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Loan size concentration under the UK enterprise finance guarantee scheme and SME access to finance

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ABSTRACT

Credit rationing is most severe for young and small firms. Public loan guarantee schemes are explicitly designed to increase the supply of loans to these types of firms. In this article, we explore how the EFG scheme evolved through the lens concentration of the cash volume of loans issued. Adopting the Herfindahl–Hirschman Index (HHI), we find that loan size concentration had increased substantially over time, and there was a smaller number of larger loan sizes issued. In short, we posit that it had less relevance to the most acutely rationed small firms and had transitioned into a less targeted scheme. However, we observe different lending behaviors for lenders of different sizes, as smaller lenders became more focused and targeted in their lending over time. It is evident that increasing the diversity of lenders for such schemes would reinforce the effectiveness and relevance of the scheme.

KEYWORDS

Small Business; loan guarantee schemes; loan size concentration; credit rationing

Introduction

Young and small firms are the most likely to face credit rationing when they seek external debt (Cowling et al., 2016). This is related to informational asymmetries between borrowers and lenders, which are most acute where firms lack a track record or do not produce full and verified accounts (Jaffee & Stiglitz, 1990). It follows that lenders will ration credit to firms that are informationally opaque rather than set a higher risk-adjusted interest rate, as making additional loans will take the lender past its profit-maximizing point (Stiglitz & Weiss, 1981), and this generates the classic backward bending loan supply curve, which leaves firms with an excess demand for loans (Shen, 2002). Where there is excess demand for loans from firms with viable projects, public policymakers have often directly intervened in the loan market through the provision of a loan guarantee, which underwrites a specified proportion of the loan for the lender (Cowling, 2010; Crawford et al., 2023). This effectively

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de-risks the loan for the lender and increases loan supply to credit rationed firms (Bachas et al., 2021).

Despite the popularity of using a government loan guarantee scheme as a tool to address the credit rationing issue for small and young firms that are more likely to be financially constrained, the evidence on the potential relevance, the effectiveness in targeting the certain groups of credit rationed borrowers, and the further in-depth discussion and review of the important design features of these schemes are still scarce. This article discusses the potential relevance of a specific UK loan guarantee scheme—Enterprise Finance Guarantee (EFG) scheme—by investigating the loan size concentration under the scheme and the evolution of the scheme over time. By doing this, we aim to provide policy implications on mitigating the financial constraints and credit rationing issues faced by SMEs and open discussions for future designs of more targeted and effective support schemes.

As the theoretical and empirical evidence clearly points to credit rationing being at its most acute for younger, smaller, informationally opaque firms, it follows that the focus of a corrective loan guarantee program should be within the lending parameters of these firms that typically request loans of rather modest size. For example, during the COVID-19 pandemic, this was explicitly recognized by the UK government, which activated three quite different loan guarantee schemes, with the largest in terms of the number of loans issued being the Bounce Back Loan (BBL) scheme, which issued loans up to a maximum loan size ceiling of £50,000. The BBL scheme issued more than one million loans under guarantee and dwarfed the sister Coronavirus Business Interruption Loan scheme (CBILS), which had a loan size ceiling of £5 million and only issued 76,000 loans under guarantee. The large firm scheme, the Coronavirus Large Business Interruption Loan scheme (CLBILS), only issued 676 loans and had a loan size ceiling of £200 million (Cowling, Nightingale, et al., 2023). However, this bunching of smaller loans for credit rationed firms was not explicitly recognized during the pre-COVID -19 Enterprise Finance Guarantee (EFG) scheme, which has a loan floor of £1,000 and a maximum loan ceiling of £1.2 million (Cowling, Wilson, et al., 2023). It was, however, partly recognized during a unique period of its predecessor guarantee scheme, the Small Firms Loan Guarantee Scheme, when loans were restricted to firms less than five years of age between 2005 and 2008, and empirical research into this period found that it was more targeted and effective in reducing credit rationing for very young firms and supporting job creation (Cowling, Robson, et al., 2018).

In this article, we consider the evolution of the EFG scheme from its inception in 2009 until its demise in early 2020 when the COVID-19 pandemic hit the UK. We are particularly interested in the evolution of loan size concentration, as we would *a priori* expect that lending under EFG would be focused explicitly on small and young firms with modest finance needs, with

lots of smaller-sized loans issued and fewer larger-sized loans issued. Thus, a low level of loan size concentration would be indicative of the scheme addressing its explicit target, which is smaller and younger firms with quite modest loan demands. Here, we adopt the Herfindahl–Hirschman Index (HHI), which has been commonly used to define market concentration, as the measure of the EFG loan market concentration. Specifically, the loan HHI is calculated by squaring the percentage share of the size of each loan issued under the EFG scheme and then summing the resulting numbers, which are constrained between 0 and 1. The loan size concentration index can be obtained for each approved lender each year during the time of the EFG scheme to fit the purpose of our specific estimation model.

Using the EFG loan market concentration to determine the EFG scheme relevance to credit rationed firms, we establish the evolution of EFG loan market concentration over its 12 years of operation and identify the underlying nature of these changes in concentration. Our analysis includes data on EFG loan contracts for 32,747 small firm loans from 2009 until 2020. Our first finding is that, in general, loan size concentration is very low at 0.0257 on average, which suggests that the EFG was hitting its target and supporting lending to credit rationed firms with modest loan funding needs. However, it is also apparent that over time EFG lending became more concentrated, which implies that it was moving incrementally away from its core target group of smaller and younger credit rationed firms. In fact, loan size concentration increased by a factor of three between 2009 and 2019, and in the last few months leading up to the COVID-19 pandemic, concentration was more than nine times that in 2009. In this respect, it was clearly, albeit slowly, moving away from its core target constituency. On balance, however, the low level of loan size concentration on EFG suggests that it supported its target constituency.

In terms of what factors were associated with this concentration dynamic on the EFG scheme, we estimate the lender-level HHI index of concentration using a generalized linear model (GLM). We find that there was a spatial pattern with loans issued to firms located in two of the poorest regions of the UK, Northern Ireland and North East England, increasing overall loan size concentration, and loan demand from firms in the West Midlands and Yorkshire and Humberside reducing concentration. Increasing use of the EFG scheme by larger firms also drove up concentration as expected, as larger-sized firms, on average, have higher loan funding needs. There was, however, no clear and robust firm age effect. Together, the evidence suggests that as more EFG loans were issued to firms that were less likely to face acute credit rationing (that is, larger firms and firms with an extensive track record) then loan size concentration increased.

For smaller lenders, loan size concentration generally diminished over time, suggesting that they were gradually becoming more relevant in supporting

lending to larger numbers of smaller firms with similar loan size demands. The opposite was true for larger mainstream bank lenders, which tended to increase their loan size concentration over time and move away from lending to the core credit rationed constituency. For medium-sized lenders, the period between 2016 and 2019 was associated with reductions in loan size concentration. In this sense, increasing lender diversity largely through the approval of smaller lenders to operate on the EFG scheme was a positive move that facilitated a closer alignment with the core UK credit-rationed population over time, even within the overall context of a relatively selective general starting point.

The findings from the article shed light on the effectiveness and relevance of the EFG scheme in reducing credit rationing targeting smaller and younger firms, and provide policy implications in the future design of such loan support schemes. It is evident that increasing the diversity of the approved lenders for such government lending schemes and more targeted programs within the lending parameters for targeted firms would enforce the effectiveness and relevance of the scheme. This represents a new and more dynamic view of how loan guarantee schemes evolve over time and how the nature of the lenders that provide loans under guarantee fundamentally influences the extent to which a scheme is able to serve its target borrowers who are typically small and young.

We proceed by reviewing the literature relating to large and small lenders and how they engage with smaller firms in the lending market and how relative differences in credit rationing manifest themselves within these relationships, and sometimes trigger public policy intervention in the credit market in Section "Literature Review". In Section "Data and Sample Statistics", we discuss the EFG scheme and present the basic statistics drawn from our loan contract data, which covers 32,747 small firm loans from 2009 until 2020 issued under a 75 percent EFG guarantee. In Section "Methodology and Result", we present our empirical methodology for analyzing loan size concentration and its determinants and discuss the key findings from our modeling. We conclude with a discussion of the findings in the context of public policy and the relevance of the EFG scheme to small credit-rationed firms in the UK.

Literature review

Credit rationing

The limited availability of financial resources presents a significant barrier to the expansion of small businesses (Berger & Udell, 1992; Freel, 2007), with economic shocks exacerbating these capital constraints (Calabrese et al., 2022; Cowling et al., 2012). Credit rationing occurs when there's a surplus demand for bank funds due to banks' reluctance

to raise interest rates to balance the market. The primary reason why banks ration credit is information asymmetry (Jaffee & Modigliani, 1969). The seminal study by Stiglitz and Weiss (1981) and subsequent models (for example, Berger & Udell, 1998; Petersen & Rajan, 1994) argue that lenders cannot accurately assess the true risk of smaller, less transparent businesses beforehand (adverse selection). This lack of information prevents lenders from adjusting interest rates, potentially penalizing good borrowers or encouraging riskier ventures (moral hazard). Behr and Güttler (2007) also point to the issue of imperfect information and how that can exacerbate the "hold-up" problem if firms cannot assess their true risk of default.

