalone firms that also share these same suppliers.

A crucial role of internal capital markets is a group's support for its affiliated firms when the customer faces financing difficulties. When aggregate credit supply is reduced and when affiliated firms face liquidity needs, a group has the ability to transfer cash and funds within the group to help cash-poor firms and fund their more favorable investment opportunities. Using Italian intra-group financial flow data, Santioni et al. (2020) show more capital transfers across affiliated firms, especially from cash-rich to cash-poor group affiliated firms when their banks are in distress and have more bad loans relative to the bank's total assets as a result of the global financial crisis and euro area sovereign debt crisis.

In addition to intra-group loans documented in the above Italian study, business groups may also support their affiliates through trade financing. Compared to intra-group loans, trade financing between affiliated firms offers greater flexibility for either delayed or accelerated cash payments to accommodate the changing financial environment. It is also subject lower disclosure requirements and hence there is less monitoring over this issue by stakeholders. As a result, business groups may provide trade credit as an attractive mechanism to support affiliated firms by exploiting their inherent financial flexibility and [operating or financial?] opacity. If this is the case, we expect group firms to receive greater trade credit when they have a greater need for it. We consider two testable cases in which the firms may face greater credit and liquidity needs and hypothesize that group affiliated firms receive higher trade credit levels from their same-suppliers when they are in needs of it.

First, a decrease in a firm's sales growth may lead it to have a higher demand for trade credit as it can indicate an adverse trend that their business is unable to generate sufficient cash flows to meet its operating needs and financial obligations. At the same time, these firms may face higher default risk as the weak cash-generating results may be unable to assure timely repayment of their debts to suppliers. Second, cash-poor firms typically have higher liquidity needs for operations and thus, have higher demand for trade credit. They are also associated with higher default risk due to their cash shortage. In these circumstances, group-affiliated suppliers face decreased default risk when a customer with declining sales growth and in need of trade credit is in the same group, compared to when the customers in need is a standalone firm. If the business groups strategically support their affiliated customers by extending them more trade credit when they are in financial need, due to slow-growing sales or otherwise are cash-poor, then we expect them to receive greater trade credit when they have same-group suppliers, compared to otherwise similar standalone firms.

H4. Compared with otherwise similar standalone firms that lack same-group

suppliers, group firms with such suppliers receive greater trade credit, even when these affiliated customers are experiencing liquidity needs.

4 Data and Sample

We discuss the construction of our sample for analysis and our data sources in this section. Our empirical analysis relies on identifying (i) firm-level supply chains and (ii) business group affiliation information. We obtain the supplier-customer linkage data from the Factset Revere Supply Chain database. We then combine the Factset Revere data set with data on business group affiliation for countries where this affiliation data is available. The sample of listed firms used in our analysis is created by merging the above supplier-customer linkage dataset with the Thomson Reuters Worldscope database. The final sample comprises 10,386 unique firms in 45 economies from 2013 to 2021.

Most studies in supply chain and trade credit literature focus on manufacturing (SIC 2000-3999) industries (Levine et al., 2018; Li et al., 2021; Bougheas et al., 2009; Ersahin et al., 2024), or exclude financial (SIC 6000-6999) and service (SIC 7000-8999) firms in their sample. In addition to excluding financial industries (Gofman and Wu, 2022), we follow Petersen and Rajan (1997) to also exclude service industries from our main sample for two reasons. Firstly, service firms typically have relatively small book values of assets, which may affect the comparability of their financial characteristics with firms in other industries. Secondly, service firms tend to have lower levels of credit purchases, as their business nature often involves infrequent purchases and are not primarily focused on supply of physical goods. We also present results for the sample of manufacturing firms. The literature in trade credit mainly focuses on manufacturing firms, because trade credit mainly exists between suppliers and customers in a supply chain and is of little relevance in non-manufacturing industries (Levine et al., 2018; Li et al., 2021; Bougheas

et al., 2009).

4.1 Supply chain data

FactSet Revere Supply Chain Relationships data provides a detailed classification of the business relationships and interconnectedness between global companies. This data is obtained from reliable primary sources and encompasses both disclosed and undisclosed relationships, resulting in a comprehensive and consistent network of relationships over time. The primary information sources for the firm's relationship data drawn from the Factset Revere datasets include annual and quarterly reports, SEC filings, conference call transcripts, investor presentations, company websites, and press releases. Several recent studies (e.g. Agca et al., 2022; Dai et al., 2023; Ersahin et al., 2024; Gofman and Wu, 2022) have utilized this dataset to examine the correlation between supplier-customer relationships and various factors, including credit shocks, corporate social responsibility, trade credit, and profitability. Studies such as Gofman and Wu (2022) exploit the newly available data to test theoretical explanations for the existence of trade credit, while Agca et al. (2022) and Ersahin et al. (2024) explore the propaganda of credit shocks along supply chain through trade credit. Our study explores how internal supply chain relationships within business groups can benefit these business groups.

In the dataset, the relationships are categorized into four main types (customer, supplier, partner, competitor) and further subdivided into 13 sub-types, enabling precise categorization from the company's perspective. In our analysis, we specifically focus on customer and supplier relationships. For non-US firms, the FactSet Revere data provides extensive coverage starting in 2013, forming the foundation of our sample period spanning the period 2013-2021.[8]

[8]Nonetheless, the data may not fully capture all the global supply-chain relationships as we can only observe relationships that are either voluntary or mandated discloses by customers and suppliers. As such, the starting and ending date of the relationship may not be accurately disclosed. (See the discussion of the time inconsistency issue associated with this data in e.g. Culot et al., 2023) To address concerns about the potential incompleteness

4.2 Business group identification

Our identification of business group firms and family business group firms relies on the business group dataset first assembled by Masulis et al. (2011) and then extended as of 2007 by Masulis et al. (2020). This comprehensive ownership dataset covers business group firms in 45 countries and is drawn from standard ownership databases such as Bureau van Dijk Orbis, Worldscope, Thomson Reuters Global Ownership, and Lionshares databases combined with hand-collected data from media reports (LexisNexis, Factiva, Bloomberg, Dun and Bradstreet's Who Owns Whom, stock exchanges, and securities regulators). Following Masulis et al. (2011), a business group is defined as a collection of two or more listed firms controlled by the same ultimate controlling shareholder. The ultimate controlling shareholder of a firm is the largest shareholder with at least 20 percent of the voting rights, or at least a 10 percent holding if the shareholder also has other forms of control through positions such as CEO, chairman of the board, or as a founder. When the ultimate controlling shareholder is a family or an individual, the business group is defined as a family-controlled business group. The controlling family can be a biologically linked family or a known alliance of families. The remaining business groups can be state owned, publicly owned or non-profit owned.

We merge Factset Revere Supply chain data with the Business Group Data from 2013 to 2021 and identify group-affiliated listed firms. For private firms reported in the Factset database, we identify them as group-affiliated if their listed parent belongs to a business group.

in the supply chain relationships data outside of the US and across time, we adjust the supplier-customer linkage data by assuming the relationship continues to exist as long as the focal firm and its supplier/customer firm exist. In other words, the supplier-customer linkage can only be "switched on" and not "switched off". We make this "switch-on only" adjustment in our main analysis. We employ robustness checks to ensure that our findings are not influenced by data gaps or incomplete information as explained below. We use unadjusted as well as "constant" supplier-customer relationships as robustness checks and we find that the results are similar. The "constant" supplier-customer relationship adjustment involves holding the relationship between a supplier and a customer constant over our sample period.

4.3 Main variable construction

To answer the question about whether groups realize added advantages from having supply chain relationships, we examine the relationship between the focal firm and its supplier(s). We propose two measures to capture the relationship. The first measure is based on indicator variables for the following four categories: Initially, a focal firm is categorized as either a BG-affiliated or a standalone firm according to our BG database. Subsequently, based on the composition of its suppliers, the firm is further classified into one of the four main variables. If a focal BG-affiliated firm has any (zero) same BG-affiliated suppliers, then $I.BG\text{-}BG$ ($I.BG\text{-}NBG$) is equal to one, and zero otherwise. Similarly, if a focal firm is a standalone firm that has any (zero) BG-affiliated suppliers, $I.SA\text{-}BG$ ($I.SA\text{-}SA$) is equal to one and zero otherwise. Figure 1 shows a diagram that illustrates the formation of the four main indicator variables corresponding to each focal firm in our sample.

The alternative measure we propose to capture the relationship between the focal firm and its supplier(s) is *BG Importance*. To capture the relative importance of the same-group-affiliated suppliers to the focal firm, this measure calculates the total sales of its same-group supplier(s) as a proportion of the total sales of all of its suppliers.

4.4 Natural disaster data

We rely on the EM-DAT database[9] collected by the Centre for Research on the Epidemiology of Disasters (CRED) to identify major disasters. This comprehensive database is global in scope and includes data on natural disasters from 1900 to the present. The information in the EM-DAT database is sourced from a variety of reliable channels, including United Nations agencies, national governments, non-governmental organizations, insurance companies, research

[9]EM-DAT, CRED / UCLouvain, Brussels, Belgium – www.emdat.be

institutions, and press agencies. For an event to be recorded in the database, it must meet at least one of the following criteria: result in more than 10 deaths, affect/injure/homeless 100 or more people, or be declared as a state of emergency by the country with an appeal for international assistance. EM-DAT is a commonly-used international database for natural disasters. Some development economics and macroeconomics literature using this database include Botzen et al. (2019); Noy (2009); Felbermayr and Gröschl (2014); Ballesteros et al. (2017).

We consider natural disasters causing significant economic damage. We identify major natural disasters as those associated with total monetary damage or a total number of people affected that fall within the top decile of the EM-DAT sample. One limitation of this international disaster dataset is that the EM-DAT disaster intensity measures (total estimated damages in USD, and total number of affected people) are likely to be correlated with the size of the economy because losses are generally higher and better recorded in developed countries (Botzen et al., 2019; Felbermayr and Gröschl, 2014). To address this data limitation and standardize the disaster intensity measures across different countries, we follow Botzen et al. (2019); Noy (2009) to scale the total estimated damages in a country by last year's GDP and scale the total number of affected people by last year's population. We identify 74 major natural disaster events which are shown in Table A.4.

After we identify the major disasters, we collect geographical coordinates of the affected areas and locations of these disasters reported in EM-DAT by using Google Maps Geocoding API. We then identify disaster-affected firms in our sample as those whose headquarter is located within 50 (100) kilometers of the affected areas. Factset provides the headquarters address locations for companies with supply chain relationships.

5 Within-Group Supply Chain Network Analysis

5.1 Same-group suppliers and customers of group firms

Table 1 presents the distribution and descriptive statistics of business groups in 45 countries in our sample. Following Masulis et al. (2023), we use the MSCI index classification system to classify our sample countries into developed and emerging markets.[10] Panel A reports the emerging capital markets and Panel B reports the developed markets.

No. of Groups is the total number of business groups in the sample for each country and *Avg Group Size* is the average number of firms in a business group. From Table 1, Japan, the United States, South Korea, and India show the largest number of business groups in the sample. On average, a business group consists of 4 group firms, while for the countries with the largest groups, there are on average 8 firms in a business group.

% *Int. Supp.* (% *Int. Cust.*) reports the average proportion of internal or same-group suppliers (customers) for each business group firm. These percentages are calculated by dividing the number of same-group suppliers (customers) by the total number of suppliers (customers) of the group firm in a given year. On average, 7% of the suppliers and 8% of the customers of a group firm are also members of the same business group. These country-average proportions are at least 60% higher in emerging markets compared to developed markets.

5.2 Supply-chain roles within a business group

Next, we show the supply-chain roles of firms within the business groups in the sample. For each firm in a business group, we define their role as *Supplier*, *Customer*, or *Neither*.

[10]Developed capital markets are the 23 countries that MSCI includes in the MSCI World Index. Emerging capital markets refer to the 22 countries that MSCI designates as "Emerging Markets" and "Frontier Markets" as of 2007.

The *Supplier* category is the group affiliated firms with same-group customers in a given year. They supply the rest of the group with their production, so we label their role within the group as an "internal supplier". Similarly, *Customer* is defined as the group-affiliated firms with same-group suppliers. They purchase from other firms in the same group, so we label their role within the group as an "internal customer". Note that a firm can be both *Supplier* and *Customer* when they supply to same-group firms and at the same time purchase from same-group firms, so the two categories are not mutually exclusive. The third category, *Neither*, contains group-affiliated firms without same-group customers or same-group suppliers. In other words, these are the group firms whose trading partners are all standalone firms or firms from other business groups.

In Table 2, Panel A reports the group-level statistics of the average proportions of firms in each role for groups. We separate the business groups based on whether they are family business groups and whether they are in a pyramidal structure. In our sample, 70% of the groups are ultimately controlled by families or individuals, and most of the family-controlled groups have a pyramidal structure. From Panel A, we see that pyramidal groups have a higher proportion of internal suppliers and customers than the horizontal groups. Moreover, family pyramidal groups have the lowest proportion of firms without internal partners, which suggests that more firms in family pyramidal groups have internal trading partners, that are part of a supply chain.

We present the firm-level statistics in Panel B of Table 2. It shows that, within a group, 49% (100%-51.4%) of group firms have either internal customers or internal suppliers. 36.8% (36.4%) of group firms are labeled as internal suppliers (customers). Moreover, the proportion of family group firms having internal trading partners is higher than in non-family groups.

We take a closer look at the pyramidal groups in Panel C. Following Masulis et al. (2011), we distinguish firms in different layers of the pyramidal chain. *Apex* firms are firms at the

top, and *Middle* and *Bottom* firms are those in the middle and at the very bottom of the pyramidal ownership chain. Statistics in Panel C show that *Middle* firms are more likely to have same-group suppliers and customers, while *Apex* firms are more likely to just trade with external firms.

5.3 Critical supplier and customer within a group

In the previous section, we show the proportion of internal suppliers and internal customers within business groups. To gain a deeper understanding of the internal supply chain dynamics within groups, we create critical supplier and customer scores. These scores serve to measure the relative importance of group firms within their business groups as internal suppliers and customers. The critical supplier score is calculated by dividing the number of same-group firms directly and indirectly supplied by the focal firm by the total number of potential same-group customer firms (i.e., the total number of firms in the group excluding the focal firm). Similarly, the critical customer score is constructed by dividing the number of group firms that purchase from the focal firm by the total number of remaining firms in the group, thus providing a scaled measure of the focal firm's importance as a customer within the group.

To comprehensively capture the number of affiliated firms directly and indirectly supplied by the focal firm, we construct the multi-tier supply chain for each group, using the term as in Mena et al. (2013). Each multi-tier supply chain within a group includes the focal group firm, its same-group customer, the customer's customer, the customer's customer's customer, and so on. These paths of multi-tier supply chains form a cascading supply chain relationship network within a group. We term the immediate (direct) supplier-customer relationship as the first-tier supplier/customer, while the subsequent (indirect) supplier-customer relationships are termed the second-tier, third-tier, and so forth. To avoid duplication, we retain only the shortest path

of the multi-tier supply chain between any two firms in the same group. For example, if firm i is both directly and indirectly purchasing from firm j, firm i is considered the first-tier customer of firm j. In our sample, the longest multi-tier supply chain path within a group spans seven tiers.

