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Firms' access to informal financing: The role of shared managers in trade credit access

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ABSTRACT

We investigate how shared managers and directors (shared M&Ds) with major suppliers affect a firm's access to trade credit. Using a sample of listed firms in China, we find that shared M&Ds play an important role in helping firms obtain trade credit. This favorable effect is strengthened for firms with higher information asymmetry, located in regions with lower social trust, operating in more innovative and heterogeneous industries, and experiencing greater financial constraints. Our findings support the proposition that shared M&Ds can reduce information asymmetry and build mutual trust between firms and their suppliers. This study contributes to the literature on the benefits of social connections within supply chain relationships and the literature on the economic consequences of interlocked managers and directors.

1. Introduction

Trade credit occurs when firms purchase goods or services from their suppliers on open accounts and serves as a widely used informal financing source for customer firms (Fisman and Love, 2003; Klapper et al., 2012; Levine et al., 2018; Rajan and Zingales, 1995). Trade credit is an important channel for firms' financing and about 80% of firms in the United States (US) offer their products on trade credit (Tirole, 2006). In China, trade credit provision has been growing rapidly, with average accounts payable ranging from 16% of debt in 2003 to 23% in 2017, while the average bank loan ratio experienced a 30% drop from 50% to 35% during the same period.

Numerous studies have investigated the determinants of trade credit, such as financial development (Fisman and Love, 2003), informal institutions (El Ghoul and Zheng, 2016; Wu et al., 2014), ownership structure (Abdulla et al., 2017; Ge and Qiu, 2007), supplier competition (Chod et al., 2019), conditional conservatism (Zhang, 2020), and vertical position in the supply chain (Gofman and Wu, 2022). However, there is limited research on the impact of managerial connectedness within customer–supplier relationships. Our study extends this line of research by examining the role of managers and directors shared with supplier firms in a firm's access to trade credit.

Information asymmetry and moral hazard problems are major concerns for firms when they provide trade credit to customers. This is because there is usually no collateral backing the trade credit and no guarantees from third parties or financial intermediaries

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(Costello, 2013; García-Teruel et al., 2014; Mian and Smith, 1992; Ng et al., 1999). A stream of research investigates how social and economic networks influence trade credit provision (Kong et al., 2020; Liu et al., 2016). Dasgupta et al. (2021) highlight the importance of prior social connections between suppliers' managers and board members and those of their customers in mitigating hold-up in bilateral relationships. We enrich this line of literature by examining how common managers and directors at both the supplier firm and the customer firm (henceforth, shared M&Ds) influence customer–supplier relationships from the perspective of firms' external financing.

Shared M&Ds can strengthen the supply chain relationship and promote trade credit provision for two reasons. First, shared M&Ds are natural conduits for the exchange of knowledge and information between the firms that they serve. They do this in various areas, such as stock option backdating and expensing (Bizjak et al., 2009; Reppenhagen, 2010), corporate governance practices (Bouwman, 2011), earnings management (Chiu et al., 2013), and voluntary disclosure practices (Cai et al., 2014). Sharing information through shared M&Ds may not only enable the two parties along the supply chain to enhance their level of cooperation and coordination, but also reduce information asymmetry with respect to the firm's future prospects (Dass et al., 2014; Schoorman et al., 1981). Minnick and Raman (2017) provide evidence that the presence of executives or directors from the supplier on the board of the customer (and vice versa) reduces underinvestment problems and mitigates contracting frictions by reducing information risks and strengthening informal contracts between the two parties. The resultant decreased information asymmetry can reduce uncertainty about future payment and facilitate the customer's acquisition of trade credit from the supplier.

Second, in a bilateral relationship, moral hazard influences the provision of trade credit (Kim and Shin, 2012). The repeated managerial interactions associated with shared M&Ds can foster greater trust between the supplier and the customer and create a relational contract that limits opportunistic behavior by either party (Baker et al., 2002; Gulati, 1995). Further, shared M&Ds tend to have more common third parties in their social circles with other managers at both the supplier and the customer, from within and beyond the current business relationship. This motivates them to ensure the enforcement of both explicit and implicit contracts between the two parties. Breaches of contract by either party could damage the reputation of the shared M&Ds and result in ostracism within their connected social networks (Dasgupta et al., 2021). Both the strengthened mutual trust and greater enforceability of contracts resulting from shared M&Ds can increase the amount of trade credit accessible to customers (Guiso et al., 2004).

We therefore hypothesize that shared M&Ds can help customer firms access trade credit. We test this hypothesis using a sample of Chinese firms listed on both the Shanghai and the Shenzhen securities exchanges during the period 2003 to 2017. China provides an ideal setting to explore this question for the following two reasons. First, Chinese firms, particularly non-state-owned firms, rely heavily on trade credit as an essential informal financing source to fund their growth due to underdeveloped financial markets and weak legal institutions (Allen et al., 2005; Cull et al., 2009). However, supplier firms face high risks when collecting trade credit because the weak legal enforcement system in China fails to provide sufficient protection for creditors. Second, unlike firms in the US, listed firms in China are required to disclose not only their sales to major customers but also their purchases from their top five suppliers in their annual reports. This requirement allows us to obtain information on the identity of these suppliers. In addition, the China National Enterprise Credit Information Publicity System (CNECIPS, http://www.gsxt.gov.cn) publicly discloses detailed profiles such as location, ownership structure, and top managers of all firms registered in China. These two sources provide us with the data necessary to investigate our research question.

Our empirical results show that trade credit received by Chinese listed firms is positively related to managerial connections with suppliers via shared M&Ds. The effect of these managerial connections on trade credit is economically significant. An increase of one standard deviation in shared M&Ds at a firm's major suppliers leads to a 0.6% increase in its trade credit, which is equivalent to RMB 41.9 million. These results support the hypothesis that shared M&Ds can mitigate information asymmetry and foster trust between suppliers and customers, in turn playing an important role in promoting customer firms' access to trade credit.

One may be concerned that the relation between shared M&Ds and customer firms' access to trade credit is endogenously determined. For example, there could be some latent factors that simultaneously affect the presence of shared M&Ds and the firm's access to trade credit. It could also be that after a supplier firm provides or intends to provide a customer firm with a significant amount of trade credit, the supplier firm appoints a director or manager at the customer firm to oversee the customer's activities and ensure the payment of trade credit. We conduct several tests to address these potential endogeneity concerns. First, following Dasgupta et al. (2021), we take advantage of the exogenous departures of shared M&Ds[2] and conduct difference-in-differences (DID) analyses. Presumably, it is unlikely that the exogenous departures of shared M&Ds would be caused by anticipated changes in trade credit. Our DID results show that after the exogenous departures of shared M&Ds, the affected customer firms experienced a decline in trade credit compared with their counterparts that did not experience a departure. In addition, we do not observe any significant difference in trade credit changes between affected customer firms and unaffected firms in the period before the exogenous events. These results imply causal evidence that shared M&Ds play an important role in helping firms to obtain trade credit.

Second, we further address endogeneity concerns about reverse causality whereby a supplier firm offering a large amount of trade credit to a customer firm is more likely to appoint a common director or manager at the customer firm. We regress the current presence of shared M&Ds on the lagged trade credit. We find no evidence that a supplier's provision of trade credit in the preceding year predicts the appointment of shared M&Ds in the current year, which helps reduce reverse causality concerns.

Third, we use the global financial crisis that hit the Chinese economy from 2008 to 2009 as an exogenous shock to the availability of trade credit. Firms significantly increased their demand for trade credit because of reduced lending from formal financial institutions,

[2] Those exogenous departures include retirement or resignation caused by irregular behavior or sanctions imposed by regulatory agencies, which are unlikely to be driven by the anticipated change in trade credit.

such as banks, during the crisis period (Carbó-Valverde et al., 2016; García-Appendini and Montoriol-Garriga, 2013). Because of increased concerns about higher credit risk, supplier firms became more reluctant to provide trade credit to accelerate cash conversion during the crisis period. Prior studies find that informal connections with suppliers become more important for customer firms to receive trade credit during periods of financial crisis (Kong et al., 2020; Liu et al., 2016). We thus expect shared M&Ds to play a more important role in helping firms to obtain trade credit during this period. Our empirical results confirm this expectation, highlighting the importance of shared M&Ds in the supply chain when extreme events occur.

Fourth, although the inclusion of firm and year fixed effects in our main analyses helps account for time-invariant firm characteristics and time trends, we also add high-dimensional fixed effects of customer province × year × industry to control for industry dynamics within a province, and find consistent results. Taken together, these tests mitigate endogeneity concerns to a large extent, though not completely, thereby supporting the causal effect of shared M&Ds on a firm's access to trade credit.

