

How Real Is Competition?

An Analysis of Profit Rate Dynamics Among German Firms After 1990

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In the paper, the neoclassical theory of perfect competition, the modern classical theory of real competition and the Marxian theory of monopoly capitalism are tested in an autoregression analysis of profit rates and incremental profit rates for 869 non-financial listed and de-listed firms headquartered in Germany in the period 1991 to 2024. The paper addresses the question whether competition was effective in equalizing profit rates among German firms after 1990, considering also the real competition hypothesis, that only incremental profit rates, profit rates on most recent investments, equalize. The analysis uses Worldscope firm-level financial data. Incremental profit rates are measured as ratio of a firm's year-to-year profit change to its previous-year capital formation. Profits are indicated by gross operating profit, capital by gross invested capital, excluding goodwill. AR functions for different orders and different groups of firms are estimated in separate time-demeaned pooled OLS regressions. Profit rates show significant positive AR coefficients below one in almost all firm groups. On average, profit rates show an AR(1) coefficient of 0.622 and take 24 years to return to the economy-wide mean. Firms with initially high profit rates as well as large firms, both in terms of net sales and total capital, are projected to have above-average profit rates in the long run. For the largest five percent of firms in the sample, projected long-run profit rates slightly decrease again. For incremental profit rates, AR coefficients and projected long-run differences to the economy-wide mean are insignificant for almost all groups. Higher long-run differences are found for firms with higher initial incremental profit rates, yet become insignificant, when controlling for measurement bias due to mergers. The persistence of profit rates yet equalization of incremental profit rates supports real competition theory and disfavours both perfect competition and monopoly capitalism theory. However, the positive association of firm size and profit rates supports monopoly capitalism theory and disfavours real competition theory. The findings are robust to different accounting systems used by firms, the alternative inclusion of firm size as linear, quadratic and interaction term in the AR function, and different treatments of outliers. Methodological refinements in measuring firm-level incremental profit rates might help future research to clarify the ambiguity.

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Abbreviations

Adj.	Adjusted
AR	Autoregression
AR(1)	First-order autoregression
CAP	Operating capital
DAG	Directed acyclic graph
DAX	Deutscher Aktienindex (German Stock Index)
EEC	European Economic Community
EU	European Union
FD	First difference
FE	Fixed effects
FIRE	Finance, insurance and real estate
GAAP	Generally Accepted Accounting Principles
GDP	Gross domestic product
GMM	Generalized method of moments
GOP	Gross operating profits
GPPE	Gross property, plant and equipment
HGB	Handelsgesetzbuch (German Commercial Code)
IFRS	International Financial Reporting Standards
i.i.d.	Independent and identical distributed
INV	Inventories
M&A	Mergers and Acquisitions
NA	No available data
NFC	Non-financial corporate
NIA	Net intangible other assets
NGW	Net goodwill
No.	Number
Obs.	Observations
OLS	Ordinary least squares
p	Percentile
PPE	Property, plant and equipment
R&D	Research and development
SD	Standard deviation
SIC	Standard Industrial Classification
TRN	Net trade receivables

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1 Introduction

The German economy, as indicated by real GDP, has been shrinking or stagnating in the last three years (German Council of Economic Experts (Sachverständigenrat) 2025: 4). Among the many reasons advanced in the debate on the structural causes of this demise, a re-occurring topic is declined business dynamism and investment. The Bundesbank (2024) warned, that the exit of old and entry of new firms, indicating business dynamism, has strongly decreased in Germany and the European Union as a whole, at least since the global financial crisis 2008/9. The German non-financial corporate sector at glance reduced investment in tangible gross fixed capital, measured as share of gross value added, since the 1990s (Giovanazzi, Victor and Putscher 2024: 10–11). Measured investments in intangible assets, assets without a physical existence like research and development (R&D) and software, can only partly offset the demise of tangible investments, like machinery, buildings or equipment. Yet, non-produced intangible assets, like goodwill or licences, which figure prominently in firm accounts, are not measured in German sector accounts (Giovanazzi, Victor and Putscher 2024: 5). At the firm level, spending on mergers and acquisitions (M&As) has increased relative to investments in real economic values (Giovanazzi, Victor and Putscher 2024: 12–13). M&As constitute investments for corporations as they increase their productive potential. However, M&As do not increase the productive capacities of an economy, but simply redistribute them, and thus cannot be considered macroeconomic investments (Giovanazzi, Victor and Putscher 2024: 23).

Lower business dynamism, more take-overs and potentially declined economic investment might all be linked with weakened competition (Gutiérrez and Philippon 2017: 3–5; Bundesbank 2024: 53–54). When firms increase their market power, the ability to receive excess rents, they face less incentives to invest in more efficient production or new products (Gutiérrez and Philippon 2017: 3–5). Instead, preventing potential rivals from entering the market becomes more important to monopolistic firms for defending these excess profits (Bundesbank 2024: 53–54). They might do so by investing in superior productivity and setting prices unprofitably low for potential competitors (Baumol, Panzar and Willig 1982: 347–350). Yet, they may also constrain entry in less socially beneficial ways, by building closed product networks (Tirole 2024: i983–i985), aggressive strategic advertising (G. Ellison and S. F. Ellison 2011: 2), or ”killer acquisitions” (Cunningham, Ederer and Ma 2021: 1) of potential upcoming rivals.

In this thesis, the hypothesis of weak competition among German firms after 1990 is tested, by studying whether firms' profit rates follow competitive patterns in different concepts of competition. In an autoregression analysis, the equalization of profit rates on total capital expected in perfect competition theory and the equalization of profit rates on newest capital assumed in real competition theory are estimated. Answering the question if competition among German firms after 1990 is weak requires, first, to set it into institutional-historical context and, second, to relate it to different understandings of competition. First, in the German model of capitalism, competition might have never been particularly "pure", probably even less than in other countries. What has been identified in the political economy literature, especially in the Varieties of Capitalism tradition (Hall and Soskice 2001), as German model is typically associated with a production model strongly dependent on export-oriented firms, which are highly specialized on certain high-quality niche products (Streeck 1991). These firms are assumed to face a medium-high price elasticity of demand for their products, allowing for comparatively high wages in the export-oriented sectors (Höpner 2019). Non-infinity price elasticity of demand, however, is just another word for market power, understood in a neoclassical sense as power to raise prices, without losing all customers (Varian 2014). Another competition-limiting force in the German model may be the intertwined ownership between firms and their mutual involvement as stake-holders in each others corporate governance (Beyer 2003: 125–126), which peaked in the era of the "Deutschland AG" before 1990 (Streeck and Höpner 2003: 16). The so-called network of mutual ownership and control of large German industrials, banks and insurances likely motivated firms to avoid too costly struggles for market share with each other (Beyer 2003: 125–126). Thus, market power among German firms, especially in the export sector, might have been a constituent part of the German production model for a long time.

Since the 1990s, the German model has come under considerable pressure, but likely remains relevant today. Particularly, globalisation and financialisation challenged the German model (Beyer 2003: 118–119; Baccaro and Benassi 2017: 93). Intensified global competition in the high-quality domains of German exports is argued to have limited the market power and "non-price competitiveness" (Baccaro and Benassi 2017: 93) of German exporters (Baccaro and Benassi 2017: 97–98). Conversely, estimates of an increasing price-elasticity for German exports from 1980 onwards are found (Baccaro and Benassi 2017: 95–97). Yet, the trajectory of price-elasticity of German exports is highly controversial. Other studies still find a considerable degree

of non-price competitiveness, particularly in the Eurozone (Horn et al. 2017: 7; Neumann 2020: 138–140). The successive dissolving of the Deutschland AG in the 1990 under the growing influence of financial markets is seen as further weakening of the institutional foundations of the German model (Streeck and Höpner 2003: 41–46). Some consider financialisation precisely as a mean to unravel conglomerate structures into leaner more focussed companies, foster shareholder orientation and thereby promote competition (Davis and Kim 2015: 406, 414–416). Rather than abandoning conglomerates however, financialisation might have just reordered business structures in more efficient ways, from a company perspective. At least in the United States, new large business groups seem to have emerged, which are more focused on specific markets where they control even larger market shares to benefit from economies of scale and market power (Reddy 2025: 4). In addition, the increasing proportion of shares in DAX-companies held by asset-managers and other institutional investors (Bundesbank 2014; Rapp et al. 2023) might have a similar competition-limiting influence as the ownership structures in the "Deutschland AG". Also institutional investors likely urge their portfolio companies to refrain from costly price wars with each other (Ederer and Pellegrino 2025).

There are also newer developments that might indicate rising market power and declining competition of German firms. One is the fall of the labour share and consequent rise of the profit share in Germany and worldwide correlating with rising market concentration (De Loecker and Eeckhout 2018; Mertens 2019). Firms in concentrated markets might earn rents in product markets which are not passed on to employees as well as depress wages due to higher labour market power (Barkai 2020). Further, considerable and increased markups over marginal cost are found for German firms (De Loecker and Eeckhout 2018). In neoclassical theory positive markups over marginal costs directly indicate market power, given they are measured correctly (Doraszelski and Jaumandreu 2021). It was argued that these trends may not reflect a general rise of market power but only the rise of some "superstar firms" combining superior technological productivity and economies of scale (Autor et al. 2020: 649). These firms might have low labour input shares, positive markups over marginal cost and a high market share, which are, due to the large size of these firms, reflected at the industry and economy level in low labour shares and high markups and concentration ratios (Autor et al. 2020). These low labour share firms might also just be "rising stars", which decrease their labour share during the process of becoming large (Kehrig and Vincent 2021). Behringer, van Treeck and Victor (2025) show that in Germany neither was the case. They find that it was incumbent

firms which managed to raise their profit share and that this is indeed a general phenomenon in Germany (Behringer, van Treeck and Victor 2025). Taken together, these developments disfavour neoclassical perfect competition and seem to indicate considerable and rising market power. However, competition might still be working fine, if understood as "real competition" (Shaikh 2016). This concept, introduced by Anwar Shaikh (2016), builds on the classical notion of competition, which is far from perfect. Following this concept, persistent differences in markups and profit rates between firms or even countries, might just be the result of persistent heterogeneity in the capital stock. The most efficient production conditions of some firms may not be reproducible by others, while other firms retain outdated production capital, since it represents sunk costs (Shaikh 2016: 261–264). "Real" competition is expected to bring an equalizing tendency only to profit rates on the newest investments, as consequence of the constant re-direction of capital towards the highest profit industries and the resulting price-wars for market share (Shaikh 2016: 264–270).

The question for the state of competition among German firms thus, second, needs to be regarded from the perspectives of different theories of competition. In this thesis, three major theories of competition are reviewed and their prepositions empirically tested: The neoclassical theory of perfect competition, the modern classical theory of real competition and the Marxian theory of monopoly capitalism. In perfect competition theory, firms are assumed to behave as price takers, that passively adopt market prices and cannot influence it. This inability is ensured by the existence of many sellers or the constant thread of entry of new sellers into the market and a deterministic consumer choice for the cheapest product (Baumol, Panzar and Willig 1982: 347–350; Varian 2014: 414–428, 431–438). The exit and entry of firms will, in the long run, adjust output and thereby bring equilibrium prices to the level of average production costs. In the long run, all firms are expected to adopt the same optimal technology and scale of production which equilibrates average costs (Varian 2014: 433–438). Total costs entail a rent for capital, which is equalized across all firms due to the constant search of capital owners for the highest rate of return. This causes equality of profit rates in the long run (Naples and Aslanbeigui 1996: 60–61; Varian 2014: 201–214).

In real competition theory, prices in each market need to follow the lowest price set by a producer, as a stochastic tendency. Because at any point of time a large variety of technologically different capitals is used and maintained in production, costs and conversely profit rates are not equalized between firms (Shaikh 2016: 261–264). Only for the newest capitals, profit rates are expected to tend towards equilibrium, due

to the movement of capital towards the most profitable industries and the resulting intensification of price-cutting competition (Shaikh 2016: 264–270).

In monopoly capitalism theory, no equalizing tendency of either profit rate between firms is assumed, because monopolization tendencies persistently disequalize firms' profit rates on both total and newest capital (Sweezy 1956: 273–274). Economies of scale, thought to exist in most sectors, force firms under the pressure of competition to grow ever larger, while liberalized financial markets greatly facilitate takeovers and the creation of monopolies. As a result, there is a persistent hierarchy of firms' profit rates following the degree of monopolization in the industries of operation (Sweezy 1956: 273–274). No distinction is made between profit rates on total capital and profit rates on newest capital. As a tendency, larger firms should receive above-average profit rates reflecting their monopoly rents (Sweezy 1956: 273–274). This is contrary to real competition theory, where larger firms are equally assumed to benefit from economies of scale but are expected to use it for fiercer price-cutting to increase their market share and thus profits in the medium run. The constant inflow of new producers in highly profitable industries should prevent single producers from collecting monopoly rents. Thus, larger firms are as tendency expected to earn below-average profit rates (Shaikh 2016: 290–295). The differences in the empirical predictions of the three competition theories thus boil down to the question whether there is equalization of profit rates in the long run and if it applies only to profit rates on newest capital or also to profit rates on total capital.

In this thesis, the different predictions of the three competition theories are tested in an autoregression (AR) analysis of profit rates on both total and newest capital for non-financial listed and de-listed firms headquartered in Germany in the period 1991 to 2024. The analysis uses firm-level financial data from the Worldscope database (LSEG 2026b). AR analysis is widely used for empirically testing both perfect competition and real competition theory (Mueller 1990; Gschwandtner 2005; Bahçe and Eres 2013; Lafalla 2024). In this thesis, autoregressive functions are estimated for different orders to test the average duration of equalization and for different groups of firms, according to initial profit rates, firm size and sector, to test for firm-specific differences in persistence. In addition to the AR coefficients indicating short-run profit persistence, estimates of the long-run profit rate differentials to the economy-wide mean are derived, for different groups of firms, by solving the estimated group-specific AR functions for an equilibrium profit rate. The profit rate on total capital, the relevant parameter to be equalized in perfect competition theory, is the conventional notion of the profit rate, profits received in one period divided

by the level of the capital stock in that period. The profit rate on newest capital, expected to be equalized in real competition theory, is approximated by the profit change in one period divided by investment in the former period. In both ratios, profits are measured as gross operating profit and capital as gross operating capital. In the AR analysis, both profit rates are demeaned by their yearly average across all firms to remove general time trends.

Earlier studies find persistent long-run differences in the profit rates of German firms, particularly in the pre-1990 period (Schwalbach, Graßhoff and Mahmood 1989; Schohl 1990), as well as considerable short-run persistence (Schwalbach and Mahmood 1990; Eklund and Lappi 2019). For incremental profit rates, no persistence is found between German industries before 1992 (Vaona 2011: 497), while no firm-level estimates thereof are available. Industry-level estimates might, however, be biased by improperly matching some firms' profit to other firms' investment (Mueller 1977: 369–370). Naturally, they also cannot account for firm differences. The central contribution of this thesis is the empirical estimation of the persistence of incremental profit rates at the firm-level among German firms in the years 1992 to 2024. A second contribution is to update older estimates of the persistence of firm-level profit rates among German firms to the period 1991 to 2024.

In the empirical analysis, previous findings of persistent profit rates on total capital could be confirmed for German firms after 1990. Between 1991 and 2024, an average first-order autoregressive effect of 0.622 is found. In later years, the AR effect slowly decreases, until it vanishes after the 24th year, indicating a high persistence of profit rate differentials to the economy-wide mean. In separate AR(1) regressions for six groups of firms according to their initial rank in the profit rate distribution, firms with initially higher profit rates show higher projected profit rates also in the long-run. Larger firms, indicated by average net sales over all periods observed, show higher long-run profit rate differentials in separate AR(1) models for six groups of firm size. For the largest percentile, the long-run profit rate differential slightly decreases again. The short-run persistence of profit rates is similar for firms of all size groups. The effects are similar for size measured by firms' average operating capital over the sample period. For size thus defined, the reversion of the size effect on long-run profits becomes visible for the largest five percent of firms. Alternatively including firm size as linear and quadratic term in the AR(1) function confirms the results. Significant differences are also found between economic sectors. Long-run profit rates are projected to be above the economy-wide mean for firms in the retail, agriculture, construction and manufacturing sector, and below the economy mean for service

sector firms. The differences seem unrelated to average operating capital, net sales or capital intensity per sector, as indicators of average size requirements of production.

For firm-level profit rates on newest capital, no indications of persistent differences are found, similar to industry-level findings for Germany prior to 1992 (Vaona 2011: 497) and in other countries (Bahçe and Eres 2013). In most cases, both short-run persistence parameters and long-run differentials to the economy-wide mean are found to not significantly differ from zero. Initially higher ranked groups show higher significant long-run profit rate differentials. However, the differentials becomes insignificant, albeit remaining positive, if excluding for every firm all observations for years, in which the firm conducted an acquisition or conducted one in the previous year. This indicates that the simultaneous profit change and investment resulting from an acquisition biases the metric of the incremental profit rate, which by construction sets profit change in relation to last period's investment. The results are robust to differences in accounting systems, different treatments of outliers and sampling differences between incremental profit rates and profit rates.

The high persistence of firms' profit rates disfavours perfect competition theory, which predicts equalization of all profit rates (Jehle and Reny 2011: 168). Matters are less clear between real competition and monopoly capitalism theory. The found equalization of incremental profit rates, after controlling for acquisitions, supports the claim from real competition theory that only the later is equalized by competition (Shaikh 2016: 262–270) and disfavours the monopoly capitalism hypothesis of general persistence. The overall positive correlation of firm size and long-run profits, however, supports the monopoly capitalism hypothesis of a positive size effect due to market power (Sweezy 1956: 273–274). Real competition, which is expected to imply smaller profit rates for larger firm due to their more aggressive price cutting (Shaikh 2016: 290–295), can barely explain this pattern.

The thesis proceeds as follows. In the next chapter 2 the three theories of perfect competition, real competition and monopoly capitalism are explained and compared. The empirical literature on testing these theories by estimating the persistence of profit rates and incremental profit rates is reviewed in chapter 3. Chapter 4 gives a description of the data, the calculation of variables and the regression design. Chapter 5 entails the results on the persistence of profit rates, essential for testing perfect competition theory. The findings on the persistence of incremental profit rates, relevant for testing real competition against monopoly capitalism theory, are described in chapter 6. The findings are discussed in chapter 7. Chapter 8 summarizes.

2 Theories of Competition, Pricing and Profit

In this chapter, three major theories of competition and their empirical predictions are summarized and compared: The neoclassical theory of perfect competition (section 2.1), the modern classical theory of real competition (section 2.2) and the Marxian theory of monopoly capitalism (section 2.3). The differences in empirical predictions of the three theories can be condensed to the question if the profit rates of firms equalize in the long run and whether only profit rates on newest capital or also profit rates on total capital equalize.

2.1 The Neoclassical Theory of Perfect Competition

The theory of perfect competition is the basic notion of competition in neoclassical mainstream economics (e.g. Jehle and Reny 2011; Varian 2014). According to this theory, unrestricted competition equilibrates the prices and costs of all producers for every good and service as well as the profit rates of all firms across all industries (Jehle and Reny 2011; Varian 2014). This is logically derived from the assumption of strict utility maximisation by consumers and firms, which translates for the latter into the assumption of strict profit maximisation (Jehle and Reny 2011: 165). Because utility maximising consumers are expected to always choose the cheapest version of identical products, no firm could successfully sell its products at a price above the going market price in a market with many other suppliers. This poses an upward barrier to prices. In addition, as long as the market price in an industry is above a firm's marginal cost, i.e. its cost of producing another unit, the firm can always increase its profit by producing more units. If thereby market supply increases relative to market demand, market prices will decrease. Conversely, if the price is below a producer's marginal cost she can increase profit by reducing production. If this decreases supply relative to demand, prices will increase. That way, for all producers in an industry marginal cost will equilibrate with the market price. Any deviation from the equilibrium price or output level would lead to losses for the producers. Thus, for every product a stable equilibrium price equal to the marginal production cost of all producers is expected to settle (Varian 2014: 414–428, 431–438). In the short run, all firms that can at least cover their average variable costs at this price can remain in the market. In the long run, firms will only remain in the market, when the market price covers their average total costs, including the cost of production capital (Varian 2014: 432–435).

In the long-run, producers are also expected to adapt the most efficient, i.e. lowest-unit-cost, technologies from their competitors to maximize profits and be able to cover their total costs. This technology is assumed to be general knowledge and therefore adoptable (Jehle and Reny 2011: 168). Technology adaption will equilibrate the cost curves of all producers. Firms will adjust their level of output, and accordingly of fixed capital and variable inputs, to produce at the most efficient scale, where average cost are at their long-run minimum. The exit and entry of firms will adjust industry output until prices equal minimum average cost of all producers in the industry. Therefore, in the long run prices will converge to the level of minimum average cost for all producers (Varian 2014: 433–438). From the supposed equality of costs and selling prices in every industry also follows the equality of profit rates for all firms within an industry.

Also between industries, profit rates are expected to equalize in the long run. Because firms exit from non-profitable industries and new firms enter profitable industries, supply and thus prices will adjust, to the point, where in every industry price equals cost and no firm therefore has an incentive to exit or entry (Jehle and Reny 2011: 168). In the words of Jehle and Reny (2011: 168):

”In a long-run equilibrium, we shall require not only that the market clears but also that no firm has an incentive to enter or exit the industry. Clearly, then, long-run profits must be non-negative; otherwise, firms in the industry will wish to exit. On the other hand, because all firms have free access to one another’s technology (in particular, firms currently not producing have access to the technology of every firm that is producing), no firm can be earning positive profits in the long run. Otherwise, firms outside the industry will adopt the technology of the firm earning positive profits and enter the industry themselves.”