As a result, collateral serves as a mechanism for lenders to induce the self-revealing of borrower quality (Choi et al., 2021; Coco, 2000). Borrowers with lower risk profiles are willing to offer collateral for loans, anticipating lower interest rates as they're more confident in their ability to repay and retain their assets. Conversely, high-risk borrowers face higher interest rates (Bester, 1987). However, disparities exist between the asset and wealth distributions in the economy and among businesses seeking financing, often resulting in good, low-risk borrowers being unfairly denied credit (Besanko & Thakor, 1987). This is the case when good and bad borrowers are tangibly different in terms of their riskiness, but the amount of collateral required from good borrowers may well exceed their collateralizable wealth endowment. Additionally, collateral availability varies, disadvantaging certain business demographics such as young (Cowling & Dvouletý, 2023), small (Kallandranis et al., 2023), innovative firms (Lee et al., 2015), service-based industries (Beyhaghi et al., 2020), and ethnic minority-led businesses (Bruder et al., 2011).

The role of loan guarantee schemes

Supply-side credit rationing not based on borrower quality is often used as the main justification for public intervention in the debt market in the form of loan guarantee schemes. Loan guarantees approximate collateral and partially exchange the future cash flow of a small or medium-sized enterprise (SME) for current cash available to finance the SME's funding gap (Luo et al, 2016). The existence of demand-side restrictions in the small business credit market offers further rationale for guaranteed loans. A credit-worthy firm may be discouraged from borrowing if the anticipated financing cost is higher than the expected return from the investment project (Kon & Storey, 2003). Those firms are self-rationed out of the capital market and represent an "under-researched, yet quantifiably important subset (Cowling et al., 2016, p. 1068)" of small businesses that could have added value to both banks and entrepreneurs. In this sense, loan guarantee programs are an essential measure to

reduce banks' lending risks to small, young, and innovative firms with viable projects but lack relevant resources, experience, or firm-bank relationships.

Since borrowers with insufficient collateral can still be subject to rationing (Bester, 1987), the effectiveness of the guaranteed loans can be affected by the extent of the government-backed guarantee against the outstanding loan balance (coverage ratio). The "benchmark" coverage ratio below, which guarantees become ineffective, varies across different countries. For example, Boschi et al. (2014) estimated the ratio to be 25 percent in Italy, while an earlier UK study suggested a threshold of 65 percent (Cowling, 1995). Internationally, the coverage rates are generally between 70 percent and 80 percent (Beck et al., 2010). However, a high coverage ratio does not automatically translate to more effective public interventions. An Italian study by Cerulli and Ventura (2021) showed that the marginal benefit diminishes as the coverage ratio gets higher. To this end, the effectiveness of loan guarantee schemes may also depend on the design and management of the program as well as the characteristics of the underlying financial market and intermediary (Bertoni et al., 2023).

The effectiveness of loan guarantee schemes can be evaluated against either financial or economic additionality, with the former focusing on the closure of the funding gap for borrowers who would typically struggle to obtain financing, and the latter on the performance outcomes of the supported firms such as job creation, productivity, and other business activities. Numerous studies have evaluated and recognized the effectiveness of loan guarantee schemes in alleviating credit rationing in both the developed and developing world (Bertoni et al., 2023). Government-guaranteed loans are shown to be more available in periods of market or economic shocks (Calabrese et al., 2022; Cowling, Kacer, et al., 2024), such as the COVID-19 pandemic (Granja et al., 2022). Two common criteria used in evaluating the financial additionality of loan guarantee schemes are whether a scheme has: (i) increased the credit supply, and (ii) lowered the borrowing cost for smaller firms being credit-rationed not based on borrower quality, without subsidizing risky firms. Generally, there is a strong consensus on the former criterion (Beck et al., 2010), from empirical studies in the UK (Cowling & Mitchell, 2003), the United States (Bachas et al., 2021), Canada (Riding et al., 2007), and Italy (Zecchini & Ventura, 2009). However, evidence regarding the effectiveness of loan guarantees in lowering borrowing costs appears to be more mixed. Ughetto et al. (2017) found that higher guaranteed coverage reduces interest rate spread but only for loans aimed at covering working capital needs rather than longer-term investments. Beck et al. (2010), in an international study, concluded that government agencies show limited effectiveness in risk assessment and management. Further, the relationship between government guarantee and subsequent default is found to be insignificant in the UK context

(Cowling, Ughetto, et al., 2018), but a significantly lower default probability was documented in a later European study of guaranteed loans over 19 countries under the SME Guarantee Facility of the European Union's MAP and CIP programs (Brault & Signore, 2019).

When evaluating the effectiveness of loan guarantees against firm-level, economic additionality metrics, the only conclusive finding relates to their positive contribution to employment growth (Brault & Signore, 2019; Briozzo & Cardone-Riportella, 2016; Brown & Earle, 2017; Riding & Haines, 2001). Regarding sales growth, while Brault and Signore (2019) found a positive impact of the European SME Guarantee Facility, no such effect was found for the UK SFLG program (Cowling, Robson, et al., 2018). Through a review of existing literature, Bertoni et al. (2023) argued that companies may benefit from government guarantees on certain performance metrics but at the cost of others, such as capital versus labor, asset versus employment, and input versus output. However, no evaluation of the performance of public interventions is meaningful without considering the financial sustainability, and once again, the evidence is mixed. Due to their different design features such as management structure, operating rules, and coverage ratios, participating lending institutions face varying administrative costs and loan default rates, which in turn affect the financial sustainability of loan guarantee schemes (Gozzi & Schmukler, 2015). In many cases, fee incomes from guaranteed loans are insufficient to cover the schemes' operating costs (Beck et al., 2010), with a few exceptions such as Chile's FOGAPE (De la Torre et al., 2017) and the SBA in the United States (Demirgüç-Kunt et al., 2008).

Lender size and loan contracting

To overcome information opaqueness when lending to smaller and younger firms, banks primarily resort to either hard- and soft-information lending technologies (Berger & Black, 2011). Hard information refers to *transactions-based* lending technologies that rely on quantitative and transferable information, such as sophisticated credit-scoring systems. In contrast, qualitative nontransferable information is termed as soft information, usually facilitated through the building of lending relationships. Previous research contends that larger banks have a competitive advantage in hard information because of economies of scale in processing huge volumes of standard loan applications in a quick and cost-efficient manner (Gilbert & Wheelock, 2013; Uchida et al., 2008). On the other hand, relationship lending is a more common approach adopted by smaller banks and lending institutions (Berger et al., 2005). However, Cowling, Nightingale, et al. (2023) propose that medium-sized lending institutions may possess a competitive advantage over both small exclusively relational lenders and large transactional banks due to its ability to utilize both types of information in their loan decision-making process.

Loan guarantee schemes are designed to facilitate lending to informationally opaque but creditworthy businesses that would otherwise be rationed without the guarantee because of their low tangible, and thus collateralizable, asset bases (Besanko & Thakor, 1987; Cole et al., 2004) especially during an economic downturn (Cowling et al, 2023). Large banks are more experienced with high-volume transactional lending and have developed in-house sophisticated credit-scoring methods. Therefore, they are more able to quantify and diversify the portfolio risks associated with hard-information loans (Berger & Black, 2011). Moreover, credit-scoring modeling facilitates risk-based pricing so the lender can set an appropriate compensating price (interest rate) rather than outright rejection (Cowling, Wilson, et al, 2023). In addition, larger banks can also seize the benefits from economies of scale and scope with their large multi-service platforms and branch networks, and sophisticated business models and risk management systems. Smaller banks, on the other hand, commonly manage the risk with the relationship lending strategy, which is limited to fewer borrowers with whom they have established trust and relationship (Boot & Thakor, 2000). Therefore, we expect larger banks to be more likely to have a lower loan size concentration given their competitive advantage in hard technologies over smaller banks. We conjecture that they will be able to utilize this comparative advantage in the sector of loan guarantee lending, which gives rise to the following hypothesis:

H1: *Loan size concentration in the EFG portfolio is negatively associated with the size of the lending institution.*

However, when the volume of hard data required for sophisticated internal credit scoring is missing, large banks are less capable of processing and transmitting soft information through the communication channels of large organizations (Stein, 2002). To avoid the cost associated with the production and use of soft information, bigger banks are found to prefer larger-size borrowers with better accounting records, and adopt a more impersonal lending approach (Berger et al., 2005). In contrast, small banks are heavily relying on relationship lending, because their simple organizational structures have comparative advantages in producing soft information. Such personal interaction is particularly appealing to informationally opaque SMEs that are less able to provide the hard information required by quantitative lending algorithms. Therefore, the average loan size of smaller banks is likely to be lower than that of larger banks.

Over time, small banks tend to establish strong firm-bank relationships that are more personal, exclusive, and with a longer duration (Berger et al., 2005). This is particularly relevant in the context of EFG, with its target being small businesses with modest loan demand. We expect that with the evolution of EFG, smaller banks are more likely to have established long-term relationships

with several small borrowers rather than one or few large borrowers. Moreover, smaller banks may become increasingly willing to accept new informationally opaque firms with smaller loans for building long-term relationships and customer base, to take advantage of the government guarantee scheme. With the soft information and firm-bank relationships further enhanced over time, smaller lenders are more likely to diversify their lending portfolio with decreasing loan size concentrations over time. In contrast, large transactional lending banks are not only less suited to dealing with businesses that often lack the volume of hard data that is required for sophisticated internal credit scoring but also find it harder to build long-term relationships because of the geographic and hierarchical distance from the borrowers (DeYoung et al., 2008; Liberti & Mian, 2008). Therefore, we might expect that lending options available to larger banks become increasingly restricted as they screen out unqualified borrowers over time.

