STOCKHOLM SCHOOL OF ECONOMICS
Department of Accounting
BE351 Degree Project in Accounting and Financial Management
Fall 2025

Beyond the Intuition of Economies of Scale

A Firm-Level Examination of Growth, Size, and Operating Performance

Emma Höjman (26088) and Ebba Nyctelius (26126)

Abstract

The purpose of this thesis is to examine whether the commonly held intuition - that growing firms will benefit from economies of scale - is supported by firm-level accounting data. Although theory predicts that expanding firms should experience declining costs relative to sales and rising profitability, empirical evidence remains mixed. Using a panel dataset of 6817 firm-year observations for Swedish high-growth firms (2013-2019), we estimate fixed-effects regression models to capture within-firm changes in size, and indicators of economies of scale. By including an interaction between firm growth and firm size we account for the diminishing nature of economies of scale. Re-estimating the regressions for industry subsamples allows us to identify industry differences. Our results show that firm growth tends to be associated with lower production and overhead costs relative to sales and higher profitability. This provides an initial indication that economies of scale can be captured in firm-level accounting data. Due to the systematically insignificant interaction term, we find no evidence that these relationships diminish as firms grow. We do, however, find that the realisation of economies of scale varies across industries. Our findings underscore the complexity of economies of scale in practice and encourage further research.

Keywords: Economies of Scale, Firm Size, Firm Growth, Operating Performance, Costs
Supervisor: Katerina Hellström

Acknowledgements: We would like to thank our supervisor, Katerina for her help. We also wish to express our gratitude to our families for their patience and support throughout this process. Most of all, we would like to thank each other. This thesis has truly been a journey, and we could not have completed it without one another, nor would we have wanted to.

Table of Contents

1. Introduction

1.1 Problem Background

Almost all business students, researchers, and practitioners are familiar with the concept of economies of scale. People encounter it early in their education, teach it in various courses, and rely on it in pitches, valuations, and everyday business discussions. Given how frequently the term appears in business, it is hardly surprising that a commonly held intuition has emerged - that growing firms will benefit from economies of scale - an assumption so ingrained that it is rarely questioned.

In short, economies of scale arise when costs increase less than proportionally to output, causing average unit costs to fall as firms expand. These scale advantages can arise through several mechanisms such as the spreading of fixed costs, greater specialisation and learning, economies of massed resources, and stronger bargaining power. In accounting terms, these advantages appear when costs relative to sales decline, or when profits relative to sales rise as firms expand.

The assumption that growing firms will benefit from economies of scale is so ingrained that it is routinely invoked despite its mixed empirical evidence. In microeconomics, where studies are typically conducted at a plant-level, there is generally support for economies of scale. However, these findings may not necessarily translate to a firm-level accounting context where multiple plants, activities, and products are aggregated. Thus, plant level insights cannot be directly mapped onto firm-level accounting measures. In contrast, accounting research offers mixed evidence. Many studies find that larger firms do not earn higher profits, and in fact, profitability often declines with size (e.g. Cowling, 2004; Stekler 1964). Industry concentration (Bain, 1951; Samuels and Smyth, 1968; Shepherd, 1972), and organisational complexity (Shepherd, 1972; Silberston, 1972) help explain why scale advantages may fail to materialise. Results from studies examining the relationship between growth and profitability are also mixed. Some find positive effects (Coad, Cowling, & Siepel, 2017; Cowling, 2004), while others find the effects to be negative (Jang and Park, 2011) or conditional on initial profitability (Davidsson, Steffens & Fitzsimmons, 2009; Mansikkamäki, 2023). Yadav, Pahi & Gangakhedkar, (2022) find that growth can raise profitability initially, but gains taper off as firms become larger. One of the few direct tests of firm-level economies of scale was conducted by Ertan, Lewellen & Thomas, (2020). They find no evidence that growing firms reduce

average costs or improve margins. Overall, accounting research provides limited support for economies of scale at the firm level. The clash between common intuition and observed outcomes highlights the need for future research in this area.

Consequently, although the concept of economies of scale is widely accepted, it is far less clear whether firms realise them in practice, or whether they can be observed in accounting terms. Understanding whether, where and for whom scale advantages arise is essential for both theoretical education and practical business application. Despite its widespread acceptance and use, it remains unclear whether economies of scale are realised at a firm level, how they appear in accounting data, which cost components they affect, and how their realisation varies with firm characteristics, size, and growth.

1.2 Purpose and Contribution

The purpose of our thesis has been to examine whether the commonly held intuition - that growing firms will benefit from economies of scale - holds in practice, given the tension between theory and existing empirical evidence. This motivates our research question:

Is firm growth associated with the realisation of economies of scale in cost and profit measures, and are these relationships conditioned by firm size and industry differences?

In answering this question, we contribute to the existing literature in several ways. First, we contribute by using firm-level accounting data, since most prior research in economics relies on plant-level data and physical output measures. There is therefore a clear need to verify whether plant-level findings also hold when measured using accounting data. Second, while most prior accounting research examines the general relationship between growth and profitability or size and profitability without directly linking these findings to economies of scale, we contribute by considering firm size and growth jointly. Through this we aim to capture how the association between growth and indicators of economies of scale evolves as firms become larger, reflecting the diminishing nature of economies of scale proposed in theory. Third, whereas most prior research focuses on the relationship between firm growth and overall profitability, our study digs deeper into where in the cost structure economies of scale arise. To do this, we examine specific operating costs such as production costs, operating overhead costs, and depreciation and amortisation relative to sales, alongside profitability measures such as

gross and operating margins. This allows us to identify whether scale advantages stem from production efficiencies, reductions in administrative and overhead costs, or improved utilisation of fixed assets, thereby providing a more granular understanding of how and where economies of scale materialise within firms. Fourth, with the use of an aggregate sample, we contribute by providing evidence on whether the average firm can expect to realise economies of scale. By subsequently splitting the sample, we contribute by showing differences between the average firm and specific industries, as well as between firms from different industries. Lastly, we contribute by following a sample of high-growth firms as they are expected to begin to realise economies of scale in their early expansion phase and continue tracking them throughout their growth journeys. This allows us to observe how economies of scale emerge and develop, effectively following firms from the outset of growth toward the point at which scale effects fully materialise. This contribution is particularly pronounced given the limited number of studies conducted in a Swedish context.

1.3 Scope and Results

To capture the patterns of economies of scale, we examine the operating performance of a sample of high-growth Swedish firms over the period 2013-2019. This period represents a sustained phase of economic expansion in Sweden, during which firms had opportunities to scale their operations following the financial crisis and before the COVID-19 pandemic introduced new sources of uncertainty. This context is particularly relevant today, as we enter a new phase of economic expansion. We employ linear regression models with firm- and time-fixed effects to capture within-firm changes in firm growth and indicators of economies of scale, while controlling for all time-invariant firm characteristics and common shocks. We also introduce an interaction between growth and firm size to test whether the potential benefits - or drawbacks - of expansion depend on a firm's existing scale.

We expect to observe a negative relationship between firm growth and the cost-to-sales ratios, and a positive relationship between firm growth and profit margins. We also expect these relationships to be moderated by firm size, such that the effect diminishes as firms grow larger, and that there are differences across industries. Many of our results confirm these expectations. We find that firm growth is associated with lower operating costs relative to sales and higher profit margins, finding initial confirmation that growing firms realise economies of scale. We also observe that these associations do differ across industries. However, we do not find

evidence that the relationships between firm growth and indicators of economies of scale are moderated by firm size.

1.4. Disposition

Our thesis is structured in the following way. We begin by outlining the mechanisms underlying economies of scale. We then highlight factors that may offset or distort the gains from increased scale, as well as the role of industry characteristics. Next, we review prior research on economies of scale, as well as studies examining the relationship between growth, size and profitability. Building on this, we present our hypotheses and detail the methodology, covering our models, variables, and the rationale behind the sample selection. In the Findings and Analysis section, we provide descriptive statistics and report our empirical findings for each regression. We highlight gaps in our results and discuss potential explanations for these while grounding our discussion in theory. We then conclude our main implications for understanding whether, where, and for whom economies of scale arise. Finally, we conclude by outlining the study's contributions and suggest directions for future research.

2. Theoretical Framework

This section develops the theoretical framework underlying economies of scale by outlining the reasons why increased scale is theorised to lead to lower costs and higher profitability. We then discuss factors that may distort or offset the realisation of scale advantages, as well as reasons why scale efficiencies may differ across industries. Together, these insights provide the conceptual foundation for the hypotheses and analysis that follow.

2.1 The Phenomenon of Economies of Scale

The idea of economies of scale is that as firms expand, they can achieve lower average costs and higher profitability. In economic terms, economies of scale occur when total costs rise less than proportionally with output, causing average costs to decline as output increases. This relationship arises when the marginal cost of producing an additional unit is below the current average cost, thereby causing overall average costs to fall (Goolsbee, Levitt & Syverson, 2020). In this thesis, we examine this concept in accounting terms, where output is measured in monetary units. This approach is necessary because financial reporting data do not include physical output measures, but viewers of such data typically assume that economies of scale

should be reflected in the accounting version of output, *sales*, as well. Economies of scale are therefore understood to arise when costs rise less than proportionally with sales.

The theoretical foundation for economies of scale is grounded in cost curve theory. Cost curves summarise the relationships between output and unit costs. While output is not identical to firm size, they can reasonably be assumed to follow a similar pattern. When output increases, firm size should increase accordingly. The curves typically follow a non-linear shape, initially declining, followed by a plateau and eventually an acceleration. Cost curves exist in both short-run and long-run forms. In the short run, firms lower average costs by spreading fixed costs and improving capacity utilisation within existing resources. In the long run, all inputs become variable, enabling firms to reorganize production, adopt more efficient technologies, and adjust capacity toward their optimal scale. The declining portion of the long-run average cost (LRAC) curve captures the range where economies of scale are theorised to occur. These effects diminish as firm size increases, causing the curve to flatten out. The flat segment reflects constant returns to scale once firms reach their minimum efficient scale. Beyond this point, total costs are theorised to rise faster than output, resulting in diseconomies of scale and reduced profitability (Goolsbee et al,. 2020).

Business life-cycle theory mirrors the LRAC framework. During the growth stage, increasing sales enable firms to reduce unit costs, whereas in the maturity stage opportunities for further reductions are limited as firms operate closer to their minimum efficient scale (Corporate Finance Institute). This alignment between life-cycle dynamics and the LRAC framework suggests that economies of scale are most likely to materialise during early expansion and diminish as firms become mature reaching their minimum efficient scale. Furthermore, Junius (1997) proposes that economies of scale should be more prominent for smaller firms than for larger ones, as fixed costs are spread more rapidly at lower output levels.

Economies of scale are commonly classified in two ways. By distinguishing between internal and external sources, and by differentiating between static and dynamic mechanisms. Economies of scale can originate within the firm or from the broader industry environment. Internal economies of scale refer to cost reductions that the single firm can influence through its decisions, actions, and production choices, while external economies of scale arise from factors beyond the control of any individual firm and occur at the industry level. Because

industries consist of multiple independent actors, external scale effects lie outside the scope of the single firm. Static economies of scale increase productivity levels at a given point in time, while dynamic economies of scale influence productivity growth over time. Static economies of scale reduce unit costs as a firm expands its current output, stemming from factors such as the spreading of fixed costs and greater specialisation. Dynamic economies of scale reduce unit costs as cumulative output increases. As firms accumulate experience, productivity improves and costs gradually decline. These dynamic effects can also arise from learning effects, investment in capital equipment, improved organisational structures, enhanced workforce skills, and technological progress (Junius, 1997).

It is often assumed that firms gain scale-related efficiencies across several parts of their operations. In production, greater productivity should reduce *Cost of Goods Sold* (COGS) relative to sales and improve *Gross Margin*. In overheads, productivity related to scale should lower *Selling, General and Administrative expenses* (SG&A) relative to sales. Larger firms should be able to utilise their fixed assets more efficiently by generating additional sales without proportional increases in capital investments, thereby reducing *Depreciation and Amortisation* (D&A) relative to sales. Consequently, operating efficiencies arising from increased scale should be reflected in a rising *Operating* (EBIT) *margin*.

2.2 Mechanisms Underlying Economies of Scale

This section examines the mechanisms through which economies of scale arise as firms grow. While larger firms may achieve lower costs relative to sales through various cost efficiencies, scale benefits in accounting terms can also emerge from the revenue side. When output is measured in monetary terms, sales and physical quantities may diverge since prices can vary with scale, making revenue-side mechanisms equally important. Scale efficiencies may therefore arise not only because costs decline, but also because revenues expand with scale.

One frequently cited driver of improved performance is operating leverage arising from fixed costs. Although such costs are not fixed in the long term, they are generally assumed to be semi-variable meaning that they grow with increased size but at a slower rate than sales. This assumption underlies the common view that many expenses, such as legal, compliance, technology, and advertising, do not increase proportionately with sales. The relatively slower

growth of the semi-variable costs relative to sales, should lead these costs to be spread over greater sales, causing average costs to fall and profitability to increase (Ertan et al., 2020).

Furthermore, Arrow (1962) highlights learning-by-doing, arguing that learning is a product of experience, which increases as firms grow larger. As firms repeat production activities, they refine processes, eliminate bottlenecks, and reduce waste. These learning effects allow productivity to increase without additional investment. In practice, it should result in lower production and overhead costs, as well as lead to a more efficient use of capital. In addition, revenues may rise due to a demand-side version of learning-by-doing. Foster, Haltiwanger & Syverson (2016) finds that as firms accumulate greater sales volumes, they expand their demand stock. The demand stock is a measure of customer awareness, reputation, and relationship capital, built through past sales. This process reflects mechanisms such as word-of-mouth, greater market visibility, and the deepening of buyer-supplier relationships. As firms build up demand through selling, they can gradually raise their prices, leading to higher sales. Taken together, learning both reduces costs and enhances revenue, thereby contributing to growing firms realising economies of scale.

On a similar note, Silberston (1972) suggests that economies of scale arise through greater specialisation and standardisation in (i) labour, (ii) plants and equipment and (iii) overheads. As firms grow, they can divide their labour more finely, enabling their workforce to develop greater expertise in their respective tasks and enhancing productivity. This should lower production costs relative to sales and improve gross margins. In addition, larger firms can economically justify investments in specialised plants and equipment, which, once capacity is utilised, generate substantial efficiency gains. These investments are theorised to reduce, in the long run, production costs and depreciation and amortisation relative to sales. When they grow, firms can also standardise and specialise their organisational activities, enabling them to reduce their operating overhead costs relative to sales and support higher EBIT margins.

Furthermore, Silberston (1972) proposes that firm growth enable efficiency improvements though economies of massed resources. As firms expand, they can transition from batch to continuous production, reducing the need to hold large inventories while maintaining smoother production and delivery flows. This improved coordination lowers storage and administrative expenses, which are reflected in declining SG&A relative to sales, thereby strengthening EBIT

margins. In addition, more stable production flows reduce inefficiencies and waste in manufacturing, contributing to lower COGS relative to sales and improved gross margins.

Finally, an important source of scale advantages is increased bargaining power vis-à-vis both suppliers and customers. As Porter (2008) notes, larger firms are more powerful trading partners. Higher purchasing volumes strengthen their position with suppliers, enabling them to negotiate lower input prices, more favourable payment terms, and better delivery conditions. At the same time, greater market presence and product visibility strengthen firms' leverage toward customers, enabling them to charge higher output prices. Together, these mechanisms both reduce costs and enhance revenue as firms grow, contributing to economies of scale.