We further examine several potential channels through which shared M&Ds influence the provision of trade credit. Chen et al. (2021) show that the advantage of information acquisition can be derived from personal connections among supply chains. We conjecture that shared M&Ds serve as conduits for information exchange, thereby reducing information asymmetry between suppliers and customers. To test this argument, we examine whether the effect of shared M&Ds on trade credit varies with the level of information asymmetry between suppliers and customers. Drawing on the literature (Cai and Sevilir, 2012; Dass et al., 2014; Hutton et al., 2009; Kong et al., 2020; Li et al., 2015), we use the customer's stock price informativeness, accrual quality, cross-listing status, and the geographic proximity between supplier and customer as the proxies for information asymmetry. We find that the favorable effect of shared M&Ds on trade credit is more pronounced for firms with lower stock price informativeness, poorer accounting quality, and longer distance away from their major suppliers, while less pronounced for cross-listed firms. These findings indicate that shared M&Ds play a more important role in customer firms' access to trade credit in the presence of greater information asymmetry between customers and suppliers.

Another channel through which shared M&Ds can increase trade credit access is by building trust and mitigating the opportunism of either party within the supply chain (Burkart and Ellingsen, 2004; McCarthy et al., 2013). We expect the effect of shared M&Ds on trade credit to be stronger for customer firms located in regions with lower levels of social trust, which are considered less trustworthy by suppliers (Wu et al., 2014). Our empirical results confirm this prediction and indicate that shared M&Ds play a more important role in facilitating the acquisition of trade credit for listed firms in regions with lower levels of social trust.

Shared M&Ds usually have common third parties in their social circles, and breaches of contract by either the supplier or customer firm could damage their reputation within their connected social networks (Dasgupta et al., 2021). Thus, we expect the effect of shared M&Ds on trade credit to be stronger for shared M&Ds with a higher personal reputation. Our empirical results confirm this prediction, supporting that senior and reputable M&Ds can more effectively promote customer–supplier relationships.

In addition, we examine cross-sectional variations in the effect of shared M&Ds on firm access to trade credit. Specifically, we find that the effect of shared M&Ds on trade credit is more pronounced for firms operating in more innovative and less homogeneous industries in which information asymmetry tends to be higher and a firm's prospects are harder for suppliers to assess. This complements the findings of Dass et al. (2014) regarding the impact of directors from related industries on firm value/performance. In contrast, we find that the effect of shared M&Ds on trade credit is weakened for firms with higher dividend payout ratios, which suggests that shared M&Ds play a less important role in firms facing no financial constraints. Finally, we conduct several robustness checks by using alternative measures and alternative sampling. Our results remain unchanged.

Our study contributes to the literature in several ways. First, it offers valuable findings on the consequences of interlocked managers/directors. The existing literature mainly focuses on the role played by interlocked directors in spreading knowledge and certain corporate practices between firms, such as corporate governance practices (Bouwman, 2011), earnings management (Chiu et al., 2013), voluntary disclosure practices (Cai et al., 2014), stock option backdating and expensing (Bizjak et al., 2009; Reppenhagen, 2010), the use of corporate-owned life insurance tax shelters (Brown, 2011), and the adoption of antitakeover provisions (Foroughi et al., 2021). Apart from Minnick and Raman (2017), few studies investigate how shared M&Ds promote business relationships between firms that they simultaneously serve. Our study sheds new light on the importance of shared M&Ds in strengthening relationships in the supply chain with respect to trade credit access.

Second, this study is related to the emerging literature on the role of directors/managers from upstream/downstream industries (DRIs). Dass et al. (2014) discuss the costs versus benefits of having DRIs, and find that DRIs have a significant positive impact on firm value. Specifically, DRIs can improve a firm's operations, for instance, by shortening the cash conversion cycle. Our study provides insights into the benefits associated with DRIs by examining shared M&Ds, a certain type of DRIs directly from supplier firms, and pinpointing additional channels through which DRIs can increase firm value. That is, shard M&Ds can improve firms' access to trade credit and help to ease financial constraints.

Third, this study adds to the literature on firms' access to trade credit. While prior studies investigate how trade credit is affected by customer firms' bargaining power or competition among supplier firms (Chod et al., 2019; Giannetti et al., 2021; Klapper et al., 2012) and (in)formal institutional environments (El Ghoul and Zheng, 2016; Johnson et al., 2002; Levine et al., 2018; Wu et al., 2014), a growing body of research emphasizes the influence of managers' connections on trade credit, including managerial professional connections (Liu et al., 2016) and hometown connections (Kong et al., 2020). Our study extends this line of research by showing the benefit of social connections in the supply chain through obtaining informal financing.

Last, our study contributes to the literature on customer–supplier connections more broadly. Bernard et al. (2019) show the value of creating buyer–seller links for firm performance as a result of reduced search costs. Bernard et al. (2018) demonstrate that strengthened relationships in the supply chain improve productivity gains and firm performance, illustrating the importance of these connections. Our study complements this line of research by showing the role of shared M&Ds in promoting informal financing within

supplier–customer relationships.

The remainder of this paper proceeds as follows: Section 2 introduces the data and research design, Section 3 discusses the empirical results, and Section 4 concludes.

2. Data and research design

2.1. Data and sample selection

Our sample includes all Chinese firms listed on both the Shanghai and Shenzhen securities exchanges during the period 2003 to 2017. We start with 31,809 unique firm-year observations of all listed firms in China. We first obtain financial data and personal background information on firms' directors and managers from the Chinese Stock and Market Accounting Research (CSMAR) database, a commonly used database in studies on China, and identify names of firms' top five suppliers from their annual reports. Next, we manually collect data on directors and managers of the top five suppliers from the China National Enterprise Credit Information Publicity System (CNECIPS) and identify shared M&Ds.

We exclude the following observations: (1) firms that do not disclose the names of their top five suppliers in annual reports, for example, firms that only list their top five suppliers as "supplier A", "supplier one", or "first supplier"; (2) firms whose suppliers' information on directors and managers is unavailable in CNECIPS; (3) firms from the financial industry and special treatment firms with financial troubles; and (4) observations with missing data on trade credit and control variables. Panel A of Table 1 details our sample selection process. Our final sample contains 22,588 firm-year observations involving 3072 unique listed firms.

Panel B of Table 1 reports the sample distribution across years. It shows that the proportion of firms with shared M&Ds experiences a steady increase from 8.6% in 2003 to 21.6% in 2017. Meanwhile, the trade credit received by sample firms shows a slight increase from 16.7% in 2003 to 23.2% in 2014 and remains stable at around 23% afterwards. The average level of trade credit received (21.6%) over the whole sample period is similar to that reported in prior literature (e.g., Kong et al., 2020). Given the average bank loan ratio of 40% during the same period, these results suggest that trade credit is an important channel for firms' external financing in China.

Table 1
Sample overview.

Panel A: Sampling process

	Firm-year obs.
Unique observations of all listed firms over the fiscal years 2003 to 2017	31,809
Less:	
Observations unavailable from the China National Enterprise Credit Information	(6571)
Observations with missing data on trade credit	(247)
Observations associated with financial firms (CSRC industry classification code 2012: J)	(316)
Observations that are specially treated by CSRC	(1540)
Observations missing necessary controls	(547)
Final sample	22,588

Panel B: Sample distribution by year

Year	Number of obs.	Obs. with shared M&Ds (%)	Ave *Credit* (%)
2003	1118	8.6	16.7
2004	1206	9.6	17.6
2005	1219	10.4	17.9
2006	1257	12.6	19.0
2007	1347	13.1	19.2
2008	1411	13.9	19.7
2009	1560	14.7	20.5
2010	1853	14.1	23.6
2011	1954	15.1	24.4
2012	1759	16.8	24.4
2013	1745	17.8	23.7
2014	1704	19.4	23.2
2015	1487	20.1	21.7
2016	1524	20.1	23.3
2017	1444	21.6	23.0
Total	22,588	15.5	21.6

This table presents the sample selection. Panel A describes the sample selection process. Panel B shows the percentage of firms with shared managers and directors by year.

2.2. Measure of trade credit

As the actual contract payment terms are unavailable, we follow prior studies (e.g., Fisman and Love, 2003; Kong et al., 2020) to define our dependent variable—firm access to trade credit (*Credit*)—as the ratio of total accounts payable divided by total liabilities in a fiscal year. For robustness tests, we also construct an alternative trade credit measure, *Credit_Assets*, calculated as the ratio of total accounts payable over total assets (Liu et al., 2016; Wu et al., 2014).