However, it may be the case that large banks may also be more likely to utilize the EFG, as the public loan guarantee reduces the problems of asymmetric information and is best suited to transactional modes of lending since less information is needed if the guarantee level is sufficiently high. In contrast, smaller banks that use relational lending and capture soft information are less likely to need the loan guarantee security net to lend to informationally opaque borrowers. It follows that large banks may particularly favor EFG lending as a channel for offering larger-sized loans to larger SMEs, as larger-sized loans represent a higher contingent liability to the lender if no guarantee is available and this would have a direct effect on loan size concentration, particularly if the proportion of loans to different types of borrowers is stable over time at the bank level. For smaller banks, the reverse logic may be true. By making a case for the channels through which EFG impacts the respective lending decisions of large and small banks, we are able to hypothesize about how these channels might impact the evolution of loan size concentration.

H2: *Over time, loan size concentration in the EFG portfolio is likely to increase for large banks and decrease for small banks.*

Data and sample statistics

UK EFG scheme

The Enterprise Finance Guarantee (EFG) is a UK government-guaranteed lending scheme intended to encourage additional lending to viable SMEs (operate in the UK and have a turnover of less than £41 million) that have been turned down for a normal commercial loan due to a lack of security or a proven track record. While the government provides lenders with

a 75 percent guarantee of the value of each individual loan, the delivery of EFG and all lending decisions are fully delegated to the lenders under their screening process.[1] For instance, when the borrower wishes to borrow money from a lender, they will approach the lender with borrowing proposals, providing all the information normally required by a lender, including business plans, historical and forecast financial information, and previous and current funding support. Then, the participating lender will first assess the viability of the business and the ability of the business to service proposed borrowing requirements according to normal lending criteria. In the case that the borrowing proposal is deemed to be viable but no or insufficient security is available from the borrower, the lender will then assess if the EFG eligibility criteria (set by BIS) could be satisfied. Additionally, the eligibility for EFG is confirmed only after the further lender's credit sanctioning process. Thereafter, the facility document, including the EFG-specific document, is forwarded to the borrower by the lender. The borrowing cost to the business, however, will include not only the regular capital and interest payments to the lender but also any arrangement fee that they may charge and a 2 percent per annual premium payable to BIS.

Table 1 reports the basic sample statistics. The data are for the UK EFG scheme and cover 32,747 loans issued under a government guarantee of 75 percent between 2009 and 2020. Our data sets are at the loan-level, and for each loan, we have detailed information including specific loan contract terms (the loan size, interest rate, maturity), the lender (name, size), and the demographic characteristics of the borrowing firms (size, age, industry sector). The EFG scheme allowed 62 approved lenders[2] to issue loans under guarantee with a loan size floor of £1,000 and a ceiling of £1.2 million. It is an interesting feature of the EFG that very few loans (in nominal terms) issued were at the £1.2 million maximum loan ceiling available. For reference, this was £1.36 million in real inflation-adjusted terms. Loans were available for a minimum term of three months and a maximum term (maturity) of 10 years, with an average maturity of 70 months. Lenders were free to set their own loan interest rates, and the average interest rate was 5.93 percent and a range from 2 percent to 14 percent. EFG loans also incurred a government interest rate premium of 2 percent, which was used to offset the cost of paid-out guarantees in default. The average real loan size was £123,213, and the median was £72,914, both of which are significantly below the maximum loan ceiling. In terms of the proportionality of lending to size of firm, average loan-to-sales ratios were 31.3 percent with a median of 11.6 percent, which is an indication of the intensity of credit rationing EFG users faced.

[1]The details about the EFG-backed loan application process can be found here: https://assets.publishing.service.gov.uk/media/5a7c651fe5274a7ee501aac7/efg-backed-loan-application-process-and-list-of-lenders-aug-2013.pdf

[2]The EFG list of lenders can be found here: https://assets.publishing.service.gov.uk/media/5a7c651fe5274a7ee501aac7/efg-backed-loan-application-process-and-list-of-lenders-aug-2013.pdf

Table 1. Sample statistics.

		by Lender Size			
	All (1)	Small (2)	Medium (3)	Large (4)	Significance
Firm Demographics					
Real Sales £s	1,460,357	934,362.03	2,020,346.80	1,377,928.40	***
Std. Dev	2,796,750	2,206,862.60	3,560,994.30	2,630,788.70	
Age at Loan Years	8.574	5.818	8.489	8.760	***
Std. Dev	11.507	8.327	11.209	11.712	
Industry Sector (%)					
Agriculture	0.56	12.02	16.94	71.04	
Mining, Utilities, Water	0.06	4.76	52.38	42.86	
Manufacturing	12.75	7.33	25.26	67.41	
Construction	0.09	3.57	10.71	85.71	
Wholesale & Retail	0.71	7.73	27.47	64.81	
Transport	6.27	4.97	18.27	76.75	
Hotels & Catering	27.44	3.31	12.74	83.95	
Info & Comms	2.74	4.35	28.65	67.00	
Finance	14.66	3.54	10.58	85.88	
Real Estate	4.75	6.82	14.48	78.70	
Prof Scientific	0.65	2.83	20.28	76.89	
Admin Services	1.78	3.77	9.42	86.82	
Public Admin	8.24	6.15	15.86	77.99	
Education	6.61	5.87	23.75	70.38	
Health	1.67	8.24	14.10	77.66	
Arts & Entertainment	5.25	3.37	11.28	85.35	
Other Services	2.97	2.98	15.72	81.29	
Household	2.80	6.98	16.79	76.23	
Total %	100	4.82	16.16	79.02	***
Fully Rationed %	20.52	28.336	34.902	17.105	***
Std. Dev	40.387	45.077	47.670	37.656	
Real Loan Size £s	123,212.5	54,793.01	125,133.41	126,994.77	***
Std. Dev	153,718.6	98,102.17	186,907.33	147,895.07	
Macroeconomy					
BoE base rate	0.698	0.596	0.600	0.725	***
Std. Dev	0.400	0.250	0.290	0.422	
Real GDP £bn	419,644	440,442.73	436,978.80	414,829.66	***
Std. Dev	25,560.57	26,731.29	26,655.58	22,955.02	
No. Loans	32,747	1,579	5,292	25,876	
Share of Total Loans %	100	4.82	16.16	79.02	

Column (1) presents the sample descriptive statistics for all the loans issued under EFG, while columns (2), (3), and (4) for EFG loans issued by small, medium, and large lenders, respectively. The last column reports the significance of the difference between the lender groups for key variables. Significance refers to Bartlett's equal-variances test or Pearson chi^2 test for the industry distributions.

The average firm using EFG had real sales of £1.46 million and the median firm real sales of £554,616. The average firm had been trading for 8.6 years and the median firm for 5.1 years. Large mainstream banks issued 79 percent of total EFG loans, medium-sized lenders 16.2 percent, and small lenders 4.8 percent. Over the period of the EFG's life, Bank of England base interest rates were on average low at 0.70 percent, with a range from 0.25 percent to 1.5 percent. This was a period of low base rates, as the UK economy struggled to emerge from the global financial crisis.

In terms of setting a benchmark for what types of firms in the UK face credit rationing, Figure 1 reports the estimates from UK government research

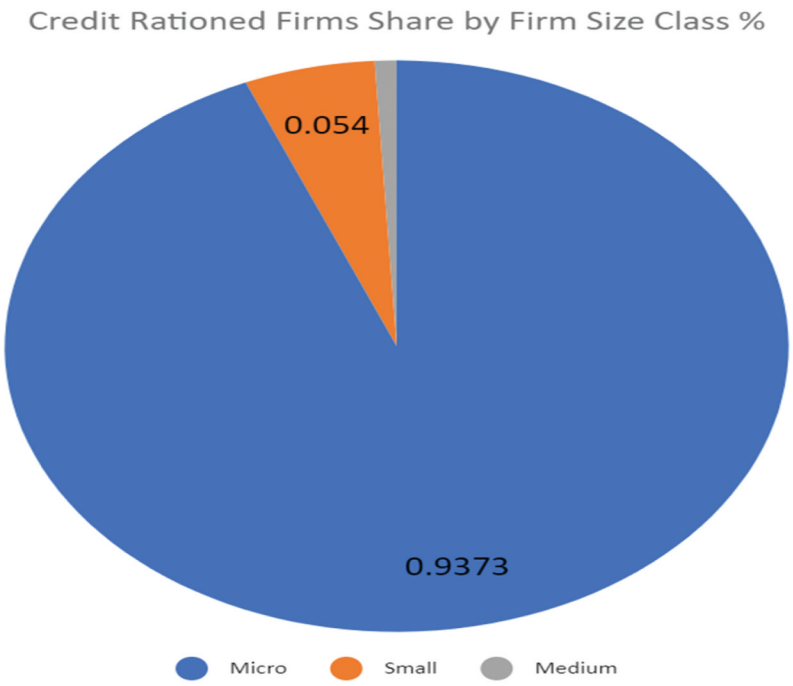

Figure 1. Estimated Credit Rationing of UK SME by Firm Size Class, 2015–2021.

conducted in 2023.[3] We observe that of the total UK SME population of 126,918 firms that faced either full credit rationing or partial credit rationing,[4] 93.73 percent (118,966 firms) were micro-businesses with fewer than 10 employees, 5.4 percent (6,852) were small firms with 10–49 employees, and only 0.90 percent (1,100) were medium-sized firms with 50–249 employees. Therefore, for achieving the political agenda of supporting credit-rationed business in the UK, the loan guarantee should be clearly and disproportionately focused on removing capital constraints for micro-businesses with very modest loan funding needs. In this sense, a well-functioning EFG scheme should be characterized by the issuance of large numbers of loans of a relatively small and similar size. In short, the types of loans that micro-firms request. Therefore, we would expect low loan size concentration under an effective EFG scheme. The average and median (real) sales turnover figures reported above show that the typical EFG borrower firm was within the parameters of a micro-business.

