

The effect of micro-firm definitions on statistical inferences

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Abstract

Regulations govern the choices that businesses make, though regulations may vary between firms of different sizes. Such variation should benefit entrepreneurs/owner-managers, who often operate (at least in the beginning) smaller businesses with lighter regulatory burdens. However, there is no universal definition of firms' sizes (e.g. micro-firm, SME, etc.), so authors of policy and academic research are free to specify whatever definition they choose, or none at all. Intuitively, it makes sense that such inconsistency in the definition of firms will lead to different data being included in statistical models and thus, different results and policy recommendations. However, this has not been explicitly explored. In this paper we explore this notion using the case of micro-firm definitions in academic research, and then use the example of the UK (and hence EU) to illustrate the apparent difficulty in applying the "full" multi-faceted legal definition. We utilise data from English micro-firms in the tourist accommodation sector to develop a simple econometric model to apply subsets of real-world research survey data in line with different micro-firm definitions, and then compare the outcomes. We find significant differences in results, the likely inferences of those results, and thus, the policy recommendations that would be made, thereby highlighting the importance of firm size definitions. We conclude with several recommendations for how best to define micro-firms and the use of definitions more broadly – in particular that authors are advised to clearly specify what definition they have employed, so that future researchers/readers can understand accordingly.

Keywords: Micro-Firms, Regulation, Firm Definition, Statistical Methods, Statistical Inferences, UK, EU

JEL Classification: L25, L26, C18

1. Introduction

The everyday choices that entrepreneurs make, from hiring/firing to day-to-day activities, are governed by regulation, often involving multiple levels of government. How these regulations apply to firms, including the requirements of what firms must (or must not) do, often vary depending on the size of the firm (i.e. micro-firms, SMEs - Small and Medium Enterprises, or larger firms). As such, the definition of firms is an essential regulatory consideration. Definitions must therefore be a similarly essential consideration for research and should, ideally, be aligned with relevant legal definitions. Doing so would allow comparability between reports/research for interpreting findings, and ultimately, for the resulting policy implications. However, despite this importance, there is actually little consistency between the firm definitions used, within both research and regulatory environments, if indeed, a specific definition is even provided by authors.

Entrepreneurs start and operate firms of all sizes, but the majority begin as micro-firms (Cooper et al., 1989; Lee, 2021), which pose a particular challenge to define. These are the smallest of firms, by any measure, but they are also the most prevalent size of firm in developed economies. As soon as an entrepreneur sells a single product or service, even for a very small monetary value, they could be defined as a business – a micro-firm in particular. Indeed, micro-firms often operate in local markets, with limited financial resources, and with most/all responsibilities falling on one entrepreneur: the owner, who is also usually the day-to-day manager (henceforth owner-manager) (Burns, 2016; Mallett et al., 2019; Meslier et al., 2022). SMEs (particularly larger SMEs) can operate over a wider market scope, generally have greater funding resources as well as easier access to more funds, and may have entire departments of specialist employees running different aspects of the business. At the extreme, Large firms, such as NVIDIA, currently the largest firm by market capitalisation (i.e. the total value of its shares) (CompaniesMarketcap.com, 2026), have many specialist divisions/teams to handle specific tasks/products/parts of the business and which therefore highlights this difference to a single entrepreneur starkly. Therefore, direct comparisons of micro-firms with (larger) SMEs and/or larger firms is of limited value. Furthermore, government, bank, and other support (financial or otherwise) as well as requirements (e.g. regulation) can be dependent to the “size” of the business. The need to appropriately and consistently differentiate between firms of different sizes is therefore important for understanding their decision-making, regulatory compliance, their success/failures, and in short, all aspects of their operations. This is inherently recognised by many academic journals that look to focus on a particular size of firm to be explored, such as this journal focussing on the management of small businesses.

But how firms are (or should be) defined is not consistent, nor is it necessarily appropriate. In the USA, definitions vary between industries, such that they capture roughly half of the firms in that industry (United States Census Bureau, 2021). This creates significant complication for the smallest of firms, who we have already noted, are the least likely to be able to deal with such

complexity. Furthermore, it takes no account of the peculiarities inherent to industries with different characteristics (e.g. capital requirements) and hence makes comparisons between industries challenging, as ‘small firms’ can vary considerably.

The chosen case study of the UK does not follow this industry proportion rule, but still illustrates the challenges involved in making distinctions between firms. The UK government (applying the EU definition) defines micro-firms using three criteria¹: headcount; revenue; and balance sheet total. There are similar criteria for SMEs, but with larger ceiling values. Despite this, micro-firms are often grouped with (or as part of) SMEs for regulatory, reporting, and research purposes. Regulations themselves can be written with (or without) specific considerations for micro-firms, in theory, to avoid a regressive regulatory burden on the smallest firms who are the least likely to be able to comply due to cost and complexity. The Public Charge Point Regulations (2023) act is one such example. It specifically exempts “micro businesses”, from half of the requirements for new public electric vehicle charging points. Here, “micro businesses” is defined in reference to the Small Business Enterprise and Employment Act (2015), where the full legal definition of a micro-firm is set out. However, some regulations, such as the Crime and Courts Act (2013) provide bespoke definitions for that one act alone. Similarly, UK government reports often create their own definitions, inconsistent with the legal definition or other governmental report definitions, or they only include micro-firms as part of a broad SME definition. Extant academic literature takes a similar approach. Indeed, even the term used: micro-firm; micro business; micro entity; etc. varies across documents with similar inconsistency. This creates difficulty when comparing reports/research and could cause confusion when applying laws – again, a particular problem for the smallest of firms with the least amount of resources to manage such considerations.

Such inconsistencies may be, in part, due to the inherent challenges around designing a definition for such a large number and hence wide range of firms. Micro-firms exist in all industries and far outnumber larger firms (BEIS, 2025). For example, in the UK, micro-firms are often defined as having 0-9 employees, which means they account for 95 percent of all firms, 31 percent of private sector employment, and 20 percent of private sector turnover. Expanding this definition to cover 0-249 employees (i.e. SMEs) accounts for 99.9 percent of all firms, 60 percent of private sector employment and 52 percent of private sector turnover. However, a firm with 249 employees is likely to be considerably and meaningfully different to one with 9 employees, meaning that such a definition lacks nuance, especially when it covers all but 0.1 percent of firms. Therefore, defining what a micro-firm is, really does matter.

There is evidence that the mere existence of a micro-firm definition, whatever it is, increases the likelihood that micro-firms benefit from greater consideration when new laws are developed (European Commission, 2018). Indeed, recent changes to UK legislation (Gov.uk, 2024b; HM

¹ This is explored in detail in section 2.2, along with the consideration of “linked firms”.

Government, 2022) has, for example, seen the SME definition employee ceiling shift from 250 to 500 employees, which demonstrates the importance of such definitions in three ways. Firstly, it contains a public acknowledgement that “*small businesses are presumed to be exempt from certain regulations*” (HM Government, 2022), showing how smaller firms should (but do not necessarily receive) special consideration when new regulations are drafted. Firm definitions will therefore be key to such considerations. Secondly, with an expansion of “small/medium” to 500 employees, the difference between the smallest firms (i.e. micro-firms) and the largest firms within the category get even greater. Finally, such a change highlights how legal definitions can and do vary over time, which suggest that research conducted at different points in time might not be directly comparable. Unless great care is taken to define the firms being explored, a study of “SMEs in the UK” will be exploring different things based upon on when it is written, and such detail will not likely be apparent to researchers in the future, thereby clouding understanding.