It is crucial to note here, that in neoclassical theory the cost of capital, entailed in total production costs, is given by its opportunity cost, the profits that it could earn elsewhere (Varian 2014: 439–442). Thus, while in neoclassical theory this equilibrium is generally termed a state of ”zero [...] economic profits” (Varian 2014: 440), firms do actually earn profit. As Varian (2014: 440–441) has it:

”In a long-run equilibrium with zero profits, all of the factors of production are being paid their market price - the same market price that these factors could earn elsewhere. The owner of the firm [...] is still collecting a payment for her labour time or for the amount of money she invested in the firm

or for whatever she contributes to the operation of the firm. [...] We should value each factor of production at its market price - its opportunity cost. If it appears that a farmer is making positive profits after we have subtracted his cost of production, it is probably because we have forgotten to subtract the cost of his land.”

The rate of profit, i.e. profits in relation to capital advanced, is expected to converge to a an equilibrium level where every factor of production is payed the same ”normal” rent or rate of interest. This is precisely seen as consequence of the continuous search of capital owners for the highest return on the markets for capitals (Naples and Aslanbeigui 1996: 60–61; Varian 2014: 201–214). While therefore, in the short run excess profit are seen as necessary for the adaption of supply to the long-run equilibrium, in the long-run equilibrium all firms earn the same rate of profit (Posner 1969: 643; Jehle and Reny 2011: 168).

These equilibrating processes importantly rest on the assumption that no single firm is large enough to significantly influence price or output in a market by its own actions. Only then, firms can be expected to behave as ”price takers”, which passively adopt market prices (Jehle and Reny 2011: 165). Typically, U-shaped cost curves with small most efficient scales in relation to the market are assumed in the short run and constant cost curves are assumed in the long run (Jehle and Reny 2011: 168; Varian 2014: 433–438), which do not incentivize the creation of large, market-controlling firms (Varian 2014: 471). Oppositely, large minimum efficient scales, which imply falling average cost curves, i.e. economies of scale, over the range of market demand, incentivize growing large (Varian 2014: 471).

If firms gain some degree of price-setting or market power (be it through outgrowing, fusions or the formation of cartels), prices might be above average cost of production, and profits therefore above equilibrium profit, also in the long run (Varian 2014: 458–461, 506–508, 537). Even then, situations are assumed in which the outcome of competition among price-making firms resembles the outcome of perfect competition. In oligopolistic markets, this might be the result of simultaneous price setting (Bertrand competition) or the likely failure of explicit or tacit collusion (Varian 2014: 531–535). Even for actual monopolies, some consider the entry of new firms as a creditable threat preventing incumbent firms from raising a markup on their costs (Baumol, Panzar and Willig 1982: 347–350).

A variety of neoclassical models incorporate some degree of price-setting power and imperfections of competition as default assumption (e.g. Chamberlin 1962; Krugman, Obstfeld and Melitz 2018: 198–213; Manning 2021). However, the model of perfect

competition is still widely used as the standard model (Varian 2014: 414–416) and generally used to politically justify the superiority of organizing an economy via free markets (Varian 2014: 655–658).

2.2 The Modern Classical Theory of Real Competition

Passive firm behaviour and general equilibria for prices and profit rates are strongly rejected by "modern classical economists" (e.g. Shaikh 2016; Tsoulfidis and Tsaliki 2019). Anwar Shaikh's (2016: 259–272) theory of real competition describes a very different concept of competition, which he sees as embodying the classical notion of competition described by Smith, Ricardo and Marx. "Real competition" (Shaikh 2016: 259) is understood as a dynamic, chaotic process, in which firms always actively cut costs and set lower prices to increase or defend their market share and profits in the medium run. As consumers are assumed to be attracted to the cheapest version of similar products, a price reduction by one firm has to be checked by the other firms, bringing some equalization to prices. However, consumer choice is not understood as deterministically directed towards the cheapest product like in perfect competition theory, but rather as a stochastic tendency (Shaikh 2016: 261–264). This implies that prices need not to be completely equal, as in the neoclassical "Law of One Price" (Shaikh 2016: 262). Rather, prices are assumed to be clustered around the price of the firm, which can produce at the lowest unit cost on large scale (Shaikh 2016: 261–264). Shaikh (2016: 262) calls this equalization tendency the "Law of Correlated Prices". Such statistical equilibrium approaches, pioneered e.g. by Foley (2003), have been often argued to be much closer to the idea of competition in classical economics than neoclassical perfect competition theory (Foley 2003; Scharfenaker and Semieniuk 2017). Even less uniformity is expected for the rate of profit in real competition theory. At any moment in time, the pieces of production capital used in an economy differ in their stage of technology and productivity. Every unit of production capital represents the best reproducible technology at the moment it was formed. This heterogeneity is also present in the pool of capital used within a firm. A firm's rate of profit thus measures the average profitability of all these technologically different pieces of production capital (Shaikh 2016: 262–264).¹ Because competition brings prices roughly down to the lowest-unit-cost firm's price, it follows, that firms with the technologically most advanced capitals, and therefore the lowest unit-costs,

¹Shaikh (2016: 68) calls the rate of profit on total capital therefore also the "average rate of profit". To avoid confusions, in this thesis the common notion "profit rate" (or "rate of profit"), if not further specified, is retained to refer to this rate.

have the highest profit rates. Thus, the equalization tendency of prices within each industry brings disequalization to the profit rates of firms within an industry (Shaikh 2016: 262–264).

A central equalizing tendency, however, is expected for the profit rates on the newest capitals, as consequence of individual capitalists' profit-seeking (Shaikh 2016: 264–270). Capital owners are assumed to invest their capital in those sectors where they expect the highest profit. They invest in plants with the most efficient technique of production, which is generally reproducible, the "best generally reproducible conditions of production" (Shaikh 2016: 265). The more new plants are erected in a sector, the more supply increases relative to demand, which will ultimately (after potential multiplier effects of the increased investment) result in excess supply inflicting downward pressure on prices and profits in this sector. Conversely, in low profit rate sectors there is little investment or even disinvestment, causing demand to exceed supply and profit rates to rise again (Shaikh 2016: 264–270). The investment flows between sectors into the most profitable as well as accessible plants are termed the "regulating capitals", due to their regulating function for profit rates on newest capitals between and within sectors (Shaikh 2016: 265).

The extent to which this equalization tendency also equalizes the mean profit rates on total capital between sectors, depends on how similar the average conditions of production are to the best reproducible ones. The extent of profit rate equalization within sectors further depends on the proximity of firms' average production conditions to the sector average ones (Shaikh 2016: 269). The similarity of average and regulating conditions in each sector is mainly driven by two things. First, it depends on how well the lowest unit-cost method of production in each sector can be generally reproduced on large scale. For instance, a uniquely fertile plot of land or rich deposit of a resource cannot simply be reproduced. This can be seen as central barrier to equalization in sectors with above-average rates of profit (Shaikh 2016: 266–268). Second, it reflects the number of producers with profit rates below the regulating ones remaining in the sector (Shaikh 2016: 266–268). Their mobility might be limited by high upfront investment constituting sunk costs which make exit very costly (Shaikh 2016: 270–272). As a tendency, real competition leads to lower profit rates for large firms (Shaikh 2016: 290–295). Large firms are considered to be more capital-intensive and thus experience scale economies in production. Therefore, aggressive price-cutting to expand market share and output promises for them higher profits in the medium-run (Shaikh 2016: 290–295).

While persistent differences in profit rates on total capital are often understood as

evidence of market power by theories of imperfect competition, this is seen as normal outcome of real competition (Shaikh 2016: 268–273). Instead, in real competition theory, persistent market power of firms would be reflected in persistent incremental rates of profit (Shaikh 2016: 272).

2.3 The Marxian Theory of Monopoly Capitalism

The Marxian monopoly capitalism school (e.g. Hilferding 1923, Sweezy 1956, Foster and McChesney 2012, Durand and Gueuder 2018) sees a very different outcome of the mechanisms described by Marx than the modern classical economists.

Proponents of monopoly capitalism theory (e.g. Hilferding 1923: 286; Sweezy 1956: 273–274) argue that Marx' tendency of ever increasing capital centralisation (Marx 1990: 541–543, 661–662) will ultimately offset the ongoing competitive process also described by Marx (2004: 144–198), which Shaikh (2016: 266, 333–337) and others (e.g. Bahçe and Eres 2013; Tsoulfidis and Tsaliki 2019: 199–202, 220–222) refer to as classical or real competition.

For Marx (1990: 541–543) the tendency of capital to be centralized in ever fewer hands has two prime causes. First, economies of scale, which he considers inherent to the whole process of capitalist production, force capitalists to ever increase their scale of production to have their firms survive in the competitive struggle, fought by price reductions (Marx 1990: 541–543). The large amounts of capital which, in the consequence, become necessary to earn profit in production pose high barriers for newcomer firms to enter the market. In addition, smaller companies, which cannot keep up with the increased productivity and lowered prices of the large firms are forced out of the market (Marx 1990: 541–543). Second, the credit system and stock markets greatly facilitate taking over or merging with other capitals (Marx 1990: 543).

In the perspective of the monopoly capitalism school, the centralisation tendency dominates, in the long run, the tendency of profit rate equalization, brought about by the movements of regulating capitals towards the highest-profit industries (Hilferding 1923: 286; Sweezy 1956: 273–274). In the words of Paul Sweezy (1956: 273):

”The tendency to an equality of profit rates which is a characteristic feature of competitive capitalism is thus doubly disrupted by monopoly: the profits of some are raised, while the profits of others are reduced. Naturally there is still a tendency for capital to try to move out of the

disadvantaged and into the favored fields, but the very essence of monopoly is the existence of effective barriers to such free movement of capital.”

As monopoly spreads, the profit rates of monopolistic firms should equilibrate to a certain degree because they are connected as producers of each others inputs and thus reap on each other’s profits when extracting monopoly rents (Hilferding 1923: 288–290; Sweezy 1956: 273–274). However, their profit rates remain detached from and above the profit rates in those industries which are not monopolized, of which some never will as very low capital requirements preclude the erection of effective entry barriers (Sweezy 1956: 273–274). Sweezy (1956: 274) clearly formulates the empirical prediction:

”We get instead a hierarchy of profit rates ranging from highest in the industries of large-scale production where close well-protected combinations are relatively easy to establish, to lowest in the industries of very small-scale production where numerous firms co-exist and the ease of entry precludes stable combinations.”

Positive returns to scale as source of monopoly power imply that particularly for larger firms higher and more persistent profit rates should be found (Sweezy 1956: 273–274). With less competitive pressure, monopolistic firms face less need to conduct cost-saving investments. However, without the need to carry on price wars, the entire efficiency gains from cost-saving investment can go to profit (Durand and Gueuder 2018: 142–143). Therefore, monopolistic firms can be expected to receive also higher and more stable profit rates on newest capital.²

Newer contributions in this line of thought stress the relevance of monopolies on intellectual property, which has become increasingly important in modern capitalist value creation, as new powerful barrier to competitive processes that should strongly facilitate monopolisation processes (Pagano 2014; Durand and Gueuder 2018). Also, they argue that modern information and communication technologies created the possibility to automatize, standardize and scale up also the production of many

²The idea of a hierarchy of profit rates due to firms’ monopoly power has also been adopted by scholars in the Kaleckian tradition of Post-Keynesian economics (Lavoie 2022: 180–182). They argue, that the ”degree of monopoly” (Kalecki 1956: 13) in the markets in which firms are operating determines the height of the markups they can charge on their costs and thereby also their profit rates (Lavoie 2022: 181–182). Yet, it has been pointed out, that Kaleckian markup-pricing is also compatible with a long-run equalizing tendency of the profit rates on new capital, if the capacity utilisation is allowed to adjust accordingly (Dutt 1987: 67–68). See Shaikh (2016: 357–363) for a detailed overview over different strands of imperfect competition theories.

services. This possibility is exemplified by firms like Uber or AirBnB and others in the so-called Gig-economy (Conyon et al. 2022). The same argument is also made by neoclassical economists (Hsieh and Rossi-Hansberg 2023), inducing them to speak of an "industrial revolution in services" (Hsieh and Rossi-Hansberg 2023: 1). As a result, monopolisation tendencies might be even stronger and exist in realms that potentially neither Marx nor Sweezy expected (Conyon et al. 2022).

The differences in empirical predictions of the three theories can be condensed to the question if the profit rates of firms equalize in the long run and whether only profit rates on newest capital or also profit rates on total capital equalize. In perfect competition theory, both profit rates are expected to equalize (Jehle and Reny 2011: 168). In real competition theory, only profit rates on newest capital are thought to equalize (Shaikh 2016: 262–270). In monopoly capitalism theory, persistent differences in both profit rates should remain between firms (Sweezy 1956: 273–274).

3 Literature on the Persistence of Profit Rates

In this chapter the empirical literature on profit rate equalization as proxy for competition in Germany and worldwide is reviewed. As established in the previous section (section 2), studying the persistence of profit rates provides a common ground on which perfect competition, real competition and monopoly capitalism theory can be empirically tested (Bahçe and Eres 2013: 205).¹ The next section (section 3.1) briefly describes the different models used and the interpretations they allow for. Section 3.2 describes previous findings on the persistence of profit rates on total capital. Section 3.3 gives an overview over previous findings on the persistence of profit rates on newest capital.

3.1 Models of Profit Rate Persistence

There is a vast literature statistically estimating the persistence of profit rates (e.g. Schwalbach and Mahmood 1990; Gschwandtner 2005; Saona Hoffmann 2011; Bahçe and Eres 2013; Gschwandtner and Hirsch 2018; Eklund and Lappi 2019; Desai, Eklund and Lappi 2020; Joffe 2024) which builds on the methodology proposed by Dennis C.

¹There are several other ways to study the state of competition and monopoly, which can not be covered in detail in the scope of this thesis. Two of the most common approaches are the estimation of market concentration ratios (and their influence on profits) and the estimation of markups over costs (Syverson 2019). Both have their conceptual merits and weaknesses (see e.g. Syverson 2019; Doraszelski and Jaumandreu 2021; Syverson 2025). Importantly, both are not suitable for the present purpose of testing the prepositions of the three mentioned theories against each other. High market concentration in itself need not imply uncompetitive outcomes, neither in neoclassical nor modern classical theory. In the neoclassical view the resulting price and output levels depend on companies behaviour (Varian 2014: 531–535). From a modern classical perspective high concentration might even indicate fiercer competition and lead to lower profit shares and rates. Markets might be divided between several large firms, that all benefit from economies of scale and thus need to cut prices even more in their pursuit of market share than in the presence of smaller competitors (Keil 2017). A negative correlation of market concentration and profits often observed empirically (Keil 2017). Even when market concentration positively correlates with profits, the causality might be spurious, because companies might gain high market shares due to superior productivity, which also causes their high profits (Autor et al. 2020). Markups over marginal cost can be seen as evidence against perfect competition theory and its core preposition of short-run equalization of price and marginal cost, when they are found to persist over a sufficiently long period of time (Lerner 1934; De Loecker and Warzynski 2012). In real competition theory, however, no equalization of prices and cost is assumed. Instead, only tendencial equalization of prices in every market and of profit rates on new capital is expected, which allows for persistent differences in cost, markup and profit rates on total capital (see section 2.2)

Mueller (1977; 1986; 1990). Mueller (1977: 369–370) argued to assess the empirical validity of perfect competition theory the process of long-run profit rate equalization at its core needs to be tested by estimating how persistently individual firms' profit rates deviate from the supposed equilibrium profit rate. Above-average profit rates in single years do not suffice to indicate imperfect competition because they might only pose temporal deviations from a normal competitive level (Mueller 1977: 369–370). Therefore, the profit rate of a firm i in period t (π_{it}) can be expressed as sum of the competitive equilibrium profit rate for all firms c , a firm-specific permanent rent r_i , and a transitory rent s_{it} (Mueller 1990: 35):

$$\pi_{i,t} = c + r_i + s_{i,t} \quad (3.1)$$

The parameter of interest r_i can be derived from the estimation of an autoregressive function of profit rates, which, in its most simple and most commonly used form, can be written as:

$$\dot{\pi}_{i,t} = \alpha_i + \lambda_i \dot{\pi}_{i,t-1} + \varepsilon_{i,t} \quad (3.2)$$

where $\dot{\pi}_{i,t}$ denotes the profit rate of firm i in period t demeaned by the mean profit rate across all firms in period t ($\dot{\pi}_{i,t} = \pi_{i,t} - \bar{\pi}_t$) (Mueller 1990: 35–37). The coefficient λ_i labels the first-order autoregressive effect of the profit rate on its own lag for firm i . It is interpreted as short-run persistence parameter (Hirsch 2018: 25; Eklund and Lappi 2019: 330). $\varepsilon_{i,t}$ represents a white noise i.i.d. error term with zero mean and constant variance (Hirsch 2018: 25). α_i denotes the firm-specific technical intercept. The permanent firm-specific rent r_i can then be obtained from solving the dynamic equation 3.2 for an equilibrium level of $\dot{\pi}_{i,t}$ ($\dot{\pi}_i^*$) (Mueller 1990: 36):

$$r_i = \dot{\pi}_i^* = \frac{\alpha_i}{1 - \lambda_i} \quad (3.3)$$

This kind of autoregressive model, also called "Partial Adjustment Model" (PA model) (Schohl 1990: 390), is most commonly used to study the persistence of profit rates, occasionally adjusted to include control variables or higher-order autoregressive terms (Hirsch 2018: 25–26; Eklund and Lappi 2019: 331–335).

An alternative way to model profit persistence is a "Polynomial Convergence Model" (PC model) (Schohl 1990: 388). In this type of model, the deviation of profit rates from the competitive norm is estimated as a polynomial function of time (Mueller 1977: 371–372). This kind of model is less common than the PA model, yet remains in practical use (Mueller 1977; Schohl 1990; Vaona 2011; Tsoulfidis and

Tsaliki 2019: 260–279).

Profit persistence is studied at different levels, most commonly at the level of firms (e.g. Schwalbach and Mahmood 1990; Gschwandtner 2005) or industries (e.g. Vaona 2011; Bahçe and Eres 2013). Mueller (1977: 369–370) makes an important argument for using firm-level data to estimate profit rate equalization. Data on the industry-level may “average out” profitability differences between firms and thus leave persistent profit rates among the individual firms undetected (Mueller 1977: 370). In the extreme case, an industry might comprise one large firm retaining an above-average profit rate and many small firms earning below-average profits, and yet show an industry-level mean profit rate equal to the economy-wide mean profit rate. This disconnect is often further increased by industry definitions, which are chosen so broad, that they actually cover multiple markets, particularly in the presence of differentiated products (Mueller 1977: 369–370). Proponents of industry-level models argue, that the value of industry-level variables is precisely to approximate average conditions of production that might indicate best reproducible ones (Bahçe and Eres 2013: 206; Vaona 2011: 470). This point is particularly important for incremental profit rates, and will be taken up in subsection 3.3 again.

3.2 Previous Findings on Profit Rate Persistence

Most firm-level estimations of autoregressive partial adjustment models indicate some degree of profit persistence (e.g. (Schwalbach and Mahmood 1990; Gschwandtner 2005; Eklund and Wiberg 2008; Hirsch 2018; Eklund and Lappi 2019; Joffe 2024)). The reported estimates of the short-run persistence parameter λ in PA models range from 0.053 to 0.921, strongly varying by country and sector, with the majority being in the range 0.3 to 0.5 (Hirsch 2018: 27–29; Eklund and Lappi 2019: 331–335). For German firms, short-run persistence parameters λ between 0.35 and 0.63 for the period 1961–1982 (Schwalbach, Graßhoff and Mahmood 1989: 1631–1633) and of 0.259 for the period 1995–2013 (Eklund and Lappi 2019: 336–337) are found. The estimates for the former period were reported separately for different groups in the initial two years’ profit rate distribution. Short-run profit persistence was highest for the firms at both edges of the spectrum and lowest in its middle (Schwalbach, Graßhoff and Mahmood 1989: 1631–1633). Such high persistence of profit rates is at odds with perfect competition theory (Jehle and Reny 2011: 168).

Significant differences are also found in the projected long-run profit rates of individual firms (Odagiri and Yamawaki 1986; Mueller 1986: 20–23; Schohl 1990: 391–392;

Gschwandtner 2005: 798–800; Gschwandtner 2012: 196; Hirsch and Gschwandtner 2013: 10–11). For German firms in the period 1961–1982, the estimated long-run profit rates were found to strongly differ between groups of firms, defined by the initial height of their profit rates. The estimated differences to the economy-wide mean profit rate range from 2.3 to -2.8 percent and are positively correlated to firms initial profit rates (Schwalbach, Graßhoff and Mahmood 1989: 1631–1633). A strong positive correlation of the long-run profit rate differential and the initial profit rate is confirmed across several profit rate measures and regression designs (Schohl 1990: 391–392; Schwalbach and Mahmood 1990: 111–112). Also in polynomial convergence models, persistent differences between firms' profit rates in the short and long run are found for instance in the US from 1949 to 1972 (Mueller 1977: 372–374) and Germany from 1961 to 1982 (Schohl 1990: 393–394).

