Trade credit, creditor protection and banking crisis

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ABSTRACT

This paper analyzes the effect of banking crises on the trade credit provided to customers and whether this effect depends on the strength of a country's legal protection of creditors. The results indicate that trade credit extensions increase in times of crisis, although this increase is smaller in countries where creditors are well protected; however, no differences are observed in trade credit extensions between countries with weak and strong creditor protection in non-crisis periods.

1. Introduction

Trade credit granted to a customer is a short-term investment that appears as accounts receivable. Many researchers confirm the importance of this investment by demonstrating how it affects a firm's value and liquidity. Trade credit stimulates demand, but the literature shows that overinvestment in accounts receivable reduces company value. In this line, Emery (1984) indicated an optimal credit period or optimal investment in accounts receivable.

Several works have studied how trade credit differs across countries. Demirgüç-Kunt and Maksimovic (2001) found that the legal and banking systems affect trade credit, explaining why this investment varies worldwide. El Ghoul and Zheng (2016) demonstrated that trade credit provision depends on national culture, while more recently, Moro, Belghitar, and Mateus (2021) found that the use of trade credit depends on countries' cultural norms. Chen, El Ghoul, Guedhami, Kwok, and Nash (2021) showed that state ownership also affects trade credit. Finally, for a sample of five formerly communist countries, Johnson, McMillan, and Woodruff (2002) found that trade credit provision depends on legal enforcement.

Some studies have shown that periods of financial crisis affect trade credit. For example, Fukuda, Kasuya, and Akashi (2006) found that trade credit became more limited during the banking crisis in Japan. Love, Preve, and Sarria-Allende (2007) studied the effect of financial crises on trade credit in six emerging economies, indicating that firms extend less trade credit to their customers due to a bank credit crunch. Love and Zaidi (2010) surveyed 3000 firms in four East Asian countries and found that firms reduced the percentage of sales they extended on credit to their customers; however, they found mixed evidence on the length of receivables after the crisis. They also observed that firms offered more discounts for cash payments after a crisis, which increased the cost of trade credit. Bastos and Pindado (2013) claimed that in periods of credit constraints, customers postponed trade credit payments because other sources of credit became less accessible to them. Tsuruta (2013) showed that trade credit decreased during Japan's 1997–1998 recession. Finally,

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Garcia-Appendini and Montoriol-Garriga (2013) studied a matched sample of suppliers and customers of US firms during the 2007–2008 financial crisis, finding that firms with high pre-crisis liquidity levels extended more trade credit to their customers.

Considering these results, this study aims to determine whether the effect of banking crises on trade credit provided to customers depends on the strength of the legal protection countries offer to creditors. In crisis periods, firms have less finance to redistribute through trade credit; thus, they could decide to tighten the terms of credit granted to their customers. Even if suppliers have a good financial situation, they may reduce credit to their financially constrained customers for precautionary reasons. In these cases, reductions in trade receivables are the consequence of the supplier's decision, while customers simultaneously increase their demand for trade credit as they have less access to other types of external financing. In countries with weak protection, customers can extract trade credit from sellers against their will by simply not paying their invoices on time, which could lead to longer payment times; however, in countries with strong creditor rights protection, suppliers can set and enforce the maturities they want, or at least receive their customers' money sooner than in countries with weak protection. Therefore, during crisis periods, the trade credit extension is expected to be greater in countries with weak creditor protection than in countries with strong protection.

To investigate this expectation, we use a sample of firms from 34 countries obtained from the *COMPUSTAT* database; specifically, we have information on 13,831 firms (112,014 observations) from 1996 to 2013.

This paper differs from previous research in several ways. While Demirgüç-Kunt and Maksimovic (2001) indicated that in standard times, strong creditor rights reduce the trade credit granted, this paper analyzes how the legal protection of creditors' rights affects trade credit once a banking crisis appears. As mentioned, some papers have analyzed how financial crises affect trade credit; however, none have addressed whether this effect depends on creditor protection. Moreover, the timeframe used allows us to analyze periods of financial expansion and banking crises in most of the countries in the sample.

The results indicate that during banking crises, characterized by a reduction in credit supply, customers repay later than in normal times; that is, investment in accounts receivable increases. Conversely, this increase differs among countries since it depends on the strength of a country's creditor rights protection. Specifically, we find that the increase is smaller in countries where creditors are well protected, consistent with the idea that in countries with strong creditor protection, suppliers can enforce contracts sooner than in countries with low protection; however, no differences are observed in trade credit extension between countries with weak and strong creditor protection in non-crisis periods. We find the same results using a different measure of trade credit granted, excluding countries with the highest number of observations and using a different estimation approach.

The rest of the paper is organized as follows. We present a literature review on trade credit and its relationship to creditor protection and financial crises in Section 2. Section 3 specifies the model and data, Section 4 presents the results, and Section 5 concludes.

2. Trade credit, creditor rights protection, and banking crises

Offering trade credit has two advantages for the seller. First, it usually increases a firm's sales, and second, it encourages long-term customer relationships. The literature indicates many reasons for offering trade credit. These include less information asymmetry between suppliers and customers (Long, Malitz, and Ravid, 1993; Smith, 1987), suppliers' relative advantage in liquidating repossessed goods (Frank and Maksimovic, 1998; Mian and Smith, 1992), product quality guarantees (Emery and Nayar, 1998; Lee and Stowe, 1993), price discrimination (Brennan, Maksimovic, and Zechner, 1988; Petersen and Rajan, 1997), more access to financing for companies with difficulties obtaining other sources of funds (Emery, 1984; Mian and Smith, 1992), lower transaction costs (Emery, 1987; Ferris, 1981), sunk costs (Cuñat, 2007), and mechanisms to mitigate moral hazard problems (Burkart and Ellingsen, 2004). These advantages justify firms' significant investment in accounts receivable (Baños-Caballero, García-Teruel, and Martínez-Solano, 2014). Nonetheless, as Emery (1984) indicated, there is an optimal credit period or optimal investment in accounts receivable, and a period or investment above the optimal level reduces a firm's value; therefore, decisions on trade credit made by firms should consider this cost-benefit tradeoff.

