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# Impact of financial literacy, perceived access to finance, ICT use, and digitization on credit constraints: evidence from Qatari MSME importers

Lanouar Charfeddine<sup>1\*</sup>, Mohamed Ismail Umlai<sup>2</sup> and Mazen El-Masri<sup>3</sup>

\*Correspondence:  
lcharfeddine@qu.edu.qa

<sup>1</sup> Center for Entrepreneurship and Organizational Excellence, College of Business and Economics, Qatar University, P.O. Box 2713, Doha, Qatar

<sup>2</sup> Department of Finance and Economics, College of Business and Economics, Qatar University, Doha, Qatar

<sup>3</sup> Department of Accounting and Information Systems, College of Business and Economics, Qatar University, Doha, Qatar

## Abstract

This study investigates the role of financial literacy (FL), perceived access to finance (PAF), information communication technology (ICT) usage, and digitization in alleviating the level of credit constraint that micro, small, and medium enterprises (MSMEs) face in an emerging market. We draw on the economic research theories of human capital, knowledge-based view, and lifecycle hypothesis to explain the relationship between the variables. Using survey data collected from 333 MSME importers in Qatar—a country with heavy reliance on foreign goods—we find strong evidence that FL, PAF, ICT usage, and digitization are key determinants of Qatari MSME access to credit. In particular, PAF and FL are significant and have their expected signs in almost all the Probit regressions. For ICT usage and digitization, although they are key determinants of credit constraints, the findings are more sensitive and dependent on the type of financing and the resulting type of credit constraint.

**Keywords:** Credit constraints, Financial literacy, Perceived access to finance, ICT usage, Digitization, Qatari MSMEs

**JEL Classification:** D21, D22, D25, D83, E51

## Introduction

In the entrepreneurship literature, micro, small, and medium enterprises (MSMEs) play a significant role in job creation, innovation, and economic growth (Beck and Demirguc-Kunt 2006; Ferrando et al. 2017; Al-Azzam and Charfeddine 2022; Charfeddine and Zaouali 2022). For instance, according to the World Bank, 600 million jobs will be required by 2030 to cope with the rapidly expanding global workforce—a demand that MSMEs are expected to satisfy (World Bank 2021). However, due to their limited access to finance, MSMEs are facing substantial challenges that hinder their ability to fulfill this mission and benefit from existing opportunities to sustain their growth (Adian et al. 2020, World Bank 2020). Some of the factors that limit MSMEs' ability to access finance (formal internal or external funds) are the lack of collateral, the absence of or

limited credit history, high-risk perception (Bonfim et al. 2023), information asymmetry (Long et al. 2022), lack of financial management skills, low creditworthiness (Lagazio et al. 2021), difficulties in finding suitable manpower (Contreras et al. 2023), and lack of angel investors or venture capitalists. Such credit obstacles can easily lead MSMEs to be credit-constrained. This study adopts a four-part definition of a credit-constrained firm. This includes a firm that either “declared a positive demand for bank financing in the last 2 years but did not apply because of possible rejection, it applied and its loan application was rejected, it applied and got less than 75% of the requested amount, or it refused the loan because the cost was too high” (Ferrando et al. 2017).

Credit constraints have devastating effects on income growth, income inequality, and finance repayment for firms worldwide (Abdulaziz et al. 2020). However, if an MSME cannot have access to adequate financing, its role in fulfilling local demands and exports and thus contributing to the global economy would be considerably jeopardized. To enhance MSMEs’ contribution to the private sector, governments often provide monetary and technological support initiatives (Doh and Kim 2014). Despite this, MSMEs regularly find themselves credit-constrained—unable to access formal sources of financing (i.e., from banks), forcing them to rely on informal sources (i.e., personal savings or family and friends) to fund their supply chains and operations (Chavis et al. 2011).

Lack of access to external financing serves as “a nail in the coffin” for many MSMEs that are either frequently denied credit, credit rationed, offered high financing rates (price rationed), or discouraged from applying (Ferrando et al. 2017). Credit constraints of this nature hamper MSMEs’ ability for growth and are commonly cited as a main driver of their high failure rates (Beck and Demirguc-Kunt 2006; Fatoki and Odeymi 2011; Mach and Wolken 2012). In developing market economies alone, the unmet financing needs of MSMEs are reported to be US\$ 4.5 trillion annually, leading to a staggering 65 million credit-constrained firms (International Finance Corporation 2017). Furthermore, credit constraints are more pronounced during recessionary periods (Bernanke et al. 1996; Dimitrov and Tice 2006) due to finance flowing from MSMEs to larger and more financially secure firms in an apparent flight-to-quality (Psillaki and Eleftheriou 2015).

While there are abundant empirical investigations on MSMEs’ credit constraints in developed countries (Ferrando et al. 2017; Domeher et al. 2017), only a few have looked at factors of MSMEs’ credit constraints in developing or emerging economies. In this study, we attempt to fill this gap in the empirical literature by investigating the impact of both systematic and unsystematic factors that affect the credit constraint of importer MSMEs in Qatar, which is located on the northeastern coast of the Arabian Peninsula and among the highest GDP per capita countries in the world. The existing literature highlights a host of factors that can significantly determine the level of credit constraints experienced by MSMEs. Generally, these factors can be classified under systematic (lie outside MSMEs locus of control) and unsystematic or firm-specific factors. Studies that have examined the systematic factors mainly investigated the behavior of financial institutions (FIs) during times of economic turmoil. For instance, Paulet et al. (2014) found that FIs choose MSMEs they lend to voluntarily and biasedly, contrary to existing monetary policies in their locality. Moreover, lending is largely dependent on established trust between the loan managers of FIs and MSMEs (Moro and Fink 2013). Braun et al. (2019)

found that an MSME has a better chance of securing external financing if there are interlocking directorates or mutual networks between themselves and the lender/Fl.

Studies that investigate unsystematic factors of credit constraints start with an examination of characteristics that are intrinsic to a firm. These include factors such as firm size and age, revenue growth, business activity, and ownership type (Nguyen et al. 2019). For example, the age and size of MSMEs are highly correlated to credit constraints, where a more adverse effect is recorded for smaller and younger MSMEs (Byiers et al. 2010; Chavis et al. 2011; Kira 2013). Recently, due to the rapid world-changing environment, new types of unsystematic factors have been identified as playing key roles in enhancing and facilitating MSME financing. These factors mainly include perceived access to finance (PAF), financial literacy (FL), ICT, and digitization. Despite their importance, the finance literature investigating the impact of these factors on MSMEs' credit constraints is scarce, especially with regard to oil-dependent economies such as Qatar.

The first factor, PAF, refers to the confidence and capability of MSMEs' decision-makers in securing external finance (Canton et al. 2013). PAF is a subjective perception of the owners or managers of MSMEs. It serves as a measure of their confidence in their ability to access financial products and services. In the finance literature, this factor has been demonstrated to have a significant impact on younger and smaller MSMEs (Canton et al. 2013) as an unsystematic factor. Research has indicated that PAF can result in unwarranted financial hardships that are even more detrimental than actual financial constraints (Ferrando and Mulier 2015).

The second unsystematic factor that has recently attracted attention in the access to finance literature is the degree of the FL of MSMEs' decision-makers and their financial competency in funding requests. FL has recently emerged as a key determinant of access to finance. For instance, FL can significantly contribute to the likelihood of a firm being credit-constrained (Marriott and Mellett 1996; Lusardi and Mitchell 2014; Derbyshire 2016; Ripain et al. 2017). While no well-defined standard definition of FL exists, a simple one is provided by Lusardi and Mitchell (2014), who defined FL as "the knowledge of basic financial concepts and ability to simple calculations..." Another definition that is more appropriate for the case of MSMEs and entrepreneurs is that of Marriott and Mellett (1996), who defined FL as "the capacity of a manager to understand and analyze financial data to take appropriate financial decisions..." (see Derbyshire 2016; and Ripain et al. 2017). In summary, FL stresses the fact that the owner or an MSME manager should have the necessary financial knowledge and understanding of both basic and advanced financial concepts, such as accounting, managing and planning budgets, cost analysis, financial management, arranging for collaterals, mitigating risks, and predicting and assessing capital requirements and financing needs. As highlighted by many authors, if MSMEs' decision-makers are financially illiterate, they will be unable to make informed financial decisions, which will affect their likelihood of access to finance, making them vulnerable and credit-constrained (Fatoki and Odeymi 2011; Drexler et al. 2014; Adomako et al. 2016).

The last two unsystematic factors that have a significant impact on access to finance are ICT usage and digitization (Masanet and Matthews 2010; Brennen and Kreiss 2016; Ross 2017). In the literature, there have been several attempts to define these

two concepts, for instance, Masanet and Matthews (2010) defined ICT as systems that involve “generation, processing, storage, communication, and/or presentation of digital information.” Regarding digitization, based on the study by Hsu (2007), Coreynen et al. (2017) defined it as “the increasing use of digital technologies for connecting people, systems, companies, products and services” (see also the studies by Brennen and Kreiss (2016) and Ross (2017) for other definitions). In previous studies, it is well acknowledged that the integration of ICT and digital technologies into financial services has helped to revolutionize the financial sector. MSMEs benefit from the availability of new financial digital products to ease credit conditions, reduce asymmetric information and costs, and facilitate financial risk assessments and monitoring. Therefore, the adequate use of ICTs by MSMEs in their financial application activities warrants investigation. It has been demonstrated that firms which incorporate higher levels of ICT adoption or digitalization have improved access to finance (Mushtaq et al. 2021) and a reduced likelihood of being credit-constrained (Sheng 2021).

PAF and FL represent the *financial astuteness* of decision-makers in MSMEs, while ICT use and digitization denote the *digital capitalization* of such organizations. Only a few studies have investigated these concepts in tandem with MSMEs’ credit constraints (see Nkundabanyanga et al. 2014).

The contribution of our study to the existing literature on access to finance is four-fold. First, to the best of our knowledge, this is the only study to empirically investigate MSMEs’ credit constraints in an emerging market country in the Gulf Cooperation Council (GCC) region. Specifically, we focus on the state of Qatar—a resource-rich nation that is striving to diversify its economy from reliance on hydrocarbon sales by bolstering support for MSMEs, which is the core of the private sector (Qatar Development Bank [QDB] 2020). For instance, according to a 2020 national MSME survey, only 13% of firms in the country reported using bank financing to start their operations despite the country’s efforts to provide high accessibility to knowledge and finance as well as a supportive regulatory framework. Personal savings continue to be the main source of financing for MSMEs, with 76% in 2020 compared with 62% in 2016 when a similar survey was conducted (QDB 2018, 2020). Moreover, reports on Qatar’s banking sector revealed improved domestic liquidity conditions that reduce banks’ reliance on external funding (Fitch 2022). For instance, from Q1 of 2020 to Q1 of 2022, the Qatar Central Bank dropped interest rates to 2.5%, thereby increasing bank competition in the financial sector, maximizing the lending capabilities of banks, and increasing consumer spending power so that MSME importers can benefit from FIs’ financing and higher domestic demand for products. Despite the encouraging lending conditions, challenges for MSMEs in obtaining bank loans to finance their establishments still exist. Some of these challenges are linked to the issues of financial astuteness and digital capitalization among MSMEs.

Second, this work differentiates itself from prior studies by focusing exclusively on MSME importers. Qatar is highly dependent on imports for its food and nonfood consumer goods demand, valued at US\$ 28.6 billion in 2019, which is 177% more than its non-oil exports of \$10.3 billion in the same year (UN Comtrade 2019). In 2017, Qatar was blockaded by key neighboring countries in a largely unforeseen move, cutting off its sole land border and trading route. They also banned cargo ships destined for the

country from docking at blockading nation ports (Charfeddine and Umlai 2020). In response, Qatari MSMEs witnessed an increased backing of national products, industry, and services by the government as well as major expansions to existing ports to bolster food security from non-GCC imports (QDB 2020). The country has also seen a doubling down on digital transformation and ICT investment initiatives after the advent of the coronavirus (COVID-19) pandemic, encouraging MSMEs to take a more digitized approach to doing business (QDB 2020).

