

# **Determinants of supplier payment times before and during the pandemic: Empirical evidence from UK firms**

**Anthony Flynn<sup>a</sup> & Qian (Jan) Li<sup>b</sup>**

<sup>a</sup> Cardiff Business School, Cardiff University, Column Drive, Cardiff, CF10 3EU. Email: [flynna2@cardiff.ac.uk](mailto:flynna2@cardiff.ac.uk)

<sup>b</sup> Cardiff Business School, Cardiff University, Column Drive, Cardiff, CF10 3EU. Email: [liq50@cardiff.ac.uk](mailto:liq50@cardiff.ac.uk)

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## **Abstract**

Timely, compliant payment to suppliers is a significant issue in purchasing and supply management (PSM) but research into its determinants is limited. Here we draw on social responsibility, fintech and digital purchasing literatures, and institutional and stakeholder theories to explain variations in supplier payment times. A sample of 509 firms spanning 2018-2021 is used for panel regression analysis. Contrary to expectations, the COVID-19 pandemic did not lead to longer payment times or reduced compliance with payment terms, which we attribute to state-funded business supports and corporate decisions to accelerate payment to vulnerable suppliers. Institutional pressure in the form of payment codes was associated with shorter payment times and improved compliance during the pandemic. Supply chain finance (SCF) was associated with longer payment times during the pandemic while e-invoicing had no effect. Overall, institutional pressure seems to contribute to faster payment but stakeholder-centred fintech and digitalisation does not.

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Keywords: supplier payment times, payment codes, responsible purchasing, supply chain finance (SCF), e-invoicing, COVID-19 pandemic.

## 1. Introduction

Getting paid in a timely manner is a perennial issue for suppliers (Cowton and San-Jose, 2017). When purchasing firms insist on extended payment terms or do not settle invoices by the contractually agreed date, it can put suppliers under financial strain and have repercussions for supply chain partners (Hofmann and Kotzab, 2010; Caniato et al., 2016). Against this backdrop, there is growing institutional pressure on purchasing firms to pay suppliers promptly or, at the very least, to pay by the agreed date. This is evident in regulations strengthening creditor rights like EC Late Payments Directive, mandatory requirements to disclose supplier payment times like the UK's 'Duty to Report', and the promotion of voluntary payment codes like Prompt Payment Code (Grewal et al., 2020; Chuk et al., 2021).

In addition to institutional pressure, digital purchasing, especially e-invoicing (Keifer, 2011; Koch, 2021), and the emergence of fintech solutions like SCF (Caniato et al., 2016; Gelsomino et al., 2016; Moretto and Caniato, 2021) are changing the landscape for how firms process invoices and when and under what circumstances they pay suppliers. These innovations, which involve supply chain stakeholders like lenders, technology providers and regulators (Moretto et al., 2019), have the potential to make life easier for suppliers. Whether this is happening in practice is debatable. Hence in this paper, we examine how institutional, digitalisation and fintech variables influence payment times and compliance with agreed payment terms. Given the momentous events surrounding COVID-19, we incorporate pre-pandemic and pandemic periods into our assessment of these relationships.

Most commercial transactions involve firms taking products and services from suppliers on a deferred payment basis, otherwise known as trade credit (Long et al., 1993; Cunit, 2007). Data from across Europe indicates that trade credit grew in importance during the pandemic, with suppliers using it as a trade enabler and "credit rationed" buyers relying on it to manage

working capital (Atradius, 2020a). The war in Ukraine and the soaring cost of energy, commodities and raw materials in 2022 are likely to have compounded this situation. Suppliers offering trade credit agree payment terms with buyers. The problems start when buyers require longer than normal to pay i.e., extended terms or do not pay by the agreed date i.e., late payment. Surveys show that most suppliers contend with lengthy payment and late payment and that their effects are felt in constrained cash flow, restrictions on growth and strained customer relations (FSB, 2017; Tymowski, 2018; Ishak et al., 2019).

Despite its universal relevance for suppliers and buyers, surprisingly little research has been carried out on the determinants of payment times, and there is a need for empirical inquiry and theorising in this area (Cowton and San-Jose, 2017). By contrast, there is an extensive “grey literature” on the prevalence and consequences of extended payment terms, late payment and non-payment (Atradius, 2020a, 2020b; Intrum, 2021). The few academic studies that have investigated the antecedents of payment times do so from an accounting perspective, testing variables like credit management practices, access to bank lending, early settlement discounts and dividend policies (Howorth and Reber, 2003; Paul and Boden, 2011; De Carvalho, 2015; Chuk et al., 2021). PSM perspectives are missing from the literature, even though payment timeliness is an issue of fundamental importance to our field.

Understanding payment times from a PSM perspective has taken on added salience since the COVID-19 pandemic and latterly the war in Ukraine. Previous studies have shown that crises of this kind can have a negative impact on the number of days buyers take to pay suppliers (Hughes, 2011; Lorentz et al., 2016; Caniato et al., 2020). Early evidence on the pandemic appears to bear this out. Survey data from small US government contractors highlighted their concerns over customers’ ability to pay on time (Melnik et al., 2021) while industry metrics in Europe and the US pointed to a deterioration in supplier payment times, an increase in bad debts and extended payment terms (Atradius, 2020a, 2020b; Hackett Group 2021; Intrum,

2021; Barclays, 2022). The ramifications of these geo-political events for PSM are still being worked through and it remains to be seen how exactly they interacted with organisational and contextual factors in influencing the time taken to pay suppliers.

The objective of this paper is to theorise, provide empirical evidence and offer managerial insights into the determinants of supplier payment times. It is guided by two research questions. The first takes a PSM lens to supplier payment times by asking: To what extent are payment time and compliance with agreed terms related to institutional, fintech and digitalisation variables? The second research question takes account of the disruptive effects of a global crisis by asking: Did the COVID-19 pandemic moderate the relationship between the above predictor variables, payment time and compliance with agreed terms? To answer these two questions the paper analyses four years of payment data spanning 2018-2021 from 509 large UK firms. The study was made possible by the UK government releasing a dataset containing information on payment times, payment compliance and other payment indicators for thousands of large firms that covers the years immediately before and during the pandemic.

The paper's scholarly contributions to the PSM field are threefold. First, it introduces factors including payment codes, SCF and e-invoicing that have not been tested before as determinants of payment times. By doing so it moves away from an accounting-centric view of supplier payments (Howorth and Reber 2003; Paul and Boden, 2011) to consider practices that are PSM-grounded. Second, it anchors its arguments in institutional theory (Dowling and Pfeffer, 1975; Meyer and Rowan, 1977) and stakeholder theory (Freeman, 1984). This helps to connect payment times to other facets of responsible purchasing that are institutionally determined like supplier development programmes (Zhang et al., 2017; Yawar and Kauppi, 2018) or that are understood through the lens of stakeholder co-operation like supply chain credit ratings (Moretto et al., 2019). Third, it provides an unprecedented view of supplier payment times

during the pandemic, thus adding to an emerging body of PSM scholarship on how firms reacted to its disruptive effects (Melnik et al., 2021; Moretto and Caniato, 2021).

The next section reviews the literature on trade credit and the determinants of supplier payment times. The review leads to a series of hypothesised relationships between PSM-related factors, payment time and compliance with agreed terms. The fourth section describes the panel dataset, variable measurement and regression approach used. The fifth section contains the results of the analysis. The sixth section discusses their implications for scholarship and managerial practice.

## **2. Literature review**

### **2.1 Trade credit**

Extending trade credit serves multiple purposes for suppliers. It maintains existing customers while adding new customers and is especially important for sales growth (Petersen and Rajan, 1997; Garcia-Teruel and Martinez-Solano, 2010; Cowton and San-Jose, 2017). Trade credit ‘signals’ to customers that the firm has sufficient working capital (Peel et al., 2000). Equally, it serves as an inventory management strategy to reduce warehousing costs and obsolescence risks (Bougheas et al., 2009). The risk of stock overage incentivises suppliers to offer trade credit to customers, even when this means straining their own cash flow and forgoing future sales to alternative customers (ibid). Trade credit also contains an implicit quality guarantee covering the goods or services provided, which is reassuring for new customers (Long et al., 1993).

Availing of trade credit also serves multiple purposes for buyers. Low cash or liquid asset availability forces firms to take goods or services from suppliers on a deferred payment basis (Petersen and Rajan, 1997). Small firms who find themselves “credit rationed” in the sense that banks are reluctant to loan them money use trade credit as a substitute for traditional financing

(Garcia-Teruel and Martinez-Solano, 2010). Even where firms have sufficient cash, it can make sense to take trade credit and defer payment as part of optimising working capital (Cowton and San-Jose, 2017). Firms can, for instance, earn interest on sums owed to suppliers by placing it on short-term deposit with financial institutions. Moreover, most firms target a favourable cash contribution from their trade credit policies i.e., get paid by customers before making payment to suppliers (Lorentz et al., 2016).

There is a downside to trade credit. Suppliers often struggle to receive timely payment because their customers either require extended payment terms or do not pay by the agreed date. Industry analysis shows that 56% of invoices were paid late in Europe (Atradius, 2020a) and 43% of the total value of invoices across the Americas were affected by late payment since the start of the pandemic (Atradius, 2020b). Late payment is the result of purchasing firms stretching the credit facilities of suppliers, sometimes cynically and sometimes out of financial necessity (Petersen and Rajan, 1997; Hajikazemi et al., 2020). A related trend since the 2008 financial crisis is corporations extending payment terms as part of freeing up cash to be invested in the business, buy back stock or issue dividends (Ng, 2013). Such aggressive cash management practices are welcomed by investors but can undermine suppliers' working capital arrangements (Hofmann and Kotzab, 2010; Ng, 2013).

The negative effects of extended payment, late payment and non-payment have been captured in cross-national studies. Suppliers have reported cash flow problems leading to difficulties paying their own suppliers, postponing investments in their operations, and freezing staff remuneration and hiring because customers did not pay on time (FSB, 2017; Ishak et al., 2019; Intrum, 2021). Then there is the resource cost incurred by suppliers in chasing up debtors; resources that could be directed towards productive activities like customer risk assessment (Paul and Boden, 2011). Arguably, not receiving payment in a timely manner erodes supplier trust in the buyer, reduces goodwill, and makes it less likely that suppliers will go the extra

mile for buyers (Hofmann and Kotzab, 2010). Finally, there is a not insignificant loss to the economy when firms collapse because of difficulties in getting paid (FSB, 2017).

## 2.2 Determinants of payment time

A range of predictive and descriptive analyses of supplier payment times have been carried out (see Table 1). Financing is a recurring theme in these analyses. Howorth and Reber (2003), De Carvalho (2015) and Chuk et al. (2021) found that firms unable to access bank finance, and hence dependent on trade credit, are slower to pay. The extent to which firms receive timely payment from business customers should enable them to pay suppliers on time, although contradictory results have been returned on this point (Howorth and Reber, 2003; De Carvalho, 2015). Weak credit management practice, including not having a policy on acceptable payment terms, and poor financial management skills are other reasons why suppliers experience payment delays (Peel et al., 2000; Paul and Boden, 2011; Peters et al., 2019). This is in addition to situations, particularly in the construction sector, where project owners are either unwilling or unable to release funds to contractors as agreed (Chen, 2012; Abdul-Rahman et al., 2014; Peters et al., 2019).

Organisational characteristics also affect the timing of supplier payments. Supply chain concentration is of them. Firms that concentrate their requirements for a given product or service with one supplier tend to pay faster (Howorth and Reber, 2003; De Carvalho, 2015). Bigger firms are slower to pay, which can be attributed to leveraging their market power over small suppliers (Peel et al., 2000; Howorth and Reber, 2003; Paul and Boden, 2011; Lorentz et al., 2016). Older firms and low growth firms are more likely to pay on time (De Carvalho, 2015), as are customer-facing firms and those with greater public exposure (Grewal et al., 2020).

Industry context is important, with research pointing to extended payment times in industries with long operating cycles like manufacturing and shorter payment times in retail, services, finance and public administration (FSB, 2017; Lloyds, 2018; Lorentz et al., 2016; Chuk et al., 2021). National context also matters. EU data shows that delayed payment to suppliers by private and public sector buyers has been a particular problem in Italy, Spain, Portugal and Greece in recent years, which may be explained by differences in business practices, institutional oversight and macroeconomic conditions (Tymowski, 2018).