Selling goods on credit is risky since customers might postpone payments or not pay their trade credit debt (Grau and Reig, 2018). El Ghoul and Zheng (2016) found that the provision of trade credit depends on national culture. They determined that suppliers tend to offer more trade credit in countries with higher collectivism, where they can obtain information about customer creditworthiness at a lower cost and rely on collective punishment in case of customer default.

Creditor rights protection could also influence supplier risk when extending trade credit to a client, as strong protection allows suppliers to enforce contracts more efficiently. Thus, suppliers in countries with an efficient legal system and less risk could decide to lengthen credit periods and sell to more customers on credit; however, in countries with inefficient legal systems, suppliers with no capacity to recover goods could require cash payments and be unwilling to deliver goods on trade credit (Demirgüç-Kunt and Maksimovic, 2001). Few studies have analyzed how the legal system affects trade credit; however, literature on bank credit supports the idea that firms receive better financing in countries where creditors are well protected (Demirgüç-Kunt and Maksimovic, 1999; Djankov, McLiesh, and Shleifer, 2007; Qian and Strahan, 2007) as these countries present fewer conflicts of interest (Davydenko and Franks, 2008).

Conversely, Demirgüç-Kunt and Maksimovic (2001) observed the opposite, finding that firms lend less to customers in countries with efficient legal systems. They indicated that this might occur because customers obtain more bank financing, reasoning that if there are efficient formal mechanisms to extract payment, non-financial firms offer fewer advantages. Thus, they suggest that this could result from the demand effect; that is, customers prefer to use more bank debt than trade credit debt in these countries. We think another possible reason for this result is that customers delay trade credit payments more regularly in countries with weak protection because suppliers have more difficulties enforcing contracts.

Given these two perspectives, the expected relationship between creditor protection and trade credit granted is unclear. Since

suppliers operating in countries that guarantee creditors' rights assume less risk, they could decide to lengthen credit periods and sell to more customers on credit, thereby increasing their sales. This situation would imply that the suppliers in such countries have more investment in accounts receivable than those in countries with low protection; however, customers having more difficulties accessing other sources of funds in countries with weak creditor protection could postpone trade credit payments more easily. Such delays would lead to longer payment times and, consequently, greater supplier investment in accounts receivable in these countries.

Only a few studies have examined how periods of financial crisis affect trade credit. For example, Fukuda et al. (2006) found that trade credit became more limited during Japan's banking crisis. In this line, Love et al. (2007) studied how the 1997 Asian crisis and the Mexican devaluation in late 1994 affected trade credit in six emerging economies. They found that trade credit decreased after these crises due to a bank credit crunch. Love and Zaidi (2010) surveyed 3000 firms in four East Asian countries before and after the financial crisis of 1998, determining that firms reduced the number of sales extended to customers on credit after the crisis; however, they found mixed evidence on the length of receivables. They also observed that firms offered more discounts for cash payments after the crisis, which increased the cost of trade credit. Bastos and Pindado (2013) studied firms from Argentina, Brazil, and Turkey after a financial crisis, indicating that in periods of credit constraints, customers postponed trade credit payments because other sources of credit became less available. Tsuruta (2013) also showed that trade credit decreased for small businesses during Japan's 1997–1998 recession. Finally, Garcia-Appendini and Montoriol-Garriga (2013) studied a matched sample of suppliers and customers, finding that US firms with high pre-crisis liquidity extended more trade credit to their customers during the 2007–2008 crisis. None of these papers analyzed whether the effect of financial crises on trade credit extension depended on how creditors were protected.

Danielson and Scott (2004), Nilsen (2002), and Petersen and Rajan (1997) indicated that firms demand and use more trade credit when they have less access to bank loans. During a banking crisis, credit from banks is reduced or unavailable, and customers want to receive more trade credit; however, suppliers want to extend less because both have less access to external finance. In countries with weak creditor protection, customers might delay their payments and extend their financing with suppliers more easily, resulting in longer payment times; thus, we study whether changes in trade credit during periods of crisis could depend on countries' levels of creditor protection.

3. Model and data

3.1. Model

First, we analyze whether protecting creditors' rights and a country's financial situation affect trade credit granted to customers. To this end, we estimate the following regression model by using data from 34 countries:

$$DSO_{i,t} = \beta_0 + \beta_1 CRP_c + \beta_2 Crisis_{c,t} + \beta_3 Size_{i,t} + \beta_4 Stlev_{i,t} + \beta_5 Fcost_{i,t} + \beta_6 Gpsales_{i,t}$$

$$+ \beta_7 Npsales_{i,t} + \beta_8 Growth_{i,t} + \beta_9 Turn_{i,t} + \beta_{10} Mkshare_{i,t} + \beta_{11} Collect_c$$

$$+ \beta_{12}\mathrm{Log}\,(\mathrm{GDP\ pc})_{c,t} + \beta_{13}\mathrm{Priv\ credit}\big/\mathrm{GDP}_{c,t} + \delta_s + \lambda_t + \varepsilon_{i,t} \tag{1}$$

We use the days-of-sales outstanding (DSO) to measure the days customers take to repay their credit. This variable is measured as (accounts receivable/sales)*360 to control the drops in economic activity common in periods of crisis. A firm's investment in accounts receivable increases in either of these two situations: granting longer payment terms or larger amounts of trade credit. A greater DSO value means customers take more days to repay their credit, implying more accounts receivable investments.