Third, we contribute to the literature by investigating whether and how significantly the impact of PAF, FL, ICT usage, and digitization differ between the types of credit constraints identified in the literature (i.e., denied, amount or price rationed, and discouraged) and across financial types (i.e., credit lines (CL)/bank overdrafts, bank loans (BL), trade credit (TC), and other financing types (OF)). The results will enable us to have important insights into the nature of the constraints that Qatari importers face and propose policies to support MSMEs' access to finance. For instance, promoting digitization and ICT usage can significantly foster or hinder MSMEs' access to credit. We also recommend better information sharing among the different Qatari stakeholders to reduce information asymmetry and prevent financing applications from being denied, rationed, or allocated unattractive rates. Our study also recommends tapping into the power of FinTech (financial technology) via the incorporation of artificial intelligence and blockchain technology to offer and provide MSMEs with nontraditional access to credit through crowdfunding, peer-to-peer lending, and initial coin offering initiatives.

Fourth, we contribute to research on access to credit for MSMEs of emerging markets in general. Although it is a country with unique characteristics, our findings for Qatar can also apply to other emerging markets, such as Qatar's immediate neighbors, i.e., countries of the GCC. Bahrain, Oman, Kuwait, Saudi Arabia, and the United Arab Emirates have several commonalities with Qatar with respect to culture and language, dependence on natural resource extraction to power their economies, and the nature of governmental subsidies offered to MSMEs. Moreover, our findings can apply to emerging oil/gas-rich nations in other regions, such as Algeria and Libya in the Middle East and North African region as well as Colombia, Ecuador, and Venezuela in South America, despite having different cultures.

The rest of this study is organized as follows. Section "[Literature review and hypotheses development](#)" presents a review of the credit constraint literature on the unsystematic factors for MSMEs and the hypotheses to be tested. Section "[Materials and methods](#)" describes our data collection methodology and the econometric approach taken. In "[results and discussion](#)" section, we present our findings and discuss them in line with the relevant literature. The paper concludes with "[Conclusion and policy recommendations](#)" section, presenting recommendations for Qatari policymakers and guidance for future studies.

### **Literature review and hypotheses development**

Understanding the main determinants of MSMEs' access to finance is vital for governments that wish to promote MSMEs as the dominant drivers of innovation, growth, and employment in their local economies. Reliance of MSMEs on TC and financing from FIs for survival and growth has been demonstrated in the literature (Rossi 2017;

McGuinness et al. 2018). For example, McGuinness et al. (2018) found that MSMEs' survival in Europe from 2003 to 2012 was positively impacted by TC. Aside from the worsening of access to financing during times of economic turbulence (Rossi 2017), the extant literature points to several factors that affect the level of credit constraints MSMEs face.

In emerging and developed markets, only a few studies have investigated the difficulties in accessing finance among MSMEs. Using generalized method of moments, Ergün and Doruk (2020) investigated whether family-owned firms possessed advantages over nonfamily-owned manufacturing firms in access to finance in Turkey. The authors found that the latter faced severe growth obstacles due to financing constraints, whereas the effect was not present for the former as they were in the control of powerful and established family groups. A recent study by Hamarat and Broby (2022) found that innovations such as peer-to-peer lending by financial technology firms have helped small businesses in the US gain access to finance from nontraditional sources.

However, despite the importance of the three dimensions of PAF, FL, and level of ICT usage/digitization in explaining access to finance, only a few studies have explored their impact using real data. The next three subsections provide an exhaustive review of the literature on each of our three dimensions and credit constraints and develop the hypotheses to be tested.

#### **PAF and credit constraints**

We operationalize the relationship between PAF and whether a firm is credit-constrained using the theory of “discouraged borrowers” (Kon and Storey 2003). In this case, discouraged borrowers represent MSMEs that desire financing but fear their applications will be rejected by FIs and are thus reluctant to apply (Canton et al. 2013). According to Kwong et al. (2012), “perceptions, even when false, can be as damaging as the presence of an actual barrier.” Oddly, this apprehension of being rejected may occur even with creditworthy MSMEs (Kon and Storey 2003; Han et al. 2009) and is thus not necessarily linked to having a weak financial status.

Previous empirical studies have pointed to several factors that can affect how MSMEs or their managers perceive their ability to access finance from FIs. For instance, finance managers may perceive lending terms from FIs as inflexible or accompanied by unfair interest rates (Nkundabayanga et al. 2014). Firms that cannot borrow from FIs have limited recourse to financing and must rely on informal sources to fund their businesses/operations, thereby increasing the likelihood of facing future financial difficulties. Ferrando and Mulier (2015) found that low PAF increases the probability of being credit-constrained. Moreover, Moscalu et al. (2020) demonstrated that the negative effects of lower PAF are even stronger in absolute value than actual financing constraints. Their findings reinforce the notion that some MSMEs can become credit-constrained due to unfounded fears or be discouraged from borrowing despite being creditworthy. Conversely, firms that actively seek out external financing (i.e., due to higher PAF) become less financially constrained over time, according to a European Central Bank study by Bańkowska et al. (2020).

A lower PAF is predominantly common in smaller-sized and younger organizations (Chivas et al. 2011). Previous studies have revealed that the impact of PAF on the credit

constraint levels of MSMEs is significantly dependent on ownership type and the sector in which an MSME operates (Canton et al. 2013; Gamage 2013). Furthermore, the perception of an MSME's ability to access financing seems to depend significantly on global and country-level economic uncertainty (Calabrese et al. 2020). A prime example of this was exhibited during the recent economic downturn resulting from the lockdowns during the COVID-19 pandemic (Bańkowska et al. 2020; Corredera-Catalán et al. 2021). This indicates that Qatari MSMEs with low PAF have a higher probability of being credit-constrained than those with higher PAF. Therefore, we formulate the following hypothesis about credit constraint:

*H1* MSMEs' PAF is inversely related to being credit-constrained.

### **FL and credit constraints**

In the finance literature, although the relationship between FL and financial outcomes for individuals has been investigated (see Hilgert and Hogarth 2003; Lusardi and Mitchell 2007; Remund 2010; Abreu and Mendes 2010), focus on FL from the perspective of MSMEs is limited. According to the International Monetary Fund, a lack of awareness or understanding of available financial products can exclude potential enterprises from the financial system (Barajas et al. 2020). In developing countries/emerging markets, FL is essential in the development of innovative financial products, offering new services, and capturing new consumers (Miller et al. 2009). FL and expertise in the form of managerial human capital have been demonstrated to be particularly relevant in the developing country context (Drexler et al. 2014).

Although there is no direct mechanism through which FL affects access to finance (Twumasi et al. 2022), several theories such as human capital, knowledge-based view, and life cycle hypothesis can help explain how higher FL can reduce the level of credit constraints MSMEs face. These three theories suggest that MSMEs' access to finance is influenced by FL through a firm's unique knowledge and capabilities, its stage in the life cycle, and the skills and education of its workforce. Firms that can demonstrate FL via their strengths in these areas reflect a better ability to obtain financing.

### ***Knowledge-based view theory (KBV)***

The KBV theory suggests that firms' knowledge and capabilities play a crucial role in their success and competitiveness. Knowledge is an intangible asset/resource that can offer a competitive advantage and enable the making of optimal financial decisions (Das 2000). FL can be considered a knowledge resource that can influence the value creation and performance of firms (Kulathunga et al. 2019). Managers enhance their firms' capabilities by updating or advancing knowledge (Nickerson and Zenger 2004). More specifically, financially literate managers are expected to make effective use of debt/TC to grow their businesses. Therefore, FL is an enabling resource that can mitigate information asymmetry, reduce the need for collateral, and enhance negotiation powers when requesting access to external finance (Hussein et al. 2018). According to García-Pérez-de-Lema et al. (2021), FL among MSME management has both a direct and an indirect impact on alleviating financial constraints. MSMEs can leverage their unique knowledge

and capabilities to gain a competitive advantage, but they need to continuously invest in developing and updating their knowledge and skills to stay ahead. In the context of MSMEs, knowledge and capabilities, i.e., FL, can facilitate their access to credit necessary for development.

#### ***Life cycle hypothesis (LCH)***

The LCH posits that sound and rational individuals will preserve a portion of their income, organizing their financing and consumption patterns to maintain marginal utility for the future (Lusardi and Mitchell 2014). As FL can be linked to the level of participation or engagement with financial services, LCH can be used to explain how financial decisions are made over time (Lusardi and Mitchell 2014). Firms go through different stages of development, and their financing needs change accordingly. MSMEs, especially in their early stages, may struggle to access credit due to limited collateral and a weak financial track record. However, as MSMEs grow and mature, they may become more attractive to traditional lenders, making access to credit easier. Firms that are financially literate with regard to when to use their own funds or borrow from external sources can mitigate the level of credit constraints they face. The literature presents a two-sided approach through which FL impacts access to finance. On the one hand, a positive effect is observed of broadened financial knowledge and understanding that increases savings and investments, allowing for a better ability to cope with financial challenges (van Rooij et al. 2011). On the other hand, especially in developing countries, FL may lead to the use of financial services at more frequent intervals to smooth income instead of accumulating capital when facing financial challenges (Twumasi et al. 2022). Thus, FL can help MSMEs navigate the financing landscape and make informed decisions about when and how to access credit.

#### ***Human capital theory (HCT)***

The HCT views human capital as a key driver of economic growth and productivity. Lusardi and Michell (2014) consider financial knowledge as a type of investment in human capital. MSMEs are often started and run by entrepreneurs, who bring their own human capital, such as skills, knowledge, and experience, to the table. The reliance and placement of finance professionals to steer a business toward healthy financial well-being is a good representation of FL in firms. Additionally, for MSMEs, FL is an essential skill and resource to sustain competitiveness in the market (Mason and Brown 2013). An adequate level of FL allows the recognition that seeking consultancy services may be required to handle complex financial decisions (Lusardi and Mitchell 2014). Therefore, FL resulting from MSMEs' investment in human capital should facilitate optimal financial decisions regarding the use of debt/external financing. On the contrary, financial illiteracy is likely to lead to challenges in MSME debt management, savings, and credit because of inadequate planning (Nkundabayanga et al. 2014), leading them to become financially constrained.

In summary, FL facilitates access to credit through different channels, depending on the focus, angle, and theory considered. Moreover, the interplay between KBV, LCH, and HCT highlights the importance of FL in promoting access to credit for MSMEs.



These concepts can help MSMEs navigate the business environment, make informed financial decisions, and facilitate access to the resources they need to grow and succeed. This indicates that Qatari MSMEs that demonstrate financial illiteracy are more likely to be credit-constrained than MSMEs that demonstrate FL. Therefore, we formulate the following hypothesis about FL and credit constraints:

*H2* MSMEs' FL is negatively related to being credit-constrained.

### **ICT usage, digitization, and credit constraints**

ICT or digitization can provide firms with greater efficiency and cost reduction in their operations. The relationships between ICT usage and credit constraints as well as digitization and credit constraints are worth exploring in the context of Qatari MSMEs. The ecological financial theory (EFT) can be used in this context to explain how ICT usage and digitization can explain access to finance/credit constraints.

### ***Ecological financial theory (EFT)***

The EFT is a framework that seeks to understand the complex relationship between FIs, the environment, and the economy. Among the theory's core concepts is that financial decisions should not be made without considering the environmental, social, and economic impacts of a particular decision (Lagoarde-Segot and Martínez 2021). In the context of MSMEs and regarding the use of ICT/digitization, the EFT recognizes the potential of technology to improve access to financial services such as credit for firms operating in under-resourced or financially constrained communities. Effective use of ICTs can aid MSMEs to become more creditworthy by better managing their finances with software/financing platforms.