2.3. Measure of shared managers and directors

We construct two measures to capture the presence of shared M&Ds. One is *Shared M&Ds Ratio*, computed as the total number of shared M&Ds between a firm and its top five suppliers divided by the total number of its managers and directors, in line with Dass et al. (2014). The other one is *Shared M&Ds*, defined as the total number of shared M&Ds between a firm and its five largest supplier firms.

2.4. Regression model

We specify the following baseline regression model to examine the effect of shared M&Ds on firms' access to trade credit:

$$\text{Credit}_{i,t} = \beta_0 + \beta_1 \text{SharedManager\_ratio}_{i,t} / \text{SharedManager}_{i,t} + \Sigma\beta_j \text{Controls}_{i,t} + \text{FirmFixdedEffects} + \text{YearFixedEffects} + \varepsilon \quad (1)$$

where the dependent variable, *Credit*, as previously defined, represents a firm's trade credit received from its supplier firms. We use two measures, *Shared M&Ds Ratio* and *Shared M&Ds*, as defined above, to capture the effect of shared M&Ds.

We include a set of control variables that are found to affect trade credit in the literature (e.g., Ge and Qiu, 2007; Kong et al., 2020; Li et al., 2021; Liu et al., 2016; Mateut, 2014; Wu et al., 2014). These control variables include firm size (*Size*), financial leverage ratio (*Lev*), return on assets (*ROA*), fixed assets (*PPE*), operating cash flow (*Cash Flow*), firm age (*Age*), firm age squared (Age^2), sales growth rate (*Growth*), fraction of independent directors on the board (*ID Ratio*), capital labour ratio (*Capital Labor Ratio*), state-owned enterprises (*SOE*), and bargaining power (*Market Share*). We present detailed definitions of all variables used in this study in the Appendix. Finally, we include firm and year fixed effects to control for any time-invariant firm characteristics and time trends, respectively.

3. Empirical results

3.1. Descriptive statistics

Table 2 presents the descriptive statistics. All continuous variables are winsorized at the top and bottom 1% to mitigate the effect of outliers. Trade credit received by an average firm is 21.6% of total liabilities (*Credit*) and 8.7% of total assets (*Credit_Assets*), similar to that reported in prior studies using Chinese data (e.g., Kong et al., 2020; Liu et al., 2016). On average, 16% of our firm-year observations have shared M&Ds. The results regarding control variables are generally consistent with those of prior studies (e.g., Kong et al., 2020; Wu et al., 2014). Specifically, Chinese listed firms have an average financial leverage ratio (*Lev*) of 45.9%, ROA of 3.6%, sales growth rate (*Growth*) of 18.8%, and 36.7% of independent directors on the board (*ID Ratio*). State-owned firms (*SOE*) account for 32.7% of our observations.

3.2. Effect of shared M&Ds on trade credit access

Table 3 reports the results of the ordinary least squares estimates of Eq. (1), with Column (1) using *Shared M&Ds Ratio* as the independent variable and Column (2) using *Shared M&Ds* as an alternative independent variable. It shows that both *Shared M&Ds Ratio* and *Shared M&Ds* are positive and statistically significant, suggesting that a firm's access to trade credit increases with the presence of shared M&Ds. The effect of shared M&Ds on a firm's trade credit is economically significant as well. Based on the results in Column (1), an increase of one standard deviation in *Shared M&Ds Ratio* increases *Credit* by approximately 0.6% ($0.173 \times 0.035 \times 100\%$). Given the mean value of total liabilities is RMB 6915.922 million in our sample, the increase of 0.6% in *Credit* is equivalent to RMB 41.9 million ($6915.922 \times 0.6\%$) worth of trade credit. In summary, the results in Table 3 support our conjecture that shared M&Ds assists firms to obtain more trade credit from their suppliers.

The results regarding control variables are generally consistent with the literature (e.g., Ge and Qiu, 2007; Kong et al., 2020). Specifically, firm size (*Size*) is negative and statistically significant, indicating that larger firms rely less on trade credit. A firm's access to trade credit is significantly and positively related to fixed assets (*PPE*), operating cash flow (*Cash Flow*), sales growth (*Growth*), and product market power (*Market Share*), while negatively associated with financial leverage (*Lev*), the fraction of independent directors (*ID Ratio*), and capital labour ratio (*Capital Labor Ratio*).

3.3. Endogeneity issues

It is possible that our results are driven by some omitted variables or suffer from reverse causality. For example, although our inclusion of firm fixed effect can control for the impact of any time-invariant firm characteristics, one could still be concerned that the

Table 2
Descriptive statistics.

Variable	N	Mean	SD	Q1	Median	Q3
Credit	22,588	0.216	0.164	0.092	0.172	0.303
Shared M&Ds Ratio	22,588	0.008	0.035	0.000	0.000	0.000
Shared M&Ds	22,588	0.155	0.644	0.000	0.000	0.000
Size	22,588	21.816	1.284	20.877	21.643	22.550
Lev	22,588	0.459	0.207	0.302	0.468	0.619
ROA	22,588	0.036	0.056	0.013	0.035	0.063
PPE	22,588	0.254	0.182	0.109	0.218	0.369
Cash Flow	22,588	0.045	0.078	0.003	0.045	0.090
Age	22,588	2.601	0.435	2.398	2.639	2.944
Growth	22,588	0.188	0.447	−0.002	0.109	0.289
ID Ratio	22,588	0.367	0.063	0.333	0.333	0.400
Capital Labor Ratio (thousand)	22,588	604.559	1197.795	131.696	253.546	531.847
SOE	22,588	0.327	0.469	0.000	0.000	1.000
Market Share	22,588	0.039	0.087	0.003	0.009	0.030
FinCrisis	22,588	0.132	0.338	0.000	0.000	0.000
Lower PriceInfo	9122	0.554	0.497	0.000	1.000	1.000
Higher Accruals	16,585	0.375	0.484	0.000	0.000	1.000
Cross-listing	22,588	0.024	0.154	0.000	0.000	0.000
Same_City	22,588	0.033	0.152	0.000	0.000	0.000
Senior Shared M&Ds	22,588	0.086	0.434	0.000	0.000	0.000
Junior Shared M&Ds	22,588	0.069	0.356	0.000	0.000	0.000
Senior Shared M&Ds Ratio	22,588	0.005	0.023	0.000	0.000	0.000
Junior Shared M&Ds Ratio	22,588	0.003	0.015	0.000	0.000	0.000
HigherDPs Shared M&Ds	22,588	0.009	0.120	0.000	0.000	0.000
LowerDPs Shared M&Ds	22,588	0.146	0.618	0.000	0.000	0.000
HigherDPs Shared M&Ds Ratio	22,588	0.001	0.006	0.000	0.000	0.000
LowerDPs Shared M&Ds Ratio	22,588	0.007	0.027	0.000	0.000	0.000
Trust	21,076	0.456	0.498	0.000	0.000	1.000
High-tech	22,588	0.540	0.498	0.000	1.000	1.000
High-R&D	18,107	0.188	0.391	0.000	0.000	0.000
Homo_Ind	22,585	0.479	0.500	0.000	0.000	1.000
Dividend	21,014	0.265	0.305	0.000	0.205	0.383
Shared Link	22,588	0.169	0.736	0.000	0.000	0.000
Ln_Shared Link	22,588	0.084	0.304	0.000	0.000	0.000
Credit_Assets	22,588	0.087	0.068	0.037	0.070	0.119

This table presents the descriptive statistics. All variable definitions are reported in the Appendix.

presence of shared M&Ds may not be random and some time-varying omitted factors could influence both the presence of shared M&Ds and the increased access to trade credit. Another possibility is that when the supplier firm provides or intends to provide a significant amount of trade credit, it appoints a manager or director at the customer firm to oversee the customer's activities and ensure the payment of the trade credit. Similarly, when at some point the supplier firm reduces or intends to reduce the provision of trade credit, it removes the shared manager or director from the customer firm. Both situations would lead to a positive relation between the presence of shared M&Ds and trade credit.[3] We carry out the following tests to mitigate these endogeneity concerns.

3.3.1. *DID analyses based on exogenous departures of shared M&Ds*

Our first set of endogeneity tests follow Dasgupta et al. (2021) and exploit the exogenous departures of shared M&Ds to conduct DID analyses. Similar to Dasgupta et al. (2021), we treat the exogenous departures of shared M&Ds as a shock to the connection between the customer firm and its supplier. Those exogenous departures include retirement and resignation due to irregular behavior or sanctions by regulatory agencies, which are unlikely to be driven by the anticipated change in trade credit.[4] We manually collect the exogenous departures of shared M&Ds from firm announcements and cross-check the departure data by exhaustively searching those departed M&Ds in the CNECIPS database to ensure they definitively left their managerial positions in all firms. After this extensive search, we are left with 18 exogenous departure events.