Following Petersen and Rajan (1997), our independent variables include size ($Size_{i,t}$), short-term financing ($Stlev_{i,t}$), cost of outside financing ($F\cos t_{i,t}$), gross profit margin ($Gpsales_{i,t}$), net income margin ($Npsales_{i,t}$), sales growth ($Growth_{i,t}$), and assets turnover ($Turn_{i,t}$). Following Dass, Kale, and Nanda (2015), we also include the firm's market share ($Mkshare_{i,t}$). At the country level, following El Ghoul and Zheng (2016), we include the variable collectivism ($Collect_c$) to control for national culture and the variables log (GDP pc) and private credit/gross domestic product (GDP).

Our independent variables also include the level of creditor rights protection (CRP_c) and a dummy variable for years of crisis ($Crisis_{c,t}$) that takes the value of one if country c goes through a banking crisis in year t and zero otherwise. δ_s are industry dummy variables, λ_t are time dummy variables, and $\varepsilon_{i,t}$ are random disturbances. The model is estimated using pooled ordinary least squares (OLS) with standard errors adjusted for clustering by country and year.

As we commented in Section 2, changes in trade credit during times of crisis could differ depending on a country's creditor protection. To check this hypothesis, we estimate the following model (2):

$$DSO_{i,t} = \beta_0 + \beta_1 Crisis_{c,t} + \beta_2 CRP_c + \beta_3 CrisisX\ CRP_{c,t} + \beta_4 Size_{i,t} + \beta_5 Stlev_{i,t}$$

$$+ \beta_6 Fcost_{i,t} + \beta_7 Gpsales_{i,t} + \beta_8 Npsales_{i,t} + \beta_9 Growth_{i,t} + \beta_{10} Turn_{i,t}$$

$$+ \beta_{11} Mkshare_{i,t} + \beta_{12} Collect_c + \beta_{13}\mathrm{Log}\,(\mathrm{GDP\ pc})_{c,t} + \beta_{14}\mathrm{Priv\ credit}\big/\mathrm{GDP}_{c,t}$$

$$+ \delta_s + \lambda_t + \varepsilon_{i,t} \tag{2}$$

If coefficient β_3 is significant, indicating that a crisis's effect on trade credit depends on the level of creditor protection.

Table 1

Descriptive statistics.

	Mean	Sd.	Median	p1	p99
DSO	79.0384	55.9395	68.7944	3.5733	293.5161
Size	5.5080	1.8469	5.4370	1.4088	9.7725
Stlev	0.3103	0.1592	0.2916	0.0460	0.7163
Fcost	0.0271	0.0253	0.0203	0.0000	0.1178
Gpsales	0.3355	0.1955	0.2983	0.0191	0.8872
Npsales	0.0003	0.3116	0.0301	−1.0018	0.3038
Growth	0.1182	0.3279	0.0723	−0.4527	1.4786
Turn	1.4086	0.9736	1.1917	0.1331	5.1191
Mkshare	0.0161	0.0505	0.0013	0.0000	0.2979
Collectivism	54.5929	26.4311	46	18	91
Log (GDP pc)	2.3396	0.2732	2.3475	2.0668	2.3980
Priv credit/GDP	157.8082	37.0766	177.65	29.79	207.84

DSO is the days-of-sales outstanding; this variable is measured as (accounts receivable/sales)*360. Size is the natural logarithm of sales; Stlev is the ratio of current liabilities to total assets; Fcost is the ratio of finance costs over outside financing minus trade credit; Gpsales is the ratio of gross profit to sales; Npsales is the ratio of net profit over sales; Growth is the ratio $(sales_t − sales_{t−1})/sales_{t−1}$. Turn is the ratio of sales over assets minus accounts receivable; Mkshare is the ratio of the firm's sales over total industry sales for the same year. Collectivism is Hofstede's cultural index on collectivism. Log (GDP pc) is the logarithm of GDP per capita in constant 2005 US dollars. Priv credit/GDP is private credit by money deposited in banks and other financial institutions divided by GDP.

3.2. Data

3.2.1. Firm-specific data

We used the *COMPUSTAT* database to obtain the data related to the firm-specific variables and selected a sample of firms from 34 countries during the 1996–2013 period.[1] We eliminated financial and utility firms and observations with lost values and errors from the sample. Finally, we dropped 0.5% of observations in each tail of each variable. We have a final sample of 112,014 observations.

The Appendix specifies the variables used in the models. We present the descriptive statistics in Table 1 and the correlation matrix in Table 2. Fig. 1 shows the number of days customers take to repay credit (DSO) by country, indicating how the number of days varies across countries, ranging from an average of 55.29 days for New Zealand to 161.75 days for Greece.

3.2.2. Country-specific variables

We use various sources to obtain the data related to country variables. First, we follow Safavian and Sharma (2007) and use the creditor rights index from the World Bank's Doing Business Report (*Creditor Rights*) as a proxy for creditor protection. This index ranges from 0 (weak creditor rights) to 10 (strong creditor rights). Second, given that an effective system might compensate for weak rules (La Porta, Lopez-de-Silanes, Shleifer, and Vishny, 1998), we control for the effectiveness of law enforcement because courts can prevent managers from expropriating investors. Specifically, we use an index that measures property rights protection (*Property rights)* and the rule of law (*Rule of law*) to control for the effectiveness of law enforcement. The Heritage Foundation published the first index. It considers the laws that protect private property rights, how the government enforces laws, and other characteristics, such as the probability of private property expropriation, the capacity to enforce contracts, corrupt judiciary, and judicial independence. The index takes values from 0 to 100, with higher values reflecting more legal protection of property rights. Regarding the *Rule of law* variable, we use the Worldwide Governance Indicators (WGI) from the World Bank. We use the 2013 values of this index, which take values from −2.5 to 2.5, with higher values representing more efficient legal systems.