### ***ICT usage and credit constraints***

ICT can provide firms with greater efficiency and operational cost reduction. A firm's ICT capacity can be determined by its online presence, the number of e-commerce activities, and the proportion of employees with broadband access or post-secondary certification in ICT education (Hagsten and Kotnik 2017). Empirically, it has been demonstrated that ICT enhances decision quality through its effect on access to finance (Singh and Maiti 2020). Using World Bank Enterprise Survey data, recently, Mushtaq et al. (2021) found that ICT adoption and innovation positively influence an MSME's access to finance. Their findings are consistent with the resource-based theory, which is related to KBV, in that greater access to and use of technological resources are more likely to facilitate a firm's access to finance from FIs (Mushtaq et al. 2021). These findings are also consistent with the notion that ICT adoption reduces information asymmetry, making lenders/FIs more willing to finance the capital needs of MSMEs, thereby lowering the probability of being constrained. This indicates that Qatari MSMEs that demonstrate minimal ICT usage are more likely to be credit-constrained than MSMEs that have advanced ICT usage. Therefore, we formulate the following hypothesis about ICT use and credit constraints:

*H3* MSMEs' ICT usage is negatively related to being credit-constrained.

### ***Digitization and credit constraints***

Firms are increasingly making use of digital finance technology to secure funding for their operations. Crowdfunding, peer-to-peer lending, and initial coin offerings are some of the many digitization tools that have developed under the broader umbrella of FinTech (Bollaert et al. 2021). These technologies are increasingly challenging the traditional roles of financial intermediation and are expected to have profound effects on access to credit for MSMEs. For instance, entrepreneurial startups that face financial constraints can seek crowdfunding to alleviate cash flow problems during the research and development stages (Bollaert et al. 2021) as opposed to approaching FIs for their needs. FinTech has also quite heavily diffused into trade financing and supply chain financing. According to Ali et al. (2020), trade digitization has a strengthening effect on the relationship between supply chain financing and firm performance. To capture a portion of the rapidly evolving digital finance industry, FIs offer online trading platforms for MSMEs to apply for financing. Thus, Qatari MSMEs that demonstrate less digitization, i.e., not using online portals, are more likely to be credit-constrained than MSMEs that are highly digitized. Based on the discussion above, we formulate the following hypothesis about digitization and credit constraints:

*H4* MSMEs' use of digital finance or digitization is negatively related to being credit-constrained.

## **Materials and methods**

### **Data and variables construction**

In this study, we aim to assess the systematic and unsystematic factors affecting credit constraints by focusing our analysis on Qatari MSMEs. The focus on MSMEs is mainly motivated by the aim of Qatari policymakers to diversify Qatar's economy by lessening its dependence on oil and gas revenues. The Qatar National Vision 2030 considers that the development of the Qatar private sector is a pre-condition for diversifying and sustaining the Qatari economy. Thus, Qatar's government has developed several measures and supports for new enterprises. For instance, MSMEs in the country can retain much of their profit due to the relatively young tax culture. The country's General Tax Authority (GTA) began urging non-listed firms to file their annual financial information in 2017 (GTA 2017). The GTA also frequently grants MSMEs grace periods to file their earnings, while fully owned subsidiaries of listed entities are taxable to the extent of nonexempt ownership (i.e., foreign or nonexempt Qatari/GCC ownership).<sup>1</sup>

In conducting this study, we aim to assess the perceptions of financial managers working in MSMEs that primarily import goods into Qatar. To achieve this objective, we conducted a survey consisting of questions adapted from the European Central Bank's "Survey on the Access to Finance of Enterprises," which is widely used in the literature on MSME constraints (see Ferrando et al. (2017), Moscalu et al. (2020), and Bańkowska et al. (2020)). Furthermore, we incorporated questions from the studies by Mabula and Ping (2018) and Nengomasha (2018) into our survey to gain insights from MSME finance managers regarding their levels of FL and perceived ability to access bank financing.

<sup>1</sup> Moreover, although its neighbors have already begun, Qatar has yet to fully implement Value Added Tax (VAT) for imported goods. In 2019, a 'sin tax' of 100% for tobacco products and 50% for energy and carbonated beverages went into effect.

Our full sample consisted of 382 individual Qatar importers,<sup>2</sup> of which 96% (i.e., 366 firms) were classified as MSMEs. Our sample is representative of the Qatari MSME population, as 98% of all private companies registered in Qatar fall under the definition of SMEs, according to statistics from the QDB (2020). Moreover, to ensure a representative sample and reduce selection bias by type of enterprise (micro, small, and medium) and by activity, we engaged a professional data collection company,<sup>3</sup> which randomly selected importer MSMEs operating in various sectors in Qatar using a stratified strategy.

### **Credit constraint variables**

Next, we identified whether the firms applied for any of the following four financing types in the past two years: CL, BL, TC, and OF (i.e., equity and debt securities, leasing, factoring, intercompany loans, etc.). Approximately 53.2% of firms in our sample applied for such financing, while 45.1% did not. By carefully examining the justifications given by firms for not applying, we formed a subsample of 333 firms that had a “positive demand for financing.” This included by default firms that applied and a portion of firms that did not apply due to “fear of rejection” (considered to be a representation of *discouraged firms*) as well as firms that did not apply because of “other reasons.” Unlike firms that did not apply due to “sufficient funds,” we consider the former justifications to be indicative of a need for financing.

“Constrained firm” is our main dependent variable<sup>4</sup> and is represented by a dummy variable that takes the value of 1 in any of the following four scenarios:

- A firm’s application for financing was denied (“denied”),
- A firm received less than 75% of the financing amount it requested (“amount rationed”),
- A firm refused the financing offer due to high premiums demanded from the FI/lender (“price rationed”), or
- A firm did not apply for financing because it feared its application was going to be rejected (i.e., “discouraged”).

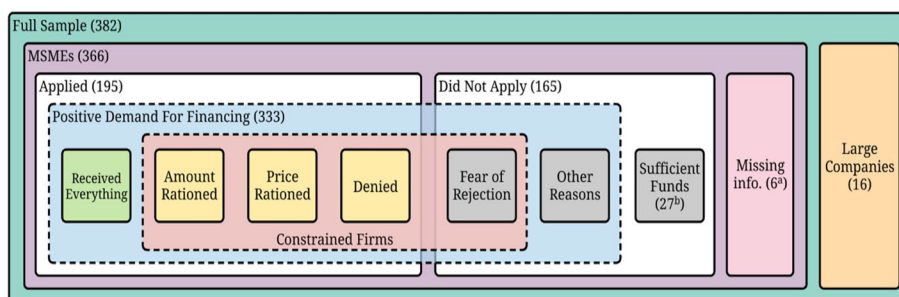
Figure 1 illustrates the composition of our overall sample and subsamples relevant to our analysis.

The dependent variable takes the value of 0 if a firm’s application for CL, BL, TC, or OF was approved in the past two years and obtained the full amount requested (“received everything”). Firms that cited “other reasons” for not applying for financing despite their positive demand for it were also assigned a value of 0 as they cannot be considered constrained per se. As will be elaborated on in “[Econometric models](#)” section, we also performed econometric analyses focusing on the type of constraint firms experienced in their access to finance by generating additional dependent variables based on the four constrained scenarios. The notation below depicts how our dependent variables were coded:

<sup>2</sup> The full initial sample consist of 403 received questionnaires were among them 21 questionnaires were dropped due to missing data. It is also important to note that the high rate of responses and low number of questionnaires with missed data is explained by the fact that the data was collected by the Ipsos professional data collection company.

<sup>3</sup> Ipsos is a global market research and public opinion collection agency headquartered in Paris, France.

<sup>4</sup> Appendix Table 11 provides definitions of all variables used in our analysis.



**Fig. 1** Sample construction. <sup>a</sup>Firms that neither mentioned applying nor specified reasons for not applying for financing were considered to have missing information and therefore excluded from the MSME sample of interest. This represented 1.6% of the total MSME sample. <sup>b</sup>Approximately 4.4% of firms in the MSME sample cited ‘sufficient funds’ as their reason for not applying for any type of financing. We exclude this category of firms from our sample of analysis considering they did not express a positive demand for financing and would be unconstrained by default

$$FT_{cons} = \begin{cases} 1 & \text{if } \bigcup_{i \in CT} FT_i = 1 \\ 0 & \text{Otherwise} \end{cases}$$

FT = LC or BL or TC or OF; CT = Amount Rationed or Price Rationed or Denied or Discouraged; (N.B. constrained abbreviated to “cons”).

As an illustration of the above coding, if a firm applied for BL and had their application denied,  $FT_i$  is substituted with  $BL_{denied}$  and equals 1, thereby allowing  $FT_{cons}$  to take a value of 1 as well (indicating a constrained firm). If a firm had received everything or did not apply because of other reasons,  $FT_{cons}$  takes a value of 0.

**PAF and FL**

We construct two additional variables—PAF and FL—using the polychoric principal component analysis (PPCA) technique. The use of the PPCA is mainly motivated by its ability to accommodate categorical data compared with the standard principal component analysis (PCA) technique (Kolenikov and Angeles 2004, 2009). For instance, the PPCA increases the explanatory power of components while accounting for violations of normality assumptions that would otherwise occur if the standard method was applied to this type of data (Phen and Brien 2019). We also conducted Kaiser–Meyer–Olkin (KMO) tests and Bartlett’s test of sphericity to verify the sampling adequacy of the PAF and FL items.

*PAF index* The PAF dimension consists of nine items adapted from the study by Bon-gomin et al. (2018) (see Table 11 in the Appendix). The respondents were asked to choose from a five-point Likert scale ranging from 1 = *strongly disagree* to 5 = *strongly agree* to rate their level of agreement with the items. The statements were framed in a negative sense, which means that higher scores indicate weak PAF among the respondents. The p-values (=0.000) from the Bartlett tests were significant at the 1% level, with the correlation matrix of the variables in our PAF dataset diverging significantly from the identity matrix. Moreover, the KMO scores for the overall dimension were strong at 0.8872, which is greater than the recommended value of 0.5 (a value indicating possible use for factor analysis) and also greater than 0.8 (a value indicating high suitability for factor

**Table 1** Results of polychoric correlation matrix and PPCA of perceived access to finance items

	PAF_1	PAF_3	PAF_5	PAF_6	PAF_7	PAF_8
<i>Panel A: Polychoric correlation matrix</i>						
PAF_1	1.0000					
PAF_3	0.6662	1.0000				
PAF_5	0.5227	0.5667	1.0000			
PAF_6	0.5592	0.5547	0.6358	1.0000		
PAF_7	0.6167	0.6280	0.6025	0.7122	1.0000	
PAF_8	0.6412	0.6100	0.5797	0.5973	0.6456	1.0000
<b>k</b>	<b>Eigenvalues</b>		<b>Proportion explained</b>		<b>Cumulative explained</b>	
<i>Panel B: Polychoric PCA</i>						
1	4.0483		0.6747		0.6747	
2	0.5634		0.0939		0.7686	
3	0.4165		0.0694		0.8380	
4	0.3820		0.0637		0.9017	
5	0.3228		0.0538		0.9555	
6	0.2671		0.0445		1.0000	

analysis) (see Kaiser (1974)). These two tests indicate that the PAF items were suitable for data reduction<sup>5</sup> (see Table 1). The results of the PPCA and PCA reveal that all the items have the positive expected sign and that only six out of the nine items (PAF\_1, PAF\_3, and PAF\_5 to PAF\_8) have high factor loadings. Moreover, based on the PPCA, we find that only the first component has an eigenvalue of 4.0483, which exceeds the unit (see Table 1). These six items explain 67.4% of the total variance of PAF in the first principal component. Finally, we calculated the alpha Cronbach for the six selected items. The result reveals an alpha Cronbach value equal to 0.8745, which is higher than the 0.8 value—the threshold for accessing suitability for conducting empirical analysis (Lance et al. 2006). The above analysis supports the construction of our PAF index based on the six retained items, as represented by the first principal component.

**FL index** The FL dimension consists of 13 items (see Table 12 in the Appendix) adapted from the study by Nengomasha (2018). The respondents were asked to choose from a five-point Likert scale ranging from 1 = *very unlikely* to 5 = *very likely*<sup>6</sup> to rate their level of agreement. A similar analysis to that of PAF was conducted for the FL variable to confirm the reliability and validity of the scale used (see Table 2). The results<sup>7</sup> from the Bartlett tests conducted for the FL items were also significant at the 1% level ( $p$  value = 0.000), with a KMO score of 0.8989, which is greater than 0.8 and indicates that it is very suitable for factor analysis (see Kaiser (1974)). This confirms the suitability of data reduction to form a composite index. The results of the PPCA and PCA of the 13 FL items also reveal that all the items have the positive expected sign and that only six out of the 13 items have high loading factors. The analysis conducted with the PPCA reveals that the seven selected items (FL\_1, FL\_5, and FL\_8 to FL\_12) loaded onto the first component of the

<sup>5</sup> Items with a commonality value of less than 0.5 were discarded during data reduction.

