

Intangible assets and trade credit policy

Sarah Taylor Hartsema and Chris Harris

Elon University, Elon, North Carolina, USA

Zhe Li

Bemidji State University, Bemidji, Minnesota, USA, and

Thibaut G. Morillon

Finance, Elon University, Elon, North Carolina, USA

Abstract

Purpose – The purpose of this paper is to identify whether the rise in intangible asset investment is related to trade credit investment and whether this relationship is driven by financial constraint and other firm factors.

Design/methodology/approach – The study conducts fixed effect regressions testing the relationship between trade credit investment and intangible asset levels. The relationship is further examined for all firms based on product type, financial constraint and sales growth.

Findings – There is a negative relationship between investment in trade credit and the level of intangible assets as a proportion of total assets. This negative relationship is largely explained by firms in industries that traditionally utilize more trade credit, firms with financial constraints and firms with low sales growth.

Practical implications – The level of investment in intangible assets continues to rise, while investment in trade credit is declining. This paper is the first to identify whether these trends could be related and to provide some explanation why.

Originality/value – This study is the first to link investment in trade credit with investment in intangible assets. There is a negative relationship that is most pronounced for firms that typically offer more trade credit, that are experiencing financial constraint and that are experiencing low growth.

Keywords Trade credit, Intangible assets, Financial constraint

Paper type Research paper

1. Introduction

In this study, we investigate the relationship between two recently documented trends among US firms: the decline in the extension of trade credit and the increase in investment in intangible assets (see [Figures 1](#) and [2](#)). Trade credit is the most important source of external short-term financing for firms in the USA ([Petersen and Rajan, 1997](#)), providing benefits to both offering and demanding firms. On the demand side, it allows firms without access to traditional forms of credit to obtain external liquidity as suppliers have a monitoring advantage over banks and can enforce debt collection better ([Meltzer, 1960](#); [Nadiri, 1969](#); [Burkart and Ellingsen, 2004](#); [Cunat, 2007](#)). On the offering side, trade credit is used as a tool to forge trade relationships while potentially gaining an extra return as trade credit is more expensive than credit supplied by traditional banks ([Dass et al., 2015](#); [Cunat, 2007](#)). Supplying firms also reap the benefits of trade credit in equity markets as an increase in trade credit is associated with excess returns ([Hill et al., 2012](#)).

Over the last few decades, both the proportion of firms offering trade credit and the proportion of receivables on firms' balance sheets have declined steadily ([Bates et al., 2009](#)). The magnitude of this decline is nonnegligible: [Harris and Roark \(2017\)](#) find that the reallocation of funds from firms traditionally extending credit to buyers amounts to a \$1.2 trillion decline from 1980 to 2000. The factors contributing to this trend include increased



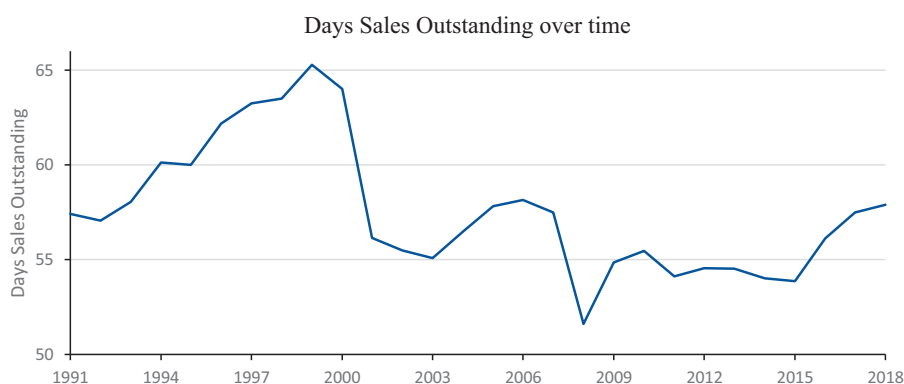


Figure 1.
Investment in trade
receivables over time

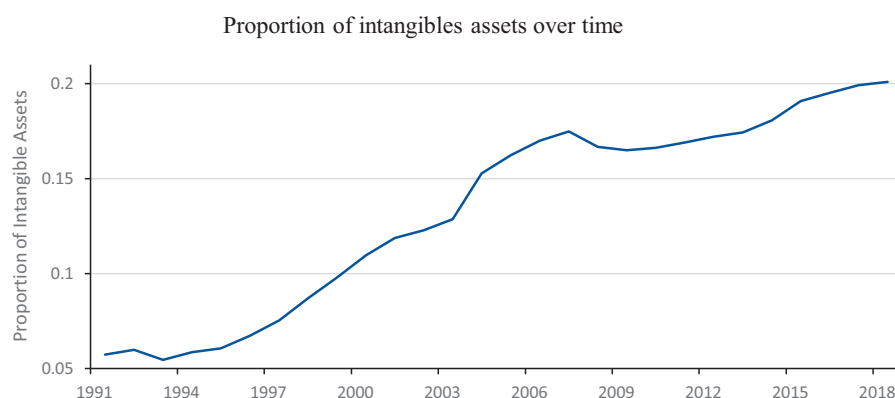


Figure 2.
Proportion of
intangible assets
over time

cash flow volatility, additional research and development (R&D) investments, as well as the evolution of the composition of listed firms (Fama and French, 2004; Bates *et al.*, 2009; Harris and Roark, 2017).

Another recent trend of interest is the increased investment in intangible assets held by US firms including R&D, patents and brand image (Falato *et al.*, forthcoming; Denis and McKeon, 2018). Corrado *et al.* (2009) find that investments in categories like R&D have a significant positive impact on growth, suggesting firms reap important benefits when investing in intangible assets. The magnitude of these benefits might even be understated as Hall (2001) argues that US corporations own substantial amounts of intangible assets that are otherwise not recorded in companies' books or in government statistics.