To summarise, these mechanisms illustrate how firms may realise economies of scale through both cost reductions and revenue enhancements as they grow. They establish the theoretical rationale for why firm growth is expected to strengthen profitability.

2.3 Factors Distorting and Offsetting Economies of Scale

Although theory suggests that growing and larger firms achieve economies of scale, these effects may not always materialise in accounting data. Accounting and reporting practices can distort their measurement, and various offsetting factors may erode the expected gains.

One source of distortion arises from accounting-based cost measurement. Traditional cost accounting typically relies on full-cost or average-cost allocations that combine fixed and variable expenses, causing reported average costs to diverge from the true marginal cost of production (Noreen & Soderstrom, 1994). Because overhead and depreciation costs are often allocated according to accounting conventions rather than underlying economic cause-effect relationships, changes in the observed accounting measures may reflect allocation rules rather than true efficiency improvements. This is particularly evident for depreciation and amortisation, where management determines how historical investments are allocated over time. As a result, these charges can shift cost ratios and profit margins independently of the firm's current operating scale. Consequently, firms may realise true economies of scale in their operations, yet these improvements may not be fully visible in accounting-based cost and profitability ratios. This underscores that accounting measures can distort both the appearance and measurement of economies of scale. These allocation rules may distort the data, making it

difficult to determine whether the observed, or unobserved, cost reductions and profitability increases are the result of economies of scale, or not.

While these distorting factors affect how economies of scale are measured and perceived, offsetting factors relate to conditions that limit their realisation in practice. Competitive pressures represent one such constraint, influencing how much of the gains stemming from economies of scale firms can capture. While larger firms may achieve lower average costs, intense rivalry can force them to pass these savings on to customers through lower prices. The entry of new competitors and strong buyer power can compress margins, meaning that the benefits of scale are passed on to customers rather than captured by the firm itself (Porter, 2008). Agency theory constitutes an additional offsetting factor. With increasing size and more dispersed ownership, managers may not fully internalise the costs of their decisions, creating a misalignment. In this setting, expansion can give rise to agency costs, as managers may prioritise personal objectives, such as prestige or control over operational efficiency (Jensen & Meckling, 1976). This causes the efficiency gains from increased scale to be offset.

2.4 Industry Factors Impacting Economies of Scale

Whether and to what extent firm growth enables cost reductions and profitability enhancements also depends on the industry in which they operate. According to Domowitz, Hubbard & Petersen (1988), one structural factor impacting firms' potential to realise economies of scale is the level of industry concentration. In concentrated industries, dominated by a few large firms, firms exercise greater market power which enable them to maintain higher prices and subsequently achieve superior profitability. Furthermore, Domowitz et al., (1988) find that a substantial share of a firm’s fixed costs relates to overhead functions such as management, administrative labour, and advertising. These varies widely across industries and thus implies that firms fixed-cost structures differ significantly depending on their industry. Similarly, Chen, Harford & Kamara (2019) note that a firm’s operating leverage is shaped by the production technology of its industry, implying that industry affiliation influences the extent to which economies of scale can be realised. Consequently, industries differ in their opportunities to spread fixed costs. In addition, the level of capital intensity impacts the firm’s ability to realise economies of scale. Capital-intensive industries require substantial upfront investments before production can begin, which translates into higher depreciation and amortisation expenses in the periods that follow. While large investments may initially reduce short-term profitability,

they create greater opportunities to improve efficiency and ultimately increase output and long-run profitability. Capital-intensive firms also have higher fixed costs, which increase their scope to spread fixed costs as they grow, thereby enhancing their potential to realise economies of scale (Investopedia).

In summary, the theoretical framework shows the many mechanisms through which greater size should enable efficiency improvements while also identifying factors that may distort or offset their materialisation. It also informs how industry conditions shape the scope for economies of scale. Although well established in theory, the empirical evidence of economies of scale remains mixed, which we now move on to.

3. Empirical Research

Empirical research on economies of scale is scattered among several disciplines. While the concept is well-established and researched within microeconomies, the accounting-based evidence is scarcer. This section begins by highlighting a few microeconomic studies before moving on to the limited accounting-based evidence. Note that in accounting, few studies explicitly examine economies of scale. Instead, the focus is on the links between firm size, growth and profitability. While capturing more than the gains from scale, these relationships are central when examining economies of scale in accounting terms.

In microeconomics, studies of economies of scale are typically conducted at the plant level using physical quantities as measures of output. This approach is used because firm-level quantity data are rarely available and are difficult to aggregate across heterogeneous products. Griliches and Ringstad's (1971) find in their analysis of manufacturing plants, evidence of economies of scale within several industries, and that these gains diminish as plants grow larger. Similarly, Christensen and Greene's (1976) find in their study of the U.S. electric power industry that scale benefits are concentrated at lower output levels and flatten out once firms reach an efficient operating scale. Taken together, these studies show that economies of scale do arise at the plant-level for industrial firms. However, while these studies are informative, their findings may not necessarily translate to firm-level accounting measures for the average firm.

Most accounting research finds that larger firms do not earn higher profits than smaller ones. Instead, profitability has been found to decline with increasing firm size (Bain, 1951; Cowling, 2004; Ertan et al., 2020; Marcus, 1969; Shepherd, 1972; Silberston, 1972; Stekler, 1964; Whittington, 1980; Yadav et al., 2022). In addition, several studies show that the association between firm size and profitability depends on industry-related factors. Marcus (1969) found that in some industries firm size has a significant effect on profitability, but in others the effect is weak or non-existent, suggesting that economies of scale may be industry specific. When aggregating the sample, he found no systematic association between firm size and profitability. Similarly, Whittington (1980) found that industry-level patterns on the relationship between firm size and profitability often differ from aggregate results, with the observed relationship between firm size and profitability being stronger when separating the data by industries.

Literature also finds that the relationship between firm size and profitability is influenced by market-based factors such as industry concentration, and firm-based factors such as organisational complexity. In terms of industry concentration, Bain (1951) found that smaller firms performed worse in highly concentrated industries but relatively better in less concentrated ones. Later, Shepherd (1972) found that a firm's market share influences its profitability. Similarly, Samuels and Smyth (1968) found that profitability was more stable in highly concentrated industries. In terms of organisational complexity, Silberston (1972) argues that limited standardisation, outdated facilities, and complex organisational structures can prevent large firms from exploiting potential scale advantages. Smaller firms, by contrast, may operate more efficiently if they have newer, more specialised, or more focused production setups, allowing them to outperform their larger counterparts. Similarly, Shepherd (1972) proposed that the negative relationship between size and profitability was consistent with X-inefficiency, where increases in coordination demands, administrative layers, and managerial complexity raise costs and reduce attainable profits. In this view, larger firms may fail to capitalise on the gains from scale due to organizational complexity offsetting these advantages.

Taken together, these studies suggest that larger firm size does not automatically lead to higher profitability, and that this effect is dependent on market- and firm-based factors. While most evidence points toward a negative relationship between firm size and profitability, there have been some studies (Gschwandtner, 2005; Hall and Weiss, 1967) pointing to the opposite. In general, Smyth, Boyes & Peseau (1975) note that whether the relationship between firm size

and profitability is positive, negative, or negligible depends largely on the specific measures used for both profitability and size. This, they argue, helps explain the conflicting findings reported in earlier research.

While most evidence on the size-profitability relationship points to a negative or non-existent association, economies of scale are not solely about the static size at which a firm operates. Instead, economies of scale are theorised to arise during periods of growth. It is therefore relevant to also consider the empirical literature examining the relationship between firm growth and profitability. Some studies (Coad et al., 2017; Cowling, 2004, Yadav et al., 2022) find a positive association between growth and profitability, while others find a negative association (Jang and Park, 2011). Capon, Farley & Hoenig (1990) find in their review of 320 empirical studies that only 88 showed a positive relationship between growth and profitability, thereby confirming the mixed evidence.

One explanation for the inconsistent findings between firm growth and profitability relates to firms' initial level of efficiency and profitability. Davidsson et al., (2009) find that firms starting from low profitability rarely improve their performance through growth alone. Without underlying efficiency, expansion can exacerbate existing weaknesses and increase financial strain. Mansikkamäki (2023) similarly finds that economies of scale depend on a firm's initial profitability. Growth strengthens future performance mainly for firms that are already profitable, while growth offers limited or even negative effects for firms starting from weak performance positions. This suggests that the advantages of growth, primarily materialise for firms that already have efficient operations and good profitability. In contrast, when firms start from a less profitable position, growth can introduce additional costs and operational inflexibilities, making it harder for them to realise efficiency gains. This reinforces that firm-specific factors impact firms' possibilities to extract efficiency gains from growth.

Yadav et al., (2022) stand out because their study examines both the size-profitability and growth-profitability relationships. They find a positive association between growth and profitability but a negative association between size and profitability. They explain this pattern by suggesting that while expanding firms may initially experience profitability gains, these benefits taper off as firms become larger, implying that size can introduce inefficiencies and limit further cost advantages. Their findings imply that firms have an optimal size, beyond

which further expansion may reduce profitability. This is in line with earlier firm-specific explanations of organisational complexity by Shepherd (1972) and Silberston (1972).

Ertan et al., (2020) provide one of the few firm-level studies that directly test whether growing companies materialise economies of scale. Using a longitudinal sample of U.S. firms following their IPOs, they examine how cost-to-sales ratios, as well as multiple profitability measures, evolve as firms expand. Their findings show that costs rise and that profit margins fall with firm growth. The absence of declining average cost ratios suggests that scale efficiencies rarely materialise in practice. Furthermore, they test a range of potential explanations, including resource constraints, agency problems, and competitive pressure, but find no evidence that these factors mask underlying scale benefits. Overall, the study challenges the widespread expectation that growth naturally leads to lower costs and higher margins, providing strong empirical evidence that firm-level economies of scale are far less common than often assumed.

3.1 Empirical Gaps and Hypotheses

Despite the considerable research on economies of scale in microeconomics, its extension to the accounting literature is limited. Instead, we are confined to general studies examining the relationship between firm growth, size, and profitability. The accounting literature highlights that market dynamics and firm-specific characteristics shape whether, and to what extent, growth and size translate into higher profitability.

One important gap in prior literature is the limited amount of firm-level analysis of economies of scale using accounting data. Many assume that firms will realise economies of scale at a firm-level, but surprisingly there is little direct empirical evidence confirming this. A second gap is that most prior accounting studies examine growth and size in isolation. This provides limited insight into how the association between growth and profitability changes as firms become larger, which is the core mechanism underlying economies of scale. Moreover, these studies rarely even mention economies of scale. A third gap concerns the lack of studies examining cost measures directly. Instead, most prior research focuses on aggregate profitability measures. A fourth gap concerns the lack of studies that follow a sample of firms throughout their growth journeys to capture how economies of scale materialise for this group of firms. A final gap concerns the limited number of studies conducted in Sweden. Few studies

examine economies of scale for different industries in a Swedish context. Building on these gaps, we formulated the following research question:

Is firm growth associated with the realisation of economies of scale in cost and profit measures, and are these relationships conditioned by firm size and industry differences?

To empirically test whether firm growth leads to the realisation of economies of scale, and how these relationships depend on firm size and industry context, we formulate three hypotheses. These hypotheses translate our conceptual expectations into testable predictions about the presence and conditions of economies of scale.

Despite the conflicting empirical evidence across disciplines, most people still believe that economies of scale materialise at a firm-level in accounting data. This conflict motivates our first hypothesis which tests whether firm growth is associated with lower operating costs relative to sales and higher profitability.

H_1: *There is a positive and significant relationship between firm growth and measures of economies of scale.*

To capture the essence of economies of scale, we formulate a second hypothesis. Smaller firms are expected to have greater unused scale potential relative to size, whereas larger firms may already operate near their efficient scale or encounter rising coordination and complexity costs, leading to diseconomies of scale. Consequently, the benefits of growth should be stronger for smaller firms and diminish as firms become larger. Introducing firm size as a moderating factor allows us to assess how economies of scale vary across the size distribution of firms.

H_2: *Firm size is moderating the relationship between firm growth and measures of economies of scale such that the effect of growth on measures of economies of scale will be higher for smaller firms than larger firms.*

In the existing literature, the realisation of economies of scale seems to depend on market dynamics and firm characteristics. Because these vary across industries, firms in different industries are not likely to benefit from growth in the same way. Splitting the sample and

redoing the analysis for the different industries, allows us to identify how different industries realise economies of scale, motivating our third hypothesis:

H_3: *The relationship between firm growth and measures of economies of scale, moderated by firm size, differs across industries.*

We now outline the empirical methodology used to test these hypotheses and examine how growth, firm size, and industry context jointly shape the realisation of economies of scale.

4. Methodology

In this section we will begin by describing the reasoning behind our sample selection and choice of variables. Moving on, we outline the data collection, before describing our research design. Lastly, we will highlight a few limitations concerning our methodology.

4.1 Sample Selection

Our study uses a panel of Swedish high-growth firms. A panel dataset allows us to track how the indicators of economies of scale evolve as firms expand, which is essential for our study. We focus on the Swedish context as it remains largely unexplored in previous literature. We also focus on a high-growth sample as economies of scale are theorised to arise during periods of expansion. Growing firms move along the declining portion of the long-run average cost curve, where total costs rise less than proportionally with output and efficiency gains are strongest, until they eventually stabilise upon reaching their minimum efficient scale (Goolsbee et al., 2020). Furthermore, we use a sample of high-growth firms as it allows us to capture the full realisation of economies of scale. By focusing on firms with strong initial potential for scale improvements, we are better able to observe their movement along the entire cost curve during the study period.

When defining what constitutes a high-growth firm, we use the Eurostat-OECD (2007) definition, which classifies a company as high-growth if it has at least ten employees in the base year and achieves an average annual growth rate of at least 20 percent in sales over a three-year period (Eurostat & OECD, 2007). For the three-year period, we use 2010-2013. Starting in 2010 is motivated by Sweden's post-crisis recovery. Although the 2008-2009 financial crisis caused a sharp downturn, economic activity had largely stabilised by 2010 (Sveriges Riksbank, 2018).

Identifying high-growth firms after this point helps ensure that our sample reflects genuine expansion rather than temporary rebound. We then collect all firm-year observations for 2013-2019. This period represents a relatively stable economic expansion, reducing the influence of major external shocks on cost and profitability ratios. We end the observation period in 2019 to avoid the distortive effects of the COVID-19 pandemic, which sharply disrupted production, sales, and employment in ways unrelated to underlying efficiency. Limiting the analysis to the pre-pandemic period ensures that firm-level indicators reflect performance under normal expansive economic conditions (IZA Institute of Labor Economics, 2023; Regeringen, 2022).

We recognise that aggregating firms across different industries, plants, and products introduces challenges. However, because our aim is to test whether firms in general realise economies of scale, an aggregated sample is necessary for part of our analysis.

4.2 Variables

4.2.1 Independent and Moderating Variables

To examine economies of scale, we regress several indicators of economies of scale on firm growth while allowing firm size to moderate the relationship. To do so, we need a proxy for firm size and growth. We choose to use total assets as our proxy for three reasons. First, total assets are a standard measure of firm size in empirical research (Smyth et al., 1975). Second, total assets reflect the firm's accumulated resources, tangible and intangible investments, production capacity, and organisational infrastructure, and are less affected by short-term revenue fluctuations or product-market shocks than sales, providing a more stable indicator of scale over time (Dang, Li & Yang, 2018). Our independent variable, *Firm Growth*, is defined as the change in total assets over the period, see Table 1. For our moderating variable, *Firm Size*, we use the natural logarithm of total assets lagged one period, see Table 1. Taking the natural logarithm reduces the influence of extreme firm sizes (Dang et al., 2018). To mitigate potential issues of simultaneity, we use lagged total assets (Wooldridge, 2010).