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### 2.3 PSM perspectives on payment time

While empirical inquiry by PSM scholars into the determinants of payment times is limited, several literature streams do engage with questions around how and when suppliers should receive payment. One of them, SCF, interposes financial intermediaries and software providers into buyer-supplier transactions. SCF aims to get money to suppliers faster while extending buyers' days payable outstanding (DPO)<sup>1</sup> (Caniato et al., 2016; Gelsomino et al., 2016; DeGoeij et al., 2021). One way to interpret SCF is by using Freeman's (1984) stakeholder theory, as Moretto et al. (2019) did recently. The essence of stakeholder theory is that value creation is best served when firms incorporate stakeholder interests into their decision making (Freeman, 1984). SCF is an example of firms incorporating supplier interests into their financial and supply management decision making by creating options for early payment without prejudicing their own commercial interests. The stakeholder element to SCF has

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<sup>1</sup> Days Payable Outstanding (DPO) is the average number of days a firm takes to settle its invoices.

arguably become more pronounced since the pandemic, and firms have used SCF to assist struggling suppliers (Moretto and Caniato, 2021).

Freeman's (1984) ideas on stakeholder interests are also relevant for a second PSM stream that addresses supplier payment times: e-invoicing and digital procurement. Purchasing firms are encouraged or even mandated by government and industry stakeholders to introduce e-invoicing systems. The reasons behind this include reducing suppliers' transaction costs, improving corporate competitiveness, enforcing tax and VAT compliance and accelerating payment to suppliers (Koch, 2021). In respect of the latter, the UK government has, for example, identified e-invoicing's streamlined, automated approach as theoretically enabling faster payment to suppliers (Dept. BEIS, 2019). The interests of suppliers as supply chain stakeholders feature strongly in debates over e-invoicing, and purchasing firms are increasingly expected to make it easier for suppliers to submit payment claims and receive settlement within a specified timeframe.

A third PSM stream relevant for supplier payments is responsible purchasing. Inter alia, this stream is interested in how firms treat their suppliers and the enablers and barriers to ethical purchasing (Miemczyk et al., 2012). Much of this literature looks to institutional theorists (Dowling and Pfeffer, 1975; Meyer and Rowan, 1977) to explain why firms implement policies that are supplier friendly or yield positive externalities. Examples of such institutionally determined initiatives that have been explored include supplier development programmes (Zhang et al., 2017; Yawar and Kauppi, 2018), sustainability assessments (Kauppi and Hannibal, 2017) and modern slavery prevention (Flynn, 2019). The assumption is that government, media and industry pressures cause firms to change their behaviour towards suppliers in ways that are pro-social. It has not been extended to supplier payment but is a natural fit, with almost seven out of ten firms agreeing that on-time payment is part of corporate social responsibility (Intrum, 2021).

The three PSM literature streams provide the basis for our hypotheses, which are defended next. Each stream has *a priori* relevance for explaining the timing of payments to suppliers and whether payments comply with agreed terms. Together they form part of this paper's attempt to broaden the debate on payment times and illustrate how it dovetails with current PSM research. The pandemic is included as a context variable given the seismic shifts in business and supply chains that it ushered in. Interactive effects between the pandemic and the main variables related to the three literature streams are also hypothesised. Industry features as a context variable given its importance to the timing of supplier payments, which we explain below.

### **3. Hypotheses**

#### **3.1 Pandemic effect**

The COVID-19 pandemic caused widespread disruption to supply chains from 2020 onwards, with production shutting down and consumer demand collapsing. Among other things, this led to concern over the ability of customers to pay their bills (Melnyk et al., 2021), some suppliers having to accept extended payment terms (Intrum, 2021) and more than half of invoice payments coming in late (Atradius, 2020a; Barclays, 2022). These indicators are consistent with precedent. In the wake of the 2008 financial crisis, large firms extended supplier payment terms by, on average, seven days in Europe and ten days in the US (Caniato et al., 2020). The same phenomenon was observed in the UK where retailers instituted delayed payment schedules after 2008 (Hughes, 2011) and in Finland where economic contractions shifted the working capital burden from business customers to suppliers (Lorentz et al., 2016).

Unlike the 2008 financial crisis, access to credit has not been a defining feature of the pandemic. Massive government stimulus programmes ensured that most firms remained liquid even as their operations were shuttered (Brien and Keep, 2021; Intrum, 2021). The rollout of

supplier payment legislation in the years leading up to the pandemic e.g., EC Late Payments Directive and the UK's 'Duty to Report' also meant that institutional standards for timely payment were higher than in 2008 and firms were expected to treat suppliers fairly. That said, the economic and social upheaval caused by the pandemic is likely to have sent firms into self-preservation mode, taking them longer to pay suppliers and even paying after the agreed deadline, as happened in other economic crises (Cox and San-Jose, 2017). Findings from Hackett Group (2021) that US firms increased their cash-on-hand by as much as 40% and slowed payments to suppliers backs up this assumption. This leads to the following hypothesis:

*H1: The pandemic is associated with longer supplier payment times and lower compliance with agreed payment terms.*

### 3.2 Institutional pressure

Institutional pressures on firms to pay suppliers promptly have increased in recent years. Some of these pressures have a legal-regulatory basis e.g., Late Payment Directive (European Commission, 2014), some have a normative basis e.g., Supply Chain Initiative<sup>2</sup>, and some are the result of campaigning by industry associations like the Federation of Small Business (FSB, 2017). Collectively, these pressures aim to engender payment timeliness, end a culture of late payment and make firms practise socially responsible purchasing. The rationale for responding to institutional pressure of this kind is to do with social legitimacy, which is central to institutional theorists' explanations of organisational behaviour (Dowling and Pfeffer, 1975; Meyer and Rowan, 1977). Dowling and Pfeffer (1975, p. 122) put it thus, "organizations seek to establish congruence between the social values associated with or implied by their activities and the norms of acceptable behaviour in the larger social system".

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<sup>2</sup> <https://www.supplychaininitiative.eu>

Applying this theoretical logic to supply management, firms that do not conform to expectations over timely, compliant payment are likely to invite unwanted attention from regulatory authorities, industry associations, media outlets and the public (Grewal et al., 2020). Admittedly, previous government interventions in this area have proved to be largely ineffective (Cowton and SanJose, 2017). Regulations that give suppliers the right to charge interest on overdue payments, for instance, have been in place for some time e.g., European Directive 2000/35/EC, yet have not made any appreciable difference to the speed of payment. Partly, this is because suppliers fear antagonising customers by invoking these regulations and partly because the market power of corporations can make such action futile. Moreover, there has been limited follow-through by authorities on payment regulations as regards policing buyer behaviour and imposing sanctions on rogue actors (Cowton and SanJose, 2017).

Another manifestation of institutional pressure for timely payment are third party codes. Third party codes provide the impetus to ‘formalize, encourage and guide employee behaviour’ towards desired ends (Bondy et al., 2004 p. 449), which is important when firms are unsure how to navigate changing institutional demands. There is a coercive as well as normative element to third party codes, as non-compliance can lead to sanctions like membership suspension (Perez-Batres et al., 2012). Mimetic control is also implicit in codes of practice, as adoption by industry leaders will persuade other firms to follow their example (Preuss, 2009). Payment codes can be industry specific e.g., Groceries Supply Code of Conduct or universal like the Prompt Payment Code (PPC). The latter requires signatories to pay 95% of invoices within 60 days and 95% of invoices from small and medium enterprises (SMEs) within 30 days. Previous studies have found that suppliers are sceptical about the effectiveness of codes as a strategy to improve payment behaviour (Peel et al., 2000). However, Grewal et al. (2020) demonstrated that corporate undertakings on responsible purchasing was linked to suppliers getting paid earlier. This leads to the following hypothesis.

*H2a: Firms signed up to payment codes have shorter supplier payment times and higher compliance with agreed payment terms.*

The importance of payment codes is expected to have risen during the pandemic. There was no relaxation of the rules governing these codes and some, like the PPC, were even strengthened. Signatories had to adhere to code rules even as the trend across industry was to fiscally retrench by delaying payment and/or extending payment terms (Atradius, 2020a; Intrum, 2021). In effect, payment codes sought to prevent firms from using suppliers' trade credit as short-term financing. Signatories to third party codes have greater institutional exposure, and expectations of them are higher given their avowed public commitment to corporate social responsibility (Perez-Batres et al., 2012). Reneging on their commitment would leave firms open to the charge of hypocrisy and be reputationally damaging (Dowling and Pfeffer, 1975), especially important in this case as equitable treatment of suppliers resonated across society during the pandemic. Public attitudes towards persistent slow and late payers hardened, with over half of those surveyed in the UK stating that they would boycott firms over such malpractice (Barclays, 2022). This leads to the following hypothesis.

*H2b: Firms signed up to payment codes had shorter supplier payment times and higher compliance with agreed payment terms during the pandemic.*

### 3.3 e-Invoicing

There are technological as well as institutional drivers for timely payment to suppliers. e-Invoicing, which is part of the move towards digital purchasing, is one of them. Different from a traditional invoice, an e-invoice is issued, transmitted and received in a structured data format like XML, which allows for its automatic and electronic processing (Hernandez-Ortega and Jimenez-Martinez, 2013). One of the benefits of e-invoicing is that it puts firms in a position to pay suppliers relatively quickly (EY, 2018; Dept. BEIS, 2019). It does this by automating

the process of capturing payment data and moves the invoice towards validation, approval and final settlement in a shorter period (Keifer, 2011). Manual processing of invoices - which includes handling, data entry, visual inspection, reconciliation and archiving - usually takes a minimum of 23-25 days and means that firms are unable to pay suppliers quickly (Koch, 2021).

e-Invoicing reduces the likelihood of errors in the transmission of payment data, which is important because inaccurate invoice content causes payment delay (Koch, 2021). Relatedly, e-invoicing improves the speed and accuracy of the reconciliation process as invoice data can be automatically cross-checked with the purchase order and goods delivery docket, which leads to approved workflows (ibid). By optimising invoice processing, firms can take advantage of early settlement discounts. Finally, e-invoicing brings visibility to the approval and final status of requests for payment (Keifer, 2011). Problems, if they arise, can be identified at an earlier stage than manual invoicing and subsequently resolved. This leads to the following hypothesis.

*H3a: Firms that use e-invoicing have shorter supplier payment times and higher compliance with agreed payment terms.*

Work-from-home directives, site closures, lockdowns, social distancing and travel bans made it difficult to operate during the pandemic. Processing suppliers' requests for payment was no exception. However, industry surveys have found that firms with e-invoicing did not encounter procedural barriers to paying suppliers (FNFE, 2021). It was possible for them to receive, process and settle invoices from suppliers while working remotely, as it was for their suppliers to transmit invoice data. On the other hand, firms without e-invoicing had to maintain an onsite presence e.g., sorting mail, and then co-ordinate manual tasks among purchasing staff based off-site if suppliers were to receive payment; all of which is likely to have lengthened the process and made delays inevitable. The various ways in which e-invoicing takes humans out of the payment process – no physical handing of documents, no manual data input, no visual

matching of orders and dockets – was advantageous during the pandemic. Essentially, e-invoicing decreased the risk of service interruption to accounts payable when staff were furloughed or sick and ensured business continuity throughout the pandemic. This leads to the following hypothesis.

*H3b: Firms that use e-invoicing had shorter supplier payment times and higher compliance with agreed payment terms during the pandemic.*

### 3.4 Supply chain finance

As with e-invoicing, fintech like supply chain finance (SCF) is becoming important for managing supplier payments. One of the original SCF solutions – reverse factoring (RF) – is a buyer-led initiative that sees financial intermediaries paying supplier invoices at a discounted rate weeks before the contractual deadline (Caniato et al., 2016; Gelsomino et al., 2016, 2019; DeGoeij et al., 2021). It is a low-cost form of financing where selected suppliers have the option of receiving early payment in exchange for a discount that reflects the buyer's credit rating (ibid). Buyers typically extend their contractual payment terms when offering SCF, meaning they can put off paying for longer. This strategy improves their DPO and pleases investors (Ng, 2013). At maturity, the original invoice amount is settled by the buyer with the financial intermediary or with the supplier if they have declined the SCF offer.