Could these two trends be related? According to the US Bureau of Labor Statistics (USBLS), manufacturing jobs declined by over 30% [1] since the 1990s, and this decline has given rise to jobs in the services industry. The USBLS predicts that around half of the 11.5 m jobs created between 2016 and 2026 will be in the services industry [2]. This prediction has implications for our study as firms in the service industry have fewer tangible assets than firms in other traditional sectors such as manufacturing, electing instead to invest more heavily in intangible assets. Industry contrasts are noteworthy because Giannetti *et al.* (2011) find evidence that trade credit policy is affected by the nature of the good a firm sells. More specifically, firms that sell either differentiated goods or services (i.e. "trade credit" firms)

extend more trade credit on average. Could trade credit policy be related to investment in intangible assets?

This paper seeks to establish whether a relationship exists between the trends of declining trade credit supply and increasing investment in intangible assets. To our knowledge, this is the first study to investigate a potential relationship between these trends. First, we add to the literature on both trade credit and intangible assets by finding evidence of a negative relationship between the two. We find that on average, firms with a higher proportion of intangible assets extend less trade credit. Moreover, we show that the nature of this relationship depends on the type of goods sold, as firms selling either differentiated goods or services drive this negative relationship. Second, we add to the literature on the effects of financial constraints by showing that access to capital also plays a role in the nature of the relationship between intangible assets and trade credit. Indeed, evidence of a negative relationship is particularly strong for firms with financial constraints and firms experiencing low growth, suggesting that firms with low growth continue to maintain investment in trade credit in an effort to increase sales growth [Molina and Preve \(2009\)](#). Conversely, firms without financial constraint and firms with high sales growth do not need to decrease investments in intangible assets to maintain or extend additional trade credit. Finally, we show that firms with low cash flows from operations do not maintain the same investment in trade credit as their intangible assets increase, while firms with high cash flows from operations do.

The paper is structured as follows. In [Section 2](#), we review relevant TC and intangibles-related findings. In [Section 3](#), we describe our empirical model and explain our hypotheses and methodology. [Section 4](#) discusses the data. In [Section 5](#), we report and discuss our results. [Section 6](#) presents the conclusions of the study.

2. Literature review

A significant portion of trade credit literature has mainly focused on the role of trade credit as a tool to address financing constraints. Trade credit plays an important role, allowing firms with limited access to traditional forms of credit to access liquidity ([Meltzer, 1960](#); [Nadiri, 1969](#)). Trade credit suppliers have comparative advantages over banks when lending to customers. First, suppliers can enforce debt collection better than banks because they can stop sending the goods to customers ([Cunat, 2007](#)). Second, suppliers have a monitoring advantage over banks because they are able to obtain information about the borrower over the course of the business relationship as they automatically know when a transaction is completed without incurring additional monitoring costs ([Burkart and Ellingsen, 2004](#)).

[Petersen and Rajan \(1997\)](#) show that firms extending trade credit are larger and more profitable on average. Firms use trade credit as a tool to create relationship-specific investments, and the relationship between the supplier and customer impacts the amount of trade credit extended ([Dass et al., 2015](#)). Trade credit suppliers are able to capitalize on their business relationships as trade credit is traditionally more expensive than traditional forms of financing ([Cunat, 2007](#)). Consistent with this idea, [Hill et al. \(2012\)](#) observe a positive relationship between excess stock returns and changes in trade receivables, suggesting that investors see trade credit as a value-creating investment.

Despite the higher costs incurred, the literature shows that trade credit is largely beneficial to demanding firms. [Barrot \(2016\)](#) and [Breza and Liberman \(2017\)](#) find evidence of various negative consequences when trade credit is restricted such as higher default rates and decreased likelihood of trade between firms. Looking at European markets, [Casey and O'Toole \(2014\)](#) and [Carbo-Valverde et al. \(2016\)](#) show that firms rely on trade

credit as a source of temporary liquidity when facing credit crunches or difficulties in accessing traditional forms of credit. Consistent with these findings, [Garcia-Appendini and Montoriol-Garriga \(2013\)](#) argue that when liquidity is harder to find in the financial markets, cash-rich suppliers have lower opportunity cost of funds and are thus more able to provide liquidity.

Given the benefits experienced by both demanding and supplying firms, it is surprising that trade credit investment has declined over time. Indeed, [Bates *et al.* \(2009\)](#) find that the proportion of receivables on firms' balance sheets dropped from 20.3% of assets in 1980 to 15.3% in the 2000s. They argue that increases in cash flow volatility have led firms to hold greater levels of cash as a response to the increased risk to the detriment of trade credit. More recently, [Harris and Roarke \(2017\)](#) examine possible reasons for the decline in the use of trade credit over the past 30 years. They find evidence that the proportion of US firms that have traditionally extended the most trade credit has been decreasing over time. This finding is consistent with [Fama and French's \(2004\)](#) observation that the composition of all firms has changed after the 1970s due to the rapid increase in the number of newly listed firms and the evolution of the profile of these newly listed firms in recent decades. This shift in firms' nature is echoed by [Brown and Kapadia \(2007\)](#) who find evidence of a market-wide increase in idiosyncratic risk as a result of changes to the composition of listed firms over time.