In this paper we explore how micro-firms are defined and how variations in these definitions can affect the results of statistical analyses that are often used in primary research. We are therefore using the case of micro-firms as an illustrative example, as similar issues might also impact larger small firms, such as SMEs. While any statistics textbook will note the importance of sampling when conducting research, there is surprisingly little research that demonstrates the effect of different entity definitions using real-world data. In the absence of widely available, individual firm-level data, we do this using real data from our existing research project into England-based accommodation micro-firms. We create an exploratory econometric model to illustrate the importance of definitions to which we apply different subsets of survey respondents in line with different UK micro-firm definitions. This will allow us to see how those different definitions may lead to different statistical results, which might in turn lead to different research recommendations and thus, different policy decisions. While this model is based on existing research into micro-firms, the statistical results in and of themselves are not central to the paper – it is how different definitions lead to changes in the results that matters.

We posit this purely as a “proof of concept”, using real-world data and analysis on a small scale, hoping to spur wider investigation and discussion using wider datasets and more statistical techniques. As such, this paper does not offer the usual theoretical development or literature review found in a traditional research paper, but given the stated purpose, instead includes background to understand the legal definition(s) of micro-firms, the aforementioned statistical model, and then the discussions/conclusions we therefore draw.

The contribution of the paper is three-fold. Firstly, to demonstrate that different definitions of micro-firms (in the English accommodation industry) have distinct research results and associated policy implications. In doing so we can then draw wider parallels for entrepreneurs and different definitions of larger firms, such as SMEs, which would have a similar effect on research and policy for the broader business population. Secondly, we explore how the existing UK (and hence EU)

legal definition might be both confusing and somewhat impractical to implement. Lastly, we aim to reflect on how micro-firms may be better defined going forwards, given that a simple definition is more likely to be widely used, and hence lessons about definitions more broadly.

The remainder of the paper is structured as follows. It begins by exploring the legal background to micro-firm definitions, in particular the EU and UK definitions which apply in our chosen context. In doing so it highlights how seldom these legal definitions are actually used. It then briefly explores the definitions used in the academic literature, again highlighting that independent research tends towards independent definitions. In section 3, we outline our method, using existing micro-firm data and an indicative statistical model to explore the results based on different subsets of data to match different micro-firm definitions. The results are then presented and discussed in section 4, before finally concluding in Section 5.

2. Background

It has long been observed that firm-size distribution is not equal, with smaller firms vastly outnumbering larger firms across industries and economies (Callejon, 2004; Decker et al., 2014; Haltiwanger et al., 2013; Simon & Bonini, 1958). It has also been clearly identified that the (business) experiences of entrepreneurs within smaller firms is different to that of larger firms, in part due to their size and the central role of the owner-manager (Burns, 2016; Mallett et al., 2019; Meslier et al., 2022). This in turn explains why some government regulations are written specifically with different requirements for smaller firms (HM Government, 2022).

While there seems to be a broad acceptance that smaller firms are inherently different from larger firms (Brooksbank, 1991; De Sordi et al., 2025; López-Ortega et al., 2016), there is limited research that explores different size classifications and, most importantly, how those classifications may affect research findings – and ultimately, the resulting policy recommendations. Given this, we posit that it is important to understand how firm sizes are defined and how these definitions could affect the outcomes of research and policy implications. Ultimately, it is the legal definition of firms that determines how policy decisions are practically applied. In our chosen illustrative case of the UK (particularly at the time that our original research was undertaken) the legal definition of micro and SME firms was based on the EU definition – demonstrating the multiple levels of governance involved. In the remainder of this section we will briefly explore the full legal definition for both the EU and UK, including highlighting both where existing research suggests there may be issues and how government departments fail to use these definitions, leading to the development of several propositions.

2.1 EU Definition of Micro-firms and the Difficulty of Applying It

The EU definition for micro-firms is particularly important as it is the basis from which member states (or in the case of the UK, former member states) have developed their own legal definitions. As defined in EU law, a micro-firm is (EUR-Lex, 2022):

Figure 1. The EU Definition of Micro-firms, as given by EUR-Lex (2022)

Article 2

Staff headcount and financial ceilings determining enterprise categories

1. The category of micro, small and medium-sized enterprises (SMEs) is made up of enterprises which employ fewer than 250 persons and which have an annual turnover not exceeding EUR 50 million, and/or an annual balance sheet total not exceeding EUR 43 million.
2. Within the SME category, a small enterprise is defined as an enterprise which employs fewer than 50 persons and whose annual turnover and/or annual balance sheet total does not exceed EUR 10 million.
3. Within the SME category, a microenterprise is defined as an enterprise which employs fewer than 10 persons and whose annual turnover and/or annual balance sheet total does not exceed EUR 2 million.

Article 3 further describes that either the enterprise must be “autonomous”, or must remain under these relevant thresholds while accounting for activities from “partner” or “linked” enterprises. This is an area of particular concern, as the headcount, turnover and balance sheet totals from “partner/linked” firms may need to be included when calculating the size of a firm, thus adding considerable complexity. Indeed, there is a sixty-page “user guide” for the SME definition (European Commission, 2020), which implies that the definition is not particularly ‘easy’ to follow, especially for micro-firm owner-managers with limited legal expertise. There is a further complication from the “and/or” relating to turnover and balance sheet, meaning that either or both of these figures must be under the relevant ceiling.

This definition has been regularly reviewed, most recently in European Commission (2021) and while they do note that there is some debate over the threshold values, the majority of stakeholders are reported to favour both the current format of the definition and the current ceiling values (European Commission, 2018, 2021)². This seemingly demonstrates both a continued commitment to such a definition (i.e. the distinction between firms of different sizes) and a general acceptance of the current format. Indeed, there is evidence that the “*large majority of companies report little or no costs associated with proving their SME status*” (European Commission, 2018p.9), though it is worth noting that this considers all SMEs, rather than just the micro-firms, who may lack the resources of larger small firms. However, there is further evidence that “*there is a distinct call for clarification of the rules on ownership and further guidance on key concepts*” (European Commission, 2021), which indicates some confusion around the “full” definition. Interestingly, there is also a note that some of the data-gathering and review are based solely on the “headcount criterion”, which is somewhat paradoxical given the wider criteria that this review seeks to investigate and justify.

² We note here that more recently, the monetary thresholds have recently been updated, though not yet widely adopted (EUR-Lex, 2024). However, the point remains, that whatever the thresholds are, these criteria are not being applied.

Nevertheless, there is a clear understanding of the value of a singular definition for an SME (and by extension, micro-firms), with the European Commission (2018, p.5) making a recommendation to “*avoid the proliferation of different ‘SME definitions’ at Community and national level, which would be detrimental to the internal market*”. This admission does acknowledge that the use of different definitions would be problematic, and also that within the EU, definitions do vary to some degree, which is itself illustrated by the fact that the review only uses the headcount criterion. This stands in stark contrast to the USA’s industry-based sliding scale (United States Census Bureau, 2021).