Several firm-level factors influence these results. Firm size is found to increase profit persistence both in the short-run and in the long-run (Hirsch and Gschwandtner 2013: 10–11; Hirsch, Lanter and Finger 2021: 260–262). However, the effect is not unambiguous and sometimes turns out negative (Gschwandtner 2012: 190–196). Also, R&D intensity (Eklund and Wiberg 2008) and advertisement (Gschwandtner 2012: 192–194) show positive effects on profit rate persistence. Industry-level estimates confirm the findings of high short-run persistence and persistent long-run differences of profit rates, both in PA (Bahçe and Eres 2013: 213–214) and PC models (Vaona 2011: 494; Tsoulfidis and Tsaliki 2019: 260–279).

Overall, the previous findings strongly oppose perfect competition theory (Jehle and Reny 2011: 168). The high profit rate persistence found for German and international firms and industries alike, rather supports monopoly capitalism (Sweezy 1956: 273–274) and real competition theory (Shaikh 2016: 262–264). However, comprehensive estimates of long-run profit differentials in Germany seem to be not existent for the period after 1990. The analysis in the present thesis addresses this gap.

3.3 Previous Findings on Incremental Profit Rate Persistence

The persistence of the profit rates on newest, "regulating", capitals has received less attention in the empirical literature so far. In the existing studies, this profit rate is typically proxied by the annual change of profits divided by the previous year's investment (Vaona 2011: 467–468; Bahçe and Eres 2013: 208; Tsoulfidis and Tsaliki

2019: 232–234; Lafalla 2024: 311–312). Because older capitals are assumed to retain, on average, their profitability from one year to the next, the current profit change is deemed solely attributable to the new capital formation (Shaikh 2016: 298–300). The ratio of profit change to investment thus gives a measure for the profit rate on newest capital, called the "incremental rate of profit" (Shaikh 2016: 300).

The dynamics of incremental profit rates are almost exclusively estimated at the industry-level (Vaona 2011; Bahçe and Eres 2013; Tsoulfidis and Tsaliki 2019: 260–279; Lafalla 2024). Sarich and Hecht (2013), as one notable exception, use firm-level data yet aggregate them to industry-level variables for deriving measures of profit persistence. Most of these studies do not find significant persistent differences in incremental profit rates (Sarich and Hecht 2013; Tsoulfidis and Tsaliki 2019: 260–279; Lafalla 2024: 311). An important exception is the study of Vaona (2011). Here in a model combining the polynomial convergence and partial adjustment processes, the null hypotheses of both convergence to and gravitation are tested (Vaona 2011: 474, 477). Both can be rejected for several western countries. For Germany in the period 1971–1991, however, the null hypothesis of a converging trend of incremental profit rates could not be rejected (Vaona 2011: 497).

These results mostly support real competition theory, predicting equalization of incremental profit rates (Shaikh 2016: 264–270) and disfavour monopoly capitalism theory, positing profit persistence (Sweezy 1956: 273–274). Yet, the exclusive focus on industry-level estimates potentially abstracts from persistence of incremental profit rates among firms. Authors studying incremental profit rate persistence at the industry-level argue that industry-level variables are more appropriate here than their firm-level counterparts, because industry averages would better capture the best generally reproducible conditions of production in an industry (Bahçe and Eres 2013: 206; Vaona 2011: 470). The regulating conditions represent, in real competition theory, the production technology which inflows of new investment are able to reproduce, and on which thus profit rates might equalize (Shaikh 2016: 265–270). However, Shaikh (2016: 265–270) argues that the average conditions of production in an industry need not be equal to the generally reproducible ones. Further, Mueller's (1977: 369–370) arguments against industry-level variables also apply to incremental profit rates. Averaging over an industry might obliterate important firm-specific differences in best reproducible conditions of production and therefore potentially not be representative for any of the firms in an industry. Also, if industry definitions do not match with actual markets, what is likely, firms in an industry do not need to have the same best generally reproducible conditions. For

these reasons, studying the persistence of incremental profit rates at the firm level might give important new insights in the process of equalization of profit rates on newest capital, predicted in real competition theory. The empirical question then rather becomes if the reproducible conditions of production differ so strongly and persistently between firms that one can hardly speak of "generally" reproducible conditions of production, for which profit rates might equalize.

This thesis, therefore, adds to the existing literature in two ways. First, the persistence of incremental profit rates is estimated at the firm-level among German firms in the years 1992 to 2024. Second, both long-run and short-run persistence of profit rates among German firms are estimated for the period from 1991 to 2024.

4 Data and Methods

In this chapter, the data used and regression design applied to estimate equalization of profit rates and incremental profit rates are described. Section 4.1 presents the data. In the next two sections, the calculation of the two major variables are explained, the profit rate (section 4.2) and the incremental profit rate (section 4.3). Section 4.4 specifies the conducted autoregression of profit rates and incremental profit rates. Within the last section, subsection 4.4.1 presents the assumed causal model in a DAG. In subsection 4.4.2 the estimated statistical models are explained. Subsection 4.4.3 summarizes the hypotheses to be tested in chapters 5 and 6.

4.1 Data

The financial data of German firms used in the empirical analysis originate from the "Worldscope Fundamentals" database provided by the London Stock Exchange Group (LSEG 2026b). A major strength of the database are the highly standardized measures of firms' financials (LSEG 2024: 27–29), making it very useful for international and long-run comparisons (Sarich and Hecht 2013: 304–307). A drawback is the databases' limitation to publicly listed firms (LSEG 2024: 34–38).¹ In a country like Germany, where a large share of companies is privately held, this excludes a considerable part of the economy (Giovanazzi and Victor 2024: 24). Particularly, smaller firms are omitted as listed firms tend to be large (Sarich and Hecht 2013: 304–307; Giovanazzi and Victor 2024: 24). Manufacturing-sector firms, in contrast, are overrepresented (Sarich and Hecht 2013: 304–307) because they tend to be large (Giovanazzi and Victor 2024: 26). Also in Germany, however, listed companies can be expected to play an important role in competition and investment and thus for the dynamics of profit rates. The listed companies account also in Germany for large proportions of total output and profit. The 869 non-financial listed and de-listed companies in the present sample of profit rates account, from 2000 onwards, for about 40 percent of total revenue of the entire German non-financial corporate (NFC) sector (figure 1 and table 3 in appendix 1). The share in sector output is somewhat smaller for the sample of 823 firms with observed incremental profit rates, fluctuating between 15 and 37 percent of NFC sector output. Both samples account,

¹For countries, like the US, where the overwhelming majority of firms is public traded, this is less of a problem. For the US, by some, Worldscope data are deemed as accurate as the often recommended Compustat Database (Ulbricht and Weiner 2005).

from 2005 onwards, for a share in total gross operating surplus of the NFC sector between 5 and 18 percent (figure 2 in appendix 1). Given that there are, as of 2023, over one million enterprises in Germany, across all sectors (Eurostat 2026), this appears to be a considerable share. In such fat-tailed distributions, considerable parts of economy-wide trends and fluctuation can often be attributed to the few large firms (Gabaix 2011). Also from the perspective of the tested competition theories, large firms are in the focus of attention. In real competition theory, large firms are thought to most fiercely cut costs to gain market share and thereby equalize profit rates on newest investments (Shaikh 2016: 264–270, 290–295). The same large firms are expected in monopoly capitalism theory to become monopolistic and maintain above-average profit rates, while smaller firms do not (Sweezy 1956: 273–274).

For constructing the sample of German non-financial firms, all listed and de-listed firms were selected, which reported their headquarter in Germany, as stated in the "LSEG Workspace" provided by the LSEG (2026a), from which all firms were excluded, whose primary SIC-Code belongs to the FIRE sector. Financial, insurance and real estate companies were excluded for three reasons. First, the limitation to non-financial firms reflects the aim of this thesis to estimate the intensity of competition in the "real", goods- and services-producing, economy, which might be a cause of weak investment in real productive capacities. Financial income is often seen as mere redistribution of income earned from real economic activities than remuneration for productive activity (Shaikh 2016: 245–246; Rabinovich 2021: 442). The studies on profit persistence and German firms which this thesis relates to (e.g. Schohl 1990; Sarich and Hecht 2013; Eklund and Lappi 2019; Giovanazzi, Victor and Putscher 2024; Behringer, van Treeck and Victor 2025), are mostly confined to non-financial firms, which is why a similar limitation in this thesis increases the comparability of the results and is more appropriate to the subject. Second, increased financial profits might be considered an important driver of monopolisation in the real economy (Hilferding 1923: 286; Reddy 2025: 4) and should thus be assessed separately. Third, from a methodological side, different accounting practices of financial firms make their reported profit and capital often hardly comparable to those of non-financial firms (Mendieta-Muñoz and Ossa 2022).

Before proceeding with the analysis, some further restrictions are made to the data. The sample is limited to firms stating either full consolidation of all subsidiaries or full consolidation of significant subsidiaries. All firms which consolidated their subsidiaries on equity or cost basis or published unconsolidated reports are removed. This removal is made to assure that the used measures of capital and investment are

actually valid measures of production capital (change) used in the firms including all their subcompanies. To limit bias from duplications, 24 firms are removed which are ultimately owned by another firm present in the remaining sample as majority owner, and are thus included in the parent firms' financial statements. Data on current ownership are taken from the LSEG (2026a). All observations with negative or zero reported change in operating capital (ΔCAP) are excluded from the calculation of incremental profit rates. This limitation is made to only consider observations where new capitals are formed, that could actually cause a change in profits. Only for these cases the calculated incremental profit rate, as ratio of operating profit change to previous investment (see section 4.3), can be reasonably interpreted as profit rate on newest capital. A negative ΔCAP indicates a net removal of old capital for a firm. The ratio of subsequent profit change to a net removal of capital, would thus only measure the profit effect of removing old capital. Equating these with profit rates on new capitals would lead the intended estimation of persistence among the latter ad absurdum. Likewise all observations reporting negative or zero operating capital (CAP) are excluded from the calculation of profit rates, as these cannot be meaningful interpreted as ratio of profits to invested capital. Finally, both profit rates and incremental profit rates are trimmed to the inner 98 percentiles of their respective resulting distributions. Trimming shall assure that the results of the analysis indeed reflect central trends in the data and are not driven by the extreme outliers (see tables 34 and 35 in appendix 3.7). High outliers can inflict severe bias to the results of regression analyses (Bramati and Croux 2007; Hamiye Beyaztas and Bandyopadhyay 2020) and thus need to be dealt with. The outliers are likely driven by temporal mismatches, high volatility and potential measurement errors of profit and investment. A company selling or abandoning a large share of its capital after a year with high positive or high negative profits might show a particularly high profit rate, as might a company receiving windfall profits in years, where it had little productive capital. The occasional miss-specification of non-operating items as operating profit or capital by firms might also produce outliers when proper operating profit or capital is small. Particularly, incremental profit rates likely display extreme values, since investment and profit change. In some years, investment is close to 0 and the change in gross operating profit in the numerator is much more volatile (as indicated by the ratio of the mean to the standard deviation) (see table 4.2). These outliers are considered not very informative of the central tendency of the data, for which reason trimming is preferred over winsorizing. The mean of the 2-percent-trimmed data is much closer to the median as indicator of

central tendency (see figure 5.1) than the mean of the 2-percent-winsorized data (see figures 7 and 8 in appendix 3.7) and extremely more so, than the mean of the data including outliers (see figures 5 and 6 in appendix 3.7). The values at the 1st and 99th percentile threshold, which are respectively imputed for the entire 1st and 99th percentile when the data are 2-percent-winsorized, are still extremely large and likely themselves uninformative of central tendencies. Since all firm-level observations of profit rates are detrended by the year-specific mean in the autoregression analysis, a very volatile mean detached from the central tendency should strongly influence the estimates of the autoregressive models. To account for potential effects of this outlier handling the main regressions are re-estimated using 2-percent-winsorized instead of 2-percent-trimmed data in appendix 3.7. However, when removing the highest and lowest percentile of one variable fundamentally changes the effect of this variable on others in a regression, the effect found including outliers is probably not very informative of the effect for the inner 98 percent of the data.

Tables 1 and 1 in appendix 1 show the resulting number of observations after each filter step per year. The sample is unbalanced, due to regularly dropouts of old firms and entry of new firms as well as due to non-reporting of certain values in certain years, as well as the two final steps of data-filtering. Reducing the sample to only firms with continuous observations over the entire period of study is not a viable option. It would exclude economically less successful firms, which did not survive the entire period, as well as newly emerging firms, and would thus create a selection bias towards old successful firms (Gschwandtner 2005; Eklund and Lappi 2019). The reduction would also greatly limit the the number of studied firms, as less than one tenth of the firms has observations for profit rates more than 30 years and only 5 firms have incremental profit rates observed in more than 30 years (see table 3 in appendix 1).

Table 4.1 shows the distribution of the variables used here. All variables are price-adjusted.²

²All deflators are taken from the German federal statistical office (Destatis 2026a). For net sales (NSL), gross operating profit (GOP) and change in GOP, as measures related to income, the general GDP-deflator is used. GPPE and change in GPPE are deflated using the deflator for gross fixed capital formation. Inventories, trade receivables net, net intangible assets and net goodwill are price-adjusted by the gross capital formation deflator. Changes express price-adjusted nominal changes. In every year, the deflator for the fourth quarter is used. Because the fiscal years of German firms widely follow calendar years (Kamp 2002: 423), the reported stocks generally represent values at the end of the calendar year. Thus, deflators reflecting price-levels at the years' end are considered more accurate for price-adjusting the capital stock. To assess also the values of sales and profits at the time they are reported, and thus have profit rates reflect a ratio of values at reporting time, also flow variables are price-adjusted using fourth-quarter deflators. As the flows are generated and can potentially be spent over the

The final data base contains 14075 firm-year-observations of profit rates over the period 1991 to 2024 and 8515 firm-year-observations of incremental profit rates over the years 1992³ to 2024. The observations are concentrated in later years. The smallest number of observed profit rates per year are 126 in 1991, the least incremental profit rates per year (after 1991) are 98 in 1994 (see tables 1 and 2 in appendix 1). On average there are 16.18 observations of profit rates per firm, while for half of the firms profit rates are observed in less than 15 years. For 83 firms there are observations of profit rates for more than 30 years (see table 3 in appendix 1). For incremental profit rates there are generally less observations per firm, with 9.79 mean and 8 median observations. Only five firms have observed incremental profit rates for more than 30 years and only 98 firms for more than 20 years. The observations are highly concentrated in the manufacturing sector, which accounts for more than half of the observations of both profit rates (see table 4 in appendix 1).

entire fiscal year, also yearly average deflators may be considered accurate for the latter. The differences to yearly average deflators are, however, not very large (Destatis 2026b) and should thus not lead to meaningful differences in the calculated values. Seasonally adjusted deflators are used, to have the calculated values not biased by typical seasonal price-fluctuations. All deflators are calculated as chain indices with 2020 as year of reference (Destatis 2026a).

³Incremental profit rates could not be calculated for 1991 due to the requirement of data on one-year-lagged price-adjusted investment, which are not available for 1991.

Table 4.1: Summary Statistics for Firms with Observed Profit Rates

Variable		Mean	SD	Min	p1	p25	Median	p75	p99	Max
Net Sales	(NSL)	3447.81	15144.43	0.00	0.05	39.08	159.42	826.30	75372.80	271648.69
Average Net Sales	($\overline{NSL}$)	3446.41	14168.87	0.00	0.95	49.47	180.54	900.18	72726.48	155656.93
Gross Operating Profit	(GOP)	169.86	1065.09	-13362.34	-507.37	-1.87	2.92	26.89	5327.72	21373.52
Gross Property, Plant and Equipment	(GPPE)	3253.62	15557.63	0.00	0.11	12.96	91.24	533.20	85149.44	253900.54
Inventories	(INV)	438.86	2194.62	-0.20	0.00	1.38	18.22	98.17	8870.00	46910.88
Trade Receivables Net	(TRN)	591.03	3223.99	0.00	0.01	5.40	24.21	128.48	11638.84	89658.05
Net Intangible Assets	(NIA)	812.93	4965.25	-458.70	0.00	1.45	11.11	67.99	17328.37	119469.51
Net Goodwill	(NGW)	632.26	2884.85	-483.78	0.00	1.13	10.78	69.11	15948.85	55061.71
Operating Capital	(CAP)	4167.95	20915.65	0.00	0.18	22.91	133.77	720.13	96445.98	366680.86
Profit Rate		-13.98	115.12	-1663.52	-536.84	-4.29	2.97	9.67	103.14	216.64

Note: All variables, except the profit rate, are given in million euros, price-adjusted with deflators from the Statistisches Bundesamt (Destatis 2026a). For NSL and GOP, as measures related to income, the general GDP-deflator is used. $\overline{NSL}$ represent mean price-adjusted NSL per firm. GPPE is deflated by the gross fixed capital formation deflator. INV, TRN, NIA and NGW are price-adjusted by the gross capital deflator. All deflators are calculated as chain indices with 2020 as year of reference (Destatis 2026a). Operating capital is the sum of deflated GPPE, INV, TRN and NIA minus deflated NGW. The profit rate is the ratio of GOP to CAP, given in percentiles.

Source: LSEG 2026b; Destatis 2026a, own calculations

Table 4.2: Summary Statistics for Firms with Observed Incremental Profit Rates

Variable	Mean	SD	Min	p1	p25	Median	p75	p99	Max
Net Sales	4066.29	16791.48	0.00	0.32	60.83	233.50	1165.76	78959.14	271648.69
Average Net Sales	3948.74	15262.59	0.00	1.43	67.32	224.11	1090.48	74216.16	155656.93
Δ Gross Operating Profit	3.93	559.27	-14644.74	-935.81	-4.47	0.43	7.55	1031.67	16999.33
Δ Gross Property, Plant and Equipment	198.45	1807.04	-59877.47	-612.69	0.26	5.96	42.33	5457.07	53656.37
Δ Inventories	16.88	395.62	-16265.00	-355.21	-0.50	0.27	6.84	749.38	15508.00
Δ Trade Receivables Net	20.00	991.50	-35877.00	-504.63	-1.26	0.76	9.14	1187.93	33609.38
Δ Net Intangible Assets	73.91	1457.22	-38860.34	-661.47	-0.82	0.05	4.51	2197.05	60080.02
Δ Net Goodwill	48.01	812.46	-15104.89	-549.51	-0.34	0.00	2.59	1792.52	28935.30
Δ Operating Capital	501.37	3078.93	0.00	0.09	6.26	25.08	122.46	10279.82	138720.64
Incremental Profit Rate	5.92	271.64	-2396.22	-1010.96	-26.95	3.35	35.79	964.25	2396.30

Note: All variables, except the incremental profit rate, are given in million euros, price-adjusted with deflators from the Statistisches Bundesamt (Destatis 2026a). For NSL and Δ GOP, as measures related to income, the general GDP-deflator is used. $\overline{NSL}$ represent mean price-adjusted NSL per firm. GPPE is deflated by the gross fixed capital formation deflator. Δ INV, Δ TRN, Δ NIA and Δ NGW are price-adjusted by the gross capital deflator. Changes express price-adjusted nominal changes. All deflators are calculated as chain indices with 2020 as year of reference (Destatis 2026a). Δ Operating capital is the change in nominal operating capital deflated by the gross capital formation deflator. The incremental profit rate is the ratio of Δ GOP to one-year-lagged Δ CAP, given in percentiles.

Source: LSEG 2026b; Destatis 2026a, own calculations

4.2 Calculation Rates of Profit

Following the operational definition proposed by Shaikh (2016: 298–301), yet adapted to the firm-level, rates of profit ⁴ are calculated as the ratio of current profits to current capital stock:

$$\pi_{i,t} = \frac{GOP_{i,t}}{(GPPE + INV + TRN + NIA - NGW)_{i,t}} \quad (4.1)$$

Profits are measured as gross operating profit (GOP) received by a firm i in one year t . This follows Shaikh’s (2016: 298–301) proposal to use real gross operating surplus at the industry-level, which translates to gross operating profit at the firm-level. The limitation to operating profit is important to only capture a firm’s profits from its productive business activities and incorporate as little distortions from this capability as possible (Shaikh 2016: 298–301). Capital is measured by the sum of gross property, plant and equipment (GPPE), operating working capital (as sum of inventories (INV) and net trade receivables (TRN)) and net intangible other assets (NIA) minus net goodwill (NGW). This definition is intended to only approximate the stock of capital used for business operations which can produce operating profit (Shaikh 2016: 298–301). Gross values for operating profit and PPE are used to reflect firms’ entire productive capacity (OECD 2001: 31; Shaikh 2016: 801), circumventing the challenges associated with measuring capital usage and deriving net measures (Shaikh 2016: 300–301).⁵

Many other studies operationalize the profit rate as return on assets, the ratio of net income to total capital (e.g. Mueller 1977; Gschwandtner 2012; Eklund and Lappi 2019). As commonly understood, this definition includes assets held as security or for speculation (Sarich and Hecht 2013: 307; LSEG 2024: 712) and earnings from interest or arbitrage (Mueller 1977; Koller, Goedhart and Wessels 2025: 252). The resulting profit rate might thus be driven by a company’s rentier income from other areas of the economy unrelated to its own operative business. As the object of this thesis

⁴For better comparability to the empirical persistence of profit rates literature, where this is the going notion, the symbol π is retained to denote the profit *rate*. It is also common elsewhere to denote the relative profit *share* of income by π and the profit *rate* by r (e.g. Lavoie 2022: 55, 172). Yet, in the persistence of profit rates literature r generally refers to the firm specific rent, i.e. excess profit rate (see equation 3.1, Mueller 1990: 35).