Next, we create a dummy variable, *Treat_Post*, which equals 1 if an observation is associated with a firm that experienced an exogenous departure of shared M&Ds and belongs to the period after the exogenous departure of shared M&Ds, and 0 otherwise. We then include *Treat_Post* in place of the variables for shared M&Ds in Eq. (1) and run a DID regression. The results reported in Column (1)

[3] Such reverse causality concerns do not necessarily contradict our argument about the role of shared M&Ds because a premise underlying the supplier firm's appointment of shared M&Ds at the customer firm is that the supplier firm believes the shared M&Ds can monitor the customer firm's opportunistic behavior related to trade credit.

[4] We define retirement as shared M&Ds leaving the firm at the age of 65 or above and holding no position in any other firm afterwards. We do not find any deaths of shared M&Ds after extensive searches conducted over our sample period. Therefore, we focus only on retirement and resignation caused by irregular behavior or sanctions imposed by regulatory agencies.

Table 3
Shared M&Ds and trade credit access.

Dependent variable	*Credit*	
	(1)	(2)
Shared M&Ds Ratio	0.173**	
	(2.57)	
Shared M&Ds		0.008**
		(2.24)
Size	−0.013***	−0.013***
	(−4.40)	(−4.40)
Lev	−0.229***	−0.229***
	(−19.75)	(−19.75)
ROA	0.010	0.010
	(1.51)	(1.50)
PPE	0.038***	0.038***
	(2.95)	(2.96)
Cash Flow	0.019*	0.019*
	(1.73)	(1.74)
Age	−0.028	−0.027
	(−0.64)	(−0.62)
Age^2	0.001	0.000
	(0.04)	(0.02)
Growth	0.009***	0.009***
	(5.21)	(5.21)
ID Ratio	−0.033**	−0.034**
	(−2.41)	(−2.43)
Capital Labor Ratio	−0.000***	−0.000***
	(−2.97)	(−2.95)
SOE	−0.003	−0.003
	(−1.01)	(−1.01)
Market Share	0.104**	0.104**
	(2.51)	(2.51)
Firm Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes
Observations	22,588	22,588
Adjusted R^2	0.743	0.743

This table presents the results on the effect of shared M&Ds on a firm's access to trade credit. The dependent variable, *Credit*, is defined as the ratio of accounts payable over total liabilities. *Shared M&Ds Ratio* is defined as the number of shared M&Ds scaled by total number of managers and directors. *Shared M&Ds* is defined as the number of shared M&Ds who also serve as managers or directors in supplier firms. The definitions of the other variables are provided in the Appendix. All continuous variables are winsorized at the top and bottom 1%. Heteroscedasticity-robust standard errors are clustered by firm. *t*-statistics are reported in parentheses. *, **, and *** represent significance levels of 10%, 5%, and 1%, respectively.

of Panel A, Table 4 show that *Treat_Post* is negative and statistically significant, suggesting that customer firms experienced a significant decline in access to trade credit after the exogenous departure of a shared M&D compared with their counterparts.

In addition, we examine the dynamic effect of the exogenous departures of shared M&Ds on trade credit to further address the possibility that both the exogenous departure of shared M&Ds and the change in trade credit are driven by some unobserved pre-existing factors. Specifically, we follow the research designs used in prior studies (i.e., Bertrand and Mullainathan, 2003; Giroud, 2013) and create five indicators: *Treat_Pre2* and *Treat_Pre1* equal 1 if an observation is associated with a firm that experienced the exogenous departure of shared M&Ds and belongs to the second year and first year prior to the exogenous departure of shared M&Ds, respectively, and 0 otherwise; *Treat_Post0, Treat_Post1* and *Treat_Post2+* equal 1 if an observation is associated with a firm that experienced the exogenous departure of shared M&Ds and belongs to the event year, first year and the years after the first year following the exogenous departure, respectively, and 0 otherwise. We then include these five indicators in place of *Treat_Post* and re-estimate the regression in Column (1). The results reported in Column (2) show that *Treat_Pre2* and *Treat_Pre1* are statistically insignificant, while *Treat_Post0, Treat_Post1* and *Treat_Post2+* are significantly negative. This suggests that there is no pre-existing trend in the decline of trade credit before the exogenous departure of shared M&Ds and that the significant decline in trade credit occurs only after the exogenous departure. In sum, our DID results mitigate endogeneity concerns to some extent, supporting the causal impact of shared M&Ds on firms' access to trade credit.

3.3.2. Further tests on reverse causality

To further mitigate the endogeneity concern about reverse causality that the supplier firm could appoint a manager or director at the customer firm after it provides a large amount of trade credit, we conduct the second set of tests by regressing the current presence of shared M&Ds on lagged trade credit. Specifically, we use shared M&Ds variables ($Shared\ M\&Ds_t$ and $Shared\ M\&Ds\ Ratio_t$) measured at year *t* as the dependent variable and the lagged trade credit ($Credit_{t-1}$) measured at year *t-1* as the independent variable, along with

Table 4
Endogeneity issues.

Panel A: DID analyses based on exogenous departures of shared M&Ds

Dependent variable	*Credit*	
	(1)	(2)
Treat_Post	−0.060**	
	(−2.23)	
Treat_Pre2		0.002
		(0.14)
Treat_Pre1		−0.017
		(−1.10)
Treat_Post0		−0.028**
		(−2.03)
Treat_Post1		−0.087***
		(−2.58)
Treat_Post2+		−0.074*
		(−1.79)
Control Variables	Yes	Yes
Firm Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes
Observations	21,016	21,016
Adjusted R^2	0.843	0.841

Panel B: Tests on reverse causality

Dependent variable	*Shared M&Ds Ratio*$_t$	*Shared M&Ds*$_t$
	(1)	(2)
Credit$_{t-1}$	0.003	0.041
	(1.31)	(1.14)
Control Variables	Yes	Yes
Firm Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes
Observations	18,895	18,895
Adjusted R^2	0.854	0.846

Panel C: Tests based on exogenous shock to trade credit supply: Global financial crisis

Dependent variable	*Credit*	
	(1)	(2)
Shared M&Ds Ratio	0.165**	
	(2.42)	
Shared M&Ds Ratio × *FinCrisis*	0.092**	
	(2.10)	
Shared M&Ds		0.007**
		(2.18)
Shared M&Ds × *FinCrisis*		0.006**
		(2.06)
Control Variables	Yes	Yes
Firm Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes
Observations	22,588	22,588
Adjusted R^2	0.743	0.743

Panel D: Tests including high-dimensional fixed effects

Dependent variable	*Credit*	
	(1)	(2)
Shared M&Ds Ratio	0.156**	
	(2.11)	
Shared M&Ds		0.007**
		(1.99)
Control Variables	Yes	Yes
Firm Fixed Effects	Yes	Yes

(*continued on next page*)

Table 4 (*continued*)

Panel D: Tests including high-dimensional fixed effects		
Dependent variable	*Credit*	
	(1)	(2)
Year Fixed Effects	Yes	Yes
Province × *Industry* × *Year Fixed Effects*	Yes	Yes
Observations	21,936	21,936
Adjusted R^2	0.755	0.755

This table presents the results addressing endogeneity issues. Panel A reports the results of the DID analyses. We treat the exogenous departures of shared M&Ds as a shock to the connection between the customer firm and its supplier. Departures include retirement and resignation due to irregular behavior or sanctions imposed by regulatory agencies. *Treat_Post* equals 1 if an observation is associated with a firm that experienced an exogenous departure of a shared M&D and belongs to the period after the exogenous departure of the shared M&D, and 0 otherwise. *Treat_Pre2* and *Treat_Pre1* equal 1 if an observation is associated with a firm that experienced the retirement of a shared M&D and belongs to the second year and first year prior to the exogenous departure of the shared M&D, respectively, and 0 otherwise. *Treat_Post0*, *Treat_Post1* and *Treat_Post2*+ equal 1 if an observation is associated with a firm that experienced an exogenous departure of a shared M&D and belongs to the event year, first year and the years after the first year following the exogenous departure, respectively, and 0 otherwise. Panel B reports the results of the tests on reverse causality by regressing the presence of shared M&Ds in the current year on trade credit measures in the prior year. Panel C reports the results of the tests using global financial crisis as an exogenous shock to trade credit supply. *FinCrisis* equals 1 for the observations from the global financial crisis period 2008–2009, and 0 otherwise. Panel D reports the results of the regressions, including high-dimensional fixed effects at customer firm province × industry × year level. Each regression includes a separate intercept and the same set of control variables as in Table 3. The definitions of the other variables are provided in the Appendix. All continuous variables are winsorized at the top and bottom 1%. Heteroscedasticity-robust standard errors are clustered by firm. *t*-statistics are reported in parentheses. *, **, and *** represent significance levels of 10%, 5%, and 1%, respectively.

the same set of control variables to run regressions. If reverse causality holds, we should observe a significantly positive coefficient of $Credit_{t-1}$. However, the results reported in Panel B of Table 4 show that $Credit_{t-1}$ is never statistically significant, suggesting that the prior year's trade credit has no relation with the presence of the shared M&Ds in the current year. These results help mitigate the concern of reverse causality.