<sup>6</sup> Some of the FL items were measured using different five-point Likert scales, i.e., from 1 = never to 5 = always.

<sup>7</sup> All the results obtained in this paper are carried out using the software Stata 17.

**Table 2** Polychoric correlation matrix for financial literacy component

	FL_1	FL_5	FL_8	FL_9	FL_10	FL_11	FL_12
Panel A: Polychoric correlation matrix							
FL_1	1.0000						
FL_5	0.5887	1.0000					
FL_8	0.6447	0.4571	1.0000				
FL_9	0.4950	0.4156	0.7798	1.0000			
FL_10	0.5884	0.3982	0.7580	0.6748	1.0000		
FL_11	0.5280	0.4911	0.7085	0.7025	0.7433	1.0000	
FL_12	0.5418	0.4516	0.6329	0.6869	0.7256	0.7620	1.0000
k	Eigenvalues		Proportion explained		Cumulative explained (%)		
Panel B: Polychoric PCA							
1	4.7289		0.6756		67.56		
2	0.7867		0.1124		78.79		
3	0.4911		0.0702		85.81		
4	0.3781		0.0540		91.21		
5	0.2580		0.0369		94.90		
6	0.2208		0.0315		98.05		
7	0.1365		0.0195		100.00		

FL dimension, i.e., the unique component with an eigenvalue greater than 1 (= 4.7289). Moreover, we find that these seven items explain approximately 67.6% of the total variance of the FL construct. This result is also confirmed by the alpha Cronbach, which is equal to 0.9136 and is greater than the value of 0.8 (a value that indicates suitability to be used in empirical analysis) (Lance et al. 2006). This analysis confirmed that the first principal component can be used to construct the FL index using the seven retained items.

**Other variables**

In addition to the measures of credit constraints, PAF, and FL introduced in the previous subsection, several other variables were included in the empirical analysis, such as the level of ICT usage and digitalization. For ICT use, it measured the impact of the level of ICT knowledge (basic versus advanced) on the probability of being constrained. Similarly, the digitization variable consisted of a dummy variable that is equal to 1 if a firm used an online trade finance platform to apply for financing in the past two years and 0 otherwise.

Table 3 outlines the variables used in our models.

**Econometric models**

To assess the impact of PAF, FL, ICT use, and digitization on a firm being credit-constrained, we used the dichotomous probit model<sup>8</sup> as follows:

$$\begin{aligned}
 Prob(Credit_{constrained} = 1) &= \Phi(X'_i\beta + Z'_i\delta) \\
 &= \Phi(\beta_0 + \beta_1PAF_i + \beta_2FL_i + \beta_3ICTU_i + \beta_4DIGIT_i + Z'_i\delta)
 \end{aligned}$$

<sup>8</sup> As a robustness results to the Probit model, we used the Logit model and we found evidence for results consistency over the two models.

**Table 3** Variable definitions

Variables	Definition
Credit constrained	Dummy variable equal to 1 if the firm declared a positive demand for bank financing in the past 2 years, but it did not apply because of possible rejection, it applied and its loan application was rejected, it applied and got less than 75% of the requested amount, or it refused the loan because the cost was too high
Loan application denied	Dummy variable equal to 1 if in the past 2 years the firm applied for a loan and its loan application was rejected
Credit rationed	Dummy variable equal to 1 if in the past 2 years the firm applied for a loan and it got less than 75% of the requested amount
Refused due to high cost	Dummy variable equal to 1 if in the past 2 years the firm applied for a loan and it refused the loan because the cost was too high
Discouraged from applying	Dummy variable equal to 1 if the firm declared a positive demand for bank financing in the past 2 years, but it did not apply because of possible rejection
Perceived access to finance	Composite index constructed using polychoric principal component analysis (PPCA) comprising of Likert scale MSMEs responses to perceived access to finance statements
Financial literacy	PPCA composite of FL1, FL2, FL3, FL4, FL5, FL6, FL7, FL8, FL9, FL10, FL11, FL12, FL13
ICTU	Dummy variable equal to 1 if a firm has basic/advance usage of IT
Digitization	Dummy variable equal to 1 if the firm used an online trade finance platform to apply for financing in the past 2 years
Outlook better	Dummy variable equals to 1 if general economic outlook, insofar as it affects the availability of external financing is better (improved)
Capital Better	Dummy variable equals to 1 if outlook, insofar as it affects the availability of capital is better (improved)
Hcredit_better	Your enterprise's credit history in other words, your credit worthiness, that is your track record over the past 2 years (improved)
Activity_1	Dummy variable equal to 1 if a firm deals in food and beverages
Activity_2	Dummy variable equal to 1 if a firm deals in clothing and apparel
Activity_3	Dummy variable equal to 1 if a firm deals in furniture, electronics and/or home appliances
Activity_4	Dummy variable equal to 1 if a firm deals in chemical products (pharmaceutical, perfumes, beauty products, construction or industrial material)
Activity_5	Dummy variable equal to 1 if a firm deals in transportation equipment
Activity_6	Dummy variable equal to 1 if a firm deals in machinery and mechanical or electrical equipment
Activity_7	Dummy variable equal to 1 if a firm deals in optical, photographic, cinematic products
Activity_8	Dummy variable equal to 1 if a firm deals in other activities
Size_1	Dummy variable equal to 1 if a firm has 1 employee to 9 employees
Size_2	Dummy variable equal to 1 if a firm has 10 employees to 49 employees
Size_3	Dummy variable equal to 1 if a firm has 50 employees to 249 employees
Size_4	Dummy variable equal to 1 if a firm has more than 250 employees
Turn_1	Dummy variable equal to 1 if had a turnover under QAR 1 million
Turn_2	Dummy variable equal to 1 if had a turnover from QAR 1 million to 5 million
Turn_3	Dummy variable equal to 1 if had a turnover from QAR 5 million to 25 million
Turn_4	Dummy variable equal to 1 if had a turnover from QAR 25 million to 50 million
Turn_5	Dummy variable equal to 1 if had a turnover over QAR 50 million
Turn_6	Dummy variable equal to 1 if the firm was not sure or preferred not to reveal turnover figures
Age_1	Dummy variable equal to 1 if a firm was established less than or equal to 2 years ago
Age_2	Dummy variable equal to 1 if a firm was established between 2 up to and including 5 years ago
Age_3	Dummy variable equal to 1 if a firm was established between 5 up to and including 10 years ago
Age_4	Dummy variable equal to 1 if a firm was established more than 10 years ago

**Table 3** (continued)

Variables	Definition
Own_1	One owner only, that is yourself or another natural person
Own_2	Family (i.e., more than one owner)
Own_3	Other enterprises or business associates
Own_4	Member's of royal family
Own_5	Venture capital enterprises or business angels (e.g., capital from individual investors)

where the dependent variable  $Credit_{constrained}$  is a dummy variable that takes a value of 1 if an MSME is credit-constrained and 0 otherwise (see "Credit constraint variables" section).  $\beta = (\beta_1, \beta_2, \beta_3, \beta_4)$  is a vector of parameters related to the four variables of interest— $PAF$ ,  $FL$ ,  $ICTU$  and  $DIGIT$ .  $\delta = (\delta_1, \dots, \delta_k)$  is a vector of the unknown parameters related to the vector of control variables,  $Z_i$ , including both MSMEs' characteristics (activity, age, ownership, size, and turnover) and other variables describing the availability of finance and market conditions (better outlook, better history credit, better capital, and better firm outlook).  $\Phi$  is the cumulative distribution function of the standard normal distribution.

## Results and discussion

### Descriptive analysis

#### *Firm characteristics of Qatari MSMEs*

Our unique dataset on Qatari MSMEs allowed us to investigate the level of credit constraint for each type of financing. For simplicity, individual firms that were constrained in more than one financing type, as per our definition above, were categorized as constrained only once. Tables 4 and 5 provide descriptive statistics of Qatari MSMEs in our sample by financing type and constraint type.

Our sample is indicative of broader financing challenges for MSME importers in the country. Of the 333 Qatari MSMEs that declared a positive demand for financing, 35.1% were credit-constrained. This is a relatively high ratio given Qatar's economic strength and the financial support provided to MSMEs by the government. Qatar has the highest per-capita net present value of hydrocarbon reserves in the GCC region (Kabbani and Mimoune 2021).<sup>9</sup> Theoretically, the private sector should be able to take advantage of the economy's wealth and leveraging/financing opportunities available to them. On the contrary, 15.6% of Qatari MSMEs in our sample suffer from amount rationing in their financing applications, followed by 13.5% having their applications denied outright. In addition, although not as high as the former two constraints, 8.1% of MSMEs in our sample refused financing offers from lenders/FIs due to unattractive rates, with approximately 3% being discouraged from applying due to fears of being rejected.

High constraint figures for MSMEs can indicate underlying access to credit issues related to firm characteristics. Figures 2, 3, 4, 5, 6, and 7 illustrate the distribution of firms in our sample across activity type, firm size, firm turnover, firm ownership,

<sup>9</sup> As reported in the Policy Briefings Report by Brookings Doha Centre.



**Table 4** Number of firms by type of financing, constraint type and firm characteristics

Firm characteristics	CL	BL	TC	OF	Denied	AR	PR	Discouraged	Total credit constrained	% of credit constrained
Activity type										
Food and beverages	4	5	3	5	4	3	1	1	9	6.3
Clothing and apparel	1	2	1	1	0	1	2	0	2	1.4
Furniture, electronics, home appliances	16	17	11	17	13	8	7	1	25	17.4
Construction or industrial material or chemical products	15	22	11	24	15	15	5	4	37	25.7
Transportation equipment	2	1	3	2	3	1	0	2	6	4.2
Machinery and mechanical or electrical equipment	19	26	19	34	14	28	12	3	47	32.6
Optical, photographic, cinematic products	1	0	0	0	0	0	0	1	1	0.7
Other activity	10	11	9	10	9	4	6	1	17	11.8
Ownership type										
Sole Proprietorship	23	23	24	35	12	33	11	8	56	47.9
Family Business (i.e. more than one owner)	23	27	16	25	17	11	11	2	35	29.9
Other enterprises or business associates	5	6	7	7	8	5	3	0	14	12.0
Venture capital enterprises or business angels	4	9	2	10	8	3	2	0	12	10.3
SME age										
Under 5 years old	11	11	16	19	4	16	8	0	24	20.5
Between 5 and (less than 10 years old	14	21	15	20	16	16	5	6	40	34.2
More than 10 years old	30	33	18	38	25	20	14	4	53	45.3
Turnover (QAR)										
Under 1 M	18	17	14	19	11	8	11	1	24	20.5
1 M to 4,999,999	19	25	18	29	19	23	6	3	47	40.2
5 M to 24,999,999	12	13	12	18	5	18	8	2	28	23.9
25–50 M	0	1	1	3	2	2	1	0	4	3.4
Over 50 M	1	0	1	2	1	1	0	0	2	1.7
Preferred not to say	5	8	2	5	7	0	1	2	12	10.3

**Table 4** (continued)

Firm characteristics	CL	BL	TC	OF	Denied	AR	PR	Discouraged	Total credit constrained	% of credit constrained
SME size										
1–9 employees	25	20	28	36	11	30	15	3	50	42.7
10–49 employees	23	25	14	24	17	15	8	5	41	35.0
50–249 employees	7	20	7	17	17	7	4	2	26	22.2
Totals per category*	55	65	49	77	45	52	27	10	117	

N.B.: Credit Line (CL), Bank Loan (BL), Trade Credit (TC) and Other Financing (OF)

\*Constrained firms in the activity category exceed the total 117 due to 52 firms dealing in more than one category

**Table 5** Credit constraint categories statistics

	Credit line		Bank loans		Trade credit		Other financing		Overall constrained	
	#	%	#	%	#	%	#	%	#	%
Constrained	55	16.5	65	19.5	49	14.7	79	23.7	117	35.1
Denied	24	7.2	30	9.0	11	3.3	25	7.5	45	13.5
Amount rationed	8	2.4	9	2.7	22	6.6	33	9.9	52	15.6
Price rationed	18	5.4	20	6.0	14	4.2	17	5.1	27	8.1
Discouraged	4	1.2	6	1.8	2	0.6	2	0.6	10	3.0

Percentages represent the proportion of constrained firms for each financing type divided by the total number of firms in the positive demand sample i.e., 333

and firm age, respectively. Apart from one firm that did not disclose its main activity, the other 280 firms reported dealing in one activity exclusively, while 52 dealt in more than one. Relative to the number of firms dealing in the same activity and as illustrated by Fig. 2,<sup>10</sup> a large portion of MSMEs in our sample mainly import “construction, industrial or chemical products” (128 firms), followed by those that deal in “machinery, mechanical or electrical equipment” (95 firms). However, the latter category of firms had the highest level of credit constraint at 52.8%. The remainder of the firms in our sample were 28.6–36.8% credit-constrained. We expect some of these characteristics to have a bearing on a firm’s ability to access or use external financing, especially suppliers of machinery and other fixed assets that are highly dependent on financing from FIs.