After constructing the multi-tier supply chain relationship network within each business group, we then calculate the critical supplier and customer scores using the aforementioned methods. Table A.1 presents the summary statistics of these scores of different types of group firms. From the table, pyramidal group firms (both family and non-family) have higher critical supplier and customer scores than horizontal group firms. Within a pyramidal group, apex, middle and bottom firms have similar critical scores.

5.4 Summary statistics of main variables

Table 3 presents summary statistics of our main variables for the four categories of focal firms based on their relationships with their suppliers. We also separately report these figures for emerging and developed capital markets in Table A.2. All continuous variables are winsorized at the 1% and 99% levels. The detailed description of variables is reported in Appendix A.1. As can be seen from the table, the unconditional mean of the trade credit measure $^{\text{AP}}/_{\text{COGS}}$ in our sample is 0.321, which suggests that accounts payable constitute 32% (16%) of the cost of goods sold for the average (median) firm in the sample. This ratio highlights the importance of trade credit that a firm receives in operation and production activities (Li et al., 2021).

5.5 Actual and "pseudo" group firms

From previous statistics, we show the business groups typically have same-group customers and suppliers and the proportion of these trading partners is non-trivial. In this section, we

aim to provide more direct evidence of the importance of group affiliation in forming customer-supplier relationships. We examine the probability of group firms having same-group customer-supplier relationships, by comparing the group firms to matched standalone firms. To control for the selection effects of business group structure Almeida and Wolfenzon (2006b); Almeida et al. (2015); Buchuk et al. (2020), we compare a group to matched standalone firms following Masulis et al. (2023)'s matching procedure.

Firstly, we create a "pseudo group" for each (actual) business group in the sample. The "pseudo group" consists of standalone firms that are matched to each affiliated firm in an actual group. For each group firm, the matched standalone firm is found in the same country and 2-digit SIC industry based on nearest neighbour matching of covariates including size, age, sales growth, leverage, cash and short-term investments, and tangibility. This procedure ensures the "pseudo group" has a portfolio of standalone firms that mimic the actual group composition. The underlying assumption is that the "pseudo" groups form the same organizational structure as the actual groups, and the difference between the actual groups and (counterfactual) "pseudo" groups is the presence of an ultimate controlling shareholder. By doing so, we aim to examine the effects of group affiliation in forming same-group customer-supplier relationships. We allow the composite of standalone firms forming a "pseudo group" to be varied year by year. Otherwise, this would limit the sample size of matches as it is difficult to find matched standalone firms with similar firm-level characteristics that hold across the entire sample period.

After we assemble the "pseudo" groups, we construct the $I.BG\text{-}BG$ measures for standalone firms in these "pseudo" groups, assuming that they are a single business group. Similar to our previous construction of the customer-supplier relationship classification variable, $I.BG\text{-}BG$ indicates the group (or pseudo group) firm having same-group suppliers/customers. We then compare the $I.BG\text{-}BG$ for the group firms to their matched"pseudo" group firms.

Table 4 reports the likelihood of a focal firm having same-group suppliers in Panel A and

that of having same-group customers in Panel B. The main variable of interest is *Actual Group*, which is an indicator variable for actual business groups, compared to "pseudo" groups in the sample. We examine the likelihood of having same-group suppliers and customers in the all industry sample as well as in the manufacturing industries only sample. The results suggest that business group affiliation has strong positive effects on having same-group trading partners.

In addition to the likelihood of forming same-group trading relationships, we also investigate the relative importance of these same-group trading partners (suppliers or customers). *BG_Sup* estimates the relative importance of the business group supplier(s) to the focal firm. For a focal firm as a customer, this measure is calculated as the proportion of the total sales measured in USD of its same-group supplier(s) to the total sales in USD of all of its suppliers. Similarly, *BG_Cus* measures the relative importance of the business group customer(s) to the focal firm. For a focal firm as a supplier, this measure is calculated as the proportion of the total cost of goods sold in USD of its same-group customer(s) to the total COGS in USD of all its customers. The intuition behind the measures is the transaction amount is associated with sales of suppliers and is associated with purchases (hence reflected in the cost of goods sold in financial statements) of customers. By scaling the group sales or cost of goods sold by the focal firm's total figure, we can capture the relative importance of group suppliers or customers to the focal firm.

We show that not only the likelihood of forming same-group customer-supplier relationships is higher for actual business group firms, but also the same-group suppliers/customers are important trading partners. In Columns (3) to (4) and (7) to (8) of Table 4, the dependent variable is *BG_Sup* and *BG_Cus*. These coefficients suggest that the same-group suppliers/customers account for proportionally more of their entire supplier/customer base when the focal firm belongs to an actual business group, instead of a "pseudo" group. This implies that business group affiliation is positively associated with the relative importance of same-group trading

partners.

6 Empirical Methodology

We begin our empirical analysis by adopting the perspective of the customer firm. From this perspective, the focal firm's accounts payable are considered to be loans from its supplier(s), so the focal firms serve as borrowers and their suppliers act as lenders (Petersen and Rajan, 1997). Therefore, from the customer's standpoint, we estimate the following equation in our baseline model.

$$TradeCredit_{i,t} = \beta_0 + \beta_1 C\text{-}S\ Classification_{i,t} + \beta_2 X_{i,t-1} + \lambda_{ind,ctry,t} + \epsilon_{i,t} \quad (1)$$

where i and t index firm and year respectively and X denotes a set of control variables. We define our main dependent variable $TradeCredit$ as a firm's accounts payable divided by the cost of goods sold, following the extant literature (e.g. Li et al., 2021; Billett et al., 2021; Gofman and Wu, 2022; Levine et al., 2018; Ersahin et al., 2024). This variable captures the amount of trade credit provided by a firm's suppliers. We also provide robustness results using an alternative $TradeCredit$ measure, accounts payables scaled by the firm's sales over the year (Petersen and Rajan, 1997; Bougheas et al., 2009; Li et al., 2021). The main explanatory variable $C\text{-}S\ Classification$ is the customer-supplier relationship classification, which captures the business group affiliation and the relationship of the focal firm to its supplier(s). We propose two measures to capture this relationship. We define four categories based on the focal firm's group affiliation status and the group affiliation of its supplier. The first measure is an indicator variable for each of the four categories. Specifically, the first category $I.BG\text{-}BG$ takes a value of one for business group affiliated firms when any of its suppliers is affiliated with the same

group, and the second category $I.BG\text{-}NBG$ takes the value of one when the focal group firm does not have any same-group supplier. In other words, all of the suppliers for $I.BG\text{-}NBG$ firms are standalone firms or affiliated with different business groups than the focal firm's group. For standalone firms, $I.SA\text{-}BG$ equals one if the firm has at least one supplier who is affiliated with a business group. $I.SA\text{-}SA$ captures the remaining category that the standalone firms where all the suppliers are also standalone firms.

The second measure we use to capture the $C\text{-}S\ Classification$ is $BG\ Importance$. It measures the relative importance of the business group supplier(s) to the focal firm. For each focal firm, this measure is calculated as the proportion of the total sales in USD of its within-same-group supplier(s) to the total sales in USD of all of its suppliers. By definition, the measure is only positive when $I.BG\text{-}BG$ takes a value of one. The transaction amounts between the focal firm and its suppliers are recorded as sales in the financial statements of the supplier firm. Thus, our crude measure $BG\ Importance$, based on the proportion of same-group sales, captures the importance of same-group suppliers relative to all suppliers of the focal firm (in terms of sales).

$X_{i,t-1}$ indicates the firm-level control variables for the focal firms in our sample. We control for firm characteristics including firm size, firm age, tangible assets, leverage, cash holdings, and sales growth. We follow Petersen and Rajan (1997) in defining $Sales\ Growth_{Pos}$ and $Sales\ Growth_{Neg}$. We also include country-industry-year fixed effects or country-year and industry-year fixed effects to control for time-invariant unobservable country-year-industry characteristics. We cluster the standard errors at the firm level.

7 Baseline Results

In the previous analysis, we investigate the role of group firms in the within-group supply chain and compare it across different types of groups. Next, we explore the question of whether the groups support their affiliates through trade financing within the production network of its business group. We show that business groups with same-group suppliers receive higher trade credit and importantly that the effects are higher when the focal firm is experiencing negative sales growth or is short of cash holdings.

7.1 Focal Firms as Customers: Who Receives More Trade Credit?

In this section, we show the effects of having same-group supplier(s) on the trade credit a focal firm receives. We estimate the regression as specified in equation (1) and present the results for our baseline analysis in Table 5. The first four columns report the regression results for the sample of firms in all industries excluding financial and services industries, and the next four columns report results for firms in manufacturing industries only.

In Columns (1), (2), (5), and (6), we regress the firm's trade credit on the four main indicator variables capturing the business group affiliation of focal firms and their suppliers. The coefficients on the $I.BG\text{-}BG$ indicators are significantly positive across multiple specifications, suggesting that group-affiliated firms with same-group suppliers tend to obtain higher levels of trade credit. For example, the coefficient of $I.BG\text{-}BG$ in Column (1) indicates that compared with standalone firms who only purchase from standalone suppliers, business group firms with same-group suppliers tend to have 0.031 higher levels of trade credit. This value represents approximately 10% of the sample mean of the ratio of accounts payable to the cost of goods sold. The magnitudes are stronger in the manufacturing firm sample shown in Columns (4) to (8).

In the manufacturing sample, the focal firm receives greater trade credit when it is a group-affiliated firm, compared with a typical manufacturing transaction by standalone firms without group suppliers. This can be seen from the significant positive coefficient on both $I.BG\text{-}BG$ and $I.BG\text{-}NBG$. This could reflect the fact that business groups have better credit quality because of their lower likelihood of default. Notably, the coefficient of $I.BG\text{-}BG$ nearly doubles that of $I.BG\text{-}NBG$, which highlights the important role of having same-group suppliers for a focal group firm's trade credit.

Columns (3), (4), (7), and (8) use the *BG Importance* measure instead of the four indicator variables to capture the relationship between focal firms and their suppliers. Consistent with the indicator variables, the results for the *BG Importance* are also significant and positive. From Column (3), we see that a one standard deviation (0.135) change in same-group suppliers' importance measure leads to 0.007 (0.052×0.135) increase in $^{\text{AP}}/_{\text{COGS}}$, which represents 4.1% of the median (or 2.2% of the sample mean) of $^{\text{AP}}/_{\text{COGS}}$.

We also examine whether these results are robust to alternative definitions of trade credit. We show the regression results of using accounts payable scaled by sales ($^{\text{AP}}/_{\text{Sales}}$) to estimate trade credit in Table A.3. The results are consistent with the previous finding that group firms with same-group suppliers receive a higher level of trade credit.

Overall, the baseline results of same-group supplier and trade credit consistently indicate that groups have advantages in trade financing. This is especially the case when they have internal suppliers, where they receive a higher level of trade credit. Although the accounts payable collectively represent the total accounts payable to all suppliers, having internal suppliers significantly increases the accounts payable of the focal group firms, which implies that their same-group suppliers are extending more trade credit to the focal group firm.

7.2 When the Group Firm and the Standalone Firm Share Suppliers

So far, our analysis has focused on group firms with same-group suppliers and their trade credit dynamics compared to standalone firms. However, we have yet to consider a scenario where both group firms and standalone firms share suppliers. In such cases, if the shared suppliers of business group firms extend more trade credit to their same-group customers, it could put the other standalone customers at a disadvantage and expose them to some degree of operational risks associated with the group supplier. To test this hypothesis, we compare group firms with same-group suppliers ($I.BG$-BG) with standalone firms with group suppliers whose customers include same-group firms ($I.SA$-BG and the group supplier in this context has the same-group customer(s)). In other words, we examine the customers of group suppliers that include some, but not all same-group customers. A graphical illustration of this comparison is in Figure 2.

For each business group firm in a given year, we find the matched standalone firms in the same country, 2-digit SIC industry with the closest firm characteristics as in Equation **??**.[11] We then run OLS regressions of the following equation.

$$TradeCredit_{i,t} = \beta_0 + \beta_1 I.BG_{i,t} + \beta_2 X_{i,t-1} + \lambda_{ind,ctry,t} + \epsilon_{i,t} \tag{2}$$

where i and t index firm and year respectively and X denotes a set of control variables. Our variable of interest is $I.BG$, which indicates whether the focal firm is affiliated with a business group.

Consider a situation where group suppliers have both same-group and standalone customers. If group suppliers have incentives to favor their same-group customers, then for the same level of customer operating risk, they are likely to extend more trade credit to their same-group

[11] For robustness, we also show in Appendix **??** that the matching covariates only include firm size.

customers than to their standalone customers. In Table 6, we compare the group and standalone customers of group-affiliated suppliers having same-group customers, and we find that same-group customers receive significantly more trade credit than their standalone customers do.

We further distinguish between family group firms and non-family group firms. The variable $I.FamBG$ ($I.NonfamBG$) takes the value of one when the firm is affiliated with a family (non-family) business group and is zero otherwise. To maintain close linkage of the affiliated firms and family control over the group, the family group suppliers may have stronger incentives than non-family groups to let outside customers bear some of their operating risks and instead offer greater support to same-group customers. In Table 6, we find that family group firms do receive more trade credit. This suggests that with stronger control over group member firms, family business groups may better facilitate trade financing along the internal supply chain.

Overall, the analysis focuses on the customers of group-affiliated suppliers having same-group customers. It shows that same-group customers receive more trade credit than standalone customers. It implies that these standalone firms may be disadvantaged because the suppliers can favor their same-group customers by extending more trade credit. This is especially true for standalone firms trading with family business group suppliers.

7.3 When Focal Firms are in Liquidity Needs

Having established that group firms with same-group suppliers have greater trade credit, we conduct cross-sectional heterogeneity tests to show which group firms receive more trade credit. In this section, we aim to answer the question of whether the business groups strategically extend trade financing to support affiliates when it is particularly needed.

First, we examine the sales growth of focal firms. Stable supply chain relationships and favorable trade financing terms are particularly valuable for focal firms when they experience a

drop in sales growth. If the business group strategically supports its downstream group affiliates and is willing to share its operational risks more than it is for its standalone customers, then we expect group firms to receive greater trade credit when they are in greater need of such trade credit. Healthy and growing companies with positive sales growth tend to exhibit lower default risk, while firms experiencing negative sales growth tend to face increased default risk. Furthermore, firms experiencing a decline in sales growth often exhibit a higher demand for trade credit. This increased demand is driven by the need for additional liquidity and financing when their business operations fail to generate sufficient cash flows. In contrast, the demand for trade credit in firms with positive sales growth can vary. On the one hand, these firms may have improved cash flows that enable them to pay their suppliers in a timely manner due to their growing sales. On the other hand, firms experiencing positive sales growth may engage in expansion plans involving significant new investments, which can be financed by the cash generated from increasing sales growth. As a result, they may still have some demand for trade credit to support their ongoing business activities and capital investments. Standalone firms, when experiencing declining sales growth, exhibit a higher demand for trade credit and, at the same time, have increased default risk. The group suppliers, with both same-group and standalone customers and a target level of total credit exposure, may be more inclined to extend additional credit to the group firms rather than to their standalone customers. If the business groups strategically support their affiliates by extending more trade credit to their customers in need, then we expect that same-group customers will receive greater trade credit when slow-growing customers have the same-group suppliers.