We take the crisis periods of each country from Laeven and Valencia (2013). These authors identified 147 banking crises proposing a methodology to date banking crisis episodes. Specifically, they defined a banking crisis as an event that meets two conditions: significant signs of financial distress in the banking system and significant banking policy intervention measures in response to extensive losses in the banking system. In this way, they established less subjective criteria to determine when a banking crisis occurs. With these data, we create the dummy variable $CRISIS_{c, t}$, which takes the value of one if country c goes through a banking crisis in year t and zero otherwise. Table 3 presents information regarding the crisis period of each country.

Table 3 presents the value of each proxy used to measure creditor rights protection by country and, if applicable, its crisis period. Table 4 shows the average number of days customers take to repay credit (DSO) in each country in normal times and during times of crisis.

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[1] We use the same countries as Pinkowitz, Stulz, and Williamson (2006). This sample of countries is also very similar to the one used by Demirgüç-Kunt and Maksimovic (2001).

Table 2
Correlations.

	DSO	Size	Stlev	Fcost	Gpsales	Npsales	Growth	Turn	Mkshare	Collectivism	Log (GDP pc)	Priv credit/GDP
DSO	1											
Size	−0.2335***	1										
Stlev	0.1192***	0.1064***	1									
Fcost	−0.0183***	−0.063***	0.0251***	1								
Gpsales	−0.0167***	−0.0988***	−0.3376***	−0.0594***	1							
Npsales	−0.1152***	0.2359***	−0.0011	−0.0542***	0.0948***	1						
Growth	0.0112***	−0.0584***	−0.0373***	0.0245***	0.0729***	0.0128***	1					
Turn	−0.1331***	0.1663***	0.4743***	−0.0493***	−0.3286***	0.0936***	−0.0108***	1				
Mkshare	−0.038***	0.2837***	0.0086***	0.1266***	0.0109***	0.0493***	0.0159***	−0.0092***	1			
Collectivism	−0.1760***	0.2009	−0.1913***	−0.0048*	0.2548***	−0.0588***	0.0501***	0.0484***	−0.0241***	1		
Log (GDP pc)	−0.0365***	0.1002***	−0.0239***	−0.0901***	0.0729***	−0.0036	−0.0124***	0.0082***	0.0032	0.1953***	1	
Priv credit/GDP	−0.1534***	0.2411***	−0.0093***	−0.2553***	0.0170***	0.0123***	−0.0722***	0.0904***	−0.2180***	0.3526***	0.1725***	1

DSO is the days-of-sales outstanding; this variable is measured as (accounts receivable/sales)*360. Size is the natural logarithm of sales; Stlev is the ratio of current liabilities to total assets; Fcost is the ratio of finance costs over outside financing minus trade credit; Gpsales is the ratio of gross profit to sales; Npsales is the ratio of net profit over sales; Growth is the ratio $(\text{sales}_t - \text{sales}_{t-1})/\text{sales}_{t-1}$. Turn is the ratio of sales over assets minus accounts receivable; Mkshare is the ratio of the firm's sales over total industry sales for the same year. Collectivism is Hofstede's cultural index on collectivism. Log (GDP pc) is the logarithm of GDP per capita in constant 2005 US dollars. Priv credit/GDP is private credit by money deposited in banks and other financial institutions divided by GDP. *** indicates significance at the 1% level.
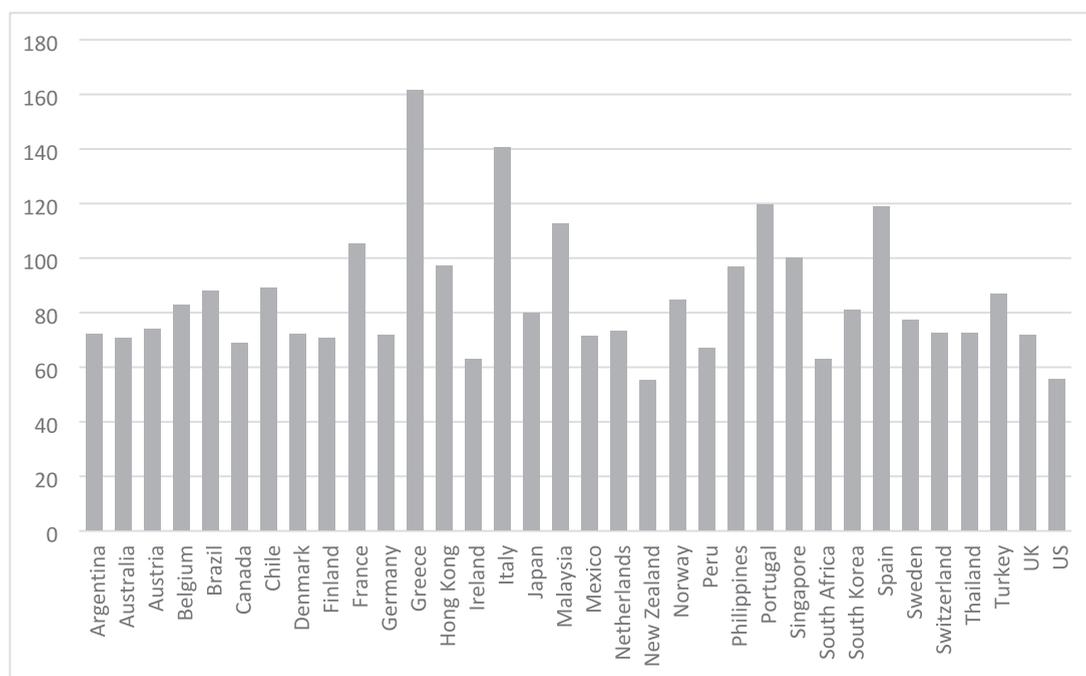
Fig. 1. Mean DSO by countries.

Table 3
Country-specific variables.