Table 1: Independent and Moderating Variable Definition

Variable	Proxy	Definition
Independent Variable	Firm Growth	$Firm\ Growth_{i,t} = \frac{Total\ assets_{i,t} - Total\ assets_{i,t-1}}{Total\ assets_{i,t-1}}$

Moderating Variable	Firm Size	$Firm\ Size_{i,t} = Ln\ (total\ assets_{i,t-1})$

4.2.2 Dependent Variables

To capture the effect of economies of scale, we use two categories of dependent variables, cost ratios and profitability margins. These are our indicators of economies of scale. The choice of cost ratios and profitability margins focuses on the operating performance of firms. We examine the following operating costs: *(1) Production Costs, (2) Operating Overhead Costs*, and (*3) Capital Utilisation.* For profitability we examine *(1) Gross Profit,* and *(2) Operating Profit.* All costs and profit measures are scaled by *Sales* (output) in the same period. Please see *Appendix A* for more detailed definitions.

Production Costs & Gross Profit

Cost efficiencies from scale are expected to appear in production costs through multiple mechanisms. Examples from theory include greater specialisation (Silberston, 1972), learning-by-doing (Arrow, 1962), stronger bargaining power vis-à-vis suppliers (Porter, 2008), and economies of massed resources (Silberston, 1972) to mention a few. Together, these mechanisms suggest that production costs, measured by *Cost of Goods Sold,* should decline as firms scale up, leading COGS/Sales to fall. These effects are also captured in the *Gross Margin*. The gross margin, in addition to capturing production efficiencies, also provides a benchmark against which the subsequent EBIT margin can be evaluated. Comparing it to the EBIT margin allows us to determine whether production efficiencies are preserved through later stages of the cost structure or eroded by additional operating expenses.

Operating Overhead Costs

Operating Overhead costs, measured using *Selling, General and Administrative* costs, are also expected to exhibit economies of scale through mechanisms such as specialisation (Silberston, 1972) and the spreading of fixed costs (Domowitz et al., 1988). Consequently, SG&A/Sales is expected to decline with firm growth.

Capital Utilisation

Economies of scale are also expected to materialise in terms of increased capital utilisation, measured through *Depreciation & Amortisation*. Increased size should enable a more efficient

utilisation of the firms fixed assets through mechanisms such as learning-by-doing (Arrow, 1962), and investments in specialised plant and equipment (Silberston, 1972). Together these mechanisms suggests that D&A/Sales should fall as firms scale up in the long run.

Operating Profit

The *EBIT margin* captures overall efficiencies in operations, reflecting the cumulative impact of economies of scale across all operating cost components. As such all mechanisms underlying economies of scale in operations underlie efficiency gains in the *EBIT margin*. If firms achieve economies of scale within operations, these should be observable in the operating margin. Examining this measure allows us to assess whether economies of scale gains are ultimately translated into higher operating profitability.

4.2.3 Control Variables

Consistent with previous literature, we include a set of control variables to isolate the associations indicative of economies of scale. The control variables are aimed to account for firm- and industry-specific factors that may affect the cost ratios and profitability measures.

Table 2: Control Variable Definitions

Control Variable	Definition
Capital Intensity	$\frac{PPE}{Total\ Asset}$
Capital Expenditure	$\frac{\Delta PPE\ +\ D\&A}{Total\ Assets}$
Leverage	$\frac{Debt}{Total\ Assets}$
Industry Concentration (HHI)	$HHI\ = S_1^2 + S_2^2 + \ldots + S_n^2$

In line with Marcus (1969) and Yadav et al., (2022), we include capital intensity as a control variable. The degree of capital intensity affects the firms' cost-structure and as such it affects the dependent variables. Including capital intensity as a control variable allows us to take this into consideration. We also follow Capon et al., (1990) in controlling for capital expenditure, which reflects a firm's current investment activity. While such investments may generate future scale advantages, they can reduce short-term profitability due to installation costs, learning effects, and initial underutilisation of capacity. Furthermore, because capital structure influences firms' investment incentives, we include leverage as a control variable, in

accordance with Jang and Park (2011) and Yadav et al., (2022), to avoid bias stemming from differences in financing conditions. Lastly, we control for industry concentration, following Marcus (1969) and Shepherd (1972), as it captures market dominance and competition levels. This helps ensure our estimates reflect internal economies of scale rather than advantages arising from external economies of scale. Please see *Appendix G* for an explanation of the HHI calculation.

4.3 Data Collection

The data collection process yielded a panel of 6 817 firm-year observations covering the period 2013-2019. To maximise sample size and ensure broad firm coverage, we used the Serrano database, which contains financial information for both private and public firms in Sweden. We first identified all firms that met the Eurostat-OECD definition of high-growth firms during the 2010-2013 identification window. Then, we retrieved the financial data necessary to construct our independent, dependent and control variables. After constructing the variables, we excluded all group companies, as well as firms with incomplete data on either the dependent or independent variables. Subsequently, we removed all firms with missing observations in any year to obtain a balanced panel dataset. Following the inclusion of SNI industry codes, we excluded firms in the financial (SNI 64-66) and utilities (SNI 35-39) sectors, as these industries operate under distinct regulatory frameworks and capital structures that limit their comparability to the rest of the firms in our sample (Ertan et al., 2022). Lastly, we excluded all observations from the identification period (2010-2013).

Table 3: Sample Construction Procedure

Step	# of observations
Total number of firms for the period 2010-2019	6 699 778 observations
Excluding firms that are not high-growth according to Eurostat-OECD	1 038 842 observations
Excluding group companies	1 024 340 observations
Excluding firms with missing data in independent or dependent variables	16 887 observations
Balancing the dataset	10 040 observations
Excluding financial and utilities firms (based on SNI codes)	9 749 observations
Excluding observations from the identification period (2010-2013)	6 817 observations

4.4 Research Design

To test our hypotheses, we estimate several regression models with moderating effects. In our regressions, we assume a linear relationship between firm growth and indicators of economies

of scale. However, theory suggests that economies of scale may be nonlinear, and the potential scale advantages diminish once firms approach their minimum efficient scale. To partially capture such nonlinear patterns within the linear regression framework, we include an interaction term between firm growth and size. This moderating effect allows the relationship between growth and indicators of economies of scale to vary systematically with firm size, thereby capturing the diminishing nature of the long-run average cost curve even within a linear model. Since interaction terms require continuous variables to be on comparable scales, both variables are standardised using z-scores.

Before introducing the moderating effect, we first need to establish that firm growth is related to the indicators of economies of scale, thereby motivating the baseline regressions:

$$\frac{Costs_{i,t}}{Sales_{i,t}} = \beta_1 * Firm\ Growth_{i,t} + Capital\ Intensity_{i,t} + Capex_{i,t} + Leverage_{i,t} + HHI_{industry} + Firm\ FE + Time\ FE + \varepsilon_{i,t}$$ *Where costs are COGS, SG&A, and D&A respectively*

$$\frac{Profit_{i,t}}{Sales_{i,t}} = \beta_1 * Firm\ Growth_{i,t} + Capital\ Intensity_{i,t} + Capex_{i,t} + Leverage_{i,t} + HHI_{industry} + Firm\ FE + Time\ FE + \varepsilon_{i,t}$$ *Where profit is Gross profit, and EBIT respectively*

According to the theory of economies of scale, firm growth is expected to lower costs relative to sales while increasing profits relative to sales. Consequently, the growth coefficient β_1 should be negative in the cost regressions and positive in the profit regressions.

Table 4: Sign Expectations in Baseline Regressions

Dependent variable	Sign Expectation β_1
Cost relative to sales	-
Profit relative to sales	+

Next, we incorporate the moderating variable, firm size, to assess how the association between growth and the indicators of economies of scale changes when accounting for differences in firm size. This motivates the main regressions:

$$\frac{Costs_{i,t}}{Sales_{i,t}} = \beta_1 * Firm\ Growth_{i,t} + \beta_2 * Firm\ Size_{i,t-1} + \beta_3 * (Firm\ Growth_{i,t} * Firm\ Size_{i,t-1}) + Capital\ Intensity_{i,t} + Capex_{i,t} + Leverage_{i,t} + HHI_{industry} + Firm\ FE + Time\ FE + \varepsilon_{i,t}$$ *Where costs are COGS, SG&A, and D&A respectively*

$$\frac{Profit_{i,t}}{Sales_{i,t}} = \beta_1 * Firm\ Growth_{i,t} + \beta_2 * Firm\ Size_{i,t-1} + \beta_3 * (Firm\ Growth_{i,t} * Firm\ Size_{i,t-1})$$
$$+Capital\ Intensity_{i,t} + Capex_{i,t} + Leverage_{i,t} + HHI_{industry} + Firm\ FE + Time\ FE$$
$$+\varepsilon_{i,t}$$ *Where profit is Gross profit and EBIT respectively*

Economies of scale arise when firm expansion leads to a reduction in costs relative to sales. In the cost regressions, this implies that both the growth coefficient β_1 and the size coefficient β_2 are expected to be negative. In the profitability regressions, the opposite applies and expanding firms should increase margins, reflected in positive coefficients for growth in β_1 and size in β_2. As firms approach their efficient scale, however, the benefits of additional growth diminish. This diminishing-return effect is captured by the interaction term, β_3, which is expected to be positive in the cost regressions, reflecting weaker cost reductions at higher scale, and negative in the profitability regressions, reflecting smaller profitability gains for already large firms.

Table 5: Sign Expectations in Main Regressions

Dependent variable	Sign Expectation β_1	Sign Expectation β_2	Sign Expectation β_3
Cost relative to sales	-	-	+
Profit relative to sales	+	+	-

The inclusion of firm- and time-fixed effects effectively controls for all time-invariant differences across firms as well as macroeconomic shocks common to all firms. As a result, the estimated relationships are identified entirely from within-firm changes over time, consistent with the logic of economies of scale. While this approach ensures that the results reflect true within-firm dynamics rather than cross-sectional differences, it also reduces the available variation for estimation, impacting the adjusted R^2. Although our regressions include both firm- and time-fixed effects, this does not guarantee that the remaining residuals are independent over time within firms. The Breusch-Pagan test and Wooldridge test confirmed that our panel suffers from heteroskedasticity and serial correlation. Heteroskedasticity violates the OLS assumption of constant error variance, and serial correlation violates the assumption that errors are independent across time. Therefore, following Wooldridge (2010), standard errors are clustered at the firm-level. This approach is valid for a panel dataset with many firms and a relatively short time dimension, such as ours. In the Pesaran CD test we discovered that our panel suffers from cross-sectional dependence, violating the assumption of independence across firms. While more robust standard errors such as Driscoll-Kraay standard errors deal with this, these are not appropriate in our context due to the limited period in our panel.

While we initially only transformed the moderating variable, total assets, by taking the natural logarithm, we then discovered that our dataset suffered from extreme values leading to unrealistic regression results. To mitigate the influence of these extreme observations, all variables were winsorised at the 1st and 99th percentiles on a yearly basis. This approach caps outliers rather than removing them, thereby preserving the sample size while reducing the leverage of extreme firm-year values that biased the initial regression coefficients. The winsorisation thresholds are computed separately for each year to account for temporal variation in the distribution of firm characteristics.

Addressing endogeneity is particularly important in our study because firm growth, size, and indicators of economies of scale are very likely to influence one another simultaneously. Endogeneity occurs when the independent variable is correlated with the error term. There are two main causes for this: (i) omitted variable bias, and (ii) simultaneity bias. In our case it is very likely that the model is omitted of variables predicting the dependent indicators of economies of scale. Costs and profitability measures are influenced by many factors, and firm growth and size only capture a fraction of this. A second source of endogeneity stems from simultaneity bias, which occurs when the dependent variable also influences the independent variable. While the theory, and common intuition, on economies of scale suggests that firm growth and scale can reduce costs and improve profitability, the reverse relationship is also plausible and observed in literature (e.g. Cowling, 2004). Both biases imply a violation of the OLS exogeneity assumption, which may bias the coefficient estimates. We partially address these concerns by lagging total assets, which reduces, but do not eliminate, the risk of simultaneity from our study. Firm-fixed effects remove all time-invariant differences between firms, while time-fixed effects account for macroeconomic shocks common to all firms each year which addresses the omitted variable bias. Together, these steps partially address endogeneity concerns in our study.

To test if our results are robust or not, we conduct robustness checks by re-estimating the main regressions using alternative proxies for firm size. Guided by Smyth et al., (1975) we use the number of employees and sales as alternative measures. Using multiple measures of size allows us to ensure that the observed associations are not driven by the choice of total assets as the proxy for size, thereby strengthening the reliability and generalisability of our findings. However, there are also drawbacks to these proxies. Labour intensity may vary across industries

impacting the number of employees. Sales can be volatile and introduce a mechanical relation with our dependent variables. Since these serves as a robustness proxies rather than our main measure, we consider their results informative when viewed collectively despite their flaws.

To examine how economies of scale manifest across different industries, we extend the analysis to the industry level. Theory and prior research suggest that the relationship between growth, firm size and profitability is industry dependent, as the potential for economies of scale varies with market- and firm-specific factors. To capture these variations, we divide our sample by industry classification and re-estimate the main regressions for each industry subsample, using total assets as the proxy for size. The sample is split based on SCB's categorisation level, *Sections* (Statistikmyndigheten, SCB). Please see *Appendix B* for more information on the different industries and their composition in the sample. We repeat the same main regressions as outlined above for each industry subset. We restrict the industries to those with more than 280 observations to ensure sufficient sample size to yield meaningful statistical inferences. The industry regressions provide a more nuanced understanding of how growth translates into efficiency gains, and how this relationship differs across industries.

4.5 Model Limitations

In this section, we discuss several limitations of our methodology. A first limitation highlighted by Junius (1997) concerns omitted variables. Changes in operating costs and profitability margins are shaped by many factors, and the effect of economies of scale may explain only a small portion of this variation. Such factors include product heterogeneity, differences in capital vintages within industries, and variation in the quality and prices of production inputs. These influences make it difficult to isolate the specific effect of economies of scale on costs and profitability and introduce endogeneity. Junius (1997) mentions a second limitation concerning the bias arising from the exit of inefficient firms. Competitive pressures may force inefficient small firms out of the market, leaving only the most efficient small firms in the sample. Larger firms, regardless of how efficient they are, are less likely to be eliminated in this way. This may bias the sample which can lead to a weaker observed relationship between growth, size, and indicators of economies of scale. A third limitation relates to winsorisation. While winsorising reduces the influence of extreme observations, it also compresses the natural variation in the data. As a result, true within-firm changes may be dampened, producing more conservative estimates. A fourth limitation concerns the time horizon of our growth measure. In the

regressions, growth is defined on a year-to-year basis. However, economies of scale may require longer periods to materialise. Finally, a limitation concerns causality. OLS regressions cannot establish causal relationships. Instead, our conclusions are limited to identifying associations between size, growth, and indicators of economies of scale.

5. Findings and Analysis

In this section we begin by describing characteristics of our full sample and the different industry subsamples. Then, we briefly discuss the correlation matrix before presenting the regression results linking them to economies of scale and our hypotheses. We begin with the baseline regressions, followed by the main regressions, then the robustness checks, and finally the industry-specific regressions.