A separate review by the Centre for Strategy and Evaluation Services (2012) found that there was very limited data available to actually apply the EU SME (and by extension, micro-firm) definition in full; noting that “*it is not possible to say how many enterprises conform to the SME Definition*” (p.4). Indeed, they found that the only reliable criterion across data sources was for headcount, ultimately stating that “*it is not possible to obtain data on enterprises defined as SMEs, according to a strict application of the SME Definition, using all the relevant criteria*” (p.4). This immediately calls into question the value of the wider criteria used in the EU definition, though somewhat explains why even reviews of the EU definition focus largely on just headcount. Where the Centre for Strategy and Evaluation Services (2012) did find wider data available – in this case by including headcount and turnover in German SMEs – the effect was to reduce the total number of SMEs by 9 percent.

Based on this evidence related to the EU definition, we present our first proposition, which seems somewhat obvious, but as the basis for our analysis needs to be tested:

P1: Applying different micro-firm definitions changes the sample size of the dataset.

Having explored the EU definition and made this first proposition, we will now explore the UK definition, which is based on EU law.

2.2 UK Definition(s) of Micro-firms

The UK definition of micro-firms is currently based on the EU legal framework given it was adopted while the UK was a member of the EU. As defined in law a micro-firm³ is (Small Business Enterprise and Employment Act, 2015):

³ While we note the legal definition here uses the term “micro business”, we will continue to exclusively use “micro-firm” for consistency.

Figure 2. The UK definition of micro-firms, as given by the Small Business Enterprise and Employment Act (2015)

- (3) In the underlying provision “micro business” means an undertaking which meets the following conditions (“the micro business size conditions”)—
- (a) it has a headcount of staff of less than 10, and
 - (b) it has—
 - (i) a turnover, or
 - (ii) a balance sheet total,
 of an amount less than or equal to the micro business threshold.

The thresholds are defined as (The Non-Domestic Rating (Alteration of Lists and Appeals) (England) (Amendment) Regulations, 2017):

Figure 3. The thresholds for the UK definition of micro-firms, as amended by the Non-Domestic Rating (Alteration of Lists and Appeals) (England) (Amendment) Regulations (2017)

- (c) “micro business threshold” means—
- (i) in relation to balance sheet total, £2 million;
 - (ii) in relation to turnover, for an undertaking that has carried on business activities for at least 12 months, £2 million;
 - (iii) in relation to turnover, for an undertaking that has carried on business activities for less than 12 months, an amount proportionally adjusted; and

This is clearly in line with the EU definition that has already been discussed, though in Pounds Sterling, rather than Euros – even though the exchange rate between the currencies has never been 1:1. This remains a simplified account, as the Small Business Enterprise and Employment Act (2015) is 331 pages long, with numerous clauses, and links to other Acts, such as The Non-Domestic Rating (Alteration of Lists and Appeals) (England) (Amendment) Regulations (2017), which clarify or update details, as we have seen here with the current threshold definition. Section 34 of the Small Business Enterprise and Employment Act (2015) alone presents nine clauses among which allow the consideration of what the EU definition calls “linked or partner firms”.

However, this is not the only micro-firm definition used by UK government departments and their agents, a small, somewhat arbitrary, selection of which are included in Table.1 below.

Table 1. Micro-Firm Definitions used by the UK Government and its Agents

Department/Agent	Firm Defined	Type	Brief Definition	Citation
Companies House	Micro (though note that “small	entity	Two of the following:	Gov.uk (2024a)

	company” is similar)	• a turnover of £632,000 or less, • £316,000 or less on its balance sheet, • 10 employees or less.	
Foreign Commonwealth and Development Office	Micro	• Headcount less than 10, • Turnover or balance sheet total less than or equal to €2 million or €2 million.	FCDO (2022)
Local Government Association	Microbusiness	A total of nine or fewer employees.	LGA (2021)
Financial Conduct Authority	Micro-enterprise	An enterprise which: • employs fewer than 10 persons; and • has a turnover or annual balance sheet that does not exceed €2 million, and in determining whether these criteria are met articles 3 to 6 of the Annex to the Micro-enterprise Recommendation must be applied⁴.	FCA (2022)
Ofgem (Strategic Review)	Microbusiness non-domestic consumer ⁵	• Employ fewer than 10 employees (or their full time equivalent) and has an annual turnover or balance sheet no greater than €2 million; or • uses no more than 100,000 kWh of electricity per year; or	Ofgem (2019)

⁴ This relates to linked firms. Note also that the term “enterprise” is defined elsewhere.

⁵ We note the added complication that accommodation firms may count as domestic for some energy use as the customers’ use can be considered domestic, but such minutiae is beyond the scope here.

		• uses no more than 293,000 kWh of gas per year.	
Department for Business, Energy & Industrial Strategy: Small Business Survey	Micro businesses	• 1-9 employees <i>Note that separate reports are made for “businesses with employees” (from which the definition above is used) and “businesses with no employees”.</i>	BEIS (2022b) and BEIS (2022c)
Department for Business, Innovation and Skills	Microbusinesses	• 0 employees • 1-4 employees • 5-9 employees <i>Note that in this case all included firms are counted as “microbusinesses”, though the analysis is split across three categories.</i>	BIS (2013)
Department of Trade & Industry	Micro firm	• Micro firm: 0 - 9 employees • Small firm: 0 - 49 employees (includes micro) <i>With an additional note: “There is no single definition of a small firm, mainly because of the wide diversity of businesses”.</i>	DTI (2001)

This demonstrates the wide range of potential definitions in use within the UK government (and related organisations), few of which follow the actual legal definition. For example, the definition in Ofgem (2019) goes beyond the others to also add in limits on the electricity and gas usage of a micro-firm, which would likely require considerable effort and expense to detail. Some authors, such as Storey and Greene (2010), suggest that industry/context specific definitions such as this, allow for greater nuance. However, this stands against the apparent EU consensus that there is greater value in a single definition (European Commission, 2018). Furthermore, it also makes data

collection more difficult (as more and varied information is required), as well as making comparisons between firms across industries/contexts challenging.

Having explored the UK definition, building upon the EU definition before it, we will now expand our understanding to other countries and the wider academic literature.

2.3 Definitions in Other Countries and in Academic Literature

Other countries have developed their own micro-firm definitions. As we have noted, different government departments in the USA use different definitions. For instance, the Small Business Administration has a system for defining “small firms” based on several factors (including turnover and employee headcount) per industry, then generally defines micro-firms as a subset of these small firms with up to 10 employees. However, the Internal Revenue Service (IRS) has broad categories based on several factors including asset value which do not closely align (National Archives, 2023). In contrast, in Canada, micro-firms are defined as a subset of SMEs having just 1-4 employees, with “self-employed” single-person firms treated independently (Government of Canada, 2023). Storey and Greene (2010, p.38-39) provide an overview of international SME definitions, including for micro-firms.