⁵The techniques considered appropriate are often dependent on different legal frameworks and accounting traditions (Burlaud, Messina and Walton 1996). Correctly writing off a productive asset also requires exact knowledge of its process of depletion, which is often unforeseeable. This may culminate in situations where assets are written off accounting-wise, yet still effectively exist in production (Shaikh 2016: 801–803). Therefore, net measures are not necessarily more accurate than gross values (Shaikh 2016: 298–301).

is to study the market conditions for companies' own business activities, the ratio of operating profit to operating capital is considered the more appropriate measure. The proposed definition of operating capital carefully extends Shaikh's 2016: 298–301 proposed measure, the stock of GPPE plus inventories, to other operating assets included in the widely acknowledged definition of invested capital (Koller, Goedhart and Wessels 2025: 222–226), given the limitations of the Worldscope database. Property, Plant and Equipment is the classical measure of fixed capital used in production, including machinery, buildings and other non-current tangible inputs to production (Vernimmen et al. 2018: 44–45). Invested capital also incorporates operating working capital and other operating assets net of other operating liabilities (Koller, Goedhart and Wessels 2025: 223–224). Operating working capital represents net holdings of current assets which are used and created in the operating cycle, importantly inventories and net receivables from trade (Vernimmen et al. 2018: 47–48). Especially in the trade sectors, current inventories constitute an important investment and thus need to be included in the capital stock (Duménil and Lévy 2002: 427; Tsoulfidis and Tsaliki 2019: 260). Net trade receivables indicate outstanding deliveries and payments to the company less its outstanding business obligations (Vernimmen et al. 2018: 48; LSEG 2024: 723). It can be seen as those items which are net owned by a company (if positive) and are thus technically available for resale or meeting obligations, just as inventories, or as the items net owed by the company (if negative) which thus need to be deducted from its inventories.

Other operating assets net of liabilities is no clearly defined asset category, but has often to be manually assembled by filtering operating net assets from a companies "other assets" and "other liabilities" (Koller, Goedhart and Wessels 2025: 224–225). The only subcategories of other assets available in Worldscope for non-financial companies are "Deferred Charges", "Tangible Other Assets", "Intangible Other Assets" and "Goodwill" (LSEG 2024: 94, 426, 443, 512, 705). The categories of "Deferred Charges" and "Tangible Other Assets" incorporate many seemingly non-operating assets, the former category for instance "Prepaid pension expense" and "Expenses for loans received" (LSEG 2024: 512) and the latter category "Assets from discontinued operations" and "Claims in litigation" (LSEG 2024: 705), and are therefore excluded. Intangible assets, assets without a physical existence such as research and development efforts, software development or branding, have become increasingly relevant in value creation in recent years (Giovanazzi, Victor and Putscher 2024: 3, 6–7). These and most other assets types included in the "Intangible Other Assets" category in Worldscope (LSEG 2024: 443) appear to be relevant for operations.

Gross intangibles would be preferable to better account for productive capacity, yet this measure is broadly available in the Worldscope database only for the years starting from 2006 (LSEG 2024: 426). Goodwill, the investors' expectations of a company's future value exceeding the current value of its assets, is sometimes included in intangible assets (Weber and Scharfenaker 2024: 5). It is generally measured as the difference between the price paid in an acquisition and the sum of the acquired firm's total assets (Ayyagari, Demirgüç-Kunt and Maksimovic 2024: 896; Giovanazzi, Victor and Putscher 2024: 7). While goodwill is per default included in Worldscope's category of intangible other assets (LSEG 2024: 717), it is excluded here to only measure a company's actual ability to derive profits on its invested capital (Ayyagari, Demirgüç-Kunt and Maksimovic 2024: 896).

What can be reported as income or asset, is also dependent on the legal framework a company is subject to. German accounting standards, defined by the German Commercial Code (Handelsgesetzbuch (HGB)), are generally more conservative on asset and income measures than International Financial Reporting Standards (IFRS) (Hung and Subramanyam 2007). As consequence of this more cautious approach, focussed on creditor protection, reported assets tend to be lower and reported income to be less volatile in HGB standards compared to IFRS (Hung and Subramanyam 2007). As a result, profit rates should be higher and more stable for firms reporting according to German accounting standards. The companies in the sample report to about equal shares in accordance with HGB and IFRS (table 6 in appendix 3.1). From 2005 onwards, all companies listed in an EU-member country are required to prepare their financial statements in according to IFRS (Bassemir 2018: 239). Since all the companies in the sample are or were listed, firm differences by accounting standards should largely diminish after 2005. Given this temporal evolution of reporting standards, the demeaning of profit rates by time-effects in the autoregression analysis likely removes a part of this reporting effect. Therefore, the AR estimates for different years are likely comparable. To account for the remaining effect of accounting system, the main autoregressive models are separately re-estimated for firms reporting in accordance with HGB and for firms applying IFRS in appendix 3.1.

4.3 Calculation Incremental Rates of Profit

Incremental rates of profit represent the rates of profit on the most recent investment, which are considered to equalize in real competition theory (Shaikh 2016: 268–273).

In this thesis, incremental profit rates are calculated as the ratio of current period's change in operating profit to last period's investment in operating capital:

$$\rho_{i,t} = \frac{\Delta GOP_{i,t}}{\Delta(GPPE + INV + TRN + NIA - NGW)_{i,t-1}} \quad (4.2)$$

To be comparable with the rate of profit and guided by the same methodological considerations (section 4.2), the same variables are used to calculate incremental profit rates, only as differentials. Profits are measured as change in gross operating profit received in the current year. Investment is measured as the one-year-lagged change in the sum of gross property, plant and equipment (GPPE), operating working capital (as sum of inventories (INV) and net trade receivables (TRN)) and net intangible other assets (NIA) minus net goodwill (NGW). This definition follows the indicator proposed by Shaikh (2016: 298–301), yet carefully extends the definition of investment to other potentially relevant operative investments of firms in contemporary capitalism.

Taking the one-year-lagged instead of the current change in capital stock follows the theoretical expectation that investments only starts to increase profits after about one year (Tsoulfidis and Tsaliki 2019: 233). Estimating the precise causality of investment and profit is beyond the scope of this thesis. Their relation might plausibly be different for every kind of investment, making it potentially very hard to generalize. For simplicity and comparability to the existing studies of incremental profit rate persistence, which almost exclusively use one-year-lagged investment in the denominator (Bahçe and Eres 2013: 208; Tsoulfidis and Tsaliki 2019: 233; Lafalla 2024: 311), Shaikh's (2016: 298–301) proposed measure is retained in this thesis. While this measure most certainly omits part of the profitability effect of new investment, it likely still captures some part of the effect, making it still a useful measure (see appendix 3.8 for the correlation of profit change and investment of several lags).

The resulting measure of incremental profit rates needs to be controlled for a potential bias by acquisitions. Acquisitions result in the acquired firm being consolidated into the parent's financial statements in the same year, leading to its profits and acquired capital being reported immediately. (Vernimmen et al. 2018: 819–822; LSEG 2024: 33). Thus, the profit change in period t attributable to the acquired company is included in the numerator of ρ_t , but the investment, the acquisition, causing it is not reflected in the denominator. This potential bias is controlled for in appendix 3.2, by re-estimating all autoregressive models of incremental profit rates excluding all observations of firms, which report acquisitions

in the current or previous year. Excluding these observations from the analysis all together is not a viable option. Acquisitions constitute an important part of contemporary corporate investments (Schoenberg 2009), also in Germany (Giovanazzi, Victor and Putscher 2024). Especially for market leaders, so-called "killer acquisitions" of potential upcoming rival firms, intended to reduce competitive pressure in the future, are crucial for securing their profitability (Cunningham, Ederer and Ma 2021: 1). Omitting the capital gains via mergers from the analysis would thus mean significantly understating corporate investment and overlook the effect of mergers on the incremental profit rate, which might originate from increases in firms' market power.

Table 4.1 displays the resulting distribution of profit rates across all firms, table 4.2 respectively the distribution of incremental profit rates. They have a similar median and similar shape, being concentrated around the centre with fat tails and approximately symmetric. The distribution of incremental profit rates shows even greater deviation and a more positive median and mean (table 4.2).

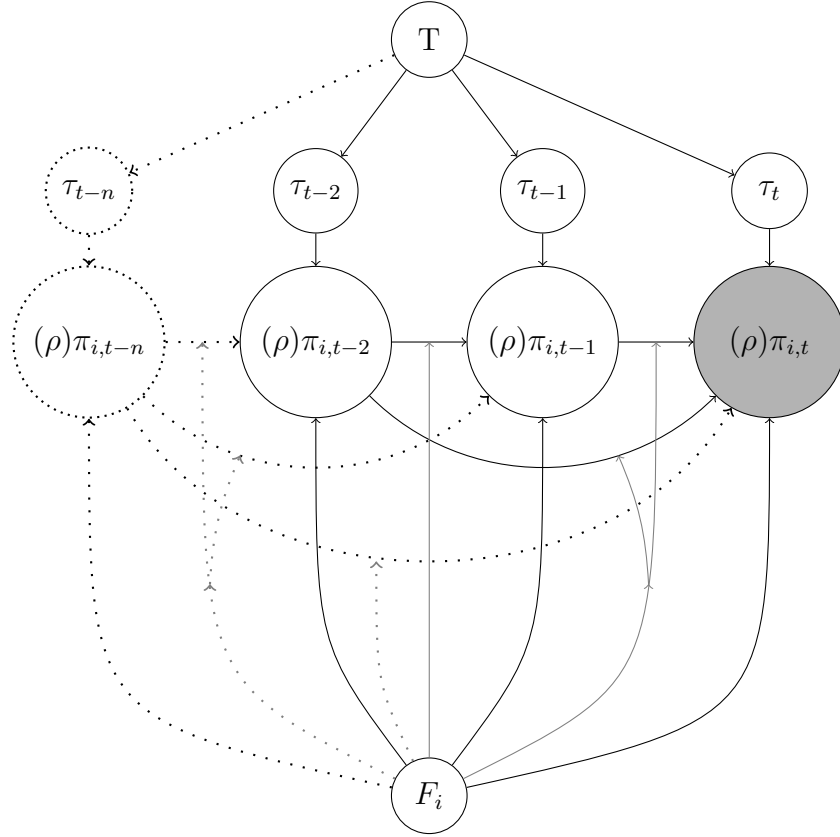
4.4 Autoregression Analysis of (Incremental) Profit Rate Persistence

To test the neoclassical hypothesis of profit rate equalization, the modern classic hypothesis of incremental profit rate equalization and the monopoly capitalism hypothesis of persistence of both profit rates, an autoregression (AR) analysis is conducted for both profit rates. AR analysis is by far the most common estimation technique used in the persistence of profit literature (Hirsch 2018: 25–26; Eklund and Lappi 2019: 331–335). Here profit rates are regressed on a lagged version of themselves to estimate the ability of firms to maintain above-average rates of profit, respectively their inability to escape from below-average rates of profit.

4.4.1 Causal Model of Profit Rate Persistence

The directed acyclic graph (DAG) in figure 4.1 illustrates the causal model assumed and tested in this paper for both profit rates and incremental profit rates. The DAG depicts the full model, of which each competition theory assumes a different subset of effects.

Figure 4.1: Causal Model of (Incremental) Profit Rate Persistence



Note: $\pi_{i,t}$ denotes the profit rate of firm i in period t , $\rho_{i,t}$ the respectively incremental profit rate. The same causal model is assumed for profit rates and incremental profit rates. A firm's current (incremental) profit rate might be influenced by its (incremental) profit rates in all earlier periods until period $t - n$, as well as by a current time effect τ_t and time-invariant firm-specific factors F_i . The dotted lines indicate all (incremental) profit rates and time effects before period $t - 2$ and their incoming and outgoing effects. Time effects are likely driven by long-term time trends T , such as business or financial cycles. Apart from the direct effects between variables, indicated by black arrows, firm-specific factors potentially also modify the effects between (incremental) profit rates of different periods, indicated by the grey arrows. Firm-specific factors might be market power or unique production advantages.

Source: own illustration

The rate of profit of firm i in period t ($\pi_{i,t}$), respectively the corresponding incremental rate of profit ($\rho_{i,t}$) might be influenced by its direct lag as well as all former lags up to $(\pi_{i,t-n})$, respectively $(\rho_{i,t-n})$. In that case, each of these lags is similarly impacted by all n lags before. Moreover, a firm's profit rate in each period is likely influenced by period-specific factors τ_t to τ_{t-n} , such as increased or decreased demand for the firm's products or shortages of its inputs. These time-factors may often be driven by longer-term time trends T , which can be business

cycles, environmental cycles or financial cycles. Finally, firm-specific factors F_i might influence a firm's ability to derive profits above the norm on its capital, as well as the persistence of these profits, indicated by the interaction effects (in grey) with the effects of profit rates on their lag. Such factors may be market power or unique production advantages.

4.4.2 Statistical Model

The causal model 4.1 can be translated to the following two equations, describing the profit rate ($\pi_{i,t}$), respectively the incremental profit rate ($\rho_{i,t}$), of every firm i in every period t :

$$\pi_{i,t} = \alpha + (\lambda_1 + \delta_{i,1})\pi_{i,t-1} + \dots + (\lambda_n + \delta_{i,n})\pi_{i,t-n} + \mu_i + \tau_t + \varepsilon_{i,t} \quad (4.3)$$

$$\rho_{i,t} = \alpha + (\lambda_1 + \delta_{i,1})\rho_{i,t-1} + \dots + (\lambda_n + \delta_{i,n})\rho_{i,t-n} + \mu_i + \tau_t + \varepsilon_{i,t} \quad (4.4)$$

λ_j denotes the average direct autoregressive effect of (incremental) profit rates after j years and $\delta_{i,j}$ the modification of the general autoregressive effect due to firm-specific factors. α denotes the average technical intercept of (incremental) profit rates, μ_i the firm-specific adjustment to this intercept, τ_t the time effect and $\varepsilon_{i,t}$ an i.i.d. error term.

To remove all period-specific effects τ_t from above equations the observed profit rate values are demeaned using the mean value for the profit rate in period t . This is common procedure in the literature (Mueller 1990: 37; Schwalbach and Mahmood 1990: 109; Eklund and Lappi 2019: 330; Lafalla 2024: 299–300).⁶ Writing time-demeaned profit rates ($\pi_{i,t} - \bar{\pi}_t$) as $\dot{\pi}_{i,t}$, time-demeaned incremental profit rates ($\rho_{i,t} - \bar{\rho}_t$) as $\dot{\rho}_{i,t}$, the firm-specific AR coefficient ($\lambda_j + \delta_{i,j}$) as $\lambda_{i,j}$ and assuming that in addition to the zero conditional mean assumption of $\varepsilon_{i,t}$ also the time-invariant firm-effect μ_i has a zero mean this gives:

$$\dot{\pi}_{i,t} = \lambda_{i,1}\dot{\pi}_{i,t-1} + \dots + \lambda_{i,n}\dot{\pi}_{i,t-n} + \mu_i + \varepsilon_{i,t} \quad (4.6)$$

$$\dot{\rho}_{i,t} = \lambda_{i,1}\dot{\rho}_{i,t-1} + \dots + \lambda_{i,n}\dot{\rho}_{i,t-n} + \mu_i + \varepsilon_{i,t} \quad (4.7)$$

⁶The entire equation 4.3 after the transformation has the following form:

$$\begin{aligned} \pi_{i,t} - \bar{\pi}_t = & (\lambda_1 + \delta_{i,1})(\pi_{i,t-1} - \bar{\pi}_{t-1}) + \dots + (\lambda_n + \delta_{i,n})(\pi_{i,t-n} - \bar{\pi}_{t-n}) \\ & + (\mu_i - \bar{\mu}) + (\varepsilon_{i,t} - \bar{\varepsilon}_t) \end{aligned} \quad (4.5)$$

The transformed equation 4.4 is identical, only with ρ instead of π .

It is evident, that the total autoregressive effect of the (incremental) profit rate deviation of firm i in period $t-j$ ($\dot{\pi}_{i,t-j}$ respectively $\dot{\rho}_{i,t-j}$) on the firm's (incremental) profit rate deviation in period t ($\dot{\pi}_{i,t}$ respectively $\dot{\rho}_{i,t}$) is the sum of the direct autoregressive effect and all indirect autoregressive effects, transmitted over the (incremental) profit rates in the years in between. The average total autoregressive effect λ is estimated in bivariate pooled OLS regressions of $\dot{\pi}_{i,t}$ on $\dot{\pi}_{i,t-j}$ (respectively $\dot{\rho}_{i,t}$ on $\dot{\rho}_{i,t-j}$) across all firms over several years.⁷:

$$\dot{\pi}_{i,t} = \alpha + \lambda \dot{\pi}_{i,t-j} + \varepsilon_{i,t} \quad (4.8)$$

$$\dot{\rho}_{i,t} = \alpha + \lambda \dot{\rho}_{i,t-j} + \varepsilon_{i,t} \quad (4.9)$$

This model specification allows to estimate the average duration of the persistence of (incremental) profit rate differentials to the economy-wide norm. According to the equalization hypotheses of perfect competition and real competition theory (only for incremental profit rates), autoregressive effects should be equally non-existent for all firms or be very small and become insignificant after a few years. Also, no specific variation μ_i in the intercept level of the (incremental) profit rate should exist for any firm. In the presence of direct firm effects μ_i the estimated effect is not an accurate representation of the total AR effect λ but overstated as shown by Hirsch (2018). In this case the firm effect induces an omitted variable bias to the estimates (Hirsch 2018: 32). By estimating the total autoregressive effect across all firms by OLS regression merely the hypotheses of profit rate equalization and incremental profit rate equalization to the general mean ought to be tested and an estimate for the duration of the equalization process derived. This is not possible in regression techniques removing firm-specific effects, since the resulting coefficients can then only be interpreted as persistence or equalization to the firm-specific mean (Baltagi 2021: 187–191).

All autoregressive models in this thesis are estimated in pooled OLS regressions. The panel-level is chosen, to be able to derive conventional aggregate precision measures, p-values and R^2 , at the panel level (Hirsch 2018: 25–26), as opposed to older studies which usually estimate equation 3.2 individually for each firm by OLS regression and report the mean or median values of λ_i and $\dot{\pi}_i^*$ as measures of aggregate profit persistence (e.g. Mueller 1990; Schohl 1990). The results from both approaches are typically comparable, in terms of relative size and direction

⁷The estimated parameter is equivalent to the autocorrelation of $\dot{\pi}_{i,t}$ and $\dot{\pi}_{i,t-j}$ (respectively $\dot{\rho}_{i,t}$ and $\dot{\rho}_{i,t-j}$) (Schaffer, Dobbins and Pearson 2021: 2–3). α only forms a technical intercept in the equation and has no meaningful interpretation.

of the effects, even if there do remain absolute differences between 0.1 and 0.2 in either direction, depending on the type of regression model used (Gschwandtner 2012: 183–186; Eklund and Lappi 2019: 347–348).

In all subsequent specifications only the first-order autoregressive coefficient λ_1 is estimated, due to the limited scope of this thesis and the better comparability to the literature. Most studies focus only on the first-order autoregressive process, as it is considered the most important AR process for investigating profit persistence (Hirsch 2018: 25–26; Eklund and Lappi 2019: 331–335). If it exists, there is by definition also some profit persistence over longer periods as it is passed on from year to year (Tsoulfidis and Tsaliki 2019: 257). The estimated models therefore reduce to the right-hand part of figure 4.1, where all higher-order autoregressive coefficients (λ_2 to λ_n in the above equations 4.3 - 4.7) are assumed to be 0:

$$\dot{\pi}_{i,t} = \lambda_{i,1}\dot{\pi}_{i,t-1} + \mu_i + \varepsilon_{i,t} \quad (4.10)$$

$$\dot{\rho}_{i,t} = \lambda_{i,1}\dot{\rho}_{i,t-1} + \mu_i + \varepsilon_{i,t} \quad (4.11)$$

While in the literature on estimating firm-level profit persistence many researchers advocate for also applying some (mostly FE, FD or GMM) transformation to remove the firm-specific effect μ_i (e.g. Gschwandtner and Hirsch 2018: 395–396; Hirsch 2018: 32), this would be inadequate for the present purpose. The aim of this thesis is to study the degree of profit rate and incremental profit rate equalization among German firms and potential exceptions to it. Thus, firm effects will be estimated, not removed.

Three variables are used in this thesis to estimate firm-specific effects: firm size, economic sector and initial (incremental) profit rate. The first two variables are associated with economies of scale. According to real competition theory, economies of scale allow firms to cut prices more aggressively in their pursuit of market dominance at the price of lower total profit rates (Shaikh 2016: 290–295). The creation of monopolies is however prevented by their continued contestation of (newly entered) competitors (Shaikh 2016: 264–270). Oppositely, in monopoly capitalism theory, economies of scale constitute entry barriers, which enable firms to monopolize industries and achieve persistent above-average profit rates (Sweezy 1956: 273–274).

Firm size is measured by a firm’s average net sales in all years observed in the sample. This way of measurement is preferred to alternative measures of size such as total assets or market capitalisation (Dang, Li and Yang 2018), since the chosen measure seems best to capture a firm’s scale of business operations comparable across

sectors.⁸ Further, average net sales seem for the present purpose to be a better indicator of firm size than only current net sales. Only if a firm is able to achieve high sales in several years, it can be expected, in monopoly capitalism theory, to be large enough to benefit from potential economies of scale, enabling it to monopolize markets and achieve persistently above-average rates of profit. High one time sales might only reflect one year's excess demand.