	Creditor rights	Property rights	Rule of law	Crisis period
Argentina	4	39.28	−0.71	2001–2003
Australia	10	90	1.78	–
Austria	6	90	1.84	2008–2013
Belgium	5	85.5	1.46	2008–2013
Brazil	3	50	−0.08	1996–1998
Canada	7	90	1.76	–
Chile	6	89.17	1.37	–
Denmark	9	90.25	1.91	2008–2013
Finland	8	90.24	1.96	–
France	5	72.86	1.41	2008–2013
Germany	7	90	1.65	2008–2013
Greece	3	55.71	0.47	2008–2013
Hong Kong	10	90	1.57	–
Ireland	9	89.76	1.72	2008–2013
Italy	3	60.95	0.44	2008–2013
Japan	7	79.52	1.44	1997–2001
Malaysia	10	56.67	0.44	1997–1999
Mexico	6	50.95	−0.54	1996
Netherlands	5	90	1.83	2008–2013
New Zealand	10	91.75	1.88	–
Norway	6	90	1.98	–
Peru	7	39.28	−0.57	–
Philippines	4	43.33	−0.40	1997–2001
Portugal	3	70	1.05	2008–2013
Singapore	10	90	1.71	–
South Africa	7	50	0.16	–
South Korea	6	73.26	0.95	1997
Spain	6	70	1.03	2008–2013
Sweden	9	84.52	1.96	2008–2013
Switzerland	8	89	1.80	2008–2013
Thailand	5	59.76	−0.12	1997–2000
Turkey	4	53.15	0.07	2000–2001
UK	10	89.52	1.70	2007–2013
US	9	88.1	1.56	2007–2013

This table presents the values of the proxies for creditor protection (*Creditor rights, Property rights,* and the *Rule of law*) and the crisis period for each country. *Creditor rights* is the creditor rights index obtained from the World Bank's Doing Business Report; *Property rights* is an index that measures the protection of private property rights; the *Rule of law* considers the country's law and order tradition.

Table 4
Mean DSO by country and period.

	Obs.	Total period	Non-crisis period	Crisis period	Variation crisis vs. non-crisis
Argentina	381	72.15	71.07	79.67	12.10%
Australia	4119	70.66	70.66		
Austria	336	74.05	79.89	70.63	−11.58%
Belgium	522	82.78	87.24	79.96	−8.35%
Brazil	1105	88.01	88.21	65.95	−25.23%
Canada	3246	68.89	68.89		
Chile	1001	89.12	89.12		
Denmark	683	72.16	74.39	70.27	−5.53%
Finland	770	70.65	70.65		
France	3118	105.50	110.41	102.50	−7.17%
Germany	3743	71.99	75.18	69.74	−7.23%
Greece	1477	161.75	163.37	160.35	−1.85%
Hong Kong	1692	97.37	97.37		
Ireland	247	63.08	64.47	61.68	−4.33%
Italy	1255	140.66	150.34	136.17	−9.43%
Japan	38,654	79.97	77.84	88.28	13.42%
Malaysia	6051	112.72	112.70	154.90	37.45%
Mexico	527	71.46	71.53	64.25	−10.18%
Netherlands	636	73.30	75.62	71.42	−5.55%
New Zealand	442	55.29	55.29		
Norway	659	84.67	84.67		
Peru	388	67.18	67.18		
Philippines	611	96.87	95.74	113.54	18.60%
Portugal	246	119.80	126.17	115.73	−8.27%
Singapore	3983	100.26	100.26		
South Africa	1480	63.21	63.21		
South Korea	14,404	80.98	81.39	54.73	−32.76%
Spain	629	118.92	118.70	119.02	0.27%
Sweden	1766	77.57	81.06	75.38	−7.01%
Switzerland	1233	72.67	74.56	71.08	−4.67%
Thailand	4002	72.59	72.67	71.91	−1.06%
Turkey	718	87.02	87.58	68.38	−21.92%
UK	7156	72.00	72.60	71.49	−1.52%
US	21,245	55.67	57.43	53.31	−7.18%

This table presents the average number of days customers take to repay their credit (DSO) during the full, non-crisis, and crisis periods.

4. Empirical evidence

4.1. Main evidence

Our first goal is to check whether creditor rights protection and banking crises influence trade credit. Table 5 presents the results of estimating model (1). Our findings indicate that creditor rights protection does not affect trade credit when we use the *credit rights index* (CRI) and the *rule of law* (RL) as creditor protection measures; however, the *property rights index* (PRI) is negatively related to DSO at the 5% significance level, indicating that in countries with a higher index (more creditor protection), the provision of trade credit is lower. The results also indicate that the number of days customers take to repay their credit increases during banking crises since the variable *crisis* is positively related to DSO at the 10% level. An increase in trade credit extension may be because suppliers voluntarily decide to extend more trade credit to customers or because customers delay payments. During banking crises, credit from banks is reduced or unavailable; therefore, firms have less finance to redistribute through trade credit. Even if suppliers have a good financial situation, they may decide to reduce credit to their customers for precautionary reasons; therefore, the increase in trade credit extension during banking crises seems to be due to customers' delayed payments.

Customers appear to delay payments during banking crises; therefore, we now analyze whether differences exist between countries with strong and weak creditor protection. During banking crises, customers typically want to receive more trade credit, while suppliers want to extend less because they have less access to bank loans. Suppliers can set and enforce their desired contract terms more easily in countries with strong creditor rights protection; however, in countries with weak protection, customers can extract trade credit from suppliers against their will by simply not paying their invoices on time, resulting in longer payment times.

To study this, we now estimate model (2). The results in Table 6 indicate that trade credit extensions increase during crisis periods in countries with strong and weak creditor protection; the variable *crisis* is positively related to DSO at the 1% significance level in the first two columns and the 10% level in the last column. This result indicates that during banking crises, customers delay payments to their suppliers regardless of creditor protection levels; however, the increase in trade credit extension is smaller in countries with strong creditor protection since the variables *CrisisxCRI, CrisisxPRI,* and *CrisisxRL* are negative and significant. This result indicates that

Table 5
Effect of creditor protection and times of crisis on trade credit granted.

