



Technology and Working Capital Finance

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1 Introduction

This chapter examines the use of technology in providing working capital finance to smaller enterprises. Technology is helping the provision of working capital finance through: (i) facilitating convenient online application with automated provision of supporting data; (ii) allowing better assessment, monitoring and management of credit and liquidity risks; and (iii) allowing a range of novel business models, including direct loan investment by individuals and investment funds, to compete alongside traditional bank provision of SME working capital.

What difference is this making? Our principal conclusion is that, while technology has the potential for substantially lowering the cost and increasing

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the convenience and availability of working capital finance for smaller enterprises, we are still at the early stages of applying new technology to the provision of small business credit. It will be some years before the full impact of the new technology-based approaches is felt across the world and fully exploiting this opportunity will require far-sighted policy interventions.

While new technology business models for credit intermediation are important, there is little or no sign that these are coming anywhere close to supplanting the major role of banks in the provision of working capital to smaller businesses. The new technologies can and will be employed by banks as well as by non-bank intermediaries and platform lenders, so their impact is increasing competition in the supply of loans and supplying new or previously underserved market segments, not completely replacing existing arrangements. The principal exception appears to be for very small businesses, defined for example as those ‘micro-enterprises’ with less than 10 employees, where short-term high-margin technology-based credit by specialised lenders is helping address what has previously been very limited access to bank credit.

The predominance of banks as a source of working capital finance is a major source of systemic financial risk. One of the most dramatic developments during the global financial crisis in 2008–2009 was the collapse in bank provision of working capital finance, as the liquidity and solvency crisis affected banks across the world. A direct consequence of the contraction in the supply of trade finance was a fall in world trade of 12% in 2009.¹ Action since then by regulators under the Basel framework has forced banks to operate with substantially more capital and less reliance on short-term wholesale market funding. But addressing this systemic risk has also further limited bank supply of working capital finance. Technology-based credit does not yet appear to have matured to the point where non-bank provision can fully replace a systemic contraction in bank supply of working capital finance.

These judgements are reached from a relatively brief examination of a complex landscape. Working capital finance is provided under a great variety of national legal, regulatory and institutional arrangements. Working capital finance is itself a broad category that includes many subdivisions (invoice finance including factoring, purchase order finance, asset-based finance, international trade finance). Small firms obtaining working capital finance also differ vastly both in their financing requirements and in their risk-profile including the extent to which they can provide collateral as security against loans. Technology may lubricate but local and transaction-specific factors also play a major role in determining outcomes.

¹ Chor and Manova (2012).

Analysis is further hampered by fragmentary and partial data. Unlike for example, the syndicated loan or corporate bond markets accessed by larger companies, there are no comprehensive global data sources on SME and working capital finance. Researchers are forced to draw on partial data sets or case studies and must be cognizant of the many peculiarities of local markets to properly understand the supply of working capital finance.

This chapter can do no more than provide a broad picture of how technology is promoting the increased supply of working capital finance. It cannot go very far in quantifying this impact. It can though provide a 'road map', a guide that will allow practitioners, policymakers and researchers to see the overall landscape and therefore better understands how technology is creating new commercial opportunities, posing new challenges and questions for regulatory and business policy and throwing up new research questions.

The chapter is organised as follows. We first use the available data to paint a picture of the provision of working capital finance in various countries (Sect. 2). One striking fact that emerges here is that explicitly technology-based intermediation, for example the 'loan-based crowdfunding' that has come to prominence for example in China and in the UK, still represents only a small share of overall working capital finance. Banks and non-bank balance sheet lenders are also adopting new financial technologies in their more conventional established lending businesses. But this is difficult to quantify. There is no clean way to distinguish their use of financial technology in credit provision.

We go onto review the demand for different forms of working capital finance and the new emerging business models, supported by modern information and communication technologies, meeting this demand (Sect. 3). We then look at some prominent case studies of technologically enabled working capital finance, highlighting some successes but also dispelling some myths (Sect. 4). We conclude with a brief discussion of future prospects, suggesting that we are still at the early stages of a revolution that will bring us much closer to meeting the gap in financing the working capital requirements of smaller firms, but full exploitation of this gap has a long way still to go and requires a range of supporting policy measures.

2 The Provision of Small Business Lending in Various Countries

This section discusses the magnitude of lending to small and medium enterprises globally. Our principal finding is that, while fintech-based provision of working capital finance continues to grow rapidly around the world, its share of overall working capital finance varies substantially between countries and everywhere remains relatively small compared to traditional bank lending.

For reasons of data availability, we are unable here to distinguish working capital finance from other forms of debt finance to small and medium sized businesses. While clearly a limitation to our discussion, this does not overturn our conclusions. Aside from property development companies using their developments as collateral, small businesses have limited access to longer term debt. Most small business lending is working capital finance. Moreover, larger companies do not normally face problems in accessing working capital finance., having a range of options for external debt finance unless they are financially distressed. Hence the focus on this section on small business lending is appropriate for understanding the impact of technology on the supply of working capital finance.