Economic sector is indicated by the SIC-division of a firm's primary field of operations. Different sectors should be associated with different minimum requirements of production scale and thus different degrees of scale economies (Sweezy 1956: 273–274; Shaikh 2016: 270). Economic sectors might also be associated with other specific conditions of production. In some sectors, such as agriculture and mining, the lowest-cost-production conditions might be non-reproducible, which might be reflected in continuously above-average profit rates of some firms (Shaikh 2016: 266–268). The order of a company's operating fields is based on the respective segments' share in the company's total revenue (LSEG 2024: 42). The assignment of a company to an industry and division, however, remains somewhat imprecise, as many firms in the database operate in several fields and therefore sometimes also in multiple divisions.

The third variable, the initial profit rate, respectively initial incremental profit rate, is supposed to capture, as an instrument, the totality of time-invariant firm effects on the (incremental) profit rate. It is measured as the mean (incremental) rate of profit of a firm in the initial four years of the respective sample (1991–1994, respectively 1992–1995 for incremental profit rates). To derive a more accurate estimation of time-invariant levels of (incremental) profit rates slightly longer initial time span is used compared to (Schohl 1990: 388) (three years) and (Schwalbach and Mahmood 1990: 111) (two years). If there are no time-invariant firm factors, the initial (incremental) profit rate, within any of these short time spans, should have no effect on the levels and persistence of (incremental) profit rates in later years. The initial (incremental) profit rate also has, originally, the interpretation as initial rank of a firm in the distribution of (incremental) profit rates, whose persistence is tested in later years. Estimating the long-run levels of profit rate deviations to the norm separately for groups of firms, defined by initial rank, allows to estimate the long-run persistence of firms' positions in the profit rate distribution (Mueller 1977: 371–373; Schohl 1990: 388–392).

Estimating the long-run difference of a group's (incremental) profit rate to the

⁸Total assets seem, for that purpose, seems only appropriate for comparing capital-intensive non-financial firms, while market capitalisation reflects more investors' expected future profits than current scale (Dang, Li and Yang 2018)

economy-wide mean, requires solving the estimated autoregressive function for an equilibrium level of $(\rho) \pi$. Due to the dynamic nature of the model, μ_i in the above equations 4.10 and 4.11, has no meaningful interpretation itself, but only forms a technical group-specific intercept. The long-run projection of the profit rate differential of a group of firms i to the general mean ($\dot{\pi}_i^*$) is calculated from the estimated parameters of the autoregressive function (equation 4.10) for that group, as ⁹:

$$\dot{\pi}_i^* = \frac{\hat{\mu}_i}{1 - \hat{\lambda}_i} \quad (4.13)$$

Likewise, the projected long-run differential in the incremental profit rate of firm group i to the mean ($\dot{\rho}_i^*$) is derived from the estimated parameters of the autoregressive function of incremental profit rates (equation 4.11):

$$\dot{\rho}_i^* = \frac{\hat{\mu}_i}{1 - \hat{\lambda}_i} \quad (4.14)$$

Long-run persistence estimates can only be derived for stationary time series, for which the AR coefficient is below the absolute value of one and therefore convergent (Gschwandtner 2005: 795). Therefore, the long-run (incremental) profit rates for groups with AR coefficients close to one, within the range of several standard deviations should not be interpreted. For a better comparability to existing studies, which in their vast majority calculate the long-run profit rate differential as in equations 4.13 and 4.14, only the first-order autoregressive effect is entailed in the denominator. This is a rather conservative estimation. In the presence of higher order autoregressive effects, these might be added as negative terms to the denominator, after finding the "best-lag model" (Gschwandtner 2005). Adding these effects if present (and positive) should generally result in even higher estimates of long run profit persistence.

⁹To derive appropriate p-values as indicators of statistical significance for the long-run profit rate differential, the correct variance of the compound measure needs to be used in the t-tests. Since both $\hat{\mu}_i$ and $\hat{\lambda}_i$ are estimated parameters, the variance of the compound measure is given by (Tsoulfidis and Tsaliki 2019: 258):

$$\begin{aligned} Var\left(\frac{\hat{\mu}_i}{1 - \hat{\lambda}_i}\right) &\approx \left(\frac{1}{1 - \hat{\lambda}_i}\right)^2 Var(\hat{\mu}_i) + \left(\frac{\hat{\mu}_i}{1 - \hat{\lambda}_i^2}\right)^2 Var(\hat{\lambda}_i) \\ &+ 2\left(\frac{1}{1 - \hat{\lambda}_i}\right)\left(\frac{\hat{\mu}_i}{1 - \hat{\lambda}_i^2}\right) Cov(\hat{\mu}_i, \hat{\lambda}_i) \end{aligned} \quad (4.12)$$

This variance, respectively its square root the standard deviation, is applied in the t-tests for the long-run (incremental) profit rate differential.

4.4.3 Hypotheses

Perfect competition theory holds to total autoregressive effect λ in equations 4.8 and 4.9 in all periods close to 0 and thus insignificant or to be significantly negative > -1 (Hirsch 2018: 25–26), corresponding to the assumed equalization of all firms' profit rates and incremental profit rates by competition (Varian 2014: 201–214). Accordingly, in the separate models for firm groups (equations 4.10 and 4.11) the group-specific AR coefficient $\lambda_{i,1}$ should be insignificant or negative > -1 . For no group of firms significant long-run differentials in profit rates ($\dot{\pi}_i^*$) or incremental profit rates ($\dot{\rho}_i^*$) to the economy-wide mean should be found (Naples and Aslanbeigui 1996: 60–61)[201-214]varianIntermediateMicroeconomicsModern2014.

From the perspective of real competition theory, only for incremental profit rates the total AR effect λ , and the firm-group-specific AR(1) effects $\lambda_{i,1}$ and predicted long-run incremental profit rate differentials $\dot{\rho}_i^*$ should be close to zero and insignificant, as consequence of their assumed equalization(Shaikh 2016: 264–270). Profit rates are expected to remain different (Shaikh 2016: 262–264), what should be reflected in positive AR coefficients < 1 λ in equation 4.8 and $\lambda_{i,1}$ in equation 4.11. The limitation to below one follows from the expectation of stationary time series of profit rates (Tsoulfidis and Tsaliki 2019: 257–258). There should be significant long-run profit rate differences $\dot{\pi}_i^*$ for different groups of firms. Firms with initially higher profit rates, should show higher long-run profit rates, indicating persistence of firms ranks in the profit rate distribution. Larger firms and firms in more capital intensity sectors, should display lower long-run profit rate differentials $\dot{\pi}_i^*$, indicating economies of scale and thus harsher price-cutting of these firms (Shaikh 2016: 290–295).

Following monopoly capitalism theory (Sweezy 1956: 273–274), positive AR coefficients λ should be found in equations 4.8 and 4.9 and positive $\lambda_{i,1}$ in equations 4.10 and 4.11, indicating persistence of both profit rates and incremental profit rates. There should be significant long-run differentials in profit rates $\dot{\pi}_i^*$ and incremental profit rates $\dot{\rho}_i^*$ for different groups of firms. Initially higher ranked firms are expected to show higher projected long-run profit rates and incremental profit rates, indicating long-run persistence of both profit rates. Larger firms and firms in more capital intensity sectors, should display higher long-run differentials of profit rates $\dot{\pi}_i^*$ as well as incremental profit rates $\dot{\rho}_i^*$, as consequence of scale economies leading to monopolisation (Sweezy 1956: 273–274).

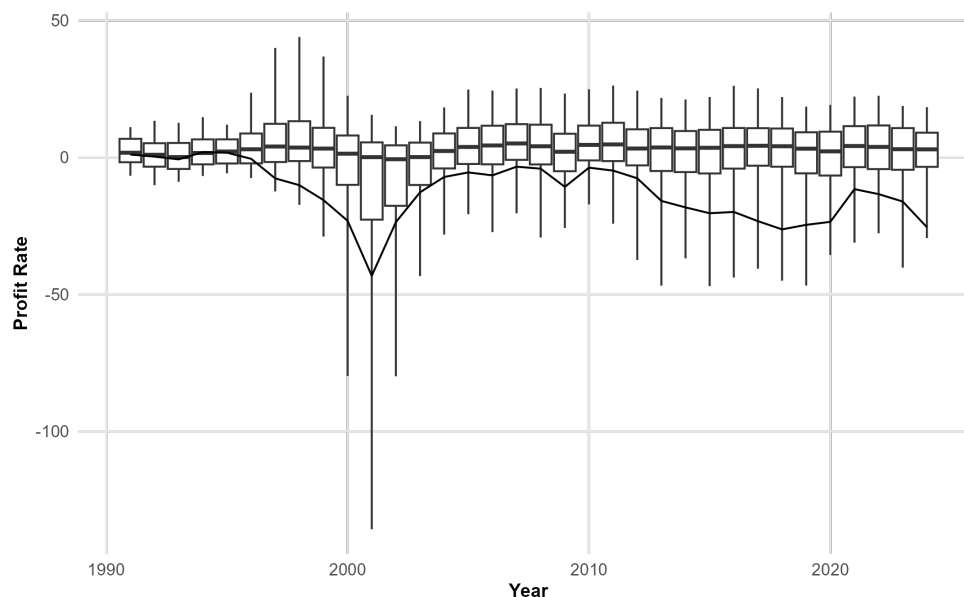
5 Results on Perfect vs Real Competition and Monopoly Capitalism

In this chapter, autoregressive functions of profit rates on total capital are estimated to assess the empirical prediction of profit rate equalization from perfect competition theory (Jehle and Reny 2011: 168) against the prediction of profit rate persistence from real competition (Shaikh 2016: 262–264) and monopoly capitalism theory (Sweezy 1956: 273–274). In section 5.1, the general persistence of profit rates across all firms in the sample is examined. The average total autoregressive effects up until year 30 is estimated to assess the average duration of profit rate equalization to the economy-wide mean. To estimate the persistence of a firms rank in the profit rate distribution, long-run and short-run persistence parameters are derived for all sextiles of the initial profit rate distribution from separate AR(1) models. The influence of firm size and economic sector on profit persistence is tested in the following section 5.2, in separate AR(1) models for groups of firms defined by size and economic sector.

5.1 Persistence of Profit Rates

Figure 5.1 illustrates the time trend of the distribution of average profit rates for all firms, in box plots. The median and inner 50 percent show a rather steady trend. The thin line displays the mean profit rate per year. In most years the mean lies below the inner 50 percent of the data, but shows little volatility, apart from a downturn in 2001 likely connected to the Dotcom-Bubble. Its change widely follows the trend of the inner 50 percent. The level of the mean is likely driven by the large negative outliers, evident from table 4.1. In the autoregression analysis the yearly mean is deducted from all firms' profit rates in the same year to remove economy-wide time trends.

Figure 5.1: Evolution of Profit Rates

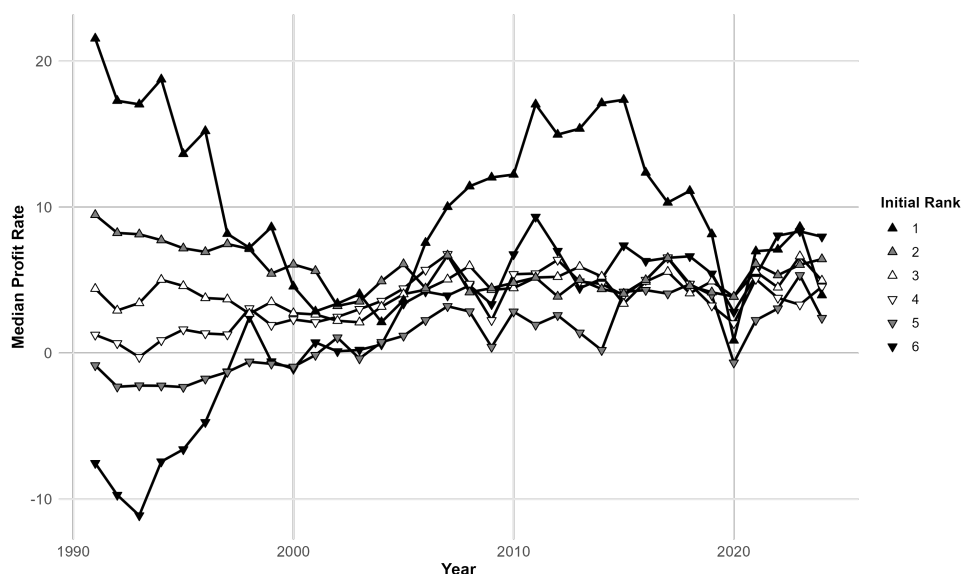


Note: The distribution of profit rates in every year is indicated by a boxplot. The thick central line represents the median, the box the central 50 percent and the whiskers the central 80 percent of the distribution. The continuous line indicates the arithmetic mean of the distribution in every year.

Source: LSEG 2026b; Destatis 2026a, own calculations

Firms' ranks in the profit rate distribution appear to be very persistent. Figure 5.2 displays the median profit rates over time for six equally sized groups of firms following their rank in the initial profit rate distribution. Firms are assigned to groups according to their mean profit rate in the initial four years (1991 to 1994). While median profit rates converge over time and significantly overlap, there remain persistent differences. Particularly, the initially first-ranked and second-ranked groups maintain their rank in the profit rate distribution in most subsequent years. Also, the initially fifth-ranked group stays behind and takes the last rank in most years. The median profit rate of the initially last group, however, sharply rises and remains in the top area in later years.

Figure 5.2: Evolution of Median Profit Rates by Initial Rank

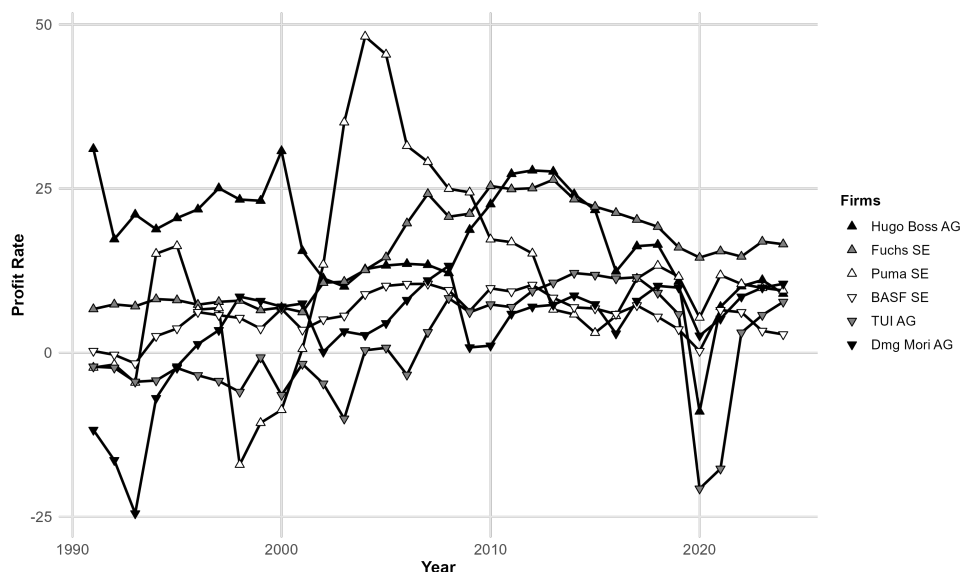


Note: The figure displays the evolution of median profit rates for sextiles of the profit rate distribution in the initial years. Firms are assigned to groups following their mean profit rate in the years 1991-1994.

Source: LSEG 2026b; Destatis 2026a, own calculations

Persistent differences in profit rates are also visible between individual firms (figure 5.3). The profit rates of some firms (like Hugo Boss AG or Fuchs SE) almost continuously lie above the profit rates of other firms (like BASF SE or TUI AG). The selected six firms represent for every group in figure 5.2 the firm with the most annual observations, whose mean profit rate in the initial four years is closest to the group median.

Figure 5.3: Evolution of Profit Rates for Selected Firms



Source: LSEG 2026b; Destatis 2026a, own calculations

Estimates of the total autoregressive effect of profit rates up until the 30th period across all firms in the sample are shown in table 5.1. A deviation of a firm's profit rate from the economy-wide mean in one year appears to have a significant effect, as indicated by a p-value below a five-percent threshold, on the firm's profit rate deviation for the following 24 years. The average total autoregressive effect λ continuously decreases from 0.622 in the first period to still 0.061 in the 24th period, indicating that firms with above-average profit rates on average need more than two decades to return to the economy-wide mean profit rate. This high persistence of firm's profit rate differentials to the economy-wide mean is contrary to the equalization hypothesis inherent to perfect competition theory (Jehle and Reny 2011). Instead, the high general persistence of profit rates aligns with real competition (Shaikh 2016: 262–264) and monopoly capitalism theory (Sweezy 1956: 273–274).

Estimates from separate AR(1) models are presented in table 5.2 for the six groups of firms, defined by initial rank in the profit rate distribution, whose median profit rates are plotted in figure 5.2. For every group, λ denotes the average AR(1) coefficient and $\hat{\pi}^*$ the projected average long-run differential of the profit rate to the mean. The rank of firms in the profit rate distribution appears to be highly persistent, particularly at the upper end. The two groups with the initially highest profit rates maintain their rank as indicated by their projected long-run profit rate differential (table 5.2). In the four lower groups there is some mobility between ranks.

Table 5.1: Autoregression (Orders 1-30) Results for Profit Rates

Regressor	α	λ	Obs.	Adj. R^2
$\dot{\pi}_{i,t-1}$	0.964 (0.732)	0.622 (0.007)***	13160	0.378
$\dot{\pi}_{i,t-2}$	2.177 (0.788)**	0.536 (0.008)***	12329	0.272
$\dot{\pi}_{i,t-3}$	3.191 (0.840)***	0.447 (0.009)***	11520	0.181
$\dot{\pi}_{i,t-4}$	4.498 (0.878)***	0.374 (0.009)***	10736	0.127
$\dot{\pi}_{i,t-5}$	5.568 (0.900)***	0.330 (0.010)***	9976	0.095
$\dot{\pi}_{i,t-6}$	6.711 (0.944)***	0.273 (0.011)***	9251	0.061
$\dot{\pi}_{i,t-7}$	7.787 (0.982)***	0.223 (0.012)***	8555	0.037
$\dot{\pi}_{i,t-8}$	9.396 (1.006)***	0.158 (0.012)***	7898	0.020
$\dot{\pi}_{i,t-9}$	9.800 (1.059)***	0.164 (0.013)***	7273	0.022
$\dot{\pi}_{i,t-10}$	10.941 (1.072)***	0.156 (0.013)***	6661	0.021
$\dot{\pi}_{i,t-11}$	11.480 (1.092)***	0.172 (0.014)***	6090	0.026
$\dot{\pi}_{i,t-12}$	12.581 (1.126)***	0.139 (0.014)***	5554	0.016
$\dot{\pi}_{i,t-13}$	14.342 (1.103)***	0.089 (0.014)***	5045	0.008
$\dot{\pi}_{i,t-14}$	15.627 (1.111)***	0.064 (0.014)***	4574	0.004
$\dot{\pi}_{i,t-15}$	16.596 (1.169)***	0.055 (0.016)***	4133	0.003
$\dot{\pi}_{i,t-16}$	17.000 (1.203)***	0.092 (0.016)***	3713	0.008
$\dot{\pi}_{i,t-17}$	17.837 (1.258)***	0.071 (0.017)***	3324	0.005
$\dot{\pi}_{i,t-18}$	18.360 (1.379)***	0.045 (0.018)*	2961	0.002
$\dot{\pi}_{i,t-19}$	18.869 (1.405)***	0.061 (0.018)***	2619	0.004
$\dot{\pi}_{i,t-20}$	19.760 (1.395)***	0.075 (0.018)***	2300	0.007
$\dot{\pi}_{i,t-21}$	20.826 (1.375)***	0.050 (0.017)**	2003	0.004
$\dot{\pi}_{i,t-22}$	20.913 (1.532)***	0.070 (0.020)***	1723	0.007
$\dot{\pi}_{i,t-23}$	21.949 (1.525)***	0.034 (0.019).	1461	0.002
$\dot{\pi}_{i,t-24}$	21.770 (1.754)***	0.061 (0.022)**	1225	0.005
$\dot{\pi}_{i,t-25}$	23.154 (1.356)***	-0.002 (0.017)	1003	-0.001
$\dot{\pi}_{i,t-26}$	24.124 (1.147)***	-0.007 (0.013)	810	-0.001
$\dot{\pi}_{i,t-27}$	23.414 (1.440)***	-0.027 (0.021)	633	0.001
$\dot{\pi}_{i,t-28}$	22.644 (1.338)***	0.143 (0.103)	487	0.002
$\dot{\pi}_{i,t-29}$	21.167 (1.684)***	0.134 (0.140)	373	0.000
$\dot{\pi}_{i,t-30}$	19.843 (2.162)***	0.119 (0.168)	283	-0.002

Note: Each row displays estimated parameters from a separate AR(n) model of time-demeaned profit rates across all firms. λ indicates the average total autoregressive effect after n years, estimated by bivariate OLS regression of $\dot{\pi}_{i,t}$ on $\dot{\pi}_{i,t-n}$. α denotes the average technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. p<0.1, * p<0.05, ** p<0.01, *** p<0.001). Additionally, the number of observations (Obs.) and adjusted R^2 (Adj. R^2), as measure of explained variance, are given for every model. Profit rate deviations from the mean show significant positive autocorrelation up until the 24th period.