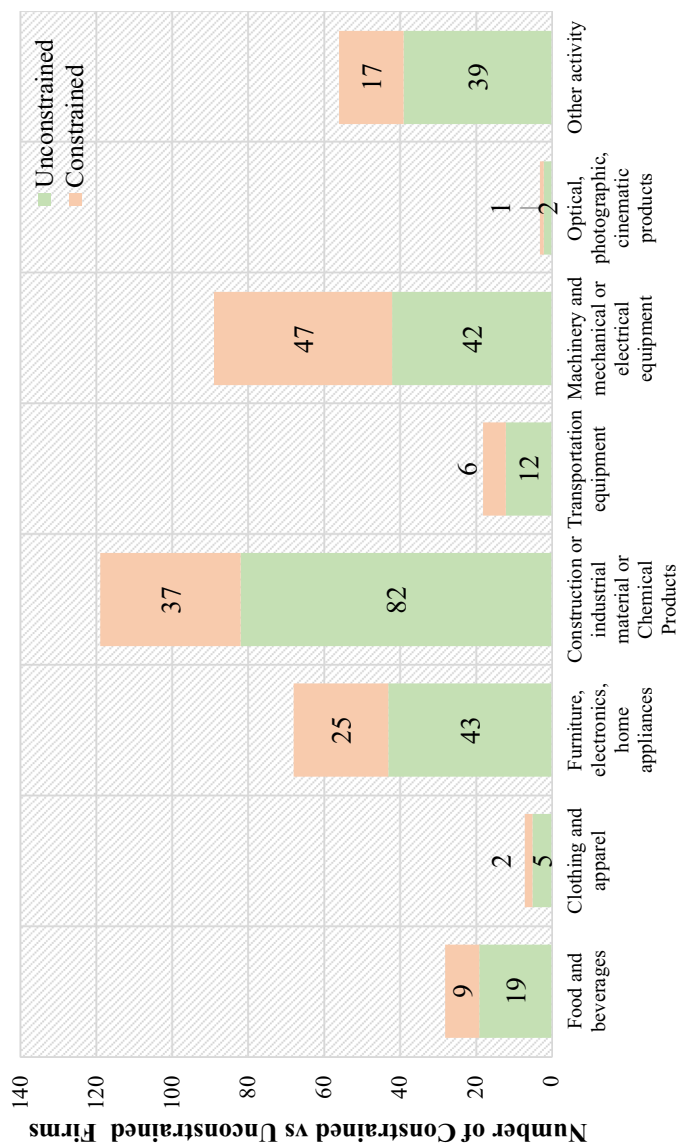
Figure 3 illustrates how credit constraints are distributed across firm size in terms of MSMEs. The former two classes, micro and small firms, make up the largest portion (84.1%), with 32.5% reporting being credit-constrained per category. As for medium-sized firms, 49.1% were constrained. These statistics suggest that although access to credit may be a greater challenge for medium-sized firms, MSMEs of all sizes in Qatar endure such financing problems.

Figure 4 illustrates credit constraints among our firm sample. A large portion of firms (33.2%) reported turnover ranging from one to five million Qatari riyals (QAR), which is closely followed by firms that reported turnover of less than one million QAR. However, in terms of credit constraints, firms that reported higher turnover figures were more constrained. An example of this is firms that reported turnover between 5 and 25 million QAR, where 47.5% were credit-constrained. Although 39<sup>11</sup> firms in our sample opted not to report the category of turnover they belonged to, 30.8% of them were credit-constrained.

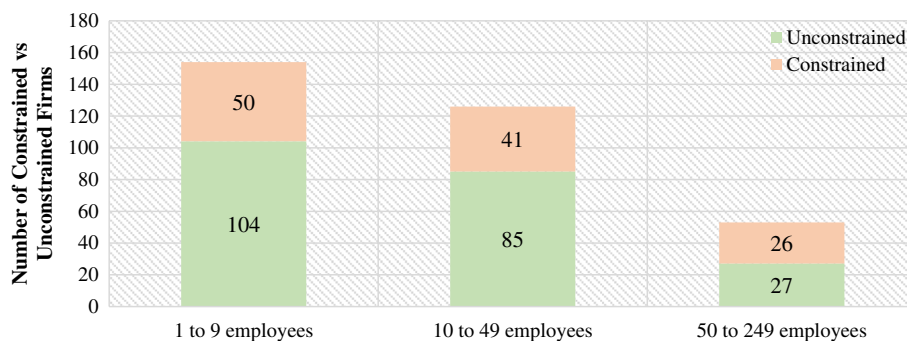
A majority (56.2%) of firms in our positive demand sample are sole proprietorships with limited liabilities, as depicted in Fig. 5. The percentage of credit-constrained firms in this category (29.9%) is almost identical to that of firms owned by other enterprises/business associates. Interestingly, family businesses (in the form of simple partnerships)

<sup>10</sup> Since firms were given the option of reporting more than one activity, MSME totals in Fig. 2 will not equal to 333. Specifically, 49, 2 and 1 firms reported dealing in two, three and four activities respectively.

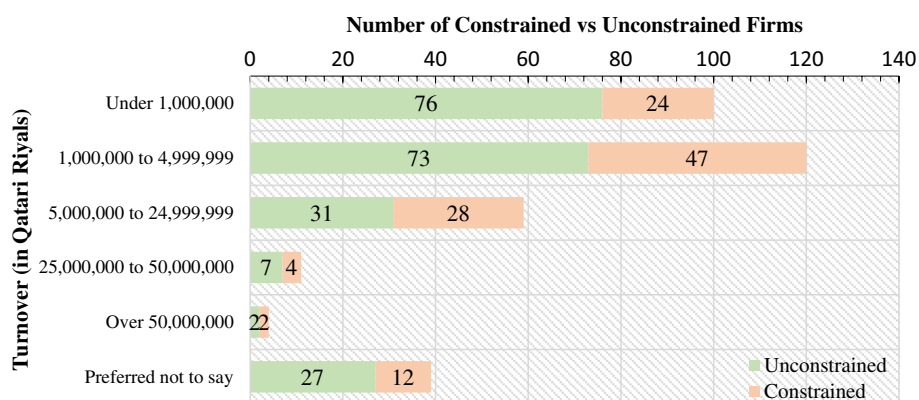
<sup>11</sup> Three firms opted out answering the turnover questions altogether, two of these firms reported being constrained regarding their financing applications. They were added to the ‘prefer not to say’ category.



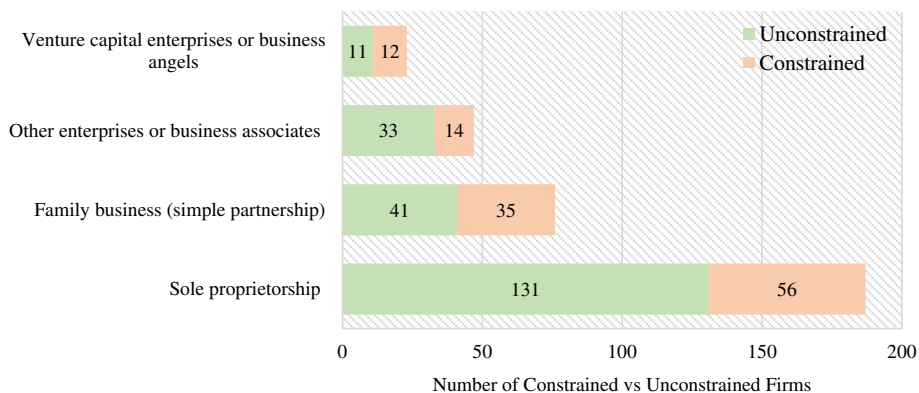
**Fig. 2** Activity types of constrained and unconstrained firms



**Fig. 3** Sizes of constrained and unconstrained firms

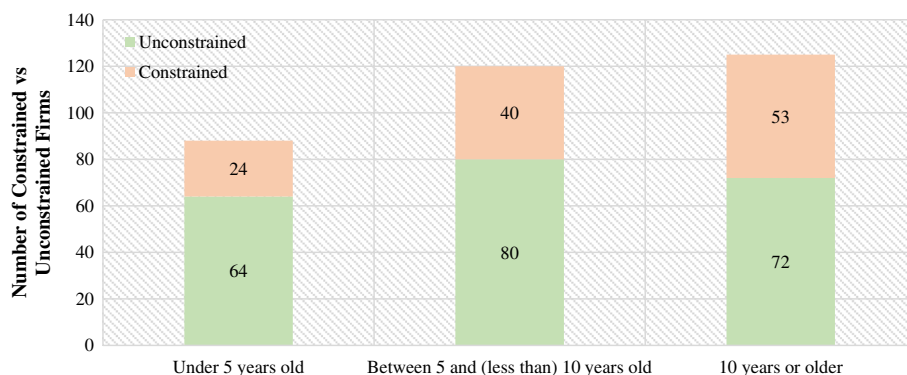


**Fig. 4** Turnover of constrained and unconstrained firms

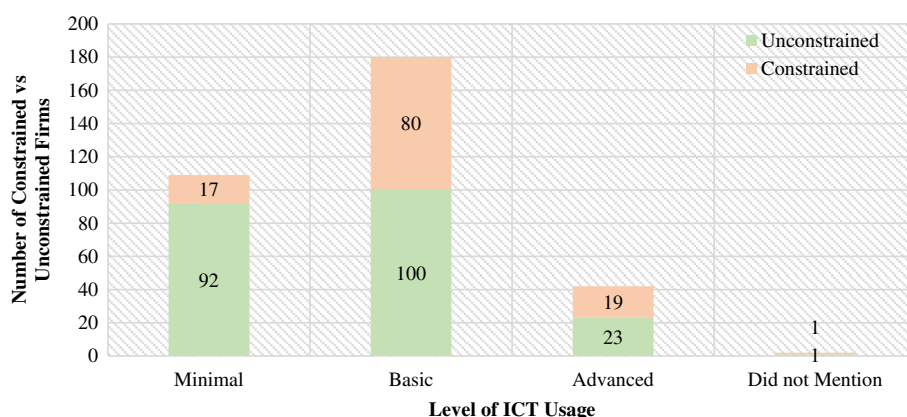


**Fig. 5** Ownership types of constrained and unconstrained firms

and venture capital enterprises are among the most credit-constrained firms in Qatar, at 46.1% and 52.2%, respectively. Although having the former category as credit-constrained is understandable, the fact that venture capital enterprises are even more constrained highlights that there are problems with their ability to access finance that are non-firm specific. Moreover, this suggests inefficiencies in decision-making by the management of MSMEs.