To explore these predicted effects, we follow Petersen and Rajan (1997) by multiplying sales growth by indicators for positive and negative growth. The $SalesGrowth_{Pos}$ ($SalesGrowth_{Neg}$) variable is the sales growth if it is positive (negative), and it takes a zero value if the sales growth is non-positive (non-negative). The main variable of interest in this analysis is the interaction

term of the positive (negative) sales growth rates with an indicator for customers having the same-group suppliers, $I.BG\text{-}BG$ and with the $BG\ Importance$ measure. We follow Masulis et al. (2023) to split the sample based on the country's capital market development as the costs of external equity financing are expected to be notably higher in emerging markets. Table 7 presents the regression results.

We find that group firms experiencing negative sales growth receive higher levels of trade credit when they have same-group suppliers and when their same-group suppliers are more important. Both the interaction of $SalesGrowth_{Neg}$ with $I.BG\text{-}BG$ and with $BG\ Importance$ are positive and significant, indicating that the business groups support affiliates experiencing drops in sales growth by extending more trade credit at a time when their default risk is rising. The effects are robust for the sample of industries, excluding financial and services firms, and for the sample of manufacturing firms only. However, we only observe the effects in emerging capital markets and not in developed capital markets. This is consistent with the evidence of Khanna and Yafeh (2007) that business groups have financing advantages in institutional settings where external financing is more costly.

Next, we consider the cash holdings of focal firms. Firms that face cash shortages typically have higher liquidity needs. In these firms, the demand for trade credit financing from their suppliers is predicted to be higher. At the same time, the relative default risk associated with group firms is higher than standalone firms not experiencing cash shortages. If the business groups strategically support the group affiliates in need of trade credit, then we expect the group firms with less cash to receive more trade credit if they have same-group suppliers. We classify firms with lower cash holdings ($LessCash$) as those whose cash and short-term investments scaled by total assets, $Cash$, are below the median for the corresponding country, industry, and year. We test the level of $^{AP}/_{COGS}$ on the interaction of $LessCash$ and $I.BG\text{-}BG$. Table 8 shows the results. The interaction term is positive and significant, which suggests that when

the focal firm has below-median cash holdings and short-term investments, they are more likely to receive greater trade credit when they have same-group suppliers.

7.4 Trade Credit and Other ICM Mechanisms

Our previous analysis shows that trade credit is one of the important internal capital mechanisms through which business groups reallocate internal funding to affiliates in need. However, it remains unclear to what extent the impacts of extending trade credit differ from those of other previously documented internal capital market (ICM) channels supporting financially weak firms. These channels include intra-group loans, intra-group dividend payments, cross-firm equity investments, among others (e.g. Gopalan et al., 2007, 2014; Buchuk et al., 2014; Almeida et al., 2011, 2015). To further investigate this question, we rely on the measure of $GroupIAF$ used by Masulis et al. (2023) as a proxy for the extent to which the focal group firm may benefit from active intragroup internal capital reallocation by all the other firms collectively in the business group.

This measure relies on the disclosure of the fair value of group firms' investment holdings (both equity and debt) in their affiliated firms (IAF) where they are deemed to have a significant influence, as per International Accounting Standard 28 (IAS 28). $GroupIAF$ calculates the asset-weighted average of the adjusted IAF changes of the other affiliates in the same group for each firm.[12][13] $I.GroupIAF$ indicates a group firm has a positive $GroupIAF$, suggesting that the group firm receives internal capital from other affiliated firms within the same group.

[12]The Investments in Associates and Joint Ventures data are from Worldscope. We adjust the estimated impairment charge as the data only reflects the book value, which can vary due to accounting revaluations. To estimate the yearly change in IAF, the book value of IAF changes is calculated and the estimated impairment charge is added back. We assume they occur at the same rate as impairment charges on the firm's investment assets when specific impairment charges for IAF are unavailable.

[13]The limitation of the IAF measure is its outbound nature, as it indicates the provision of finance by the reported firm. By constructing the $GroupIAF$ measure, we argue that the capital reported and provided by all other affiliated firms within the same group has directly or indirectly reached the focal group firms.

Table 9 reports the results of having same-group supplier(s) and receiving intra-group internal capital on a group firm's trade credit for the sample of business group firms in manufacturing industries. We split the sample into pyramidal group firms (Columns (1) and (2)) and horizontal group firms (Columns (3) and (4)). Our variable of interest is the interaction of $I.GroupIAF$ and $I.BG\text{-}BG$. In pyramidal group firms, we observe a substitution effect between internal capital reallocation received from other channels, represented by $I.GroupIAF$, and trade credit. While pyramidal group firms with same-group suppliers tend to receive more trade credit, this decreases when other forms of internal capital are provided. This substitution effect is not observed in horizontal business groups, which is consistent with prior literature suggesting that internal capital reallocation can offer financing advantages for pyramidal firms.

Furthermore, we distinguish between the firm's position in the controlling pyramidal chain. In Columns (5) and (6), we find that when the group is at the very bottom of the pyramid, as indicated by the *Bottom* indicator, there exists a complementary relationship between trade credit and other forms of ICM mechanisms. This suggests that for financially weaker affiliates(i.e. bottom firms), pyramidal groups provide support through various internal capital channels, while apex and middle firms that are not at the bottom of the organizational structure, receive either extended trade credit or alternative capital investments from the group. This is consistent with the literature that the bottom firms are typically younger, riskier, and more opaque (Masulis et al., 2011) and also consistent with our hypothesis that business groups have incentives to maximize overall group welfare through supporting weaker affiliates.

8 Identification Strategy

8.1 Effects on disaster-affected firms

In previous sections, we show that the group firms with same-group suppliers receive more trade credit. In this section, we investigate how the trade credit received by downstream affiliated firms varies with its needs by utilizing natural disasters as exogenous shocks raising its financing needs. Previous literature shows that operating shocks caused by natural disasters are transmitted along the supply chain network (e.g. Agca et al., 2022; Barrot and Sauvagnat, 2016; Carvalho et al., 2021; Pankratz and Schiller, 2021; Ersahin et al., 2024). Ersahin et al. (2024) argue that disaster affected firms receive more trade credit because their upstream suppliers extend more trade credit to maintain the supplier-customer relationship to ensure continuing product demand and transactions in the future. Business groups are known to have greater economic power in many countries (Morck et al., 2005). If the business group strategically supports their affiliated firms through trade financing while sharing much of the operating risks of their affiliated customers, but not of its standalone trading partners, then we expect group firms with same-group suppliers to receive more trade credit when they are adversely affected by major natural disasters.

We identify major natural disasters as those associated with total monetary damages or a total number of people affected that is in the top decile of the EM-DAT sample. Our disaster impact measures are scaled by country size measures. Specifically, we scale the total estimated damages by the country's prior year's GDP and we scale the total number of people adversely affected by the disaster by last year's population. The country and yearly distribution of the 74 major natural disaster events are reported in Table A.4. Each country has at least one major natural disaster event causing significant damage during our sample period. After we identify

the major disasters, we collect geographical coordinates of the affected areas and locations of these disasters reported in EM-DAT. We rely on Factset data for firm headquarters address locations. Firms whose headquarters is located within 50 (100) kilometers of the affected areas are identified as natural disaster affected in our sample.

We first investigate the impact of natural disasters on the sales growth of firms whose headquarters are located in the affected areas. We regress the sales growth of firms in our sample. Table A.5 presents the results. Columns (1) and (2) show the coefficients of the variable $I.Disaster50$ are both negative and statistically significant. This implies that when a major natural disaster strikes a firm, its sales growth experiences a decline of 2.1 to 2.6 percentage points. When we expand the definition of affected firms to those whose headquarters are located within 100 kilometers of the natural disaster, the drop in a firm's sales growth remains negative and significant. The effect of a drop in sales growth is not only statistically significant, but is also economic significant, given that the mean sales growth is 9.2 percentage points. Overall, the results suggest that a firm's sales growth drops significantly when the firm is located nearby the area affected by a natural disaster.

To examine whether the group firms react differently in terms of their trade financing when they are adversely affected by natural disasters, we estimate the following equation.

$$\begin{aligned} TradeCredit_{i,t} = \beta_0 + \beta_1 DisasterAffected + \beta_2 C\text{-}S\ Classification_{i,t} \\ +\beta_3 DisasterAffected \times C\text{-}S\ Classification_{i,t} + \beta_4 SupplierDisasterAffected \\ +\beta_5 X_{i,t-1} + \lambda_{ind,ctry,t} + \epsilon_{i,t} \end{aligned} \tag{3}$$

where $DisasterAffected$ indicates the firm is located in the affected area of a major disaster. We use two alternative indicators to measure whether a firm is $DisasterAffected$: $I.Disaster50$ represents any firm located within 50 kilometers of the affected disaster area,

and $I.Disaster100$ extend the firm's distance to the affected disaster area to 100 kilometers.[14] $SupplierDisasterAffected$ is the indicator of at least one of the suppliers of the firm is hit by a major natural disaster.[15]

Following Masulis et al. (2023), the "treatment" in our analysis is whether a firm is affiliated with a business group. This is purely based on observational data as there is no experiment that can randomly sorts firms into either affiliated or standalone firms. Our variable of interest is thus the interaction term of $C\text{-}S\ Classification$ and $DisasterAffected$ as we are only interested in the difference in the crisis-induced effects for observed same-group firms and for standalone firms, not for all firms in the population. Throughout the disaster analysis, we focus on the sample of manufacturing firms because the trade credit is mainly relevant to manufacturing industries (Levine et al., 2018; Bougheas et al., 2009; Li et al., 2021).

Table 10 reports the regression results of equation 3. The coefficients on the $I.BG\text{-}BG$ and $I.BG\text{-}NBG$ remains significantly positive, which supports our baseline results that the group firms receive more trade credit and they receive more trade credit when at least one of their suppliers is in the same business group. Furthermore, when a firm is adversely affected by natural disasters, its trade credit measured by the ratio of accounts payable and the cost of goods sold drops. The negative effects are both statistically significant and economically meaningful. When the firm is located in an area hit by a natural disaster, the ratio of accounts payable relative to the cost of goods sold dropped by 4.1 to 5.9 percentage points, which corresponds to 34.9% relative to the sample median (0.169). This is consistent with these firms experiencing higher default risk and lower demand for their good and services, due to some of their customers being adversely affected by the disaster. Our variable of interest is the

[14] In robustness tests, we also use 500 kilometers as the cutoff point to identify affected firms.

[15] Based on the geographical coordinates, the mean value of the disaster affected area is around 420k square kilometers. Note that this is just a crude calculation as the geographical coordinates we identify is just one point (combination of longitude and latitude) of the affected cities/provinces recorded in the database.

interaction between $C\text{-}S\ Classification$ and $DisasterAffected$. The positive and significant coefficients of the interaction of $I.BG\text{-}BG$ and $I.Disaster50$ indicate that the group firms with same-group suppliers receive more trade credit when they are hit by major natural disasters, compared with the standalone firms without same-group suppliers. The effects are robust when we expand the definition of affected areas to identify disaster-hit firms in Columns (3) and (4). Thus, for a group firm hit by a natural disaster, they receive more trade credit if they have same-group suppliers. At the same time, these firms should be experiencing increasing default risk.

Using Capital IQ capital structure data, we also examine the changes in percentage leverage funded by bank loans in firms impacted by disasters. Our results in Table A.6 show that when the area nearby where a firm's headquarters is located is hit by a major disaster, the firm also experiences a loss in bank loans as a percentage of their total debt, as suggested by the negative significant coefficient on *Bank Share*. The results, however, are only statistically significant when we use the within 50km measure as the definition for disaster-affected firms.

8.2 Stacked Difference-in-Differences

To mitigate potential issues associated with a staggered Difference-in-Differences (DiD) approach (Gormley and Matsa, 2011, 2016), we employ a stacked-cohort DiD methodology for more robust testing. Previous studies such as Ersahin et al. (2024); Barrot and Sauvagnat (2016) have indicated that the impact of a disaster on a firm generally persists for approximately one year. Therefore, we adopt a three-year time frame centered around the event year for each cohort in our analysis. We employ country-year cohort, industry-year cohort, and country-industry-year-cohort fixed effects in our specifications. Additionally, to further validate our findings, we conduct a separate stacked-DiD analysis using a five-year window for robustness,

and the results remain both qualitatively and quantitatively consistent with our three-year window results.

Next, we run the stacked-cohort DiD regressions on the time dynamics of the effect of the major natural disaster events on trade credit from 2013-2021 in the manufacturing firms sample. First, we construct a stacked-matched event sample. To ensure that natural disasters have a homogeneous impact on firms located in affected areas, we focus on major events that result in substantial economic damage. The major natural disasters in our sample are those associated with the top 10th percentile of scaled total monetary damages or scaled number of people adversely affected. For each natural disaster year (event) in a country, treated firms that are hit by (located nearby) natural disasters are paired with a group of control firms that are never hit by natural disasters (i.e., never-treated firms) one year prior to and one year after the event year. After forming all the cohorts for treated firms, we stack the cohorts of treated and control firms together to finalize the stacked cohort DiD sample. We then examine whether the group firms having same-group suppliers receive more trade credit when they are hit by natural disasters. We compare the changes in trade credit between disaster-affected and control firms one year before and after the natural disaster. Columns (5) to (8) in Table 10 show that the results are consistent with our prior Diff-in-Diff analysis.

Overall, the disaster analysis implies that business groups support the affiliates by extending more trade credit when an affiliated firm is hit by operating shocks.[16] This result is consistent with Masulis et al. (2023) that family business groups utilize their greater economic power and cash pool in the internal capital markets to acquire more market share after the economic

[16]For suppliers hit by major natural disasters, their customers could be pressured to pre-pay for goods or pay back trade credits early, leading to a reduced level of accounts receivable for the suppliers. From the supplier's perspective, empirical studies typically use accounts receivable scaled by firm sales to measure trade credit extended by the suppliers (e.g. Petersen and Rajan, 1997; Li et al., 2021; Gofman and Wu, 2022). In contrast, the results in Table A.7 imply that customers of disaster-hit firms repay slower. If at least one of the customers is also affected by the natural disaster (negatively significant $I.DisasterHitCust$ dummies), then the suppliers receive the overall payment quicker.

crisis. It provides additional evidence on channels through which the business groups support member firms. We also separately examine whether firms hit by major disasters face reduced trade credit for standalone firms and $I.BG$-BG firms subsamples. However, as shown in Table A.8, in both samples of group affiliated and standalone firms, we do not find evidence of a decrease in trade credit in disaster-affected firms, using both 50 and 100 km proximity to the firm's HQs to define disaster affected firms.