From Figure 2, which shows the temporal variation in the total annual number of EFG loans issued between 2009 and 2020, we clearly observe that

[3]Cowling, Wilson, et al. (2023) Estimates of credit rationing of UK SMEs. Report to the Department of Business and Trade.

[4]Full credit rationing refers to those whose loan applications were rejected outright and therefore received none of the funds, while partial credit rationing refers to those that received some but not all of the funds requested in their loan applications.

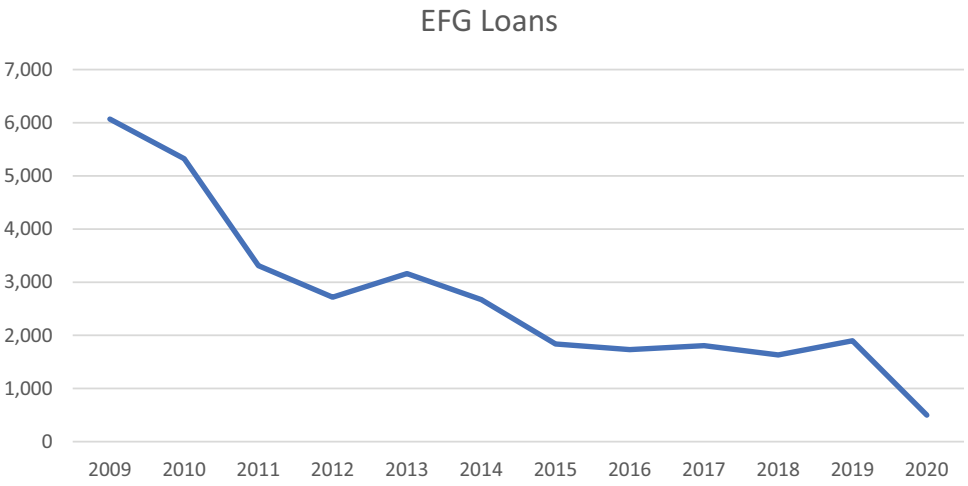

Figure 2. Total EFG Loans Issued, 2009–2020. In 2020, the EFG was phased out and replaced by the COVID-19 pandemic schemes after March 2020, although 54 EFG loans were drawn down between April and September 2020.

the number of EFG loans issued gradually diminished over the period, from a peak of 6,068 loans in 2009 to only 1,895 in the last full year of the scheme in 2019. More generally, the scheme stabilized at around 1,800–2,000 loans per annum from 2015 onward. While 2009 was within the global financial crisis period, which would help explain the relatively high number of EFG loans, the subsequent evolution of UK gross domestic product (GDP) does not fully explain the subsequent collapse in annual loans issued, as real GDP only grew by 19.5 percent over the entire decade from 2009–2019.

EFG loan market concentration

As we are explicitly interested in tracing out the temporal evolution of EFG lending through loan size concentration, we calculate the Herfindahl–Hirschman Index (HHI), which we adopt as our measure of the EFG loan market concentration. For a particular approved lender under the EFG scheme at a certain year, the HHI is calculated by squaring the loan market share of each loan issued and then summing the resulting numbers. For example, an approved lender issued four loans in 2011 totaling £1 million, with loan shares of 30 percent (£300,000), 30 percent (£300,000), 20 percent (£200,000), and 20 percent (£200,000); the HHI in 2011 for this lender is 0.26 ($30\ \text{percent}^2$ $+30\ \text{percent}^2$ $+20\ \text{percent}^2$ $+20\ \text{percent}^2$ $= 0.26$). By the nature of the calculation for HHI, it is constrained between 0 and 1. The HHI takes into account the relative size distribution of the loans issued in the EFG market. It approaches zero when the lender's loan portfolio is occupied by a large

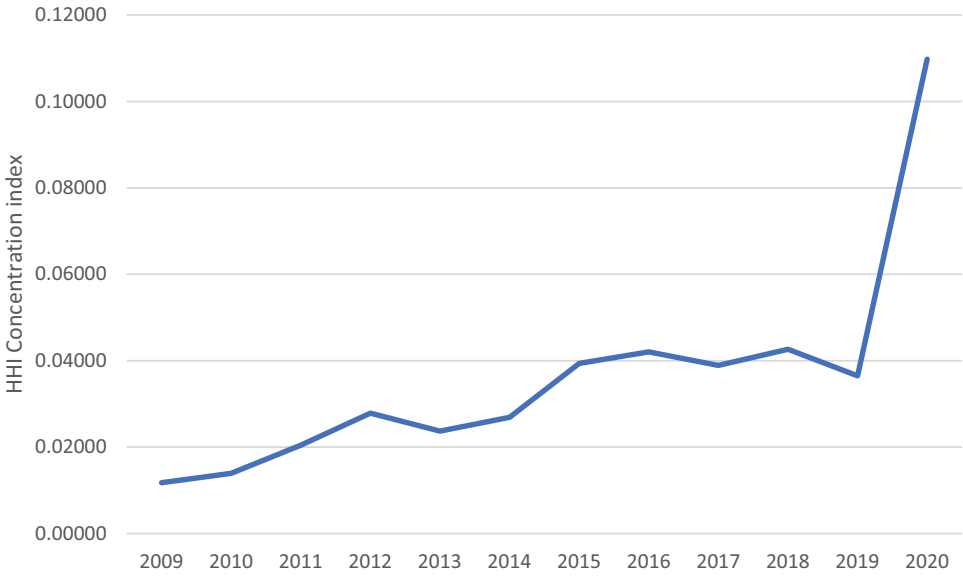

Figure 3. HHI Concentration, 2009–2020.

number of loans of relatively equal size and reaches its maximum of 1 when a market contains one loan issued to a single firm. Figure 3 shows the evolution of HHI concentration from 2009 to 2020.

We observe that, in general, the average concentration in loan size was very low at 2.53 percent. This implies a large number of EFG loans issued at a similar size. This is consistent with the subsequent distributions of loans issued under the COVID-19 pandemic period loan guarantee schemes, which were overwhelmingly dominated by loans under £50,000 on the BBL scheme. However, within the context of a low concentration of EFG loans, we do observe some significant temporal variation in the evolution of EFG loans size concentration from 2009 until 2020. For example, the HHI was only 1.18 percent in 2009, yet by 2019, it had increased to 3.65 percent. In the final (incomplete) year as the EFG was replaced by the specialist COVID-19 schemes, loan size concentration reached its highest ever level of 10.98 percent. For reference, in antitrust competition cases a market concentration of up to 15 percent would be considered a competitive market. Between 15 percent and 25 percent would be considered moderately competitive, and above that threshold highly concentrated (U.S. Department of Justice[5]). Obviously, our interpretation is different in that we are not considering market competition *per se* but using concentration as an indicator of the relevance of the EFG scheme to credit-rationed firms in the UK. Here low concentration is indicative of the greater relevance of EFG in reducing credit rationing, as large numbers of loans are issued under EFG of a similar size rather than a small

[5]https://www.justice.gov/atr/herfindahl-hirschman-index

set of very large loans dominating the scheme, which we take as an indication of less relevance to reducing credit rationing.

If we consider the two features of EFG shown in Figure 2 (declining number of EFG loans issued) and Figure 3 (increasing loan size concentration) then we can suggest that over the decade from 2009, the EFG became less relevant to UK small firms *per se* but also less able to resolve credit rationing among its core target constituency of smaller and younger firms. However, this must be considered within the overall context that even at the peak of concentration the EFG scheme would be well within the accepted bounds of competition, or for us, relevance to a large number of credit-rationed firms. Rather, we posit that the scheme was generally well focused but increasingly less so as it evolved.

If we consider the evolution of EFG loan size concentration over the period by lender size, then some clear differences are evident (Figure 4). For example, large mainstream banks consistently have the lowest concentration, even though concentration has increased significantly over the decade. This suggests that they issued a large number of similar-sized loans to a large number of credit-rationed firms. Medium-sized lenders were generally in the region indicative of strong competition and, for us, the issuing of larger numbers of similar-sized loans. In fact, the evolution of concentration for medium-sized lenders shows that they became more relevant over time. This was not obviously the case for smaller lenders up until 2017, as they were often either above the 15 percent threshold of concentration in 2009, 2012, and 2015 and around the threshold in 2010, 2013, 2014, and 2016. They would be considered to be operating in the moderately competitive region rather than the competitive region, and thus their EFG lending would be less relevant to credit-rationed micro businesses. It is clear though that after 2017 they were increasingly gravitating toward hitting the target smaller credit rationed firm target group.