	(1)	(2)	(3)	(4)	(5)
CRI		−1.8528			
		(−0.90)			
PRI			−0.5786**		
			(−1.97)		
RL				−5.7010	
				(−0.81)	
Crisis					7.4427*
					(1.86)
Size	−4.5228***	−4.8141***	−4.5373***	−4.5308***	−4.5826***
	(−4.94)	(−4.40)	(−5.07)	(−4.92)	(−5.04)
Stlev	76.1396***	73.6097***	75.7004***	77.1290***	73.7958***
	(5.32)	(5.88)	(5.59)	(5.34)	(5.34)
Fcost	−79.4027	−70.8093	−108.9268*	−101.7088*	−73.4210
	(−1.38)	(−1.22)	(−1.89)	(−1.87)	(−1.28)
Gpsales	−2.2272	−2.6233	−1.7213	−1.9458	−2.5919
	(−0.42)	(−0.49)	(−0.34)	(−0.38)	(−0.48)
Npsales	−11.4035***	−11.3117***	−12.1046***	−11.7799***	−11.5279***
	(−4.22)	(−4.27)	(−4.51)	(−4.39)	(−4.27)
Growth	1.0658	1.6721	1.6236	1.2015	1.8994
	(0.53)	(0.81)	(0.84)	(0.60)	(1.06)
Turn	−10.1901***	−10.0275***	−10.0550***	−10.1771***	−9.9179***
	(−4.61)	(−4.89)	(−4.81)	(−4.67)	(−4.57)
Mkshare	−14.8608	−16.2467	−17.8690	−16.3483	−14.1202
	(−0.83)	(−0.97)	(−1.08)	(−0.94)	(−0.80)
Collectivism	−0.3020***	−0.2666**	−0.1742	−0.2487**	−0.3390***
	(−2.95)	(−2.25)	(−1.42)	(−2.47)	(−3.29)
Log (GDP pc)	1.9487	2.1532	5.7017	4.0214	1.3680
	(0.87)	(0.84)	(1.39)	(1.34)	(0.59)
Priv credit/GDP	−0.1097	−0.0901	−0.0622	−0.0895	−0.1134*
	(−1.58)	(−1.18)	(−1.01)	(−1.31)	(−1.73)
Constant	132.0797***	142.7078***	154.4549***	128.0481***	133.8386***
	(10.97)	(7.83)	(7.79)	(11.94)	(11.85)
R^2	0.1878	0.1906	0.1951	0.1951	0.1903
Observations	112,014	112,014	112,014	112,014	112,014

This table reports the results of estimating model (1). CRI is the creditor rights index; PRI is the property rights index; RL is the rule of law; and *Crisis* is a dummy variable that takes the value of one if country c goes through a banking crisis in year t and zero otherwise. All the variables are defined in the Appendix. Industry and time dummies are included in the estimations but not reported. All the parameters are estimated using pooled OLS with standard errors adjusted for clustering by country and year. *t-statistic* in brackets. *** indicates significance at the 1% level. * indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level.

suppliers collect earlier in countries with strong creditor protection than in countries with weak protection.[2]

In contrast, during normal times, no differences are observed between countries with strong and weak creditor protection in the number of days customers take to pay their credit; the variables CRI, PRI, and RL are insignificant.

4.2. Robustness checks

We estimated the results based on clustered standard errors by firm and year instead of reporting the results based on clustered standard errors by country and year. Furthermore, we ran all the estimations again after excluding firms from the countries with the highest number of observations in our sample (the United States and Japan). We also re-estimated all the regressions using another proxy for trade credit granted to customers (dependent variable). Specifically, we used accounts receivable scaled by a firm's total assets (REC). Finally, we analyzed whether the effect of banking crises on trade credit provision depends on the country's legal system. According to La Porta et al. (1998), common-law countries have the strongest legal protection for investors (shareholders and creditors). Thus, to confirm our hypothesis, the increase in the provision of trade credit during crisis periods in these countries should be less than in civil-law countries; Table 7 presents the results for robustness. For space reasons, we only report the results for the variable *Crisis*, the creditor protection variables, and the multiplicative term. The coefficients for these variables keep the same sign, confirming the previously mentioned results.

5. Discussion and conclusions

This paper studies the effect of international banking crises since 1996 on the number of days customers take to repay their credit,

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[2] The results hold when the data are winsorized at different values (e.g, 0.5% or 2%).

Table 6
Changes in trade credit during crises.

	(1)	(2)	(3)
Crisis	51.6333***	102.9923***	39.6105*
	(4.37)	(3.28)	(1.91)
CRI	−0.0554		
	(−0.03)		
Crisis x CRI	−5.9378***		
	(−4.15)		
PRI		−0.3934	
		(−1.60)	
Crisis x PRI		−1.1756***	
		(−3.31)	
RL			−2.5257
			(−0.47)
Crisis x RL			−22.5108*
			(−1.80)
Size	−4.6897***	−4.5395***	−4.5847***
	(−4.52)	(−4.97)	(−4.91)
Stlev	69.1767***	69.6265***	72.6435***
	(6.05)	(5.88)	(5.86)
Fcost	−63.6373	−96.8323*	−98.3155*
	(−1.17)	(−1.75)	(−1.89)
Gpsales	−2.3062	−1.9130	−2.0396
	(−0.44)	(−0.39)	(−0.42)
Npsales	−11.2773***	−11.8489***	−11.6395***
	(−4.25)	(−4.48)	(−4.40)
Growth	2.4453	2.6624	2.3299
	(1.31)	(1.55)	(1.33)
Turn	−9.5309***	−9.3867***	−9.5935***
	(−4.99)	(−5.08)	(−4.92)
Mkshare	−16.7415	−20.1756	−17.6196
	(−1.02)	(−1.30)	(−1.06)
Collectivism	−0.2909***	−0.1980*	−0.2808***
	(−2.77)	(−1.86)	(−3.29)
Log (GDP pc)	0.9476	5.0188	3.8113
	(0.45)	(1.56)	(1.62)
Priv credit/GDP	−0.0666	−0.0589	−0.0951
	(−1.01)	(−1.10)	(−1.48)
Constant	124.1295***	137.9491***	123.8264***
	(7.88)	(7.58)	(12.38)
F-test	26.84	60.98	85.01
R^2	0.1989	0.2040	0.1965
Observations	112,014	112,014	112,014