Data provided by the Financial Stability Board provide a convenient starting point. A series of reports, of which the latest is FSB (2019b), collects a range of data on the magnitude and growth of bank and non-bank intermediation since the global financial crisis of 2008.² The Financial Stability Board also monitors SME lending.³ We use these sources to provide a bird's-eye perspective on the importance of technology-based lending in total credit intermediation.

FSB (2019b) reports a stock of global credit assets at the end 2017 of 169.5 trillion dollars (211% of global GDP), of which \$97.2 trillion are loan assets and \$78.9 trillion are bank loans. A separate FSB survey indicates that this bank lending approximately \$14.3 trillion or 18% of total global bank lending are to small and medium-sized enterprises.⁴ Noteworthy is the exceptionally high volume of small business lending in China. In 2017 the Chinese

² The motive for these FSB reports is monitoring the potential for destabilising 'runs' on non-bank institutions employing money-market funding to hold loans or other illiquid assets. This is a concern because these institutions typically are unable to access lender of last resort facilities from central banks. Their data collection is however broader, covering all non-bank investment in loans and other illiquid assets. Until October 2018 the FSB described such intermediation as 'shadow banking'. Recognising that such alternative forms of intermediation are not necessarily a source of systemic risk, they now simply refer to non-bank intermediation.

³ In FSB (2019a).

⁴ This \$14.3 trillion is our calculation based on Graph 7 in Appendix A of FSB (2019a) (graphing ratios to GDP from the FSB survey of SME lending for advance, emerging and developing countries)

economy amounted to 15% of global GDP, but bank lending to small and medium-sized businesses in China was \$7.4 trillion, some 61% of Chinese GDP and more than half of global small business lending.⁵ The same Financial Stability Board survey suggests that the US had a correspondingly small ratio of small business lending of only 1.5% of GDP or \$0.29 trillion.⁶

How important is alternative lending to small and medium-sized enterprises ('loan-based crowdfunding' to SMEs directly funded through lending platforms, i.e. peer-to-peer or marketplace lending) when compared to bank lending to SMEs? This is a difficult question to answer precisely. But an approximate answer can be given, showing that the stock of alternative finance lending to SMEs compared to total SME bank lending was still very small in 2017: around 2% in China and the UK; between 1 and 5.6% in the US depending on the assumptions behind the calculations⁷; and averaging less than 0.1% across all other countries.

These findings are obtained as follows. The various surveys from the Cambridge Centre for Alternative Finance of platform-based lenders (those that support loan investment without themselves having any loan participation) reveal a total global *flow* of new alternative SME lending in 2017 of \$103.4 billion.⁸ They provide no corresponding figures for the stock of alternative SME lending. However, illustrative calculation suggests that the ratio of stock to flow for end 2017 SME lending will be about 1.5 in countries such as the UK and China where growth has been most rapid (and about 2 in the US where growth has been slower).⁹ Using these estimated stock to

and figures for nominal GDP from the IMF datamapper. <https://www.imf.org/external/datamapper/NGDPD@WEO/OEMDC/ADVEC/WEOWORLD>.

⁵ This Chinese figure of \$7.4 trillion is computed in the same way as the figure in the previous footnote.

⁶ There are various institutional differences explaining this small US figure, inter alia: an important role for credit unions in lending to small business; widespread use of credit cards for funding business debt which may not be classified as bank SME lending; borrowing from finance companies for purchases of vehicles and other equipment; and securitisation of loans issued under the government SBA guarantee programme (Federal Reserve Board 2017).

⁷ We note that the Financial Stability Board reports a ratio of FinTech credit to bank SME credit of 25% for the US (FSB 2019a). They use the same sources as we use in our analysis from which we obtain an upper value of 5.6%. We are unable to make sense of their figure.

⁸ For the source of this figure see notes to our Table 1.

⁹ The assumptions behind this ratio of 1.5 are that the flow of loans has doubled every year for the past five years, that SME lending is evenly divided between maturities of 2, 3, 4 and 5 years with all loans are amortised on a straight-line basis. This yields the following tabulation of flows and stocks and the 1.5 stock-flow ratio. For the US, where growth in alternative lending has been slower in recent years, similar calculation yields a stock-flow ratio of about 2.

flow ratios, implies that the global stock of total alternative platform-based lending to SMEs at end 2017 was \$154.6, or 1.1% of global SME bank lending.

Comparison on the same basis reveals large differences between countries. In China and in the UK—the two countries where platform-based lending to SMEs has developed furthest—the end 2017 ratio of total alternative finance SME lending to total SME bank lending was 1.99 and 1.96%, respectively. The corresponding figure for the US was 0.99%. In the rest of the world excluding China, the US and the UK alternative finance lending was less than 0.1% of bank lending to SMEs.