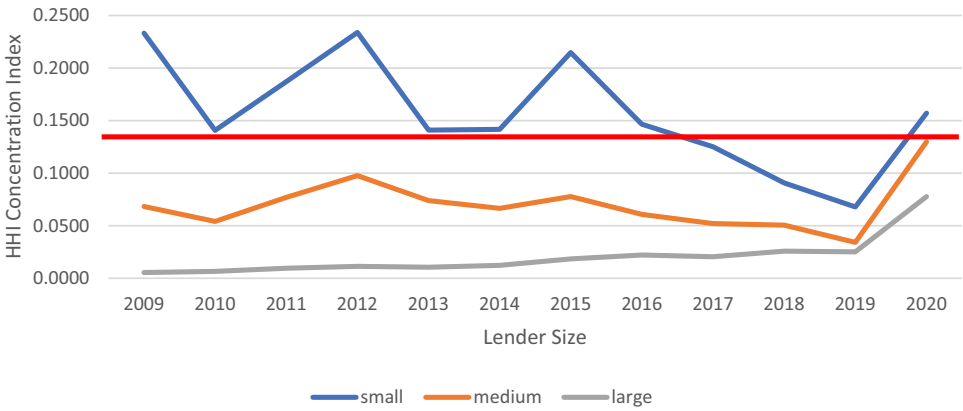

Figure 4. HHI Concentration by Lender Size, 2009–2020.

We have established that in general, the EFG scheme did reach its core credit-rationed micro- business target group and was generally characterized by low concentration and the issuance of large numbers of smaller and similar-sized loans. However, over time this was eroded, and general concentration increased (relevance decreased) but not to a level that would be of serious concern. We also found that larger mainstream banks were more focused on the target group of rationed firms than medium-sized lenders, and particularly small lenders, and this is a concern, as over time there has been increasing diversity in the approved lender pool. Thus, we appear to have two countervailing forces at work. The first is that lender concentration has reduced over time which we would normally consider to be a positive step. The second is that as much of the increased lender diversity has been smaller lenders being added to the approved list, the actual concentration of EFG lending has increased and moved away from lending to large numbers of firms with modest loan funding requirements toward fewer and larger loans.

Table 1, columns (2), (3), and (4) report the sample statistics disaggregated by lender size into small, medium, and large lenders. We observe that, on average, the (real) sales of firms whose EFG loans were issued by small lenders had the lowest sales at £934,362, and this is significantly lower than the average sales of firms whose loans were issued by medium-size lenders, which were £2.02 million, which was significantly larger than the average sales of firms using large banks at £1.38 million. There were also significant differences in average firm age across lender size, with the average age of firms accessing small lender EFG loans being the lowest at 5.8 years; this compares to 8.5 years for medium lenders and 8.8 years for large lenders. In these respects, small lenders typically supported EFG lending to smaller and younger borrowers, who were most likely to face rationing in the conventional loan market.

The distribution of loans within industry sectors also varied considerably across lender types. Small lenders had an over-representation of EFG loans issued to firms in agriculture, health services, wholesale & retail, and manufacturing compared to their global share of 4.82 percent of EFG loans. In contrast, they also had relatively low shares of lending to firms in other services and hotels & catering, both sectors being associated with low entry barriers and low profit margins. Medium lenders were over-represented in primary industry lending where their share of total loans was 52.38 percent compared to their global average share of 16.16 percent. They were also over-represented in information and communications with a share of 28.65 percent and under-represented in administrative services, finance, and construction. Large lenders had high proportional shares of lending to firms in administrative services, 86.82 percent, financial services, 85.88 percent, and arts & entertainment, 85.35 percent, compared to their global average of 79.02 percent of EFG loans. Large lenders had a particularly low representation in loans issued to firms in primary industries where their share was only 42.86 percent.

In terms of issuing loans to firms with no available loan security, who would for certain be fully credit rationed to access conventional bank loans under normal bank screening processes without the support scheme,[6] we find that only 17.11 percent of large lender loans were issued to these fully rationed firms, and this compares to 28.34 percent for small lenders and 34.90 percent for medium lenders. In this respect, large lenders favored using EFG to address issues of partial rationing, relating to firms not being able to borrow enough than full rationing, firms not being offered loans at all. We also observe that small lenders issued EFG loans averaging £54,793, which was significantly lower than the average loans issued by medium lenders, which averaged £125,133 and large lenders, which averaged £126,995. Again, our evidence points to smaller lenders addressing credit rationing at the lower end of the loan distribution where smaller and younger firms face rationing.

Our measures of the state of the UK macroeconomy also highlighted some lender size variations in EFG lending, with small lenders tending to offer loans when the Bank of England base interest rates were, on average, lower and larger lenders when BoE base rates were higher on average. This might suggest that small lenders are more concerned about the underlying cost of finance than large lenders. In contrast, medium lenders, on average, issued loans when real GDP was lower and small lenders when real GDP was higher. If periods of low economic growth and crisis tend to be when smaller firms are most likely to face credit rationing, then medium lenders tend to fill this gap. Conversely, when the macroeconomy is buoyant, larger lenders are able to expand their lending to meet the growth constraints faced by smaller firms.

In summary, smaller lenders are more likely to issue EFG loans to smaller and younger firms with more modest loan requirements but that face full credit rationing. All lender sizes have a different portfolio of EFG loans in terms of their industry composition, although there is no obvious pattern apparent. The state of the general macroeconomic environment does appear to increase or reduce the appetite of lenders of different sizes to issue EFG loans, with smaller lenders appearing to prefer a more stable economy with low base interest rates.

Methodology and Result

Model specification

Here we focus on modeling the determinants of EFG loan size concentration. The dependent variable is the HHI index of concentration, which is bounded between 0 and 1. The loan size concentration index can be obtained for each lender, j, at a certain year, t. We use a generalized linear model (glm), which fits a linear model of $HHI_{j,t}$ with covariates $X_{ij,t}$ that include both firm and

[6]Here, we identify them as otherwise fully rationed firms in our dataset.

lender control variables for each loan contract:

$$g\{E(HHI_{j,t})\} = X_{ij,t}\boldsymbol{\beta}, HHI_{j,t} \sim F \quad (1)$$

Here g() is called the link function, and F is the distributional family. If $HHI_{j,t}$ is distributed as Gaussian (normal) and g() is the identity function, we have:

$$E(HHI_{j,t}) = X_{ij,t}\boldsymbol{\beta}, HHI_{j,t} \sim \text{Normal} \quad (2)$$

On the right-hand side of our base model we include key firm characteristics such as 18 one-digit industry sectors, real sales turnover, age of firm expressed as age and age squared to test for non-linear effects, and 12 standard geographic regions. We also include lender size expressed as large mainstream bank, medium-sized lender, and small lender, and a set of year dummies. In a second base model, we remove the year dummies and replace them with real GDP and the Bank of England base interest rate (or reference interest rate). We then estimate separate models of both types for each of the three lender size classes.

Base HHI Concentration Models

As shown in Table 2, our first base model [Model 1] including the full set of year time dummies, shows that there were different regional patterns in loan size concentration. Specifically, EFG loans issued by firms located in Wales and Northern Ireland, which are the most economically disadvantaged regions in the UK with a GDP per capita in 2021 of only £25,665 and £27,154 compared to the UK average of £33,745,[7] were associated with higher loan size concentration. In contrast, Scotland and Yorkshire & Humberside regions of England were associated with relatively lower loan size concentration. It would appear that the ability of EFG to serve its target market is subject to substantial regional variation.

As expected, firm size, as measured by real sales turnover at the point of loan issue, was associated with higher loan size concentration, as larger firms require, on average, larger loans. In this respect, EFG lending, if issuing loans to larger SMEs, would be moving away from its core target constituency of credit-rationed micro-businesses. The results for firm age with full sets of controls, however, do not show a clear and robust effect on the loan size concentrations.

In respect of lender size, we observe that there is a clear and significant decrease in concentration as we move through the lender size classes, and the large mainstream bank coefficient is about three times the magnitude of

[7] https://www.ons.gov.uk/economy/grossdomesticproductgdp/bulletins/regionaleconomicactivitybygrossdomesticproductuk/1998to2021#:~:text=At%20the%20ITL1%20level%2C%20London,in%20North%20Hampshire%20at%201.9%25

Table 2. HHI Concentration Base Models.