3.3.3. Financial crisis as a shock to the supply of trade credit

Our third set of tests uses the financial crisis as an exogenous shock to the supply of trade credit because external financing was tightly constrained during the crisis period. If shared M&Ds can facilitate access to trade credit by reducing information asymmetry and enhancing mutual trust between the customer and the supplier firms, their role is expected to become more important in the crisis period with a sudden drop in financing resources. To test this possibility, we follow Kong et al. (2020) and create a dummy variable, *FinCrisis*, to indicate the financial crisis period. *FinCrisis* equals 1 for observations from the global financial crisis period of 2008 to 2009, and 0 otherwise. We then re-estimate Eq. (1) by further including the interaction between *FinCrisis* and the two variables of shared M&Ds, respectively.

We report the results in Panel C of Table 4. The results show that the interaction between *FinCrisis* and shared M&Ds variables is positive and statistically significant, while shared M&Ds variables remain significantly positive in both regressions. This suggests a stronger effect of shared M&Ds on firms' access to trade credit during the financial crisis period. In terms of economic significance, a one standard deviation increase in Shared M&Ds Ratio leads to an additional increase in trade credit of 0.092 (equivalent to about 22.3 million RMB) during the financial crisis period compared to other periods. These results lend further support to the important role of shared M&Ds in helping customer firms to obtain trade credit, especially when they face tight financial constraints during financial crises.

3.3.4. High-dimensional fixed effects

Our final set of tests re-estimates Eq. (1) by including high-dimensional fixed effects. Trade credit fluctuates in bust and boom years and varies significantly across different industries (Barrot, 2016). Moreover, because of differences in regional development over time, our findings could be driven by time-varying regional characteristics. Therefore, we further control for high-dimensional fixed effects *Province* × *Year* × *Industry* in the baseline regression. The results reported in Panel D of Table 4 remain qualitatively similar, confirming that our main findings are not driven by any unobserved trends in regional or sector development.[5]

[5] We also perform the impact threshold of the confounding variable (ITCV) analysis recommended by Chapman et al. (2019), Frank (2000), Larcker and Rusticus (2010) to assess how large the endogeneity problem has to be to change our main results. The ITCV is specifically calculated as the lowest product of the partial correlations that an omitted variable should have with the independent and dependent variables of interest to make a significant coefficient become insignificant. The unreported results show that a confounding variable would have to be 8.2 (2.1) times larger than the most impactful included control variable (*Size*) to overturn the significant relationship between *Credit* and *Shared M&Ds* (*Shared M&Ds Ratio*) observed in Table 3. Under the assumption that we have a good set of control variables, this ITCV analysis provides some confidence in the estimate of the effect of shared M&Ds on the access to trade credit, although these results cannot directly rule out omitted variable concerns.

3.4. Channel tests

We previously proposed that shared M&Ds in the supply chain can effectively reduce information asymmetry, enhance mutual trust, and promote contract enforcement due to reputational concerns, thereby increasing customer firms' access to trade credit. In this section, we investigate potential channels through which shared M&Ds assist customer firms to obtain trade credit. We first explore heterogeneity in customer firms' information opacity and the geographic proximity between the paired customer and supplier firms to test each information channel. Second, we test the social trust channel by examining the main effect in regions with varying levels of trust. Last, we test personal reputational incentives by using personal age and number of directorships held at other firms as proxies for the reputation of shared M&Ds.

3.4.1. Information asymmetry

Firms with information opacity suffer from high financing costs. Shared M&Ds could serve as a conduit of information exchange and improve the communication between supplier firms and customer firms, thereby reducing information asymmetry between the two parties. Thus, we expect the effect of shared M&Ds on trade credit to be more pronounced for customer firms with higher levels of information asymmetry given that the role of shared M&Ds in reducing information asymmetry would be more important for these customer firms.

Drawing on the existing literature (e.g., Bernard et al., 2019; Cai and Sevilir, 2012; Dass et al., 2014; Hutton et al., 2009; Kong et al., 2020; Li et al., 2015), we capture a firm's information asymmetry using four measures: stock price informativeness, unsigned discretionary accruals, cross-listing status, and geographic distance from the supplier firm. Specifically, we create a dummy variable, *Lower PriceInfo*, equals to 1 if a firm's stock price informativeness, estimated following Chen et al. (2007), is lower than the sample mean value, and 0 otherwise; *Higher Accruals*, equals to 1 if the sum of the absolute values of a firm's discretionary accruals over the previous 3 years is higher than the sample mean value, and 0 otherwise[6]; *Cross-listing*, equals to 1 if a firm is cross-listed in capital markets of developed economies, including Hong Kong and the US, and 0 otherwise; and *Same_City*, defined as the proportion of suppliers registered in the same city as the customer firm.[7] A larger (or smaller) value of *Lower PriceInfo* and *Higher Accruals* (*Cross-listing* and *Same_City*) indicates a higher level of information asymmetry.

We then re-estimate Eq. (1) by including the four information asymmetry measures and their interaction with the shared M&D variables, respectively. The results reported in Table 5 show that the interactions of *Lower PriceInfo* and *Higher Accruals* with the shared M&Ds variables are significantly positive in Panel A and Panel B, while the interactions of *Cross-listing* and *Same_City* with the shared M&Ds variables are significantly negative as expected in Panel C and Panel D. This supports the notion that the effect of shared M&Ds on access to trade credit is more pronounced for the customer firms with higher information asymmetry.

3.4.2. Social trust

Informal financing such as trade credit is relationship-based, and firms in regions with low social trust receive low trade credit (Wu et al., 2014). If shared M&Ds can help build and enhance mutual trust and mitigate hold-up problems between firms and their suppliers, we expect the effect of shared M&Ds on trade credit to be stronger for firms located in regions with lower levels of social trust. To examine this possibility, we measure social trust at the provincial level based on the results from the 2013 China General Social Survey, which has been conducted since 2003 and is widely used to capture levels of social trust across different regions in China (e.g., Kong et al., 2020; Wu et al., 2014).

Specifically, we define a dummy variable, *Trust*, which equals 1 if the trust index of a firm's province is higher than the sample mean value, and 0 otherwise. We then re-estimate Eq. (1) by further including *Trust* and its interaction with the shared M&Ds variables. The results reported in Table 6 show that the interactions between *Trust* and the shared M&Ds variables are significantly negative, while the shared M&Ds variables remain positive and statistically significant in both regressions. This suggests an increased effect of shared M&Ds on trade credit in less trustworthy regions. This supports our conjecture that shared M&Ds can promote mutual trust between firms and their suppliers, and play a more important role in helping firms located in regions with weaker social trust to obtain trade credit.

3.4.3. Personal reputation

Reputation plays an important role in informal financing as there is no collateral or guarantees from third parties in trade credit provision (Ayyagari et al., 2010). Thus, we test whether shared M&Ds with a higher personal reputation can strengthen contract enforceability and play a more important role in helping customer firms obtain trade credit. Specifically, we employ age and the number of outside directorships or managerial positions to capture M&Ds' personal reputation. Older M&Ds and M&Ds holding more outside directorships or managerial positions in other firms have built up a better reputation in the labor market (e.g., Bizjak et al., 1993; Fich and Shivdasani, 2007; Francis et al., 2008; Jiang et al., 2016).

Accordingly, we introduce two sets of variables to measure shared M&Ds' reputation. One set includes *Senior Shared M&Ds* (*Senior Shared M&Ds Ratio*), defined as the number of shared M&Ds whose age is above the sample mean value (divided by total number of M&Ds), and *Junior Shared M&Ds* (*Junior Shared M&Ds Ratio*), defined as the number of shared M&Ds whose age is not above the sample

[6] Discretionary accruals are estimated using the modified Jones model (Dechow et al., 1995) as in Hutton et al. (2009).