The US has an especially large presence of non-bank balance sheet lenders providing credit to SMEs.¹⁰ Such non-bank balance sheet intermediaries (sometimes called ‘shadow banks’) lend from their own balance sheets, funded by debt and equity held by institutional investors. The Cambridge Centre for Alternative Finance reports US data for such non-bank balance lending to SMEs.¹¹ Including these along with platform-based lenders increases the US ratio of new technology-based SME platform lending to total Bank SME lending to 5.59%. If we allow though for the wider range of non-bank provision in the US and low volume of bank lending to SMEs, when compared to other countries, this suggests that the overall provision of working capital finance by technology-based lenders in the US is similar to the UK.

Despite its comparatively small size, alternative lending still represents the most prominent example of technology-based credit intermediation. As can be seen in Table 1, China is much the biggest market, followed by the US and then the UK where this alternative form of intermediation first developed. The other countries shown are the ten other countries with the highest

Total loan flow	100	200	400	800	160	3200
2 year loans flow	25	50	100	200	400	800
3 year loans flow	25	50	100	200	400	800
4 year loans flow	25	50	100	200	400	800
5 year loans flow	25	50	100	200	400	800
2 year loans stock	25	63	131	266	533	1066
3 year loans stock	25	67	144	296	598	1198
4 year loans stock	25	69	152	314	635	1276
5 year loans stock	25	70	156	325	660	1328
Total loan stock						4869

¹⁰ See Gawrych (2019), a recent webpage reviewing more than a dozen leading providers.

¹¹ In Ziegler et al. (2018).

Table 1 Alternative finance total and SME lending in the most important jurisdictions

Countries	Total alternative finance market in millions					SME lending in millions	SME as % of total alternative finance
	2013	2014	2015	2016	2017	2017	2017
China (\$)	5,560	24,240	102,000	243,000	358,000	97,430	27
US (\$)	4,400	11,560	28,400	34,530	42,810	1450	3
UK (£)	666	1,740	3,200	4,580	6,190	2039	33
Australia (\$)	27	104	398	610	1,149	23	2
Canada (\$)	44	86	207	335	868	9	1
France (€)	76	154	319	444	661	88	13
Germany (€)	65	140	249	322	595	71	12
Japan (\$)	87	115	351	398	349	189	54
Netherlands (€)	46	78	111	194	280	86	31
India (\$)	5	12	40	124	269	29	11
New Zealand (\$)	3	22	268	223	262	14	5
Italy (€)	1	8	32	127	241	24	10
Brazil (\$)	4	8	24	64	219	34	16

Note Alternative finance lending (also referred to as loan-based crowdfunding, P2P lending and sometimes as marketplace lending) where investment in loans takes place through an online platform without the platform participation. This includes unsecured personal lending, short-term property lending and SME lending

Source Authors calculations based on data from the database of the Cambridge Centre for Alternative Finance. We are grateful to Leyla Mammadov for her help with accessing this data

volumes of alternative finance lending. The share of SME lending in total alternative finance lending varies markedly. It is highest in the Netherlands (54% of the total) around one-third of the total in the UK, Japan and China and as low as 3% in the US.

This analysis reveals a growing but still relatively small contribution of technology-based credit to the supply of working capital finance. There are reasons for thinking that the impact is bigger than suggested by these aggregated figures:

- First, technology-based platform lenders are providing a relatively large share of lending the very smallest ‘micro-enterprises’. Cambridge Centre for Alternative Finance data indicate that in the UK for 2017 these accounted for some 30% of lending to the smallest companies with turnover of less than £2 million.¹²

¹² Reported in Zhang et al. (2018).

- Second, this analysis does not take any account of the adoption of technology-based tools of credit application and credit-risk assessment by established banks and finance companies. There is however no easy way to separate technology-based provision of working capital finance for these lenders.

As our case study analyses below suggest, the new providers of technology-based working capital finance have certain competitive advantages over established banks. They are not subject to the same high level of capital requirements as banks (though on the other hand they cannot benefit from any lowering of funding costs from bank deposit insurance schemes). Compared to banks they can often operate with relatively light requirements for compliance with 'know your customer' (KYC, effectively piggybacking on bank KYC compliance). They are not constrained by legacy systems and are hence able to offer a convenient and easy to use interface for business loan applications without for example any requirements for visiting branches. In some cases, they are able to use novel data sources for assessment of credit risks.

At the same time there may be limits to new business models. In both the UK and the US, alternative finance platforms have turned increasingly to institutional investment as a source of funding. In the US many non-bank providers operate through both alternative lending platform and balance sheet lending.¹³ Banks themselves will in time be able to develop better customer interfaces and employ novel methods of credit assessment. As we will discuss in the following section, banks will continue to have a comparative advantage in providing some forms of working capital finance.

3 Market Segments

This section discusses the various forms of working capital finance and the substantial differences in size and risk-profile of different small and medium-sized enterprises seeking access to working capital finance.

3.1 What Is Working Capital Finance?

Working capital as most narrowly defined is an accounting concept. In accounting terminology, gross working capital is total short term or current

¹³ See Ziegler et al. (2018).

assets, i.e. those that are expected to be turned into cash within one year. On the other side if the balance sheet are short term or current liabilities that are expected to be paid within one year. Net working capital, the difference between current assets and liabilities (expressed in absolute terms or as a ratio), is a measure of the liquidity position of the firm.