We next explore the increase in investment in intangible assets over time. A segment of the literature focuses on the relationship between intangible assets and growth. [Corrado *et al.* \(2009\)](#) argue that investments in R&D lead to increased growth. [Falato *et al.* \(forthcoming\)](#) find evidence suggesting that an increase in intangible assets can explain the increase in US corporate cash holdings. [Hall \(2001\)](#) suggests that the impact of investment in intangible assets might even be understated as accounting methods do not account for their full value which is unmeasurable. [Corrado *et al.* \(2009\)](#) echo this view suggesting accounting practices exclude business intangible capital stock to the tune of \$3 trillion for US firms.

The intersection of these streams of the literature provides an interesting opportunity to investigate whether a relationship exists between the decline in trade credit over time and the contrasting increase in investment in intangible assets.

3. Empirical model, hypotheses and methodology

The decline in investment in trade credit over the past decades is significant and well documented ([Bates *et al.*, 2009](#); [Harris and Roark, 2017](#)). [Figure 1](#) graphically shows a sharp decrease following the dot-com bubble and the Great Recession. Over this period, the profile of US firms evolved and investment in intangible assets increased significantly, explaining the increase in US cash holdings ([Fama and French, 2004](#); [Falato *et al.*, forthcoming](#)). [Figure 2](#) graphically shows evidence that the proportion of intangible assets in a firm's books has consistently increased over the past three decades. We seek to understand whether these trends are related and whether the additional investment in intangible assets comes at the expense of investment in trade credit. If the two trends are indeed related, we expect a negative relationship between investment in intangible assets and the amount of trade credit extended. In other words, we expect firms investing more resources in intangible assets to extend less trade credit all else equal.

H1. Investments in intangible assets are negatively related to the amount of trade credit supplied to a customer.

To test our hypothesis, we follow [Molina and Preve \(2009\)](#) and [Harris and Roark \(2017\)](#), using the following fixed effects panel regression:

$$\begin{aligned} \text{Days Sales Outstanding(DSO)}_{i,t} = & \beta_0 + \beta_1 \text{Intangibles} / \text{Sales}_{i,t} + \beta_2 \text{Ln}(\text{Firm Size}_{i,t}) \\ & + \beta_3 \text{Payables}_{i,t} + \beta_4 \text{Leverage}_{i,t} + \beta_5 \text{Inventory}_{i,t} \\ & + \beta_6 \text{Sales Growth}_{i,t} + \beta_7 \text{Distress}_{i,t} \\ & + \beta_8 \text{Cash Flow Risk}_{i,t} + \beta_9 \text{Profitability}_{i,t} \\ & + \beta_{10} \text{Firm Age}_{i,t} + f_i + \delta_t + \varepsilon_{i,t} \end{aligned} \tag{1}$$

In addition to the impact of investments in intangible assets (our variable of interest), we control for several other variables past literature has shown to impact trade credit policies. Our model includes the following variables:

- (1) *Days Sales Outstanding (DSO)*: We proxy for trade credit by taking the ratio of the firm's receivables over its daily sales. This is the dependent variable in our regressions.
- (2) *Intangibles/Sales*: This is our variable of interest. It is computed as intangibles assets divided by total assets.
- (3) *Firm Size*: Larger firms with access to traditional forms of credit are more likely to provide trade credit to their customers (Petersen and Rajan, 1997; Molina and Preve, 2009). We control for firm size by using the log value of the firm's total assets measured in US\$2,000 to account for inflation.
- (4) *Payables*: Molina and Preve (2009) show that firms with higher levels of trade payables tend to increase their level of trade receivables. We compute this measure by dividing payables by daily cost of goods sold.
- (5) *Leverage*: Cunat (2007) argues that trade credit is a form of financing similar to traditional forms of debt. Molina and Preve (2009) show that debt is positively related to trade credit. Consequently, we control for firms' degree of leverage, computed as total debt over total assets.
- (6) *Inventory to COGS*: Molina and Preve (2009) argue that firms with higher levels of inventory are more likely to extend trade credit to convert excess inventory to sales. We compute the variable as inventory over daily cost of goods sold.
- (7) *Sales Growth*: Hill et al. (2012) show that sales growth is positively related to trade credit. We compute sales growth as the rate of change in sales from the previous year.
- (8) *Financial distress*: Molina and Preve (2009) find that constrained firms administer more aggressive trade credit policies in an attempt to gain sales. Following Asquith et al. (1994), to control for financial distress, we use an indicator variable equal to 1 if the firm's earnings before interest, taxes, depreciation and amortization (EBITDA) is less than 80% of its interest expenses and 0 otherwise.
- (9) *Cash Flow Risk*: Harris and Roark (2017) find that cash flow volatility contributed to an overall decrease in trade credit investment. Following Bates et al. (2009), we proxy for cash flow risk with the SD of operating cash flow (OCF) over the past 10 years.
- (10) *Profitability*: Molina and Preve (2009) find evidence that firms increase the use of trade receivables when they are facing profitability problems. We compute our measure of profitability as net income divided by total assets (return on total assets [ROA]).

-
- (11) *Firm Age*: Long *et al.* (1993) observe that younger and smaller firms grant more trade credit than established firms with a reputation. To account for this relation, we compute firm age as the number of years since public listing [3].

Our model also includes firm fixed effects (f_i) to control for time-invariant unobserved heterogeneity and year fixed effects (δ_t) to address market-wide shocks. Firm fixed effects capture variation within firm over time; this allows us to disentangle the variation due to changes in the nature of listing firms from the variation due to firms' change in attitude toward trade credit. This is an important addition because of the changing composition of US firms (Fama and French, 2004).