We find the same lack of consistency in the extant academic literature across various research domains, such as entrepreneurship, business, and management. While it is fair to say that this is, in part, due to the international nature of much academic research, there remains little consistent use of (legal) definitions. This is compounded by large variations in research focus and in the research questions being explored. Instead, where micro-firms are explicitly explored, each researcher can (and seemingly does) choose to define micro-firms however they see fit and with little regard for similar works. Indeed, De Sordi et al. (2024) explored a broad diversity in the definitions of “small and medium-sized enterprises” and ultimately found a need for clear delineation between firms of different (small) sizes. We extend their literature review-based work by exploring the statistical implications of using different firm definitions. In doing so, we note other research into the topic of business classification (such as Brooksbank, 1991; De Sordi et al., 2025), often focused on boundary setting. However, as we are not attempting to statistically define the “best” boundaries (or similar), our focus is simply on seeing what governments/researchers currently do and how small variations in the definition can affect outcomes.

Table 2 presents another small, arbitrary selection of papers from extant literature regarding micro-firms (though often encompassed within the broader SME category), covering various international contexts. Given that we are exploring the statistical impact of definitions, a fully detailed meta-analysis of definitions used in literature, is beyond our scope. However, even this limited exploration demonstrates that even when researchers claim to use the official EU definition, sometimes even citing it, they do not include all criteria and hence technically do not use that definition. Furthermore, some papers do not provide a clear definition at all. This makes it difficult for future researchers to understand the data that is being presented and the extent to

which results can be compared between studies. Most importantly, it demonstrates the lack of consistency in the extant literature. Anecdotally, we note that in more than a decade and a half of researching this and related topics, we have *never* seen the full UK (or indeed EU) micro-firm definition actually used in any piece of research or government report.

Table 2. Micro-Firm Definitions used in extant literature

Brief Definition and <i>Explanation</i>	Context	Citation
“Enterprises are broadly classified into micro, small, medium, and large entities. Small and medium-scale enterprises (SMEs) fall within the larger size category, necessitating a certain level of formal structure” <i>and while details are not given beyond this, wider references are made to a government agency from which a definition could be inferred.</i>	Nigeria	(Umosen & Essien, 2026)
“Small and medium-sized enterprises (SMEs)” <i>which is not defined beyond this.</i>	Portugal	(Rodrigues & Rua, 2025)
“SBME (small businesses and microenterprises)” <i>which is not defined beyond this.</i>	India	(Hussain & Tyagi, 2024)
“The definition of firm size (micro, small, medium, large) is based on the Commission Recommendation 2003/361/EC.” <i>which is the EU definition, but the methods section only refers to headcount (from 1 employee up, which leaves confusion about whether the 1 employee is the owner-manager, or the first employee after them) and turnover. There is no obvious consideration of balance sheet or linked firms.</i>	Italy	(Soana et al., 2024)
<i>No definition of “small firms” (or similar) is given at all.</i>	UK	(Blackburn & Smallbone, 2008)
“With fewer than 10 employees, a firm is considered to be a micro firm, with between 10 and 49 employees it is considered to be a small firm, and where there are	EU	Henschel and Lantzsich (2022)

between 50 and 249 employees, one speaks of a medium-sized firm.”

Note that while there is a citation to the European Commission SME size definition – specifically to “ensure better comparability with other research results”, no mention is made of the criteria beyond headcount.

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|--|----------------|---------------------------|
| <ul style="list-style-type: none"> • 0-10 people • €0-2 million turnover | USA and Canada | Turner and Ledwith (2018) |
|--|----------------|---------------------------|

Note here 10 workers are included, rather than 9. Also that turnover is included, but not the rest of the definition, despite a citation to the legal definition. A US definition was also detailed.

“An enterprise which employs fewer than 10 persons and whose annual turnover and/or annual balance sheet total does not exceed euro 2 million.”	Sweden	Achtenhagen et al. (2017)
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Note that while close to the full definition, as it cites the European Commission, it omits linked firms. This paper also fails to define references to US micro-enterprises, which are detailed as well.

“Fewer than ten employees.”	France	Jaouen and Gundolf (2009)
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“Less than ten employees, as defined by the European Commission.”	Sweden	Brouder and Eriksson (2013)
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<i>No definition of micro-firms (or similar) is given at all.</i>	England	Chell and Baines (2000)
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Without asking each author what decisions led to the definitions used, which is beyond our scope (but would in itself be an interesting exercise), there is no way to know the justification found in each paper. What is clear from any review of the literature (and governmental reports) is that “employee headcount” is the most common criterion for a micro-firm definition, though how that headcount is demarcated varies. We posit that the widespread use of the headcount is due in part to the ease of assessing and applying this criterion (hence it is what we have used thus far in our own research).

Perhaps equally as important, there is very limited publicly available data, none of which is available to us, on smaller firms that includes all of the various criteria used by different countries and their micro-firm definitions. For example, industry and country level data are available in some contexts (e.g. BEIS (2022a) or OECD (2023)) but these generally include data on headcount and turnover, but not other criteria like balance sheets and also omit data around linked firms (or the lack thereof). This makes it difficult, perhaps impossible, for academic/policy authors to fully apply the relevant definition in their own work. Moreover, it makes an analysis of how definitions might affect results equally difficult/impossible – hence our approach using original survey data, which is also more in line with how many individual researchers/groups actually operate.

Having explored the different definitions used by the UK Government, as well as extant literature, and given the indication from Centre for Strategy and Evaluation Services (2012), we posit that applying different criteria can lead to a reduction in a dataset (which is what we are exploring in a UK context) and hence that the output of statistical analyses would be affected, thereby changing the results. This in turn, would therefore limit the direct comparability between different studies.

Based on this evidence from the UK, and building on what we have seen in the EU, we can therefore make our final two propositions:

P2: Application of different micro-firm definitions leads to different statistical results.

P3: There is difficulty in applying the “full” micro-firm definition.

When exploring these propositions, we acknowledge that we are focusing on specific areas of inquiry (the definition used and an example of real-world data collected by researchers) in relation to these issues. As such, it should be noted that other issues may also be relevant. For example, P1 is likely to demonstrate that more restrictive (i.e. more highly specified) definitions yield smaller data samples and thus, P2 posits differing statistical results. The wider issue here may simply be that of statistical power, which could be somewhat addressed by an increased sample size and composition. However, our contention is that in any given dataset there is no (or at best, very limited) scope to simply “collect more data”, so we must understand how researchers operate with what is available to them. Indeed, if highly nuanced definitions are more difficult to apply (as suggested in P3), then this would naturally reduce sample sizes and thus, statistical power.

3. Method

To explore how different definitions may lead to different results and how the different facets of the definition can be applied, this study uses real-world data, which was collected for an original research project regarding several aspects of regulation in English accommodation micro-firms in 2014. Given that we are investigating the use of the dataset itself, rather than the content of the data, the age of the dataset is of little importance.

3.1 Data Collection

We have chosen to use real-world survey data, rather than relying on publicly available (i.e. government) datasets, for two reasons: firstly, the availability of such data in a relevant research context (as previously noted); and secondly, because we believe it more closely represents much of the self-collected data that individual researchers actually use, particularly in regard to subjective and newly developed variables. In our case, for a wide-ranging research project into micro-firms, we developed a survey, which was pilot tested, before being sent via post and email to a database of 3805 potential respondents. The database itself was developed from publicly available sources, targeting English accommodation firms with up to 9 employees. There was a respectable 19 percent response rate (Saunders et al., 2015). Since it is not the primary concern of this paper, more detail on the data collection can be found in Betton et al. (2020a).