More broadly working capital can be used to refers to any investments with a relatively short and predictable repayment period, from expenditures such as wages, raw materials and inventories to purchase of equipment and marketing, that are expected to paid off through generation of cash revenues in the short to medium term, i.e. around one to three years. In this broader sense working capital goes well beyond the narrow accounting concept, including also equipment such as computers and vehicles with shorter payoff periods and also off-balance sheet assets such as opportunities for future sales and predictable revenue opportunities of longer than one year.

Working capital finance is all forms of short-term and medium-term finance of working capital, paid back once the anticipated cash flows are realised. It thus covers all balance sheet liabilities except equity, long-term debt and hybrid debt-equity instruments.

Table 2 tabulates some of the main forms of working capital finance. This includes arrangements where assets are not owned by the enterprise. Consequently, assets and their financing are no longer recorded on balance sheet (invoice factoring and discounting; equipment leasing). Assets can be used as collateral for secured borrowing.

3.2 The Heterogeneity of Small and Medium-Sized Enterprises

A further challenge in studying the provision of working capital finance so smaller business is the heterogeneity of small and medium-size enterprises (SMEs). Definitions used for compiling SME statistics, usually based on number of employees or on annual revenue, vary substantially from one jurisdiction to another.¹⁴ At the same time a hugely diverse range of enterprises are classified as SMEs. Take the UK as an example. The standard definition is that a small enterprise is one with 50 or less employees, while a medium-sized enterprise is one with 51–250 employees.¹⁵ Enterprises with 10 or less employees are separately distinguished ('micro enterprises').¹⁶ Some banking

¹⁴ See FSB (2019a, section 2.1, p 7).

¹⁵ See Rhodes (2018).

¹⁶ Of the 5.7 million businesses in the UK in 2018 only one quarter had any employees at all, down from one-third in 2002. This shift to self-employment has driven in part by response tax

Table 2 The variety of working capital finance

	Definition and examples	Distinguishing features
Purchase order finance	Advance of money to the firm's supplier to meet a customer's order ^a	Unsecured with a repayment based on existing orders
Invoice finance/account receivables finance	Advance of funds to the firm by a third party in return for a percentage of the value of firm's invoices or a loan using invoices as collateral^b There are different types Invoice factoring/debt factoring. The firm sells to a factoring company unpaid invoices at a discount for an advance of money^c Invoice discounting. The firm sells to a third party the unpaid invoices from the firm^d Invoice financing. The firm borrows money using invoices as collateral	The factoring company has responsibility to follow up unpaid invoices from the firm's clients Unlike invoice factoring, the firm controls administration of debtors^d Secured loan. Repayment typically within around 90 days Unsecured. Based on prospective cash flows. Can be flexible, used as required by the firm or amortised on a fixed schedule
Unsecured credit	Bank overdrafts. A line of credit linked to the firms Line of credit. A separate financial that can be drawn on Term loans Credit cards	Secured. Repayment typically within around 90 days
Other asset-based finance	Equipment finance. Loans of 3–5 years collateralised on the equipment Leasing Term loans secured on property	Secured. The vehicle, machine or property can be claimed if loan not repaid

	Definition and examples	Distinguishing features
Trade finance	Letters of credit forfaiting	Additional arrangements and instruments to deal with the challenges of international trade

^aSee Prosser (2015)
^bSee Business Expert (2019)
^cSee Prosser (2015) and Business Expert (2019)
^dSee Business Expert (2019) and Market Finance (2019)

statistics in the UK use revenue of less than £2 million as an alternative criteria for distinguishing micro-enterprises.

The available information on and the risks of credit provision are very different for microenterprises with less than 10 employees than for medium-sized enterprises with 50–249 employees. The smallest companies often have relatively undiversified revenues with the loss of a single customer or an essential employee can undermine their viability. Risk of fraudulent credit application is especially large for micro-business credit applications, when the business may not even exist in the first place or not have any reliable audited accounts.

Within these size categories financing needs vary hugely. An established business with strong and steady cash flows but limited opportunities for expansion is likely to have relatively little need for external working capital finance. External working capital financing requirements are much larger for newly established enterprises, when revenues are uncertain or have substantial seasonal variation, when margins are tight or when opportunities for expansion arise.

This great variety in both financing products, risks and financing needs, means that there are no simple standardised technology-based solutions for providing working capital finance to SMEs. Non-bank technology-based lenders have focused on specific niches where new approaches can give them a competitive edge over the standard established bank provision.

4 Case Studies and Examples

This section discusses some prominent case studies technology-driven change in working capital finance.¹⁷ We begin with the most prominent Chinese example, that of Ant Financial Services. We then look at a number of examples of balance sheet lenders in the US. We go on to describe two of the most prominent technology-enabled providers of working capital finance in the UK, MarketInvoice and Funding Circle. Finally, we review the role of technology in provision of international trade finance.

and administrative burden of formal employment, with employees of larger firms switching to self-employment to provide flexible service.