To further investigate the relationship between intangibles and investment in trade credit, we identify firms more likely to supply trade credit to their customers. Smith (1987) and Lee and Stowe (1993) argue that the type of good sold factors into the decision to extend trade credit. Building on this theory, Gianetti *et al.* (2011) classify firms based on the nature of goods they sell at the two-digit Standard Industrial Classification (SIC) code level. They find that firms selling differentiated goods and services are more likely to extend trade credit ("High TC firms"), as opposed to traditional manufacturing firms ("Low TC firms"). We use Gianetti *et al.* (2011)'s methodology to identify a firm's likelihood to extend trade credit. We expect the negative relationship to be stronger for firms likely to extend trade credit. In other words, we expect the relationship to be particularly negative for high TC firms as opposed to low TC firms.

- H2. High TC firms exhibit a stronger negative relationship between intangible assets and trade credit than low TC firms.

Next, we look at whether financial constraints play a role in this relationship. Molina and Preve (2009) find that financially constrained firms will decrease investment in trade credit because they cannot afford to delay the receipt of cash. Consequently, we predict that the relationship between intangibles and investment in trade credit is stronger for financially constrained firms.

- H3. Financially constrained firms exhibit a stronger negative relationship between investment in intangible assets and trade credit than nonfinancially constrained firms.

Additionally, Denis and McKeon (2018) find that firms with more intangible assets have lower profitability because they are forced to expense the entire intangible asset in a single year as opposed to depreciating it over time. Consequently, firms with lower OCF may have a more negative relationship between intangible assets and trade credit because having more intangible assets makes their reported financial situation worse, causing them to stop delaying the receipt of cash in the form of receivables.

- H4. Firms with lower OCF exhibit a negative relationship between investment in intangible assets and trade credit.

Finally, we investigate the role of growth in the intangibles–trade credit relationship. Ferrando and Mulier (2013) argue that trade credit can serve as an important tool in managing growth, allowing firms to balance sales performance by adjusting the amount of trade credit offered. Consequently, we posit that firms experiencing slow growth are likely unable to maintain their investment in intangible assets when extending trade credit, thus leading to an inverse intangible–trade credit relationship. Conversely, we do not expect it to be the case for firms experiencing high growth.

- H5. Slow growth firms exhibit a negative relationship between investment in intangible assets and trade credit, while high growth firms do not.

4. Data description and summary statistics

We gather data from Compustat. We include all firms with assets over \$10m, with sales over \$5m from 1991 to 2018. We exclude financial firms and utility firms as they are subject to specific regulations that might alter our results [4]. Our final sample consists of 107,450 observations covering 11,869 firms. Note that we run some tests using subsamples of our initial dataset; hence, the lower number of observations reported on some tables.

Table 1 reports summary statistics for our sample. The average firm manages roughly \$3.7bn in assets, has an intangible asset to sales ratio of 14% and extends over \$56m in trade credit to customers. Additionally, the average firm in our sample has \$71m in inventory, \$73m in payables, a 25% debt ratio and a negative ROA at -1%. In total, 14% of the firms in the sample are considered in financial distress. These figures are consistent with previous studies.

5. Empirical tests and results

We start by exploring the relationship between trade credit and intangible assets. We follow Molina and Preve (2009) and Harris and Roark (2017) by using a firm fixed effect regression with the firm's investment in trade credit as the dependent variable. This investment is measured using the ratio of the firm's receivables over its daily sales.

Table 2 presents the results of our baseline regression of the relationship between investment in intangible assets on trade credit. This specification captures within firm variation over time. This is an important control as looking at within firm variation over time allows us to disentangle the impact of a change in the composition of public listed firms on trade credit from that of investment in intangible assets. Results point to a negative relationship between intangible assets and the amount of trade credit extended. Consistent with our first hypothesis, this finding implies that on average, as firms increase their investments in intangible assets, the amount of trade credit they provide to customers decreases. The coefficient suggests that an increase of 1% in the proportion of intangible-to-assets ratio is associated with a decrease in days sales outstanding of 2.7 days on average. Causality cannot be determined from this result. However, we interpret this result as indicative that firms making additional investments in intangible assets are less likely to maintain traditional investment in extending trade credit. We note that control variables are consistent with past findings, reinforcing the credibility of our results.

Next, we split our sample to separate firms into two categories depending on the type of goods they bring to market to test our second hypothesis. Gianetti et al. (2011) find that trade

Table 1.
Summary statistics

Variable	<i>N</i>	Mean	Std	25th	Median	75th
<i>Firm Size</i> (in \$ million)	107,450	3,685	16,838	88	333	1,501
<i>Sales</i> (in \$ million)	107,450	3,468	15,610	86	334	1,480
<i>Trade Credit</i> (in days)	107,450	56.110	39.280	32.470	52.250	71.980
<i>Intangibles/Sales</i>	107,450	0.14	0.18	0.00	0.05	0.22
<i>ROA</i>	107,450	-0.01	0.18	-0.02	0.03	0.07
<i>Inventory</i> (in \$ million)	107,450	71.56	81.41	9.58	52.81	101.90
<i>Payables</i> (in \$ million)	107,450	73.01	270.00	26.33	42.56	67.26
<i>Leverage</i>	107,450	0.25	0.23	0.05	0.21	0.37
<i>Sales Growth</i>	107,450	0.11	0.32	-0.03	0.07	0.20
<i>Cash Flow Risk</i>	107,450	0.07	0.08	0.02	0.04	0.08
<i>Firm Age</i> (in years)	107,450	15.70	12.19	6.00	12.00	23.00
<i>Financial distress</i>	107,450	0.14	0.34	0	0	0

Note(s): This table reports the summary statistics for the observations of our sample