This table reports the results of estimating model (2). *Crisis* is a dummy variable that takes the value of one if country c goes through a banking crisis in year t and zero otherwise; CRI is the creditor rights index; PRI is the property rights index; and RL is the rule of law. All the variables are defined in the Appendix. Industry and time dummies are included in the estimations but not reported. All the parameters are estimated using pooled OLS with standard errors adjusted for clustering by country and year. *t-statistic* in brackets. *F*-test refers to an *F*-test on the null hypothesis that the coefficient $\beta_2 + \beta_3$ is zero. * indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level.

examining whether this effect depends on the level of creditor protection. Our selected timeframe allowed us to analyze both crisis and non-crisis periods for most countries in the sample. During banking crises, bank credit is reduced or unavailable; therefore, firms have less finance to redistribute through trade credit. During these periods, suppliers with good financial situations can compensate for the reduction in bank credit by granting more trade credit to constrained firms (substitution effect); however, even if suppliers have good financial situations, they may also decide to reduce credit to their customers for precautionary reasons. In this case, suppliers may try to tighten the terms of credit granted to their customers (complementary effect).

Our results show that customers repay later during banking crises than in normal times. This finding could be explained by the substitution effect either from the supply side, supporting the redistribution theory, or from the demand side due to delayed payments to suppliers, provoking a credit contagion in the supply chain; however, the increase in trade credit extension during these crisis periods is lower in countries with strong creditor protection, supporting the critical role played by creditors' rights. This result is consistent with the idea that suppliers can set and enforce the contract terms they want more readily in countries with strong creditor protection during periods of financing restrictions and increased credit risks; however, our findings indicate that the level of creditor protection does not influence trade credit extension in non-crisis periods.

Our results complete the previous literature in several ways. First, the impact of financial crises on the relationship between trade credit and bank credit has been studied with mixed results in works focused on individual countries (Garcia-Appendini and Montoriol-Garriga, 2013; Tsuruta, 2013) and similar countries, for example, Bastos and Pindado (2013) for emerging countries and Love and

Table 7
Robustness checks.

	(1)	(2)	(3)
Panel A: Clustering of standard errors by firm and year			
Crisis	51.6333***	102.9923***	39.6105**
	(4.81)	(3.84)	(2.41)
CRI	−0.0554		
	(−0.07)		
Crisis x CRI	−5.9378***		
	(−5.14)		
PRI		−0.3934***	
		(−3.52)	
Crisis x PRI		−1.1756***	
		(−3.93)	
RL			−2.5257
			(−1.42)
Crisis x RL			−22.5108**
			(−2.31)
Panel B: Without US and Japan			
Crisis	46.5818***	99.6701***	39.0655**
	(3.55)	(3.61)	(2.05)
CRI	−1.0790		
	(−0.45)		
Crisis x CRI	−5.7450***		
	(−3.22)		
PRI		−0.4284**	
		(−2.00)	
Crisis x PRI		−1.1578***	
		(−3.78)	
RL			−3.0459
			(−0.59)
Crisis x RL			−22.3809**
			(−2.06)
Panel C: Accounts receivable/assets			
Crisis	0.0626***	0.1323***	0.0446*
	(3.91)	(3.22)	(1.65)
CRI	−0.0020		
	(−0.84)		
Crisis x CRI	−0.0069***		
	(−3.49)		
PRI		−0.0005**	
		(−1.97)	
Crisis x PRI		−0.0014***	
		(−3.12)	
RL			0.0004
			(0.06)
Crisis x RL			−0.0226
			(−1.35)
Panel D: Legal system			
Crisis	11.2682***		
	(2.75)		
Legal system	−1.0332		
	(−0.21)		
Crisis x Legal system	−9.9410**		
	(−2.19)		

This table shows the influence of crisis periods on investments in accounts receivable according to the level of creditor protection. In Panel A, we estimate the results based on clustered standard errors by firm and year. In Panel B, we estimate the regressions once we have excluded firms from the United States and Japan. In Panel C, we use another proxy for trade credit. Specifically, we use accounts receivable scaled by a firm's total assets. *Crisis* is a dummy variable that takes the value of one if country c goes through a banking crisis in year t and zero otherwise; CRI is the creditor rights index; PRI is the property rights index; and RL is the rule of law. Finally, in Panel D, we analyze whether the legal system influences the effect of banking crises on trade credit. *Legal system* equals 1 for common-law countries and zero for civil-law countries. The *t-statistic* is in brackets. * indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level.

Zaidi (2010) for Asian countries. We shed new light on this question by conducting a cross-country analysis considering the role played by creditor protection and the efficiency of the legal system, with particular attention paid to several banking crises across 34 countries with different legal systems. After considering these country-specific variables, our results are consistent with studies that found an increase in trade credit during financial crises. This substitution effect is lower in countries with strong creditor protection and law enforcement, indicating the greater importance of the demand side of trade credit than the supply side (redistribution effect).