9 Conclusion

Using a comprehensive dataset of customer-supplier relationships of business group firms and standalone firms globally, we analyze the role of internal supply chains within business groups. Our study provides insights into supplier-customer relationships within business groups and their significance relative to the group's overall supplier networks and customer base. We find that a substantial proportion of suppliers and customers of group firms are members of the same business group. The average proportions of same-group suppliers and customers are higher in emerging markets compared to developed markets, suggesting the importance of mitigating market frictions and institutional constraints through business group formation in much greater in developing economies.

Moreover, we observe that a significant percentage of group firms have at least one same-group customer or supplier, with higher proportions found among family business group firms. Our study provides valuable insights into the trade credit dynamics within business groups and their implications for firm financing. We find that supplier-customer relationships within business groups constitute a significant proportion relative to the group's overall supplier networks and customer base. The proportions of same-group suppliers and customers are higher in emerging markets compared to developed markets, indicating the importance of mitigating

market friction through business group affiliation in these markets. This is the first study to provide a comprehensive overview of the internal workings of supply chains inside business groups and across different countries by examining the frequencies of affiliated firms with different roles based on their positions within the internal supply chain. Additionally, we discuss the importance of firm attributes, such as critical (major) suppliers and critical (major) customers, in shaping the dynamics of these supply chain relationships. Overall, our findings shed new light on the operations of business group firms and enhance our understanding of their supply chain networks and the financial stability of business groups.

Throughout our empirical analysis, we show that business groups strategically use trade financing along the supply chain when their affiliated downstream firms are in need of trade credit. Group firms, particularly those with same-group suppliers, are associated with higher trade credit compared to standalone firms. This can be attributed to their lower default risk and better information flow within same-group customer-supplier relationships. Family business group firms, which exhibit centralized control, receive more trade credit and demonstrate the beneficial effects of same-group relationships to a greater extent compared to non-family business group firms. We also provide evidence of higher trade credit for group firms with same-group suppliers when these customers have a higher demand for trade credit (negative sales growth, less cash, and affected by natural disasters), which presumably implies greater credit or default risk. Since trade credit terms are typically the same for all the firm's customers, this implies greater financing subsidies to affiliated customers in financial need. Our study provides novel empirical evidence on a new channel (trade financing) through which business groups support their member firms. This adds to the prior literature which highlights several other financial advantages of business groups, by broadening the scope of mechanisms business groups have at their disposal to support their member firms.

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Table 1: Internal Trading Partners of Business Groups

This table reports business group statistics for each of the 45 countries. *No. of Groups* is the total number of business groups in the sample for each country. *Avg Group Size* is the average number of firms in a business group. % *Int. Supp.* and % *Int. Cust.* report the average proportion of internal suppliers (customers) for each group firm. These percentages are calculated by dividing the number of internal suppliers (customers) by the total number of suppliers (customers) in a given year.

	No. of	Avg	Business Groups		Family Groups		Non-family Groups	
Country	Groups	Group Size	% Int. Supp.	% Int. Cust.	% Int. Supp.	% Int. Cust.	% Int. Supp.	% Int. Cust.
Panel A: Emerging Capital Markets								
Argentina	11	4.31	13.13	5.51	17.56	7.63	6.63	2.41
Brazil	29	3.38	4.06	7.46	2.55	8.19	5.77	6.65
Chile	25	4.23	9.86	6.61	10.84	7.21	5.37	3.88
Colombia	4	4.25	12.10	3.59	12.10	3.59		
Czech Republic	2	6.00	0.00	2.19			0.00	2.19
Hungary	2	3.27	22.59	22.12			22.59	22.12
India	95	4.78	8.24	9.91	6.73	8.58	15.86	16.65
Indonesia	47	5.46	16.53	18.01	14.97	17.36	27.14	22.42
Israel	29	3.01	2.31	4.57	2.08	4.83	6.32	0.00
Malaysia	52	3.57	12.72	13.90	14.23	16.44	9.78	8.94
Mexico	13	3.87	3.88	14.07	4.04	14.61	0.00	0.00
Pakistan	17	3.61	10.67	18.64	17.08	26.19	4.66	11.57
Peru	13	4.11	8.66	4.08	11.34	2.31	5.92	5.88
Philippines	27	4.16	7.46	6.11	6.56	6.10	13.90	6.18
Poland	17	2.68	13.85	14.57	4.88	5.64	28.95	29.61
South Africa	20	3.78	1.56	1.46	0.55	2.91	2.36	0.29
South Korea	109	5.34	12.01	12.84	12.62	13.41	4.56	5.82
Sri Lanka	12	2.23	4.70	5.90	3.13	4.93	7.44	7.59
Taiwan	60	5.14	9.27	11.16	9.41	11.02	8.16	12.23
Thailand	56	4.08	15.47	16.90	14.97	15.79	16.70	19.65
Turkey	29	4.89	24.55	28.08	23.80	25.30	27.88	40.28
Venezuela	1	1.00	0.00	0.00	0.00	0.00		
Average	30	3.96	9.71	10.35	9.47	10.10	11.00	11.22
Panel B: Developed Capital Markets								
Australia	27	4.16	0.24	5.74	0.00	6.25	0.36	5.47
Austria	7	2.63	0.57	2.71	0.00	0.00	0.74	3.58
Belgium	18	3.46	0.67	3.30	0.06	2.03	1.72	5.46
Canada	27	2.61	3.36	4.45	3.79	4.31	1.28	5.16
Denmark	7	1.89	1.15	0.87	0.00	0.00	3.38	2.55
Finland	6	2.32	0.65	0.06	0.00	0.13	1.20	0.00
France	44	4.13	1.34	1.82	1.59	2.92	1.05	0.52
Germany	37	5.66	5.72	6.83	5.10	4.63	6.28	8.78
Greece	10	2.07	26.60	16.86	30.74	18.69	1.16	5.65
Hong Kong	54	3.82	15.49	28.62	16.15	29.78	4.77	9.72
Ireland	1	3.00	0.00	0.00			0.00	0.00
Italy	30	3.14	10.42	11.52	14.32	10.24	3.42	13.80
Japan	160	7.63	8.54	10.66	4.30	6.23	9.05	11.20
Netherlands	9	6.73	4.28	4.48	14.28	15.44	0.29	0.11
New Zealand	1	2.00	0.00	3.66	0.00	3.66		
Norway	17	2.90	7.77	8.69	10.63	10.77	0.17	3.14
Portugal	7	2.54	2.78	4.37	0.00	5.95	3.92	3.72
Singapore	27	2.85	5.43	5.53	8.19	8.85	1.43	0.75
Spain	17	5.40	2.92	5.30	0.58	3.79	4.45	6.29
Sweden	19	4.42	4.41	2.91	2.04	0.26	20.44	20.86
Switzerland	22	4.75	3.82	5.14	5.62	5.08	1.55	5.21
United Kingdom	36	5.37	2.68	6.50	4.78	3.57	0.71	9.25
United States	148	4.23	2.33	3.25	1.70	3.21	2.87	3.28
Average	32	3.81	4.83	6.23	5.63	6.63	3.19	5.66
Average	31	3.89	7.22	8.24	7.46	8.28	6.91	8.31

Table 2: Frequency of the suppliers and customers within business groups

This table reports the role of group-affiliated firms in the sample. *Supplier* is defined as the group affiliated firms with same-group customers in a given year. *Customer* is defined as the group-affiliated firms with same-group suppliers. *Neither* is the group affiliated firms without same-group customers nor same-group suppliers. Panel A reports the number of groups and the average proportion of group firms as *Supplier*, *Customer*, and *Neither* for each group in the sample for four categories of business groups. Panel B separately reports the number of observations and proportions of each category for family groups and non-family groups. Panel C separately presents the number of observations and proportions of suppliers and customers at different levels of control pyramids for group firms in the pyramidal structure.

Panel A: Group Level Statistics

		Proportion of Group Firms (Mean)		
Business Groups	No.of Groups	Supplier %	Customer %	Neither %
Family Pyramid Groups	402	42.80	43.35	43.24
Family Horizontal Groups	354	21.99	21.48	68.89
Non-family Pyramid Groups	98	45.22	40.51	45.49
Non-family Horizontal Groups	236	29.17	30.10	59.43

Panel B: Frequency of suppliers and customers in family vs non-family groups

	Business Group Firms					
	Family Group Firms		Non-family Group Firms		Total	
	No.	Percent.	No.	Percent.	No.	Percent.
Supplier	4,503	37.4%	2,803	35.9%	7,306	36.8%
Customer	4,536	37.7%	2,691	34.5%	7,227	36.4%
Neither	6,009	49.9%	4,184	53.6%	10,193	51.4%

Panel C: Frequency of suppliers and customers within pyramidal groups

	Pyramidal Group Firms							
	Apex Firms		Middle Firms		Bottom Firms		Total	
	No.	Percent.	No.	Percent.	No.	Percent.	No.	Percent.
Supplier	2,073	39.1%	1,064	49.4%	2,158	45.6%	5,295	43.5%
Customer	2,064	38.9%	1,103	51.2%	2,023	42.8%	5,190	42.6%
Neither	2,513	47.4%	799	37.1%	2,031	42.9%	5,343	43.8%

Table 3: Summary Statistics

This table reports summary statistics of the main variables. *BG With Internal Supplier* is the category where the focal firm is a business group-affiliated firm (BG firm) and has group-affiliated supplier(s) within the same business group. *BG Without Internal Supplier* is the category where the focal firm is a BG firm and does not have any supplier within the same business group (i.e., all of its suppliers are standalone firms or affiliated with other business groups). *SA With BG Supplier* is the category where the focal firm is a standalone firm and has group-affiliated supplier(s). *SA Without BG Supplier* is the category where the focal firm is a standalone firm and does not have any group-affiliated supplier. $BG\ Importance_{supplier}$ measures the relative importance of the business group supplier(s) to the focal firm. For a focal firm as a customer, this measure is calculated as the proportion of the total sales in USD of its within-same-group supplier(s) to the total sales in USD of all of its suppliers. By definition, the measure is only positive when the firm belongs to *BG With Internal Supplier* category. Detailed description of other variables are listed in A.1.

	mean	p25	p50	p75	sd
BG With Internal Supplier					
AP/COGS	0.257	0.106	0.163	0.253	0.543
AP/Sales	0.147	0.073	0.111	0.165	0.222
Size	21.810	20.241	21.815	23.366	2.031
Age	3.225	2.996	3.296	3.526	0.472
Sales Growth	0.060	-0.043	0.033	0.124	0.290
Leverage	0.273	0.126	0.264	0.387	0.191
Cash	0.128	0.052	0.099	0.173	0.109
Tangibility	0.336	0.179	0.312	0.471	0.198
BG Importance	0.565	0.383	0.608	0.821	0.253
BG Without Internal Supplier					
AP/COGS	0.287	0.120	0.188	0.283	0.589
AP/Sales	0.159	0.077	0.118	0.174	0.273
Size	22.104	20.338	22.151	23.929	2.315
Age	3.265	2.996	3.332	3.638	0.483
Sales Growth	0.052	-0.048	0.029	0.112	0.292
Leverage	0.286	0.159	0.278	0.396	0.182
Cash	0.133	0.056	0.104	0.174	0.116
Tangibility	0.302	0.136	0.268	0.429	0.204
BG Importance	0.000	0.000	0.000	0.000	0.000
SA With BG Supplier					
AP/COGS	0.295	0.101	0.162	0.254	0.723
AP/Sales	0.155	0.060	0.098	0.153	0.355
Size	20.855	19.421	20.776	22.260	2.063
Age	2.865	2.398	3.045	3.434	0.790
Sales Growth	0.087	-0.045	0.040	0.139	0.389
Leverage	0.262	0.101	0.243	0.382	0.201
Cash	0.157	0.048	0.111	0.213	0.154
Tangibility	0.301	0.114	0.245	0.444	0.229
BG Importance	0.000	0.000	0.000	0.000	0.000
SA Without BG Supplier					
AP/COGS	0.368	0.105	0.168	0.274	0.928
AP/Sales	0.218	0.062	0.102	0.166	0.561
Size	20.349	18.671	20.141	21.982	2.394
Age	2.794	2.398	2.996	3.367	0.838
Sales Growth	0.118	-0.050	0.044	0.161	0.497
Leverage	0.259	0.093	0.234	0.376	0.209
Cash	0.160	0.045	0.109	0.215	0.163
Tangibility	0.298	0.105	0.238	0.442	0.237
BG Importance	0.000	0.000	0.000	0.000	0.000
Total					
AP/COGS	0.321	0.106	0.169	0.267	0.786
AP/Sales	0.181	0.064	0.104	0.163	0.436
Size	20.915	19.253	20.793	22.579	2.333
Age	2.925	2.565	3.091	3.466	0.774
Sales Growth	0.092	-0.047	0.039	0.140	0.419
Leverage	0.265	0.108	0.247	0.382	0.201
Cash	0.153	0.049	0.108	0.204	0.150
Tangibility	0.302	0.116	0.252	0.443	0.227
BG Importance	0.028	0.000	0.000	0.000	0.135
Observations	112177				

Table 4: Comparison between Actual vs "Pseudo" Group Firms Forming Same-group Supply Chain Relationships

The table reports the probability of a group firm to form a same-group customer-supplier relationship. The sample is composed of actual group firms and "pseudo group" firms. We create a "pseudo" group for each corresponding group by forming a group of standalone firms that are in the same country and 2-digit SIC industry, and share otherwise similar firm-level observables (size, age, sales growth, leverage, cash, and tangibility) as each of the group firms. *Actual Group* is an indicator variable that equals one for actual group firms, and zero otherwise. The dependent variables are *I.BG-BG*, which indicates group firms with same-group supplier/customer, and BG_Sup (BG_Cus), which measures the relative importance of the group supplier(s)/customer(s) to the focal firm. Detailed variable description are in appendix A.1. Panel A (B) presents the probability of actual and matched "pseudo" group firms having suppliers (customers) from the same group and the corresponding importance measure attached to these same-group suppliers (customers). Standard errors are corrected for clustering of observations at the firm level, and associated t-statistics are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A: Same-group Suppliers