There are also newer SCF solutions like dynamic discounting, purchase order (PO) financing and inventory financing (Gelsomino et al., 2019). Dynamic discounting, for example, is where an incremental discount is applied for every day of early payment while PO financing enables suppliers to secure funds from a financial intermediary using a PO as collateral (ibid). Irrespective of its exact form, the purpose of SCF is to optimise financial flows in the supply chain using the services of lenders and technology providers (Gelsomino et al., 2016). Buyers get to settle invoices on extended payment terms, thus improving their cash flow position, but

in a way that cushions the potential effect on supply partners (Caniato et al., 2016; DeGoeij et al., 2021). This leads to the following hypothesis.

*H4a: Firms that offer SCF have longer supplier payment times and higher compliance with agreed payment terms.*

SCF gained traction after the 2008 financial crisis when bank lending dried up and supply chain actors needed ways to optimise their working capital (Caniato et al., 2016; Gelsomino et al., 2016). Fast forward to 2020 and Moretto and Caniato (2021) claim that SCF can mitigate pandemic disruption by keeping supply chains liquid. There is anecdotal evidence of this happening in industry, with corporations like Danone using SCF to accelerate cash payment to suppliers<sup>3</sup>. As well improving their working capital position by tying it to extended payment terms, firms adopt SCF to mitigate supply chains risks (Caniato et al., 2016). The pandemic heightened the risk of financially weaker suppliers entering administration. Faced with this prospect, we expect focal firms in the supply chain to have expanded SCF eligibility to prevent suppliers becoming illiquid. In a similar vein, Moretto and Caniato (2021) identified a social sustainability logic to purchasing firms' adoption of SCF, especially to improve the cash flow of SMEs. Conceivably, SCF eligibility was expanded to help SMEs survive the pandemic. The net result should be purchasing firms settling a greater proportion of invoices on extended payment terms. This leads to the following hypothesis.

*H4b: Firms that offer SCF had longer supplier payment times and higher compliance with agreed payment terms during the pandemic.*

### 3.5 Industry

Industry context affects supplier payment times. The evidence suggests that firms in wholesale/retail, finance, professional services, information/communications, utilities and

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<sup>3</sup> <https://www.theglobaltreasurer.com/2021/10/18/covid-19-turbo-charges-take-up-of-supply-chain-finance/>

public administration are among the quickest to pay while manufacturing, engineering and construction are among the slowest (FSB, 2017; Lloyds, 2018; Bolton et al., 2022). Some of this variation can be attributed to retail firms having zero Days Sales Outstanding (DSO) as cash payment takes place on receipt of goods (Lorentz et al., 2016; Cowton and San-Jose, 2017). These firms can quickly release funds to suppliers without compromising their own cash flow. Manufacturing, construction and some other business-to-business (B2B) firms have much longer DSOs, which translates into longer payment times.

Another reason is that finance and professional service firms' revenues do not depend on the re-sale of supplier inputs, which is conducive to paying suppliers faster. The opposite is the case for manufacturing firms. Their revenues depend on converting raw materials or intermediate inputs into goods for onward sale, and their operating cycles are long (Chuk et al., 2021). In addition, EC Directives stipulate shorter payment times in certain industries. Examples include the Unfair Trading Practices (UTP) Directive requiring firms to pay suppliers of perishable food products within 30 days and the EC Late Payment Directive requiring public authorities to pay all suppliers within 30 days (European Commission, 2014, 2019). The latter has become standard practice in the UK. Public authorities there take, on average, 27 days to pay suppliers and have a compliance rate with agreed terms of approximately 77% (Lloyds, 2018). This puts them among the quickest and best performing of all UK sectors when it comes to supplier payments.

The construction industry is a special case for payment times because of its triadic supply chain arrangement consisting of project owners, main contractors and sub-contractors (Chen, 2012). Main contractors wait on the release of fund instalments from project owners, and sub-contractors wait on payment from main contractors. By the time this happens sub-contractors may have waited several months – a practice known as ‘subby-bashing’ (Hajikazemi et al., 2020). Long payment waits and late payment are prevalent in the construction sector – 46% of

the 355 payments across 30 projects examined by Bolton et al. (2022) were late, for example. These problems stem from paymasters' deliberately withholding funds or mismanaging their finances (Abdul-Rahman et al., 2014; Ishak et al., 2019), high frequency of payments (Bolton et al., 2022) and the bureaucracy involved in having payments authorised or variations approved (Peters et al., 2019). This leads to the following hypothesis.

*H5: Firms in manufacturing and construction industries have longer supplier payment times and lower compliance with agreed payment terms than industries like retail, finance, public administration and professional services.*

## **4. Method**

### **4.1 Research context**

In 2017 the UK government imposed a statutory requirement on large firms to disclose information about their supplier payment times, referred to as the 'Duty to Report on Payment Practices and Performance' (Dept. BEIS, 2019). 'Duty to Report' aims for greater transparency on payment practices without constraining companies' freedom to contract. It assumes that by having their practices put under the public spotlight and scrutinised, firms will feel compelled to pay suppliers on time. Whether this assumption holds true is moot. Critics have pointed to the fact that the data is unaudited as proof that the system is not trustworthy (Price, 2019). Conversely, some of the biggest government contractors in the UK are known to have shortened supplier payment times to counter government threats to bar late payers from public contracting (Tussell, 2020). Other studies show corporations reducing their accounts payable and supplier payment times owing to the reputational risks carried by 'Duty to Report' (Grewal et al., 2020; Chuk et al., 2021).

## 4.2 Data source and extraction

The secondary data used in this study comes from corporate disclosures made under ‘Duty to Report’.<sup>4</sup> In early 2022, the UK government published an Excel file containing all disclosures made between March 2017 and December 2021. The file contains numeric data on payment times, compliance with agreed terms, and supplementary information on whether firms are signatories to a payment code, use e-invoicing and offer SCF. A random sample of 750 firms was taken from the Excel spreadsheet. The sample was reduced to 509 after eliminating 29 duplicates and 212 firms with missing data. Only firms that submitted payment data in 2018, 2019, 2020 and 2021 were used.

The panel dataset was completed by collecting data on industry, liquidity, revenue and profitability from FAME. Liquid firms are ones whose short-term assets match or exceed their short-term liabilities, which means that they should have the funds available to pay their creditors in a timely manner and as agreed (Cunat, 2007). Revenue is a proxy of firm size and has been found in other studies to negatively correlate with payment timeliness (Howorth and Reber, 2003; Lorentz et al., 2016). Profitability is a proxy of firm performance and is expected to positively correlate with payment timeliness and compliance. Measurement details on the dependent, independent and control variables are listed in Table 2 and their descriptive statistics and correlations are presented in Table 3.

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<sup>4</sup> <https://check-payment-practices.service.gov.uk/export>

### 4.3 Model specification

Based on the data above, we carry out a multivariate regression for panel data with year and industry fixed effects. The econometric equation (1) is formulated below:

$$\begin{aligned} SupplierPayment_{i,t} = & \alpha + \alpha_1 Signatory_{i,t} + \alpha_2 EInvoicing_{i,t} + \\ & \alpha_3 SCFinance_{i,t} + \alpha_4 Pandemic_{i,t} + \sum_{k=1}^3 \theta_k CONTROL_{k,i,t-1} + \sum_{k=1}^{10} \partial_k INDUSTRY_{k,i,t} + \mu_t + \\ & \mu_i + \varepsilon \end{aligned} \quad \text{Eq. (1)}$$

where  $i$  indexes the sample of firms,  $t$  indexes years, and the dependent variable *SupplierPayment* represents the six dependent variables on supplier payment times: 1) days to pay, 2) payment days less than 30 days, 3) payment days between 31 and 60 days, 4) payment days more than 60 days, 5) non-compliant with agreed terms and 6) maximum payment period. We repeat the regressions using the six different dependent variables while the independent variables and control variables remain the same. Independent variables *Signatory*, *EInvoicing* and *SCFinance* measure whether the company is a signatory to payment code, uses e-invoicing and offers SCF, respectively. Independent variable *Pandemic* is a dummy variable indicating whether the sample period is before or during the pandemic. *CONTROL* includes firm-level financial control variables of revenue, profit margin and liquidity. *INDUSTRY* are the ten industry dummy variables.  $\mu_t$  denotes year fixed effects and  $\mu_i$  denotes industry fixed effects. The time-and industry-fixed effects are used to control for time-varying industry-level effects such as the varying impact of independent variables on a dependent variable in a particular industry, at a particular time.  $\varepsilon$  is the error term. Robust standard errors are clustered at the company level.

To test differences between pre-pandemic and pandemic periods, we developed additional regressions to interact the variable *Pandemic* with three main independent variables: *Signatory*, *EInvoicing* and *SCFinance*. *Pandemic* is a dummy variable: 0 indicates years 2018 and 2019

and 1 indicates years 2020 and 2021. We also constructed variable *PrePandemic* to reverse the dummy variable (2018-2019 = 1 and 2020-2021 = 0).

To address endogeneity issues around the impact of independent and control variables on dependent variables, we apply two measures. Firstly, the control variables are one-year lagged to address potential endogeneity issues caused by reverse causality, so the regressions examine the impact of previous year's financial performance (i.e., revenue, profitability and liquidity) on payment times in the current year. This method is used to address the identification purpose by replacing  $X_t$  with  $X_{t-1}$  to reduce concerns that  $X$  is endogenous to  $Y$  because  $Y_t$  is less likely to cause  $X_{t-1}$  (Bellemare et al., 2017). Secondly, for the main independent variables, we applied the difference-in-differences method which has been commonly used to address endogeneity issues (Bertrand et al., 2004; Goodman-Bacon and Marcus, 2020). This method is used to take two differences for both treatment and control groups and differences across time [see Note 1]. Specifically, we estimate the following equations (2), (3) and (4) to respectively examine the treatment groups who are signatories to payment code, use e-invoicing and offer SCF. Where *Post* is a dummy variable in which 1 indicates the pandemic period during 2020-2021, and 0 otherwise. The dependent variables and control variables are the same as in Eq (1).

$$y_{it} = \alpha + \beta Post_i + \gamma Signatory_t + \delta Post_i \times Signatory_t + \mu controls_t + \varepsilon_{it} \quad \text{Eq. (2)}$$

$$y_{it} = \alpha + \beta Post_i + \gamma EInvoicing_t + \delta Post_i \times EInvoicing_t + \mu controls_t + \varepsilon_{it} \quad \text{Eq. (3)}$$

$$y_{it} = \alpha + \beta Post_i + \gamma SCFinance_t + \delta Post_i \times SCFinance_t + \mu controls_t + \varepsilon_{it} \quad \text{Eq. (4)}$$

## 5. Results

### 5.1 Panel regression results

Table 4 contains the results from testing the effect of independent variables on payment times.

Table 5 contains the results from testing the interaction of the three main independent variables

*Signatory*, *E-invoicing* and *SCF* and the variable *Pandemic* on payment times. H1 predicted that the COVID-19 pandemic is associated with longer payment times and lower compliance with agreed payment terms. The results in Table 4 go against predictions. The pandemic did not increase the number of days firms took to pay suppliers – in line with pre-pandemic trends, the average was 36 days over 2020-2021 - nor did it increase non-compliance with payment terms. In fact, there were improvements in payment performance during the pandemic. Holding other independent variables constant (see Table 4), the average difference in firms that settled invoices within 30 days increased by 6.8% across the two years of the pandemic and there was a corresponding decrease in invoices settled between 31-60 days or later than 60 days ( $p < .01$ ). The average difference in invoices not paid according to the agreed terms also decreased by 12.8% in the pandemic period ( $p < .01$ ). There was no significant extension of firms' maximum contractual payment periods during the pandemic, either. The failure of the pandemic to negatively affect payment times is illustrated in Fig.1-2.

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Insert Figures 1 and 2 about here

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H2a predicted that signatories to payment codes have a better record in making timely payment to suppliers and have higher compliance with agreed payment terms. Table 4 does not show significant results to accept H2a. H2b predicted the same positive relationship between signatories and timely payment during the pandemic. This hypothesis is supported. Table 5 shows statistical differences in payment times for signatory firms before and during the pandemic. Compared to non-signatory firms, the average difference in number of days taken by signatory firms to pay suppliers increased by 24.1% before the pandemic but decreased by 19.8% during the pandemic ( $p < .01$ ). The results on paying suppliers within 30 days, 31-60 days and after 60 days reinforce this finding. During the pandemic, signatory firms settled a

higher proportion of their supplier invoices within 30 days and were less likely to pay suppliers at any point after 30 days ( $p < .01$ ). Signatory firms also had higher compliance rates with agreed terms during the pandemic ( $p < .01$ ).