5.1 Descriptive Statistics and Correlation Matrix

Table 6 presents descriptive statistics for the variables in our full sample after winsorising at 1st and 99th percentiles.

Table 6: Descriptive Statistics for the Full Sample

Variable	Mean	SD	Min	P25	Median	P75	Max	N
Total assets (in mSEK)	58 232.73	121 724.97	1 604.19	10 699.00	20 986.00	46 400.00	1 231 435.42	6817
Natural log of total assets	17.00	1.20	14.29	16.19	16.86	17.65	20.93	6817
Growth in total assets (in %)	10.16	30.09	-60.55	-7.26	6. 68	22.59	162.81	6817
COGS/Sales (in %)	51.95	26.63	2.48	30.69	54.02	72.12	148.91	6817
SG&A/Sales (in %)	42.49	24.95	0.01	22.16	38.65	61.21	101.73	6817
D&A/Sales (in %)	1.11	2.02	0.00	0.11	0.42	1.14	15.22	6817
Gross margin (in %)	48.05	26.63	-48.91	27.88	45.98	69.31	97.52	6817
EBIT margin (in %)	6.48	9.64	-59.06	2.04	5.61	10.39	42.30	6817

The sample exhibits substantial heterogeneity in firm size with a minimum of 1 604 mSEK and maximum of 1 231 435 mSEK. The mean size is 58 233 mSEK (median 20 986 mSEK), indicating a strongly right-skewed distribution in which a relatively small number of very large firms are pulling the average upward while the typical firm remains considerably smaller. Firms grow by 10.16% per year on average (median 6.68%), revealing that mean growth is driven by a smaller subset of firms that expand very rapidly, while the majority grow more moderately.

Cost-structure variables also show substantial variation and moderate differences between means and medians. COGS/Sales averages 51.95% (median 54.02%), but spans from 2.48% to 148.91% showing wide dispersion in the level of production cost. SG&A/Sales has a mean of 42.49% (median 38.65%), implying that some firms incur unusually high operating overhead costs that inflate the average above the experience of the median firm. Mean depreciation and amortisation are modest at 1.11% of sales (median 0.42%). This may imply that in our sample most firms are already efficient in how they utilise their fixed assets (i.e. they generate a lot of sales from their existing capital base) or that they do not have high depreciation and amortisation charges. As such there may be limited opportunities for them to become more efficient. Based on the mean cost values, the average firm has slightly higher production costs than overheads, and modest depreciation and amortisation charges. The profitability measures also exhibit variation. Gross margin averages 48.05% (median 45.98%), indicating solid overall pricing power and cost control for the typical firm. EBIT margin reaches 6.48% on average (median 5.61%), showing that most firms have decent operating profits, but the average is pushed by a group of strong performers. Notably, a share of firms still reports negative gross margins (min -48.91%) and substantial operating losses (min EBIT margin -59.06%), indicating the presence of financially distressed or strategically loss-making firms in the sample.

Despite the sample selection filtering out high-growth firms, the descriptive statistics portray a diverse sample. It is characterised by pronounced right-skewness in size, growth, most costs relative to sales, and profitability.

We now turn to describing key characteristics of the different industries, please see *Appendix Industry Descriptive Statistics.* While some subsamples are excluded from the industry regressions due to a lack of observations, they are still included in this section as they make up the full sample. Based on mean size, the industries with the largest firms are the *Wholesale & Retail trade* (118 984 mSEK), *Transportation & Storage* (96 053 mSEK), *Agriculture, Forestry, Fishing* (93 064 mSEK), and *Manufacturing* (69 555 mSEK). The fastest growing firms, based on mean growth, are *Administrative & Support Services Activities* (13.92%), *Construction* (12.36%), *Human Health & Social Work Activities* (10.12%) and *Accommodation & Food Service Activities* (9.95%). The industries with the highest mean gross profitability are *Human Health & Social Work Activities* (81.26%), followed by *Administrative & Support Services Activities* (70.19%), *Education* (63.22%) and *Other Service Activities* (60.54%). The

industries with the highest mean operating profitability are *Human Health & Social Work Activities* (8.99%), followed by *Other Service Activities* (8.40%), *Real Estate Activities* (8.17%), and *Administrative & Support Services Activities* (7.21%). The industries with the highest mean production costs relative to sales are *Wholesale & Retail Trade* (74.53%), *Real Estate Activities* (64.96%), *Construction* (64.41%) and *Manufacturing* (60.69%). In terms of operating overhead costs relative to sales, the *Human Health & Social Work Activities* (72.89%), *Administrative & Support Services Activities* (63.29%), *Real Estate Activities* (62.08%) and the *Arts, Sport & Recreation* (59.07%) industries have the highest means. The industries with the highest mean D&A relative to sales are *Real Estate Activities* (4.56%), *Agriculture, Forestry, Fishing* (2.80%), *Manufacturing* (2.22%) and *Accommodation & Food Service Activities* (1.88%). Since these industries have the largest average costs, it is also likely that these are the ones most likely to realise economies of scale in their respective functions.

As shown in the correlation matrix in *Appendix C,* there are indications that firm growth is associated with lower costs relative to sales and higher margins. Firm growth is negatively correlated with COGS/Sales (-0.016), SG&A/Sales (-0.064*), and D&A/Sales (-0.085***), and positively correlated with Gross Margin (+0.016) and EBIT Margin (+0.200***). For firm size, the results are more inconclusive. Firm size is positively correlated with COGS/Sales (0.391***) and D&A/Sales (0.188***) and negatively correlated with SG&A/Sales (-0.429***). For the profit margins, the correlation with the Gross margin is negative (-0.391***), and for EBIT margin positive (0.013).

5.2 Regression Results

Since growth and size are standardised using z-scores, the regression coefficients should be interpreted as the effect on each cost-to-sales or margin measure of a one standard deviation increase in the respective variable, holding all other variables constant. As the purpose of this thesis is primarily to test whether economies of scale exist, we do not delve further into the marginal effects of each individual coefficient.

5.2.1 Discussion on adjusted R^2

Before discussing the regression results, we first address the adjusted R^2 values. In nearly all regressions, the adjusted R^2 is negative. While this indicates that our model explains less within-firm variation than a simple mean model, it is also an expected outcome given our research

design. The combination of firm- and time-fixed effects, winsorisation, and standardisation removes a substantial portion of the overall variance. This makes the negative adjusted R^2 values a mechanical by-product of our research design.

Because cost structures and profitability tend to be somewhat consistent, changing only gradually from year to year, the fixed effects may absorb most of the within-firm variation, leaving very little variation for the model to explain. Because the model includes a large set of firm-fixed effects (973 for each firm) and time-fixed effects (7 for each year), the intercept becomes perfectly collinear with the fixed-effects structure. As a result, it cannot be estimated and is therefore omitted, as is common for large panel datasets. In addition, winsorising the variables at the year level and standardising them prior to estimation compresses the distributions even further, reducing within-firm dispersion. In combination with the omitted variable bias, this results in negative adjusted R^2 values.

5.2.2 Main Regression Results

Table 7 shows the regression results from the baseline regressions. As outlined in *4.4 Research Design,* efficiencies from increased scale should materialise in our study as falling cost ratios and rising profitability as firms grow.

Table 7: Regression Results - Baseline Regression

	(1)	(2)	(3)	(4)	(5)
Variable	COGS/Sales	SG&A/Sales	D&A/Sales	Gross margin	EBIT margin
Firm Growth	-0.626***	-1.114***	0.009	0.626***	1.898***
	(0.004)	(0.000)	(0.530)	(0.004)	(0.000)
Capital Intensity	-11.887***	1.324	6.811***	11.887***	-0.521
	(0.004)	(0.740)	(0.000)	(0.004)	(0.888)
Capex	7.049***	5.576	-3.735***	-7.049***	-4.141*
	(0.010)	(0.193)	(0.000)	(0.010)	(0.077)
Leverage	6.635**	5.027**	-0.070	-6.635**	-14.588***
	(0.019)	(0.049)	(0.820)	(0.019)	(0.000)
Industry HHI	0.005	0.000	0.000	-0.005	-0.001
	(0.131)	(0.984)	(0.519)	(0.131)	(0.606)
Adjusted R^2	-0.158	-0.145	0.026	-0.158	-0.070
Observations	6811	6811	6811	6811	6811
Firm & Time FE	Yes	Yes	Yes	Yes	Yes

*Significance levels: *** (p-value < 0.01), ** (p-value < 0.05), * (p-value < 0.1)*
P-values are shown in parentheses

For the cost ratios, the coefficient is significant and negative for COGS/Sales (-0.626***) and SG&A/Sales (-1.114***) but not for D&A/Sales (0.009). The profit margin coefficients are

significant and positive for the gross margin (0.626***) and the EBIT margin (1.898***). This indicates that firm growth is associated with lower production costs relative to sales and operating overheads relative to sales, indicative of economies of scale in such functions.

Among the control variables, there are several significant associations. Capital intensity is negatively associated with COGS/Sales (-11.887***) and positively associated with gross margin (11.887***) and D&A/Sales (6.811***). This indicates that higher capital intensity is associated with lower production costs relative to sales, and higher depreciation and amortisation charges relative to sales. Capital expenditure is positive and significant for COGS/Sales (7.049***) and negative and significant for gross margin (-7.049***), D&A/Sales (-3.735***) and EBIT margin (-4.141*), which may reflect that investments initially coincide with higher production costs and temporarily lower margins. This may be due to new capital investments entailing additional installation costs, learning effects, or an initial underutilisation of capacity. The negative association with D&A/Sales may be explained by capital expenditure on new assets increasing total sales before the increased charge settles in for D&A. Leverage is positively associated with COGS/Sales (6.635**) and SG&A/Sales (5.027**). It is negatively associated with Gross margin (-6.635**), as well as EBIT (-14.588***), which may indicate that more levered firms have a harder time financing investments that lower costs and increase profitability.

Taken together, the baseline regressions find a significant association between firm growth and most indicators of economies of scale. The results provide partial support for the first hypothesis and offer initial support for the commonly held intuition that growing firms realise economies of scale in production and operating overheads. To more precisely capture the underlying mechanisms of economies of scale, we now turn to the regressions that incorporate an interaction term with firm size.

In Table 8 the results from the main regressions, which include the interaction term, are shown. It is the interaction term that allows us to assess whether growing firms display patterns consistent with economies of scale and whether such associations vary with firm size.

Table 8: Regression Results - Main Regression

	(1)	(2)	(3)	(4)	(5)
Variable	COGS/Sales	SG&A/Sales	D&A/Sales	Gross margin	EBIT margin

Firm Growth	-0.440*	-1.667***	-0.001	0.440*	2.336***
	(0.097)	(0.000)	(0.935)	(0.097)	(0.000)
Firm Size	1.096	-4.810***	-0.083	-1.096	3.742***
	(0.351)	(0.000)	(0.455)	(0.351)	(0.000)
Firm Growth * Firm Size	0.255	0.131	-0.002	-0.255	-0.065
	(0.225)	(0.300)	(0.873)	(0.225)	(0.720)
Capital intensity	-11.961***	2.114	6.823***	11.961***	-1.122
	(0.004)	(0.600)	(0.000)	(0.004)	(0.756)
Capex	7.212***	4.991	-3.746***	-7.212***	-3.682
	(0.009)	(0.255)	(0.000)	(0.009)	(0.104)
Leverage	6.355**	5.337**	-0.061	-6.355**	-14.857***
	(0.025)	(0.046)	(0.843)	(0.025)	(0.000)
Industry HHI	0.005	-0.000	0.000	-0.005	-0.001
	(0.119)	(0.886)	(0.542)	(0.119)	(0.756)
Adjusted R^2	-0.157	-0.120	0.026	-0.157	-0.050
Observations	6811	6811	6811	6811	6811
Firm & Time FE	Yes	Yes	Yes	Yes	Yes

*Significance levels: *** (p-value < 0.01), ** (p-value < 0.05), * (p-value < 0.1)*
P-values are shown in parentheses

When firm size and the interaction term are included in the model, the coefficients of growth on D&A/Sales remain insignificant. We continue to observe a negative and significant relationship between firm growth and both COGS/Sales (-0.440*) and SG&A/Sales (-1.667***). Similarly, firm growth remains positively and significantly associated with gross margin (0.440*) and EBIT margin (2.336***). These results suggest that growing firms tend to reduce production costs and operating overheads relative to sales, thereby achieving higher operating profitability. This pattern is indicative of economies of scale. Note that while still significant, the association between firm growth and production costs is now weaker.

The only significant associations between firm size and indicators of economies of scale are found in SG&A/Sales (-4.810***) and the EBIT margin (3.742***). This suggests that larger firms may be able to lower operating overheads relative to sales and increase operating profitability. A pattern suggesting that larger firms realise economies of scale.

Across all regressions, the interaction term between growth and firm size is statistically insignificant. This implies that we do not have sufficient evidence to conclude that firm size moderates the relationship between growth and the indicators of economies of scale. Instead, the associations between growth, costs, and profitability appear broadly consistent across firms of different sizes. In other words, the potential reductions in COGS/Sales and SG&A/Sales, as well as the increases in gross and EBIT margins associated with growth, do not appear to diminish as firms become larger.

For the control variables the only difference in terms of statistical significance and sign concerns capital expenditure in the EBIT margin regression, which no longer remains significant. All other control variables are in line with the previous results.

In line with the baseline regression results, the main regressions provide partial support for the first hypothesis, although the associations between firm growth and COGS/Sales and gross margin are notably weaker. Additionally, we do not find sufficient support for the second hypothesis. Our regression results diverge from the expected pattern of diminishing effects from economies of scale. In sum, although growth is linked to patterns consistent with economies of scale, firm size does not appear to condition this relationship contrary to what common intuition suggests.

5.2.3 Robustness Checks

Using the full sample, we repeat the main regressions with alternative measures of size as independent variables. We first use the *Number of Employees* as a proxy for size, see *Appendix D*, and secondly use *Total Sales* as a proxy for size, see *Appendix E*. When reviewed collectively, the two robustness checks reveal several important patterns. First, production-related economies of scale appear stronger when using these alternative proxies compared to total assets as seen in the stronger associations between firm growth, COGS/Sales and gross margin. We also observe a significant association between firm size, COGS/Sales and gross margin in the regression using employees as a proxy. Second, in contrast to the main regressions, we find a significant negative association between both firm growth and D&A/Sales and between firm size and D&A/Sales, in both robustness checks. This suggests that capital-utilisation efficiency may exist but is not captured in the main regressions. Third, both robustness checks reinforce the previously observed result that economies of scale materialise in the EBIT margin. Fourth, in the robustness regressions using total sales, the interaction term with SG&A/Sales is significant but negative. This goes against expectations and suggests that the negative association between firm growth and operating overhead, may be accelerating rather than diminishing. Lastly, when using the number of employees as proxy for size, the association between firm growth and size with respect to SG&A/Sales becomes positive. This is likely the result of SG&A expenses being driven by salaries. Overall, the robustness check results show that the conclusions from the main regressions are robust. They

also align with Smyth et al., (1975), who emphasise that the choice of proxy influences empirical outcomes in studies concerning firm size, growth and profitability.