The survey included questions on a number of subjects regarding regulatory issues, both specific and in general. These questions have been used to develop the variables discussed in section 3.2. The survey also included an open comments box, in which many respondents made unsolicited comments regarding the survey and the issues raised within it. Some of these comments are referred to in our results and discussion to provide some indication of respondents thought processes, particularly in regards to P3.

We additionally included several questions that explored the micro-firm itself. A simple headcount question was used to verify this criterion of the definition. A question relating to revenue was also included with several bands, the highest being for “more than £2 million”. Due to sampling and the nature of the study, the dataset does not include any firms that do not meet these criteria.

Although not used in any previous analysis, two further questions, related to the remaining legal definition criteria (set out in section 2.2) of micro-firms, were also included (shown below). These questions are admittedly simplified, which was a conscious decision given the apparent difficulty with understanding the full definition, along with the need to explain why such questions were included (both ascertained in a pilot study); as well as the need for brevity, because this was a non-central part of that wider study (and the 60-page EU definition guide could not be attached).

Figure 4. The micro-firm questions as presented in our survey, using necessary simplification and explanation

One part of the definition of micro-firms is having a balance sheet total under £2 million, are you a micro-firm according to this criteria?

☐ Yes ☐ No ☐ Not sure

Another part of the definition of micro-firms is your business owning no more than 25% of another and/or having no more than 25% of your business being owned by another business, are you a micro-firm according to this criteria?

☐ Yes ☐ No ☐ Not sure

For both questions, respondents that indicated “no” or “not sure” were counted as not being micro-firms, which is again, a necessary simplification. That means, for example, that when respondents reported owning more than 25 percent of another firm, we assumed the linked firm would push the respondent beyond the limits of the micro-firm definition. As it was neither relevant nor used in our prior research, we did not ask respondents any additional questions about linked firms to explore this further.

3.2 Model and Variable Definition

To explore P1 and P2, we have developed a statistical model, which we then run with different subsets of respondent data, each in line with different definitions of micro-firms. The model is purely indicative, developed using the same methodology as our prior work, but with a previously unused independent variable. The purpose here is not to explore the results themselves, but the differences between the results of each model, thereby investigating how different definitions lead to different results. Therefore, while we provide basic information on the model and variables, we have refrained from delving too deeply into their development – we believe it is neither necessary nor relevant to the analysis we wish to make.

The OLS regression model investigates “regulatory benefit” using the same broad methodology and variables as we have used in prior research (Betton et al., 2019, 2020b, 2023). In this case, “regulatory benefit” is based on the level of agreement with a statement regarding how the respondent firm has benefitted from regulation. The variables and models themselves, are not of central importance here, but provide a reasonable way to explore how different micro-firm definitions could affect the model outputs. For that reason, the detail of their definition is included in the appendix.

Over the course of our prior research (and the resulting papers, cited above), these variables have been thoroughly justified, tested, and validated. Across several iterations, there were no concerns around omitted variable bias. Common method bias, which was also not found to be a concern, has been mitigated by comparing some variables (such as the number of employees and revenue) in our survey against independently gathered data. Cronbach’s alpha values for the construct variables exceeded the accepted minimum of 0.7 (DeVellis, 2012). Face validity and subjective assessment validity were satisfied through the use of previously successful methodologies (such as testing knowledge) and through an assessment of our initial pilot study (Hair et al., 2010; Rong & Wilkinson, 2011). Every model (including the one used herein) was checked for robustness, with residuals found to be randomly distributed with no major deviation from normality. Our prior work includes several factors that extant literature has indicated are likely related to regulatory benefit, along with the measures that we developed over the course of the research project. The VIFs for each variable were checked and found to be well within the acceptable range (Pallant, 2011; Tabachnick & Fidell, 2013). To avoid repetition (and because it is neither relevant, nor necessary to understand in this context), we suggest reading our aforementioned other outputs to

fully understand how each variable was developed. The importance in this case is how the statistical results vary, rather than detail how the variables/model were derived. All versions of the model, formally specified below, were estimated using Stata v13.

Regulatory Benefit

$$\begin{aligned} &= B_0 + B_1 \text{Perceived Knowledge} + B_2 \text{Actual Knowledge} \\ &+ B_3 \text{Perceived Value} + B_4 \text{Perceived Burden} + B_5 \text{Perceived Own} \\ &- \text{Firm Compliance} + B_6 \text{Perceived Competitor Compliance} \\ &+ B_7 \text{Years In Business} + B_8 \text{Serviced Accommodation} \\ &+ B_9 \text{Accommodation Units} + B_{10} \text{Gender} + B_{11} \text{All Areas Included} + \varepsilon_i \end{aligned}$$

Dependent variable: *Regulatory Benefit*, the level of agreement (1-7 strongly disagree to strongly agree scale) with the statement “overall, my business has benefitted from regulations”. Independent variables: *Perceived Knowledge*, self-reported percentage score of regulatory knowledge level; *Actual Knowledge*, percentage score of a test of regulatory knowledge; *Perceived Value*, 1-7 strongly disagree/agree scale regarding the positives of regulation; *Perceived Burden*, 1-7 strongly disagree/agree scale regarding the negatives of regulation; *Perceived Own-Firm Compliance*, 1-7 strongly disagree/agree scale regarding self-assessed regulatory compliance; *Perceived Competitor Compliance*, 1-7 strongly disagree/agree scale regarding the regulatory compliance of similar firms. Control variables: *Years In Business*, the number of years that the current owner-manager has operated the firm; *Serviced Accommodation*, categorical with 0 indicating non-serviced firms (i.e. caravan parks) and 1 indicating serviced firms (i.e. B&Bs); *Accommodation Units*, total number of accommodation units (i.e. rooms, pitches, lodges, etc); *Gender*, categorical with 0 indicating the respondent is female and 1 indicating male; *All Areas Included*, categorical (0/1) control to ensure no bias in the way the survey was administered. Further detail on these variables is contained in the appendix.

The model (1) is first run with the entire dataset – which includes firms with 0-9 employees and revenue under £2 million. Note that this is how we defined micro-firms in our previous papers, thus it reflects our general use of the data to date. Each subsequent model (2-6) uses only the responses which meet each of the following definitional criteria in table.3. Model 2 explores the “full” micro-firm definition; model 3 explores the smallest sole-traders; model 4 explores the “full” micro-firm definition for employers of any size; model 5 explores the “full” micro-firm definition for smaller micro-firms with employees; and model 6 explores the “full” micro-firm definition for larger micro-firms with employees. In each case, we verified the model’s robustness by examining the residuals, which were found to be randomly distributed, with no major deviation from normality (Pallant, 2011; Tabachnick & Fidell, 2013). Furthermore, the base model (1) is in line with our previous work, which has undergone rigorous testing in various forms, details of which are available with each of those papers.