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Insert Tables 4 and 5 about here  
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H3a predicted that e-invoicing enables faster and more compliant payment to suppliers. The results in Table 4 do not suggest that there is any significant relationship between e-invoicing and payment timeliness. In terms of interaction effects between e-invoicing and the pandemic, the results in Table 5 show that firms with e-invoicing systems are less likely to settle invoices after 60 days ( $p < .1$ ) during the pandemic. However, there is no difference on average days to pay suppliers or non-compliance with agreed terms. As such, H3b is also rejected.

H4a predicted that SCF is associated with longer payment times as it typically involves purchasing firms extending terms for suppliers. Evident in Table 4, firms offering SCF have longer payment times ( $p < .01$ ), and an increased likelihood of settling invoices within 31-60 days ( $p < .1$ ) and after 60 days ( $p < .1$ ). This allows us to accept H4a. SCF is not associated with higher compliance with agreed terms but firms offering it do have longer maximum contractual periods ( $p < .1$ ). H4b predicted that SCF was associated with longer payment times during the pandemic. The results in Table 5 show that this hypothesis is also supported. During the pandemic, firms offering SCF took longer to pay suppliers ( $p < .01$ ) and the average difference in SCF firms settling invoices within 31-60 days increased by 19.2% ( $p < .01$ ). There was again no difference in compliance rates compared to non-SCF firms.

There is a strong industry effect on payment time – see Table 4. The prediction of H5 was that manufacturing and construction would take longer to pay suppliers than retail, finance, public

administration and service sectors. This proved true with manufacturing but not with construction. The average difference in days to pay was 44% greater in the manufacturing industry compared to non-manufacturing industries. Manufacturing firms were statistically less likely to pay within 30 days and more likely to wait until after 60 days ( $p < .01$ ). Neither manufacturing nor construction had lower compliance rates with agreed payment terms – the opposite was the case for construction, in fact. Manufacturing, construction and some other sectors e.g., retail and utilities increased their maximum contractual payment period over the four years of our analysis. Finance and public administration had shorter average days to pay than other industries ( $p < .1$ ). Overall, our results return qualified support for H5 that manufacturing and construction firms have longer payment times and lower compliance with agreed terms.

## 5.2 Robustness test – difference-in-differences

To address endogeneity concerns, Tables 7.1, 7.2 and 7.3 (see Appendix B) respectively report the effect of payment codes, e-invoicing and SCF on payment times based on the difference-in-differences (DID) regressions. To interpret the results, the coefficient of variable *Signatory\_treat* is the estimated mean difference in payment times between signatory firms and non-signatory firms prior to the pandemic period. The coefficient of variable *Pandemic* is the expected mean difference in payment times before and during the pandemic among the control group and the pure effect of time is presented. However, the focus of interest of DID results is the coefficient of variable *Signatory\_treat#Pandemic* in which the treatment group interacts with the pandemic period.

In Table 7.1, the variable *Signatory\_treat#Pandemic* shows an estimated mean difference of 18.3% quicker average payment times from signatory firms during the pandemic, which strongly supports the main results reported in Table 5. Table 7.2 and 7.3 also support the main results on e-invoicing and SCF reported in Table 5. The coefficient of variable

*EInvoicing\_treat#Pandemic* in Table 7.2 confirms that e-invoicing does not have a significant impact across most of the dependent variables, except for PaidAfter60 days. The coefficient of variable *SCFinance\_treat#Pandemic* in Table 7.3 also confirms that firms using SCF recorded longer payment times during the pandemic.

## **6. Discussion**

### **6.1 Research implications**

This study was guided by two research questions. The first was about the relationships between institutional, fintech and digitalisation variables and supplier payment times and compliance. The second focused on how the pandemic moderated these relationships. The results returned were mixed. There was no evidence that institutional pressure, as proxied by payment codes, was directly associated with payment times or compliance levels. The interaction of payment codes with the pandemic variable put a different complexion on matters, however. Then payment codes were associated with shorter payment times and higher compliance with agreed terms. The difference is due to payment code signatories reducing payment times and non-compliance rather than any change in non-signatories' payment performance. The latter's pattern of payment behaviour stayed relatively constant throughout pre-pandemic and pandemic years.

Rationalising this finding, we contend that signatories' commitment on ethical conduct placed them under greater institutional pressure to pay promptly when many suppliers were known to be struggling during the pandemic. This manifested itself in signatories lowering the average time to pay from 34 days before the pandemic to 27 days during the pandemic. From the perspective of suppliers and regulators, payment codes proved their worth during the pandemic and differentiated firms that proactively improved their payment performance from firms that maintained the status quo. The results suggest that the normative type of institutional pressure

channelled through payment codes influences treatment of suppliers, at least during times of crisis when timely payment is a hot button issue.

SCF was associated with longer average days to pay, which supports our hypothesis. Pre-pandemic, firms offering SCF were not any better or worse for payment times, but the situation changed during the pandemic. This suggests an increased reliance by firms on SCF to stabilise their own and suppliers' financial positions during a period of economic uncertainty. SCF firms tend to have lengthier payment terms to begin with and extend them further as part of their SCF proposition to suppliers (Caniato et al., 2016; Moretto and Caniato, 2021); hence the association we see between SCF and longer time to pay. Our result has caveats attached. First, the UK's 'Duty to Report' states that firms should record SCF payments as the time taken to settle with the financial intermediary, not the earlier time the supplier receives the funds. If firms follow this advice, it will make their payment times appear longer than they are in actuality. We suggest that the UK government alters this advice so that a more accurate picture of when suppliers receive funds emerges, especially as SCF starts to become commonplace across industry. Second, some eligible suppliers probably declined SCF and waited until maturity for payment during the pandemic because they had unrestricted access to low interest, government guaranteed loans under the UK's rescue plan. Suppliers declining SCF would show up in longer average days to pay by the purchasing firm. This is likely to be a temporary phenomenon and SCF will become attractive to suppliers in the post-pandemic era of higher interest rates and an end to government financial supports.

e-Invoicing did not emerge as a factor linked to faster payment times. This was surprising in the context of the pandemic, as research has shown that e-invoicing enabled firms to process requests for payment normally, even when work-from-home rules were in force (FNFE, 2021). Our assumption was that because e-invoicing tackles the causes of unintentional payment

delays like errors in manual data entry and streamlines the authorisation and reconciliation process, it would engender timely, compliant payment. This wasn't the case. One explanation is that the government's measurement of e-invoicing does not discriminate between firms that exploit the full functionality of e-invoicing and firms that do not; the latter may not be any quicker than firms reliant on manual systems. The UK government survey simply asks firms if they use e-invoicing. Besides measurement weakness, it could be that firms are guilty of adopting e-invoicing without first ensuring that their payment approval process is efficient. Technology is not a quick fix for organisational inefficiency, and layering e-invoicing on top of a flawed purchasing process is unlikely to produce positive results for either the firm or its suppliers. All it does is automate existing inefficiencies and delays in payment approval. This is something that firms should be mindful of and look to correct before adopting e-invoicing.

That the COVID-19 pandemic didn't negatively affect supplier payment times or compliance with agreed terms runs contrary to the 2008 banking crisis when firms delayed payment to suppliers to conserve cash (Caniato et al., 2020). Early indications were that the pandemic would trigger similar reactions (Atradius, 2020a, 2020b; Intrum, 2021). Not alone was there no negative impact, our study shows that improvements in payment performance occurred during the pandemic. We posit four explanations here. The first is state aid. The UK's business support package amounted to £150 bn and included grants, low interest loans, VAT deferrals, rates relief and furlough payments for employees (Brien and Keep, 2021). This injection of liquidity helped firms to meet their debt obligations. The second is corporate initiatives. There are examples of corporations from across finance, retail and manufacturing sectors showing solidarity with vulnerable suppliers by paying them earlier than the agreed terms<sup>5</sup>. This would

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<sup>5</sup> Lockheed Martin accelerated \$1.3 bn in payments to small suppliers in the 2021 second quarter. Nationwide Building Society UK reduced its average time to pay SMEs from 23 days before the pandemic to 9 days during

have reduced the same corporations' average payment times. The third is the cumulative impact of institutional pressure for timely payment since 2008, including 'Duty to Report' in the UK, which we believe may have restrained corporations from delaying payment during the pandemic. The fourth is that a combination of demand spikes and production bottlenecks in 2020 and 2021 shifted the balance of power towards suppliers. In such circumstances, buyers felt minded to pay suppliers on time to maintain continuity of supply.

## 6.2 Theoretical implications

The results indicate that institutional theory has validity for explaining supplier payment times. We see this primarily in third party codes eliciting faster payment. As per theoretical prediction (Dowling and Pfeffer, 1975; Meyer and Rowan, 1977), we interpret this change in practice as signatory firms responding to institutional pressures embodied in such codes and signalling to institutional actors their agreement with norms on paying suppliers promptly. Arguably, it is evident too in the population sample maintaining consistency in payment performance despite the economic turbulence brought about by the pandemic. The cumulative effect of government regulations, industry campaigns and public awareness has, we surmise, acted as a brake on large firms abusing the trade credit facilities of smaller suppliers. Institutional actors have become more vocal over timely payment, which invariably conditions managerial attitudes and shapes procurement practices.

Taking an institutional lens also helps connect supplier payment times to an established body of research on socially responsible purchasing. Studies in this area have frequently used institutional theory to explain why firms engage in purchasing practices that benefit suppliers and society (Zhang et al., 2017; Yawar and Kauppi, 2018; Flynn, 2019), but have so far

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the pandemic. Marks & Spencer (M&S) retailer committed to paying all small grocery suppliers within 7 days in 2021.

overlooked supplier payment times as a line of inquiry. Our research embarks on a new direction by extending institutional theory to payment times and situating it within sustainable PSM. It does this on the basis that payment times is a universal corporate social responsibility issue, attracts multi-stakeholder interest and is affected by a growing array of regulatory and normative institutional forces (Cowton and San-Jose, 2017; Grewal et al., 2020; Intrum, 2021). As part of taking this line of inquiry forward, there is scope for scholars to investigate the impact of coercive, normative and mimetic pressures for timely payment on firm practices. Kauppi and Luzinni's (2021) development of multi-item scales to measure institutional pressures in a purchasing context is helpful in this respect.

The results are less encouraging for the second theoretical lens we used to make sense of supplier payment times: Freeman's (1984) stakeholder view of the firm. We had reasoned that tech and fintech solutions like e-invoicing and SCF represented a co-operative and stakeholder-centred approach to payment times where buyers, suppliers and other supply chain participants like financiers and software providers stand to gain. The adoption of these solutions by purchasing firms would indicate sensitivity to the interests of suppliers, particularly around ease of claiming and receiving payment. This logic was not empirically supported for e-invoicing, with reasons for it suggested in section 6.1. SCF is more complicated insofar as it is a supplier-friendly payment initiative that encompasses the interests of multiple stakeholders, but it technically shows up as longer settlement times. Negative findings aside, it remains the case that the business of how and when suppliers get paid involves multiple primary and secondary stakeholders (Moretta et al., 2019); and these stakeholders will exert varying degrees of influence over the purchasing firm (Freeman, 1984). It may be that future research needs to directly engage with these stakeholders and explore their interests and power on the question of timely payment to suppliers.

### 6.3 Managerial implications

The mandated disclosure of supplier payment times is a potential risk to purchasing firms. It gives suppliers access to accurate payment time data, which they can use to assess the relative attractiveness of prospective customers and, thereafter, design contracts that offer enhanced protection against slow or late payers (Chuk et al., 2021). Purchasing firms with worse than industry-average payment records might find suppliers trying to impose stringent trade credit terms on them. Equally serious, firms might find themselves locked out of public contracting as punishment for perceived unethical conduct towards suppliers (Tussell, 2020). Given these developments, purchasing managers will need to re-evaluate suppliers' interests when deciding on payment terms and associated performance measures like DPO. Satisfying investors has always been pre-eminent in this regard, but there are signs that a recalibration is taking place because of the pressure firms face from payment disclosure legislation (Grewal et al., 2020; Chuk et al., 2021).