**Fig. 6** Ages of constrained and unconstrained firms



**Fig. 7** ICT usage of constrained and unconstrained firms

Figure 6 describes firms in our sample according to age. According to the SME literature, young firms commonly face difficulties in accessing external financing (Chivas et al. 2011). However, in our sample, Qatari MSMEs are credit-constrained across firm age at 27.3%, 33.3%, and 42.4% for under 5 years, 5–10 years, and older than 10 years firms, respectively. This serves as another indication of the underlying management problems in MSMEs in Qatar.

To determine whether the level of ICT usage had a bearing on the likelihood of being credit-constrained, we first categorize firms in our MSME sample based on minimal (applications such as MS Office or MS Outlook), basic (software to support functions such as accounting, e.g., Peachtree and Tally), and advanced usage (enterprise-level systems to manage an overall business, i.e., ERP<sup>12</sup> or CRM<sup>13</sup>). Figure 7 compares the ICT usage of constrained and unconstrained firms. A majority of firms had basic usage of ICT, representing 54.1% of firms (positive demand sample). This category is also the most credit-constrained at 68.4% compared with 14.5% and 16.2% of firms with minimal and advanced ICT usage, respectively.

<sup>12</sup> Enterprise Resource Planning (ERP).

<sup>13</sup> Customer Relationship Management (CRM).

In addition, before running and estimating the probit and logit model used as robustness, we examined several statistical properties of the collected data. First, the analysis of correlation between all the variables used in this study reveals the highest value of correlation, which is an absolute value of 0.74 between the first and second categories of size, but the relationship is negative. In terms of positive correlation, the highest value is found between “ownership 3” and “activity 8.” As the results clearly indicate that there is a possible problem of multicollinearity between variables, we ran variance inflation factor tests, confirming conclusions drawn from the results of the correlation matrix. Finally, we tested for the normality of all the variables in our model. As most of our variables are categorical, the hypothesis of normality is rejected for almost all the variables.<sup>14</sup>

### **Econometric results**

The main results of the probit (logit) regressions using our overall sample and categorization by financing type—CL, BL, TC, and OF—are presented in Tables 6, 7, 8, 9 and 10. In the discussion of the findings, PAF, FL, ICT use, and digitization serve as our four main variables of interest. The findings for our control results are also presented briefly.

### ***Credit constraints and MSMEs’ characteristics***

We obtain interesting results from the Probit regression. The results provided in Table 6 are based on our broad definition of credit constraint and include all types of financing. Among the entire sample, MSMEs dealing with imports for miscellaneous activities increased the likelihood of being price rationed, which is positive and significant at the 10% level. Further, MSMEs with sole proprietor ownership and 5–25 million QAR turnover (in 2019) had a higher chance of being amount rationed, which was positive and significant at the 1% level.

Global constraints in specific financing types reveal other interesting observations. For instance, price rationing was negatively related to MSMEs that had an optimistic view of their capital in the short term in relation to BL financing at the 5% level. A similar (negative) result was also found for overall credit constraint when it came to this optimism but at the 10% level.

We found that the activities of MSMEs have a bearing on whether they are price rationed. Evidence for this is found particularly for firms that import miscellaneous products instead of one type of product. In terms of PAF, optimism in the face of short-term capital and general firm performance greatly helped firms secure BL financing from FIs.

According to the probit results, MSMEs that predominantly imported food and beverage goods were more likely to have their BL and CL financing amount rationed, which was significant at the 10% level. Additionally, firms with an optimistic outlook on general firm performance were unlikely to be credit-constrained, which was significant at the 1% level. Firms applying for CL financing and dealing in “furniture and home appliance” imports and those dealing in “machinery/mechanical equipment” had a higher probability of being price rationed, which was significant at the

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<sup>14</sup> All the results related to testing for correlation, and normality can be obtained upon request from the corresponding author.

**Table 6** Global constrained results (including all financial types)

	Constrained	Discouraged	Denied	Price rationed	Amount rationed
PAF	0.045*** (0.014)	0.023* (0.012)	0.064** (0.028)	0.035** (0.016)	0.021 (0.014)
FL	-0.025** (0.011)	0.003 (0.007)	-0.016 (0.021)	-0.022* (0.012)	-0.046*** (0.014)
ICT use	0.276*** (0.061)	-0.024 (0.032)	0.007 (0.025)	0.105 (0.089)	0.257*** (0.093)
Digitization	0.014 (0.060)	-0.025 (0.034)	-0.161* (0.086)	0.127 (0.085)	0.086 (0.096)
Activity_1	0.097 (0.109)	0.033 (0.049)	0.037 (0.151)	-0.001 (0.144)	-0.086 (0.135)
Activity_2	-0.059 (0.177)	-	-	-	-0.134 (0.267)
Activity_3	0.029 (0.083)	-0.020 (0.047)	0.032 (0.112)	0.021 (0.096)	-0.022 (0.105)
Activity_4	0.002 (0.071)	0.002 (0.032)	-0.071 (0.099)	-0.019 (0.092)	0.058 (0.094)
Activity_5	0.009 (0.114)	0.027 (0.039)	-0.076 (0.156)	-	-0.111 (0.188)
Activity_6	0.206*** (0.069)	0.030 (0.036)	0.024 (0.057)	0.039 (0.081)	0.126 (0.086)
Activity_8	0.056 (0.085)	-0.019 (0.046)	0.073 (0.114)	0.196* (0.104)	-0.042 (0.122)
Age_1	-0.080 (0.068)	-	-0.045 (0.101)	0.013 (0.063)	0.023 (0.078)
Age_2	-0.025 (0.057)	-0.003 (0.032)	0.031 (0.073)	-0.092 (0.066)	-0.120 (0.077)
Ownership_1	0.038 (0.097)	-	-0.183* (0.102)	0.085 (0.093)	0.364*** (0.114)
Ownership_2	0.091 (0.099)	-	-0.062 (0.095)	0.111 (0.092)	0.111 (0.116)
Ownership_3	0.021 (0.117)	-	0.057 (0.134)	0.201 (0.120)	0.269* (0.138)
Size_1	-0.049 (0.078)	-0.019 (0.043)	-0.236** (0.104)	0.016 (0.083)	0.105 (0.096)
Size_2	-0.086 (0.072)	-0.002 (0.035)	-0.199** (0.087)	-0.019 (0.073)	-0.020 (0.087)
Turnover_1	-0.021 (0.090)	-0.110* (0.056)	-0.029 (0.098)	0.072 (0.103)	0.071 (0.137)
Turnover_2	0.062 (0.076)	-0.036 (0.033)	-0.011 (0.088)	-0.019 (0.095)	0.159 (0.116)
Turnover_3	0.121 (0.081)	-0.022 (0.036)	-0.252** (0.122)	0.091 (0.094)	0.239** (0.115)
Outlook better	0.096* (0.057)	-0.050 (0.032)	0.009 (0.018)	-0.030 (0.063)	0.015 (0.072)
Hcredit better	0.013 (0.060)	0.030 (0.031)	-0.043 (0.057)	-0.061 (0.091)	0.092 (0.079)
Capital Better	-0.111* (0.059)	-0.001 (0.030)	-0.039 (0.078)	-0.090 (0.076)	-0.193*** (0.073)
Firm outlook better	0.072 (0.056)	-	0.050 (0.063)	-0.050 (0.075)	-0.033 (0.069)
#Obs	333	240	169	179	189
McFadden R <sup>2</sup>	0.176	0.358	0.268	0.305	0.287

\*, \*\*, and \*\*\* indicate significance level at 10%, 5%, and 1%, respectively



**Table 7** Trade line credit constrained results (global and by type of constraint)

Dependent variable	Denied	Price rationed	Amount rationed	Discouraged	Constrained
PAF	0.009 (0.019)	0.032 (0.024)	0.108** (0.053)	0.028* (0.016)	0.027* (0.017)
FL	-0.062* (0.036)	-0.041** (0.018)	-0.089** (0.037)	0.005 (0.007)	-0.025** (0.011)
ICT use	0.139 (0.172)	0.256 (0.192)	0.038 (0.145)	0.027 (0.025)	0.149** (0.062)
Digitization	-0.369*** (0.112)	0.416*** (0.155)	-0.031 (0.127)	-0.026 (0.031)	-0.005 (0.059)
Activity_1	-0.276 (0.404)	0.715* (0.412)	0.077* (0.255)	-	0.048 (0.102)
Activity_2	-	-	-	-	-0.115 (0.137)
Activity_3	0.195 (0.134)	0.559** (0.276)	-	0.016 (0.042)	0.045 (0.073)
Activity_4	0.035 (0.142)	0.429* (0.235)	0.049 (0.164)	0.031 (0.050)	-0.035 (0.066)
Activity_5	0.371* (0.202)	-	-	0.082* (0.049)	-0.098 (0.128)
Activity_6	-0.170* (0.99)	0.490** (0.242)	0.234 (0.181)	0.037 (0.036)	0.078 (0.067)
Activity_8	0.245 (0.158)	0.999** (0.455)	-	0.011 (0.050)	0.083 (0.077)
Age_1	-0.219 (0.144)	-0.223** (0.99)	-	-	-0.109* (0.059)
Age_2	-0.202* (0.115)	-	-0.324 (0.229)	-	-0.119** (0.052)
Ownership_1	-0.127 (0.148)	-	-	-	0.101 (0.095)
Ownership_2	0.057 (0.121)	-	-	-	0.155* (0.089)
Ownership_3	0.179 (0.217)	-	-	-	0.005 (0.015)
Size_1	0.362** (0.172)	0.710** (0.352)	-0.864** (0.401)	-	0.084 (0.071)
Size_2	0.325** (0.135)	-0.014 (0.105)	0.058 (0.128)	-	0.078 (0.062)
Turnover_1	-0.097 (0.149)	-0.102 (0.167)	0.980** (0.489)	-	0.025 (0.085)
Turnover_2	-0.128 (0.119)	0.072 (0.124)	0.086 (0.126)	-	0.059 (0.076)
Turnover_3	-0.179 (0.150)	0.463 (0.230)	0.077 (0.255)	-	0.160** (0.079)
Outlook_Better	-0.367*** (0.131)	-0.491** (0.455)	-0.589** (0.280)	-0.060 (0.050)	-0.028 (0.055)
Hcredit_Better	-0.114 (0.116)	-0.452* (0.265)	-0.077 (0.199)	0.026 (0.027)	-0.062 (0.057)
Capital Better	0.103 (0.132)	0.085 (0.170)	-0.184 (0.136)	0.039 (0.041)	-0.021 (0.057)

**Table 7** (continued)

Dependent variable	Denied	Price rationed	Amount rationed	Discouraged	Constrained
Firm_Outlook_Better	0.099 (0.127)	0.179 (0.190)	0.204 (0.167)	-0.041 (0.038)	-
#Obs	94	90	46	187	283
McFadden R <sup>2</sup>	0.508	0.695	0.527	0.471	0.176

5% level. We obtained a similar finding for firms that imported “chemical products” but was significant at the 10% level. However, MSMEs dealing with imports for miscellaneous activities had positive and significant relationships with the probability of price rationing across all four financing types, which was significant at the 5% level.

Furthermore, micro and small firms (i.e., 1–9 employees) were more likely to be price and amount rationed for CL financing than medium-sized firms and was significant at the 5% level, while the likelihood of being denied financing was positive and significant for both categories at the 5% level. Our Probit findings are comparable to those of Asiedu et al. (2013), who found that small firms in Sub-Saharan Africa are more likely to face credit constraints compared with larger firms. However, a majority of constrained firms in our sample are sole proprietorships, whereas Aseidu et al. (2013) found that such firms and those with better technological capability are less financially constrained. In a more recent study, Karlsson (2021) also consigned credit constraints to smaller firms and suggested that larger firms face barriers related to competition and recruitment.