Source: LSEG 2026b; Destatis 2026a, own calculations

Table 5.2: Autoregression (Order 1) Results for Profit Rates, by Initial Rank

Initial Rank	μ	λ	$\hat{\pi}^*$	Obs.	Adj. R^2
1	5.202 (1.075)***	0.779 (0.036)***	23.552 (2.882)***	400	0.541
2	6.221 (0.598)***	0.695 (0.027)***	20.370 (1.105)***	775	0.467
3	5.582 (0.668)***	0.689 (0.025)***	17.921 (1.779)***	883	0.468
4	4.741 (0.477)***	0.748 (0.023)***	18.814 (1.336)***	808	0.566
5	5.036 (2.098)*	0.480 (0.032)***	9.677 (4.003)*	751	0.228
6	6.865 (0.836)***	0.546 (0.030)***	15.116 (1.701)***	642	0.334

Note: Each row displays estimated parameters from a separate AR(1) model of time-demeaned profit rates. The model is estimated for every sextile of the initial years' profit rate distribution. Firms are assigned to groups following their mean profit rate in the years 1991-1994. λ denotes the group-specific AR(1) coefficient, indicating short-run persistence of profit rates. $\hat{\pi}^*$ indicates the projected group-specific long-run differential of profit rates to the economy-wide mean profit rate. μ denotes the group-specific technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). Firms with higher initial rank in the profit rate distribution show higher persistence of profit rates both in the short-run and in the long-run.

Source: LSEG 2026b; Destatis 2026a, own calculations

All groups show high and significant short-run profit persistence, particularly the four highest-ranked groups, indicating that profit rates are relatively stable, also in the short run. The results correspond to the trends in group medians shown in figure 5.2. λ is significantly below one in all models in tables 5.1 and 5.2 as well as decreasing over time, as shown in table 5.1. This indicates that the stationarity requirement for computing equilibrium long-run profit rate deviations (Gschwandtner 2012: 178) holds.

5.2 Influence of Firm Size and Economic Sector on Profit Persistence

Firm Size

To assess whether the profit rate differences may be explained by firm size as expected in real competition (Shaikh 2016: 290–295) and monopoly capitalism theory (Sweezy 1956: 273–274), separate AR(1) models are estimated for percentile groups defined by average net sales (table 5.3). The percentile bin width is progressively narrower at the top to better estimate the profit rate dynamics at the upper end of the heavily right-tailed distribution of average net sales (table 4.1). The predicted long-run profit

Table 5.3: Autoregression (Order 1) Results for Profit Rates, by Percentiles of Firm Size

Perc.	μ	λ	$\hat{\pi}^*$	Obs.	Adj. R^2
100	5.010 (0.878)***	0.761 (0.043)***	20.987 (2.195)***	224	0.580
96-99	3.988 (0.495)***	0.845 (0.020)***	25.800 (2.116)***	792	0.697
91-95	4.989 (0.748)***	0.779 (0.018)***	22.552 (3.196)***	774	0.716
81-90	8.934 (0.971)***	0.516 (0.020)***	18.469 (1.888)***	1823	0.273
51-80	10.397 (0.650)***	0.403 (0.011)***	17.414 (1.050)***	4416	0.231
1-50	-8.565 (1.763)***	0.634 (0.011)***	-23.393 (4.775)***	5131	0.379

Note: Each row displays estimated parameters from a separate AR(1) model of time-demeaned profit rates. The model is estimated for different percentiles (perc.) of the distribution of firm size, measured by a firm's average net sales (price-adjusted) over all years observed. λ denotes the group-specific AR(1) coefficient, indicating short-run persistence of profit rates. $\hat{\pi}^*$ indicates the projected group-specific long-run differential of profit rates to the economy-wide mean profit rate. μ denotes the group-specific technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). Larger firms show higher persistence of profit rates both in the short-run and in the long-run.

Source: LSEG 2026b; Destatis 2026a, own calculations

rates differentials increase with firm size, yet slightly decrease again for the largest percent of firms. This potentially indicates a (partial) reversion of the size effect from a certain firm size. Yet, it might also be caused by other common characteristics of the eight firms (BMW AG, Deutsche Post AG, Deutsche Telekom AG, E.ON SE, Mercedes-Benz Group AG, Siemens AG, Volkswagen AG and Uniper SE) forming the upper percent of average net sales in the present sample. The short-run persistence parameter is significantly positive for all groups of firm size. It is particularly high for the largest 10 and smallest 50 percent of firms, indicating that profit rate differentials at the top and bottom show particularly little volatility.

To account for different functional forms the effect of firm size is re-estimated as a linear and as a quadratic term, both with and without including an interaction term with the autoregressive effect (table 23 in appendix 3.4). In almost all specifications average firm size has a significant positive effect on a firm's profit rate differential to the economy-wide mean. The quadratic term, included in model 2 and 4, is in both specifications estimated to be significantly negative. This supports the earlier finding of a generally positive effect of firm size on a firm's long-run profit rate, which decreases with firm size and eventually even becomes negative. The interaction term of average firm size and the autoregressive effect of profit rates is insignificant, supporting the finding of no unidirectional effect of firm size on short-run profit persistence.

Economic Sector

Pronounced differences in profit rates also exist between economic sectors, as indicated by table 5.4. Particularly firms in the retail, agriculture, construction and manufacturing sector display profit rates persistently above the economy-wide mean in the long run. Firms in the service sector appear to have persistently below-average profit rates. In both real competition and monopoly capitalism theory, these differences are expected to be generally related to conditions of economies of scale in production, negatively in the first theory positively for the second (see chapter 2). There is no apparent correlation of the long-run profit rate differences with average operating capital, net sales or capital intensity (indicated by the ratio of average operating capital to average net sales) per sector (shown in table 5), which are different indicators of average capital or size requirements of production. Likely production conditions strongly differ between firms.

Table 5.4: Autoregression (Order 1) Results for Profit Rates, by Economic Sector

Sector	μ	λ	$\dot{\pi}^*$	Obs.	Adj. R^2
Agriculture ¹	8.762 (3.578)*	0.233 (0.063)***	11.431 (4.653)*	79	0.142
Mining	-1.153 (8.323)	0.447 (0.054)***	-2.085 (15.023)	105	0.390
Construction	10.505 (3.620)**	0.068 (0.090)	11.266 (3.599)**	259	-0.002
Manufacturing	4.825 (0.683)***	0.569 (0.011)***	11.191 (1.561)***	6699	0.302
TransComm ²	1.173 (2.093)	0.651 (0.025)***	3.362 (5.995)	1015	0.403
Retail	8.572 (0.944)***	0.473 (0.034)***	16.273 (1.477)***	621	0.241
Wholesale	1.069 (3.922)	0.578 (0.035)***	2.530 (9.292)	514	0.347
Services	-5.634 (2.038)**	0.638 (0.013)***	-15.554 (5.600)**	3868	0.398

Note: Each row displays estimated parameters from a separate AR(1) model of time-demeaned profit rates. The model is estimated by economic sector, indicated by the SIC-division of a firm's primary field of operations. λ denotes the sector-specific AR(1) coefficient, indicating short-run persistence of profit rates. $\dot{\pi}^*$ indicates the projected sector-specific long-run differential of profit rates to the economy-wide mean profit rate. μ denotes the sector-specific technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). In the short-run profit rates appear stable for all sectors but construction. The predicted long-run profit rate differential to the economy-wide mean is particularly high for firms in the retail, agriculture, construction and manufacturing sector and particularly low for firms in the service sector.

¹ Agriculture, Forestry and Fishing

² Transportation, Communication, Electric, Gas and Sanitary Service

Source: LSEG 2026b; Destatis 2026a, own calculations

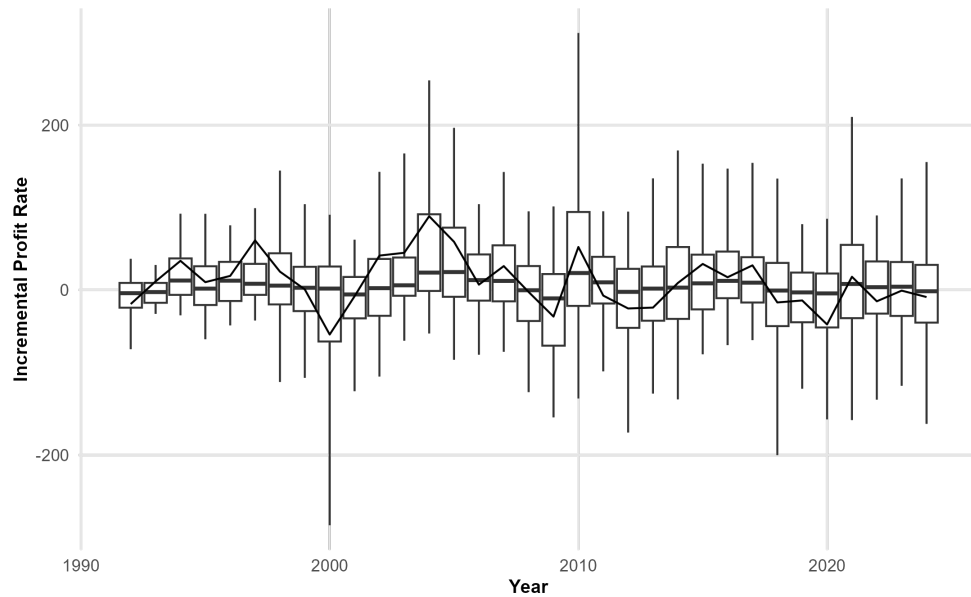
6 Results on Real Competition vs Monopoly Capitalism

In this chapter autoregressive functions in the same specifications as in chapter 5 are estimated for incremental profit rates, to test the real competition hypothesis of incremental profit rate equalization (Shaikh 2016: 262–270) against the monopoly capitalism hypothesis of persistence (Sweezy 1956: 273–274). Section 6.1 displays estimates of the general persistence of incremental profit rates. Average total autoregressive effects up until year 30 indicate the average duration of incremental profit rate equalization to the economy-wide mean. From separate AR(1) models for groups of firms with different initial incremental profit rates, the long-run and short-run persistence of firms' ranks in the incremental profit rate distribution is estimated. In section 6.2 the impact of firm size and economic sector on incremental rates of profit is assessed in group-specific AR(1) models.

6.1 Persistence of Incremental Profit Rates

Figure 6.1 shows the time trend for the distribution of incremental profit rates across all firms in box-plots for every year. No clear trend is visible. The mean incremental profit rate by year is displayed as continuous line. It gravitates around the median and follows its trend. For the autoregression analysis the yearly mean incremental profit rate is deducted from all firms' incremental profit rates in the process of time demeaning.

Figure 6.1: Evolution of Incremental Profit Rates

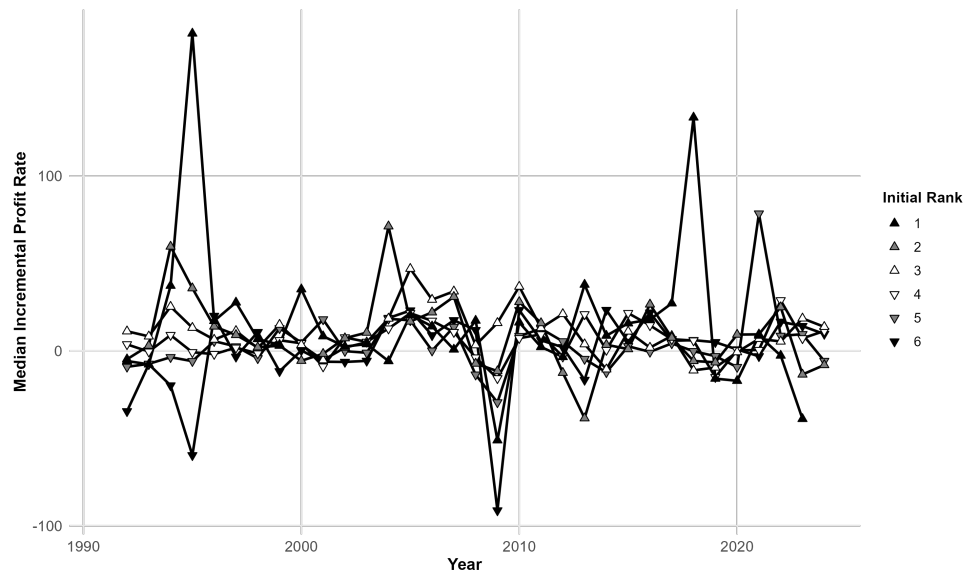


Note: The distribution of incremental profit rates in every year is indicated by a boxplot. The thick central line represents the median, the box the central 50 percent and the whiskers the central 80 percent of the distribution. The continuous line indicates the arithmetic mean of the distribution in every year.

Source: LSEG 2026b; Destatis 2026a, own calculations

The ranks of firms in the distribution of incremental profit rates show little up to no visible persistence. Figure 6.2 displays the median profit rates over time for all sextiles of the initial distribution of incremental profit rates. Firms are assigned to the sextiles following to their mean incremental profit rate in the initial 4 years (1992 to 1995). The medians often overlap indicating that firms do not maintain their initial rank in the distribution in later years.

Figure 6.2: Evolution of Median Incremental Profit Rates by Initial Rank

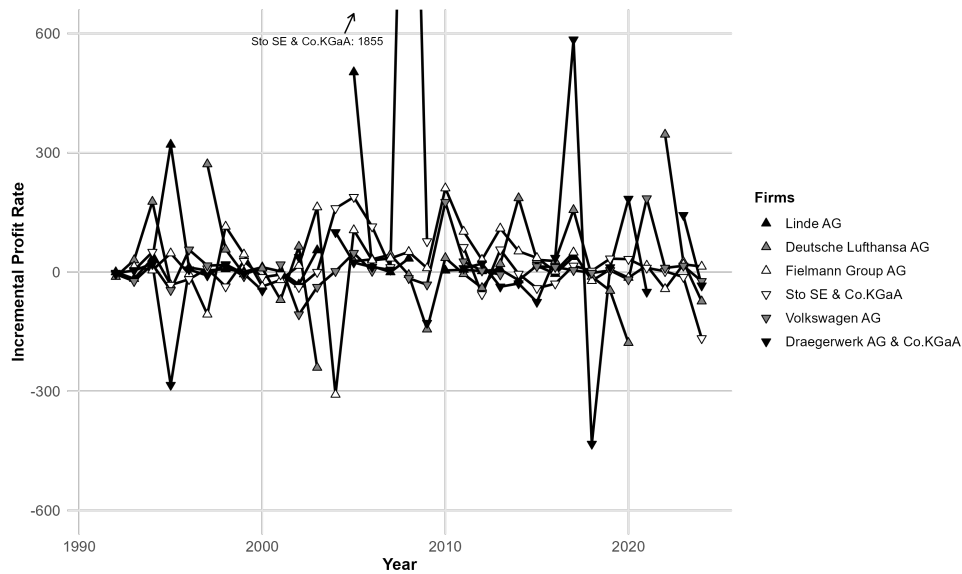


Note: The figure displays the evolution of median incremental profit rates for sextiles of the incremental profit rate distribution in the initial years. Firms are assigned to groups following their mean incremental profit rate in the years 1992-1995.

Source: LSEG 2026b; Destatis 2026a, own calculations

Plotting the evolution of incremental profit rates for single firms (table 6.3) illustrates, that the high volatility and frequent overlapping of incremental profit rates is also reflected at the level of individual firms. The selected six firms represent for every group in figure 6.2 the firm with the most annual observations, whose mean profit rate in the initial four years is closest to the group median.

Figure 6.3: Evolution of Incremental Profit Rates for Selected Firms



Source: LSEG 2026b; Destatis 2026a, own calculations

Estimates of the total autoregressive effect of incremental profit rates up until the 30th period across all observed firms (table 6.1) indicate no significant economy-wide autocorrelation. After seven and 19 years the autoregressive effect becomes significantly positive at a very small level. These effects might, however, also be caused by autocorrelation of some large outliers (see table 4.2).

Between different groups of firms, however, differences in incremental profit rates appear to persist in the long-run. Table 5.2 displays the results from separate AR(1) models for six groups of firms according to their initial rank in the distribution of incremental profit rates. Firms with higher initial incremental profit rates tend to have higher projected incremental profit rates in the long-run. In the short run, incremental profit rates show little persistence pointing to high volatility.

Table 6.1: Autoregression (Orders 1-30) Results for Incremental Profit Rates

Regressor	α	λ	Obs.	Adj. R^2
$\dot{\rho}_{i,t-1}$	-0.665 (3.122)	-0.002 (0.013)	5766	0.000
$\dot{\rho}_{i,t-2}$	1.833 (3.150)	-0.006 (0.012)	5222	0.000
$\dot{\rho}_{i,t-3}$	-0.059 (3.322)	0.015 (0.013)	4813	0.000
$\dot{\rho}_{i,t-4}$	2.478 (3.341)	0.003 (0.014)	4477	0.000
$\dot{\rho}_{i,t-5}$	3.832 (3.556)	-0.009 (0.015)	4083	0.000
$\dot{\rho}_{i,t-6}$	0.161 (3.667)	-0.002 (0.014)	3768	0.000
$\dot{\rho}_{i,t-7}$	0.796 (3.988)	0.032 (0.016)*	3476	0.001
$\dot{\rho}_{i,t-8}$	4.377 (3.989)	0.017 (0.016)	3192	0.000
$\dot{\rho}_{i,t-9}$	4.971 (4.039)	-0.030 (0.016).	2877	0.001
$\dot{\rho}_{i,t-10}$	8.622 (4.354)*	-0.010 (0.018)	2635	0.000
$\dot{\rho}_{i,t-11}$	7.143 (4.272).	-0.026 (0.018)	2492	0.000
$\dot{\rho}_{i,t-12}$	2.635 (4.952)	0.018 (0.022)	2253	0.000
$\dot{\rho}_{i,t-13}$	11.152 (4.686)*	-0.030 (0.020)	2043	0.001
$\dot{\rho}_{i,t-14}$	8.638 (5.063).	0.032 (0.021)	1876	0.001
$\dot{\rho}_{i,t-15}$	12.847 (5.116)*	0.039 (0.023).	1717	0.001
$\dot{\rho}_{i,t-16}$	5.032 (4.954)	-0.023 (0.021)	1586	0.000
$\dot{\rho}_{i,t-17}$	4.903 (4.499)	0.018 (0.020)	1396	0.000
$\dot{\rho}_{i,t-18}$	5.441 (5.413)	-0.038 (0.026)	1236	0.001
$\dot{\rho}_{i,t-19}$	10.557 (5.542).	0.085 (0.026)**	1119	0.009
$\dot{\rho}_{i,t-20}$	3.809 (6.241)	0.023 (0.023)	992	0.000
$\dot{\rho}_{i,t-21}$	13.676 (5.617)*	0.005 (0.024)	885	-0.001
$\dot{\rho}_{i,t-22}$	5.446 (6.853)	-0.022 (0.030)	763	-0.001
$\dot{\rho}_{i,t-23}$	2.154 (7.133)	0.002 (0.035)	657	-0.002
$\dot{\rho}_{i,t-24}$	3.246 (7.636)	0.030 (0.031)	545	0.000
$\dot{\rho}_{i,t-25}$	1.052 (8.234)	-0.061 (0.042)	423	0.003
$\dot{\rho}_{i,t-26}$	6.586 (9.430)	0.044 (0.052)	338	-0.001
$\dot{\rho}_{i,t-27}$	6.428 (9.989)	-0.005 (0.073)	282	-0.004
$\dot{\rho}_{i,t-28}$	6.823 (13.723)	0.009 (0.115)	216	-0.005
$\dot{\rho}_{i,t-29}$	13.471 (17.095)	0.053 (0.146)	160	-0.005
$\dot{\rho}_{i,t-30}$	31.951 (18.302).	0.348 (0.189).	126	0.019

Note: Each row displays estimated parameters from a separate AR(n) model of time-demeaned incremental profit rates across all firms. λ indicates the average total autoregressive effect after n years, estimated by bivariate OLS regression of $\dot{\rho}_{i,t}$ on $\dot{\rho}_{i,t-n}$. α denotes the average technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). The deviation of incremental profit rates from the mean shows little autocorrelation.

Source: LSEG 2026b; Destatis 2026a, own calculations

Table 6.2: Autoregression (Orders 1) Results for Incremental Profit Rates, by Initial Rank

Initial Rank	μ	λ	$\dot{\rho}^*$	Obs.	Adj. R^2
1	35.310 (17.422)*	-0.129 (0.070).	31.278 (15.152)*	149	0.016
2	-3.455 (6.522)	0.018 (0.041)	-3.520 (6.650)	270	-0.003
3	13.264 (6.166)*	-0.092 (0.070)	12.146 (5.586)*	295	0.002
4	0.922 (8.103)	0.112 (0.054)*	1.039 (9.123)	411	0.008
5	-13.179 (8.475)	0.024 (0.050)	-13.504 (8.659)	421	-0.002
6	-21.919 (11.264).	-0.017 (0.070)	-21.556 (11.075).	287	-0.003

Note: Each row displays estimated parameters from a separate AR(1) model of time-demeaned incremental profit rates. The model is estimated for every sextile of the initial distribution of incremental profit rate. Firms are assigned to groups following their mean incremental profit rate in the years 1992-1995. λ denotes the group-specific AR(1) coefficient, indicating short-run persistence of incremental profit rates. $\dot{\rho}^*$ indicates the projected group-specific long-run differential of incremental profit rates to the economy-wide mean incremental profit rate. μ denotes the group-specific technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). Firms with higher initial incremental profit rate tend to have higher projected incremental profit rates in the long-run. In the short run incremental profit rates show little persistence, pointing to high volatility.