¹⁷ We have selected these case studies to illustrate the range of different approaches to technology-supported provision of working capital finance. There are many other examples that we could have used. In Argentina, Brazil, Mexico, Mercado Crédito provides working capital loans to entrepreneurs on Mercado Libre (Claessens et al. 2018). PayPal Working Capital has provided over \$2 billion loans as of 2017 since launching in 2013 in the US, UK and Australia (Dean 2017).

These case studies reinforce the findings of the previous sections. Each of these platforms operates in its own particular niche, providing specific working capital finance solutions among those listed in Table 2 to particular customer segments. While successful, none of these platforms are emerging as disruptors that are displacing the established role of banks in provision of working capital finance. To an important degree they are providing finance to smaller businesses that have been previously underserved by bank lenders.

4.1 Ant Financial Services¹⁸

Alibaba, the Chinese e-commerce conglomerate that is the leading provider of business to business e-commerce platforms (1688.com, Alibaba.com) auction platform (Taobao) and business to consumer sales online marketplace (Tmall). The company was restructured in 2014 as Ant Financial Services Group with minority ownership from Alibaba enabling it to raise external venture funding.

The growth of Ant Financial Services (AFS) has been substantial. The user base is a significant proportion of the Chinese population which provides growth opportunities. AFS is sometimes characterised as the most valuable FinTech in the world. There is no clear distinction between their business and consumer lending. AFS often provides loans to unincorporated businesses as personal loans.

AFS includes the hugely successful Alipay payments solution facilitating transactions domestically, both mobile to mobile payments and for transactions on Taobao and Tmall, and internationally. As well as wealth management services aimed at Alipay users, Ant Financial also provides a variety of technology-based forms of working capital finance. These include Zhao Cai Bao, launched in April 2014, is a marketplace lending facility embedded in Alipay that matches individual investors as lenders to individuals, micro-businesses and SME borrowers; and MYbank: a private online bank, established on 25 June 2015 with a mission to serve small and micro-enterprises.

MYbank relies on internet and machine learning in data collection and a big data computing in risk analysis. This allows MYbank to offer a highly convenient customer services, taking only 3 minutes to assess risks and decide the amount of lending and 1 second to issue the loan to an Alipay account, with no manual intervention during the whole process and flexibility of both timing of repayment and amount of borrowing, with the minimum be on 1

¹⁸ We are grateful to Chusu He for her help in writing this case study.

yuan. By April 2017 MYbank had loaned out 800 billion yuan (\$112 billion) far outstripping the loan volumes of any of the other technology-based credit providers around the world (though still a small share of the total of \$7.4 trillion of small business lending in China in 2017).

4.2 Balance Sheet Lending in the US

We now examine three prominent US balance lenders active in the technology-supported provision of working capital finance.

4.2.1 OnDeck

Founded in 2006, OnDeck is the most prominent of the technology-based lenders in the US, publicly listed as OnDeck Capital. In September 2018, it became the first non-bank online lender to exceed \$10 billion in cumulative loans originated to small businesses (OnDeck Capital 2018). It now has loaned out \$12 billion in total globally (OnDeck 2019a) to customers in 700 countries (OnDeck 2019b). In 2018, OnDeck had record number of originations of \$2.5 billion, 17% increase from 2017 (OnDeck 2019c). Originations have been over \$2 billion for each of the last three years.

On Deck provides terms loans between \$5,000 and \$500,000. Terms loans can range from 3 to 36 months, with weekly lines of credit. OnDeck's 2018 annual report provides a number of key financial and operating metrics. Over the past three years the loan yield—the rate of return that is achieved on loans outstanding and so effectively a measure of the average annual rate of interest on its lending—was 36.2% (2018), 33.8% (2017), 33.2% (2016).

During 2018, the average size of a term loan made by OnDeck was \$55,490 line of credit being \$33,689 (OnDeck 2019c). The typical customer is a 7-year-old business with \$450,000 gross annual revenue (compared with minimum requirements of a 1-year-old business with \$100,000 gross annual revenue). Thus OnDeck is very much operating in the microenterprise space, charging fairly high rates of interest for relatively short-term loans.

While focused on lines of credit and unsecured term loans, OnDeck has been preparing to move into asset-based finance. In 2019, OnDeck plans to begin making their own equipment loans ranging from \$5,000 to \$150,000 (OnDeck 2019c). OnDeck points out that the 'equipment finance market is ripe for disruption' aiming to target loans from \$5,000 to \$150,000 with 2–5 years secured by essential-use equipment.

4.2.2 Kabbage

Kabbage operates in a similar market to OnDeck providing convenient access to short-term credit for the smallest microbusinesses. The company provides credit up to \$250,000. Kabbage can qualify a loan of \$200,000 loan within only with access to business bank data. It can approve the loan within minutes by using its technology. Kabbage obtains 'read-only access to banking information, marketplace information, shipment histories, accounting logs and web analytics' (Bary 2019). A business needs to have revenues greater than \$50 K per annum and be at least one-year old. Businesses can choose between 6, 12 and 18 month terms (Kabbage 2019a).