There are trade-offs to third party payment codes, which purchasing firms should know about before signing up. Payment codes symbolise a firm's commitment to equitable treatment of suppliers. This type of commitment is reputationally beneficial and fosters positive relationships with business partners (Bondy et al., 2004; Perez-Batres et al., 2012). The flipside is that payment codes limit discretion over setting payment terms. The Prompt Payment Code, for example, stipulates that 95% of SMEs should be paid within 30 days. This is more onerous than normal industry practice and doesn't take account of supplier status, sector norms or macroeconomic conditions. The cost of adhering to the payment terms of an external code over their own payment terms will not be insubstantial for corporations, as it implies less cash available for capital investments, stock buybacks and dividends. Purchasing firms, therefore, must weigh the reputational benefits of payment codes against the opportunities forgone from externally enforced shorter payment terms.

One solution for firms to navigate competing tensions between pursuing their own financial interests versus prompt payment to suppliers is SCF. Our study shows that SCF is not mainstream practice among UK firms – approximately 10% in the sample were using it. This is likely to change with inflation at its highest rate in decades, spiralling interest rates and the end of pandemic financial supports. In these circumstances, firms under financial strain will look to extend payment terms as a cash preservation strategy, which is what happened after the 2008 financial crisis (Ng, 2013; Caniato et al., 2020). SCF can help them achieve this goal while offering suppliers advanced payment at an attractive interest rate, thus placating institutional stakeholders (Moretto and Caniato, 2021). SCF is not a panacea to managing accounts payable - buyers tend to onboard only strategically important partners (PwC, 2019) and there is no guarantee that suppliers will accept SCF even when it is financially attractive (DeGoeij et al., 2021) - but it can help reconcile buyers' and suppliers' divergent priorities on payment time.

#### 6.4 Limitations and future research

The study has several methodological limitations. The outcome variable of days taken to pay suppliers ignores underlying characteristics on the movement of products through the supply chain towards final customers and the receipt of cash from their sale (Cowton and San-Jose, 2017). Supermarkets, for example, pay food suppliers faster than hardware suppliers. The payment time figures are aggregated averages and obscure situations where purchasing firms treat suppliers differently based on strategic importance. Some of our independent variables also obscure subtle variations in corporate practice. We have already stated that the e-invoicing measure used doesn't distinguish basic from advanced functionality. Future research could attempt to separate out aspects of e-invoicing like payment status visibility and information sharing and examine their connection to payment times.

We encourage future research to conduct fine-grained analysis of industry effects. Our results show that manufacturing firms pay later than every other industry, but this overlooks the heterogeneity of manufacturing. Manufacturing firms differ based on production times e.g., clothing versus airplanes, order penetration points e.g., raw materials versus final assembly and operating cycles. To capture this heterogeneity, we recommend categorising manufacturing firms based on above dimensions and investigating their association with payment times. The range of independent variables we test is not exhaustive. New studies could include additional financial controls like cash conversion cycle in place of liquidity. Studies could also incorporate PSM variables like supply base concentration, dependency on government contracting and sustainability performance when modelling payment times.

## 6.5 Conclusion

Supplier payments is an under-researched topic in PSM even though it is pored over in the practitioner literature. Academic studies to date have approached it from an accounting perspective, and this has been reflected in the variables and literatures/theories employed (Paul and Boden, 2011; Lorentz et al., 2016). This paper examines supplier payments from a PSM standpoint. It draws on the contemporary literature streams of responsible purchasing, digital purchasing and fintech to test factors associated with payment time and compliance with agreed terms. The results suggest that institutional forces are significant in influencing payment timeliness but stakeholder-centred tech and fintech are not. One of the main takeaways from our research is that the pandemic did not negatively affect average days to pay or compliance, which is a reminder that not every crisis is the same and we need to be careful when extrapolating from the past to predict the future. There is scope for future research on supplier payment times, particularly as the medium-term economic forecast for developed economies is higher inflation and higher borrowing costs. These conditions will make decisions around payment times even more consequential for buyers and suppliers.

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## Notes

1. Taking the impact of variable *Signatory* on payment times as an example, our research setting has two firm groups (firms that are signatories to payment code as the treatment group and firms that are not signatories as the control group) and two time periods (pre-pandemic during 2018-2019 and pandemic period during 2020-2021). We compare the pre-pandemic and pandemic difference on the dependent variables between the treatment group with signatory and the control group without signatory. As we can compare across both time and groups, we can fix the concerns of bias of either time or group. For example, if we estimate the difference in pandemic period after the change of firms' "signatory" status relevant to the pre-pandemic period, we can estimate the time bias. After this, we can then subtract that estimate from the difference by comparing firms' "non-signatory" status over time, and we could estimate the treatment effect. This approach is more advantageous than simply comparing the before and after difference in the treatment sample, as there are many other factors that can impact the outcome.

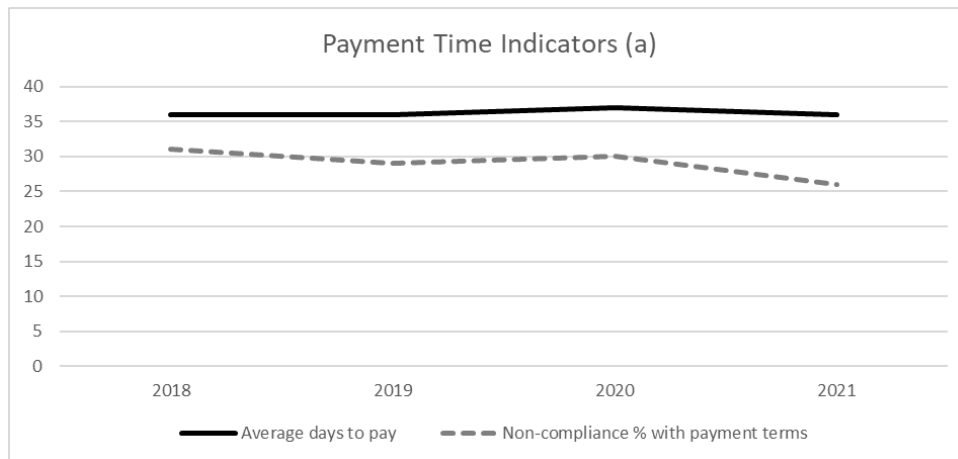


Fig. 1 Average days to pay and compliance rates, 2018-2021

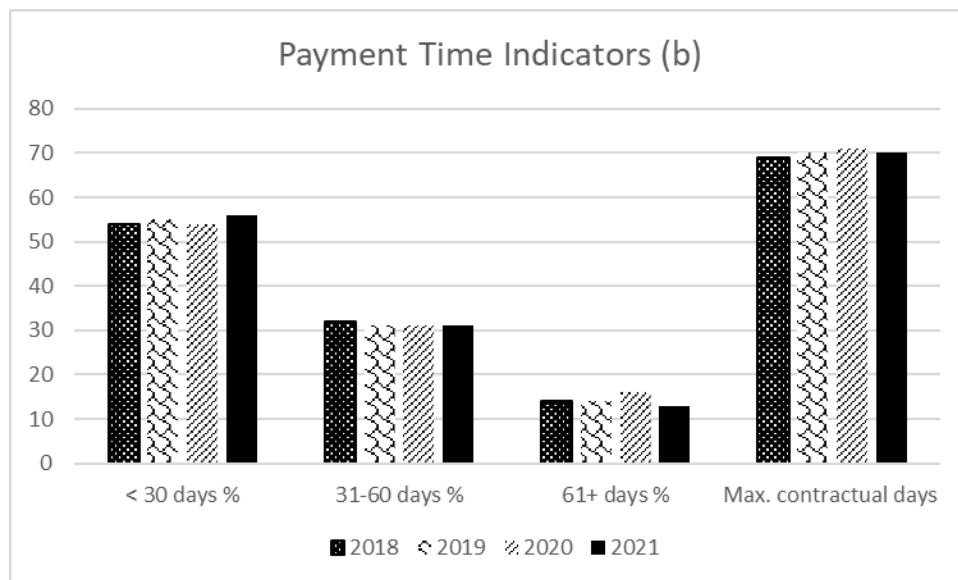


Fig. 2 Breakdown of payment times by typical ranges, 2018-2021

Table 1 Factors influencing supplier payment times

| <b>Authors</b>           | <b>Research context</b> | <b>Analysis</b> | <b>Relationship of variables to payment timeliness</b>                                                                                                                                               |
|--------------------------|-------------------------|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Howorth and Reber (2003) | UK: all industries      | Predictive      | Early settlement discounts (+)<br>Customers paying on time (+)<br>Supply base concentration (+)<br>Difficulty accessing bank finance (-)<br>Firm size (-)<br>Time spent managing working capital (-) |
| De Carvalho (2015)       | Brazil: all industries  | Predictive      | Firm age (+)<br>Firm growth (+)<br>Customers paying on time (-)<br>Difficulty accessing bank finance (-)                                                                                             |
| Lorentz et al. (2016)    | Finland: all industries | Predictive      | Firm size (-)<br>International commercial activity (-)<br>Recession (-)<br>Retailers (+)                                                                                                             |
| Grewal et al. (2020)     | UK: all industries      | Predictive      | Exposure to ‘Duty to Report’ legislation (+)<br>Consumer-facing firms (+)<br>Media exposure (+)<br>Existing commitment to timely payment (+)                                                         |
| Chuk et al. (2021)       | UK: all industries      | Predictive      | Exposure to ‘Duty to Report’ legislation (+)<br>Long operating cycles (-)<br>Difficulty accessing bank finance (-)<br>Pay dividends (-)                                                              |
| Bolton et al. (2022)     | UK: construction        | Predictive      | Frequency of payments in a project (-)                                                                                                                                                               |
| Peel et al. (2000)       | UK: manufacturing       | Descriptive     | Power imbalances between SME suppliers and large customers (-)<br>Poor financial management skills (-)<br>Insufficient attention to working capital management (-)                                   |

|                            |                        |             |                                                                                                                                                                                                             |
|----------------------------|------------------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Paul and Boden (2011)      | UK: all industries     | Descriptive | Power imbalances between SME suppliers and large customers (-)<br>Weak credit management practices (-)<br>Lack of policies on acceptable payment terms (-)                                                  |
| Chen (2012)                | Taiwan: construction   | Descriptive | Paymaster withholding funds (-).                                                                                                                                                                            |
| Abdul-Rahman et al. (2014) | Malaysia: construction | Descriptive | Client's poor financial management (-)<br>Insufficient financial resources (-)<br>Paymaster withholding funds (-)                                                                                           |
| Ishak et al. (2019)        | Malaysia: construction | Descriptive | Paymaster's financial problems (-)<br>Paymaster withholding funds (-)<br>Delay in certification (-)<br>No agreement for timely payment (-)<br>Error submitting claim (-)                                    |
| Peters et al. (2019)       | Trinidad: construction | Descriptive | Bureaucratic procedures (-)<br>Slow approval of variations (-)<br>Unfavourable macroeconomic conditions (-)<br>Poor process implementation by contractors (-)<br>Cultural acceptability of late payment (-) |

Table 2 List of Variables and their Operationalisation, Measurement and Source

| Variable                     | Operationalisation                                                                                                                                                                    | Measurement              | Source                |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-----------------------|
| <i>Dependent variables</i>   |                                                                                                                                                                                       |                          |                       |
| Days to pay                  | Average number of days taken to make payments in the reporting period, measured from the date of receipt of invoice or other notice to the date the cash is received by the supplier. | Scale                    | UK government dataset |
| < 30 days                    | The percentage of payments made within the reporting period which were paid within 30 days.                                                                                           | Scale                    | UK government dataset |
| 31-60 days                   | The percentage of payments made within the reporting period which were paid between 31-60 days.                                                                                       | Scale                    | UK government dataset |
| > 60 days                    | The percentage of payments made within the reporting period which were paid after 60 days.                                                                                            | Scale                    | UK government dataset |
| Non-compliant                | The percentage of payments due within the reporting period which were not paid within the agreed timeframe.                                                                           | Scale                    | UK government dataset |
| Max. contractual             | The maximum contractual payment period in days.                                                                                                                                       | Scale                    | UK government dataset |
| <i>Independent variables</i> |                                                                                                                                                                                       |                          |                       |
| Signatory                    | Is the company a member of any payment code?                                                                                                                                          | Binary<br>0 =No, 1 = Yes | UK government dataset |
| e-Invoicing                  | Does the company use e-invoicing?                                                                                                                                                     | Binary<br>0 =No, 1 = Yes | UK government dataset |
| Supply chain finance (SCF)   | Does the company offer SCF?                                                                                                                                                           | Binary<br>0 =No, 1 = Yes | UK government dataset |
| Pandemic                     | Is the sample year impacted by the COVID-19 pandemic?                                                                                                                                 | Binary<br>0 =No, 1 = Yes | Self-constructed      |
| <i>Control variables</i>     |                                                                                                                                                                                       |                          |                       |
| Size                         | Turnover £ for the financial year.                                                                                                                                                    | Scale                    | FAME                  |
| Profitability                | Profit margin % for the financial year.                                                                                                                                               | Scale                    | FAME                  |
| Liquidity                    | Liquidity ratio for the financial year.                                                                                                                                               | Scale                    | FAME                  |
| Industry                     | Standard Industry Classification (SIC) identifier.                                                                                                                                    | Categorical x 10         | FAME                  |