Dep. Var. =	I.BG-BG		BG_Sup		I.BG-BG		BG_Sup	
	All Industry				Manufacturing			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Actual Group	0.247***	0.246***	0.135***	0.133***	0.271***	0.271***	0.152***	0.151***
	(29.68)	(29.57)	(27.48)	(27.42)	(24.39)	(24.22)	(22.63)	(22.66)
Size	0.019***	0.016***	0.007***	0.005***	0.021***	0.019***	0.008***	0.006***
	(6.08)	(6.07)	(3.63)	(3.40)	(5.31)	(5.27)	(3.34)	(3.07)
$Sales\ Growth_{Pos}$	-0.002	-0.002	-0.003	-0.004	-0.003	0.005	-0.006	-0.003
	(-0.24)	(-0.23)	(-0.53)	(-0.75)	(-0.20)	(0.34)	(-0.67)	(-0.34)
$Sales\ Growth_{Neg}$	0.044*	0.032	0.019	0.017	0.085**	0.083***	0.055***	0.052***
	(1.84)	(1.52)	(1.27)	(1.33)	(2.43)	(2.61)	(2.63)	(2.74)
Age	-0.020**	-0.020**	-0.013**	-0.010**	-0.022*	-0.026**	-0.015*	-0.015**
	(-2.03)	(-2.30)	(-2.20)	(-2.09)	(-1.68)	(-2.16)	(-1.86)	(-2.20)
Tangibility	0.017	0.038	0.010	0.018	0.015	0.022	0.024	0.026
	(0.48)	(1.29)	(0.47)	(1.08)	(0.29)	(0.49)	(0.79)	(0.97)
Leverage	-0.129***	-0.088***	-0.090***	-0.078***	-0.165***	-0.116***	-0.114***	-0.106***
	(-4.04)	(-3.24)	(-4.63)	(-4.91)	(-4.03)	(-3.15)	(-4.76)	(-5.03)
Cash	-0.004	-0.040	-0.002	-0.032	0.005	-0.022	0.015	-0.020
	(-0.10)	(-1.03)	(-0.09)	(-1.40)	(0.08)	(-0.45)	(0.46)	(-0.65)
Country-Industry-Year FE	Y		Y		Y		Y	
Country-Year FE		Y		Y		Y		Y
Industry-Year FE		Y		Y		Y		Y
Obs.	38,355	38,396	36,747	36,834	22,861	22,876	21,794	21,825

Table 4: Comparison between Actual vs "Pseudo" Group Firms Forming Same-group Supply Chain Relationships

The table reports the probability of a group firm to form a same-group customer-supplier relationship. The sample is composed of actual group firms and "pseudo group" firms. We create a "pseudo" group for each corresponding group by forming a group of standalone firms that are in the same country and 2-digit SIC industry, and share otherwise similar firm-level observables (size, age, sales growth, leverage, cash, and tangibility) as each of the group firms. *Actual Group* is an indicator variable that equals one for actual group firms, and zero otherwise. The dependent variables are $I.BG\text{-}BG$, which indicates group firms with same-group supplier/customer, and BG_Sup (BG_Cus), which measures the relative importance of the group supplier(s)/customer(s) to the focal firm. Detailed variable description are in appendix A.1. Panel A (B) presents the probability of actual and matched "pseudo" group firms having suppliers (customers) from the same group and the corresponding importance measure attached to these same-group suppliers (customers). Standard errors are corrected for clustering of observations at the firm level, and associated t-statistics are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Panel B: Same-group Customers

Dep. Var. =	I.BG-BG		BG_Cus		I.BG-BG		BG_Cus	
	All Industry				Manufacturing			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Actual Group	0.308***	0.305***	0.204***	0.201***	0.323***	0.321***	0.213***	0.213***
	(28.51)	(29.21)	(26.89)	(27.90)	(24.30)	(24.60)	(22.57)	(23.15)
Size	0.038***	0.035***	0.011***	0.009***	0.039***	0.038***	0.011***	0.010***
	(9.12)	(9.47)	(4.02)	(3.99)	(7.54)	(7.91)	(3.19)	(3.29)
$Sales\ Growth_{Pos}$	-0.010	-0.007	-0.013	-0.004	0.012	0.016	0.000	0.006
	(-0.67)	(-0.52)	(-1.28)	(-0.37)	(0.59)	(0.82)	(0.02)	(0.39)
$Sales\ Growth_{Neg}$	0.055	0.031	0.084***	0.056***	0.021	-0.007	0.062**	0.044*
	(1.55)	(1.04)	(3.74)	(2.99)	(0.45)	(-0.17)	(2.09)	(1.71)
Age	-0.031**	-0.023**	-0.023***	-0.013*	-0.029*	-0.019	-0.014	-0.008
	(-2.40)	(-2.05)	(-2.61)	(-1.80)	(-1.85)	(-1.33)	(-1.32)	(-0.89)
Tangibility	-0.001	-0.028	-0.048	-0.041*	0.035	0.018	0.009	0.012
	(-0.03)	(-0.75)	(-1.51)	(-1.69)	(0.55)	(0.32)	(0.20)	(0.32)
Leverage	-0.150***	-0.133***	-0.070**	-0.068***	-0.215***	-0.208***	-0.110***	-0.118***
	(-3.76)	(-3.90)	(-2.54)	(-2.97)	(-4.37)	(-4.78)	(-3.35)	(-4.13)
Cash	-0.052	-0.085*	-0.006	-0.027	-0.135**	-0.147**	-0.029	-0.050
	(-0.90)	(-1.70)	(-0.14)	(-0.78)	(-2.01)	(-2.44)	(-0.64)	(-1.24)
Country-Industry-Year FE	Y		Y		Y		Y	
Country-Year FE		Y		Y		Y		Y
Industry-Year FE		Y		Y		Y		Y
Obs.	24,563	25,256	23,405	24,145	15,860	16,085	15,146	15,380

Table 5: Same-group Supplier and Trade Credit (AP/COGS)

This table presents results on the effect of having a BG supplier on a firm's trade credit from 2013–2021. The dependent variable, trade credit, is measured by accounts payable divided by the cost of goods sold. *I.BG-BG*, *I.BG-NBG*, and *I.SA-BG* are dummy variables that represent group firms with internal supplier(s), without internal supplier(s), and standalone firms with group supplier(s), respectively. *BG Importance* measures the relative importance of the business group supplier(s) to the focal firm. Detailed variable descriptions are in appendix A.1. Columns (1) to (4) present baseline results for firms in industries excluding finance (SIC 6000-6999) and service (SIC 7000-8999) and Columns (5) to (8) present baseline results for firms in manufacturing industries only (SIC 2000-3999). Country-Industry-Year Fixed effects are included in Columns (1), (3), (5), and (7), and Industry-Year and Country-Year fixed effects are included in Columns (2), (4), (6), and (8). Standard errors are corrected for clustering of observations at the firm level, and associated t-statistics are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Trade Credit = AP/COGS	All Industry				Manufacturing			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
I.BG-BG	0.031*	0.031*			0.059***	0.056***		
	(1.82)	(1.82)			(4.97)	(4.98)		
I.BG-NBG	0.011	0.011			0.029**	0.029***		
	(0.85)	(0.88)			(2.57)	(2.73)		
I.SA-BG	-0.017*	-0.022**			0.004	-0.002		
	(-1.81)	(-2.38)			(0.33)	(-0.22)		
Size	-0.032***	-0.031***	-0.032***	-0.031***	-0.030***	-0.029***	-0.029***	-0.028***
	(-9.99)	(-10.78)	(-9.98)	(-10.79)	(-7.74)	(-8.11)	(-7.61)	(-7.97)
Sales Growth$_{Pos}$	0.281***	0.281***	0.280***	0.281***	0.338***	0.342***	0.334***	0.338***
	(15.13)	(15.93)	(15.10)	(15.93)	(12.61)	(13.24)	(12.49)	(13.14)
Sales Growth$_{Neg}$	-1.334***	-1.321***	-1.337***	-1.327***	-1.403***	-1.392***	-1.407***	-1.396***
	(-21.88)	(-23.35)	(-21.81)	(-23.27)	(-17.07)	(-17.81)	(-17.00)	(-17.71)
Age	0.013**	0.015***	0.015**	0.017***	0.005	0.009	0.007	0.011
	(2.18)	(2.68)	(2.43)	(3.00)	(0.67)	(1.28)	(0.95)	(1.62)
Tangibility	0.010	-0.048	0.008	-0.049	-0.055	-0.055*	-0.060	-0.059*
	(0.27)	(-1.40)	(0.21)	(-1.42)	(-1.49)	(-1.69)	(-1.62)	(-1.80)
Leverage	0.317***	0.320***	0.319***	0.325***	0.366***	0.385***	0.370***	0.391***
	(8.61)	(9.21)	(8.55)	(9.23)	(7.81)	(8.67)	(7.77)	(8.65)
Cash	0.464***	0.466***	0.468***	0.470***	0.641***	0.666***	0.650***	0.675***
	(7.92)	(7.71)	(7.89)	(7.70)	(8.80)	(9.44)	(8.83)	(9.48)
BG Importance			0.052*	0.062**			0.070***	0.074***
			(1.88)	(2.12)			(5.12)	(5.29)
Country-Industry-Year FE	Y		Y		Y		Y	
Country-Year FE		Y		Y		Y		Y
Industry-Year FE		Y		Y		Y		Y
Obs.	112,177	115,209	110,421	113,478	64,548	65,857	63,443	64,756

Table 6: Group and Matched Standalone Customer Firms of Group Suppliers

This table presents the results on the matched sample consists of business group firms with same-group suppliers, and standalone firms with business group suppliers whose customers include same-group firms. $I.BG$ takes the value of one when it is a BG firm with same-group supplier, and takes the value of zero when it is a standalone firm with group-affiliated suppliers who have same-group customer. The matched control firms are drawn from all these standalone firms in the same country and 2-digit SIC industry in the same year, and are the nearest neighbor match based on the following covariates: $Size$, $SalesGrowth$, Age, $Tangibility$, $Leverage$, and $Cash$. Figure 2 illustrates our empirical setting under this analysis. The dependent variable, trade credit, is measured by accounts payable divided by the cost of goods sold. $I.FamBG$, and $I.NonfamBG$ are dummy variables represent family and non-family group firms with internal suppliers. Detailed variable description are in appendix A.1. Columns (1) to (4) present results for firms in industries excluding finance (SIC 6000-6999) and service (SIC 7000-8999) and Column (5) to (8) present baseline results for firms in manufacturing industries only (SIC 2000-3999). Country-Industry-Year Fixed effects are included in Columns (1), (3), (5), and (7), and Industry-Year and Country-Year fixed effects are included in Columns (2), (4), (6), and (8). Standard errors are corrected for clustering of observations at the firm level, and associated t-statistics are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Trade Credit = AP/COGS	All Industry				Manufacturing			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
I.BG	0.022	0.017			0.021***	0.021**		
	(1.08)	(0.83)			(2.64)	(2.34)		
I.FamBG			0.043*	0.037			0.033***	0.028**
			(1.86)	(1.49)			(3.36)	(2.51)
I.NonfamBG			-0.010	-0.014			0.001	0.010
			(-0.35)	(-0.50)			(0.13)	(0.93)
Size	-0.017	-0.012	-0.017	-0.012	-0.011**	-0.009*	-0.011**	-0.009*
	(-1.45)	(-1.12)	(-1.45)	(-1.11)	(-2.54)	(-1.90)	(-2.55)	(-1.90)
Sales Growth	0.007	0.013	0.007	0.012	0.113	0.110	0.112	0.110
	(0.11)	(0.19)	(0.10)	(0.17)	(1.36)	(1.22)	(1.35)	(1.22)
Age	-0.034*	-0.030	-0.036**	-0.031	0.010	0.000	0.009	0.000
	(-1.84)	(-1.40)	(-1.99)	(-1.48)	(1.11)	(0.05)	(1.02)	(0.01)
Tangibility	-0.155	-0.168	-0.149	-0.166	-0.101**	-0.095***	-0.099**	-0.095***
	(-1.21)	(-1.31)	(-1.17)	(-1.30)	(-2.39)	(-2.63)	(-2.34)	(-2.64)
Leverage	0.220	0.159	0.214	0.152	0.168***	0.147***	0.166***	0.145***
	(1.47)	(1.18)	(1.44)	(1.13)	(3.36)	(2.80)	(3.34)	(2.79)
Cash	0.013	0.050	0.010	0.047	0.014	0.076	0.014	0.076
	(0.13)	(0.53)	(0.10)	(0.49)	(0.15)	(0.83)	(0.15)	(0.83)
Country-Industry-Year FE	Y		Y		Y		Y	
Country-Year FE		Y		Y		Y		Y
Industry-Year FE		Y		Y		Y		Y
Obs.	11,756	11,775	11,756	11,775	7,694	7,710	7,694	7,710

Table 7: Negative Sales Growth BG Firms and Same-group Supplier in Emerging and Developed Markets

This table presents results on the effect of having a BG supplier on a firm's trade credit from 2013–2021. The dependent variable, trade credit, is measured by accounts payable divided by the cost of goods sold. *I.BG-BG*, *I.BG-NBG*, and *I.SA-BG* are dummy variables that represent group firms with internal supplier(s), without internal supplier(s), and standalone firms with group supplier(s), respectively. $BG\ Importance_{supplier}$ measures the relative importance of the business group supplier(s) to the focal firm. Detailed variable descriptions are in appendix A.1. Columns (1) to (4) present baseline results for firms in industries excluding finance (SIC 6000-6999) and service (SIC 7000-8999) and Columns (5) to (8) present baseline results for firms in manufacturing industries only (SIC 2000-3999). Country-Industry-Year Fixed effects are included in Columns (1), (3), (5), and (7), and Industry-Year and Country-Year fixed effects are included in Columns (2), (4), (6), and (8). Standard errors are corrected for clustering of observations at the firm level, and associated t-statistics are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A: Emerging Markets

Trade Credit = AP/COGS	All Industry				Manufacturing			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sales Growth$_{Pos}$	-0.057	-0.064*	-0.008	-0.010	-0.069*	-0.072**	-0.019	-0.022
	(-1.46)	(-1.71)	(-0.37)	(-0.48)	(-1.90)	(-1.99)	(-0.88)	(-1.09)
Sales Growth$_{Neg}$	-0.877***	-0.810***	-0.826***	-0.817***	-0.627***	-0.580***	-0.581***	-0.562***
	(-6.02)	(-5.68)	(-9.39)	(-9.84)	(-3.90)	(-3.82)	(-5.53)	(-5.78)
I.BG-BG	-0.034*	-0.039**			-0.015	-0.011		
	(-1.75)	(-2.20)			(-0.89)	(-0.69)		
I.SA-BG	0.012	0.005			-0.002	-0.005		
	(0.65)	(0.26)			(-0.10)	(-0.31)		
SalesGrowth_Pos × *I.BG-BG*	0.068	0.074			0.068	0.080*		
	(1.47)	(1.61)			(1.45)	(1.69)		
SalesGrowth_Pos × *I.BG-NBG*	0.047	0.049			0.025	0.022		
	(0.82)	(0.80)			(0.48)	(0.44)		
SalesGrowth_Pos × *I.SA-BG*	0.124**	0.128**			0.140**	0.136**		
	(2.25)	(2.42)			(2.28)	(2.30)		
SalesGrowth_Neg × *I.BG-BG*	0.501**	0.424**			0.466***	0.382**		
	(2.24)	(2.07)			(2.69)	(2.35)		
SalesGrowth_Neg × *I.BG-NBG*	0.368*	0.127			0.376	0.233		
	(1.85)	(0.60)			(1.61)	(0.98)		
SalesGrowth_Neg × *I.SA-BG*	-0.044	-0.093			-0.060	-0.073		
	(-0.23)	(-0.50)			(-0.25)	(-0.33)		
BG Importance			0.002	-0.015			0.015	0.016
			(0.07)	(-0.62)			(0.61)	(0.76)
SalesGrowth_Pos × *BG Importance*			-0.006	-0.003			-0.030	-0.027
			(-0.10)	(-0.06)			(-0.55)	(-0.57)
SalesGrowth_Neg × *BG Importance*			0.751*	0.679*			0.712***	0.627***
			(1.95)	(1.87)			(4.42)	(4.43)
Firm Controls	Y	Y	Y	Y	Y	Y	Y	Y
Country-Industry-Year FE	Y		Y		Y		Y	
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y
Industry-Year FE		Y		Y		Y		Y
Country-Year FE		Y		Y		Y		Y
Obs.	35,221	36,566	33,967	35,336	22,362	23,007	21,571	22,215