Kabbage has now 200,000 customers (Kabbage 2019b) in 2015, the average line of credit was \$25,000, with average borrowing taking 7/8 loans a year totalling \$50,000 (Dahl 2015). By December 2019, Kabbage had loaned out in total more than \$6.5 billion since 2009, with \$2 billion in 2018 (Perez 2019). Kabbage finished the third quarter of 2019 with \$100 million in revenue, with loans originations of \$715 million, an increase of 43% year on year (Bary 2019).

The Kabbage business model differs from standard bank term loans, by allowing customers considerable flexibility in repayment. This is compensated by charging relatively high fees in the first months of a loan (so revenue is earned even if the loan is outstanding for only as short period). In 2015, CEO, Frohwein acknowledged that the average annual percentage rate of loans could be as high as 40%, with rates as high as 20% for the first 2 months, falling sharply in subsequent months (reported by Dahl 2015, their webpages provide similar illustrative calculations).

4.2.3 Biz2Credit

Biz2Credit is another leading US fintech-based business lender. It is a non-bank balance sheet lender. Founded in 2007, as of the time of writing Biz2Credit has arranged over \$2 billion in small business lending across the US. They also license their 'AI-Powered Digital Banking' platform Biz2X to other lenders including many commercial banks (a 'software as a service' SaaS platform that implements loan management, loan servicing, risk analytics and customer interface).

There is a short, informative, case study on the AWS website of the development of Biz2Credit <https://aws.amazon.com/solutions/case-studies/biz2credit/>. Biz2Credit originally worked as an 'aggregator', seeking to provide SME

loan applicants with an interface that would lead them to appropriate lenders, both banks and non-bank balance lenders.

It then found, however, that while this service worked well for loan origination, it did not provide the quality of 'end-to-end' services that they desired to provide for their customers. The total loan approval process could still take 7–10 days, because their client banks had to process the application through several different departments using different systems.

To offer the service they desired, Biz2Credit then made several developments in their business model:

- They began to also operate as a balance sheet lender, extending their platform to provide a unified operation that covered all the elements of the lending decision, including post loan servicing.
- Introducing technology for automating the transcription of information, e.g. from digital images.
- Developing a proprietary machine learning tool for credit risks assessment, using cash flows from banking records as well as standard accounting information, can more accurately assess credit risk. This though has yet to be tested in a major economic downturn.

This combination of a unified platform, together with automated information processing, allows them to make a credit decision and fund a loan in 24–48 hours. They are also though purely virtual, they provide their customers with telephone access to an adviser to help them get the right financing for their needs. Altogether they have provided arranged small loans to around 225,000 customers with a total value of \$2 billion, so their average loan size in the US is about \$10,000 (so on average serving even smaller businesses than OnDeck or Kabbage).

In May 2019 they announced the launch of a new service Biz2X, a 'Software as a Service' solution which allows banks worldwide to use the same unified platform that Biz2Credit has developed for their own lending. Their website <https://www.biz2x.com/index.php> indicates that their cloud-based platform can be integrated into existing bank systems and launched in 2 months (for smaller community banks) and 4 months (for global banks).

Biz2Credit has recently, in June 2019, successfully obtained \$52 million of Series B funding from WestBridge capital that will support their continued expansion.

4.2.4 Amazon Lending

Amazon Lending launched in 2012, provides loans to merchants on Amazon. Amazon Lending provides loans range from \$1,000 to \$750,000 for up to a year with annual interest of 6–17% (Dean 2017). In 2017, 20,000 SMEs in UK, US and Japan have taken loans (Dean 2017). Amazon investigates whether the SMEs are creditworthy and then invites them to apply for loans. Their technology can ascertain the financial viability of companies and whether they are having difficulties. Consequently, it can freeze accounts immediately (Dean 2017).

Note the unusual feature that these loans are invitation only: Amazon observes revenues and subject to minimum total sales of at least \$10,000 over the past year, good customer metrics and increasing or at least stable revenues they may offer a loan. Loan terms are for up to one year and at rates between 6 and 14%, rather lower than US credit card rates of 14–24%. The recipient can accept the loan, accept a smaller loan or reject. Once a loan is accepted then repayments are made automatically from the customer revenues passing through the Amazon site (in the event of non-payment it can also take further actions, e.g. confiscating inventory, preventing payments from the seller account).

The obvious disadvantage for borrowers is that, while the loans are pre-approved and so very fast to disburse, the Amazon loan offers are unlikely to be made at the time when finance is most needed.

Amazon Lending has subsequently expanded into the UK, Canada, China, France, Germany, India, Italy and Spain. In 2017 it reportedly loaned about \$1 billion with \$3 billion total lending since 2012 (though later press reports based on Amazon's annual reports lowered these initially announced figures). In 2017 it also announced plans for further expansion, something interpreted as a sign that the big tech players were making serious inroads into small business lending challenging established banks.