Table 3 Descriptive Statistics and Correlations

|      | Variable         | Obs   | Mean | Std. Dev. | Min   | Max   | (1)    | (2)    | (3)    | (4)    | (5)    | (6)    | (7)   | (8)   | (9)   | (10)  | (11)  | (12)  | (13) |
|------|------------------|-------|------|-----------|-------|-------|--------|--------|--------|--------|--------|--------|-------|-------|-------|-------|-------|-------|------|
| (1)  | Days to pay      | 2,036 | 3.49 | 0.56      | 0.00  | 4.80  | 1      |        |        |        |        |        |       |       |       |       |       |       |      |
| (2)  | < 30 days        | 2,036 | 3.81 | 0.76      | 0.00  | 4.62  | -0.69* | 1      |        |        |        |        |       |       |       |       |       |       |      |
| (3)  | 31-60 days       | 2,036 | 3.13 | 0.98      | 0.00  | 4.62  | 0.73*  | -0.61* | 1      |        |        |        |       |       |       |       |       |       |      |
| (4)  | > 60 days        | 2,036 | 2.12 | 1.15      | 0.00  | 4.54  | 0.78*  | -0.65* | 0.49*  | 1      |        |        |       |       |       |       |       |       |      |
| (5)  | Non-compliant    | 2,036 | 2.95 | 1.13      | 0.00  | 4.62  | 0.45*  | -0.22* | 0.41*  | 0.41*  | 1      |        |       |       |       |       |       |       |      |
| (6)  | Max. contractual | 2,036 | 4.14 | 0.50      | 0.69  | 5.90  | 0.41*  | -0.38* | 0.34*  | 0.42*  | 0.12*  | 1      |       |       |       |       |       |       |      |
| (7)  | Signatory        | 2,036 | 0.09 | 0.28      | 0.00  | 1.00  | -0.09* | 0.08   | -0.10* | -0.12* | -0.12* | -0.11* | 1     |       |       |       |       |       |      |
| (8)  | e-Invoicing      | 2,036 | 0.26 | 0.44      | 0.00  | 1.00  | 0.05   | -0.12* | 0.05   | 0.07   | -0.08  | 0.13*  | 0.16* | 1     |       |       |       |       |      |
| (9)  | SCFinance        | 2,036 | 0.08 | 0.28      | 0.00  | 1.00  | 0.19*  | -0.16* | 0.11*  | 0.20*  | 0.05   | 0.26*  | 0.04  | 0.28* | 1     |       |       |       |      |
| (10) | Pandemic         | 2,036 | 0.50 | 0.50      | 0.00  | 1.00  | -0.01  | 0.01   | -0.02  | 0.01   | -0.03  | 0.01   | 0.01  | 0.01  | 0.01  | 1     |       |       |      |
| (11) | Revenue          | 1,990 | 4.94 | 1.30      | 0.20  | 10.83 | -0.01  | -0.03  | -0.01  | -0.02  | -0.09* | 0.10*  | 0.30* | 0.30* | 0.17* | -0.01 | 1     |       |      |
| (12) | Profitability    | 1,942 | 4.66 | 0.26      | 1.03  | 5.59  | -0.10* | 0.08   | -0.09  | -0.10* | -0.08  | -0.05  | 0.03  | 0.01  | -0.05 | -0.1  | 0.06  | 1     |      |
| (13) | Liquidity        | 2,012 | 0.30 | 0.94      | -3.51 | 4.39  | -0.07  | 0.08   | -0.12* | -0.07  | -0.04  | -0.08  | -0.01 | 0.03  | -0.01 | -0.01 | -0.07 | 0.20* | 1    |

Note: Pearson correlations at or above +/- .07 are statistically significant at  $p < .05$  or better. Industry categories (x 10) are excluded for space reasons. Note all dependent variables and control variables are log transformed, which is a widely used method to transform skewed data to a normal or near normal distribution. Additional descriptive statistics of the original scale of the variables are presented in Appendix A (Table 6).

Table 4 Panel Regression Results of Predictive Tests

| VARIABLES                           | (1)<br>Average days<br>to pay | (2)<br>Paid within<br>30 days | (3)<br>Paid 31-60<br>days | (4)<br>Paid 60+<br>days | (5)<br>Non-<br>compliant | (6)<br>Max payment<br>terms |
|-------------------------------------|-------------------------------|-------------------------------|---------------------------|-------------------------|--------------------------|-----------------------------|
| Signatory                           | 0.058<br>(0.110)              | -0.021<br>(0.049)             | 0.036<br>(0.108)          | -0.050<br>(0.125)       | -0.304<br>(0.193)        | -0.031<br>(0.028)           |
| EInvoicing                          | -0.004<br>(0.028)             | -0.067<br>(0.050)             | -0.027<br>(0.065)         | 0.051<br>(0.072)        | -0.073<br>(0.090)        | 0.070**<br>(0.031)          |
| SCFinance                           | 0.133***<br>(0.040)           | -0.121<br>(0.097)             | 0.176*<br>(0.094)         | 0.246*<br>(0.146)       | 0.162<br>(0.121)         | 0.050*<br>(0.029)           |
| Pandemic                            | -0.032<br>(0.020)             | 0.068***<br>(0.020)           | -0.102***<br>(0.035)      | -0.125***<br>(0.046)    | -0.128***<br>(0.038)     | 0.010<br>(0.012)            |
| Revenue                             | -0.015<br>(0.017)             | 0.002<br>(0.021)              | -0.014<br>(0.030)         | -0.020<br>(0.035)       | -0.041<br>(0.038)        | 0.009<br>(0.010)            |
| Profit Margin                       | -0.013<br>(0.024)             | 0.039<br>(0.051)              | 0.002<br>(0.063)          | -0.149**<br>(0.073)     | 0.006<br>(0.057)         | -0.009<br>(0.019)           |
| Liquidity                           | -0.027*<br>(0.015)            | 0.000<br>(0.020)              | -0.014<br>(0.025)         | -0.059*<br>(0.035)      | -0.055*<br>(0.031)       | 0.003<br>(0.008)            |
| Manufacturing                       | 0.440***<br>(0.146)           | -0.715***<br>(0.170)          | 0.275<br>(0.173)          | 1.113***<br>(0.282)     | -0.262<br>(0.192)        | 0.546***<br>(0.099)         |
| Utilities                           | -0.153<br>(0.186)             | 0.162<br>(0.218)              | -0.749**<br>(0.346)       | -0.227<br>(0.395)       | -0.869***<br>(0.317)     | 0.070<br>(0.118)            |
| Retail & Transport                  | 0.134<br>(0.150)              | -0.272<br>(0.171)             | -0.014<br>(0.185)         | 0.323<br>(0.284)        | -0.569***<br>(0.191)     | 0.294***<br>(0.100)         |
| Information &<br>Communication      | 0.027<br>(0.168)              | -0.032<br>(0.196)             | -0.196<br>(0.241)         | 0.134<br>(0.303)        | -0.446*<br>(0.229)       | 0.119<br>(0.123)            |
| Financial & Property                | -0.262*<br>(0.158)            | 0.338**<br>(0.162)            | -0.793***<br>(0.198)      | -0.100<br>(0.287)       | -0.526***<br>(0.191)     | -0.159<br>(0.105)           |
| Services                            | -0.024<br>(0.155)             | 0.078<br>(0.161)              | -0.398**<br>(0.193)       | 0.331<br>(0.281)        | -0.568***<br>(0.195)     | 0.018<br>(0.112)            |
| Public Admin, Health &<br>Education | -0.305*<br>(0.165)            | 0.384**<br>(0.162)            | -0.876***<br>(0.245)      | -0.489<br>(0.305)       | -0.276<br>(0.209)        | -0.165<br>(0.121)           |
| Construction                        | 0.158<br>(0.149)              | -0.080<br>(0.176)             | 0.079<br>(0.187)          | 0.582*<br>(0.310)       | -0.563**<br>(0.224)      | 0.186*<br>(0.104)           |
| Hospitality & Leisure               | -0.036<br>(0.190)             | -0.147<br>(0.198)             | -0.056<br>(0.255)         | 0.032<br>(0.298)        | -0.662***<br>(0.232)     | 0.062<br>(0.115)            |
| Constant                            | 3.536***<br>(0.201)           | 3.717***<br>(0.286)           | 3.427***<br>(0.377)       | 2.520***<br>(0.432)     | 3.652***<br>(0.338)      | 3.931***<br>(0.134)         |
| Observations                        | 1,935                         | 1,931                         | 1,895                     | 1,780                   | 1,380                    | 1,936                       |
| Number of id                        | 501                           | 501                           | 498                       | 490                     | 489                      | 501                         |
| Year FE                             | YES                           | YES                           | YES                       | YES                     | YES                      | YES                         |
| Industry FE                         | YES                           | YES                           | YES                       | YES                     | YES                      | YES                         |
| Adjusted R-squared                  | 0.169                         | 0.218                         | 0.155                     | 0.166                   | 0.059                    | 0.235                       |

Note: Agriculture & Extractives is the referent category for industry. It is automatically omitted in regressions. Robust standard errors in parentheses.

Table 5 Interactive Effect Comparison Results of Pre-pandemic and Pandemic

| VARIABLES                    | Panel A: Pre-Pandemic  |                        |                     |                     |                      |                         | Panel B: Pandemic      |                        |                     |                      |                      |                         |
|------------------------------|------------------------|------------------------|---------------------|---------------------|----------------------|-------------------------|------------------------|------------------------|---------------------|----------------------|----------------------|-------------------------|
|                              | (1)                    | (2)                    | (3)                 | (4)                 | (5)                  | (6)                     | (7)                    | (8)                    | (9)                 | (10)                 | (11)                 | (12)                    |
|                              | Average<br>days to pay | Paid within<br>30 days | Paid 31-<br>60 days | Paid 60+<br>days    | Non-<br>compliant    | Max<br>payment<br>terms | Average<br>days to pay | Paid within<br>30 days | Paid 31-<br>60 days | Paid 60+<br>days     | Non-<br>compliant    | Max<br>payment<br>terms |
| Signatory*<br>(Pre)Pandemic  | 0.241***<br>(0.064)    | -0.132***<br>(0.040)   | 0.264***<br>(0.100) | 0.447***<br>(0.114) | 0.186*<br>(0.107)    | -0.027<br>(0.022)       | -0.198**<br>(0.098)    | 0.122***<br>(0.035)    | -0.238**<br>(0.110) | -0.502***<br>(0.107) | -0.347***<br>(0.122) | 0.005<br>(0.025)        |
| EInvoicing*<br>(Pre)Pandemic | -0.012<br>(0.027)      | -0.006<br>(0.035)      | -0.015<br>(0.046)   | 0.123*<br>(0.071)   | 0.055<br>(0.066)     | -0.005<br>(0.015)       | -0.012<br>(0.031)      | -0.019<br>(0.034)      | -0.030<br>(0.052)   | -0.116*<br>(0.067)   | -0.093<br>(0.065)    | 0.043**<br>(0.017)      |
| SCFinance*<br>(Pre)Pandemic  | -0.017<br>(0.036)      | 0.028<br>(0.056)       | -0.084<br>(0.060)   | 0.039<br>(0.087)    | 0.148*<br>(0.085)    | 0.014<br>(0.021)        | 0.095***<br>(0.037)    | -0.079<br>(0.076)      | 0.192***<br>(0.073) | 0.132<br>(0.098)     | -0.007<br>(0.099)    | -0.004<br>(0.019)       |
| Revenue                      | -0.016<br>(0.016)      | -0.002<br>(0.020)      | -0.017<br>(0.029)   | -0.031<br>(0.034)   | -0.068*<br>(0.037)   | 0.014<br>(0.010)        | -0.006<br>(0.016)      | -0.006<br>(0.020)      | -0.007<br>(0.029)   | 0.003<br>(0.034)     | -0.045<br>(0.037)    | 0.012<br>(0.010)        |
| Profit Margin                | -0.009<br>(0.023)      | 0.037<br>(0.051)       | 0.008<br>(0.063)    | -0.142**<br>(0.071) | 0.017<br>(0.057)     | -0.011<br>(0.019)       | -0.011<br>(0.023)      | 0.037<br>(0.050)       | 0.008<br>(0.062)    | -0.145**<br>(0.071)  | 0.013<br>(0.059)     | -0.010<br>(0.019)       |
| Liquidity                    | -0.030*<br>(0.015)     | 0.001<br>(0.020)       | -0.017<br>(0.024)   | -0.063*<br>(0.035)  | -0.058*<br>(0.031)   | 0.004<br>(0.008)        | -0.028*<br>(0.015)     | 0.001<br>(0.020)       | -0.014<br>(0.024)   | -0.060*<br>(0.035)   | -0.057*<br>(0.031)   | 0.003<br>(0.008)        |
| Manufacturing                | 0.441***<br>(0.145)    | -0.714***<br>(0.172)   | 0.277<br>(0.172)    | 1.134***<br>(0.296) | -0.219<br>(0.189)    | 0.546***<br>(0.103)     | 0.415***<br>(0.147)    | -0.700***<br>(0.169)   | 0.250<br>(0.173)    | 1.066***<br>(0.275)  | -0.262<br>(0.190)    | 0.548***<br>(0.103)     |
| Utilities                    | -0.165<br>(0.188)      | 0.174<br>(0.223)       | -0.760**<br>(0.350) | -0.218<br>(0.410)   | -0.853***<br>(0.318) | 0.065<br>(0.123)        | -0.163<br>(0.186)      | 0.173<br>(0.218)       | -0.759**<br>(0.344) | -0.283<br>(0.398)    | -0.876***<br>(0.319) | 0.066<br>(0.123)        |
| Retail & Transport           | 0.130<br>(0.149)       | -0.270<br>(0.173)      | -0.018<br>(0.185)   | 0.335<br>(0.299)    | -0.532***<br>(0.188) | 0.294***<br>(0.105)     | 0.109<br>(0.151)       | -0.257<br>(0.170)      | -0.038<br>(0.184)   | 0.275<br>(0.278)     | -0.571***<br>(0.188) | 0.294***<br>(0.105)     |