#### **Credit constraint results by constraint type**

As hypothesized in “Materials and methods” section, MSMEs with lower PAF are expected to be more credit-constrained than those that exhibited higher PAF. The results from our main regression sample confirm this expectation, with PAF being positively and significantly related to the probability of an MSME being credit-constrained at the 1% level. To reiterate, our PAF variable was constructed using negative statements/items, so positive results are indicative of an inverse relationship between PAF and credit constraints. Positive and significant results are also found with PAF for the probability of firms to be discouraged from applying for finance (at the 10% level). When they apply for financing, the probability of being denied or price rationed is positive and significant for PAF at the 5% level. In our main regression, we find insignificant results for PAF in terms of the probability of an MSME to be amount rationed in their financing applications. Our results on PAF partially support those of Calabrese et al. (2021), who found that credit rationing and higher financing/loan pricing increase the likelihood of borrower discouragement. Although the authors concluded that this is more prominent for less creditworthy firms, they also suggested that policy initiatives need to accompany financial integration to address the financing gap and flight-to-quality that MSMEs face. Moreover, Hainz and Nabokin (2019) revealed that PAF depends significantly on whether a group of firms has a demand for credit, uses loans, and has access to credit. Their results reveal that, as expected, firms without credit demand have a high positive PAF compared with those that already requested credit.

**Table 8** Bank Loan credit constrained results (global and by type of constraint)

Dependent variable	Denied	Price rationed	Amount rationed	Discouraged	Constrained
PAF	0.074* (0.041)	0.090*** (0.028)	0.057*** (0.019)	0.018* (0.099)	0.036** (0.014)
FL	-0.113*** (0.033)	-0.046** (0.018)	-0.044** (0.018)	0.003 (0.005)	-0.018* (0.010)
ICT use	0.268* (0.150)	0.129 (0.112)	0.348** (0.139)	-0.002 (0.024)	0.005 (0.007)
Digitization	-0.128 (0.130)	0.498 (2.435)	0.091 (0.139)	0.011 (0.025)	0.161*** (0.054)
Activity_1	0.247 (0.195)	0.210 (0.179)	0.201* (0.102)	-	0.106 (0.093)
Activity_2	-	1.165 (2.362)	0.171 (0.148)	-	0.155 (0.126)
Activity_3	0.129 (0.122)	0.162 (0.111)	0.031 (0.075)	-	0.103 (0.074)
Activity_4	-0.009 (0.121)	0.129 (0.106)	-0.099 (0.077)	-	0.030 (0.064)
Activity_5	-0.049 (0.151)	-	-	-	-0.100 (0.155)
Activity_6	-0.037 (0.117)	0.147 (0.106)	-	-	0.183*** (0.063)
Activity_8	0.146 (0.129)	0.379** (0.182)	-	-	0.197** (0.078)
Age_1	0.172 (0.158)	-0.098 (0.081)	0.173** (0.076)	0.268 (2.667)	-0.067 (0.053)
Age_2	0.168* (0.089)	-0.200** (0.085)	-0.147 (0.100)	0.274 (2.635)	-0.033 (0.053)
Ownership_1	-0.415*** (0.128)	-	-	0.036 (0.024)	-
Ownership_2	-0.112 (0.141)	-	-	-	-
Ownership_3	-0.204 (0.157)	-	-	-	-
Size_1	-0.008 (0.016)	0.438*** (0.122)	-0.150* (0.091)	0.014 (0.030)	-0.200*** (0.079)
Size_2	0.165 (0.161)	-0.098 (0.081)	-0.019 (0.083)	0.003 (0.023)	-0.112* (0.064)
Turnover_1	0.009 (0.017)	-0.043 (0.138)	1.125 (0.723)	-0.049 (0.037)	0.053 (0.087)
Turnover_2	-0.073 (0.142)	0.0629 (0.116)	0.970 (0.720)	-0.032 (0.031)	0.119 (0.078)
Turnover_3	-0.377** (0.168)	0.230** (0.117)	1.008 (0.754)	0.008 (0.024)	0.070 (0.083)
Outlook_Better	-0.155 (0.141)	-0.279** (0.182)	-0.060 (0.096)	-0.019 (0.022)	0.043 (0.057)
Hcredit_Better	-0.020 (0.112)	-0.235* (0.128)	-0.063 (0.105)	0.023 (0.020)	-0.012 (0.060)
Capital Better	0.072 (0.148)	0.046 (0.109)	-0.052 (0.102)	0.007 (0.018)	-0.048 (0.057)

**Table 8** (continued)

Dependent variable	Denied	Price rationed	Amount rationed	Discouraged	Constrained
Firm_Outlook_Better	−0.131 (0.118)	−0.072 (0.131)	−0.219** (0.101)	–	−0.159*** (0.060)
#Obs	92	96	96	285	283
McFadden R <sup>2</sup>	0.611	0.580	0.571	0.328	0.215

\*, \*\*, and \*\*\* indicate significance level at 10%, 5%, and 1%, respectively

The results in Table 6 also confirm the hypothesized relationship between FL and credit constraints MSMEs face. FL is negatively and significantly related to the probability of an MSME being credit-constrained at the 5% level. This result supports our second hypothesis and the findings of several studies in the access to finance and MSME literature. For instance, Brown and Lee (2019) found that firms with qualified, i.e., financially literate, owners/management are more likely to apply for finance and help achieve firm growth. The education levels of such individuals can affect the perception of access and use of formal credit, especially considering the findings by Nguyen et al. (2021) that loan application procedures are less burdensome for entrepreneurs who have university degrees or higher. This, together with an unjustified aversion to debt by less financially literate managers, was found to add to the complexity of applying for formal credit, affecting access to credit in SMEs in Vietnam, according to Nguyen et al. (2021). Hewa Wellalage et al. (2020) reported that access to credit is easier for more innovative SMEs that have experienced managers who have personally taken loans in the past. Our findings also align with several other studies that found strong evidence for the positive impact of FL on access to credit (see Wise 2006, 2013; Binks et al. 2006; Kotzé and Smit 2008; Fatoki 2014; Adomako et al. 2016; Hussain et al. 2008, 2018). However, to the best of the authors' knowledge, no study has found that FL has a deteriorating effect on access to credit.

In this study, our credit constraint findings for PAF and FL are also consistent across all financing types at various levels of significance (i.e., 1%, 5%, and 10%). Although FL is not significantly related to firms being discouraged or denied financing, FL is negatively and significantly related to the probability of being price and amount rationed at the 10% and 1% levels, respectively. The overall credit constraint findings for PAF and FL are also consistent across all financing types at various levels of significance (i.e., 1%, 5%, and 10%).

However, in terms of ICT use, our probit results reveal an unexpected relationship with overall credit constraints. Instead of a negative relationship, MSMEs are found to be positively and significantly related to the probability of being credit-constrained at the 1% level. The results for all other constraint types are positive but insignificant for ICT use, except for amount rationing, which exhibits a significant relationship at the 1% level. More noteworthy results are found for ICT use and credit constraints in the case of specific financing types for MSMEs (as will be elaborated on).

We also hypothesized a negative relationship between trade finance digitization and credit constraints. Although we find insignificant results for this variable with overall credit constraints, for being discouraged, amount rationed, and price rationed, we find a negative and significant relationship with the probability of being denied financing at the 10% level. We can explain this by considering the issues of trust between loan managers

**Table 9** Trade credit—credit constrained results (global and by type of constraint)

Dependent variable	Denied	Price rationed	Amount rationed	Constrained
PAF	0.008 (0.019)	0.015 (0.034)	0.024 (0.024)	0.052*** (0.015)
FL	-0.042** (0.019)	-0.019* (0.089)	-0.034** (0.140)	-0.023*** (0.009)
ICT use	0.230** (0.102)	0.013 (0.096)	0.008 (0.035)	0.274*** (0.055)
Digitization	0.031 (0.071)	-	0.065 (0.088)	-0.105* (0.054)
Activity_1	0.041 (0.148)	0.269 (0.216)	-0.133 (0.143)	0.024 (0.092)
Activity_2	-	-	-	-0.148 (0.143)
Activity_3	-0.037 (0.095)	0.298 (0.215)	-0.164 (0.130)	0.003 (0.069)
Activity_4	-0.153 (0.122)	0.215 (0.162)	-0.094 (0.122)	-0.048 (0.062)
Activity_5	-0.084 (0.886)	-	0.018 (0.151)	-0.001 (0.091)
Activity_6	-0.076 (0.103)	0.229 (0.155)	-0.122 (0.110)	0.065 (0.060)
Activity_8	0.010 (0.114)	0.567** (0.154)	-0.092 (0.137)	0.046 (0.070)
Age_1	-0.004 (0.079)	0.039 (0.083)	0.074 (0.071)	0.029 (0.051)
Age_2	0.081 (0.063)	-0.096 (0.097)	-0.039 (0.086)	-0.002 (0.048)
Ownership_1	-0.088 (0.114)	0.040 (0.132)	0.482 (2.556)	-
Ownership_2	0.002 (0.097)	0.088 (0.127)	0.364 (2.554)	-
Ownership_3	0.178* (0.096)	0.134 (0.169)	0.606 (3.546)	-
Size_1	0.142 (0.162)	0.325** (0.148)	0.144 (0.111)	0.085 (0.064)
Size_2	0.145 (0.114)	0.036 (0.128)	0.049 (0.109)	-0.034 (0.062)
Turnover_1	-0.207* (0.114)	-	0.262 (2.657)	0.008 (0.076)
Turnover_2	-0.079 (0.062)	-	0.456 (2.209)	0.049 (0.067)
Turnover_3	-0.097 (0.080)	-	0.423 (2.845)	0.116* (0.068)
Outlook_Better	-0.050 (0.056)	-0.233* (0.125)	-0.079 (0.075)	-0.054 (0.049)
Hcredit_Better	0.042 (0.0801)	0.085 (0.187)	0.115 (0.081)	0.029 (0.052)
Capital Better	-0.001 (0.060)	-0.230* (0.125)	-0.201** (0.087)	-0.012 (0.052)

**Table 9** (continued)

Dependent variable	Denied	Price rationed	Amount rationed	Constrained
Firm_Outlook_Better	−0.040 (0.064)	−0.158 (0.134)	−0.013 (0.073)	0.013 (0.049)
# Obs	129	99	137	299
McFadden R <sup>2</sup>	0.544	0.409	0.385	0.254

\*, \*\*, and \*\*\* indicate significance level at 10%, 5%, and 1%, respectively

and MSMEs, as pointed out by Moro and Fink (2013). MSME importers in Qatar may rely on establishing rapport with FIs via a more personal mode such as face-to-face meetings. Financing applications made online may be vetted more stringently, which may have a bearing on the overall credit constraints of firms. In their study, Santos and Cincera (2022) also found that the supply side of the financial market, such as extensive paperwork and high-interest rates, are some of the most crippling in terms of access to credit for firms.

#### **Credit constraint results by financing type**

Taking a closer look at our probit regression results, we gain deeper insights into our variables of interest when considering the type of financing applied for by MSMEs i.e., CL, BL, TC, and OF (see Tables 7, 8, 9 and 10). For instance, the results reveal a significant and positive relationship between PAF and the probability of MSMEs being discouraged<sup>15</sup> when applying for both CL and BL financing at the 10% level. This is indicative of the wider underlying problem of poor PAF that MSMEs face. If firms muster the courage to apply for financing, low PAF would affect the success of their applications (i.e., halfhearted attempts). This is supported by the significant and positive relationship found between PAF and the likelihood of MSMEs having their applications denied for BL at the 10% level and OF at the 1% level. Regarding the probability of MSMEs being price rationed,<sup>16</sup> PAF is positive and significant for both BL and OF at the 1% level. The relationship between PAF and amount rationing is significant and positive for BL, CL, and OF at the 1%, 5%, and 10% levels, respectively. How MSMEs perceive that their access to finance is an important factor contributing to credit constraints, especially when applying for CL and BL financing.

Among all the four financing types, the results for our FL variable reveal a negative and significant relationship with the likelihood of MSMEs being credit-constrained with TC at the 1% level, CL at the 5% level, and both BL and OF at the 10% level. However, we do not find conclusive results about how FL is related to discouragement among the financing types. However, FL is negatively and significantly related to the probability of being denied financing for BL at the 1% level, TC at the 5% level, and CL at the 10% level while insignificant but still negative for OF. In terms of price rationing, we find that FL is negative and significant across all financing types (with CL and BL at the 5% level but TC and OF at the 10% level). Similar results are found for MSMEs in terms of the likelihood of being amount rationed. To this end, we find that FL is negatively and significantly related to CL, BL, and TC at the 5% level and OF at the 10% level. These results reveal

<sup>15</sup> Due to insignificant results of PAF with the probability of being discouraged from applying for TC and OF financing types, we do not report their Probit coefficients/marginal effects in Tables 7 and 8.