Table 3. Model breakdown

Criteria	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
0-9 employees	✓	✓				
Turnover up to £2 million	✓	✓	✓	✓	✓	✓
Balance sheet up to £2 million		✓	✓	✓	✓	✓
Ownership Firms that neither own 25% of another firm nor are more than 25% owned by another firm.		✓	✓	✓	✓	✓
Non-employers Firms that consist of just an owner-manager and no-one else.			✓			
Employers Firms with an owner-manager and 1-8 employees.				✓		
1-4 employees Firms with an owner-manager and 1-4 employees.					✓	
5-8 employees Firms with an owner-manager and 5-8 employees.						✓

4. Results and Discussion

4.1 Exploring the Models

In Table.4, we present the base model (1) and five variations (2-6), as described above. Cells are coloured to highlight when the results of a model deviates from the base results – including becoming, changing, or falling out of significance, and in one case, the coefficient changing sign.

Table 4. OLS Regression - Dependent Variable: Regulatory Benefit

Independent variables	(1) All responses	(2) Balance Sheet and Ownership	(3) Balance Sheet, Ownership, and Non-Employers	(4) Balance Sheet, Ownership, and Employers	(5) Balance Sheet, Ownership, and 1-4 Employees	(6) Balance Sheet, Ownership, and 5-8 Employees
Intercept	3.157*** (0.894)	3.823*** (1.103)	4.468* (2.309)	3.336** (1.372)	3.053** (1.402)	3.854 (3.45)
Perceived Knowledge	-0.004 (0.004)	-0.003 (0.005)	-0.014 (0.011)	0.001 (0.006)	0.007 (0.007)	-0.006 (0.010)
Actual Knowledge	-0.009** (0.005)	-0.014** (0.006)	-0.008 (0.011)	-0.015** (0.008)	-0.010 (0.008)	-0.045** (0.015)
Perceived Value	0.824*** (0.091)	0.762*** (0.113)	0.974*** (0.239)	0.730*** (0.136)	0.828*** (0.154)	0.695** (0.240)
Perceived Burden	-0.085 (0.061)	-0.223** (0.077)	-0.425** (0.198)	-0.192** (0.091)	-0.161 (0.101)	-0.273 (0.168)
Perceived Own-Firm Compliance	-0.281*** (0.082)	-0.199* (0.105)	-0.389* (0.226)	-0.113 (0.126)	-0.056 (0.133)	-0.299 (0.275)
Perceived Competitor Compliance	-0.119 (0.074)	-0.147 (0.100)	-0.042 (0.209)	-0.202 (0.125)	-0.525*** (0.134)	0.590** (0.244)
Years In Business	-0.003 (0.005)	-0.005 (0.007)	0.025 (0.017)	-0.001 (0.008)	0.001 (0.009)	0.013 (0.014)
Serviced Accommodation	-0.354** (0.126)	-0.405** (0.167)	-1.007** (0.314)	-0.412* (0.219)	-0.710** (0.233)	-0.264 (0.561)
Accommodation Units	-0.001 (0.001)	-0.001 (0.002)	0.005 (0.009)	0.001 (0.002)	-0.002 (0.004)	0.003 (0.003)
Gender	-0.322*** (0.120)	-0.338** (0.151)	-0.670 (0.410)	-0.466** (0.174)	-0.419** (0.191)	-0.799** (0.343)
All Areas Included	-0.007 (0.125)	-0.100 (0.157)	0.163 (0.647)	-0.075 (0.192)	0.095 (0.217)	0.187 (0.361)
Adjusted R ²	0.21	0.23	0.37	0.23	0.34	0.34
F	(11, 543) 14.08	(11, 328) 10.34	(11, 58) 4.69	(11, 220) 7.31	(11, 159) 8.90	(11, 49) 3.81
N	555	340	70	232	171	61
Becomes significant						
Significance level changes						
Falls out of significance						

Changes Sign

* p<0.1, ** p<0.05, *** p<0.001. Note: Standard Error in parentheses.

Model 1 has a respectable adjusted r-squared value of 0.21, with five variables that are significant and associated with regulatory benefit, four of which are negative. From this we would make a number of inferences, posit potential causality and ultimately, make a number of recommendations for policy and future research. Indeed, had we explored model 1 as the subject of a paper (rather than using it to demonstrate statistical variations, as we are doing here), we likely would have focused our efforts on Perceived Value and Perceived Own-Firm Compliance, which have the strongest associations. We would not have spent much, if any, time considering the Perceived Burden (of Regulation), which shows no statistical significance.

However, table.4 clearly demonstrates what originally seems to be intuitively obvious – that by using different micro-firm definitions, and thus, different (sub)sets of data, the results of our model change substantially.

Firstly, across the models, the adjusted r-squared values range from 0.21 (model 1) to 0.37 (model 3), which is an increase of up to 0.16 that, in itself, would be a noteworthy r-squared value. Such changes are, in part, due to the varying sizes in the number of observations – since each model restricts the respondents that are included. Indeed, the number of observations ranges from 555 (model 1) to 61 (model 6). This supports P1, with differing micro-firm definitions changing the sample size of the dataset.

Secondly, across the models presented here, we see the full gamut of possible changes: variables falling into and out of statistical significance; changes in the level of significance; and in the sign of the coefficient. This, in turn, will inevitably lead to different inferences, analyses, and ultimately, conclusions/recommendations. To return to our earlier example, if we use the full (simplified) definition (model 2), then we would now infer that there is a significant and negative association between Perceived Burden and Regulatory Benefit (which was previously an insignificant relationship). That would lead to us to make different conclusions and recommendations, likely aimed at addressing Perceived Burden. Beyond the changes to the number of observations, this can only be because of changes in the best fit line identified during the regression progress.

This finding therefore supports P2: the definition of firms used will alter the data that is included in an analysis, which will then change the results. This has significant implications for research and policy. Furthermore, it clearly demonstrates a potential impact of our concern that extant literature, governments, and their agents, utilise a number of definitions (sometimes without detailing the definition at all). This substantially limits the comparability between research papers/reports and may lead them to unintentionally generate questionable policy recommendations.

We therefore recommend that as a bare minimum, all authors across research and policy domains clearly state what definitions they are using. Furthermore, it would be useful to include a brief note about why the given definition was chosen, in line with De Sordi et al. (2025), and the specific

quantitative evidence provided herein. With these two pieces of information, readers and future researchers will have the opportunity to evaluate how best to interpret results, as well as compare their own results to extant literature. While consistency would be the preferred option here, that is simply not always practical. For example, even taking the relevant local legal definition (in this case, the UK definition of EU rules, stated in Pounds Sterling), there would be some variation against literature using the EU definition (in Euros/other EU currencies). There would be further variation when considering literature using US and other definitions as well. Moreover, the legal definitions require a level of detail that can be difficult, potentially impossible, to collect, as we will see in the following section.

4.2 Reflections on Definitions

As noted above, the full UK/EU legal definition for micro-firms contains three elements. We now consider each of these in turn to determine how and how easily, each criterion can be applied to firms within our context. First, and most widely used in our experience (although we would welcome a detailed investigation to verify this point), the headcount criterion is generally taken to be a variation on “up to 9 employees”. This is relatively easy to understand and apply, though is slightly complicated by two factors: part-time or seasonal workers, who are treated as a decimal (so someone working half of full-time, or full-time for only half the year, would count as 0.5 employees); and “informal workers”, such as family members, friends, or even sub-contractors, who may contribute to the business without being paid (formally or otherwise). The former factor here is merely a complication, though micro-firm owner-managers may need help to calculate the Full Time Equivalent (FTE) hours. The latter factor is of particular importance for micro-firms, many of whom rely on informal and family labour. European Commission (2020) suggests only people who “derive financial advantage” should count here, though anecdotal data suggests that would miss many important workers (such as family members who work without pay). This issue of informal workers is beyond the scope of this paper but is an area that requires further study in both a micro-firm context and beyond.