Recent reports by the Financial Times, in June of 2019, suggest that this expansion effort has not worked out as anticipated, with actual loan uptake disappointingly small. The volume of loans increased by only 4.7% in 2017 compared to 2016 and fell further to 2.6% in 2018.

Amazon publishes little information and there is no public data on loan losses from the programme. Some critical comments suggest that Amazon may not have effectively priced credit risk (though unclear that the problem was credit risk rather than simply lack of demand). The notion of a 'you wait until we offer you a loan product' does seem to have its limitations. But without adequate credit scoring, something that its customer data seems

as yet unable to support, it is difficult for it to operate more traditionally responding to loan requests.

Amazon is still suggesting that it may make a renewed effort to expand its lending business. Other large 'BigTech' players are more successful at credit. Most notably Ant Financial in China (see above). Paypal has a lending business that now loans more than \$1 billion per quarter. A more conventional approach based on traditional credit modelling may yet work for Amazon.

4.3 UK Technology-Supported Lending

- MarketInvoice.

New technology has been particularly prominent in providing invoice factoring and lending. Invoice factoring is when invoices are sold by businesses at a discount. In the event of late payment or non-payment, it is the factoring company, the financial company buying the invoices, that is responsible for collecting the amounts due. Invoice lending, when invoices are used as security against a short-term loan. In the event of late payment the business is responsible for collecting the due payments.

A UK alternative lender that has been particularly successful in this area is MarketInvoice <https://www.marketinvoice.com/>, providing credit against client invoices. Founded in 2011, it has already after eight years by the end of 2019 provided £2.7 billion of invoice and other business loans with 46,237 'trades' on their platform (<https://marketfinance.com/investor-statistics>). The gross interest rate charged has fallen gradually from 12% in 2014 to 7.5% in 2019 with loss ratios also falling to 1.6% in 2018. MarketInvoice investors must be high net worth, institutional investors or government authorities.

MarketInvoice supports two main products:

- confidential invoice financing secured against a business's entire portfolio of outstanding invoices. This involves an account migration, with the borrowing company setting up a new business account into which invoices are paid and from which market invoice is repaid, with an accompanying flexible line of credit related the total invoices due. The borrowing company must use an approved accounting software, effectively giving MarketInvoice oversight of its invoice book as well as direct claim on the invoice cash flows, but without passing on confidential client information to MarketInvoice are having to inform clients that their invoices
- selective (or single) invoice financing where an individual account is set up for the client to pay their invoices. Otherwise this is similar to confidential

invoice finance, although the request to transfer payment to a new account with a new bank could reveal that the invoice is being used as a cash flow commitment to repay borrowing.

They are also offering a purchase order finance solution and credit insurance and control services. MarketInvoice has been (but is no longer) a member of the UK Peer-to-Peer Finance Association, with their loan book financed by investment from institutional investors. This is reflected in the transparency of their business with their entire historical loan book available to download from their webpages.

Their website contains some informative examples that illustrate their appeal to customers. A particular strength seems to be the ease of use of their online systems. Another technological feature is that MarketInvoice, unlike factoring companies, does not take ownership of invoices or take responsibility for chasing repayment. Rather the security of their lending is cash flow based, by having the invoices paid directly into the same bank account where marketinvoice provides a line of credit. As invoices are paid down then the line of credit is automatically paid down with additional credit offered as new invoices are accepted by MarketInvoice.

- Funding Circle

Funding Circle is one the leading small business loan platforms, being praised as a '*real success story for British fintech*' by the UK Chancellor of the Exchequer, Philip Hammond (Turvill 2017). The platform was launched in 2010 (Collinson 2010) focusing exclusively on SMEs. Funding Circle has worked with a substantial number of prominent organisations. The UK Government started lending through the platform in 2013. In June, 2016, a £100 million lending partnership was agreed with European Investment Bank and a \$1 billion lending partnership with Alcentra in the US. The commercial arm of the government-owned British Business Bank in 2017 pledged to lend £40 million to UK SME through Funding Circle (British Business Bank 2017). In October 2018 it had an IPO on the London Stock Exchange.

It has provided \$5.8 billion in funds to 54,000 UK businesses (Funding Circle 2019a). However, Funding Circle's biggest market is the UK, however, the platform has extended its presence globally. Their 2018 annual report states that as of 31 December 2018, cumulative lending (from 2010) was \$1.9 billion to US borrowers, £ 4.6 billion to UK borrowers, €210 million to German borrowers and €140 million to borrowers from the Netherlands. The 2018 annual report goes on to suggest that it has £3.1 billion

loans outstanding as of 31 December 2018. This represents a 49% growth from 2017 (Funding Circle [2019b](#)). Loan originations grew 40% to £2.3 billion in 2018. As of 31 December 2018, Funding Circle's typical customer across all countries has 10-year trading history, £950,000 of annual revenue and 8 employees. The average loan size and loan terms were £70,000 and 52 months, respectively (the loans range from 6 to 60 months). 11% was the average interest rate on loans originated from their platform (Funding Circle [2019a](#)).