Source: LSEG 2026b; Destatis 2026a, own calculations

6.2 Influence of Firm Size and Economic Sector on Incremental Profit Persistence

Firm Size

To test whether differences in incremental profit rates can be related to firm size, separate AR(1)-models for different percentile groups of the firm size distribution are estimated 6.3. The short-run persistence parameter for incremental profit rates remains insignificant for most groups of firm size. For the 50th to 79th percentile, the autoregressive term shows a significant positive coefficient of 0.05. No size group shows significant long-run persistence parameter at a five-percent threshold. Testing for the effect of firm size as linear and quadratic term as well as including an interaction term with the autoregressive effect shows no significant effects either (table 24 in appendix 3.4). Therefore, a firm's average net sales seem unable to

explain the long-run differences of incremental profit rates between firms.

Table 6.3: Autoregression (Order 1) Results for Incremental Profit Rates, by Percentiles of Firm Size

Perc.	μ	λ	$\dot{\rho}^*$	Obs.	Adj. R^2
100	-18.192 (9.972).	-0.080 (0.105)	-16.844 (9.286).	125	-0.003
96-99	-0.165 (7.039)	0.062 (0.043)	-0.176 (7.508)	429	0.003
91-95	4.443 (8.573)	-0.083 (0.046).	4.104 (7.896)	417	0.005
81-90	6.014 (5.933)	0.065 (0.038).	6.433 (6.325)	1032	0.002
51-80	3.896 (4.684)	0.048 (0.023)*	4.092 (4.913)	1988	0.002
1-50	-10.974 (7.485)	-0.030 (0.022)	-10.658 (7.272)	1775	0.000

Note: Each row displays estimated parameters from a separate AR(1)-model of time-demeaned incremental profit rates. The model is estimated for different percentiles (perc.) of the distribution of firm size, measured by a firm's average net sales (price-adjusted) over all years observed. λ denotes the group-specific AR(1) coefficient, indicating short-run persistence of incremental profit rates. $\dot{\rho}^*$ indicates the projected group-specific long-run differential of incremental profit rates to the economy-wide mean incremental profit rate. μ denotes the group-specific technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). In no group of firm size incremental profit rates show significant persistence in the long run. Significant short-run persistence of incremental profit rates is found for only the 51st to 80th percentile of firm size, and even then at a very low level.

Source: LSEG 2026b; Destatis 2026a, own calculations

Economic Sector

The broad economic sector (indicated by the SIC-division) of a firm's primary field of operations also seems unable to explain the long-run differences in incremental profit rates between firms (table 6.4). For none of the eight sectors in the sample a significant average AR(1) effect or a significant long-run differential of incremental profit rates is found (table 6.4).

Table 6.4: Autoregression (Order 1) Results for Incremental Profit Rates, by Economic Sector

Sector	μ	λ	$\dot{\rho}^*$	Obs.	Adj. R^2
Agriculture ¹	60.869 (34.035).	0.008 (0.086)	61.378 (33.235).	54	-0.019
Mining	84.634 (44.387).	-0.087 (0.136)	77.877 (40.728).	55	-0.011
Construction	-19.250 (12.690)	0.008 (0.044)	-19.399 (12.841)	110	-0.009
Manufacturing	-1.134 (3.720)	-0.024 (0.019)	-1.108 (3.635)	3108	0.000
TransComm ²	-9.245 (9.486)	0.067 (0.040).	-9.912 (10.177)	492	0.004
Retail	-5.703 (11.777)	-0.083 (0.060)	-5.264 (10.862)	223	0.004
Wholesale	20.184 (13.345)	-0.016 (0.054)	19.876 (13.044)	241	-0.004
Services	-3.077 (7.986)	0.006 (0.025)	-3.097 (8.039)	1483	-0.001

Note: Each row displays estimated parameters from a separate AR(1)-model of time-demeaned incremental profit rates. The model is estimated by economic sector, indicated by the SIC-division of a firm's primary field of operations. λ denotes the sector-specific AR(1) coefficient, indicating short-run persistence of incremental profit rates. $\dot{\rho}^*$ indicates the projected sector-specific long-run differential of incremental profit rates to the economy-wide mean incremental profit rate. μ denotes the sector-specific technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. p<0.1, * p<0.05, ** p<0.01, *** p<0.001). In no sector the incremental profit rates of firms show significant persistence neither in the short run nor in the long run.

¹ Agriculture, Forestry and Fishing

² Transportation, Communication, Electric, Gas and Sanitary Service

Source: LSEG 2026b; Destatis 2026a, own calculations

7 Discussion

In summary, the results (chapters 5 and 6) disfavour perfect competition theory and partially lend support to real competition theory and partially to monopoly capitalism theory. To be able to judge between real competition and monopoly capitalism theory, methodical refinements to the indicator of profit rates on newest capital seem necessary.

Differences in profit rates between firms are found to be highly persistent (section 5.1), in line with the existing literature (Schohl 1990: 391, 396; Hirsch 2018: 27–29; Eklund and Lappi 2019: 331–335)). The magnitude of the average first-order autoregressive effect of 0.62 is in line with the AR(1) effects found in the literature, but rather on the high end (Hirsch 2018: 27–29; Eklund and Lappi 2019: 331–335). Until the 24th year, profit rate deviations from the economy-wide mean appear to have a positive autoregressive effect on the current profit rate, statistically significant at a five-percent-threshold. Likely, the AR coefficients received in this thesis via OLS regression are upward-biased due to the presence of direct firm effects on profit rates. Yet, they indicate that on average profit rates take over two decades to return to the economy-wide mean profit rate. Firms are able to maintain their rank in the distribution of profit rates results (table 5.2), mirroring Schohl’s (1990: 391, 396) findings for Germany in the period 1961 to 1984. The found persistence of profit rates in the short and long run is contrary to the perfect competition hypothesis of profit rate equalization (Jehle and Reny 2011: 168) and supportive of the real competition (Shaikh 2016: 262–264) and monopoly capitalism (Sweezy 1956: 273–274) hypotheses of persistent differences in profit rates.

Contrary to both perfect competition (Jehle and Reny 2011: 168) and real competition theory (Shaikh 2016: 290–295) and in line with monopoly capitalism theory (Sweezy 1956: 273–274), firm size is found to positively affect profit persistence (section 5.2). The effect partially reverts its direction with increasing firm size. For the largest percent of firms a slight decrease in the projected long-run profit rate is found, albeit to a level, which is still above the projected long-run profit rate of the smallest 90 percent of firms in the sample. Alternatively including firm size as linear and quadratic term (table 23 in appendix 3.4) confirm a generally positive yet reverting effect of firm size on profits. Given that the sample represents only listed and de-listed firms, which tend to be large, the effect reversion concerns only a very small subgroup of firms and is potentially not indicative of a general trend. The largest percent in the present sample comprises only eight firms (BMW AG,

Deutsche Post AG, Deutsche Telekom AG, E.ON SE, Mercedes-Benz Group AG, Siemens AG, Volkswagen AG and Uniper SE), which might share characteristics other than firm size causing the effect reversion. The positive effect of firm size on projected long-run profit rates is robust to the alternative measurement of firm size as average operating capital in all periods observed (see appendix 3.3). Here for the top five percent of firms, projected long-run profit rates decline again, yet remain above the long-run profit rates of the lower 80 percent of firms. The found positive relation is contrary to many studies finding a negative relation of firm size and profit rates (e.g. Dhawan 2001). Several studies, however, do find positive relationship of profit rates and firm size (Comanor and Wilson 1969; Doğan 2013; Nanda and Panda 2018). The present results for German firms after 1990 rather support the monopoly capitalism claim that larger firms face less competitive downward-pressure on prices than the real competition claim that they are subject to intensified price-cutting. The slight reversion of the size effect at the very top of the firm size distribution might yet indicate a partial intensification of competition for the largest firms.

High short-run profit persistence in all sectors but agriculture and construction and significant long-run differentials in most sectors (section 5.2) further question perfect competition theory (Jehle and Reny 2011: 168). Long-run profit rates are projected to be above the economy-wide mean for firms in the retail, agriculture, construction and manufacturing sector and below the economy-wide average for service sector firms. The sector differences seem unrelated to indicators of capital intensity or average size (see table 5 in appendix 2.1), as expected in both real competition and monopoly capitalism theory, albeit negatively in the former and positively in the latter (Sweezy 1956: 273–274; Shaikh 2016: 290–295). The informative value of these average sector conditions of production is very limited, as they might average out and not be reflective of individual firms’ production conditions, particularly in light of such broad sector definitions (Mueller 1977: 369–70). Yet these differences might point to differential production conditions unrelated to firm size, emphasized in real competition theory (Shaikh 2016: 266–268).

For profit rates on newest capital, estimated by the incremental profit rate, the ratio of current profit change to previous periods investment, little persistence is found, mirroring industry-level estimates for Germany from 1971 to 1991 (Vaona 2011: 497) and estimates worldwide (Bahçe and Eres 2013: 213–214; Tsoulfidis and Tsaliki 2019: 260–279; Lafalla 2024: 314–315). Insignificant autoregressive coefficients in almost all specifications (section 6) suggest that incremental profit rates experience little short-run persistence but instead high volatility. While firms

with initially higher incremental profit rates also show higher long-run projections in incremental profit rates (table 6.2), these differences become insignificant if the effect of acquisitions is controlled for (table 16 in appendix 3.2). Acquisitions of other firms cause the acquired firm, and its profit and capital, to be included in the new parent company's consolidated financial statements in the year of the acquisition (Vernimmen et al. 2018: 819–822; LSEG 2024: 33). The resulting change in the parent company's capital and profit cannot be captured in the measure of incremental profit rates applied in this thesis, which assumes a one-year lag between investment and the resulting profit change. Rather, the profit change attributable to the business operations of the acquired firm should positively bias the incremental profit rate in the year of the acquisition. The capital change caused by the acquisition should negatively bias the incremental profit rate in the subsequent year. The disappearance of significant long-run incremental profit persistence in AR models, where observations in and after years with acquisitions are excluded, indicates that incremental profit persistence in the main models is likely inflated by a measurement bias due to acquisitions. This finding underlines the need for a more flexible measure of incremental profit rates, which accounts for different payback periods of different types of investment. No significant effects of firm size or economic sector on the long-run projections or short-term persistence of incremental profit rates are found (section 6.2). The size effect does not change, when firm size is measured by average operating capital (appendix 3.3).

The difference in persistence between incremental profit rates and profit rates seems robust to the different samples available for incremental profit rates and profit rates resulting from the calculation of the variables. Re-estimating all autoregressive models of profit rates on a reduced sample of only firm-year combinations for which also incremental profit rates are observed (appendix 3.6) yields similar results as the autoregressive models on the full sample of profit rates. Calculating operating capital with gross intangible assets minus gross goodwill, as the more appropriate measure of productive capacity, instead of their more widely available net equivalents used in the main models, produces estimates similar to the main models (appendix 3.5). The results for the gross measures are however confined to the years from 2006 onwards, when measures of gross intangibles and gross goodwill become generally available in the *Worldscope* data base. The results for both profit rates and incremental profit rates are robust to different accounting systems. Estimating the AR models separately for subsamples of the two dominant accounting systems in the sample, IFRS and HGB, gives similar results for both samples (appendix 3.1). Regarding the

handling of outliers, winsorizing the data symmetrically at one percent produces in all specifications similar results (appendix 3.7) to the main models, in which outliers are trimmed symmetrically at one percent. A potential limitation of the findings is the presence of unit root or explosive processes. Long-run persistence estimates can only be derived, when the AR coefficient does not exceed an absolute value of one, as this would cause the long-run persistence parameter to be not defined for $\lambda = 1$ or lead to explosive dynamics for $|\lambda| > 1$ (Gschwandtner 2005: 795). In most models, short-run persistence parameter are found to not exceed 0.65, and have very small standard deviations. These effect size is line with the effect size found in the literature Hirsch 2018: 27–29; Eklund and Lappi 2019: 331–335 and far from the threshold of one. However, formal testing for unit root processes might re-assure the validity of the found long-run persistence parameters.

The high persistence of profit rates and absence of persistence of incremental profit rates, after controlling for acquisitions, supports the real competition hypothesis, that competition equalizes only the latter (Shaikh 2016: 262–270). Yet, the selective scope of the indicator of incremental profit rates challenges the interpretation of their equalization as evidence against market power of German firms. A proper measure of profit rates on newest capital needs to account for variation in the payout periods between different types of investment. The present indicator captures only profit rates on those investments which start to yield profits exactly in the next accounting year.¹ Table 40 in appendix 3.8 shows the results from bivariate OLS regressions of current operating profit change on investment in operating capital with lags ranging from 0 to 30 years. Profit change is considerably positively correlated with investment in all of the previous eight years as well as in the current year. In these nine years the correlation after one year is the smallest. This suggests that a considerable part of the profit change caused by investment is not captured in the measure of incremental profit rates applied in this and most other studies.

Given this limitation, the interpretation of the correlation of long-run profit rates and firm size as indication of monopoly power becomes more plausible. The monopoly explanation is further supported by the upward trend of profit rates for the largest 50 percent of firms (figure 3 in appendix 2.1). In real competition theory the persistence of profit rates above the economy-wide average might be explained by non-reproducible superior conditions of production for some firms (Shaikh 2016: 266–

¹To be measured correctly, investments would need to start yielding profits exactly at the beginning of the next accounting year. While this kind of imprecision always remains, when working with accounting data, it may be reduced by using quarterly data for assessing the payout periods of investments.

268). However, as this superior profit persistence is positively correlated with firm size, it appears to represent one common condition to large firms, which might be the superior ability to charge monopoly rents. It cannot be ruled out, that the found correlation reflects the reverse causality, namely that more profitable firms invest and grow more (Cowling 2004: 3). Subsequent research should address this possibility.

8 Conclusion

The autoregression analysis in the present thesis reveals considerable short-run and long-run persistence of profit rates and little persistence of incremental profit rates among German non-financial listed firms in the period 1991 to 2024 using Worldscope (LSEG 2026b) financial data. These results disfavour perfect competition theory (Jehle and Reny 2011: 168) and lend support to real competition theory (Shaikh 2016: 262–264). Projected long-run profit rates are positively related to firm size, contrary to real competition theory (Shaikh 2016: 290–295) and in line with monopoly capitalism theory (Sweezy 1956: 273–274). Better estimates of the profit rate on newest investment than the applied common measure of the incremental profit rate seem necessary to make a clear empirical distinction between real competition and monopoly capitalism theory. A more appropriate metric should capture the profit effect of investment over more than just the next period.

For profit rates an average first-order autoregressive effect of 0.622 is found. In later years the AR effect slowly decreases until it becomes insignificant after the 24th year, indicating a high persistence of profit rate differentials to the economy-wide mean. In separate AR(1) regressions for six groups of firms according to their initial rank in the profit rate distribution, firms with initially higher profit rates show higher projected profit rates also in the long run. Larger firms, indicated by average net sales over all periods observed, show higher long-run profit rate differentials in separate AR(1) models for six groups of firm size. For the largest percentile the long-run profit rate differential slightly decreases again. The short-run persistence of profit rates is rather similar for firms of all size group. Effects are very similar, when measuring size by a firm's average operating capital over the sample period, with the exception that a reversion of the size effect on long-run profits is found for the largest five percent of firms. Alternatively including firm size as linear and quadratic term in the AR(1) function confirms the results. Significant differences are also found between economic sectors. Long-run profit rates are projected to be above the economy-wide mean for firms in the retail, agriculture, construction and manufacturing sector, and below the economy mean for service sector firms. The differences seem unrelated to average operating capital, net sales or capital intensity per sector, as indicators of average size requirements of production.

For profit rates on newest capital no indications of persistent differences are found. In almost all models both short-run persistence parameters and long-run differentials to the economy-wide mean are insignificant. Initially higher ranked groups show

higher significant long-run profit rate differentials. Yet, the differentials become insignificant if excluding all observations in years, in which the respective firm conducted an acquisition or conducted one in the previous year. This indicates that the simultaneous profit change and investment resulting from an acquisition (Vernimmen et al. 2018: 819–822) biases the metric of the incremental profit rate, which by construction sets profit change in relation to last period’s investment. The results are robust to different accounting systems and different treatments of outliers. The persistence of profit rates is nearly unchanged on the reduced sample available for incremental profit rates resulting from the calculation of the variables.

The high persistence of firms’ profit rates strongly disfavour perfect competition theory, which predicts equalization of all profit rates (Jehle and Reny 2011: 168). Matters are less clear between real competition and monopoly capitalism theory. The found equalization of incremental profit rates, after controlling for acquisitions, supports the claim from real competition theory, that only the later is equalized by competition (Shaikh 2016: 262–270) and disfavours the monopoly capitalism hypothesis of general persistence. The overall positive correlation of firm size and long-run profits, however, supports the monopoly capitalism hypothesis of a positive size effect due to market power (Sweezy 1956: 273–274). Real competition, which is expected to imply smaller profit rates for larger firm due to their more aggressive price-cutting (Shaikh 2016: 290–295), can barely explain this pattern.

The findings relate to recent debates on declined business dynamism and increased market power of German firms. Competition among German firms after 1990 seems to be at least as little perfect as before 1990. Firms maintain highly different rates of return on their invested capital. There is indication, that highly profitable firms are nonetheless not isolated from competition. Also they appear to cut prices at the detriment of profits. This reflects the inability of any group of firms to maintain above-average profit rates on newest investments. This interpretation is challenged by the difficulty to attribute profit change to particular investments and the likely omitting of considerable parts of the resulting profit changes. There are also hints on monopoly rents of large firms across the economy. These should be further observed, given the potentially detrimental effect of investment, growth and economic dynamism.

Future research should address the methodical short-comings in measuring incremental profit rates at the firm-level. A proper measure of profit rates on newest investments needs to account for variation in the payout periods between different types of investment. Assuming per default a one-year lag, as the commonly used

measure of incremental profit rate does (Bahçe and Eres 2013: 208; Tsoulfidis and Tsaliki 2019: 233; Lafalla 2024: 311), is likely a too strong generalisation. When correctly measured, yet, equalization in the profit rate on newest investment seems to be a promising indicator of real competition and its absence of monopoly capitalism. Also, the observed positive correlation of firm size and profit rates among German firms should be validated and the direction of causality clarified in further research. Particularly, the possibility that more profitable firms invest and grow more (Cowling 2004: 3) should be accounted for. When, however, larger firm size is found to cause higher profit rates persistently above the norm, it may indicate a spread of monopoly.