Second, Demirgüç-Kunt and Maksimovic (2001) addressed the legal system's impact on trade credit using firm-level data for 39 countries. They found a complementary relationship between trade credit and the development of the banking system, particularly in countries with inefficient legal systems; however, unlike our study, they did not consider the impact of a financial crisis with the corresponding negative shock to the supply of credit by financial intermediaries, thus drying up liquidity for firms. In this scenario, the role played by creditor protection becomes more critical since the informational advantage of suppliers is less significant in countries with weak legal systems, and firms may have more difficulties recovering their accounts receivable. We expanded the study of Demirgüç-Kunt and Maksimovic (2001) by verifying the role played by creditor protection in reducing customer payment delays during banking crises. Moreover, unlike previous studies, this research jointly analyzes several financial crises in a single study: the crises in Mexico, Brazil, and Argentina in the nineties, the 1997 Asian crisis, and the 2007 global crisis.

This study helps explain the importance of creditor rights protection and banking crises for firms' financial management. Weak creditor protection makes it easier for customers to delay payment, causing firms to bear a more significant investment in accounts receivable, thereby reducing the firm's value. This situation is even worse during banking crises because less funding is available, which could drive firms into bankruptcy. In summation, we observe a substitution effect from bank credit to trade credit during banking crises, but this effect is lower in countries with strong creditor protection, revealing the importance of the demand for trade credit in times of credit shortages.

Our findings have interesting implications for firms since the quality of legal enforcement may reduce moral hazard problems between buyers and sellers. This reduction allows firms to decrease the costs of managing trade credit and enhance their capacity to recover non-payment of outstanding invoices, reducing delinquency rates. This finding is also relevant for exporters who use letters of credit and credit insurance to reduce credit risk in international trade. Furthermore, our results are valuable for governments of countries where creditors are less protected. More rights and better-quality law enforcement could help reduce delayed payments and unpaid trade credit debt and prevent many firms from going bankrupt, limiting the contagion effect during financial crises. Our evidence supports the importance of an adequate institutional setting for financial decision-making.

One limitation of this paper is that we do not have information on the credit periods established by suppliers or when customers pay their credit; therefore, we cannot verify that customers delay payments to their suppliers during crises. Future research can explore these contract terms and utilize an updated sample that includes more countries.

Credit author statement

Sonia Baños-Caballero: Conceptualization, Methodology, Writing – original draft preparation, Formal analysis.
Pedro J García-Teruel: Conceptualization, Methodology, Data curation, Formal analysis.
Pedro Martínez-Solano: Conceptualization, Methodology, Writing – review & editing, Supervision.

Term	Definition
Conceptualization	Ideas; formulation or evolution of overarching research goals and aims
Methodology	Development or design of methodology; creation of models
Software	Programming, software development; designing computer programs; implementation of the computer code and supporting algorithms; testing of existing code components
Validation	Verification, whether as a part of the activity or separate, of the overall replication/ reproducibility of results/experiments and other research outputs
Formal analysis	Application of statistical, mathematical, computational, or other formal techniques to analyze or synthesize study data
Investigation	Conducting a research and investigation process, specifically performing the experiments, or data/evidence collection
Resources	Provision of study materials, reagents, materials, patients, laboratory samples, animals, instrumentation, computing resources, or other analysis tools
Data Curation	Management activities to annotate (produce metadata), scrub data and maintain research data (including software code, where it is necessary for interpreting the data itself) for initial use and later reuse
Writing - Original Draft	Preparation, creation and/or presentation of the published work, specifically writing the initial draft (including substantive translation)
Writing - Review & Editing	Preparation, creation and/or presentation of the published work by those from the original research group, specifically critical review, commentary or revision – including pre-or postpublication stages
Visualization	Preparation, creation and/or presentation of the published work, specifically visualization/ data presentation
Supervision	Oversight and leadership responsibility for the research activity planning and execution, including mentorship external to the core team
Project administration	Management and coordination responsibility for the research activity planning and execution
Funding acquisition	Acquisition of the financial support for the project leading to this publication

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data subject to third party restrictions.

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Appendix A. Description of variables and sources

Name	Description	Source
	Panel A: Firm-specific variables	
DSO	Days-of-sales outstanding = (accounts receivable/sales)*360	Compustat Global
Size	The natural logarithm of sales	Compustat Global
Stlev	Short-term financing: the ratio of current liabilities to total assets	Compustat Global
Fcost	The cost of outside financing; the ratio of finance costs over outside financing minus trade credit	Compustat Global
Gpsales	The gross profit margin; the ratio of gross profit to sales	Compustat Global
Npsales	The net income margin; the ratio of net profit over sales	Compustat Global
Growth	Sales growth = (sales$_t$ − Sales$_{t-1}$)/Sales$_{t-1}$	Compustat Global
Turn	Asset turnover; the ratio of sales over assets minus accounts receivable	Compustat Global
Mkshare	Bargaining power; the ratio of the firm's sales over the total sales of the industry for the same year	Compustat Global
	Panel B: Country-specific variables	
CRI	The creditor rights index measures whether applicable collateral and bankruptcy laws facilitate lending, which takes values from 0 (weak creditor rights) to 10 (strong creditor rights).	World Bank's Doing Business Report. Available at www.doingbusiness.org.
PRI	This index measures how a country's laws protect private property rights and how governments enforce laws. This index takes values from 0 to 100. Higher scores reflect greater legal protection of property rights.	Heritage Foundation
RL	This variable assesses a country's law and order tradition. This variable takes values from −2.5 to 2.5. Higher scores reflect greater legal system efficiency.	Worldwide Governance Indicators (WGI) from the World Bank
CRISIS	A dummy variable that takes the value of one if country i goes through a banking crisis period in year t and zero otherwise.	Laeven and Valencia (2013)
Collectivism	Hofstede's cultural index on collectivism	Hofstede
Log (GDP pc)	Logarithm of GDP per capita in constant 2005 US dollars	World Development Indicators (World Bank)
Priv credit/ GDP	Private credit by money deposited in banks and other financial institutions divided by GDP	Global Financial Development Database (World Bank)
Legal system	This variable equals 1 for common-law countries and zero for civil-law countries.	La Porta et al. (1998)

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