Table 7: Negative Sales Growth BG Firms and Same-group Supplier in Emerging and Developed Markets

This table presents results on the effect of having a BG supplier on a firm's trade credit from 2013–2021. The dependent variable, trade credit, is measured by accounts payable divided by the cost of goods sold. *I.BG-BG*, *I.BG-NBG*, and *I.SA-BG* are dummy variables represent group firms with internal supplier, without internal supplier, and standalone firms with group supplier, respectively. $BG\ Importance_{supplier}$ measures the relative importance of the business group supplier(s) to the focal firm. Detailed variable description are in appendix A.1. Columns (1) to (4) present baseline results for firms in industries excluding finance (SIC 6000-6999) and service (SIC 7000-8999) and Column (5) to (8) present baseline results for firms in manufacturing industries only (SIC 2000-3999). Country-Industry-Year Fixed effects are included in Columns (1), (3), (5), and (7), and Industry-Year and Country-Year fixed effects are included in Columns (2), (4), (6), and (8). Standard errors are corrected for clustering of observations at the firm level, and associated t-statistics are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Panel B: Developed Markets

Trade Credit = AP/COGS	All Industry				Manufacturing			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sales Growth$_{Pos}$	0.001	0.006	0.005	0.006	-0.067*	-0.051	-0.028	-0.021
	(0.03)	(0.27)	(0.25)	(0.34)	(-1.65)	(-1.33)	(-0.86)	(-0.68)
Sales Growth$_{Neg}$	-0.529***	-0.545***	-0.519***	-0.525***	-0.571***	-0.628***	-0.560***	-0.579***
	(-7.08)	(-7.69)	(-9.69)	(-10.66)	(-4.88)	(-5.60)	(-7.04)	(-7.76)
I.BG-BG	-0.023	-0.020			-0.043	-0.039		
	(-0.86)	(-0.79)			(-1.41)	(-1.37)		
I.SA-BG	-0.013	-0.014			-0.032	-0.024		
	(-0.76)	(-0.89)			(-1.26)	(-0.95)		
SalesGrowth_Pos × *I.BG-BG*	0.165	0.112			0.478*	0.358		
	(1.19)	(0.86)			(1.88)	(1.42)		
SalesGrowth_Pos × *I.BG-NBG*	0.049	0.025			0.338	0.284		
	(0.56)	(0.32)			(1.42)	(1.26)		
SalesGrowth_Pos × *I.SA-BG*	0.004	-0.004			0.064	0.050		
	(0.10)	(-0.12)			(1.10)	(0.88)		
SalesGrowth_Neg × *I.BG-BG*	-0.113	-0.079			-0.440	-0.245		
	(-0.66)	(-0.50)			(-1.45)	(-0.82)		
SalesGrowth_Neg × *I.BG-NBG*	0.175	0.179			0.228*	0.311**		
	(1.18)	(1.38)			(1.66)	(2.47)		
SalesGrowth_Neg × *I.SA-BG*	-0.012	0.012			0.004	0.076		
	(-0.12)	(0.13)			(0.03)	(0.48)		
BG Importance			0.023	0.010			-0.023	-0.028
			(0.69)	(0.36)			(-0.57)	(-0.80)
SalesGrowth_Pos × *BG Importance*			0.100	0.069			0.439	0.267
			(0.59)	(0.48)			(1.13)	(0.73)
SalesGrowth_Neg × *BG Importance*			0.253	0.250			0.123	0.376
			(1.20)	(1.53)			(0.45)	(1.45)
Firm Controls	Y	Y	Y	Y	Y	Y	Y	Y
Country-Industry-Year FE	Y		Y		Y		Y	
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y
Industry-Year FE		Y		Y		Y		Y
Country-Year FE		Y		Y		Y		Y
Obs.	75,108	77,014	74,602	76,505	41,184	41,985	40,857	41,661

Table 8: Less Cash BG Firms and Same-group Supplier

This table presents results on the effect of having a BG supplier on a firm's trade credit from 2013–2021. The dependent variable, trade credit, is measured by accounts payable divided by the cost of goods sold. *I.BG-BG*, *I.BG-NBG*, and *I.SA-BG* are dummy variables that represent group firms with internal supplier(s), without internal supplier(s), and standalone firms with group supplier(s), respectively. *BG Importance* measures the relative importance of the business group supplier(s) to the focal firm. Detailed variable descriptions are in appendix A.1. Columns (1) to (4) present baseline results for firms in industries excluding finance (SIC 6000-6999) and service (SIC 7000-8999) and Columns (5) to (8) present baseline results for firms in manufacturing industries only (SIC 2000-3999). Country-Industry-Year Fixed effects are included in Columns (1), (3), (5), and (7), and Industry-Year and Country-Year fixed effects are included in Columns (2), (4), (6), and (8). Standard errors are corrected for clustering of observations at the firm level, and associated t-statistics are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Trade Credit = $^{AP}/_{COGS}$	All Industry				Manufacturing			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
LessCash × *I.BG-BG*	0.051**	0.045*			0.091***	0.069***		
	(2.53)	(1.95)			(4.66)	(3.81)		
LessCash × *I.BG-NBG*	0.048***	0.022			0.037*	0.024		
	(2.77)	(1.32)			(1.93)	(1.38)		
LessCash × *I.SA-BG*	0.006	0.001			-0.005	-0.011		
	(0.34)	(0.03)			(-0.26)	(-0.59)		
LessCash × *BG Importance*			0.050*	0.064*			0.096***	0.083***
			(1.65)	(1.71)			(4.25)	(3.69)
I.BG-BG	0.010	0.017			0.022	0.032**		
	(0.56)	(0.81)			(1.50)	(2.38)		
I.BG-NBG	-0.009	0.007			0.014	0.023		
	(-0.54)	(0.48)			(0.94)	(1.63)		
I.SA-BG	-0.017	-0.018			0.011	0.008		
	(-1.31)	(-1.49)			(0.67)	(0.52)		
BG Importance			0.032	0.036			0.031*	0.043**
			(1.16)	(1.04)			(1.82)	(2.41)
LessCash	-0.040***	-0.024*	-0.029***	-0.020***	-0.069***	-0.058***	-0.064***	-0.058***
	(-3.17)	(-1.95)	(-3.76)	(-2.68)	(-4.67)	(-4.24)	(-7.13)	(-6.87)
Size	-0.037***	-0.036***	-0.037***	-0.036***	-0.037***	-0.036***	-0.036***	-0.035***
	(-11.32)	(-12.18)	(-11.36)	(-12.22)	(-9.24)	(-9.73)	(-9.18)	(-9.63)
Sales Growth$_{Pos}$	0.298***	0.299***	0.297***	0.300***	0.372***	0.380***	0.370***	0.378***
	(15.73)	(16.57)	(15.70)	(16.58)	(13.37)	(14.02)	(13.26)	(13.92)
Sales Growth$_{Neg}$	-1.357***	-1.347***	-1.359***	-1.353***	-1.456***	-1.449***	-1.461***	-1.455***
	(-22.17)	(-23.74)	(-22.09)	(-23.67)	(-17.46)	(-18.18)	(-17.40)	(-18.09)
Age	0.007	0.009	0.009	0.011*	-0.006	-0.004	-0.004	-0.001
	(1.14)	(1.51)	(1.40)	(1.90)	(-0.82)	(-0.52)	(-0.57)	(-0.19)
Tangibility	-0.078**	-0.138***	-0.083**	-0.141***	-0.193***	-0.196***	-0.202***	-0.204***
	(-2.12)	(-4.01)	(-2.21)	(-4.05)	(-5.27)	(-5.90)	(-5.46)	(-6.07)
Leverage	0.256***	0.252***	0.255***	0.256***	0.277***	0.285***	0.278***	0.287***
	(7.15)	(7.64)	(7.05)	(7.65)	(6.10)	(6.68)	(6.02)	(6.61)
Country-Industry-Year FE	Y		Y		Y		Y	
Country-Year FE		Y		Y		Y		Y
Industry-Year FE		Y		Y		Y		Y
Obs.	112,177	115,209	110,421	113,478	64,548	65,857	63,443	64,756

Table 9: Trade Credit and Other ICM Mechanisms

This table reports the effect of having same-group supplier(s) and receiving intragroup internal capital on a group firm's trade credit from 2013–2021. The dependent variable, trade credit, is measured by accounts payable divided by the cost of goods sold. *I.BG-BG* represents group firms with same-group suppliers. The omitted dummy variable is *I.BG-NBG*, which represents group firms without same-group suppliers. *I.GroupIAF* is an indicator of the group firm receiving positive *GroupIAF*. *Bottom* indicates the firm is located in the lowest level in a pyramidal group. Detailed variable descriptions are in Appendix A.1. The sample consists of business group firms in manufacturing industries only (SIC 2000-3999). Standard errors are corrected for clustering of observations at the firm level, and associated t-statistics are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Trade Credit = AP/COGS	Pyramidal		Horizontal		Pyramidal	
	(1)	(2)	(3)	(4)	(5)	(6)
I.BG-BG × *I.GroupIAF*	-0.026*	-0.028*	0.015	0.012	-0.050**	-0.057***
	(-1.68)	(-1.77)	(0.50)	(0.53)	(-2.55)	(-2.77)
I.BG-BG	0.026	0.029*	-0.023	-0.024	0.045**	0.050**
	(1.64)	(1.84)	(-1.17)	(-1.41)	(2.21)	(2.34)
I.GroupIAF	0.021*	0.022**	-0.006	-0.004	0.016	0.022**
	(1.69)	(2.17)	(-0.14)	(-0.17)	(1.14)	(1.97)
I.BG-BG × *I.GroupIAF* × *Bottom*					0.076**	0.090**
					(1.99)	(2.51)
I.BG-BG × *Bottom*					-0.059*	-0.063**
					(-1.87)	(-2.05)
I.GroupIAF × *Bottom*					0.010	-0.008
					(0.37)	(-0.35)
Bottom					-0.024	-0.022
					(-1.14)	(-1.13)
Size	0.002	0.002	-0.018	-0.013	0.000	-0.000
	(0.54)	(0.56)	(-1.30)	(-1.14)	(0.09)	(-0.06)
Sales Growth$_{Pos}$	0.482***	0.441***	0.159	0.139	0.481***	0.440***
	(3.63)	(3.36)	(1.25)	(1.15)	(3.63)	(3.36)
Sales Growth$_{Neg}$	-0.675***	-0.606***	-0.902**	-0.803**	-0.675***	-0.606***
	(-4.06)	(-3.98)	(-2.07)	(-2.15)	(-4.09)	(-4.00)
Age	-0.012	-0.009	-0.146*	-0.114	-0.013	-0.011
	(-0.70)	(-0.70)	(-1.67)	(-1.41)	(-0.81)	(-0.88)
Tangibility	-0.092	-0.094**	-0.236	-0.240**	-0.079	-0.084*
	(-1.51)	(-2.05)	(-1.57)	(-2.38)	(-1.27)	(-1.80)
Leverage	0.136***	0.135***	0.309**	0.295**	0.135***	0.134***
	(2.74)	(2.93)	(2.40)	(2.54)	(2.72)	(2.92)
Cash	0.167	0.126	0.524	0.380	0.178*	0.135
	(1.60)	(1.33)	(1.43)	(1.28)	(1.70)	(1.42)
Country-Industry-Year FE	✓		✓		✓	
Country-Year FE		✓		✓		✓
Industry-Year FE		✓		✓		✓
Obs.	8,664	9,350	4,002	4,482	8,664	9,350

Table 10: Group Firms and the Impact of Major Natural Disasters

This table presents results on the effect of having a BG supplier on a firm's trade credit when the focal firm gets hit by natural disasters. The dependent variable, trade credit, is measured by accounts payable divided by the cost of goods sold. $I.Disaster50$ ($I.Disaster100$) is a dummy indicates that the firm is located within 50(100)km of the disaster-affected area. $I.BG\text{-}BG$, $I.BG\text{-}NBG$, and $I.SA\text{-}BG$ are dummy variables represent group firms with internal supplier(s), without internal supplier(s), and standalone firms with group supplier(s), respectively. *BG Importance* measures the relative importance of the business group supplier(s) to the focal firm. Detailed variable descriptions are in appendix A.1. The sample includes firms in manufacturing industries only (SIC 2000-3999). Columns (1) to (4) present results from Diff-In-Diff regressions, and Columns (5) to (8) present results from stacked Diff-In-Diff regressions with a three-year window ($[t-1,\ t+1]$). Standard errors are corrected for clustering of observations at the firm level, and associated t-statistics are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Trade Credit = AP/COGS	DID				Stacked DID			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$I.Disaster50 \times I.BG\text{-}BG$	0.078**	0.076**			0.087**	0.088**		
	(1.99)	(2.16)			(2.06)	(2.29)		
$I.Disaster50 \times I.BG\text{-}NBG$	0.024	0.022			0.029	0.028		
	(0.86)	(0.85)			(0.95)	(1.03)		
$I.Disaster50 \times I.SA\text{-}BG$	0.058*	0.047			0.058*	0.050*		
	(1.85)	(1.59)			(1.83)	(1.68)		
$I.Disaster100 \times I.BG\text{-}BG$			0.067**	0.068**			0.077**	0.079**
			(1.97)	(2.20)			(2.06)	(2.31)
$I.Disaster100 \times I.BG\text{-}NBG$			0.037	0.029			0.039	0.030
			(1.42)	(1.25)			(1.40)	(1.19)
$I.Disaster100 \times I.SA\text{-}BG$			0.060*	0.052*			0.062**	0.057*
			(1.94)	(1.77)			(1.99)	(1.93)
$I.BG\text{-}BG$	0.058***	0.053***	0.057***	0.053***	0.047***	0.042***	0.047***	0.043***
	(4.80)	(4.67)	(4.77)	(4.66)	(3.82)	(3.63)	(3.74)	(3.60)
$I.BG\text{-}NBG$	0.027**	0.027**	0.026**	0.027**	0.028**	0.030**	0.030**	0.032***
	(2.30)	(2.52)	(2.22)	(2.47)	(2.10)	(2.42)	(2.15)	(2.58)
$I.SA\text{-}BG$	0.003	-0.002	0.003	-0.003	0.004	-0.003	0.004	-0.003
	(0.30)	(-0.23)	(0.23)	(-0.29)	(0.34)	(-0.24)	(0.31)	(-0.26)
$I.Disaster50$	-0.054**	-0.041*			-0.046*	-0.036		
	(-2.02)	(-1.68)			(-1.66)	(-1.40)		
$I.DisasterHitSupp50$	0.017*	0.020**			0.015	0.017*		
	(1.83)	(2.26)			(1.49)	(1.84)		
$I.Disaster100$			-0.059**	-0.047**			-0.052**	-0.043*
			(-2.49)	(-2.13)			(-2.11)	(-1.85)
$I.DisasterHitSupp100$			0.017*	0.017*			0.014	0.014
			(1.82)	(1.91)			(1.42)	(1.43)
Firm Controls	Y	Y	Y	Y	Y	Y	Y	Y
Country-Industry-Year FE	Y		Y					
Country-Year FE		Y		Y				
Industry-Year FE		Y		Y				
Country-Year-Cohort FE						Y		Y
Country-Industry-Year-Cohort FE					Y		Y	
Industry-Year-Cohort FE						Y		Y
Obs.	62,517	63,841	62,517	63,841	166,353	170,110	164,847	168,590

Figure 1: Construction of Customer-Supplier Relationship Classification Variables

The diagram illustrates the formation of the main four variables corresponding to each focal firm in our sample. Initially, a focal firm is categorized as either a BG-affiliated or a standalone firm. Subsequently, based on the composition of its suppliers, the firm is further classified into one of the four main variables. If a focal BG-affiliated firm has any (zero) same BG-affiliated supplier, then $I.BG - BG$ ($I.BG - NBG$) is equal to one, and zero otherwise. Similarly, if a focal firm is a stand-alone firm that has any (zero) BG-affiliated supplier, $I.SA - BG$ ($I.SA - SA$) is equal to one and zero otherwise.