[7] We also follow Uysal et al. (2008) and create a variable, *Distance*, as the proportion of suppliers with a spatial distance of less than 100 km from the focal customer firm. We find similar results using this variable in place of *Same_City*.

Table 5
Shared M&Ds and trade credit: Role of customer information opacity.

Panel A: Stock price informativeness		
Dependent variable	*Credit*	
	(1)	(2)
Shared M&Ds Ratio	0.173**	
	(2.26)	
Lower PriceInfo × *Shared M&Ds Ratio*	0.096**	
	(2.05)	
Shared M&Ds		0.006
		(1.55)
Lower PriceInfo × *Shared M&Ds*		0.006**
		(2.07)
Lower PriceInfo	−0.002	−0.002
	(−0.81)	(−0.87)
Control Variables	Yes	Yes
Firm Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes
Observations	9122	9122
Adjusted R^2	0.730	0.730

Panel B: Unsigned discretionary accruals		
Dependent variable	*Credit*	
	(1)	(2)
Shared M&Ds Ratio	0.111	
	(1.63)	
Higher Accruals × *Shared M&Ds Ratio*	0.164***	
	(2.76)	
Shared M&Ds		0.004
		(1.15)
Higher Accruals × *Shared M&Ds*		0.009***
		(2.69)
Higher Accruals	−0.001	−0.001
	(−0.27)	(−0.28)
Control Variables	Yes	Yes
Firm Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes
Observations	16,585	16,585
Adjusted R^2	0.725	0.725

Panel C: Cross-listing status		
Dependent variable	*Credit*	
	(1)	(2)
Shared M&Ds Ratio	0.201***	
	(2.62)	
Cross-listing × *Shared M&Ds Ratio*	−0.692**	
	(−2.51)	
Shared M&Ds		0.009**
		(2.19)
Cross-listing × *Shared M&Ds*		−0.026**
		(−2.20)
Cross-listing	0.059	0.059
	(1.40)	(1.40)
Control Variables	Yes	Yes
Firm Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes
Observations	22,588	22,588
Adjusted R^2	0.724	0.724

Panel D: Geographic proximity		
Dependent variable	*Credit*	
	(1)	(2)
Shared M&Ds Ratio	0.213***	

(*continued on next page*)

Table 5 (*continued*)

Panel D: Geographic proximity		
Dependent variable	*Credit*	
	(1)	(2)
	(2.95)	
Same_City × *Shared M&Ds Ratio*	−0.188**	
	(−2.50)	
Shared M&Ds		0.011***
		(2.81)
Same_City × *Shared M&Ds*		−0.011***
		(−2.76)
Same_City	0.009	0.009
	(1.14)	(1.22)
Control Variables	Yes	Yes
Firm Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes
Observations	22,588	22,588
Adjusted R^2	0.743	0.743

This table presents the results examining whether the effect of shared M&Ds on trade credit varies with customer firms' information opacity. Panel A uses stock price informativeness as a proxy for information opacity. *Lower PriceInfo* equals 1 if a firm's stock price informativeness, estimated following Chen et al. (2007), is lower than the sample mean value, and 0 otherwise. Panel B uses unsigned discretionary accruals as a proxy for information opacity. *Higher Accruals* equals 1 if the sum of the absolute values of a firm's discretionary accruals over the previous 3 years is higher than the sample mean value, and 0 otherwise. Panel C uses cross-listing status as a proxy for information opacity. *Cross-listing* equals 1 if a firm is cross-listed in capital markets of developed economies, including Hong Kong and the US, and 0 otherwise. Panel D uses the distance to the customer firm as a proxy for information opacity. *Same_City* is defined as the proportion of suppliers registered in the same city as the customer firm. Each regression includes a separate intercept and the same set of control variables as in Table 3. The definitions of the other variables are provided in the Appendix. All continuous variables are winsorized at the top and bottom 1%. Heteroscedasticity-robust standard errors are clustered by firm. *t*-statistics are reported in parentheses. *, **, and *** represent significance levels of 10%, 5%, and 1%, respectively.

Table 6
Shared M&Ds and trade credit: Role of regional social trust.

Dependent variable	*Credit*	
	(1)	(2)
Shared M&Ds Ratio	0.315***	
	(3.43)	
Trust × *Shared M&Ds Ratio*	−0.278**	
	(−2.03)	
Shared M&Ds		0.016***
		(3.46)
Trust × *Shared M&Ds*		−0.015**
		(−2.04)
Trust	0.003	0.003
	(0.16)	(0.15)
Control Variables	Yes	Yes
Firm Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes
Observations	21,076	21,076
Adjusted R^2	0.748	0.748

This table presents the results examining whether the effect of shared M&Ds on trade credit varies with the levels of social trust in the customer firms' regions. *Trust* equals 1 if the trust index of a firm's province is higher than the sample mean value, and 0 otherwise. Each regression includes a separate intercept and the same set of control variables as in Table 3. The definitions of the other variables are provided in the Appendix. All continuous variables are winsorized at the top and bottom 1%. Heteroscedasticity-robust standard errors are clustered by firm. *t*-statistics are reported in parentheses. *, **, and *** represent significance levels of 10%, 5%, and 1%, respectively.

mean value (divided by total number of M&Ds). The other set includes *HigherDPs Shared M&Ds* (*HigherDPs Shared M&Ds Ratio*), defined as the number of shared M&Ds with outside directorships or managerial positions above the sample mean value (divided by total number of M&Ds), and *LowerDPs Shared M&Ds* (*LowerDPs Shared M&Ds Ratio*), defined as the number of shared M&Ds with outside directorships or managerial positions not above the sample mean value (divided by total number of M&Ds). We then include these paired variables in place of shared M&Ds variables and re-estimate Eq. (1).

The results in Columns (1) and (2), Table 7 show that *Senior Shared M&Ds Ratio/Senior Shared M&Ds* is significantly positive but

Table 7
Shared M&Ds and trade credit: Role of personal reputation.

Dependent variable	*Credit*			
	(1)	(2)	(3)	(4)
Senior Shared M&Ds Ratio	0.151**			
	(2.03)			
Junior Shared M&Ds Ratio	0.145			
	(1.24)			
Senior Shared M&Ds		0.007*		
		(1.69)		
Junior Shared M&Ds		0.007		
		(1.15)		
HigherDPs Shared M&Ds Ratio			0.655**	
			(2.44)	
LowerDPs Shared M&Ds Ratio			0.151*	
			(1.81)	
HigherDPs Shared M&Ds				0.026**
				(2.13)
LowerDPs Shared M&Ds				0.006*
				(1.78)
Control Variables	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	22,588	22,588	22,588	22,588
Adjusted R^2	0.743	0.743	0.743	0.743

This table presents the results examining whether the effect of shared M&Ds on trade credit varies with shared M&Ds' personal reputation. *Senior Shared M&Ds (Senior Shared M&Ds Ratio)* is defined as the number of shared M&Ds whose age is above the sample mean value (divided by total number of M&Ds), while *Junior Shared M&Ds (Junior Shared M&Ds Ratio)*, is defined as the number of shared M&Ds whose age is not above the sample mean value (divided by total number of M&Ds). *HigherDPs Shared M&Ds (HigherDPs Shared M&Ds Ratio)* is defined as the number of shared M&Ds with outside directorships or managerial positions above the sample mean value (divided by total number of M&Ds), while *LowerDPs Shared M&Ds (LowerDPs Shared M&Ds Ratio)*, is defined as the number of shared M&Ds with outside directorships or managerial positions not above the sample mean value (divided by total number of M&Ds). Each regression includes a separate intercept and the same set of control variables as in Table 3. The definitions of the other variables are provided in the Appendix. All continuous variables are winsorized at the top and bottom 1%. Heteroscedasticity-robust standard errors are clustered by firm. *t*-statistics are reported in parentheses. *, **, and *** represent significance levels of 10%, 5%, and 1%, respectively.

Junior Shared M&Ds Ratio/Junior Shared M&Ds is statistically insignificant though positive. Columns (3) and (4) show that the coefficient of *HigherDPs Shared M&Ds Ratio/HigherDPs Shared M&Ds* is much larger in magnitude than *LowerDPs Shared M&Ds Ratio/LowerDPs Shared M&Ds*, though both *HigherDPs Shared M&Ds Ratio/HigherDPs Shared M&Ds* and *LowerDPs Shared M&Ds Ratio/LowerDPs Shared M&Ds* are significantly positive. These results are consistent with the notion that shared M&Ds with a higher reputation are better able to assist customer firms to obtain trade credit.