	Predicted sign	Trade Credit	Intangible assets and trade credit policy
<i>Intangibles/Sales</i>	—	−2.729* (−1.66)	1293
<i>Firm Size</i>	+	3.338*** (8.32)	
<i>Payables</i>	+	0.011*** (5.53)	
<i>Leverage</i>	+	2.094* (1.85)	
<i>Inventory</i>	+	0.056*** (9.25)	
<i>Sales Growth</i>	+	2.029*** (4.98)	
<i>Financial distress</i>	+	1.364*** (3.08)	
<i>Cash Flow Risk</i>	—	−1.979 (−0.43)	
<i>ROA</i>	—	1.327 (1.46)	
<i>Firm Age</i>	—	−0.285*** (−7.39)	
<i>N</i>		107,450	
<i>Adjusted R²</i>		0.76	
<i>Year FE</i>		Yes	
<i>Firm FE</i>		Yes	
<i>Clustered SE</i>		Firm	

Note(s): ***, ** and * denote significance of coefficients at the 1%, 5% and 10% levels, respectively, computed using robust (Rogers (1993)) firm clustered standard errors

Table 2. The relation between intangible assets and trade credit

credit policies are affected by the type of goods sold. They find that firms that sell differentiated goods and services extend more trade credit on average. Following their methodology, we divide our sample into two subgroups: high trade credit firms (*high TC firms*) and low trade credit firms (*low TC firms*).

Table 3 reports the results of our specification for the two subgroups, leading to two main observations [5]. First, our main result of a negative relationship between investment in intangible assets and trade credit is clearly driven by *high TC firms* as the magnitude and significance of the coefficients are roughly twice that of our base results. Second, this relationship becomes positive when looking at firms selling standardized goods, implying that more investment in intangible assets translates to additional trade credit for these firms. These contrasting results are consistent with the findings of Gianetti *et al.* (2011) and confirm the role played by the type of goods sold in trade credit policy as stipulated in our second hypothesis.

Next, we investigate the role of financial constraints on the intangible assets–trade credit relationship as stated in hypothesis 3. Similar to Molina and Preve (2009), we split our sample into two subgroups: the *financially constrained* firms and the *nonfinancially constrained* firms. We rank firm-year observations based on cash holdings and place firm-year observations below the median in the *financially constrained* group and firm-years over the median in the *nonfinancially constrained* group.

Table 4 reports the coefficients of our regression after splitting the sample based on financial constraint. Financially constrained firms clearly drive the negative relationship between intangible assets and trade credit, confirming our initial hypothesis. In contrast, there is no evidence of any relationship for firms that are not financially constrained. This finding is consistent with that of Molina and Preve (2009), who conclude that constrained firms will decrease investment in trade credit because their need for liquidity prevents them from delaying the receipt of cash by extending credit. On the flip side, non-constrained firms are able to maintain their investment in trade credit; hence, the lack of any statistically significant relationship.

We further investigate our relationship of interest by looking at operating profitability levels. According to Denis and McKeon (2018), firms with more intangible assets have lower

Table 3.
The role of the type of
good sold on the
relation between
intangible assets and
trade credit

	High TC firms	Low TC firms
<i>Intangibles/Sales</i>	−8.042*** (−3.96)	6.440* (1.82)
<i>Firm Size</i>	4.155*** (8.36)	3.071*** (3.26)
<i>Payables</i>	0.017*** (4.70)	0.003 (1.36)
<i>Leverage</i>	1.708 (1.18)	4.972* (1.73)
<i>Inventory</i>	0.064*** (8.29)	0.049*** (4.34)
<i>Sales Growth</i>	2.971*** (6.01)	0.172 (0.15)
<i>Financial distress</i>	1.624*** (3.44)	0.522 (0.41)
<i>Cash Flow Risk</i>	2.157 (0.34)	14.308 (1.43)
<i>ROA</i>	0.313 (0.30)	−0.455 (−0.16)
<i>Firm Age</i>	−0.223*** (−4.50)	−0.178** (−2.26)
<i>N</i>	65,297	18,868
<i>Adjusted R²</i>	0.79	0.64
<i>Year FE</i>	Yes	Yes
<i>Firm FE</i>	Yes	Yes
<i>Clustered SE</i>	Firm	Firm

Note(s): ***, ** and * denote significance of coefficients at the 1%, 5% and 10% levels, respectively, computed using robust (Rogers (1993)) firm clustered standard errors
Table 3 presents the firm fixed effects regression results for *high TC firms* and *low TC firms* subsamples estimating the effect of our independent variables including our variable of interest, *Intangible assets over sales*, on trade credit

Table 4.
The role of financial
constraints on the
relation between
intangible assets and
trade credit

	Constrained firms	Non-constrained firms
<i>Intangibles/Sales</i>	−10.085*** (−3.89)	−1.577 (−0.62)
<i>Firm Size</i>	3.968*** (6.41)	2.748*** (5.51)
<i>Payables</i>	0.021*** (4.38)	0.008*** (3.88)
<i>Leverage</i>	0.323 (0.22)	1.614 (0.97)
<i>Inventory</i>	0.055*** (6.04)	0.047*** (5.57)
<i>Sales Growth</i>	2.548*** (4.30)	0.669 (1.08)
<i>Financial distress</i>	0.684 (1.20)	2.109*** (3.15)
<i>Cash Flow Risk</i>	−1.354 (−0.18)	0.863 (0.16)
<i>ROA</i>	5.340*** (3.97)	−0.711 (−0.57)
<i>Firm Age</i>	−0.298*** (−5.63)	−0.269*** (−4.74)
<i>N</i>	27,341	24,550
<i>Adjusted R²</i>	0.81	0.72
<i>Year FE</i>	Yes	Yes
<i>Firm FE</i>	Yes	Yes
<i>Clustered SE</i>	Firm	Firm

Note(s): ***, ** and * denote significance of coefficients at the 1%, 5% and 10% levels, respectively, computed using robust (Rogers (1993)) firm clustered standard errors
Table 4 presents the firm fixed effects regression results for *Constrained firms* and *Non-constrained firms* subsamples estimating the effect of our independent variables including our variable of interest, *Intangible assets over sales*, on trade credit

profitability levels because they are forced to expense the entire intangible asset in a single year as opposed to depreciating it over time. Consequently, in hypothesis 4, we posit that firms with lower operating cash flows should exhibit a more negative relationship between intangible assets and trade credit because having more intangible assets makes their reported financial situation worse, causing them to stop delaying the receipt of cash in the form of receivables in an effort to reduce their cash conversion cycle. To test this conjecture,

we divide our sample into two groups: above or below the median operating cash flow to assets.