Second, the revenue threshold on which we received no questions or comments on the meaning of this criterion which implies it was straightforward for survey respondents to understand. However, it is worth noting that several comments were made about the revenue bands that were provided, indicating that a majority of firms were not only in the lowest band (81 percent of respondents said their revenue was “up to £75,000”), but that they were significantly closer to the lower end of this scale. There were several unsolicited comments that indicated revenue was under £10,000. This suggests that future researchers or policy makers are “safe” to use revenue as part of a definition, but that bands should be somewhat granular, particularly at the lower end where most firms are likely to be.

Third, the balance sheet threshold. Knowledge of this concept, or indeed, what this term even means, was somewhat low. This suggests that the balance sheet total is not a concept of immediate

importance to owner-managers, who may instead be more focused on ensuring that they are making profit. We tentatively posit that this is an area that a micro-firm's accountant may arrange, given prior evidence of the roles that accountants play for micro-firms (BEIS, 2016). For researchers, the added step, along with potential cost, of consulting an accountant to complete a survey may prove to be an insurmountable impediment.

Finally, the ownership criterion was similarly confusing for our respondents despite our simplification. Overall, 11.21 percent of respondents said they were unsure about ownership – considerably more than the 6.04 percent that were unsure about the balance sheet total. We concede that in our case, there may have been some added confusion, as many of the respondents were (anecdotally or otherwise) seen as an aside to a farm business. However, it seems justified to posit that if we had followed up by asking respondents to calculate the values of “linked firms”, success and/or accuracy would have been poor at best and not possible at worst, potentially impacting survey response/completion rates.

Comments from the open comments box of both our pilot and main survey made it clear that (even this simplified) “full” definition remained somewhat confusing to many respondents. Given this, and the number who reported they were unsure about the wider definition questions, there is strong support for P3, demonstrating the difficulty in applying even a simplified version of the “full” definition. Furthermore, while the European Commission (2018) may believe “the majority” of firms may find the “full” definition suitable, the remaining firms, who are likely the relatively business-naïve owner-managers of the smallest micro-firms, simply cannot understand it. The importance of this finding, such as the possible ramifications on policy, requires further research.

Our overall findings therefore suggest that a strict application of the UK legal definition (and by extension, the EU legal definition) would not have been possible in our case and therefore, likely would not be possible for future research either. Given this, and the fact that even governmental reports generally do not use the full definition, we posit that the legal definition should be simplified – it is simply not practical as written currently, nor is it widely used. Furthermore, given that headcount is generally well understood, we would cautiously suggest a simple “headcount only” definition. If further a distinguishing feature is needed, (the impact of which should be researched) then a “headcount and turnover” definition would remain relatively easy to implement. We would, therefore, recommend that future research explores the implications of implementing such a simplified definition in a UK/EU context. We do note that this stands in contrast to authors who prefer more nuanced definitions, often tied to specific circumstances (Brooksbank, 1991; De Sordi et al., 2025; Ščeuľovs & Gaile-Sarkane, 2012). However, we question whether the required data can be sufficiently collected from this particular group, namely micro-firm owner-managers.

5. Conclusion

We set out to explore the implication of different firm definitions using the case of micro-firms: how these definitions can impact analyses, thus policy suggestions; and also, how usable the legal

definition is in practice. Our case exploration showed that *definitions do, indeed, matter*. How we define firms determines what data we collect and, as we have demonstrated here, this impacts statistical results, thus policy recommendations. The implications of this therefore span both research and policy domains well beyond the small-scale explored illustrative case of English accommodation micro-firms. This is an area that would greatly benefit from further exploration, using both: wider datasets, that encompass other industries and countries; and a greater array of statistical techniques. From this, we can make several further recommendations.

Firstly, that at a bare minimum, *the definition used for firms should be listed in each report or piece of research*. It is not enough to say “micro-firms” (or some variation) – authors must clearly explain what they mean by this. While such reporting would not necessarily allow results to be directly compared between studies, it would at least allow future researchers to better understand who and what firms have been included and potentially, trying to control for this in their own work. Furthermore, this need to explain a definition is not limited to micro-firms, or indeed, firms of any size – *properly (though briefly) defining any unit used in a statistical analysis would aid the understanding of future researchers*. Given the ease of doing so, likely at most only a few sentences, there should be little to prevent this. Indeed, we suggest that journals could perhaps seek to ask for clear definitions in their various “author guidelines” to help ensure that such information is included.

Secondly, we can attest to the relative difficulties of each criterion in the legal definition. Even despite the potential complications - of part-time and seasonal workers, as well as family members (who may or may not be paid) - *headcount was relatively well understood* by our sample of owner-managers. Similarly, *turnover was well understood*, though our research points to the need to consider firms with “low” turnover, as there was some consternation that our lowest band was “up to £75,000”, when many firms made less than a tenth of this. *Balance sheet was less well understood*, which we posit may be due to the smallest of firms not being entirely cognisant of it and not inclined to research it for our survey. Lastly, the *autonomy criterion proved very confusing for respondents*, with 11.21 percent not understanding even our simplified question. Autonomy requires a detailed understanding of a firm’s ownership, as well as the accounting status of any linked firms, leading to wider calculations. That many of our respondents failed to understand their own balance sheet, the wider complications seem unlikely to be resolved. These findings support the Centre for Strategy and Evaluation Services (2012) position that *it is largely impossible to use the full definition of a micro-firm in research*. Furthermore, we note that governmental data (such as BEIS, 2022a) does not include these wider criteria, meaning that there is no wider official data to use or to offer as a comparison for independent research.

Finally, given our findings and the evidence that many researchers and government departments apply variations of the definition, we suggest both that a “simple” definition is of more value and hence, that the “official” definition of a micro-firm needs careful re-examination. *It seems*

unhelpful to have a definition which most micro-firms cannot understand (even with a 60-page guide) and most researchers, both governmental and academic, cannot and do not adopt. Policymakers should consider the importance of, for example, a firm with £10,000 yearly revenue and 2 employees having a balance sheet total of £2.1 million, and in particular, whether this seemingly unlikely occurrence suggests enough of a material difference relative to the added complexity (and confusion) for the vast majority of firms which are “micro” by every criterion. Future research should investigate this issue, exploring the likelihood of a firm meeting different variations of some, but not all, parts of the current legal definition. Such research could also explore the value and material difference of additional criteria used within specific industries/contexts. Furthermore, *exploring the policy implications that a simplification, such as headcount only or in/excluding revenue would bring*. Such work would be prescient given the UK government’s goal of simplification and deregulation following Brexit, and it would allow for easy, global comparability of research and reports if adopted more broadly.