<sup>16</sup> Again, we find positive but insignificant results for PAF in terms of price rationing when MSMEs apply for CL and TC financing.

**Table 10** Others credit constrained results (global and by type of constraint)

Dependent variable	Denied	Price rationed	Amount rationed	Constrained
PAF	0.108*** (0.041)	0.078*** (0.024)	0.036* (0.018)	0.0292** (0.014)
FL	-0.022 (0.023)	-0.029* (0.016)	-0.039* (0.020)	-0.019* (0.01)
ICT use	-0.092 (0.105)	-0.151 (0.109)	-0.112 (0.167)	0.140* (0.08)
Digitization	0.176** (0.086)	0.405*** (0.142)	0.196 (0.129)	0.222*** (0.060)
Activity_1	-0.325 (0.264)	0.178 (0.188)	-0.066 (0.202)	-0.015 (-0.111)
Activity_2	-	-	-	-0.072 (0.183)
Activity_3	-0.029 (0.098)	0.202 (0.126)	-0.200 (0.154)	-0.001 (0.082)
Activity_4	-0.180 (0.098)	0.174 (0.127)	-0.014 (0.143)	-0.016 (0.072)
Activity_5	-	-	-	-0.027 (0.135)
Activity_6	0.033 (0.073)	0.197* (0.114)	0.030 (0.135)	0.154** (0.068)
Activity_8	-	0.397*** (0.151)	-0.054 (0.196)	0.042 (0.088)
Age_1	0.038 (0.015)	0.105 (0.079)	-0.156 (0.109)	-0.008 (0.064)
Age_2	0.015 (0.086)	0.029 (0.088)	-0.213** (0.103)	-0.068 (0.057)
Ownership_1	-0.079 (0.137)	-0.050 (0.125)	0.304** (0.149)	-0.079 (0.088)
Ownership_2	0.048 (0.106)	0.078 (0.110)	0.032 (0.161)	-0.021 (0.088)
Ownership_3	-0.336 (0.235)	0.403 (0.153)	0.136 (0.193)	-0.146 (0.107)
Size_1	-0.020 (0.093)	0.028 (0.110)	0.423** (0.206)	0.012 (0.085)
Size_2	0.103 (0.088)	0.028 (0.097)	0.373** (0.185)	-0.015 (0.081)
Turnover_1	0.058 (0.106)	0.062 (0.177)	-0.270 (0.213)	0.042 (0.088)
Turnover_2	-0.046 (0.114)	-0.110 (0.174)	-0.173 (0.189)	0.054 (0.078)
Turnover_3	-0.325 (0.265)	0.094 (0.163)	-0.179 (0.173)	-0.114 (0.081)
Outlook_Better	-0.020 (0.087)	0.113 (0.102)	0.006 (0.105)	0.046 (0.055)
Hcredit_Better	0.103 (0.088)	-0.173 (0.126)	0.176 (0.112)	0.027 (0.057)
Capital Better	0.147 (0.106)	-0.127 (0.115)	-0.265** (0.106)	-0.020 (0.059)

**Table 10** (continued)

Dependent variable	Denied	Price rationed	Amount rationed	Constrained
Firm_Outlook_Better	− 0.226*** (0.081)	0.092 (0.093)	0.051 (0.093)	0.016 (0.054)
# Obs	100	114	114	311
McFadden R <sup>2</sup>	0.545	0.423	0.283	0.167

\*, \*\*, and \*\*\* indicate significance level at 10%, 5%, and 1%, respectively

that possessing strong FL can improve access to credit for MSMEs when applying for most financing types, even if not completely approved.

The results of ICT usage and its relationship with the probability of being credit-constrained (among other types of constraints) are mixed and further complicated when considering financing types. For instance, we find a positive and significant relationship between ICT usage and credit constraints for MSMEs applying for TC at the 1% level, CL at the 5% level, and OF at the 10% level but not for BL. BL is the only financing type for which ICT usage is positively and significantly related to being amount rationed (at the 5% level). Moreover, ICT usage is found to have a positive and significant relationship with the likelihood of being denied financing for TC and BL at the 5% and 10% levels, respectively. However, ICT usage has negative but insignificant relationships with the probability of being denied financing, price rationed, and amount rationed for OF. Our findings highlight the benefit of advanced technology and ICT use for MSMEs. As purported in a study by Mitchell and Pearce (2011), the use of such technologies may help firms or new loan applicants overcome some of the hindrances that would prevent FIs from granting credit to firms with no or poor credit history. However, our results do not support the findings by Lee et al. (2015) that innovative firms were more likely to have their applications rejected or credit rationed by FIs. They attributed this FI behavior to prior financial crises that have tightened credit granting conditions.

Regarding the relationship between digitization and being credit-constrained in general, we find a negative and significant relationship with only TC financing at the 10% level and an insignificant but negative relationship for BL applications. When looking at the other constraint types, a negative and significant relationship is found in terms of the likelihood of CL applications being denied at the 1% level, with an insignificant but negative relationship for BL applications. On the other hand, OF applications are found to have a positive and significant relationship between digitization and denied applications at the 5% level. MSMEs that apply for financing for CL and OF are more likely to be price rationed, as evidenced by their positive and significant relationship with digitization at the 1% level. A negative but insignificant relationship is found between digitization and amount rationing as well as digitization and discouraged MSMEs for CL financing.

### Conclusion and policy recommendations

In this study, we aimed to identify the factors that contribute to credit constraints in oil-exporting economies, specifically in Qatar. By surveying 366 Qatari MSME importers, we collected data to understand the impact of various variables—PAF, FL, ICT usage, and digitization—on the likelihood of credit constraints. Using these data, we constructed several proxies of credit constraints by type of constraint and financing. Our



results indicate that all the four variables of interest (PAF, FL, ICT usage, and digitization) play a significant role in determining credit constraints by type of constraint and financing. In particular, we found that PAF and FL are critical drivers of credit constraints, with expected results in most of the probit regressions. ICT usage and digitization were also identified as key determinants of credit constraints, but the results were more nuanced and depended on the type of financing and credit constraint.

Our results have significant implications for emerging markets in general and Qatari policymakers in particular. In this section, we put forward several policy recommendations related to FL, FinTech, and credit reporting to improve MSMEs' access to credit.

As the private sector and MSMEs are the cornerstone of the economic diversification of the Qatar National Vision 2030, it is vital to provide training for MSMEs to help them become more financially literate and better their PAF to improve their access to finance and overall financial decision-making. Such efforts would decrease instances of MSMEs being discouraged from applying for financing, thereby improving working capital turnover in the private sector.

Policy recommendations that can ease lending to MSMEs in Qatar and other oil/gas exporting countries can dampen the overall effect of credit constraints in private sectors. FIs in such countries need to be encouraged to be more flexible, and MSMEs should be supportive of initiatives that can improve their financial competence. MSMEs in need of legitimate financing can benefit from more effective methods of applicant screening from FIs. For instance, to better infer behaviors and identify potential risks, the detection and interpretation of clusters in financial data require the use of improved clustering algorithms and cluster quality evaluation (Kou et al. 2014; Li et al. 2021).

In scenarios where MSMEs lack suitable credit history, through machine learning, FIs may use bankruptcy prediction architecture, such as those developed by Kou et al. (2021), to help with loan decision-making and generate more justified credit scoring models (Kou et al. 2019; Shen et al. 2020) instead of arbitrary rejection of finance requests. Furthermore, to provide MSMEs with better opportunities to access FinTech options from FIs and similar institutions, cost-sensitive classifiers can be used to improve the cost-effectiveness of peer-to-peer financing platforms (Wang et al. 2021).

We also recommend that particular attention should be paid to rapid digitization and ICT usage as it has the potential to foster or (if used incorrectly) hinder MSMEs' access to credit. We argue that better information sharing about MSMEs by the country's Ministry of Trade, Ministry of Commerce and Industry (MOCI), and GTA with FIs, perhaps at the request of financing applicants, can reduce some of the information asymmetry, thereby preventing such firms from having their financing applications denied, rationed, or allocated unattractive rates. The government is essentially a statistics powerhouse that can help FIs and MSMEs bridge informational gaps and highlight opportunities for growth in their respective sectors.

Policymakers and regulators in the country should spearhead/support (existing) initiatives, such as crowdfunding, peer-to-peer lending, and initial coin offering, to provide MSMEs with nontraditional access to credit such as those provided by FinTech platforms currently under development in the country. Alternative sources of finance will naturally motivate FIs to become more competitive as they will have less monopoly power over the financial sector. We provide more specific recommendations to various stakeholders below:

- MOCI: As the main regulator for MSMEs in the country, an effective method the ministry can employ is to enforce or encourage MSMEs to have at least one shareholder, partner, or employee with finance expertise during the incorporation of their company. Moreover, the ministry can host exhibitions/events where financial consultants can network with local MSMEs to encourage their usage, thereby increasing access to credit for MSMEs and reducing financial-constraint-related business closures.
- Qatar Central Bank: Establishing an information platform for local banks to inform MSMEs about the latest products that can cater to the financing needs of importers. This would raise awareness among MSME importers and other MSME categories on how they can benefit from the products on offer from FIs.

## Appendix

See Tables 11 and 12.

**Table 11** Perceived access to finance items (adapted from Nengomasha 2018)

Item	Statement
PAF1	Lack of credit history will make it difficult to borrow money from banks & financial institutions
PAF_2	Banks will be reluctant to finance our business because of the high risk involved
PAF_3	Banks and financial institutions will charge high interest rates
PAF_4	The size of our business will affect its ability to access funding
PAF_5	The credit application process is too complex
PAF_6	The credit application process requires too much paperwork
PAF_7	The waiting period to get external finance is too long
PAF_8	Collateral requirements are too strict
PAF_9	We did not think it would be approved

**Table 12** Financial items (adapted from Bengomin 2018)

Item	Statement
FL_1	Our firm analyzes its financial performance periodically
FL_2	Our firm prepares monthly income statements
FL_3	We received training on book-keeping
FL_4	Our firm has bought formal insurance for our business
FL_5	The management of our firm can compute the cost of its loan capital
FL_6	Our firm has a savings account
FL_7	Our management can prepare basic accounting books
FL_8	Our firm is aware of the required documents to get a bank loan in order to fulfil our financial needs
FL_9	Our firm is aware of the costs and benefits of accessing credit
FL_10	Our firm is able to calculate interest rates and loan payments correctly
FL_11	Our finance team have the skills required to assess the financial outlook for the firm
FL_12	Our finance team has skill for minimizing losses by minimizing bad debts
FL_13	The managers of our firm have basic accounting knowledge

### Abbreviations

BL	Bank loans
CL	Credit lines
Cons	Constrained
CRM	Customer Relationship Management
ECB	European Central Bank
ERP	Enterprise Resource Planning
EU	European Union
FI	Financial Institution
FL	Financial literacy
FT	Financing type
GCC	Gulf Cooperation Council
GDP	Gross Domestic Product
ICT	Information Communication Technology
IMF	International Monetary Fund
KBV	Knowledge-based view
KMO	Kaiser–Meyer–Olkin
LCH	Life cycle hypothesis
MSME	Micro, small and medium enterprises
OF	Other financing
PAF	Perceived access to finance
PPCA	Polychoric principal component analysis
QAR	Qatari riyals
QDB	Qatar Development Bank
RBT	Resource-based theory
SAFE	Survey on the access to finance of enterprises
SCF	Supply chain financing
SME	Small and medium enterprises
TC	Trade credit

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### Author contributions

LC: conceptualization; MU: data organization and cleaning; LC and MU, MM: Abstract, introduction, literature review and conclusion; MU: Figures development and data analysis. LC: review and validate the final version of the paper. All authors read and approved the final manuscript.

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### Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

### Declarations

#### Competing interests

None of the authors has conflicts of interest to disclose, and they all approve this submission.

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