4.3.1 Trade Finance

Trade finance is another area that technology is supporting new finance. Trade finance is one of the most fragmented areas in the world of finance. Trade finance involves multiple documents and multiple parties which are largely paper-based and require substantial manual processing. Furthermore, complexity increases due to substantial regulatory compliance.

Kavuri and Milne ([2019](#)) find that trade finance is one of the most promising areas for technology-based provision of working capital. Costs are significant and technologies such as distributed ledger technologies have the potential to address the numerous inefficiencies arising from the failure to share data. This has led to various competing initiatives in the area which include:

- HSBC's VoltraOne platform (now being developed to a commercial scale by CryptoBLK). This aims to automate the entire trade finance process, and purely digital versions of the principal trade finance instruments.
- TIX platform of TradeIX and Marco Polo. It aims to improve transparency in the bank accounting systems that track customer trade finance.
- IBM supported we.trade which is based on the Hyperledger Fabric. It focuses on helping small and medium-sized enterprises access financing solutions.
- The Hong Kong Trade Finance Platform established as a co-operation between seven Hong Kong banks in 2017 in an effort to digitise all aspects of trade finance.
- Komgo initiative developed for the specialised area of commodity finance (oil, metals, agricultural commodities). They have the advantage of working in a specialised area with small number of large commodity traders and their banks, making the problem of co-ordination on a single solution relatively easy.

Despite this promise and several competing data sharing solutions, there is as yet no widespread adoption of technology-based international trade finance. A concern is that much international trade is transactional, with no guarantee that the same parties (importer, exporter, providers of finance) will continue working together. The costs of investing in access to a technology platform are therefore comparatively high compared to the gains from current client relationships and likely to have only limited payback. It will require much greater interoperability between all the different platforms for trade supply chains and trade finance in order to persuade the many parties involved to invest in the adoption of new processes. Thus, greater standardisation seems to be key to supporting full adoption.

5 Conclusions

Recent years have seen an explosion of new forms of technology-based credit. In this chapter we have focused on the provision of technology-enabled working capital finance to SMEs, looking at the overall magnitude of this lending and exploring the range of different ways in which this is being provided.

What emerges from our analysis is a picture of great variety of new products and business, but also that these are as yet only providing a relatively small proportion of the overall supply of working capital finance. Technology-based credit platforms provide around 2% of the stock of SME bank lending in the UK, a slightly higher proportion in the US and much less in almost all other countries. China, as so often in financial technology, has some of the most adventurous business models for working capital finance but again still small compared to conventional bank lending.

The new technologies are proving relatively successful at providing short-term credit to the very smallest 'micro-enterprises' in China, the US and the UK. Companies such as OnDeck, Kabbage and Funding Circle and others are successfully meeting demand for working capital finance from firms that previously would have been too small to access the same credit from conventional banks. An indication of the high levels of untapped demand are the high-interest rates and hence substantial margins achieved from this lending (albeit with some uncertainty about the underlying risks since these new business models have never been tested in a recession).

These new lenders are also pioneering much greater convenience and improved customer experience in loan applications, ideal for the smallest businesses that are under individual control and do not have the detailed

accounting and business modelling that is expected in application for conventional bank business loans. We can anticipate, over time, similar developments in other countries and, also, that banks will respond, either by acquiring loans from platform-based lenders or acquiring or developing their own more convenient customer interfaces (the cloud-based Biz2X software offering from Biz2Credit is an example of the potential for shared processing).

We can compete our analysis with a brief and preliminary policy discussion. Can technology ensure a much greater supply working capital: offsetting the contraction that has followed the post-crisis re-regulation of banking and avoiding the possibility of another collapse in the supply of working capital finance such as that which contributed so substantially to the post-crisis global downturn of 2018–2019? Can this increase the supply of the more sophisticated forms of working capital finance set out in Table 2, providing credit for longer periods or at lower risk and cost than the current generation of technology-enabled short-term high-margin lines of credit being provided to microbusinesses?

Our judgement is that this can happen, but it will require vigorous and far-sighted policy intervention, in order to support a much greater range of alternatives to bank provision of working capital finance. We can refer to Open Banking in the UK as an example of the kind of measures that are likely to be necessary. Open Banking means that bank customers are able to securely release their banking data to third parties, including non-bank credit providers, opening up a range of new potential customer services.¹⁹ This has employed competition law to force UK banks to work together to produce standardised application programming interfaces (APIs) that will work across the industry to support Open Banking. A fully competitive market in working capital finance will in our view require similar technological standardisation to support open access to and analysis of accounting records and for the digitisation and e-documentation of purchase orders and invoices.

The struggle of Amazon Lending to gain traction indicates that a pure ‘big data’ strategy based on internet traffic is not enough to offset the advantages that banks have in providing working capital finance through their access to banking transaction information. Without a broad policy to promote standardised access to accounting and supply chain as well as banking data, non-bank lenders will continue to face an un-level playing field against banks in most aspects of working capital finance.

¹⁹ For discussion of the potential benefits of UK Open Banking, see The Open Data Institute and Fingleton (2019).

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