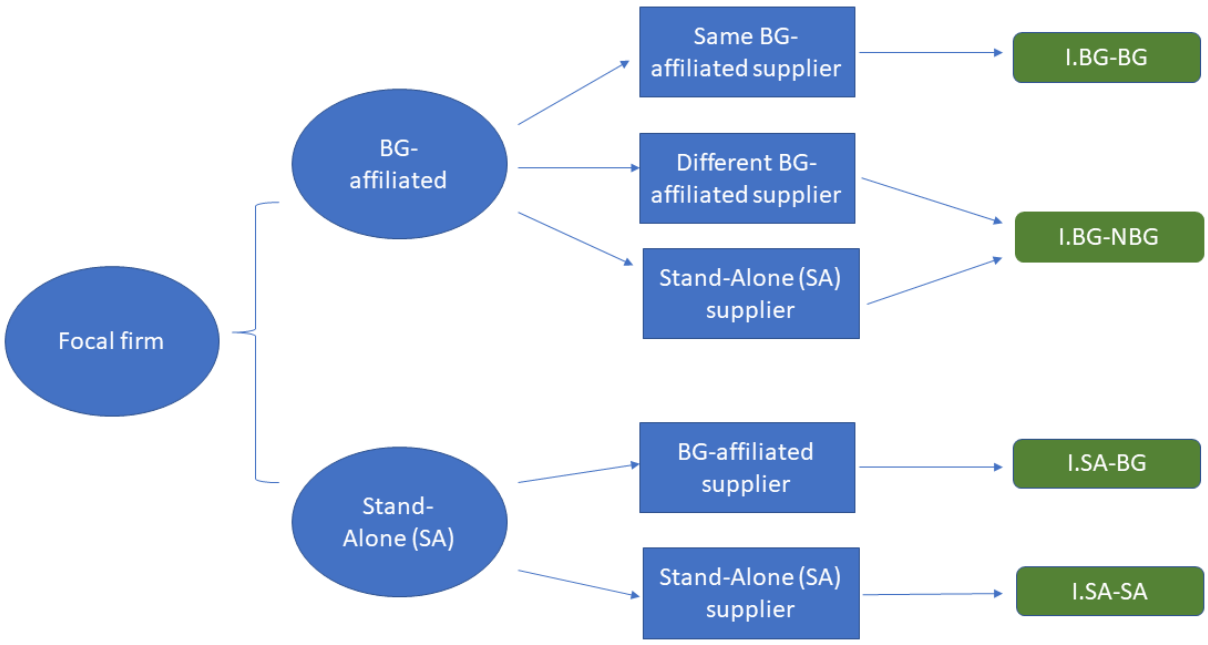
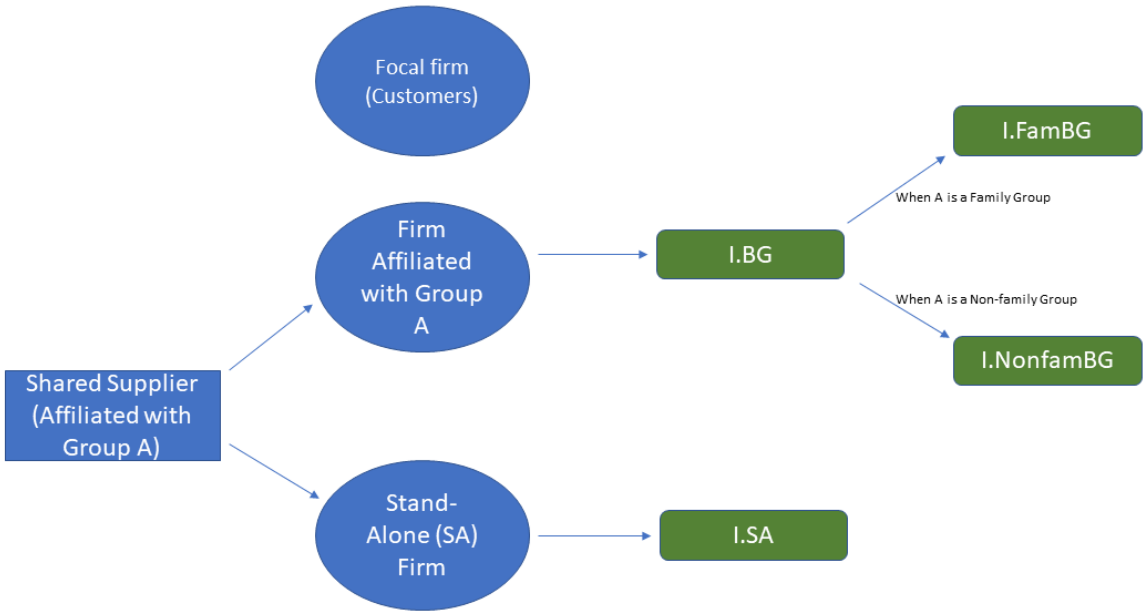


Figure 2: Construction of Overlapping Supplier Analysis

The diagram illustrates the the sample of for the analysis on firms with overlapping suppliers. The sample consists of business group firms with same-group suppliers, and standalone firms with business group suppliers whose customers include same-group firms. In this sample, a focal firm is categorized as either a BG-affiliated or a stand-alone firm. $I.BG$ takes the value of one when it is a BG firm with same-group supplier, and takes the value of zero when it is a standalone firm with group-affiliated suppliers who have same-group customer.



A Appendix

A.1 Variable Definitions

Supply Chain Relationship Information

Focal Firms as Customers

I.BG-BG: A dummy variable takes one when the focal firm is a business group-affiliated firm (BG firm) and has group-affiliated supplier(s) within the same business group. See Figure 1 for a graphic illustration.

I.BG-NBG: A dummy variable takes one when the focal firm is a BG firm and does not have any supplier within the same business group (i.e., all of its suppliers are standalone firms or affiliated with other business groups). See Figure 1 for a graphic illustration.

I.SA-BG: A dummy variable takes one when the focal firm is a standalone firm and has group-affiliated supplier(s). See Figure 1 for a graphic illustration.

I.SA-SA: A dummy variable takes one when the focal firm is a standalone firm and does not have any group-affiliated supplier. See Figure 1 for a graphic illustration.

BG Importance It measures the relative importance of the business group supplier(s) to the focal firm. For a focal firm as a customer, this measure is calculated as the proportion of the total sales in USD of its within-same-group supplier(s) to the total sales in USD of all of its suppliers. By definition, the measure is only positive when $I.BG - Internal_{supplier}$ takes one.

Trade Credit Measures

AP/COGS: Accounts payable (Worldscope ITEM3040) divided by the cost of goods sold (Worldscope ITEM1051).

AP/Sales: Accounts payable divided by the net sales or revenues (Worldscope ITEM1001).

Firm Characteristics

Size: Natural logarithm of the book value of total assets.

Age: Natural logarithm of the number of years since listing.

Cash: Cash and short-term investments (Worldscope ITEM2001) divided by total assets.

Leverage: Total debt (Worldscope ITEM3255) divided by total assets.

Capex: Capital expenditure (Worldscope ITEM4601) divided by total assets.

ROA: Net income before extraordinary items (Worldscope ITEM1751) divided by total assets.

Sales Growth: Sales at the end of year t minus sales at the beginning of year t, divided by sales at the beginning of year t.

Sales Growth_Pos: Percentage sales growth if positive, 0 otherwise.
Sales Growth_Neg: Percentage sales growth if negative, 0 otherwise.
Tangibility: Total property, plant, and equipment (Worldscope ITEM2501) divided by total assets.
Finished Goods: Finished goods (Worldscope ITEM2099) divided by total inventory (Worldscope ITEM2101).
Tobin's Q: Natural logarithm of the market value of total assets/book value of total assets, where the market value of total assets equals the market value of equity plus book value of assets minus book value of equity, and market value of equity equals the stock price at the end of period t multiplied by the total number outstanding shares.
Debt Issuance: Total debt at the end of period t minus total debt at the beginning of period t scaled by the book value of total assets at the beginning of period t, where total debt equals the sum of short-term debt and long-term debt excluding capitalized leases.
FCF: The free cash flow measure is calculated from operating income before depreciation/ amortization (Worldscope ITEM18155) minus interest expense on debt (Worldscope ITEM1251), income taxes (Worldscope ITEM1451), and capital expenditure, scaled by total assets.

Table A.1: Critical Supplier and Critical Customer Scores Within Group

This table reports the statistics of the critical supplier score and the critical customer score of group affiliated firms in the sample. *Supp.* represents the critical supplier score of the focal firm relative to the group. It is calculated by the number of affiliated firms directly and indirectly supplied by the focal firm, scaled by the total number of potential internal customer firms (the total number of firms of the group - 1). *Cust.* represents the critical customer score of the focal firm relative to the group. It is calculated by the number of affiliated firms directly and indirectly supply to the focal firm, scaled by the total number of potential internal supplier firms (the total number of firms of the group - 1).

	Mean		Median		Sd	
	Supp.	Cust.	Supp.	Cust.	Supp.	Cust.
Business Group Firms						
Family Pyramid Group Firms	0.16	0.16	0.00	0.00	0.30	0.30
Family Horizontal Group Firms	0.09	0.09	0.00	0.00	0.27	0.26
Non-family Pyramid Group Firms	0.16	0.15	0.00	0.00	0.28	0.29
Non-family Horizontal Group Firms	0.11	0.12	0.00	0.00	0.25	0.27
Total	0.14	0.14	0.00	0.00	0.28	0.28
Pyramidal Group Firms						
Apex Firms	0.16	0.15	0.00	0.00	0.30	0.29
Middle Firms	0.16	0.16	0.00	0.00	0.27	0.27
Bottom Firms	0.16	0.16	0.00	0.00	0.30	0.30
Total	0.16	0.16	0.00	0.00	0.29	0.29

Table A.2: Summary Statistics

This table reports summary statistics of the main variables. *BG With Internal Supplier* is the category where the focal firm is a business group-affiliated firm (BG firm) and has group-affiliated supplier(s) within the same business group. *BG Without Internal Supplier* is the category where the focal firm is a BG firm and does not have any supplier within the same business group (i.e., all of its suppliers are standalone firms or affiliated with other business groups). *SA With BG Supplier* is the category where the focal firm is a standalone firm and has group-affiliated supplier(s). *SA Without BG Supplier* is the category where the focal firm is a standalone firm and does not have any group-affiliated supplier. $BG\ Importance_{supplier}$ measures the relative importance of the business group supplier(s) to the focal firm. For a focal firm as a customer, this measure is calculated as the proportion of the total sales in USD of its within-same-group supplier(s) to the total sales in USD of all of its suppliers. By definition, the measure is only positive when the firm belongs to *BG With Internal Supplier* category. Detailed descriptions of other variables are listed in A.1.

	mean	p25	p50	p75	sd
Emerging Markets					
AP/COGS	0.284	0.098	0.162	0.261	0.669
AP/Sales	0.170	0.066	0.108	0.174	0.353
Size	20.191	18.880	19.985	21.402	1.880
Age	2.788	2.485	2.996	3.296	0.671
Sales Growth	0.083	-0.061	0.047	0.161	0.386
Leverage	0.272	0.106	0.257	0.396	0.204
Cash	0.147	0.046	0.105	0.203	0.139
Tangibility	0.337	0.162	0.313	0.488	0.214
BG Importance	0.051	0.000	0.000	0.000	0.182
Developed Markets					
AP/COGS	0.338	0.111	0.171	0.270	0.836
AP/Sales	0.186	0.064	0.102	0.158	0.471
Size	21.257	19.589	21.283	23.030	2.446
Age	2.990	2.639	3.178	3.638	0.810
Sales Growth	0.097	-0.041	0.037	0.129	0.434
Leverage	0.262	0.109	0.243	0.375	0.199
Cash	0.155	0.050	0.109	0.204	0.155
Tangibility	0.286	0.103	0.224	0.410	0.230
BG Importance	0.017	0.000	0.000	0.000	0.104
Total					
AP/COGS	0.321	0.106	0.169	0.267	0.786
AP/Sales	0.181	0.064	0.104	0.163	0.436
Size	20.915	19.253	20.793	22.579	2.333
Age	2.925	2.565	3.091	3.466	0.774
Sales Growth	0.092	-0.047	0.039	0.140	0.419
Leverage	0.265	0.108	0.247	0.382	0.201
Cash	0.153	0.049	0.108	0.204	0.150
Tangibility	0.302	0.116	0.252	0.443	0.227
BG Importance	0.028	0.000	0.000	0.000	0.135
Observations	112177				

Table A.3: Same-group Supplier and Trade Credit (AP/Sales)