5.2.4 Industry Regression Results

In the main regressions, see above in *Table 8*, firm growth was only weakly associated with production costs relative to sales (-0.440*). However, when regressing the separate industry subsamples the results change, see *Appendix Industry Regressions*. In the *Manufacturing* and *Human Health and Social Work Activities* industries, we still observe a significant negative, and stronger, relationship between firm growth and COGS/Sales (-2.017** & -1.334*** respectively), but the association disappears for *Construction*, *Wholesale and Retail Trade, Publishing, broadcasting, and content production, Professional, Scientific and Technical Services,* and *Administrative and Support Services Activities*, indicating that those industries do not appear to exhibit production-related economies of scale.

In terms of the operating overheads, most industries still have a negative association with firm growth and firm size. These industries include *Manufacturing* (-2.703*** & -6.001*), *Construction* (-1.504*** & -6.285***), *Professional, Scientific and Technical Activities* (-2.617*** & -5.940*) and *Administrative and Support Service Activities* (-2.047*** & -5.626**), suggesting that growing firms in these industries can lower operating overhead costs relative to sales, indicative of economies of scale within overheads. For *Human Health and Social Work Activities,* however, only the association with firm growth remain significant (-1.472***). While for *Wholesale and Retail Trade,* and *Publishing, Broadcasting, and content Production* no association is significant.

While we found significant associations between firm growth, size and D&A/Sales in the robustness checks, we found no such significant association in the main regressions. In the industry regression, certain industries find a significant association with respect to D&A while others do not. For the *Publishing, Broadcasting, and Content Production* industry, there is a positive and significant association between firm size and D&A/Sales (0.609**). Similarly, for *Administrative and Support Service Activities* there is a positive and significant association between firm growth and D&A/Sales (0.065**).

Although most industries show a positive and significant association with the EBIT margin, there are two exceptions. For both the *Wholesale and Retail Trade* industry and the *Publishing,*

Broadcasting, and Content Production industry the association with firm size is no longer significant.

When reviewing the industry regression results, it is evident that there are clear differences between the aggregate main regressions and the different industry regressions. We also observe clear differences between the different industries, suggesting that the scope to realise economies of scale differs across industries. The clearly observed differences allow us to find support for our third hypothesis.

When reviewing all the regression results collectively, we can draw conclusions regarding our hypotheses. We find a somewhat consistent confirmation of the first hypothesis. In general, we find that production costs, operating overheads, gross profitability and operating profitability show patterns indicative of economies of scale. However, there is limited evidence in supporting that firm growth is associated with higher capital utilisation, captured by D&A/Sales. We fail to find support for the second hypothesis due to the consistent lack of a significant interaction term. We do not find that firm size moderates the relationship between firm growth and indicators of economies of scale. Lastly, we find support for our third hypothesis, that there are significant differences across industries. Again, we underscore that the adjusted R^2 values are low across all regressions, thereby limiting the explanatory power of the models and reducing confidence in our results. Most of our results supports the commonly held intuition – that growing firms will benefit from economies of scale – however the results are not conclusive and as such require additional discussion.

6. Discussion

Taken together, we find evidence indicating that growing firms in our sample realise economies of scale as theory suggests. While growing or larger firms generally exhibit lower operating costs relative to sales and higher profitability, the interaction term, intended to capture the diminishing nature of economies of scale, remains insignificant. This suggests that our observed cost curve is negative and linear rather than flattening as firms become larger. Although our results support the existence of economies of scale, they also reveal gaps that warrant further explanation, gaps that the following discussion seeks to address. In addition, we will examine a set of offsetting and distorting factors that may explain the observed gaps and influence all our results. We also reflect on potential model misspecifications and their impact.

6.1 Discussion around Observed Gaps

This section discusses the gaps observed in our results. We examine how both the mechanisms underlying economies of scale and key industry characteristics help explain the gaps.

One gap we observe is that, in the main regressions where industries are aggregated, there is only a weak association between firm growth and production costs relative to sales and no association between firm size and production costs relative to sales. This despite theory clearly suggesting that firms should realise economies of scale in production.

One potential explanation lies in the variation in cost structures across the industries that make up the aggregate sample. As shown in *Appendix B*, a large share of the firms operates in service sectors where variable labour costs likely dominate, and fixed production costs are probably relatively small. According to operating leverage theory, when fixed and semi-fixed costs constitute only a minor share of total costs, the scope for economies of scale is limited (Ertan et al., 2020). Product-based firms should thus be better positioned to realise economies of scale in production than service firms. When aggregated, the differences in cost structures are combined, making it harder to detect economies of scale in production for these firms, explaining the weaker overall results. However, when we split the sample, the product-based industries such as *Manufacturing* show stronger evidence of production-related economies of scale compared to the full sample, while most service industries do not. This is consistent with prior studies (Marcus, 1969; Whittington, 1980) and emphasises the need to compare similar firms within the same industry, since aggregation can obscure the data.

A second explanation for this gap concerns a lack of specialisation in labour and plant and equipment (Silberston, 1972). The high-growth firms in our sample may not yet have refined production processes, removed bottlenecks, or achieved the division of labour that typically enhances production efficiencies, nor have they reached the size at which it becomes economically justifiable to invest in specialised plant and equipment which would lower production costs relative to sales.

A third reason relates to firms' bargaining power vis-à-vis suppliers. Porter (2008), suggests that larger firms should possess greater bargaining power, enabling them to negotiate lower

input prices and thereby reduce production costs. However, industry concentration in our sample is generally low as seen in *Appendix F,* indicating a fragmented and highly competitive environment for all firms. In such settings, firms may struggle to reach a scale relative to their competitors that would allow them to exercise meaningful bargaining power. This could help explain why we do not observe lower production costs relative to sales for larger firms. Alternatively, even if larger firms do gain greater bargaining power, they may not be able to reduce input prices immediately, as production activities often rely on longer-term supplier contracts. While bargaining power may increase continuously with firm size, the effects would only materialise once contracts are renegotiated, which may occur at intervals exceeding one year. This implies that economies of scale in production may become stronger when growth is measured over longer horizons.

A second gap in our results relates to the systematically insignificant interaction terms. As noted earlier, our observed cost curve appears negative and linear rather than flattening as firms grow. One explanation could be that our sample of high-growth firms had not yet reached their minimum efficient scale by the end of the observation period. Instead, they remain on the downward-sloping portion of the long-run average cost curve where the association between growth and efficiencies is somewhat linear (Goolsbee et al., 2020). Alternatively, the firms may not have reached the size where organisational complexity limits economies of scale (Shepherd, 1972).

A third gap concerns the difference in statistical significance between production costs and operating overheads. We observe a more consistent and significant realisation of economies of scale in operating overheads than in production. This can be explained by the fundamentally different nature of the two cost categories (Ertan et al., 2020). Production costs tend to be more linear, with higher sales requiring proportionally higher inputs in production, resulting in lower operating leverage and therefore less scope for economies of scale. Operating overheads, by contrast, tend to be more semi-variable, making them easier to spread across larger output. As a result, scale effects are more likely to materialise in overheads than in production, which is consistent with our findings.

While most regressions indicate that firms generally realise economies of scale in operating overheads, and that this holds for most industries, a fourth gap emerges for the *Wholesale and*

Retail Trade and *Publishing, Broadcasting, and Content Production* industries where no overhead economies of scale are realised. One explanation consistent with Domowitz et al. (1988) is that many firms carry substantial fixed costs in their overhead functions, giving them significant scope to spread these costs over a larger output base as they grow. However, as the authors note, this mechanism varies across industries. In sectors such as *Wholesale and Retail Trade* and *Publishing, Broadcasting, and Content Production*, fixed overhead costs may be lower, limiting the potential for cost spreading and thus the realisation of economies of scale. An alternative explanation concerns economies of massed resources. These arise when firms share resources such as administrative systems, distribution networks, or marketing platforms, thereby lowering average costs (Silberston, 1972). The *Wholesale and Retail Trade* and *Publishing, Broadcasting, and Content Production* sectors may be less able to exploit shared resources, or less effective in disciplining themselves to do so.

Finally, a fifth gap concerns the systematic lack of significant capital utilisation among larger and growing firms, as seen in the insignificant association between firm size, growth and D&A/Sales. One explanation may be the strategic prioritisation of continued capital investment during periods of high growth (Ertan et al., 2020). As firms expand, they may keep investing in assets, increasing depreciation and amortisation, while simultaneously raising output. The two effects largely offset each other, resulting in the non-significant relationship between firm growth and D&A/Sales in the main regressions. A second explanation concerns capital intensity. Capital-intensive firms make large upfront investments, causing depreciation and amortisation to rise before they eventually fall. In the early years of high growth, the association with D&A/Sales may therefore be positive as firms continue to invest. Later, as they begin to use their capital more efficiently, and thus generate higher sales, the association may turn negative. So, when we regress the data collectively, these associations may cancel each other out, resulting in insignificant overall associations.

In sum, the gaps identified in our results may be explained by the mechanisms underlying economies of scale and by industry-specific characteristics. Alternatively, they may arise from a broader set of offsetting or distorting factors, which we now turn to examine.

6.2 Factors Offsetting the Gains from Economies of Scale

The observed gaps in our results may also stem from a range of offsetting factors. Additionally, these factors may also impact our overall results. Firstly, economies of scale may be offset by rising agency costs as firms grow. According to agency theory, larger organisations make it harder to monitor managerial actions, increasing the risk that managers pursue objectives that do not align with shareholder value (Jensen & Meckling, 1976). Such misaligned incentives can include overhiring, overinvesting, or expanding administrative structures beyond what is economically justified, thereby increasing operating costs and eroding potential gains from scale. Even when firms attempt to mitigate these problems by implementing incentive systems, performance controls, or additional layers of oversight, these governance mechanisms themselves can become costly and may offset the efficiencies gained from increased scale. A second offsetting mechanism preventing firms from capturing the cost advantages that scale theoretically provides is competitive pressure. As seen in *Appendix F*, the average HHI across the industries in our sample ranges from 42 to 564. These values are far below the 2000 threshold considered unconcentrated by the Swedish Competition Authority and indicate that all our firms operate in highly fragmented and competitive sectors throughout the sample period (Bergman, Norbäck & Suveg, 2024). According to Porter (2008), in such fragmented and competitive markets larger firms may be forced to pass cost savings on to customers through lower prices. Thus, even if internal economies of scale are realised, they may be reflected more in market prices than in higher margins or lower cost ratios, especially in sectors with thin mark-ups and intense rivalry.

6.3 Accounting Practices Distorting the Measurement of Economies of Scale

Another set of factors affecting our results relates to accounting practices that distort how costs are reflected in accounting data. As highlighted by Noreen and Soderstrom (1994), financial reporting often allocates fixed and overhead costs using conventions that do not reflect their true economic behaviour. Traditional cost accounting typically relies on full-cost or average-cost allocations that combine fixed and variable expenses, causing reported average costs to diverge from the true marginal cost. When distributed in this way, gains from economies of scale may not translate into visible changes in cost and profit ratios. This is particularly evident for depreciation and amortisation, where historical investment costs are allocated over time, potentially shifting cost ratios and profit margins in ways that do not reflect the firm's current operating scale. Since the choice of how to depreciate and amortise non-current assets is a

managerial decision, there may be a disconnect between these accounting choices and the true economic behaviour of the firm. This disconnect may distort the data and help explain the insignificant D&A/Sales results. Taken together, these factors highlight that accounting-based measures can distort the detection of economies of scale. Firms may achieve real efficiency gains as they grow, but these improvements may not be fully reflected in the accounting ratios used in our study, contributing to the gaps observed.

6.4 Methodology Misspecification

Our overall results are also impacted by the research design and sample. In this thesis, we have attempted to test whether economies of scale exist at a firm-level using accounting data, an assumption widely accepted in the literature and business but rarely examined empirically. To do so, we developed a model in which firm size moderates the relationship between growth and indicators of economies of scale. The underlying rationale was that economies of scale should become observable in accounting terms as firms grow, but that these benefits should diminish as firms approach their minimum efficient scale. However, the negative adjusted R^2 values suggest that the model may still be weak. If the model is weak, then the results and conclusions drawn from it must also be interpreted with caution. In addition, we chose a sample of high-growth firms, as theory suggests that it is during the growth stage that firms are expected to realise the greatest economies of scale. While this may still hold, the moderate period length of seven years implies that many firms may not yet have reached their minimum efficient scale but are still in their growth phase. Thus, the consistent absence of a significant interaction term may simply reflect that firms in our sample remain on the initial downward-sloping part of the long-run average cost curve. Had we tracked the firms for a longer period, they might have reached their minimum efficient scale, and we might have observed a significant interaction, as is anticipated in the theory.

6.5 Implications of Our Results

When viewing our results and discussion in conjunction, three main implications emerge for whether, where, and for whom economies of scale arise.

First, we find partial evidence in support that economies of scale can be observed in accounting data. This offers partial empirical support for the commonly held intuition that growing firms

will benefit from economies of scale. It is particularly notable given that most prior evidence does not use accounting data and stems from plant-level studies, but their results are still assumed to apply on a firm level. Instead, our results imply that economies of scale can indeed be observed in accounting data at the firm level, providing support for the notion that growing firms anticipate performance improvements from scale.

Second, economies of scale materialise differently across cost categories and industries. Our results therefore suggest that economies of scale are not a uniform phenomenon. We observe more consistent results supporting economies of scale in operating overheads than in production or capital utilisation, an important insight for managers and educators alike. Moreover, the cost and profit measures in which economies of scale materialise vary between industries, underscoring the need for industry-specific expectations when assessing productivity improvements for high-growth firms.

Third, for high-growth firms in their early expansion phase, size does not appear to condition the gains generated by firm growth. However, this relationship may look different over a longer horizon, after firms enter maturity and reach their minimum efficient scale. Building on this, our findings suggest that the gains from economies of scale may require a substantially longer time horizon than the seven-year period examined in this study. Managers, investors, and educators should keep this in mind when interpreting accounting data, conducting valuations, and assessing firms' future performance.

7. Conclusion

The overarching purpose of our study has been to test whether the commonly held intuition - that growing firms will benefit from economies of scale - holds in practice. We questioned this intuition given the clash between theory and empirical evidence, and formulated the following research question:

Is firm growth associated with the realisation of economies of scale in cost and profit measures, and are these relationships conditioned by firm size and industry differences?

The answer to this question is a nuanced one. While our findings provide initial confirmation for firm growth being associated with the realisation of economies of scale, and that these

associations differ across industries, we do not find evidence that they are moderated by firm size. In terms of our hypotheses, we find support for our first hypothesis, that firm growth is associated with measures indicative of economies of scale. However, given the consistently insignificant interaction term, we do not find support for our second hypothesis, that firm size moderates the relationship between firm growth and measures of economies of scale. Lastly, we find support for our third hypothesis, confirming previous findings that economies of scale materialise differently across industries. Despite a few inconsistencies, our findings generally support economies of scale being realised at the firm level, confirming much of the common intuition.