|                                  |                     |                     |                      |                     |                      |                     |                     |                     |                      |                     |                      |                     |
|----------------------------------|---------------------|---------------------|----------------------|---------------------|----------------------|---------------------|---------------------|---------------------|----------------------|---------------------|----------------------|---------------------|
| Information & Communication      | 0.022<br>(0.169)    | -0.032<br>(0.198)   | -0.204<br>(0.242)    | 0.141<br>(0.320)    | -0.417*<br>(0.225)   | 0.124<br>(0.128)    | 0.000<br>(0.169)    | -0.020<br>(0.195)   | -0.223<br>(0.240)    | 0.091<br>(0.299)    | -0.454**<br>(0.225)  | 0.124<br>(0.128)    |
| Financial & Property             | -0.286*<br>(0.159)  | 0.359**<br>(0.163)  | -0.826***<br>(0.198) | -0.133<br>(0.302)   | -0.534***<br>(0.190) | -0.164<br>(0.109)   | -0.285*<br>(0.160)  | 0.356**<br>(0.160)  | -0.814***<br>(0.197) | -0.147<br>(0.281)   | -0.556***<br>(0.191) | -0.165<br>(0.109)   |
| Services                         | -0.037<br>(0.155)   | 0.085<br>(0.163)    | -0.419**<br>(0.194)  | 0.309<br>(0.297)    | -0.575***<br>(0.194) | 0.020<br>(0.116)    | -0.038<br>(0.157)   | 0.084<br>(0.159)    | -0.414**<br>(0.192)  | 0.302<br>(0.275)    | -0.586***<br>(0.195) | 0.019<br>(0.117)    |
| Public Admin, Health & Education | -0.316*<br>(0.165)  | 0.398**<br>(0.164)  | -0.892***<br>(0.246) | -0.502<br>(0.317)   | -0.270<br>(0.210)    | -0.172<br>(0.124)   | -0.321*<br>(0.167)  | 0.399**<br>(0.160)  | -0.891***<br>(0.244) | -0.531*<br>(0.300)  | -0.289<br>(0.209)    | -0.170<br>(0.124)   |
| Construction                     | 0.150<br>(0.149)    | -0.078<br>(0.179)   | 0.067<br>(0.188)     | 0.567*<br>(0.321)   | -0.589***<br>(0.216) | 0.189*<br>(0.108)   | 0.158<br>(0.151)    | -0.083<br>(0.175)   | 0.080<br>(0.188)     | 0.584*<br>(0.307)   | -0.573**<br>(0.224)  | 0.186*<br>(0.108)   |
| Hospitality & Leisure            | -0.059<br>(0.189)   | -0.123<br>(0.199)   | -0.086<br>(0.254)    | 0.004<br>(0.310)    | -0.655***<br>(0.231) | 0.053<br>(0.119)    | -0.064<br>(0.192)   | -0.124<br>(0.197)   | -0.081<br>(0.256)    | -0.033<br>(0.292)   | -0.690***<br>(0.231) | 0.055<br>(0.119)    |
| Constant                         | 3.528***<br>(0.202) | 3.721***<br>(0.286) | 3.427***<br>(0.376)  | 2.507***<br>(0.433) | 3.647***<br>(0.331)  | 3.938***<br>(0.137) | 3.513***<br>(0.202) | 3.725***<br>(0.284) | 3.395***<br>(0.375)  | 2.462***<br>(0.408) | 3.619***<br>(0.342)  | 3.941***<br>(0.136) |
| Observations                     | 1,935               | 1,931               | 1,895                | 1,780               | 1,380                | 1,936               | 1,935               | 1,931               | 1,895                | 1,780               | 1,380                | 1,936               |
| Number of id                     | 501                 | 501                 | 498                  | 490                 | 489                  | 501                 | 501                 | 501                 | 498                  | 490                 | 489                  | 501                 |
| Year FE                          | YES                 | YES                 | YES                  | YES                 | YES                  | YES                 | YES                 | YES                 | YES                  | YES                 | YES                  | YES                 |
| Industry FE                      | YES                 | YES                 | YES                  | YES                 | YES                  | YES                 | YES                 | YES                 | YES                  | YES                 | YES                  | YES                 |
| Adjusted R-squared               | 0.153               | 0.202               | 0.147                | 0.148               | 0.039                | 0.219               | 0.171               | 0.211               | 0.161                | 0.164               | 0.055                | 0.220               |

Note: Agriculture & Extractives is the referent category for industry. It is automatically omitted in regressions. To save space, the first column lists variables used for both Panel A and B. Signatory\*PrePandemic was used in Panel A while Signatory\*Pandemic was used in Panel B, etcetera. Robust standard errors in parentheses.

## Appendix A

Table 6 Descriptive Statistics (original scale)

| Variable            | Obs   | Mean   | Std. Dev. | Min    | Max      |
|---------------------|-------|--------|-----------|--------|----------|
| Days to pay         | 2,036 | 36.43  | 17.52     | 0.00   | 121.00   |
| < 30 days           | 2,036 | 54.80  | 28.76     | 0.00   | 100.00   |
| 31-60 days          | 2,036 | 31.10  | 21.34     | 0.00   | 100.00   |
| > 60 days           | 2,036 | 14.09  | 16.78     | 0.00   | 93.00    |
| Non-compliant       | 2,036 | 28.97  | 23.74     | 0.00   | 100.00   |
| Max.<br>contractual | 2,036 | 70.12  | 43.54     | 1.00   | 365.00   |
| Signatory           | 2,036 | 0.09   | 0.28      | 0.00   | 1.00     |
| e-Invoicing         | 2,036 | 0.26   | 0.44      | 0.00   | 1.00     |
| SCFinance           | 2,036 | 0.08   | 0.28      | 0.00   | 1.00     |
| Pandemic            | 2,036 | 0.50   | 0.50      | 0.00   | 1.00     |
| Revenue             | 1,990 | 599.86 | 3155.59   | 0.22   | 50378.00 |
| Profitability       | 1,942 | 7.72   | 20.50     | -97.20 | 167.00   |
| Liquidity           | 2,012 | 2.23   | 4.20      | 0.03   | 80.88    |

Note: This table presents the original scales of the variables. The dependent variables and control variables are log transformed for regression analysis.

## Appendix B

Table 7.1 Difference-in-differences – Signatory to payment code

| VARIABLES                | (1)<br>AvDaystoPaySupplier | (2)<br>PaidWithin<br>30 | (3)<br>PaidBetween31<br>_60 | (4)<br>PaidAfter<br>60 | (5)<br>Noncompliance | (6)<br>Maxcontractual |
|--------------------------|----------------------------|-------------------------|-----------------------------|------------------------|----------------------|-----------------------|
| Signatory_treat          | -0.069<br>(0.094)          | 0.128<br>(0.090)        | -0.127<br>(0.134)           | -0.164<br>(0.169)      | -0.280*<br>(0.152)   | -0.200**<br>(0.094)   |
| Pandemic                 | -0.012<br>(0.019)          | 0.055***<br>(0.021)     | -0.072**<br>(0.034)         | -0.076*<br>(0.045)     | -0.089**<br>(0.038)  | 0.008<br>(0.012)      |
| Signatory_treat#Pandemic | -0.183**<br>(0.087)        | 0.125***<br>(0.039)     | -0.293***<br>(0.099)        | -0.528***<br>(0.104)   | -0.354***<br>(0.102) | 0.019<br>(0.023)      |
| log_Revenue              | -0.003<br>(0.017)          | -0.008<br>(0.021)       | 0.003<br>(0.031)            | 0.003<br>(0.035)       | -0.026<br>(0.037)    | 0.016<br>(0.010)      |
| log_ProfitMargin         | -0.012<br>(0.023)          | 0.038<br>(0.051)        | 0.005<br>(0.063)            | -0.143**<br>(0.071)    | 0.013<br>(0.059)     | -0.011<br>(0.019)     |
| log_Liquidity            | -0.029*<br>(0.015)         | 0.002<br>(0.020)        | -0.018<br>(0.024)           | -0.065*<br>(0.035)     | -0.061**<br>(0.031)  | 0.003<br>(0.008)      |
| EInvoicing               | 0.001<br>(0.027)           | -0.071<br>(0.050)       | -0.021<br>(0.065)           | 0.058<br>(0.071)       | -0.072<br>(0.089)    | 0.071**<br>(0.031)    |
| SCFinance                | 0.135***<br>(0.038)        | -0.124<br>(0.094)       | 0.183*<br>(0.103)           | 0.257*<br>(0.141)      | 0.187<br>(0.119)     | 0.051*<br>(0.029)     |
| Manufacturing            | 0.410***<br>(0.149)        | -0.686***<br>(0.166)    | 0.231<br>(0.177)            | 1.054***<br>(0.265)    | -0.290<br>(0.195)    | 0.525***<br>(0.095)   |
| Utilities                | -0.144<br>(0.185)          | 0.150<br>(0.210)        | -0.734**<br>(0.337)         | -0.255<br>(0.379)      | -0.826***<br>(0.310) | 0.085<br>(0.112)      |
| RetailTransport          | 0.108<br>(0.153)           | -0.248<br>(0.169)       | -0.052<br>(0.188)           | 0.269<br>(0.267)       | -0.591***<br>(0.192) | 0.278***<br>(0.096)   |
| InformationCommunication | -0.003<br>(0.169)          | -0.003<br>(0.192)       | -0.239<br>(0.242)           | 0.075<br>(0.286)       | -0.474**<br>(0.232)  | 0.098<br>(0.119)      |
| FinancialProperty        | -0.273*<br>(0.161)         | 0.347**<br>(0.158)      | -0.808***<br>(0.200)        | -0.120<br>(0.271)      | -0.532***<br>(0.195) | -0.163<br>(0.100)     |
| Services                 | -0.031<br>(0.158)          | 0.084<br>(0.156)        | -0.412**<br>(0.194)         | 0.310<br>(0.264)       | -0.576***<br>(0.199) | 0.015<br>(0.108)      |
| PublicSector             | -0.309*<br>(0.168)         | 0.388**<br>(0.158)      | -0.881***<br>(0.244)        | -0.499*<br>(0.292)     | -0.261<br>(0.208)    | -0.166<br>(0.117)     |
| Construction             | 0.171<br>(0.153)           | -0.095<br>(0.172)       | 0.098<br>(0.192)            | 0.610**<br>(0.297)     | -0.527**<br>(0.235)  | 0.202**<br>(0.101)    |
| HospitalityLeisure       | -0.051<br>(0.194)          | -0.133<br>(0.195)       | -0.075<br>(0.259)           | 0.005<br>(0.284)       | -0.663***<br>(0.235) | 0.053<br>(0.112)      |
| Constant                 | 3.496***<br>(0.204)        | 3.742***<br>(0.284)     | 3.368***<br>(0.381)         | 2.424***<br>(0.402)    | 3.554***<br>(0.348)  | 3.935***<br>(0.130)   |
| Observations             | 1,935                      | 1,931                   | 1,895                       | 1,780                  | 1,380                | 1,936                 |
| Number of id             | 501                        | 501                     | 498                         | 490                    | 489                  | 501                   |
| Year FE                  | YES                        | YES                     | YES                         | YES                    | YES                  | YES                   |
| Industry FE              | YES                        | YES                     | YES                         | YES                    | YES                  | YES                   |
| Adjusted R-squared       | 0.177                      | 0.224                   | 0.164                       | 0.178                  | 0.0652               | 0.245                 |

Note: Agriculture&Extractives is the referent category for industry and it is automatically omitted in regressions. Robust standard errors in parentheses.