3.5. Additional cross-sectional tests

In this subsection, we examine whether the effect of shared M&Ds on trade credit varies with industry characteristics and financial constraints.

3.5.1. Industry characteristics

We focus on two industry attributes (i.e., industry innovativeness and homogeneity), that are found to affect the information gap between firms and their suppliers. Firms in innovative industries generally produce differentiated products and entail relationship-specific investments, which incurs more contracting and information problems with their suppliers (e.g., Grossman and Hart, 1986; Klein et al., 1978; Williamson, 1979). Firms in homogeneous industries tend to have low information asymmetry because it is easier to benchmark a firm's performance against its peers in the same industry. Dass et al. (2014) find that DRIs have a stronger impact on firm value/performance for firms in innovative and heterogeneous industries. Therefore, we expect that the role of shared M&Ds in facilitating access to trade credit will be more important for customer firms in more innovative and heterogeneous industries.

To test this prediction, we define innovative industries in two ways. One follows the approach adopted by Rauch (1999) and proxies for innovativeness using the classification of high-tech industries defined by the China National Bureau of Statistics.[8] We create a dummy variable, *High-tech*, which equals 1 if a firm operates in a high-tech industry, and 0 otherwise. The other proxy for

[8] The high-tech industries defined by the China National Bureau of Statistics include electronic component manufacturing, other electronic equipment manufacturing, medical device manufacturing, aerospace vehicle manufacturing, electrical machinery and equipment manufacturing, measuring instruments and office machinery, pharmaceutical manufacturing, communication and related equipment manufacturing, computers and related equipment manufacturing.

innovativeness is based on the total research and development (R&D) expenditure of an industry. We construct a dummy variable, *High-R&D*, which equals 1 if the total R&D expenditure of an industry in a year is higher than the sample mean value, and 0 otherwise. To measure industry homogeneity, we follow Parrino (1997) and calculate the correlation between common stock returns within two-digit China Securities Regulatory Commission (CSRC) industries. Specifically, we construct a dummy variable, *Homo_Ind*, which equals 1 if the average partial correlation coefficient between monthly stock returns of all firms in the same two-digit CSRC code and monthly industry returns calculated at the two-digit CSRC level is higher than the sample mean value in a year. We then re-estimate Eq. (1) by further including these industry variables and their interactions with shared M&Ds variables, respectively.

Columns (1) to (4) in Table 8 present the results regarding industry innovativeness. All interactions of industry innovativeness measures with shared M&Ds variables are significantly positive, suggesting that the effect of shared M&Ds is more pronounced for firms in more innovative industries. Columns (5) and (6) report the results regarding industry homogeneity and show that both interactions of industry homogeneity measures with shared M&Ds variables are significantly negative, while shared M&Ds variables remain significantly positive. This suggests that the effect of shared M&Ds is attenuated for firms in more homogeneous industries. In sum, the results in Table 8 confirm our prediction that shared M&Ds are of greater value for customer firms in more innovative and heterogeneous industries where the information gap is larger.

3.5.2. Financial constraints

Abdulla et al. (2017) find that financially constrained firms have greater difficulty accessing external capital and tend to rely more heavily on trade credit as a source of financing. Financially constrained customer firms may also be more likely to appoint a director or manager from their key suppliers in the hope that this will lead to increased trade credit. Thus, the effect of shared M&Ds on trade credit is expected to be more pronounced for financially constrained firms.

To test this possibility, we follow prior studies (e.g., Campello et al., 2010; Gilchrist and Himmelberg, 1995) and use the dividend payment ratio (*Dividend*) as a proxy for financial constraints. We then re-estimate Eq. (1) by including *Dividend* and its interactions with shared M&Ds variables. The results reported in Table 9 show that the interactions between *Dividend* and shared M&Ds variables are significantly negative, while shared M&Ds variables remain significantly positive. This is consistent with our prediction that the effect of shared M&Ds on trade credit is mitigated for less financially constrained firms.

3.6. Robustness tests

In this subsection, we conduct several tests to examine the robustness of our main results to alternative shared M&Ds measures, an alternative trade credit measure, and a restricted sample excluding affiliated firms.

3.6.1. Alternative measures of shared M&Ds

In previous analyses, we measure shared M&Ds based on the number of directors and managers who serve at both customer firms and supplier firms. In this subsection, we examine the robustness of our baseline results to the two alternative measures of shared M&Ds. We follow Chiu et al. (2013) and define the first alternative measure, *Shared Link*, as the number of customer–supplier pairs that share common managers or directors.[9] Our second alternative measure, *Ln_Shared Link*, is defined as the natural logarithm of 1 plus *Shared Link*, as in Bizjak et al. (2009). The results using these two alternative measures are reported in Panel A of Table 10. Both *Shared Link* and *Ln_Shared Link* are positive and statistically significant, suggesting that our results are not driven by the measures of shared M&Ds.

3.6.2. Alternative measure of trade credit

In addition to the primary measure of firms' access to trade credit as the ratio of accounts payable over total liabilities, we create an alternative measure, *Credit_Assets*, as the ratio of accounts payable divided by total assets, which is also frequently used in the literature (e.g., Liu et al., 2016; Wu et al., 2014). The results reported in Panel B of Table 10 show that the coefficients of shared M&Ds variables are both positive and statistically significant, suggesting that our results are robust to the measure of firms' access to trade credit.

3.6.3. Restricted sample excluding affiliated firms

Some of our sample customer firms are parent firms or subsidiaries of their major suppliers or have formed joint ventures with their top suppliers. Our main results could be driven by these customer firms economically linked to their top suppliers. To address this concern, we exclude those observations in which customer firms are economically linked to their top suppliers and re-estimate Eq. (1). The results reported in Panel C of Table 10 show that shared M&Ds variables remain qualitatively unchanged.

4. Conclusions

In this study, we investigate whether directors or managers shared by customer firms and supplier firms can improve the customer firms' access to trade credit based on a large sample of Chinese listed firms. We find a robust positive relationship between shared M&Ds and firms' access to trade credit. Our channel analyses reveal that the effect of shared M&Ds on firms' access to trade credit is

[9] For example, if a firm's manager *A* holds a directorship or other managerial position at the firm's two suppliers in a year, then *Shared Link* takes the value of 2 for that firm. In contrast, *Shared M&Ds* takes the value of 1 in this case.

Table 8
Cross-sectional test: Industry characteristics.

Dependent variable	*Credit*					
	(1)	(2)	(3)	(4)	(5)	(6)
Shared M&Ds Ratio	−0.135	0.036			0.243*	
	(−1.14)	(0.33)			(1.93)	
High-tech	0.054***		0.053***			
	(10.16)		(10.12)			
High-R&D		0.072***		0.072***		
		(12.66)		(12.64)		
High-tech × Shared M&Ds Ratio	0.288**					
	(2.01)					
High-R&D × Shared M&Ds Ratio		0.330**				
		(1.99)				
Shared M&Ds			−0.007	0.003		0.014**
			(−1.12)	(0.53)		(2.08)
High − tech × Shared M&Ds			0.016**			
			(2.11)			
High-R&D × Shared M&Ds				0.018**		
				(2.00)		
Homo_Ind					−0.006*	−0.006*
					(−1.84)	(−1.83)
Homo_Ind × Shared M&Ds Ratio					−0.193*	
					(−1.87)	
Homo_Ind × Shared M&Ds						−0.011*
						(−1.90)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	22,588	18,107	22,588	18,107	22,585	22,585
Adjusted R^2	0.210	0.217	0.210	0.217	0.188	0.188

This table presents the results examining whether the effect of shared M&Ds on trade credit varies with customer firms' industry characteristics. *High-tech* equals 1 if a firm operates in a high-tech industry, and 0 otherwise. *High-tech* industries are defined by the China National Bureau of Statistics. *High-R&D* equals 1 if the total R&D expenditure of an industry in a year is higher than the sample mean value, and 0 otherwise. *Homo_Ind* equals 1 if the average partial correlation coefficient between monthly stock returns of all firms in the same two-digit CSRC code and monthly industry returns calculated at the two-digit CSRC level is higher than the sample mean value in a year. Each regression includes a separate intercept and the same set of control variables as in Table 3. The definitions of the other variables are provided in the Appendix. All continuous variables are winsorized at the top and bottom 1%. Heteroscedasticity-robust standard errors are clustered by firm. *t*-statistics are reported in parentheses. *, **, and *** represent significance levels of 10%, 5%, and 1%, respectively.

Table 9
Cross-sectional test: Financial constraints.