Table 5 reports the results of our test after splitting our sample in the two groups: *Low Operating Cash Flows (Low OCF)* and *High Operating Cash Flows (High OCF)*. As expected, we find a significant negative relationship between intangible assets and trade credit only for the *low OCF* group, consistent with the findings reported in previous literature. For *low OCF* firms, coefficients suggest that an increase of 1% in the intangible-to-sales ratio is associated with a decrease of 5.5% in trade credit extended.

We also look at the role of sales growth in our relationship of interest. We posit that firms with lower growth are likely aggressive in their trade credit policy in an effort to increase sales, which may result in decreasing investment in other areas, such as in intangible assets. To test our hypothesis, we divide the sample around the median growth rate in sales for each industry-year.

Table 6 reports the results of our test. We confirm that *low growth firms* indeed exhibit a strong negative relationship between intangible assets and trade credit, while *high growth firms* do not. This is consistent with hypothesis 5 and further confirms the importance of sales growth on trade credit policy.

As a robustness check, we also consider sales volatility in our regression. Because sales could either spike or drop significantly, we understand this can have an impact on our measure for days' receivables. To control for this possibility, we include an independent variable of "sales volatility." We measure sales volatility as the log of the coefficient of variation in sales over the past three years. For the coefficient of variation, we use the ratio of the SD of sales to the mean of sales (Tuli *et al.*, 2010).

Table 7 reports the results with this additional independent variable. We confirm our original results and find that the negative relationship between intangible assets and trade credit remains for the entire sample. Additionally, there is a stronger negative relationship for high TC firms, constrained firms, low OCF firms and low growth firms. These results, controlling for volatility in sales, confirm the results of prior tables.

	<i>Low OCF firms</i>	<i>High OCF firms</i>
<i>Intangibles/Sales</i>	-5.494** (-2.19)	-2.207 (-0.97)
<i>Firm Size</i>	4.192*** (-6.35)	2.274*** (-4.98)
<i>Payables</i>	0.008*** (-4.24)	0.013*** (-2.60)
<i>Leverage</i>	1.168 (-0.63)	1.346 (-0.93)
<i>Inventory</i>	0.059*** (-6.54)	0.034*** (-5.17)
<i>Sales Growth</i>	2.388*** (-3.71)	2.101*** (-3.73)
<i>Financial distress</i>	0.836 (-1.53)	-0.313 (-0.31)
<i>Cash Flow Risk</i>	1.05 (-0.13)	-5.477 (-1.15)
<i>ROA</i>	6.228*** (-4.72)	-2.591* (-1.74)
<i>Firm Age</i>	-0.278*** (-4.22)	-0.207*** (-4.72)
<i>N</i>	48,680	56,932
<i>Adjusted R²</i>	0.73	0.82
<i>Year FE</i>	Yes	Yes
<i>Firm FE</i>	Yes	Yes
<i>Clustered SE</i>	Firm	Firm

Note(s): ***, ** and * denote significance of coefficients at the 1%, 5% and 10% levels, respectively, computed using robust (Rogers (1993)) firm clustered standard errors

Table 5 presents the firm fixed effects regression results for *Low OCF* and *High OCF* subsamples estimating the effect of our independent variables including our variable of interest, *Intangible assets over sales*, on trade credit

Table 5.
The role of operating
profitability on the
relation between
intangible assets and
trade credit

	<i>Low growth firms</i>	<i>High growth firms</i>
<i>Intangibles/Sales</i>	−5.730** (−2.45)	0.279 −0.14
<i>Firm Size</i>	2.772*** −5.2	3.434*** −6.92
<i>Payables</i>	0.011*** −3.75	0.012*** −4.07
<i>Leverage</i>	1.833 −1.37	2.681 −1.6
<i>Inventory</i>	0.058*** −7.44	0.058*** −6.47
<i>Sales Growth</i>	−0.93 (−0.77)	2.306*** −3.72
<i>Financial distress</i>	1.001* −1.95	0.995 −1.04
<i>Cash Flow Risk</i>	−7.08 (−1.27)	1.022 −0.15
<i>ROA</i>	2.581** −2.39	−4.045** (−2.11)
<i>Firm Age</i>	−0.158*** (−3.22)	−0.393*** (−7.33)
<i>N</i>	57,174	50,276
<i>Adjusted R²</i>	0.77	0.77
<i>Year FE</i>	Yes	Yes
<i>Firm FE</i>	Yes	Yes
<i>Clustered SE</i>	Firm	Firm

Table 6. The role of sales growth on the relation between intangible assets and trade credit

Note(s): ***, ** and * denote significance of coefficients at the 1%, 5% and 10% levels, respectively, computed using robust (Rogers (1993)) firm clustered standard errors

Table 6 presents the firm fixed effects regression results for *Low growth firms* and *High growth firms* subsamples estimating the effect of our independent variables including our variable of interest, *Intangible assets over sales*, on trade credit

6. Conclusion

In this paper, we investigate the nature of the relationship between two trends recently identified: the decline in trade credit and the increase in investment in intangible assets over the same period. This is the first study, to our knowledge, that investigates this relationship. We find evidence of a negative relationship between the two. We believe this relationship implies that investment in intangible assets is detrimental to trade credit and vice versa. Moreover, we find that some industries drive this relationship: specifically, firms selling diversified goods and services experience a strong decline in trade credit when investing in new intangible assets, whereas firms selling manufactured goods experience the opposite relationship.