Thus, our study contributes to the literature and intuition in several ways. First, we contribute by using firm-level accounting data, which most of the prior research on economies of scale has not employed. This allows us to confirm that economies of scale can manifest at a firm-level in the financial statements, rather than simply inferring that they should do so based on evidence derived primarily from plant-level studies. Second, whereas prior research has typically examined the relationships between growth and profitability or size and profitability separately, our study jointly considers growth and size to capture how the effects of growth change as firms become larger - a mechanism central to understanding economies of scale. By introducing firm size as a moderating factor, we offer a more nuanced assessment of how scale benefits might emerge at different points in the firm-size distribution. Third, we move beyond broad profitability measures often used in existing literature. Instead, we analyse individual costs in production, operating overhead, and depreciation and amortisation. This allows us to identify where within the cost structure economies of scale arise, rather than inferring them from overall margins alone. Fourth, by first using an aggregate sample, we provide evidence on whether, and where the average firm can expect to realise economies of scale. By subsequently splitting the sample, we reveal how these patterns differ between the average firm and specific industries, as well as between firms from different industries. Our findings reinforce prior research by showing that industry characteristics meaningfully shape economies of scale, and that firms in different industries realise them in different parts of their operations. Finally, we follow a panel of high-growth firms through their expansion phase and continue tracking them throughout their growth journeys, allowing us to observe how economies of scale emerge and develop. Our contribution is particularly pronounced given the limited number of studies conducted in a Swedish context.

While we contribute to several gaps in the literature, there are still several limitations to our study, which we hope future research will address. Our first limitation relates to the model itself. Although we have attempted to address several issues identified in earlier accounting research, our model has a few flaws (please see *4.5 Model Limitation* and 5.2.1 *Discussion on adjusted R^2* for more details), as indicated by the negative adjusted R^2 values. We therefore encourage future research to explore alternative research designs to better capture economies of scale. A second limitation stems from the relatively short panel. While we selected a seven-year period to avoid distortions and deemed it reasonable at the beginning, our results show a systematic lack of significant interaction terms, suggesting that many firms may not reach their minimum efficient scale within this timeframe. We therefore suggest that future research uses longer panels to assess whether firms continue to realise economies of scale beyond the seven years and exhibit diminishing returns. A third limitation relates to the possibility that economies of scale materialise with a delay. While our study focuses on the more immediate associations between firm growth and indicators of economies of scale, the effects may take longer to materialise. We therefore suggest that future studies incorporate lagged growth variables or growth measured over longer periods of time. A fourth limitation concerns our focus on high-growth firms. While we have only looked at the development of high-growth firms, it would be valuable to compare these firms' development with non-high-growth firms to understand how the realisation of economies of scale differs across growth profiles. We therefore recommend replicating the analysis on a broader firm sample or conducting separate analyses on high-growth and non-high-growth firms and comparing the results. A fifth limitation concerns endogeneity. Prior research debates whether growth leads to profitability or whether profitability leads to growth. Although our research design differs from these studies, endogeneity remains a concern. Future work could explore alternative measures of scale or adopt a design that better addresses endogeneity. A final limitation concerns the limited depth of our industry analysis. Our primary objective was to test whether common intuition about economies of scale holds in accounting data, and whether it differs across industries. As such, our industry analysis should be viewed as a starting point and future research could benefit from examining specific industry characteristics in greater detail.

All things considered, this study has deepened our understanding of whether, where, and for whom economies of scale arise. This process has highlighted the concept’s inherent complexity

- a complexity sometimes forgotten in the simplified narrative presented in both education and business. We leave you with the hope that future research will revisit the concept of economies of scale to determine how closely the common intuition aligns with reality, especially as we enter a new era of economic expansion where growing companies expect to benefit from economies of scale.

8. Bibliography

Arrow, K.J. (1962). *The economic implications of learning by doing*, Review of Economic Studies, 29(3), 155–173.

Bain, J.S. (1951) *Relation of Profit Rate to Industry Concentration: American Manufacturing, 1936–1940*, The Quarterly Journal of Economics.

Bergman, M., Norbäck, P-J., Nyberg, S. & Suveg, M. (2024). *Att mäta konkurrensen i Sverige. Uppdragsforskningsrapport 2024:6.* Stockholm: Konkurrensverket.

Capon, N., Farley, J.U. and Hoenig, S. (1990) *Determinants of Financial Performance: A Meta-Analysis*, Management Science, 36(10), pp. 1143–1159.

Chen, Z., Harford, J. and Kamara, A. (2019) *Operating Leverage, Profitability, and Capital Structure*, Journal of Financial and Quantitative Analysis, 54(1), pp. 369–392.

Christensen, L.R. & Greene, W.H. (1976). *Economies of scale in U.S. electric power generation. Journal of Political Economy*, 84(4, Part 1), 655–676.

Coad, A., Cowling, M. and Siepel, J. (2017) *Growth processes of high-growth firms as a four-dimensional chicken and egg*, Industrial and Corporate Change, 26(4), pp. 537–554.

Cowling, M. (2004) *The Growth–Profit Nexus*, Small Business Economics, 22(1), pp. 1–9.

Dang, C.D., Li, F. & Yang, C. (2018). *Measuring firm size in empirical corporate finance.* Journal of Banking & Finance, 86, 159–176.

Davidsson, P., Steffens, P. and Fitzsimmons, J. (2009) *Growing profitable or growing from profits: Putting the horse in front of the cart?*, Journal of Business Venturing, 24(4), pp. 388–406.

Domowitz, I., Hubbard, R.G. & Petersen, B.C. (1988) *Market structure and cyclical fluctuations in U.S. manufacturing*, The Review of Economics and Statistics, 70(1), 55–66.

Ertan, A., Lewellen, S. and Thomas, J.K. (2020) *Do Profit Margins Expand for High Growth Firms?*, Journal of Management Accounting Research, 32(3), pp. 117–135.

Eurostat & OECD. (2007). *Eurostat–OECD manual on business demography statistics*. Luxembourg: Publications Office of the European Union.

Foster, L., Haltiwanger, J. and Syverson, C. (2016) *The Slow Growth of New Plants: Learning about Demand?*, Economica, 83(329), pp. 91–129.

Goolsbee, A., Levitt, S. & Syverson, C. (2020). *Microeconomics (3rd ed.)*, Worth Publishers.

Griliches, Z. & Ringstad, V. (1971). *Economies of scale and the form of the production function: An econometric study of Norwegian manufacturing establishment data*. Amsterdam: North-Holland Publishing Company.

Gschwandtner, A. (2005) *Profit persistence in the "very" long run: evidence from survivors and exiters*, Applied Economics, 37(7), pp. 793–806.

Hall, M. and Weiss, L. (1967) *Firm Size and Profitability', The Review of Economics and Statistics*, 49(3), p. 319.

IZA Institute of Labor Economics. (2023). *IZA Policy Paper No. 200.* Bonn: IZA Institute of Labor Economics.

Jang, S. (Shawn) and Park, K. (2011) *Inter-relationship between firm growth and profitability*, International Journal of Hospitality Management, 30(4), pp. 1027–1035.

Jensen, M.C. & Meckling, W.H. (1976). *Theory of the firm: Managerial behavior, agency costs and ownership structure*, Journal of Financial Economics, 3(4), 305–360.

Junius, K. (1997) Economies of scale*: A survey of the empirical literature*. Kiel Institute of World Economics. (Kiel Working Paper No. 813).

Mansikkamäki, S. (2023) *Firm growth and profitability: The role of age and size in shifts between growth–profitability configurations*, Journal of Business Venturing Insights, 19, p. e00372.

Marcus, M. (1969) *Profitability and Size of Firm: Some Further Evidence*, The Review of Economics and Statistics, 51(1), p. 104.

Noreen, E., Noreen, E. and Soderstrom, N. (1994) *Are overhead costs strictly proportional to activity?*, Journal of Accounting and Economics, 17(1–2), pp. 255–278.

Porter, M.E. (2008). *The five competitive forces that shape strategy*, Harvard Business Review, 86(1), 78–93.

Regeringen. (2022). *Pandemins effekter på svensk ekonomi under 2020*. Stockholm: Regeringen.

Samuels, J.M. and Smyth, D.J. (1968) *Profits, Variability of Profits and Firm Size*, Economica, 35(138), p. 127.

Shepherd, W.G. (1972) *The Elements of Market Structure*, The Review of Economics and Statistics, 54(1), p. 25.

Silberston, A. (1972) *Economies of Scale in Theory and Practice*, The Economic Journal, 82(325), p. 369.

Smyth, D. J., Boyes, W. J. & Peseau, D. E. (1975). *Size, growth, profits and executive compensation in the large corporation: A study of the 500 largest United Kingdom and United States industrial corporations.* Holmes & Meier Publishers.

Stekler, H.O. (1964). *The variability of profitability with size of firm, 1947–1958*, Journal of the American Statistical Association, 59(308), 1183–1193.

Sveriges Riksbank. (2018). *Dramatic years in Sweden and globally – economic developments 2006–2017.* Stockholm: Sveriges Riksbank.

Whittington, G. (1980) *The Profitability and Size of United Kingdom Companies, 1960–74*, The Journal of Industrial Economics, 28(4), p. 335.

Wooldridge, J. M. (2002). *Econometric analysis of cross section and panel data*, MIT Press.

Yadav, I.S., Pahi, D. and Gangakhedkar, R. (2022) *The nexus between firm size, growth and profitability: new panel data evidence from Asia–Pacific markets*, European Journal of Management and Business Economics, 31(1), pp. 115–140.

Electronic Sources

CFI Team, Corporate Finance Institute *Business Life Cycle*
https://corporatefinanceinstitute.com/resources/valuation/business-life-cycle/
[Accessed: 20.10.2025]

Investopedia Team. Investopedia, *Capital Intensive Industries Explained: Definition, Examples, and Impact*
https://www.investopedia.com/terms/c/capitalintensive.asp#citation-3
[Accessed: 27.10.2025]

Statistikmyndigheten SCB. SNI search.
https://snisok.scb.se/en
[Accessed: 29.10.2025]

9. Appendix

Appendix A: Dependent Variable Definitions

Appendix A details the dependent variables used in all regressions.

Dependent Variable	Proxy	Definition
Production costs	Cost of Goods Sold (COGS)	$\frac{COGS_{i,t}}{Sales_{i,t}}$
Operating overhead costs	Selling, General & Administrative expenses (SG&A)	$\frac{SG\&A_{i,t}}{Sales_{i,t}}$
Capital Utilisation	Depreciation & Amortisation (D&A)	$\frac{D\&A_{i,t}}{Sales_{i,t}}$
Gross profit	Gross profit	$\frac{Gross\ profit_{i,t}}{Sales_{i,t}}$
Operating profit	Earnings Before Interest Tax (EBIT)	$\frac{EBIT_{i,t}}{Sales_{i,t}}$

Appendix B: Industry Composition

Appendix B outlines all the industries that are included in our full sample. We outline the number of firms and observations. The industry descriptions are retrieved from the SCB website (Statistikmyndigheten, SCB). Please note that only the industries with over 280 observations are included in the industry regressions, as indicated by the right-hand column.

Industry	Description	# of firms	# of observations	% of sample	Separate industry regression
S - Arts, sports and recreation	This category includes a broad range of activities intended to meet the public's cultural, entertainment, and recreational interests, including performances, the operation of museums, gaming, sports, and leisure activities.	7	49	0.72%	No
Q - Education	This category covers education at all levels and for all professions. Instruction may be delivered orally or in writing, and can be provided via radio, television, the Internet, or through correspondence.	23	155	2.27%	No
A - Agriculture, forestry and fishing	This division includes the exploitation of natural resources in the form of plants and animals. It covers the cultivation of crops, the raising and breeding of animals, logging and the harvesting of other plants, as well as the collection of animals and animal products from agriculture or from their natural habitats and breeding grounds.	8	56	0.82%	No
J – Publishing, broadcasting, and content production	This category covers the production and distribution of information and cultural products, the provision of the means to transmit or distribute these products, as well as data or communications services, information technology activities,	93	599	8.79%	Yes

	and the processing of data and other information-related services.				
C - Manufacturing	This category includes the physical or chemical transformation of materials, substances, or components into new products.	133	852	12.50%	Yes
N - Professional, scientific and technical activities	This category includes specialised professional, scientific, and technical activities. These activities require a high level of education and provide users with expert knowledge and specialised skills.	133	865	12.69%	Yes
R - Human health and social work activities	This category includes health care and social services. The activities range from medical care provided by trained medical professionals in hospitals and other facilities, and services connected to residential care that include health care interventions, to social services delivered without the involvement of professional medical staff.	76	527	7.73%	Yes
F - Construction	This category includes general construction activities and specialised activities related to buildings and civil engineering works. It covers new construction, repairs, additions, alterations, the on-site assembly of prefabricated buildings or structures, as well as the construction of temporary buildings.	224	1545	22.66%	Yes
M - Real estate services	This category includes activities carried out as lessors, agents, and/or brokers in one or more of the following areas: the sale or purchase of real estate, the rental of real estate, and the provision of real estate-related services such as property valuation or escrow services. Activities in this category may be performed in relation to owned or leased property and may be conducted for a fee or under contract. It also includes the construction of buildings or structures carried out while retaining ownership or leasing them out.	10	54	0.79%	No
T - Other service activities	This category covers (as a residual grouping) the activities of organisations and associations, the repair of computers, personal items and household goods, as well as various personal services not classified elsewhere.	10	64	0.94%	No
H - Transportation and storage	This category includes the provision of passenger or freight transport - whether scheduled or not - by rail, pipeline, road, water, or air, as well as related activities such as the operation of terminals, parking facilities, cargo handling, storage, and similar services. The category also includes the rental of transport equipment with operators. Postal and courier services are likewise included.	27	186	2.73%	No
O - Administrative and support service activities	This category includes various support activities for general business operations. These activities do not involve specialised expertise.	120	796	11.68%	Yes
G - Wholesale and retail trade	This category includes wholesale and retail trade (the sale of goods without transformation) of all types of products, as well as services related to the sale of such goods. Wholesale and retail trade represent the final stages of the goods distribution chain. This category also includes the repair of motor vehicles.	145	953	13.98%	Yes

I - Accommodation and food service activities	This category includes the provision of short-term accommodation for visitors and other travellers, as well as prepared meals and beverages intended for immediate consumption. The range and type of additional services offered within this category can vary widely.	16	110	1.61%	No

Appendix C: Correlation Matrix

The table below presents the correlation matrix for all variables included in the main regressions.

	Ln (Total Assets)	Growth Total Assets	COGS/Sales	SG&A/Sales	D&A/Sales	Gross margin	EBIT margin	Capital Intensity	Capex	Leverage	HHI
Ln (Total Assets)	1.000										
Growth Total Assets	-0.148***	1.000									
COGS/Sa1es	0.391***	-0.016	1.000								
SG&A/Sales	-0.429***	-0.064***	-0.808***	1.000							
D&A/Sales	0.188***	-0.085***	0.098***	-0.018	1.000						
Gross margin	-0.391***	0.016	-1.000***	0.808***	-0.098***	1.000					
EBIT margin	0.013	0.200***	-0.328***	-0.085***	-0.071***	0.328***	1.000				
Capital Intensity	0.109***	-0.037***	0.084***	-0.113***	0.617***	-0.084***	0.002	1.000			
Capex	-0.100***	0.233***	-0.002	0.004	-0.307***	0.002	0.023*	-0.006	1.000		
Leverage	0.063	-0.001	0.183***	-0.145***	0.286***	-0.183***	-0.108***	0.473***	0.026**	1.000	
HHI	-0.056***	-0.020*	-0.121***	0.151***	0.074***	0.121***	0.015	0.052***	-0.026**	-0.024**	1.000

Appendix D: Robustness check: Employees as a proxy for Size

The table below presents the regression results from the five main specifications. Each regression uses a different dependent variable, COGS/Sales, SG&A/Sales, D&A/Sales, Gross margin, and EBIT margin, and includes both firm- and time-fixed effects. The independent variables, firm growth (measured by growth in number of employees) and firm size (measured as ln number of employees lagged one period), are winsorised at the 1st and 99th percentiles and subsequently standardised using z-scores.