	Loan Concentration (Lender-level)			
	(1) Base Model + year		(2) Base Model + macro	
Dependent Variables:	β	OIM S.E	β	OIM S.E
Geography (base: East Midlands)				
East of England	0.6357***	(0.0467)	0.6449***	(0.0470)
London	0.6528***	(0.0411)	0.6139***	(0.0420)
North East	0.4412***	(0.0565)	0.4626***	(0.0595)
North West	0.5562***	(0.0363)	0.5406***	(0.0374)
Northern Ireland	1.4297***	(0.0385)	1.4023***	(0.0390)
Scotland	0.1541***	(0.0434)	0.1572***	(0.0441)
South East	0.7412***	(0.0424)	0.6768***	(0.0428)
South West	0.5826***	(0.0441)	0.7101***	(0.0423)
Wales	1.0801***	(0.0502)	1.0663***	(0.0504)
West Midlands	0.4459***	(0.0390)	0.4390***	(0.0400)
Yorkshire & Humber	0.4517***	(0.0386)	0.3911***	(0.0399)
Key Firm Characteristics				
ln Real Sales	0.1098***	(0.0056)	0.1101***	(0.0057)
Firm Age	−0.0042***	(0.0016)	0.000003	(0.0017)
Firm Age Squared	−0.00001	(0.00003)	−0.0001**	(0.00003)
Sector (base: Agriculture)				
Mining, Utilities, Water	0.1183	(0.3868)	−0.0126	(0.4089)
Manufacturing	0.8794***	(0.0950)	0.9103***	(0.0985)
Construction	0.5637	(0.3916)	0.4775	(0.4026)
Wholesale and Retail	0.5673***	(0.1183)	0.8077***	(0.1200)
Transport	0.7103***	(0.0994)	0.8027***	(0.1027)
Hotels and Catering	0.8613***	(0.0951)	0.9277***	(0.0985)
Information & Comms	0.9310***	(0.1038)	0.8848***	(0.1084)
Finance	0.8096***	(0.0957)	0.8869***	(0.0992)
Real Estate	0.5719***	(0.0094)	0.6891***	(0.1026)
Prof Scientific	0.6044***	(0.1663)	0.9100***	(0.1662)
Admin Services	0.2316*	(0.1209)	0.3807***	(0.1231)
Public Admin	0.7946***	(0.0964)	0.8623***	(0.0997)
Education	0.8494***	(0.0974)	0.9322***	(0.1009)
Health	0.9782***	(0.1025)	1.1529***	(0.1057)
Arts & Entertainment	1.4508***	(0.0971)	1.5530***	(0.1004)
Other Services	0.9587***	(0.1062)	1.0094***	(0.1099)
Household	0.6605***	(0.1044)	0.8753***	(0.1071)
Lender size (base: small lenders)				
Medium	−1.7310***	(0.0206)	−1.6573***	(0.0206)
Large	−4.5563***	(0.0769)	−4.4558***	(0.0769)
Macroeconomy				
Ln Real GDP			−4.6677***	(0.1404)
BOE Base Rate			0.0534**	(0.0268)
Year (base: 2009)				
2010	−0.7164***	(0.0347)		
2011	−0.3324***	(0.0331)		
2012	−0.7864***	(0.0391)		
2013	−0.4538***	(0.0319)		
2014	−0.7131***	(0.0342)		
2015	−0.8466***	(0.0393)		
2016	−0.9274***	(0.0374)		
2017	−0.9385***	(0.0363)		
2018	−1.0591***	(0.0359)		
2019	−1.4844***	(0.0368)		
2020	−0.2588***	(0.0344)		
Constant	−3.5803***	(0.1241)	56.0932***	(1.8168)
Number obs	29,418		29,418	
AIC	−3.647		−3.594	
Log Likelihood	53,685.06		52,894.45	

Model (1) and (2) use the HHI at the lender level as the dependent variable. Model (1) uses year dummies as additional control, while Model (2) uses Macroeconomic variables instead. *** indicates significance at the 1 percent level, ** indicates significance at the 5 percent level, and * indicates significance at the 10 percent level. Figures in parentheses are standard errors.

the medium-sized lender coefficient, which is contrary to H1. Thus, the greater the share of EFG loans issued by mainstream banks, the lower the concentration of loan size. This is indicative of large mainstream banks using EFG to issue large numbers of loans of a similar size to smaller credit-rationed firms and smaller lenders issuing fewer, but larger-sized, loans, thus moving away from the core target constituency. This may relate to the lower user cost of capital for lending of mainstream banks, the fact that they have millions of small business bank accounts to support their lending decisions, and the per unit cost of loan administration being lower. In contrast, smaller lenders, on average, face a higher cost of capital, have less information available, and have higher fixed lending costs, which means that it is more cost efficient to issue larger loans (Boot & Thakor, 2000; Fabbro & Hack, 2011; Pennacchi, 1988).

There is a time dynamic apparent, which shows that in general over the lifetime of the EFG scheme, loan size concentration was relatively high between 2009 and 2014, with lots of variation, and gradually decayed from 2014 to 2019. There was a return to high concentration in the final months of the scheme in 2020. In general, this suggests that EFG, although servicing fewer small firms *per se* over time, became more relevant to the core population of micro-businesses that were credit rationed. This feature continued in the special replacement COVID-19 loan guarantee schemes, and particularly the BBL scheme, which was highly relevant to micro-businesses suffering in the pandemic and requiring quite modest loans averaging around £30,000.

At the industry sector level, we also observe significant variation in concentration effects. In this respect, we find that the arts and entertainment, health, and other services sectors were particularly associated with increases in loan size concentration, as was the information and comms industry. The health and information and comms sectors would be considered to be within knowledge intensive services (KIS). More generally, the industry sector was associated with significant variations in loan size concentration.

Our second base model [Model 2], which replaces the year dummies with real GDP and the BOE base interest rate, shows that higher real GDP was associated with a decrease in concentration and increasing relevance to smaller credit-rationed firms. This is consistent with lenders relaxing their lending standards, as the state of the macroeconomy improved, and advancing more loans of similar size to larger numbers of firms (Rodano et al., 2018). The positive coefficient on the BOE rate also shows that as the reference interest rate declined, concentration decreased. This is intriguing, as we often consider loan guarantee schemes to be a counter-cyclical policy instrument that are most effective in crisis periods (Martín-García & Morán Santor, 2021).

Table 3. HHI Concentration by Lender Size Models.

	Loan Concentration (Lender-level)											
	(3) Small Lender + year		(4) Medium Lender + year		(5) Large Lender + year		(6) Small Lender + macro		(7) Medium Lender + macro		(8) Large Lender + macro	
Dependent Variables:	β	OIM S.E	β	OIM S.E	β	OIM S.E	β	OIM S.E	β	OIM S.E	β	OIM S.E
Geography (base: East Midlands)												
East of England	0.6216***	(0.2236)	0.3078***	(0.1114)	−0.0268	(0.0233)	0.6773***	(0.2195)	0.2689**	(0.1167)	−0.0149	(0.0262)
London	0.5882***	(0.1909)	0.3818***	(0.0973)	−0.1113***	(0.0211)	0.5309***	(0.1944)	0.3124***	(0.1024)	−0.0938***	(0.0238)
North East	0.6249***	(0.2402)	−0.2552	(0.1688)	−0.0543*	(0.0303)	0.7475***	(0.2530)	−0.2760	(0.1771)	−0.0136	(0.0336)
North West	0.5106***	(0.1634)	0.3594***	(0.0894)	−0.0370*	(0.0216)	0.4647***	(0.1705)	0.3764***	(0.0925)	−0.0736***	(0.0245)
Northern Ireland	1.4278***	(0.1706)	0.2297	(0.2089)	−0.0658	(0.0653)	1.3324***	(0.1731)	0.5035**	(0.1994)	−0.0603	(0.0780)
Scotland	−0.4643*	(0.2661)	0.5629***	(0.0879)	−0.2757***	(0.0332)	−0.2516	(0.2346)	0.5011***	(0.0929)	−0.2371***	(0.0360)
South East	0.7545***	(0.1973)	0.4011***	(0.1004)	−0.1551***	(0.0220)	0.6203***	(0.1981)	0.4585***	(0.1027)	−0.1665***	(0.0248)
South West	0.7331***	(0.2004)	0.3376***	(0.1122)	−0.0116	(0.0226)	0.8926***	(0.1916)	0.2964**	(0.1170)	−0.0286	(0.0255)
Wales	1.1042***	(0.2638)	1.0483***	(0.0972)	0.0614**	(0.0263)	1.2103***	(0.2567)	1.0901***	(0.1027)	0.0687**	(0.0306)
West Midlands	0.5431***	(0.1737)	0.1437	(0.0923)	−0.0086	(0.0226)	0.5701***	(0.1804)	0.1047	(0.0975)	0.0108	(0.0256)
Yorkshire & Humber	0.5951***	(0.1746)	−0.1404	(0.0891)	−0.0035	(0.0235)	0.4862***	(0.1850)	−0.1380	(0.0930)	−0.0436	(0.0267)
Key Firm Characteristics												
In Real Sales	0.1491***	(0.0265)	0.0173	(0.0136)	0.0412***	(0.0046)	0.1535***	(0.0275)	0.0189	(0.0137)	0.0290***	(0.0050)
Firm Age	−0.0003	(0.0076)	0.0058	(0.0036)	−0.0032***	(0.0009)	0.0054	(0.0084)	0.0047	(0.0037)	0.0027***	(0.0010)
Firm Age Squared	−0.00003	(0.0001)	−0.0001	(0.0001)	0.00001	(0.00001)	−0.0001	(0.0002)	−0.0001	(0.0001)	−0.00004**	(0.00002)
Sector (base: Agriculture)												
Mining, Utilities, Water	−0.0744	(2.7502)	−0.7958	(0.6031)	−0.2158	(1.1178)	−0.3038	(2.8726)	−0.7400	(0.6373)	−0.0542	(1.4340)
Manufacturing	0.8830**	(0.3900)	−0.0344	(0.2556)	0.1180	(0.0911)	0.9917**	(0.4125)	0.0397	(0.2666)	0.1514	(0.1000)
Construction	0.3830	(1.5365)	−0.8720	(2.3917)	0.2295	(0.1934)	0.4885	(1.6055)	−0.9997	(2.4473)	0.1428	(0.2158)
Wholesale and Retail	0.7044	(0.5135)	−0.1989	(0.2842)	−0.0912	(0.1276)	1.0558**	(0.5255)	−0.1176	(0.2984)	−0.0450	(0.1402)
Transport	0.6792	(0.4147)	−0.3321	(0.2655)	0.0737	(0.0929)	0.8601**	(0.4363)	−0.2960	(0.2780)	0.0933	(0.1025)
Hotels and Catering	0.8668**	(0.3916)	−0.0025	(0.2547)	−0.0083	(0.0903)	0.9976**	(0.4129)	0.0538	(0.2661)	0.0759	(0.0988)
Information & Comms	1.1028**	(0.4439)	−0.1925	(0.2687)	0.1895**	(0.0943)	1.0276**	(0.4782)	−0.1191	(0.2786)	0.2280**	(0.1034)
Finance	0.7956**	(0.3920)	−0.0858	(0.2599)	−0.1262	(0.0906)	0.9593**	(0.4146)	0.0022	(0.2705)	−0.0519	(0.0992)
Real Estate	0.6281	(0.4080)	−0.0362	(0.2646)	0.0555	(0.0928)	0.8321*	(0.4310)	0.0002	(0.2773)	0.1548	(0.1020)
Prof Scientific	0.3765	(0.8662)	−0.1196	(0.3153)	−0.0187	(0.1021)	0.8722	(0.9798)	−0.0198	(0.3307)	0.1258	(0.1122)
Admin Services	0.1709	(0.4943)	−0.3465	(0.3359)	0.0252	(0.0960)	0.4899	(0.5139)	−0.2426	(0.3456)	0.0679	(0.1053)
Public Admin	0.8890**	(0.3952)	−0.1824	(0.2609)	0.0604	(0.0916)	1.0324**	(0.4173)	−0.0775	(0.2717)	0.1228	(0.1005)
Education	0.8081**	(0.4043)	−0.1959	(0.2592)	0.0443	(0.0925)	1.0073**	(0.4258)	−0.0858	(0.2706)	0.1031	(0.1014)
Health	0.9469**	(0.4230)	−0.0949	(0.2988)	−0.1487	(0.0997)	1.2632***	(0.4443)	0.0011	(0.3096)	0.0496	(0.1084)
Arts & Entertainment	1.5584***	(0.4022)	−0.0155	(0.2666)	−0.0623	(0.0918)	1.7919***	(0.4220)	0.0884	(0.2771)	0.0482	(0.1005)
Other Services	1.0234**	(0.4478)	−0.0597	(0.2711)	−0.0804	(0.0925)	1.1166**	(0.4746)	0.0119	(0.2831)	0.0495	(0.1015)
Household	0.6803	(0.4330)	−0.1187	(0.2737)	0.0173	(0.0953)	1.0183**	(0.4541)	−0.0215	(0.2849)	0.0921	(0.1047)