We also find evidence that firms presenting specific characteristics drive the negative relationship between intangible assets and trade credit. Financially constrained firms and firms with slow sales growth are particularly likely to decrease trade credit when investing in intangible assets. This is because these firms either cannot afford to maintain trade credit levels (by delaying the receipt of cash payments) or because they do not need to. Additionally, we find evidence that the negative relationship between intangible assets and trade credit is particularly strong for firms with negative OCF, while it is virtually nonexistent for firms with positive OCF. Finally, given the potential for sales to be a volatile measure, we include a robustness check by controlling for sales volatility across each of our previous tables. We find our results to be robust to the volatility of sales both in the primary relationship of interest (intangible assets and trade credit) as well as throughout each of the subsamples.

	Table 2	Table 3	Table 3	Table 4	Table 4	Table 5	Table 5	Table 6	Table 6
	Base result	High TC	Low TC	Constrained firms	Non-constrained firms	Low OCF	High OCF	Low growth firms	High growth firms
<i>Intangibles/ Sales</i>	-2.831* (-1.70)	-8.037*** (-3.90)	6.047* (1.71)	-10.394*** (-3.93)	-1.584 (-0.62)	-5.479** (-2.15)	-2.321 (-1.01)	-5.849** (-2.47)	0.325 (0.16)
<i>Sales volatility</i>	4.959*** (4.20)	2.875** (2.13)	5.694* (1.73)	4.560*** (2.79)	5.347*** (2.93)	4.037** (2.25)	2.432 (1.62)	7.021*** (3.71)	-2.130 (-1.08)
<i>N</i>	104,450	63,410	18,257	53,399	51,051	47,346	55,462	55,598	48,852
<i>Adjusted R²</i>	0.76	0.79	0.64	0.81	0.73	0.73	0.82	0.77	0.77
<i>Controls</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Year FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Firm FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Clustered SE</i>	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Variables									
Definition									
<i>Cash Flow Risk</i>	The SD of operating cash flow over the past ten years (see Bates <i>et al.</i> (2009))								
<i>Constrained firms</i>	An indicator variable equal to 1 if the firm-year cash holdings is below the 50th percentile								
<i>Financial distress</i>	An indicator variable equal to 1 if the firm's EBITDA is less than 80% of its interest expenses and 0 otherwise								
<i>Firm Age</i>	The number of years since public listing								
<i>Firm Size</i>	The firm's total assets in \$ million								
<i>High OCF firms</i>	An indicator variable equal to 1 if the firm's operating cash flow are above the median, 0 otherwise								
<i>High growth firms</i>	An indicator variable equal to 1 if the firm's growth rate in sales is above the median that year, 0 otherwise								
<i>High TC firms</i>	An indicator variable equal to 1 if the firm sells differentiated goods and services, 0 otherwise								
<i>Intangibles over sales</i>	The ratio of intangibles assets divided by total assets								
<i>Inventory to COGS</i>	The ratio of inventory over daily cost of goods sold								
<i>Leverage</i>	The ratio of the firm's total debt over total assets								
<i>Low OCF firms</i>	An indicator variable equal to 1 if the firm's operating cash flow are below the median, 0 otherwise								
<i>Low growth firms</i>	An indicator variable equal to 1 if the firm's growth rate in sales is below the median that year, 0 otherwise								
<i>Low TC firms</i>	An indicator variable equal to 1 if the firm operates in traditional manufacturing sectors, 0 otherwise								
<i>Non-constrained firms</i>	An indicator variable equal to 1 if the firm-year cash holdings is above the 75th percentile								
<i>Payables</i>	The ratio of payables by daily cost of goods sold								
<i>ROA</i>	The ratio of net income divided by total assets								
<i>Sales Growth</i>	The rate of change in sales from the previous year								
<i>Trade credit</i>	The ratio of the firm's receivables over its daily sales								
Note(s): Table 7 presents results for all our tests controlling for sales volatility									

Table 7.
Robustness check

Overall, these findings shed light on the relationship between intangible assets and trade credit that was previously unaccounted for. There is a relationship between the level of investment a firm makes in intangible assets and the level of investment made in trade credit extended. This relationship is consistent across each subsample in the study. Since each subsample is related to a known trade credit determinant, it appears the negative relationship between intangible asset investment and trade credit investment is real and related to the same factors that have traditionally influenced trade credit policy.

One limitation of our study is that we cannot claim causality based on the current results. So, an avenue of future research includes further work that may be able to identify whether it has been the rise in intangible assets that has led to a decrease in trade credit investment or whether the decline in trade credit investment has led to a rise in intangible asset investment. Future research will be important to identify the relationship, given the significance of both intangible assets and trade credit within the corporate environment and within the broader economy.

Notes

1. <https://data.bls.gov/pdq/SurveyOutputServlet>.
2. <https://www.bls.gov/news.release/ecopro.nr0.htm>.
3. We calculate *Firm Age* as the number of years since the first year with available data in Compustat.
4. We exclude firms with an SIC code between 6000 and 6999 (financial firms) and firms with an SIC code between 4900 and 4999 (utility firms).
5. Note that the total number of observations between *high TC firms* and *low TC firms* combined does not equal the full sample as some firms cannot be identified as clearly belonging to any group.