Dependent variable	*Credit*	
	(1)	(2)
Shared M&Ds Ratio	0.191***	
	(2.70)	
Dividend × Shared M&Ds Ratio	−0.008***	
	(−2.73)	
Shared M&Ds		0.009**
		(2.44)
Dividend × Shared M&Ds		−0.001***
		(−3.06)
Dividend	−0.003	−0.003
	(−1.01)	(−1.03)
Control Variables	Yes	Yes
Firm Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes
Observations	21,014	21,014
Adjusted R^2	0.751	0.751

This table presents the results examining whether the effect of shared M&Ds on trade credit varies with customer firms' financial constraints. We use dividend payment ratio (*Dividend*) as a proxy for financial constraints. Each regression includes a separate intercept and the same set of control variables as in Table 3. The definitions of the other variables are provided in the Appendix. All continuous variables are winsorized at the top and bottom 1%. Heteroscedasticity-robust standard errors are clustered by firm. *t*-statistics are reported in parentheses. *, **, and *** represent significance levels of 10%, 5%, and 1%, respectively.

Table 10
Robustness tests.

Panel A: Alternative measures of shared M&Ds		
Dependent variable	*Credit*	
	(1)	(2)
Shared Link	0.007**	
	(2.39)	
Ln_Shared Link		0.015**
		(2.00)
Control Variables	Yes	Yes
Firm Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes
Observations	22,588	22,588
Adjusted R^2	0.743	0.743

Panel B: Alternative measure of trade credit		
Dependent variable	*Credit_Assets*	
	(1)	(2)
Shared M&Ds Ratio	0.067**	
	(2.02)	
Shared M&Ds		0.003*
		(1.87)
Control Variables	Yes	Yes
Firm Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes
Observations	22,588	22,588
Adjusted R^2	0.738	0.738

Panel C: Excluding affiliated firms		
Dependent variable	*Credit*	
	(1)	(2)
Shared M&Ds Ratio	0.175***	
	(2.62)	
Shared M&Ds		0.008**
		(2.23)
Control Variables	Yes	Yes
Firm Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes
Observations	22,543	22,543
Adjusted R^2	0.743	0.743

This table presents the robustness tests. Panel A shows the results using alternative measures of shared M&Ds. *Shared Link* is defined as the total number of the customer–supplier pairs that have common managers or directors. *Ln_Shared Link* is defined as the natural logarithm of 1 plus *Shared Link*. Panel B reports the results using an alternative measure of trade credit. *Credit_Assets* is defined as the ratio of accounts payable over total assets. Panel C reports the results excluding affiliated firms. When customer firms are parent firms, subsidiaries of supplier firms, or form joint ventures with supplier firms, they are categorized as affiliated firms. Each regression includes a separate intercept and the same set of control variables as in Table 3. The definitions of the other variables are provided in the Appendix. All continuous variables are winsorized at the top and bottom 1%. Heteroscedasticity-robust standard errors are clustered by firm. *t*-statistics are reported in parentheses. *, **, and *** represent significance levels of 10%, 5%, and 1%, respectively.

more pronounced for customer firms with greater information asymmetry and weaker regional social trust, and when shared M&Ds have a higher personal reputation. Our findings highlight the role played by shared M&Ds in mitigating the information gap and moral hazard problems inherent in customer–supplier relationships. We further find that the role of shared M&Ds in promoting firms' access to trade credit is particularly more important for financially constrained firms and for customer firms in more innovative and heterogeneous industries.

Our results are robust to a series of tests addressing endogeneity issues, including DID analyses based on exogenous departure events of shared M&Ds, tests using the global financial crisis as an exogenous shock to trade credit supply, and the additional inclusion of high-dimensional fixed effects. Moreover, our results remain unchanged when we use alternative measures for both dependent and

key explanatory variables as well as a restricted sample excluding customer firms that are economically linked to their major suppliers.

Our study contributes to the literature on trade credit by shedding light on the role of shared M&Ds in promoting trade credit access. Our findings also provide a better understanding of the benefits versus the costs of having DRIs on a firm's board, as discussed by Dass et al. (2014), because shared M&Ds are actually a certain group of DRIs. We identify an additional specific channel through which DRIs, shared M&Ds in particular, can improve firm value/performance by facilitating trade credit access. Our study has important implications for firms with a greater reliance on informal financing in emerging markets such as China. Firms with limited formal external financing sources can approach shared M&Ds at their key suppliers to obtain more trade credit. Finally, our findings also have implications for global investors by clarifying the functionality of informal financing in relation-based countries such as China, which are attracting increasing attention from foreign investors around the world.

Our study has some limitations. Specifically, listed firms in China are only required to disclose their five largest suppliers, making complete supplier data unavailable. Chinese firms also seldom disclose trade credit balances and other terms specific to each top supplier, preventing us from comprehensively investigating the effect of shared M&Ds on trade credit at the customer–supplier pair level.

Data availability

Data will be made available on request.

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Appendix A. Variable definitions

Variable	Description
Credit	The ratio of accounts payable over total liabilities.
Shared M&Ds	Number of shared managers or directors who also serve as managers or directors in their first five biggest suppliers' firms.
Shared M&Ds Ratio	Number of shared managers or directors/Total number of managers and directors.
Size	Natural logarithm of firm's total assets.
Lev	The ratio of long-term debt to total assets.
ROA	Total net earnings over total assets.
PPE	Total fixed assets over total assets.
Cash Flow	Total operating cash flows over total assets.
Age	Natural logarithm of 1 plus firm age.
Growth	The sales growth rate, which is the ratio of difference between sales in the current year and sales in the prior year to the sales in the prior year.
ID Ratio	The ratio of the number of independent directors divided by total number of board directors.
Capital Labor Ratio	A firm's total fixed assets divided by the total number of employees.
SOE	A dummy variable which equals 1 if the listed firm is state-owned.
Market Share	The share of a firm's own sales among total two-digit industry sales.
FinCrisis	A dummy variable which equals 1 for the observations in the years 2008 and 2009, and 0 otherwise.
Lower PriceInfo	A dummy variable which equals 1 if a firm's stock price informativeness, estimated following Chen et al. (2007), is lower than the sample mean value, and 0 otherwise.
Higher Accruals	A dummy variable which equals 1 if the sum of the absolute values of a firm's discretionary accruals over the previous 3 years is higher than the sample mean value, and 0 otherwise. Discretionary accruals are estimated using the modified Jones model (Dechow et al., 1995) as in Hutton et al. (2009).
Cross-listing	A dummy variable which equals 1 if a firm is cross-listed in capital markets of developed economies, including Hong Kong and the US, and 0 otherwise.
Same_City	The proportion of top suppliers that registered in the same city as the customer firm.
Trust	A dummy variable, which equals 1 if the social trust index of a firm's province is higher than the sample mean value, and 0 otherwise. The social trust index is constructed using the data from the 2013 China General Social Survey.
Senior Shared M&Ds	The number of shared M&Ds whose age is above the sample mean value.
Junior Shared M&Ds	The number of shared M&Ds whose age is not above the sample mean value.
Senior Shared M&Ds Ratio	The number of shared M&Ds whose age is above the sample mean value, divided by total number of M&Ds.
Junior Shared M&Ds Ratio	The number of shared M&Ds whose age is not above the sample mean value, divided by total number of M&Ds.
HigherDPs Shared M&Ds	The number of shared M&Ds with outside directorships or managerial positions above the sample mean value.
LowerDPs Shared M&Ds	The number of shared M&Ds with outside directorships or managerial positions not above the sample mean value.
HigherDPs Shared M&Ds Ratio	The number of shared M&Ds with outside directorships or managerial positions above the sample mean value, divided by total number of M&Ds.

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(*continued*)

Variable	Description
LowerDPs Shared M&Ds Ratio	The number of shared M&Ds with outside directorships or managerial positions not above the sample mean value, divided by total number of M&Ds.
High-tech	A dummy variable, which equals 1 if a firm operates in a high-tech industry, and 0 otherwise. The high-tech industries are classified according to the China National Bureau of Statistics.
High-R&D	A dummy variable, which equals 1 if the total R&D expenditure of an industry in a year is higher than the sample mean value, and 0 otherwise.
Homo_Ind	A dummy variable which equals 1 if the average partial correlation coefficient between monthly stock returns of all firms in the same two-digit CSRC code and monthly industry returns calculated at the two-digit CSRC level is higher than the sample mean value in a year.
Dividend	The dividend payment ratio as a proxy for financial constraint.
Shared Link	Total number of customer–supplier pairs with common managers or directors.
Ln_Shared Link	Natural logarithm of 1 plus *Shared Link*.
Credit_Assets	The ratio of accounts payable over total assets.

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