	(1)	(2)	(3)	(4)	(5)
Variable	COGS/Sales	SG&A/Sales	D&A/Sales	Gross margin	EBIT margin
Firm Growth	-2.023***	0.805**	-0.086**	2.023***	1.052***
	(0.000)	(0.013)	(0.010)	(0.000)	(0.000)
Firm Size	-4.565***	2.389***	-0.260***	4.565***	1.410**
	(0.000)	(0.006)	(0.010)	(0.000)	(0.011)
Firm Growth * Firm Size	-0.062	0.001	0.026	0.062	0.067
	(0.810)	(0.997)	(0.325)	(0.810)	(0.711)
Capital Intensity	-6.438**	2.687	6.625***	6.438**	-7.894**
	(0.041)	(0.471)	(0.000)	(0.041)	(0.025)
Capital Expenditure	3.181*	4.507	-3.788***	-3.181*	2.528**
	(0.055)	(0.320)	(0.000)	(0.055)	(0.042)
Leverage	4.811*	4.472*	-0.041	-4.811*	-11.810***
	(0.076)	(0.054)	(0.890)	(0.076)	(0.000)
Industry HHI	0.002	0.001	0.000	-0.002	0.001
	(0.406)	(0.799)	(0.592)	(0.406)	(0.782)
Adjusted R^2	-0.122	-0.153	0.036	-0.122	-0.133
Observations	6734	6734	6734	6734	6734
Firm & Time FE	Yes	Yes	Yes	Yes	Yes

*Significance levels: *** (p-value < 0.01), ** (p-value < 0.05), * (p-value < 0.1)*
P-values are shown in parentheses

Appendix E: Robustness check: Sales as a proxy for Size

The table below presents the regression results from the five main specifications. Each regression uses a different dependent variable, COGS/Sales, SG&A/Sales, D&A/Sales, Gross margin, and EBIT margin, and includes both firm- and time-fixed effects. The independent variables, firm growth (measured by growth in total sales) and firm size (measured as ln total sales lagged one period), are winsorised at the 1st and 99th percentiles and subsequently standardised using z-scores.

	(1)	(2)	(3)	(4)	(5)
Variable	COGS/Sales	SG&A/Sales	D&A/Sales	Gross margin	EBIT margin
Firm Growth	-1.040***	-3.045***	-0.156***	1.040***	2.085***
	(0.007)	(0.000)	(0.000)	(0.007)	(0.000)
Firm Size	-l.883	-4.713***	-0.548***	1.883	3.425***
	(0.160)	(0.000)	(0.000)	(0.160)	(0.000)
Firm Growth * Firm Size	0.393	-0.682***	-0.000	-0.393	0.083
	(0.171)	(0.003)	(0.986)	(0.171)	(0.659)
Capital Intensity	-10.021***	3.183	6.869***	10.021***	-4.863
	(0.007)	(0.427)	(0.000)	(0.007)	(0.167)
Capital Expenditure	5.022**	3.759	-3.839***	-5.022**	0.584
	(0.028)	(0.417)	(0.000)	(0.028)	(0.754)
Leverage	5.101*	2.277	-0.237	-5.101*	-11.596***
	(0.059)	(0.365)	(0.452)	(0.059)	(0.000)
Industry HHI	0.005	-0.001	0.000	-0.005	0.000
	(0.162)	(0.751)	(0.750)	(0.162)	(0.979)
Adjusted R^2	-0.147	-0.048	0.070	-0.147	-0.072
Observations	6811	6811	6811	6811	6811
Firm & Time FE	Yes	Yes	Yes	Yes	Yes

*Significance levels: *** (p-value < 0.01), ** (p-value < 0.05), * (p-value < 0.1)*
P-values are shown in parentheses

Appendix F: Herfindahl-Hirschman Index (HHI) and Capital Intensity by Industry

Appendix F summarise the mean HHI and Capital Intensity values for each industry to provide an indication of their industry concentration (level of competition) and capital-intensity requirements of each industry.

Industry	# of Firms	# of Observations	Mean HHI	Capital Intensity
S - Arts, sports and recreation	7	49	564.24	0.157
Q - Education	23	155	476.76	0.074
A - Agriculture, forestry and fishing	8	56	259.06	0.129
J – Publishing, broadcasting, and content production	93	599	249.65	0.022
C - Manufacturing	133	852	213.02	0.163
N - Professional, scientific and technic al activities	133	865	172.47	0.034
R - Human health and social work activities	76	527	143.26	0.059
F - Construction	224	1545	121.21	0.084
M - Real estate services	10	54	105.54	0.110
T - Other service activities	10	64	102.93	0.048
H - Transportation and storage	27	186	97.50	0.226
O - Administrative and support service activities	120	796	70.37	0.058

G - Wholesale and retail trade	145	953	45.73	0.057
I - Accommodation and food service activities	16	110	42.25	0.101
Full sample	974	6817	145.90	0.078

Appendix G: Explanation on calculation of the Herfindahl-Hirschman Index (HHI)

For industry concentration we use the Herfindahl-Hirschman Index (HHI). The index is defined as $HHI = S_1^2 + S_2^2 + \ldots + S_n^2$ where *S* is the market share of a firm *i* in an industry and *n* is the number of firms in that industry. We follow the same approach as the Swedish Competition Authority does in their report "*Att mäta konkurrensen i Sverige"* (2024), where sales is used as a proxy for market share. For the industry classifications, the SNI system was applied. Based on all the firms in the Serrano database, we compute an HHI value for each industry and each year.

Industry Regressions

The tables below presents the regression results from the five regressions. Each regression uses a different dependent variable, COGS/Sales, SG&A/Sales, D&A/Sales, Gross margin, and EBIT margin, and includes both firm- and time-fixed effects. The independent variables, firm growth (measured by total assets) and firm size (measured as ln total assets), are winsorised at the 1st and 99th percentiles and subsequently standardised using z-scores.

Appendix Industry Regressions: Manufacturing

	(1)	(2)	(3)	(4)	(5)
Variable	COGS/Sales	SG&A/Sales	D&A/Sales	Gross margin	EBIT margin
Firm Growth	-2.017**	-2.703***	0.087	2.017**	3.798***
	(0.029)	(0.000)	(0.193)	(0.029)	(0.000)
Firm Size	-2.370	-6.001*	-0.257	2.370	6.811***
	(0.514)	(0.065)	(0.581)	(0.514)	(0.006)
Firm Growth * Firm Size	-0.014	0.012	0.049	0.014	-0.192
	(0.983)	(0.980)	(0.470)	(0.983)	(0.556)
Capital intensity	-27.678*	10.017	10.158***	27.678*	8.110
	(0.051)	(0.465)	(0.000)	(0.051)	(0.492)
Capex	14.677**	2.834	-4.835***	-14.677**	-8.861***
	(0.020)	(0.644)	(0.005)	(0.020)	(0.007)
Leverage	15.996**	12.466	0.402	-15.996**	-26.477**
	(0.019)	(0.120)	(0.646)	(0.019)	(0.018)
Adjusted R^2	-0.144	-0.088	0.062	-0.144	0.002
Observations	852	852	852	852	852
Firm & Time FE	Yes	Yes	Yes	Yes	Yes

*Significance levels: *** (p-value < 0.01), ** (p-value < 0.05), * (p-value < 0.1)*
P-values are shown in parentheses

Appendix Industry Regressions: Construction

	(1)	(2)	(3)	(4)	(5)
Variable	COGS/Sales	SG&A/Sales	D&A/Sales	Gross margin	EBIT margin

Firm Growth	-0.115	-1.504***	0.001	0.115	2.035*
	(0.656)	(0.000)	(0.941)	(0.656)	(0.000)
Firm Size	1.705	-6.285***	-0.002	-1.705	3.755***
	(0.271)	(0.000)	(0.977)	(0.271)	(0.000)
Firm Growth * Firm Size	-0.193	0.105	0.008	0.193	-0.103
	(0.423)	(0.563)	(0.429)	(0.423)	(0.701)
Capital intensity	-8.775	9.811**	5.541***	8.775	-6.823
	(0.199)	(0.030)	(0.000)	(0.199)	(0.121)
Capex	3.313	-1.207	-3.223***	-3.313	-1.274
	(0.433)	(0.651)	(0.000)	(0.433)	(0.643)
Leverage	1.473	8.012**	-0.538	-1.473	-12.785***
	(0.765)	(0.018)	(0.254)	(0.765)	(0.000)
Adjusted R^2	-0.172	-0.053	0.116	-0.172	0.007
Observations	1545	1545	1545	1545	1545
Firm & Time FE	Yes	Yes	Yes	Yes	Yes

*Significance levels: *** (p-value < 0.01), ** (p-value < 0.05), * (p-value < 0.1)*
P-values are shown in parentheses

Appendix Industry Regressions: Wholesale and Retail Trade

	(1)	(2)	(3)	(4)	(5)
Variable	COGS/Sales	SG&A/Sales	D&A/Sales	Gross margin	EBIT margin
Firm Growth	-0.354	-0.366	0.036	0.354	1.026**
	(0.447)	(0.450)	(0.106)	(0.447)	(0.012)
Firm Size	4.426	-1.043	0.045	-4.426	-2.933
	(0.138)	(0.710)	(0.696)	(0.138)	(0.179)
Firm Growth * Firm Size	0.756	0.159	-0.032*	-0.756	-0.490**
	(0.226)	(0.531)	(0.071)	(0.226)	(0.042)
Capital intensity	-12.126**	-2.864	4.130***	12.126**	6.283
	(0.035)	(0.545)	(0.001)	(0.035)	(0.167)
Capex	1.705	-1.767	-1.364*	-1.705	-1.931
	(0.209)	(0.321)	(0.056)	(0.209)	(0.243)
Leverage	5.186	4.007**	0.371	-5.186	-7.075**
	(0.196)	(0.015)	(0.486)	(0.196)	(0.030)
Adjusted R^2	-0.139	-0.187	-0.075	-0.139	-0.062
Observations	953	953	953	953	953
Firm & Time FE	Yes	Yes	Yes	Yes	Yes

*Significance levels: *** (p-value < 0.01), ** (p-value < 0.05), * (p-value < 0.1)*
P-values are shown in parentheses

Appendix Industry Regressions: Publishing, Broadcasting and Content Production

	(1)	(2)	(3)	(4)	(5)
Variable	COGS/Sales	SG&A/Sales	D&A/Sales	Gross margin	EBIT margin
Firm Growth	0.823	-0.342	0.045	-0.823	2.515***
	(0.592)	(0.759)	(0.215)	(0.592)	(0.002)
Firm Size	5.641	-3.281	0.609**	-5.641	1.181
	(0.122)	(0.488)	(0.023)	(0.122)	(0.557)

Firm Growth * Firm Size	-0.500 (0.685)	0.378 (0.506)	0.023 (0.623)	0.500 (0.685)	2.035 (0.142)
Capital intensity	-1.947 (0.910)	-13.179 (0.472)	9.908*** (0.000)	1.947 (0.910)	3.460 (0.824)
Capex	23.241*** (0.000)	4.731 (0.255)	-12.462*** (0.000)	-23.241*** (0.000)	5.133 (0.251)
Leverage	26.714 (0.155)	-23.511 (0.189)	0.251 (0.751)	-26.714 (0.155)	-9.164 (0.407)
Adjusted R^2	-0.178	-0.192	0.377	-0.178	-0.047
Observations	599	599	599	599	599
Firm & Time FE	Yes	Yes	Yes	Yes	Yes

*Significance levels: *** (p-value < 0.01), ** (p-value < 0.05), * (p-value < 0.1)*
P-values are shown in parentheses

Appendix Industry Regressions: Professional, Scientific and Technical Activities

	(1)	(2)	(3)	(4)	(5)
Variable	COGS/Sales	SG&A/Sales	D&A/Sales	Gross margin	EBIT margin
Firm Growth	-0.609 (0.412)	-2.617*** (0.000)	-0.093 (0.184)	0.609 (0.412)	2.903*** (0.000)
Firm Size	3.759 (0.335)	-5.940* (0.067)	-0.316 (0.408)	-3.759 (0.335)	4.087*** (0.021)
Firm Growth * Firm Size	0.141 (0.844)	-0.569 (0.337)	0.062 (0.440)	-0.141 (0.844)	-0.133 (0.785)
Capital intensity	-29.549 (0.135)	-7.374 (0.736)	6.307*** (0.002)	29.549 (0.135)	13.033 (0.468)
Capex	38.691 (0.009)	17.005 (0.205)	-3.422* (0.067)	-38.691*** (0.009)	-25.278*** (0.004)
Leverage	-0.454 (0.958)	5.262 (0.608)	-1.079 (0.214)	0.454 (0.958)	-15.585* (0.069)
Adjusted R^2	-0.167	-0.144	-0.143	-0.167	-0.084
Observations	865	865	865	865	865
Firm & Time FE	Yes	Yes	Yes	Yes	Yes

*Significance levels: *** (p-value < 0.01), ** (p-value < 0.05), * (p-value < 0.1)*
P-values are shown in parentheses

Appendix Industry Regressions: Administrative and Support Service Activities

	(1)	(2)	(3)	(4)	(5)
Variable	COGS/Sales	SG&A/Sales	D&A/Sales	Gross margin	EBIT margin
Firm Growth	-0.452 (0.260)	-2.047*** (0.000)	0.065** (0.024)	0.452 (0.260)	2.100*** (0.000)
Firm Size	-0.072 (0.973)	-5.626** (0.013)	0.073 (0.648)	0.072 (0.973)	3.754*** (0.000)
Firm Growth * Firm Size	0.236 (0.421)	-0.096 (0.791)	-0.014 (0.749)	-0.236 (0.421)	0.031 (0.905)
Capital intensity	11.735 (0.166)	-10.172 (0.333)	5.934*** (0.000)	-11.735 (0.166)	-18.545*** (0.000)
Capex	0.036 (0.979)	15.318** (0.018)	-3.682*** (0.004)	-0.036 (0.979)	1.574 (0.349)
Leverage	13.025* (0.086)	-8.136 (0.255)	0.581 (0.574)	-13.025* (0.086)	-10.897** (0.048)
Adjusted R^2	-0.176	-0.083	0.308	-0.176	0.009

Observations	796	796	796	796	796
Firm & Time FE	Yes	Yes	Yes	Yes	Yes

*Significance levels: *** (p-value < 0.01), ** (p-value < 0.05), * (p-value < 0.1)*
P-values are shown in parentheses

Appendix Industry Regressions: Human Health and Social Work Activities

	(1)	(2)	(3)	(4)	(5)
Variable	COGS/Sales	SG&A/Sales	D&A/Sales	Gross margin	EBIT margin
Firm Growth	-1.334***	-1.472***	0.041	1.334***	2.705***
	(0.000)	(0.000)	(0.232)	(0.000)	(0.000)
Firm Size	-4.904***	-2.608	-0.043	4.904***	7.484***
	(0.001)	(0.137)	(0.629)	(0.001)	(0.000)
Firm Growth *	-0.209	0.359	0.013	0.209	-0.147
Firm Size	(0.216)	(0.239)	(0.561)	(0.216)	(0.692)
Capital intensity	4.127	9.745	2.065**	-4.127	-16.355**
	(0.401)	(0.216)	(0.012)	(0.401)	(0.046)
Capex	-4.094*	3.837	-1.132***	4.094*	0.543
	(0.086)	(0.258)	(0.000)	(0.086)	(0.858)
Leverage	-3.049	0.314	0.165	3.049	4.121
	(0.428)	(0.965)	(0.796)	(0.428)	(0.593)
Adjusted R^2	-0.084	-0.054	0.037	-0.084	0.038
Observations	527	527	527	527	527
Firm & Time FE	Yes	Yes	Yes	Yes	Yes