References

- Asquith, P., Gertner, R. and Scharfstein, D. (1994), "Anatomy of financial distress: an examination of junk-bond issuers", *The Quarterly Journal of Economics*, Vol. 109 No. 3, pp. 625-658.
- Barrot, J.N. (2016), "Trade credit and industry dynamics: evidence from trucking firms", *The Journal of Finance*, Vol. 71 No. 5, pp. 1975-2016.
- Bates, T.W., Kahle, K.M. and Stulz, R.M. (2009), "Why do US firms hold so much more cash than they used to?", *The Journal of Finance*, Vol. 64 No. 5, pp. 1985-2021.
- Breza, E. and Liberman, A. (2017), "Financial contracting and organizational form: evidence from the regulation of trade credit", *The Journal of Finance*, Vol. 72 No. 1, pp. 291-324.
- Brown, G. and Kapadia, N. (2007), "Firm-specific risk and equity market development", *Journal of Financial Economics*, Vol. 84 No. 2, pp. 358-388.
- Burkart, M. and Ellingsen, T. (2004), "In-kind finance: a theory of trade credit", *American Economic Review*, Vol. 94 No. 3, pp. 569-590.
- Carbo-Valverde, S., Rodriguez-Fernandez, F. and Udell, G.F. (2016), "Trade credit, the financial crisis, and SME access to finance", *Journal of Money, Credit and Banking*, Vol. 48 No. 1, pp. 113-143.
- Casey, E. and O'Toole, C.M. (2014), "Bank lending constraints, trade credit and alternative financing during the financial crisis: evidence from European SMEs", *Journal of Corporate Finance*, Vol. 27, pp. 173-193.
- Corrado, C., Hulten, C. and Sichel, D. (2009), "Intangible capital and US economic growth", *Review of Income and Wealth*, Vol. 55 No. 3, pp. 661-685.
- Cunat, V. (2007), "Trade credit: suppliers as debt collectors and insurance providers", *The Review of Financial Studies*, Vol. 20 No. 2, pp. 491-527.
- Dass, N., Kale, J.R. and Nanda, V. (2015), "Trade credit, relationship-specific investment, and product market power", *Review of Finance*, Vol. 19 No. 5, pp. 1867-1923.

- Denis, D.J. and McKeon, S.B. (2018), "Persistent operating losses and corporate financial policies", SSRN 2881584.
- Falato, A., Kadyrzhanova, D., Sim, J. and Steri, R. "Rising intangible capital, shrinking debt capacity, and the U.S. corporate savings glut", *Journal of Finance*, forthcoming.
- Fama, E.F. and French, K.R. (2004), "New lists: fundamentals and survival rates", *Journal of Financial Economics*, Vol. 73 No. 2, pp. 229-269.
- Ferrando, A. and Mulier, K. (2013), "Do firms use the trade credit channel to manage growth?", *Journal of Banking and Finance*, Vol. 37 No. 8, pp. 3035-3046.
- Garcia-Appendini, E. and Montoriol-Garriga, J. (2013), "Firms as liquidity providers: evidence from the 2007-2008 financial crisis", *Journal of Financial Economics*, Vol. 109 No. 1, pp. 272-291.
- Giannetti, M., Burkart, M. and Ellingsen, T. (2011), "What you sell is what you lend? Explaining trade credit contracts", *Review of Financial Studies*, Vol. 24 No. 4, pp. 1261-1298.
- Hall, R.E. (2001), "The stock market and capital accumulation", *American Economic Review*, Vol. 91 No. 5, pp. 1185-1202.
- Harris, C. and Roark, S. (2017), "Exploring the decline in trade credit investment", *Managerial Finance*, Vol. 43 No. 12, pp. 1375-1391.
- Hill, M.D., Kelly, G.W. and Lockhart, G.B. (2012), "Shareholder returns from supplying trade credit", *Financial Management*, Vol. 41 No. 1, pp. 255-280.
- Lee, Y.W. and Stowe, J.D. (1993), "Product risk, asymmetric information, and trade credit", *Journal of Financial and Quantitative Analysis*, Vol. 28 No. 2, pp. 285-300.
- Long, M.S., Malitz, I.B. and Ravid, S.A. (1993), "Trade credit, quality guarantees, and product marketability", *Financial Management*, Vol. 22 No. 4, pp. 117-127.
- Meltzer, A.H. (1960), "Mercantile credit, monetary policy, and size of firms", *The Review of Economics and Statistics*, Vol. 42, pp. 429-437.
- Molina, C.A. and Preve, L.A. (2009), "Trade receivables policy of distressed firms and its effect on the costs of financial distress", *Financial Management*, Vol. 38 No. 3, pp. 663-686.
- Nadiri, M.I. (1969), "The determinants of trade credit in the US total manufacturing sector", *Econometrica*, Vol. 37, pp. 408-423.
- Petersen, M.A. and Rajan, R.G. (1997), "Trade credit: theories and evidence", *Review of Financial Studies*, Vol. 10 No. 3, pp. 661-691.
- Rogers, W. (1993), "Quantile regression standard errors", *Stata Technical Bulletin*, Vol. 2 No. 13, pp. 19-23.
- Smith, J.K. (1987), "Trade credit and informational asymmetry", *The Journal of Finance*, Vol. 42 No. 4, pp. 863-872.
- Tuli, K.R., Bharadwaj, S.G. and Kohli, A.K. (2010), "Ties that bind: the impact of multiple types of ties with a customer on sales growth and sales volatility", *Journal of Marketing Research*, Vol. 47 No. 1, pp. 36-50.

Corresponding author

Chris Harris can be contacted at: charris24@elon.edu