Table 7.2 Difference-in-differences – E-invoicing

| VARIABLES                 | (1)<br>AvDaystoPaySupplier | (2)<br>PaidWithin<br>30 | (3)<br>PaidBetween31<br>_60 | (4)<br>PaidAfter<br>60 | (5)<br>Noncompliant  | (6)<br>Maxcontractual |
|---------------------------|----------------------------|-------------------------|-----------------------------|------------------------|----------------------|-----------------------|
| EInvoicing_treat          | 0.065<br>(0.053)           | -0.195***<br>(0.075)    | 0.104<br>(0.084)            | 0.084<br>(0.111)       | -0.155<br>(0.107)    | 0.075*<br>(0.041)     |
| Pandemic                  | -0.031<br>(0.023)          | 0.066***<br>(0.021)     | -0.100***<br>(0.037)        | -0.070<br>(0.050)      | -0.099**<br>(0.042)  | 0.002<br>(0.014)      |
| EInvoicing_treat#Pandemic | -0.001<br>(0.030)          | -0.000<br>(0.033)       | -0.006<br>(0.052)           | -0.164**<br>(0.070)    | -0.095<br>(0.066)    | 0.027<br>(0.018)      |
| log_Revenue               | -0.020<br>(0.017)          | 0.011<br>(0.021)        | -0.024<br>(0.030)           | -0.018<br>(0.035)      | -0.028<br>(0.038)    | 0.008<br>(0.010)      |
| log_ProfitMargin          | -0.012<br>(0.024)          | 0.035<br>(0.051)        | 0.005<br>(0.063)            | -0.149**<br>(0.072)    | 0.002<br>(0.057)     | -0.008<br>(0.019)     |
| log_Liquidity             | -0.028*<br>(0.015)         | 0.001<br>(0.020)        | -0.015<br>(0.025)           | -0.057<br>(0.035)      | -0.053*<br>(0.031)   | 0.003<br>(0.008)      |
| Signatory                 | 0.056<br>(0.110)           | -0.024<br>(0.050)       | 0.029<br>(0.109)            | -0.048<br>(0.124)      | -0.310<br>(0.192)    | -0.023<br>(0.028)     |
| SCFinance                 | 0.123***<br>(0.040)        | -0.105<br>(0.096)       | 0.160*<br>(0.095)           | 0.278*<br>(0.145)      | 0.197*<br>(0.119)    | 0.041<br>(0.029)      |
| Manufacturing             | 0.438***<br>(0.143)        | -0.710***<br>(0.168)    | 0.271<br>(0.172)            | 1.112***<br>(0.284)    | -0.257<br>(0.194)    | 0.545***<br>(0.100)   |
| Utilities                 | -0.150<br>(0.182)          | 0.158<br>(0.213)        | -0.742**<br>(0.341)         | -0.228<br>(0.398)      | -0.878***<br>(0.324) | 0.069<br>(0.118)      |
| RetailTransport           | 0.131<br>(0.147)           | -0.266<br>(0.169)       | -0.020<br>(0.183)           | 0.325<br>(0.285)       | -0.563***<br>(0.194) | 0.291***<br>(0.101)   |
| InformationCommunication  | 0.017<br>(0.164)           | -0.012<br>(0.194)       | -0.214<br>(0.238)           | 0.138<br>(0.304)       | -0.423*<br>(0.231)   | 0.114<br>(0.124)      |
| FinancialProperty         | -0.267*<br>(0.155)         | 0.350**<br>(0.160)      | -0.802***<br>(0.196)        | -0.095<br>(0.288)      | -0.511***<br>(0.193) | -0.164<br>(0.105)     |
| Services                  | -0.032<br>(0.152)          | 0.093<br>(0.159)        | -0.412**<br>(0.191)         | 0.335<br>(0.282)       | -0.549***<br>(0.197) | 0.015<br>(0.113)      |
| PublicSector              | -0.309*<br>(0.162)         | 0.396**<br>(0.161)      | -0.883***<br>(0.244)        | -0.489<br>(0.306)      | -0.257<br>(0.214)    | -0.171<br>(0.122)     |
| Construction              | 0.150<br>(0.145)           | -0.062<br>(0.171)       | 0.064<br>(0.185)            | 0.586*<br>(0.313)      | -0.541**<br>(0.230)  | 0.181*<br>(0.104)     |
| HospitalityLeisure        | -0.036<br>(0.188)          | -0.148<br>(0.196)       | -0.051<br>(0.253)           | 0.033<br>(0.299)       | -0.661***<br>(0.234) | 0.062<br>(0.116)      |
| Constant                  | 3.539***<br>(0.199)        | 3.723***<br>(0.283)     | 3.431***<br>(0.375)         | 2.492***<br>(0.431)    | 3.624***<br>(0.339)  | 3.927***<br>(0.134)   |
| Observations              | 1,935                      | 1,931                   | 1,895                       | 1,780                  | 1,380                | 1,936                 |
| Number of id              | 501                        | 501                     | 498                         | 490                    | 489                  | 501                   |
| Year FE                   | YES                        | YES                     | YES                         | YES                    | YES                  | YES                   |
| Industry FE               | YES                        | YES                     | YES                         | YES                    | YES                  | YES                   |
| Adjusted R-squared        | 0.171                      | 0.223                   | 0.159                       | 0.168                  | 0.0621               | 0.231                 |

Note: Agriculture&Extractives is the referent category for industry and it is automatically omitted in regressions. Robust standard errors in parentheses.

Table 7.3 Difference-in-differences – SCF

| VARIABLES                | (1)<br>AvDaystoPaySupplier | (2)<br>PaidWithin<br>30 | (3)<br>PaidBetween31<br>_60 | (4)<br>PaidAfter<br>60 | (5)<br>Noncompliant  | (6)<br>Maxcontractual |
|--------------------------|----------------------------|-------------------------|-----------------------------|------------------------|----------------------|-----------------------|
| SCFinance_treat          | 0.309***<br>(0.060)        | -0.335***<br>(0.110)    | 0.182*<br>(0.107)           | 0.751***<br>(0.153)    | 0.286**<br>(0.140)   | 0.286***<br>(0.064)   |
| Pandemic                 | -0.036*<br>(0.021)         | 0.073***<br>(0.020)     | -0.113***<br>(0.037)        | -0.116**<br>(0.048)    | -0.111***<br>(0.041) | 0.011<br>(0.012)      |
| SCFinance_treat#Pandemic | 0.068*<br>(0.037)          | -0.080<br>(0.065)       | 0.139**<br>(0.064)          | -0.026<br>(0.098)      | -0.147**<br>(0.074)  | 0.002<br>(0.023)      |
| log_Revenue              | -0.021<br>(0.017)          | 0.009<br>(0.020)        | -0.017<br>(0.030)           | -0.034<br>(0.035)      | -0.042<br>(0.038)    | 0.004<br>(0.010)      |
| log_ProfitMargin         | -0.009<br>(0.023)          | 0.034<br>(0.051)        | 0.006<br>(0.062)            | -0.138*<br>(0.074)     | 0.008<br>(0.056)     | -0.006<br>(0.019)     |
| log_Liquidity            | -0.027*<br>(0.015)         | -0.000<br>(0.020)       | -0.013<br>(0.025)           | -0.061*<br>(0.035)     | -0.057*<br>(0.031)   | 0.003<br>(0.008)      |
| Signatory                | 0.061<br>(0.110)           | -0.025<br>(0.048)       | 0.041<br>(0.108)            | -0.048<br>(0.125)      | -0.317<br>(0.194)    | -0.030<br>(0.028)     |
| EInvoicing               | -0.020<br>(0.028)          | -0.052<br>(0.051)       | -0.036<br>(0.066)           | 0.010<br>(0.072)       | -0.072<br>(0.090)    | 0.061**<br>(0.031)    |
| Manufacturing            | 0.454***<br>(0.147)        | -0.732***<br>(0.171)    | 0.283<br>(0.174)            | 1.146***<br>(0.277)    | -0.260<br>(0.192)    | 0.560***<br>(0.087)   |
| Utilities                | -0.160<br>(0.193)          | 0.169<br>(0.227)        | -0.754**<br>(0.350)         | -0.246<br>(0.405)      | -0.874***<br>(0.317) | 0.065<br>(0.112)      |
| RetailTransport          | 0.139<br>(0.150)           | -0.279<br>(0.171)       | -0.013<br>(0.185)           | 0.335<br>(0.278)       | -0.574***<br>(0.190) | 0.300***<br>(0.089)   |
| InformationCommunication | 0.034<br>(0.167)           | -0.040<br>(0.198)       | -0.196<br>(0.242)           | 0.153<br>(0.294)       | -0.452**<br>(0.228)  | 0.128<br>(0.112)      |
| FinancialProperty        | -0.226<br>(0.160)          | 0.295*<br>(0.164)       | -0.777***<br>(0.199)        | -0.013<br>(0.281)      | -0.519***<br>(0.190) | -0.119<br>(0.095)     |
| Services                 | -0.008<br>(0.156)          | 0.058<br>(0.162)        | -0.391**<br>(0.193)         | 0.370<br>(0.276)       | -0.569***<br>(0.193) | 0.037<br>(0.102)      |
| PublicSector             | -0.291*<br>(0.165)         | 0.366**<br>(0.165)      | -0.872***<br>(0.245)        | -0.454<br>(0.299)      | -0.275<br>(0.208)    | -0.146<br>(0.115)     |
| Construction             | 0.165<br>(0.152)           | -0.089<br>(0.177)       | 0.082<br>(0.187)            | 0.601*<br>(0.310)      | -0.563**<br>(0.223)  | 0.195**<br>(0.093)    |
| HospitalityLeisure       | 0.001<br>(0.191)           | -0.192<br>(0.199)       | -0.039<br>(0.256)           | 0.120<br>(0.292)       | -0.657***<br>(0.232) | 0.103<br>(0.105)      |
| Constant                 | 3.508***<br>(0.199)        | 3.750***<br>(0.287)     | 3.413***<br>(0.373)         | 2.451***<br>(0.424)    | 3.632***<br>(0.335)  | 3.900***<br>(0.125)   |
| Observations             | 1,935                      | 1,931                   | 1,895                       | 1,780                  | 1,380                | 1,936                 |
| Number of id             | 501                        | 501                     | 498                         | 490                    | 489                  | 501                   |
| Year FE                  | YES                        | YES                     | YES                         | YES                    | YES                  | YES                   |
| Industry FE              | YES                        | YES                     | YES                         | YES                    | YES                  | YES                   |
| Adjusted R-squared       | 0.182                      | 0.228                   | 0.156                       | 0.185                  | 0.0608               | 0.252                 |

Note: Agriculture&Extractives is the referent category for industry and it is automatically omitted in regressions. Robust standard errors in parentheses.