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Appendix

Variable Definition

The details of the variables used in the models are described in Table.5 below. We would again highlight that across several previously published papers these variables have been tested and used in similar models. The only “new” variable is the dependent: Regulatory Benefit, which is a unique construct for this paper to explore the differences between micro-firm definitions. The research survey providing the data explored four areas of regulation: employment; anti-discrimination; fire; and health and safety. In line with (Clarke, 2005) and (Mitra & Washington, 2012), we originally conducted a literature review to suggest what variables may reasonably demonstrate an association and focused on these for our research. We also focused on reasonable confounders, rather than adding numerous additional variables, which may negatively affect the accuracy of results (Breiman, 1992; Clarke, 2005).

Table 5. Survey items and variable construction

Variable	Construction
Regulatory Benefit	The level of agreement on a 1-7 Likert scale (strongly disagree to strongly agree) for the statement: i) <i>Overall, my business has benefitted from regulations</i>
(dependent)	In line with our prior research, there is reason to believe that each of the independent and control variables may have an association with this belief in regulatory benefit. For example, greater knowledge (perceived or actual) could lead to a greater understanding of a regulation and thus, how it may benefit the business itself. Similarly, we could expect that the perceived-value and perceived-burden (of regulation), would be associated with the perception of business benefit. Note that the purpose of this paper is to explore variations in the definition of micro-firms, so the “merit” of this variable for study is of limited importance. Mean: 3.88. Standard deviation: 1.47.
Perceived-Knowledge	Construct variable of self-reported knowledge using the following item measured on a 1-5 Likert scale (not at all knowledgeable to extremely knowledgeable) for each of the (up to) four areas of regulation. These results were combined to generate a mean which was then converted to an overall percentage:
(independent)	

i) How knowledgeable are you about [each] regulation

Note this statement was presented for each included regulation (employment, anti-discrimination, fire, and health and safety), with the name of the regulation in place of [each]. Cronbach's alpha = 0.79.

This variable is based upon prior literature including (Stokols et al., 2001) and (Eva et al., 2004), who both employ similar measures to test self-assessments of knowledge.

Actual-Knowledge (independent)	Construct variable based on a set of five true/false questions for each of the (up to) four areas of regulation. These questions covered varying levels of complexity based on routine regulatory knowledge. This variable was calculated as the percentage of correctly answered questions relative to the number which were attempted (i.e. X out of 20 for respondents answering all areas, and X out of 15 for respondents only attempting three regulatory areas).
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Perceived-Value of regulation (independent)	Construct variable created using the following items measured on a 1-7 Likert scale (strongly disagree to strongly agree) for each of the (up to) four areas of regulation. The mean of the scores is calculated as the construct variable:
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- i) I understand why [each] regulations exist*
- ii) I believe [each] regulations are good for business*
- iii) [Each] regulations are a sensible control on firms*

Note each statement was presented for each included regulation, with the name of the regulation in place of [each]. Cronbach's alpha = 0.88.

This variable, along with Perceived-Burden of regulation (below), was devised to explore the ambivalence that owner-managers may feel towards regulation. Creating variables for value and burden (below) allows for both feelings to simultaneously co-exist. The individual items listed above (i-iii) were partly developed based on the work of (Edwards et al., 2003) and (IpsosMORI, 2007), using Spector's (1992) guidelines.

Perceived-Burden of regulation (independent)	Construct variable created using the following items measured on a 1-7 Likert scale (strongly disagree to strongly agree) for each of the (up to) four areas of regulation. The mean of the scores is calculated as the construct variable: i) <i>Small businesses, such as my own, should be exempt from the full force of [each] regulation</i> ii) <i>The protections afforded by [each] regulations are an unreasonable burden on my firm</i> Note each statement was presented for each included regulation, with the name of the regulation in place of [each]. Cronbach's alpha = 0.83. As with Perceived-Value, items were partly developed based on Edwards <i>et al</i> (2003) and IpsosMORI (2007), using Spector's (1992) guidelines.
Perceived Own-Firm regulatory Compliance (independent)	Construct variable created using the following item measured on a 1-7 Likert scale (strongly disagree to strongly agree) for each of the (up to) four areas of regulation (employment, anti-discrimination, fire, and health and safety). The mean of the scores is calculated as the construct variable: i) <i>I do not knowingly breach [each] regulation</i> Note this statement was presented for each included regulation, with the name of the regulation in place of [each]. Cronbach's alpha = 0.74. This variable, developed using Spector's (1992) guidelines, reduces the ambiguity caused by (potentially) poor knowledge or understanding of regulation, by specifying only intentional breaches. As with the perceived level of knowledge variable, this is a subjective, self-assessed measurement, testing only what respondents believe their compliance level to be, rather than an objective assessment of what it actually is.
Perceived Competitor regulatory Compliance (independent)	Construct variable created using the following item measured on a 1-7 Likert scale (strongly disagree to strongly agree) for each of the (up to) four areas of regulation. Scores were reverse coded to make it comparable with the Perceived Own-Firm Compliance variable and the mean of the scores is calculated as the construct variable: i) <i>I think my firm is more compliant with [each] regulation than my competitors are</i>

	Note this statement was presented for each included area of regulation, with the name of the regulation in place of [each]. Cronbach's alpha = 0.82. This variable was developed using Spector's (1992) guidelines to ensure that the construct was well defined and matches the desired outcome. Like Perceived-Knowledge, this construct is purely subjective. In a survey setting, there is little opportunity to provide the feedback that would be required to calibrate respondents' views. However, the statement is worded such that estimates are generalised, rather than being directly compared to Own-Firm Compliance levels, or requiring respondents to denote relative percentiles of Own-Firm and Competitor Compliance levels (Brown, 2011; Meeran et al., 2016; Merkle & Weber, 2011).
Years in business	The number of years that the current owner-manager has operated the business. An owner-manager with more years may be more experienced with regulatory issues and changes (Carter et al., 2009), while an owner-manager with fewer years may indicate a firm in a different stage of its lifecycle, such as a new and expanding firm (Andersson et al., 2002). Furthermore, Lewis et al. (2015) found newer firms struggle with record keeping, which Arocena and Núñez (2010) attribute to inexperience.
Serviced accommodation	Categorical to identify the sub-industry. <i>Category 0: non-serviced accommodation (such as caravan parks).</i> <i>Category 1: serviced accommodation (such as B&Bs).</i>
(control)	The sub-industry denotes the level of service provided by the firm and designates differences relating to the type, extent, and enforcement of regulation for the firm, along with inferring to which trade-associations each firm may be a member.
Accommodation Units	The number of accommodation units (rooms, pitches, lodges, etc.) that the respondent business has. This helps to distinguish between smaller and larger firms.
(control)	Mean: 18.81. Standard deviation: 47.15.

Gender	Categorical to identify the gender of the survey respondent.
	<i>Category 0: female.</i>
(control)	<i>Category 1: male.</i>

All areas of regulation	The values of the dependent and main independent variables are determined by the mean score of up to four areas of regulation. This categorical (0/1) variable distinguishes between respondents who answered for every area of regulation (cat 1) and those who did not answer at least one area (cat 0). It tests for any bias created by the different number of questions answered by the respondents, which was preferred to either forcing respondents to answer all areas, or treating scores at face value (such that someone scoring 15/15 is treated the same as someone scoring (15/20), as both would create significant bias.
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