This table presents results on the effect of having a BG supplier on a firm's trade credit from 2013–2021. The dependent variable, trade credit, is measured by accounts payable divided by sales. *I.BG-BG*, *I.BG-NBG*, and *I.SA-BG* are dummy variables that represent group firms with internal suppliers, without internal suppliers, and standalone firms with group suppliers, respectively. *BG Importance* measures the relative importance of the business group supplier(s) to the focal firm. Detailed variable descriptions are in appendix A.1. Columns (1) to (4) present baseline results for firms in industries excluding finance (SIC 6000-6999) and service (SIC 7000-8999) and Columns (5) to (8) present baseline results for firms in manufacturing industries only (SIC 2000-3999). Country-Industry-Year Fixed effects are included in Columns (1), (3), (5), and (7), and Industry-Year and Country-Year fixed effects are included in Columns (2), (4), (6), and (8). Standard errors are corrected for clustering of observations at the firm level, and associated t-statistics are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Trade Credit = $^{AP}/_{Sales}$	All Industry				Manufacturing			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
I.BG-BG	0.036***	0.026***			0.041***	0.032***		
	(4.80)	(3.75)			(5.81)	(4.86)		
I.BG-NBG	0.015**	0.013**			0.020***	0.017***		
	(2.24)	(2.08)			(2.96)	(2.92)		
I.SA-BG	-0.013**	-0.019***			-0.004	-0.007		
	(-2.45)	(-3.66)			(-0.65)	(-1.21)		
Size	-0.029***	-0.028***	-0.028***	-0.028***	-0.022***	-0.020***	-0.021***	-0.020***
	(-15.12)	(-16.27)	(-15.06)	(-16.26)	(-9.90)	(-10.17)	(-9.75)	(-10.04)
Sales Growth$_{Pos}$	0.129***	0.143***	0.128***	0.143***	0.129***	0.135***	0.127***	0.133***
	(13.37)	(15.64)	(13.30)	(15.59)	(9.90)	(10.77)	(9.78)	(10.66)
Sales Growth$_{Neg}$	-1.219***	-1.224***	-1.224***	-1.231***	-1.138***	-1.126***	-1.142***	-1.129***
	(-30.85)	(-33.21)	(-30.80)	(-33.12)	(-21.66)	(-22.51)	(-21.58)	(-22.41)
Age	0.007**	0.010***	0.009**	0.012***	-0.001	-0.000	-0.000	0.001
	(2.08)	(3.26)	(2.49)	(3.80)	(-0.31)	(-0.10)	(-0.03)	(0.21)
Tangibility	-0.000	-0.016	-0.002	-0.018	0.022	0.012	0.019	0.009
	(-0.00)	(-0.87)	(-0.09)	(-0.98)	(0.92)	(0.54)	(0.78)	(0.41)
Leverage	0.117***	0.104***	0.118***	0.106***	0.136***	0.144***	0.137***	0.147***
	(5.84)	(5.70)	(5.83)	(5.72)	(5.80)	(6.76)	(5.79)	(6.78)
Cash	0.147***	0.184***	0.148***	0.186***	0.201***	0.223***	0.204***	0.226***
	(4.67)	(6.16)	(4.65)	(6.14)	(5.50)	(6.23)	(5.50)	(6.25)
BG Importance			0.056***	0.046***			0.049***	0.042***
			(4.60)	(3.97)			(5.77)	(5.08)
Country-Industry-Year FE	Y		Y		Y		Y	
Country-Year FE		Y		Y		Y		Y
Industry-Year FE		Y		Y		Y		Y
Obs.	114,002	117,028	112,222	115,273	65,515	66,826	64,410	65,725

Table A.4: Distribution of Major Natural Disaster Events

This table reports the distribution of the number of major natural disaster events identified from EM-DAT.

Panel A: Distribution By Country and Year

Country	Year									
	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Argentina	1	0	0	1	0	1	0	0	0	3
Australia	1	0	0	0	1	0	0	0	1	3
Austria	1	0	0	0	0	0	0	0	0	1
Belgium	0	0	0	0	0	0	0	0	1	1
Brazil	0	1	0	0	0	0	0	1	1	3
Canada	1	0	0	1	0	0	0	0	0	2
Chile	1	0	3	0	1	0	0	0	0	5
Czech Republic	1	0	0	0	0	0	0	0	1	2
France	0	0	0	0	0	0	0	0	1	1
Germany	2	0	0	0	0	0	0	0	1	3
Greece	0	1	0	0	0	0	0	0	1	2
Hong Kong	0	0	0	0	1	0	0	0	0	1
India	0	2	1	0	0	0	1	2	0	6
Indonesia	1	0	0	0	0	1	0	0	0	2
Israel	0	0	0	1	0	0	0	1	0	2
Italy	0	0	0	1	0	0	0	0	0	1
Japan	0	0	0	2	0	2	2	0	1	7
Malaysia	0	0	0	0	0	0	0	0	1	1
Mexico	1	1	0	0	2	0	0	0	0	4
New Zealand	1	0	0	1	0	0	0	0	0	2
Pakistan	1	1	0	0	0	0	0	1	0	3
Peru	0	0	0	0	1	0	0	0	0	1
Philippines	2	1	1	0	0	0	0	0	1	5
Portugal	0	0	0	0	1	0	0	0	0	1
South Africa	0	0	0	0	2	0	0	0	0	2
Spain	0	0	0	0	0	0	1	0	1	2
Sri Lanka	0	0	0	1	2	0	0	0	0	3
Thailand	0	0	1	0	1	0	0	0	0	2
United States	0	0	0	0	2	0	0	0	1	3
Total	14	7	6	8	14	4	4	5	12	74

Panel B: Distribution By Disaster Type

Disaster Type	No.
Drought	8
Earthquake	10
Extreme temperature	2
Flood	26
Storm	21
Volcanic activity	1
Wildfire	6
Total	74

Table A.5: The Impact of Natural Disasters on a Firm's Sales Growth

This table presents results on the effect of major natural disasters on a firm's sales growth. $I.Disaster50$ ($I.Disaster100$) is a dummy that indicates that the firm is located within 50(100)km of the disaster-affected area. $I.DisasterSupp50$ ($I.DisasterSupp100$) is a dummy that indicates that the firm has supplier(s) who is located within 50(100)km of the disaster-affected area. Detailed variable descriptions are in appendix A.1. The Table presents results for firms in manufacturing industries only (SIC 2000-3999). Country-Industry-Year and Firm fixed effects are included in Columns (1) and (2), and Industry-Year, Country-Year, and firm fixed effects are included in Columns (3) and (4). Standard errors are corrected for clustering of observations at the firm level, and associated t-statistics are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Dep. Var. = Sales Growth	Manufacturing			
	(1)	(2)	(3)	(4)
$I.Disaster50$	-0.021**	-0.026***		
	(-2.12)	(-2.74)		
$Size$	-0.135***	-0.134***	-0.135***	-0.134***
	(-11.32)	(-11.43)	(-11.32)	(-11.43)
Age	-0.098***	-0.095***	-0.098***	-0.095***
	(-5.21)	(-5.45)	(-5.21)	(-5.46)
$Tangibility$	-0.117*	-0.129**	-0.117*	-0.129**
	(-1.74)	(-1.98)	(-1.74)	(-1.98)
$Leverage$	0.066*	0.061*	0.066*	0.061*
	(1.78)	(1.75)	(1.78)	(1.75)
$Cash$	0.230***	0.231***	0.230***	0.231***
	(4.48)	(4.75)	(4.48)	(4.75)
$I.Disaster100$			-0.018*	-0.022**
			(-1.95)	(-2.51)
Country-Industry-Year FE	Y		Y	
Firm FE	Y	Y	Y	Y
Industry-Year FE		Y		Y
Country-Year FE		Y		Y
Obs.	62,928	64,271	62,928	64,271

Table A.6: The Impact of Natural Disasters on a Firm's Bank Loan

This table presents results on the effect of major natural disasters on a firm's sales growth. $I.Disaster50$ ($I.Disaster100$) is a dummy that indicates that the firm is located within 50(100)km of the disaster-affected area. The dependent variable is the firm's bank loan as a share of its total debt. Detailed variable descriptions are in appendix A.1. The Table presents results for firms in manufacturing industries only (SIC 2000-3999). Country-industry-year and firm fixed effects are included in Columns (1) and (2), and industry, country, and year fixed effects are included in Columns (3) and (4). Standard errors are corrected for clustering of observations at the firm level, and associated t-statistics are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Dep. Var. = Bank share	Manufacturing			
	(1)	(2)	(3)	(4)
*I.Disaster*50	-0.111*	-0.089*		
	(-1.86)	(-1.77)		
Size	-0.054***	-0.059***	-0.054***	-0.059***
	(-10.28)	(-14.17)	(-10.24)	(-14.14)
Age	-0.068***	-0.064***	-0.068***	-0.064***
	(-6.15)	(-7.59)	(-6.14)	(-7.60)
Tangibility	0.100	0.080	0.103	0.081
	(1.35)	(1.42)	(1.38)	(1.43)
Leverage	-0.076	-0.074*	-0.075	-0.074*
	(-1.45)	(-1.73)	(-1.43)	(-1.73)
Cash	-0.169**	-0.217***	-0.168**	-0.217***
	(-2.21)	(-3.45)	(-2.20)	(-3.45)
Sales Growth	0.004	0.006	0.004	0.007
	(0.24)	(0.48)	(0.28)	(0.51)
*I.Disaster*100			-0.039	-0.046
			(-0.85)	(-1.15)
Country-Industry-Year FE	Y		Y	
Country FE		Y		Y
Year FE		Y		Y
Industry FE		Y		Y
Obs.	2,803	3,235	2,803	3,235

Table A.7: The Impact of Natural Disasters on a Supplier Firm's Receivables ($^{AR}/_{Sales}$)

This table presents results on the effect of major natural disasters on a firm's sales growth. $I.Disaster50$ ($I.Disaster100$) is a dummy that indicates that the firm is located within 50(100)km of the disaster-affected area. $I.DisasterCust50$ ($I.DisasterCust100$) is a dummy that indicates that the firm has customer(s) who is located within 50(100)km of the disaster-affected area. The dependent variable is the firm's accounts receivable as a proportion of its sales. Detailed variable descriptions are in appendix A.1. The Table presents results for firms in manufacturing industries only (SIC 2000-3999). Country-industry-year and firm fixed effects are included in Columns (1) and (2), and industry, country, and year fixed effects are included in Columns (3) and (4). Standard errors are corrected for clustering of observations at the firm level, and associated t-statistics are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

	Manufacturing			
	(1)	(2)	(3)	(4)
$I.Disaster50$	0.008	0.011		
	(1.01)	(1.43)		
$I.DisasterHitCust50$	-0.010***	-0.011***		
	(-2.61)	(-2.95)		
$Size$	-0.014***	-0.015***	-0.014***	-0.015***
	(-10.53)	(-11.60)	(-10.52)	(-11.60)
Age	-0.008***	-0.007**	-0.008***	-0.007**
	(-2.58)	(-2.42)	(-2.58)	(-2.42)
$Tangibility$	-0.186***	-0.194***	-0.186***	-0.194***
	(-8.39)	(-9.30)	(-8.38)	(-9.29)
$Leverage$	0.068***	0.069***	0.068***	0.069***
	(4.83)	(5.14)	(4.83)	(5.14)
$Cash$	0.068***	0.068***	0.068***	0.068***
	(2.69)	(2.80)	(2.70)	(2.80)
$Sales\ Growth$	-0.035***	-0.033***	-0.035***	-0.033***
	(-4.62)	(-4.20)	(-4.62)	(-4.20)
$I.Disaster100$			0.013*	0.014*
			(1.69)	(1.90)
$I.DisasterHitCust100$			-0.010***	-0.011***
			(-2.89)	(-3.12)
Country-Industry-Year FE	Y		Y	
Country-Year FE		Y		Y
Industry-Year FE		Y		Y
Obs.	64,416	65,646	64,416	65,646

Table A.8: The Impact of Natural Disasters on a Firm's Trade Credit (AP/COGS)

This table presents results on the effect of major natural disasters on a firm's sales growth. $I.Disaster50$ ($I.Disaster100$) is a dummy that indicates that the firm is located within 50(100)km of the disaster-affected area. $I.DisasterSupp50$ ($I.DisasterSupp100$) is a dummy that indicates that the firm has supplier(s) who is located within 50(100)km of the disaster-affected area. The dependent variable is the firm's trade credit measured by accounts payable divided by costs of goods sold. Detailed variable descriptions are in appendix A.1. The Table presents results for firms in manufacturing industries only (SIC 2000-3999). The sample in Columns (1) to (4) consists of business group firms with same group suppliers, while the sample in Columns (5) to (6) consists of standalone firms. Standard errors are corrected for clustering of observations at the firm level, and associated t-statistics are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Dep. Var = AP/COGS	I.BG-BG Firms				Standalone Firms			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
I.Disaster50	0.011	0.005			-0.014	-0.006		
	(0.82)	(0.35)			(-0.59)	(-0.26)		
I.DisasterHitSupp50	0.002	0.008			0.028**	0.022*		
	(0.16)	(0.59)			(2.03)	(1.70)		
Size	-0.013**	-0.014*	-0.013**	-0.013*	-0.057***	-0.054***	-0.057***	-0.054***
	(-2.37)	(-1.93)	(-2.35)	(-1.87)	(-10.27)	(-11.04)	(-10.30)	(-11.06)
Age	-0.010	-0.002	-0.010	-0.001	-0.000	0.006	-0.000	0.006
	(-0.68)	(-0.10)	(-0.67)	(-0.07)	(-0.03)	(0.78)	(-0.05)	(0.77)
Tangibility	-0.063	-0.076	-0.063	-0.076	-0.034	-0.027	-0.034	-0.027
	(-0.71)	(-0.97)	(-0.70)	(-0.97)	(-0.70)	(-0.63)	(-0.70)	(-0.63)
Leverage	0.261***	0.266***	0.261***	0.266***	0.505***	0.527***	0.505***	0.527***
	(3.69)	(2.94)	(3.68)	(2.94)	(8.32)	(9.33)	(8.32)	(9.33)
Cash	0.080	0.101	0.080	0.101	0.837***	0.867***	0.836***	0.867***
	(0.63)	(0.72)	(0.63)	(0.72)	(9.66)	(10.29)	(9.65)	(10.28)
Sales Growth	0.230**	0.207*	0.231**	0.207*	0.085***	0.086***	0.085***	0.086***
	(2.08)	(1.66)	(2.08)	(1.66)	(3.30)	(3.56)	(3.30)	(3.56)
I.Disaster100			-0.007	-0.009			-0.023	-0.014
			(-0.52)	(-0.61)			(-1.01)	(-0.67)
I.DisasterHitSupp100			0.004	0.002			0.033**	0.024*
			(0.30)	(0.12)			(2.37)	(1.88)
Country-Industry-Year FE	Y		Y		Y		Y	
Country-Year FE		Y		Y		Y		Y
Industry-Year FE		Y		Y		Y		Y
Obs.	3,650	4,233	3,650	4,233	48,584	49,969	48,584	49,969