(*Continued*)

Table 3. (Continued).

	Loan Concentration (Lender-level)											
	(3) Small Lender + year		(4) Medium Lender + year		(5) Large Lender + year		(6) Small Lender + macro		(7) Medium Lender + macro		(8) Large Lender + macro	
Dependent Variables:	β	OIM S.E	β	OIM S.E	β	OIM S.E	β	OIM S.E	β	OIM S.E	β	OIM S.E
Macroeconomy												
Ln Real GDP							−7.7354***	(0.7224)	0.5107	(0.3554)	9.3694***	(0.1237)
BOE Base Rate							0.5310***	(0.1330)	−0.5959***	(0.0890)	−1.1064***	(0.0350)
Year (base: 2009)												
2010	−1.4383***	(0.1752)	0.0015	(0.1196)	0.2195***	(0.0444)						
2011	−0.8555***	(0.1695)	0.2556**	(0.1156)	0.6549***	(0.0413)						
2012	−1.7367***	(0.1903)	0.7390***	(0.1073)	0.9974***	(0.0378)						
2013	−1.2084***	(0.1659)	0.4086***	(0.1086)	0.9329***	(0.0376)						
2014	−1.5614***	(0.1743)	0.4902***	(0.1082)	1.0002***	(0.0379)						
2015	−1.8522***	(0.1919)	0.7136***	(0.1053)	1.4387***	(0.0363)						
2016	−1.9269***	(0.1936)	0.3761***	(0.1084)	1.5948***	(0.0362)						
2017	−1.8675***	(0.1915)	0.2022*	(0.1107)	1.6070***	(0.0364)						
2018	−2.0072***	(0.1836)	0.2620**	(0.1103)	1.7542***	(0.0362)						
2019	−2.5081***	(0.1872)	0.1772	(0.1113)	1.5666***	(0.0375)						
2020	−1.3575***	(0.1800)	1.2046***	(0.1052)	2.7903***	(0.0347)						
Constant	−3.3208***	(0.5400)	−3.9047***	(0.3191)	−6.8373***	(0.1122)	94.9089***	(9.3100)	−9.9000**	(4.6437)	−126.5827***	(1.6044)
Number obs	1.335		5,036		23,047		1,335		5,036		23,047	
AIC	−0.964		−3.125		−8.183		−0.882		−3.080		−8.028	
Log Likelihood	686.261		7,910.847		94,334.688		622.588		7,789.601		92,545.223	

All models use the HHI at the lender level as the dependent variable. Models (3), (4), and (5) use year dummies as additional control and are estimated for each lender group, while Models (6), (7), and (8) uses macroeconomic variable controls instead. *** indicates significance at 1 percent level, ** indicates significance at the 5 percent level, and * indicates significance at the 10 percent level. Figures in parentheses are standard errors.

Concentration by lender size models

In Table 3, we repeat the two core models but for each of the three size classes of lender separately. We find that loan size concentration is influenced by different factors, and where there is commonality in the factors, the magnitude of the effects can be quite different. With respect to geography, for example, we find that small and medium lenders issuing EFG loans to firms located in East of England, London, North West, South East, South West, and Wales were facing an increase in loan size concentration, implying a smaller number of larger loans to firms in these regions. However, small lenders issuing EFG loans in Scotland were seeing low loan size concentration. For medium lenders, however, issuing loans to firms located in Scotland was associated with increases in concentration of lending. In contrast, large mainstream banks issuing loans to firms located in Scotland and South East faced reduced concentration, our indicator of relevance. For large mainstream banks, lending to firms in London was also associated with reductions in concentration. In general, our results show that spatial differences in EFG lending are driving differences in loan size concentration both within size classes of lender and across lenders. This would imply different levels of reduction in core credit rationing given that the most credit-rationed firms are micro- businesses requiring rather modest loans.

Firm size was associated with a general increase in loan size concentration but only for small and large lenders, and the small lender effect was of much greater magnitude than for large lenders. No significant effect was identified for medium-sized lenders. In relation to firm age, we find that this was only important for concentration for large-sized lenders. Some interesting findings with respect to industry sector variations in concentration were also apparent. For medium and larger mainstream bank lenders, there were no significant industry variations in the effect on loan size concentration. But for small lenders, loan size concentration was increasing substantially when loans were issued to firms in art and entertainment, information and comms, and other services.

We also identified some distinct time differences in the evolution of loan size concentration over the life of the EFG scheme between 2009 and 2020. For smaller lenders, loan size concentration generally diminished over time, suggesting that they were gradually becoming more relevant in supporting lending to larger numbers of smaller firms with similar loan size demands. The opposite was true for larger mainstream bank lenders, which tended to increase their loan size concentration over time and move away from lending to the core credit-rationed constituency. For medium-sized lenders, the period between 2016 and 2019 was associated with reductions in loan size concentration. In this respect, smaller lenders and, to a lesser degree, medium-sized lenders, improved with respect to their ability to reach smaller firms, which

were most likely to face acute credit rationing at the same time as larger mainstream banks did the opposite and moved away from smaller-scale lending. This is supportive of H2, as smaller lenders reduced their lending concentration over time and larger lenders increased it.

The set of models using the macroeconomics controls show consistent and similar results as using year dummies. In addition, the state of the macroeconomy also had different effects on loan size concentration. Here, we observe that small-sized lenders faced reductions in loan size concentration when real GDP was higher. This is consistent with reducing their lending standards and allowing more marginal smaller firms to access loans. The precise opposite was true for larger mainstream banks, which faced increasing loan size concentration in periods of relative economic prosperity, and the magnitude of the positive real GDP–loan size concentration effect was very large compared to the negative relationships identified for smaller-sized lenders. The BOE base (or reference rate) had a significant positive impact on loan size concentration for smaller lenders but exerted a negative (concentration reducing) effect for medium-sized lenders and a much larger negative concentration effect for larger lenders.

The effects of full credit rationing on loan size concentration

We ran a final set of models with the inclusion of the full credit rationing dummy variable,[8] and these effects are reported in Table 4. In the general models, we find that full rationing is marginally associated with an increase in concentration at the 1 percent significance level, which is consistent and robust using both sets of models. This suggests that in general, the more loans that are issued under EFG to fully credit rationed firms, these loans tend to focus on just a few firms and concentration increases. In terms of whether full credit rationing impacts loan size concentration differently across lender size groups, we find no significant result.