*Significance levels: *** (p-value < 0.01), ** (p-value < 0.05), * (p-value < 0.1)*
P-values are shown in parentheses

Industry Descriptive Statistics

Appendix Industry Descriptive Statistics: Agriculture, Forestry and Fishing

Variable	Mean	SD	Min	p25	Median	p75	Max	N
Total Assets (in mSEK)	93 063.64	132 269.57	2 623.00	14 856.25	29 640.50	95 292.25	479 016.00	56
Natural log of total assets	17.40	1.44	14.78	16.51	17.20	18.33	19.99	56
Growth in total assets (in %)	7.05	15.15	-28.31	-1.69	5.13	13.75	42.12	56
COGS/Sales (in %)	60.17	39.04	13.37	21.40	57.33	96.67	148.91	56
SG&A/Sales (in%)	40.93	27.35	2.71	14.05	41.19	64.92	81.72	56
D&A/Sales (in%)	2.80	3.87	0.00	0.82	1.73	2.35	15.22	56
Gross margin (in%)	39.83	39.04	-48.91	3.33	42.67	78.60	86.63	56
EBIT margin (in %)	3.71	16.27	-59.06	0.07	6.50	12.57	24.07	56

Appendix Industry Descriptive Statistics: Publishing, Broadcasting and Content Production

Variable	Mean	SD	Min	p25	Median	p75	Max	N
Total Assets (in mSEK)	48 135.85	74 596.44	1 884.00	12 057.00	24 950.00	46 753.00	696 657.02	599
Natural log of total assets	17.08	1.03	14.45	16.31	17.03	17.66	20.36	599
Growth in total assets (in %)	8.50	29.95	-60.35	-9.54	5.80	20.81	143.82	599
COGS/Sales (in %)	42.61	24.52	2.48	24.40	38.03	56.84	148.91	599
SG&A/Sales (in%)	50.40	21.05	0.01	37.01	53.16	66.09	101.04	599
D&A/Sales (in%)	0.79	1.64	0.00	0.03	0.19	0.59	15.05	599
Gross margin (in%)	57.39	24.52	-48.91	43.16	61.97	75.60	97.52	599
EBIT margin (in %)	7.86	10.89	-57.97	1.68	7.61	12.94	42.30	599

Appendix Industry Descriptive Statistics: Administrative and Support Service Activities

Variable	Mean	SD	Min	p25	Median	p75	Max	N
Total Assets (in mSEK)	26 829.07	44 358.63	1 604.19	6 623.75	14 577.00	27 246.25	440 086.02	796
Natural log of total assets	16.49	1.05	14.29	15.71	16.49	17.12	19.90	796
Growth in total assets (in %)	13.92	32.88	-60.55	-5.60	10.27	28.50	162.81	796
COGS/Sales (in %)	29.81	23.86	2.48	10.02	22.10	43.58	129.17	796
SG&A/Sales (in%)	63.29	25.23	0.01	46.17	70.63	83.04	101.73	796
D&A/Sales (in%)	0.89	2.10	0.00	0.05	0.22	0.61	15.22	796
Gross margin (in%)	70.19	23.86	-29.17	56.42	77.90	89.98	97.52	796
EBIT margin (in %)	7.21	8.92	-33.90	2.02	5.84	10.39	42.30	796

Appendix Industry Descriptive Statistics: Education

Variable	Mean	SD	Min	p25	Median	p75	Max	N
Total Assets (in mSEK)	50 614.57	89 137.12	1 604.19	6 422.00	13 065.00	37 672.00	558 228.99	155
Natural log of total assets	16.68	1.41	14.29	15.68	16.39	17.44	20.14	155
Growth in total assets (in %)	8.02	28.60	-56.66	-13.32	6.82	24.79	111.46	155
COGS/Sales (in %)	36.78	12.95	10.87	28.28	34.02	42.70	75.16	155
SG&A/Sales (in%)	59.62	14.04	23.96	51.99	62.53	68.90	99.71	155
D&A/Sales (in%)	1.15	2.41	0.00	0.07	0.41	1.20	14.73	155
Gross margin (in%)	63.22	12.95	24.84	57.30	65.98	71.72	89.13	155
EBIT margin (in %)	4.97	7.60	-37.41	1.90	5.25	9.19	24.64	155

Appendix Industry Descriptive Statistics: Real Estate Services

Variable	Mean	SD	Min	p25	Median	p75	Max	N
Total Assets (in mSEK)	23 418.26	17 138.75	1 604.19	6 504.00	20 775.00	33 444.50	70 146.00	54
Natural log of total assets	16.60	0.98	14.29	15.69	16.85	17.33	18.07	54
Growth in total assets (in %)	5.91	38.71	-60.55	-10.89	-0.33	13.82	155.55	54
COGS/Sales (in %)	64.96	43.16	15.29	31.94	43.78	108.11	148.91	54
SG&A/Sales (in%)	62.08	25.82	15.11	41.36	59.97	87.13	101.73	54
D&A/Sales (in%)	4.56	5.84	0.00	0.00	0.35	11.13	15.22	54
Gross margin (in%)	35.04	43.16	-48.91	-8.11	56.22	68.06	84.71	54
EBIT margin (in %)	8.17	24.06	-59.06	-2.98	8.36	32.55	42.30	54

Appendix Industry Descriptive Statistics: Professional, Scientific, and Technical Activities

Variable	Mean	SD	Min	p25	Median	p75	Max	N
Total Assets (in mSEK)	65 900.91	149 604.67	2 064.00	10 994.000	19 304.00	41 786.00	1 231 435.42	865
Natural log of total assets	17.01	1.21	14.54	16.21	16.78	17.55	20.93	865
Growth in total assets (in %)	7.91	32.73	-60.55	-11.22	5.57	23.09	143.82	865
COGS/Sales (in %)	43.88	25.34	2.48	25.54	38.06	59.24	148.91	865
SG&A/Sales (in%)	51.55	21.83	0.01	36.69	54.23	66.23	101.73	865
D&A/Sales (in%)	0.93	1.84	0.00	0.07	0.37	0.97	15.22	865
Gross margin (in%)	56.12	25.34	-48.91	40.76	61.94	74.46	97.52	865
EBIT margin (in %)	6.34	12.86	-59.06	1.62	6.21	11.78	42.30	865

Appendix Industry Descriptive Statistics: Other Service Activities

Variable	Mean	SD	Min	p25	Median	p75	Max	N
Total Assets (in mSEK)	16 420.54	14 442.82	2 247.49	5 147.25	11 140.00	26 668.50	47 739.00	64
Natural log of total assets	16.22	0.91	14.63	15.45	16.23	17.10	17.68	64
Growth in total assets (in %)	8.77	24.91	-56.86	-5.03	6.69	26.20	57.29	64
COGS/Sales (in %)	39.46	17.29	5.80	33.28	38.74	47.77	75.44	64
SG&A/Sales (in%)	53.17	17.26	22.93	38.87	53.59	67.48	83.96	64
D&A/Sales (in%)	0.72	0.80	0.00	0.11	0.36	1.14	3.33	64
Gross margin (in%)	60.54	17.29	24.56	52.23	61.26	66.72	94.20	64
EBIT margin (in %)	8.40	8.49	-11.76	2.92	6.62	14.12	37.45	64

Appendix Industry Descriptive Statistics: Manufacturing

Variable	Mean	SD	Min	p25	Median	p75	Max	N
Total Assets (in mSEK)	69 554.67	133 093.62	1 933.00	13 712.75	25 436.50	59 404.25	1 231 435.42	852
Natural log of total assets	17.23	1.17	14.47	16.43	17.05	17.90	20.93	852
Growth in total assets (in %)	7.69	27.76	-60.55	-7.76	4.58	18.21	162.81	852
COGS/Sales (in %)	60.69	17.57	6.79	50.51	60.86	70.47	146.98	852
SG&A/Sales (in%)	32.45	16.06	1.04	21.36	30.56	41.52	100.05	852
D&A/Sales (in%)	2.22	2.42	0.00	0.77	1.46	2.84	15.22	852
Gross margin (in%)	39.31	17.57	-46.98	29.53	39.14	49.49	93.21	852
EBIT margin (in %)	6.42	10.57	-59.06	2.13	5.84	10.42	42.30	852

Appendix Industry Descriptive Statistics: Transportation and Storage

Variable	Mean	SD	Min	p25	Median	p75	Max	N
Total Assets (in mSEK)	96 053.12	201 402.69	3 073.00	13 300.75	35 424.00	62 090.75	1 231 435.42	186
Natural log of total assets	17.36	1.30	14.94	16.40	17.38	17.94	20.93	186
Growth in total assets (in %)	5.72	26.73	-59.91	-6.54	3.66	15.84	143.62	186
COGS/Sales (in %)	56.60	19.07	26.97	40.42	54.91	67.04	114.48	186
SG&A/Sales (in%)	36.13	17.78	2.23	20.65	37.86	50.84	67.29	186
D&A/Sales (in%)	3.30	3.70	0.00	0.32	1.46	5.84	14.73	186
Gross margin (in%)	43.40	19.07	-14.48	32.96	45.09	59.58	73.03	186
EBIT margin (in %)	5.06	5.90	-26.30	2.03	4.04	7.72	26.68	186

Appendix Industry Descriptive Statistics: Accommodation and Food Service Activities

Variable	Mean	SD	Min	p25	Median	p75	Max	N
Total Assets (in mSEK)	13 680.22	9 965.47	1 604.19	6 754.25	10 774.50	18 229.50	43 253.00	110
Natural log of total assets	16.18	0.73	14.29	15.73	16.19	16.72	17.58	110
Growth in total assets (in %)	9.95	32.21	-46.39	-5.57	5.29	16.44	143.62	110
COGS/Sales (in %)	55.88	15.10	35.26	47.04	53.61	62.96	142.04	110
SG&A/Sales (in%)	37.28	10.69	1.74	34.10	37.93	43.20	100.05	110
D&A/Sales (in%)	1.88	2.80	0.00	0.24	0.64	2.11	11.66	110
Gross margin (in%)	44.12	15.10	-42.04	37.04	46.39	52.96	64.74	110
EBIT margin (in %)	7.84	12.05	-59.06	2.67	7.63	14.52	39.58	110

Appendix Industry Descriptive Statistics: Human Health and Social Work Activities

Variable	Mean	SD	Min	p25	Median	p75	Max	N
Total Assets (in mSEK)	20 464.61	26 709.18	1 604.19	6 629.00	12 207.00	22 087.50	197 118.00	527
Natural log of total assets	16.35	0.93	14.29	15.71	16.32	16.91	19.10	527
Growth in total assets (in %)	10.12	26.46	-56.60	-5.99	8.65	21.74	162.81	527
COGS/Sales (in %)	18.74	14.66	2.48	5.71	13.99	29.23	67.14	527
SG&A/Sales (in%)	72.89	18.29	26.28	58.38	77.12	89.73	98.58	527
D&A/Sales (in%)	0.47	0.72	0.00	0.06	0.30	0.61	6.30	527
Gross margin (in%)	81.26	14.66	32.86	70.77	86.01	94.29	97.52	527
EBIT margin (in %)	8.99	8.84	-21.83	3.37	6.92	13.47	40.79	527

Appendix Industry Descriptive Statistics: Arts, Sport and Recreation

Variable	Mean	SD	Min	p25	Median	p75	Max	N
Total Assets (in mSEK)	39 827.33	37 075.11	1 604.19	5 573.00	32 432.00	70 023.00	126 488.00	49
Natural log of total assets	16.82	1.36	14.29	15.53	17.29	18.06	18.66	49
Growth in total assets (in %)	10.44	21.53	-53.54	0.04	10.09	22.29	52.81	49
COGS/Sales (in %)	53.58	36.35	7.71	31.78	43.32	56.83	148.91	49
SG&A/Sales (in%)	59.07	24.42	23.56	36.51	62.78	72.65	101.73	49
D&A/Sales (in%)	2.03	3.23	0.00	0.18	0.96	1.88	11.84	49
Gross margin (in%)	46.42	36.35	-48.91	43.17	56.68	68.22	92.29	49
EBIT margin (in %)	5.30	15.09	-54.54	0.31	3.53	15.20	31.22	49

Appendix Industry Descriptive Statistics: Construction

Variable	Mean	SD	Min	p25	Median	p75	Max	N
Total Assets (in mSEK)	45031.39	91648.54	1 684.00	10 854.	19 451.00	37 859.00	1231435.42	1545
Natural log of total assets	16.91	1.05	14.34	16.20	16.78	17.45	20.93	1545
Growth in total assets (in %)	12.36	32.07	-60.55	-7.36	7.44	26.32	162.81	1545
COGS/Sales (in %)	64.41	15.70	8.48	54.37	65.49	75.57	148.91	1545
SG&A/Sales (in%)	29.89	14.17	0.02	19.05	28.00	38.62	101.73	1545
D&A/Sales (in%)	0.77	1.28	0.00	0.12	0.32	0.87	13.69	1545
Gross margin (in%)	35.59	15.70	-48.91	24.43	34.51	45.63	91.52	1545
EBIT margin (in %)	5.98	6.65	-40.25	2.28	5.35	9.36	30.93	1545

Appendix Industry Descriptive Statistics: Wholesale and Retail Trade

Variable	Mean	SD	Min	p25	Median	p75	Max	N
Total Assets (in mSEK)	118 984.08	184 012.61	4 083.00	21 632.00	48 456.00	128 700.00	1 231 435.42	953
Natural log of total assets	17.81	1.21	15.22	16.89	17.70	18.67	20.93	953
Growth in total assets (in %)	10.44	26.52	-59.06	-4.04	8.14	21.00	162.81	953
COGS/Sales (in %)	74.53	20.15	2.48	67.10	79.60	87.35	148.91	953
SG&A/Sales (in%)	21.23	18.37	0.01	9.40	15.35	26.76	101.73	953
D&A/Sales (in%)	0.72	1.03	0.00	0.16	0.42	0.89	11.17	953
Gross margin (in%)	25.47	20.15	-48.91	12.65	20.40	32.90	97.52	953
EBIT margin (in %)	4.90	7.00	-59.06	1.65	4.23	7.50	39.58	953

Appendix H: Use of Generative AI

In writing this thesis, we have used two AI-based tools, ChatGPT-5.1 (by Open AI) and Grok AI (by xAI). Both tools were used throughout the thesis process. ChatGPT-5 was used primarily to improve grammar and overall readability, including correcting punctuation, resolving spelling inconsistencies, and refining sentence structure. We also used both ChatGPT-5.1 and Grok AI when coding. The tools assisted us in writing Stata code to retrieve and construct our sample from the Serrano database, as well as in R to run our regressions. This was primarily during (24 October-24 November). In addition, we used them to clarify certain concepts and enhance our understanding of the theories applied in this thesis. We also used AI to help identify potential mistakes and encourage us to challenge our own reasoning.

We have critically reviewed all suggestions to ensure accuracy and consistency with the aims of the thesis. We recognise the risks associated with using AI in academic work, particularly the possibility of incorrect or fabricated content. Therefore, we have not used these tools to gather information or generate empirical or theoretical material.

Links:

- *https://grok.com/*
- *https://chatgpt.com/*