[8]The full credit rationing dummy variable is identified based on whether the firm has collateral (loan security) or not. This is in line with Coco (2000), who stated that the use of collateral as a screening device restricts the possibility of rationing in models with private information to cases of binding wealth constraints," and Bester (1987), p. 887), who argued that "Rationing occurs only if the borrowers' collaterizable wealth is too small to allow perfect sorting or to create sufficiently strong incentives." Empirically, this construct has been adopted in research by Cowling, Brown, et al. (2024). Getting left behind? The localized consequences of exclusion from the credit market for UK SMEs. *Cambridge Journal of Regions, Economy and Society*, *17*(1), 181–200 and Cole et al. (2024). The effect of collateral on small business rationing of term loans and lines of credit. *Journal of Financial Stability*, *74*, 101320. It is also consistent with Helsen and Chmelar (2014). Collateral and Credit Rationing. *ECRI Policy Brief*, *7*, 1–13, who, using European data, stated that, "The data confirm the high importance that lenders attach to collateral and guarantees when making their lending decisions," and further that, "the bigger the company, the lower the chance of quoting missing collateral or guarantee as the main obstacle in getting finance, signalling that collateral is more important for SMEs."

Table 4. Full rationing and loan size concentration.

	Loan Concentration (Lender-level)							
	All Lenders		Small Lender		Medium Lender		Large Lender	
Dependent Variables:	Base model + year	Base model + macro	Base model + year	Base model + macro	Base model + year	Base model + macro	Base model + year	Base model + macro
Full Rationing	0.5916***	0.5587***	−0.0405	−0.1098	0.0426	0.0481	−0.0079	−0.0049
	(0.0277)	(0.0285)	(0.0833)	(0.0857)	(0.0378)	(0.0382)	(0.0160)	(0.0178)
Firm, Industry, Region Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Controls	Yes		Yes		Yes		Yes	Yes
Macroeconomy Controls		Yes		Yes		Yes		Yes
Number obs	29,418	29,418	1,335	1,335	5,036	5,036	23,047	23,047
AIC	−3.098	−3.083	−0.962	−0.881	−3.124	−3.080	−8.182	−8.028
Log Likelihood	45,617.162	45,381.69	686.385	623.451	7,911.483	7,790.297	94,334.810	92,545.261

All models use the HHI at the lender level as the dependent variable. The full credit rationing dummy variable is identified based on whether the firm have collaterals (loan security) or not. *** indicates significance at the 1 percent level, ** indicates significance at the 5 percent level, and * indicates significance at the 10 percenthas level. Figures in parentheses are standard errors.

Individual lender loan size concentration

We previously estimated loan size concentration relationships for different size classes of lenders and found some interesting findings. As a further robustness check, we estimated a final set of individual lender regression models for the largest four UK banks, two medium-sized lenders, and two small lenders. The core findings for the big four banks were that firm characteristics (size and age) played a more significant role in the determination of their loan size concentration rates than was the case for the medium and smaller lenders. For the big four banks, there was consistency between the effects of real GDP (increasing loan size concentration) and Bank of England base rates (reducing loan size concentration). This level of consistency in terms of the effects of real GDP and BoE base rates was not apparent for medium or small lenders. These results are reported in a separate appendix. These results are generally consistent with our lender size model estimates, although there is more individual lender variation within smaller and medium-sized lenders. Obviously, for data protection reasons we cannot name the individual lenders.

Conclusion

We set out to explore the evolution of loan size concentration over the whole life cycle of the UK's flagship loan guarantee scheme, the EFG, between its inception in 2009 and its cessation at the start of the COVID-19 pandemic in 2020. We used the standard measure of industry concentration, the Herfindahl–Hirschman index, as a means of establishing whether the EFG scheme was focusing on its core target constituency, which is the young micro

business with very modest loan demands. If the EFG scheme is effectively reaching its core target constituency, the HHI index would be low and consistent with a large number of similar-sized loans, as was the COVID-19 pandemic period experience in the UK with more than one million loans issued under the BBL scheme at an average loan size of only £38,000. Otherwise, if it was characterized by a relatively high HHI index, which would be indicative of a smaller number of loans of much larger size, we would consider the EFG scheme to be a move away from the core credit-rationed target group of firms.

Our findings show that loan size concentration had increased substantially from 2009 to 2020, which means that there was a smaller and larger set of loan sizes issued. In short, we posit that the increased concentration of the EFG loans suggests that it had less relevance to the most acutely rationed small firms, the small and the young, and had transitioned into a less targeted scheme supporting larger loans. However, smaller lenders became more focused and targeted in their lending over time and reached more credit-rationed small firms, suggesting that lender diversity has been a force for the good. In this sense, we have traced out an important evolutionary dynamic with large mainstream lenders migrating to safer and larger loans and smaller, alternative lenders iterating toward a broader set of smaller, more targeted loans. Within the context of UK government support for increasing diversity within the SME loan market, it is apparent that the EFG appears to have facilitated this process to the benefit of firms that face the most acute credit rationing. However, within the broad parameters of lending concentration, it is also the case that the EFG exhibited very low levels of overall loan size concentration, even though this increased over time.

Finally, we observe that smaller lenders were more likely to support EFG lending to younger and smaller firms, and those who faced full credit rationing. In this respect, an increase in the diversity of EFG lenders has most likely contributed to the scheme being more focused on the types of firms that are most likely to face significant barriers in accessing bank loans through conventional channels in the UK. It is also evident that this trend increased and accelerated during the recent COVID-19 pandemic, as approved UK government scheme lending became even more diverse. Our findings are novel and add to our understanding of how loan guarantee schemes evolve over time, particularly if the lending base is varied and includes different types and sizes of lenders. This is important, as we have shown that the size of the lender has important distributional effects in terms of the size of the loans under guarantee thta they issue and that this materially impacts the relevance of schemes to their target constituency, which is smaller and younger, financially opaque firms.

In terms of wider relevance and generalizability of our findings, as the EFG scheme had many characteristics in common with other country-level loan

guarantee schemes, in particular the level of the guarantee coverage rate, the target group of firms, and the loan size parameters, our findings are relevant to a broader constituency than the UK. However, while there is a large body of literature examining the relative contributions of different types of lenders to reducing credit rationing, to our knowledge this has not been examined to this extent in the specific context of loan guarantee schemes. This is important in terms of the general supply of loan-guaranteed loans to credit-rationed firms, but also in periods of crisis when governments seek to expand loan guarantee schemes to accommodate greater numbers of rationed borrowers. The extreme case was most recently in the COVID-19 pandemic period when, in the UK, loans under guarantee increased from a few thousand to more than one million per annum. This was even beyond the scale of the combined conventional loan portfolios of the big four UK banks. It is also the case that by having a larger and more diverse set of lenders, and particularly smaller and locally focused relational lenders, that loan guarantee schemes will be able to reach and service the loan requirements of the smallest local businesses, which are often those most likely to face the most acute credit rationing. This aspect of loan guarantee schemes has been found to be important in U.S. research with respect to community development banks (Petach et al., 2021), although Erel and Liebersohn (2022) also found that fintech lenders were a major supplier of small business PPP loans in areas with fewer bank branches and managed to reach new types of customers.

There are some limitations of our study, and one of the big questions will always be whether increasing the diversity of the lender pool has any impact on subsequent loan default, even though our evidence shows that loan supply was more focused on the target group of smaller and younger credit-rationed firms. It is an empirical question of importance, as if default increases, then a deliberate policy of increasing the lender pool may not deliver the outcomes desired for a loan guarantee scheme, which is to advance loans to credit-rationed, but fundamentally good, borrowers. As many country loan guarantee schemes have quite different lender pools, there is scope for new research that examines some of the issues in this article, but also the relationships between lender types and scheme outcomes. Further, many countries have experienced changes in the core loan guarantee scheme parameters over time, and investigating how these changes impacted the willingness of different types of lenders to issue loans under guarantee would provide new valuable information. We were not able to investigate this, as the core parameters of the scheme remained constant over time.

Discussion

In terms of the evolution of the banking system and borrowers, if larger banks lend more to fewer borrowers, and this is an increasing trend

over time, then this would imply that there is a future for smaller banks as the pool of borrowers that are not served by large banks increases. For smaller firms, it is apparent that they are better served with respect to their borrowing needs if they approach a small bank. While this is not a completely new finding, it has relevance to EFG given its explicit aim, which is to facilitate access to borrowing for smaller firms by allowing the lender to offset a significant proportion of the lending risk they face. It is also the case that even with a 75 percent public guarantee, large banks are still not able to compensate for the problems of asymmetric information that they face in small firm lending.

While we made a case for wider generalizability of our results in the concluding section, given that many countries have quite similar public loan guarantee schemes, it is also the case that the institutional (and here explicitly the loan market and wider capital market) environments are often quite different. This is the case if we compare the UK and continental Europe, as the UK capital market has a strong equity market element to it with very large venture capital, private equity, and business angel representation. In these respects, it is more similar to the United States rather than continental Europe. The latter is characterized by a very large and well-established system of local small banks, including networks of public banks such as the Sparkassen in Germany and cooperative banks and mutual guarantee organizations in Italy. However, while our findings, when considering the institutional environment across countries, clearly have most resonance in the United States and other countries where the financial system is more evenly balanced between equity and debt, it is clear that all continental European countries, and most developed countries in the world, have a non-trivial presence of large multinational banking groups, and this should not be ignored when considering the potential role of loan guarantee schemes in reducing small firm credit rationing.

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