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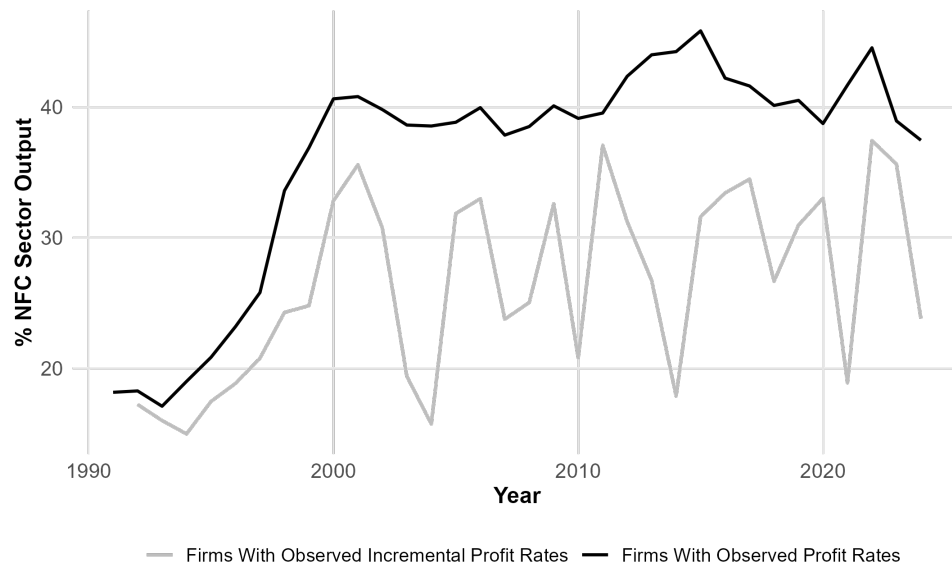
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Appendix

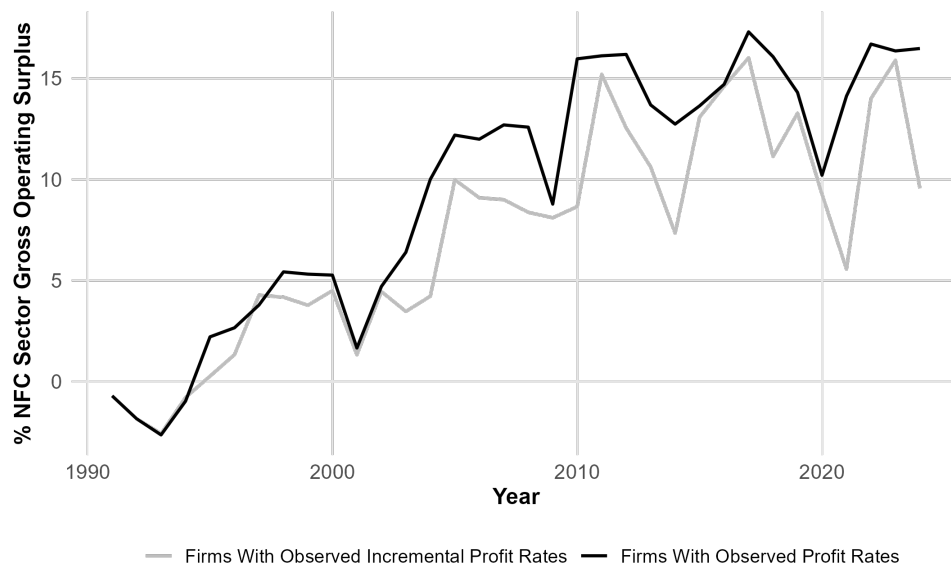
1 Observations

Figure 1: Share of Firms' Aggregate Net Sales in Total Output of the German Non-Financial Corporate Sector



Note: The figure displays the shares of aggregate nominal net sales of firms with observed profit rates and firms with observed incremental profit rates in total nominal output of the German non-financial corporate (NFC) sector. *Source:* LSEG 2026b; Destatis 2026a; Destatis 2026c, own calculations

Figure 2: Share of Firms' Aggregate Operating Profits in Total Operating Surplus of the German Non-Financial Corporate Sector



Note: The figure displays the shares of aggregate nominal gross operating profit of firms with observed profit rates and firms with observed incremental profit rates in total gross operating surplus of the German non-financial corporate (NFC) sector. Gross operating surplus is calculated by the sum of net operating surplus and consumption of fixed capital. *Source:* LSEG 2026b; Destatis 2026a; Destatis 2026c, own calculations

Table 1: Number of Observations of Profit Rates per Year, After Every Step of Data-Filtering

Year	Non-FIRE	Consolidated	Non-Subsidiaries	Positive Operating Capital	Trimmed (Final)
1991	167	128	126	126	126
1992	182	138	136	136	136
1993	204	151	148	148	148
1994	213	162	159	159	159
1995	222	175	172	170	170
1996	336	243	239	235	224
1997	441	328	320	316	297
1998	499	382	373	366	348
1999	494	388	379	373	361
2000	532	446	436	434	426
2001	527	453	443	439	430
2002	551	472	462	461	456
2003	575	492	481	478	472
2004	605	517	505	500	498
2005	629	545	531	525	522
2006	640	558	546	541	537
2007	635	562	553	548	540
2008	618	551	542	538	533
2009	609	545	536	529	521
2010	597	534	526	518	508
2011	585	525	517	509	502
2012	568	548	540	527	516
2013	559	549	541	521	510
2014	555	548	541	513	502
2015	543	537	529	505	489
2016	541	535	526	494	483
2017	536	530	521	495	481
2018	541	536	525	496	482
2019	530	524	511	487	479
2020	530	523	508	484	472
2021	512	506	491	465	454
2022	508	502	486	464	454
2023	492	486	470	448	434
2024	455	450	435	414	405
Total	16731	15069	14754	14362	14075

Note: Observations of profit rates calculated from price-adjusted variables.

Source: LSEG 2026b; Destatis 2026a, own calculations

Table 2: Number of Observations of Incremental Profit Rates per Year, After Every Step of Data-Filtering

Year	Non-FIRE	Consolidated	Non-Subsidiaries	Positive Δ Operating Capital	Trimmed (Final)
1991	0	0	0	0	0
1992	167	114	112	102	102
1993	181	124	122	101	100
1994	204	138	136	99	98
1995	212	148	145	112	111
1996	221	157	154	125	125
1997	334	172	169	127	126
1998	440	239	235	180	178
1999	473	305	297	222	212
2000	481	363	355	275	264
2001	505	373	365	281	278
2002	505	415	405	273	266
2003	539	425	415	241	239
2004	566	450	440	198	195
2005	597	481	470	269	260
2006	617	500	490	347	340
2007	616	513	504	350	345
2008	604	516	507	387	380
2009	593	515	506	348	340
2010	586	503	495	224	217
2011	576	509	501	349	341
2012	552	504	496	355	350
2013	536	484	476	289	284
2014	527	505	498	275	271
2015	532	507	500	308	303
2016	525	513	506	330	318
2017	523	505	497	317	306
2018	525	509	501	318	315
2019	523	502	494	342	334
2020	515	501	490	355	350
2021	505	483	470	241	235
2022	500	492	477	346	341
2023	484	474	459	347	342
2024	454	443	428	255	249
Total	15718	13382	13115	8688	8515

Note: Observations of incremental profit rates calculated from price-adjusted variables

Source: LSEG 2026b; Destatis 2026a, own calculations

Table 3: Number of Panel Observations per Firm

Observations per Firm	Number of Firms	
	Profit Rate	Incremental Profit Rate
1-5	139	266
6-10	156	208
11-20	278	251
21-30	213	93
31-34	83	5
Total	869	823
<i>Mean Observations:</i>	16.18	9.79
<i>Median Observations:</i>	15	8

Note: Observations of (incremental) profit rates calculated from price-adjusted variables

Source: LSEG 2026b; Destatis 2026a, own calculations

Table 4: Number of Observations per Economic Sector

SIC-Code	SIC-Division	Observations	
		Profit Rate	Incremental Profit Rate
A	Agriculture, Forestry and Fishing	84	66
B	Mining	116	78
C	Construction	284	168
D	Manufacturing	7120	4472
E	Transportation, Communications, Electric, Gas and Sanitary Services	1083	694
F	Wholesale Trade	660	373
G	Retail Trade	552	330
I	Services	4176	2334

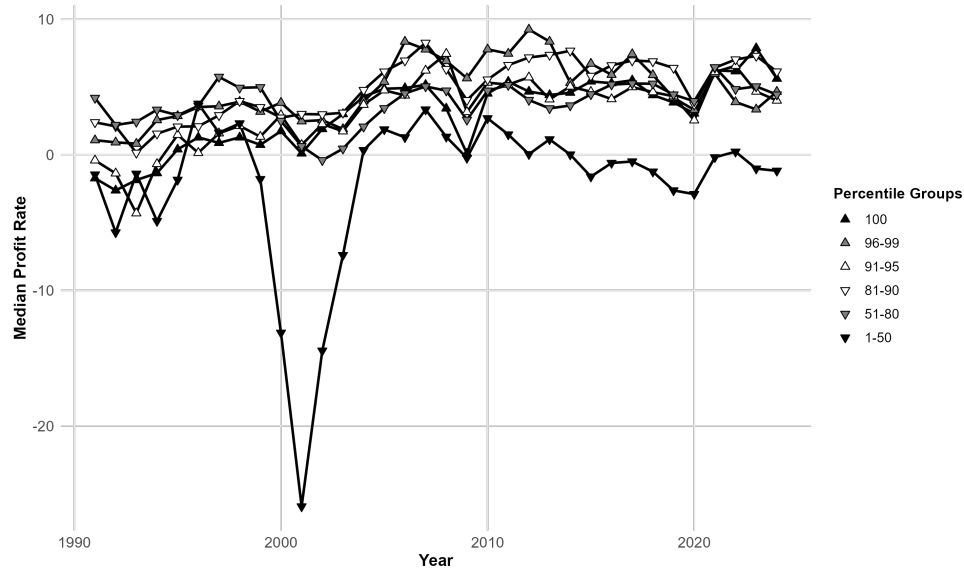
Note: Observations of (incremental) profit rates calculated from price-adjusted variables

Source: LSEG 2026b; Destatis 2026a, own calculations

2 Additional Distributions by Firm Size and Sector

2.1 Profit Rates and Incremental Profit Rates by Firm Size

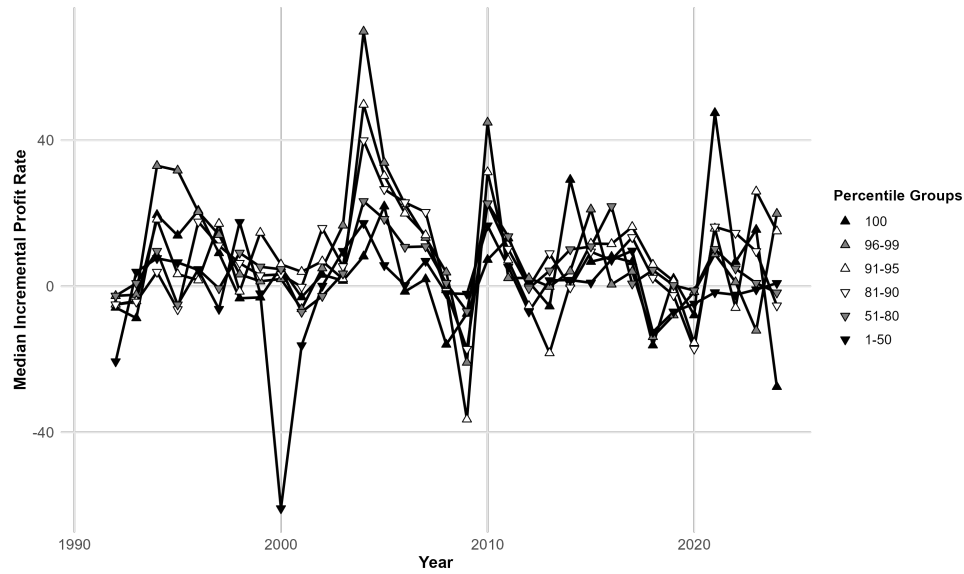
Figure 3: Evolution of Median Profit Rates by Percentiles of Firm Size



Note: The figure displays the evolution of median profit rates for six groups of firm size, defined by percentiles in the firm size distribution. Size is measured by a firm's mean net sales (price-adjusted) in the period 1991-2024.

Source: LSEG 2026b; Destatis 2026a, own calculations

Figure 4: Evolution of Median Incremental Profit Rates by Percentiles of Firm Size



Note: The figure displays the evolution of median incremental profit rates for six groups of firm size, defined by percentiles of the firm size distribution. Size is measured by a firm's mean net sales (price-adjusted) in the period 1991-2024.

Source: LSEG 2026b; Destatis 2026a, own calculations

2.2 Operating Capital, Net Sales and Capital Intensity per Economic Sector

Table 5: Average Operating Capital, Net Sales and Capital Intensity per Economic Sector

Sector	$\overline{OperatingCapital}$	$\overline{NetSales}$	Capital Intensity
Wholesale	2328.02	4769.92	0.49
Retail	3718.53	4866.30	0.76
Construction	1196.65	1524.01	0.79
Services	519.40	621.10	0.84
Agriculture ¹	405.46	331.47	1.22
Manufacturing	4679.55	3849.83	1.22
TransComm ²	14640.74	9787.12	1.50
Mining	26484.02	12119.91	2.19

Note: $\overline{OperatingCapital}$ and $\overline{NetSales}$ denote average values in million euros (price-adjusted). Capital intensity indicates the ratio of $\overline{OperatingCapital}$ to $\overline{NetSales}$.

¹ Agriculture, Forestry and Fishing

² Transportation, Communication, Electric, Gas and Sanitary Services

Source: LSEG 2026b; Destatis 2026a, own calculations

3 Robustness Checks

3.1 Accounting System

Table 6 shows the distribution of observations by applied accounting system. To assess the influence of different accounting systems on the estimates of profit persistence the main AR models are re-estimated separately for firms that apply International Financial Reporting Standards (IFRS) and for firms that report in accordance with German local accounting standards, defined by the German Commercial Code (Handelsgesetzbuch (HGB)). These are the two dominant accounting systems applied by the firms in the sample. For the subsample of HGB standards all observations of firms, that use "local standards" as main accounting framework, are selected, including firms, that additionally apply some international guidelines.

Table 6: Number of Observations per Accounting System

Accounting System	Observations	
	Profit Rate	Incremental Profit Rate
IFRS	8232	5337
International standards	346	235
International standards and some EEC guidelines	28	16
Local standards	2314	1191
Local standards with EEC and IASC guidelines	19	18
Local standards with some EEC guidelines	2045	1254
Local standards with some IASC guidelines	1	0
US standards (GAAP)	499	284
US GAAP reclassified from local standards	5	2
Other	16	10
Not disclosed	1	0
NA	569	168

Note: Observations of (incremental) profit rates calculated from price-adjusted variables under different accounting systems. Deflators available for all years from 1991.

Source: LSEG 2026b; Destatis 2026a, own calculations

Table 7: Autoregression (Order 1-30) Results for Profit Rates, Only Firms Using IFRS

Regressor	α	λ	Obs.	Adj. R^2
$\dot{\pi}_{i,t-1}$	2.632 (0.650)***	0.763 (0.008)***	8026	0.544
$\dot{\pi}_{i,t-2}$	4.280 (0.764)***	0.629 (0.009)***	7830	0.369
$\dot{\pi}_{i,t-3}$	5.098 (0.839)***	0.530 (0.011)***	7612	0.247
$\dot{\pi}_{i,t-4}$	6.907 (0.862)***	0.403 (0.010)***	7374	0.168
$\dot{\pi}_{i,t-5}$	7.864 (0.882)***	0.336 (0.011)***	7117	0.122
$\dot{\pi}_{i,t-6}$	9.432 (0.904)***	0.242 (0.011)***	6828	0.066
$\dot{\pi}_{i,t-7}$	10.186 (0.942)***	0.210 (0.012)***	6513	0.047
$\dot{\pi}_{i,t-8}$	11.925 (0.937)***	0.138 (0.011)***	6182	0.024
$\dot{\pi}_{i,t-9}$	12.578 (0.953)***	0.141 (0.011)***	5820	0.026
$\dot{\pi}_{i,t-10}$	13.907 (0.950)***	0.117 (0.012)***	5457	0.017
$\dot{\pi}_{i,t-11}$	14.641 (0.973)***	0.133 (0.013)***	5108	0.021
$\dot{\pi}_{i,t-12}$	15.791 (0.983)***	0.116 (0.013)***	4759	0.017
$\dot{\pi}_{i,t-13}$	17.543 (0.895)***	0.089 (0.012)***	4409	0.012
$\dot{\pi}_{i,t-14}$	18.661 (0.864)***	0.070 (0.011)***	4053	0.009
$\dot{\pi}_{i,t-15}$	19.650 (0.892)***	0.054 (0.013)***	3685	0.004
$\dot{\pi}_{i,t-16}$	19.949 (0.922)***	0.095 (0.013)***	3325	0.015
$\dot{\pi}_{i,t-17}$	21.177 (0.891)***	0.061 (0.012)***	2990	0.008
$\dot{\pi}_{i,t-18}$	22.004 (0.960)***	0.033 (0.013)*	2672	0.002
$\dot{\pi}_{i,t-19}$	23.086 (0.797)***	0.027 (0.010)**	2368	0.002
$\dot{\pi}_{i,t-20}$	23.509 (0.863)***	0.024 (0.011)*	2085	0.002
$\dot{\pi}_{i,t-21}$	24.290 (0.859)***	0.005 (0.011)	1818	0.000
$\dot{\pi}_{i,t-22}$	24.643 (0.963)***	-0.005 (0.013)	1567	-0.001
$\dot{\pi}_{i,t-23}$	24.630 (0.973)***	0.002 (0.012)	1330	-0.001
$\dot{\pi}_{i,t-24}$	24.478 (1.090)***	0.008 (0.014)	1117	-0.001
$\dot{\pi}_{i,t-25}$	24.160 (1.302)***	0.008 (0.016)	917	-0.001
$\dot{\pi}_{i,t-26}$	25.298 (0.914)***	0.004 (0.010)	740	-0.001
$\dot{\pi}_{i,t-27}$	24.777 (1.133)***	0.003 (0.016)	578	-0.002
$\dot{\pi}_{i,t-28}$	23.006 (1.446)***	0.108 (0.111)	446	0.000
$\dot{\pi}_{i,t-29}$	21.402 (1.818)***	0.099 (0.147)	344	-0.002
$\dot{\pi}_{i,t-30}$	19.970 (2.321)***	0.099 (0.176)	263	-0.003

Note: Each row displays estimated parameters from a separate AR(n) model of time-demeaned profit rates across all firms. Observations are limited to firms reporting in accordance with IFRS. λ indicates the average total autoregressive effect after n years, estimated by bivariate OLS regression of $\dot{\pi}_{i,t}$ on $\dot{\pi}_{i,t-n}$. α denotes the average technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. p<0.1, * p<0.05, ** p<0.01, *** p<0.001). Additionally, the number of observations (Obs.) and adjusted R^2 (Adj. R^2), as measure of explained variance, are given for every model. Profit rate deviations from the mean show significant positive autocorrelation up until the 20th period.

Source: LSEG 2026b; Destatis 2026a, own calculations

Table 8: Autoregression (Order 1-30) Results for Profit Rates, Only Firms Using HGB Reporting Standards

Regressor	α	λ	Obs.	Adj. R^2
$\dot{\pi}_{i,t-1}$	-4.507 (1.750)*	0.550 (0.013)***	3942	0.304
$\dot{\pi}_{i,t-2}$	-4.366 (1.909)*	0.551 (0.016)***	3546	0.253
$\dot{\pi}_{i,t-3}$	-4.527 (2.139)*	0.476 (0.019)***	3168	0.162
$\dot{\pi}_{i,t-4}$	-3.855 (2.383)	0.399 (0.022)***	2797	0.106
$\dot{\pi}_{i,t-5}$	-3.369 (2.604)	0.375 (0.027)***	2429	0.075
$\dot{\pi}_{i,t-6}$	-2.879 (2.912)	0.422 (0.034)***	2092	0.069
$\dot{\pi}_{i,t-7}$	-2.522 (3.189)	0.329 (0.044)***	1787	0.030
$\dot{\pi}_{i,t-8}$	-2.170 (3.561)	0.253 (0.049)***	1520	0.016
$\dot{\pi}_{i,t-9}$	-3.794 (4.130)	0.242 (0.051)***	1289	0.016
$\dot{\pi}_{i,t-10}$	-3.468 (4.520)	0.274 (0.048)***	1080	0.028
$\dot{\pi}_{i,t-11}$	-5.206 (4.924)	0.267 (0.048)***	893	0.033
$\dot{\pi}_{i,t-12}$	-7.224 (5.554)	0.193 (0.059)**	743	0.013
$\dot{\pi}_{i,t-13}$	-10.075 (6.415)	0.057 (0.060)	607	0.000
$\dot{\pi}_{i,t-14}$	-10.533 (7.277)	-0.007 (0.079)	501	-0.002
$\dot{\pi}_{i,t-15}$	-9.904 (8.048)	0.015 (0.088)	434	-0.002
$\dot{\pi}_{i,t-16}$	-9.667 (8.409)	0.043 (0.088)	380	-0.002
$\dot{\pi}_{i,t-17}$	-12.001 (9.626)	0.088 (0.099)	329	-0.001
$\dot{\pi}_{i,t-18}$	-14.707 (10.861)	0.072 (0.106)	287	-0.002
$\dot{\pi}_{i,t-19}$	-18.828 (12.234)	0.330 (0.153)*	251	0.014
$\dot{\pi}_{i,t-20}$	-13.417 (11.932)	0.415 (0.137)**	215	0.036
$\dot{\pi}_{i,t-21}$	-11.006 (11.830)	0.382 (0.134)**	185	0.037
$\dot{\pi}_{i,t-22}$	-11.234 (13.121)	0.528 (0.140)***	156	0.079
$\dot{\pi}_{i,t-23}$	-3.617 (13.566)	0.257 (0.146).	131	0.016
$\dot{\pi}_{i,t-24}$	-19.452 (15.242)	1.347 (0.279)***	108	0.173
$\dot{\pi}_{i,t-25}$	18.643 (8.044)*	-0.388 (0.191)*	86	0.036
$\dot{\pi}_{i,t-26}$	19.334 (9.360)*	-0.509 (0.219)*	70	0.060
$\dot{\pi}_{i,t-27}$	20.908 (10.349)*	-1.248 (0.290)***	55	0.245
$\dot{\pi}_{i,t-28}$	19.024 (2.228)***	0.528 (0.176)**	41	0.166
$\dot{\pi}_{i,t-29}$	20.706 (2.140)***	1.153 (0.281)***	29	0.361
$\dot{\pi}_{i,t-30}$	19.549 (2.551)***	0.665 (0.293)*	20	0.179

Note: Each row displays estimated parameters from a separate AR(n) model of time-demeaned profit rates across all firms. Observations are limited to firms reporting in accordance with HGB standards. λ indicates the average total autoregressive effect after n years, estimated by bivariate OLS regression of $\dot{\pi}_{i,t}$ on $\dot{\pi}_{i,t-n}$. α denotes the average technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. p<0.1, * p<0.05, ** p<0.01, *** p<0.001). Additionally, the number of observations (Obs.) and adjusted R^2 (Adj. R^2), as measure of explained variance, are given for every model. Profit rate deviations from the mean show significant positive autocorrelation up until the 12th period and after the 19th period.

Source: LSEG 2026b; Destatis 2026a, own calculations

Table 9: Autoregression (Order 1) Results for Profit Rates, by Initial Rank, Only Firms Using IFRS

Initial Rank	μ	λ	$\hat{\pi}^*$	Obs.	Adj. R^2
1	3.256 (1.527)*	0.896 (0.030)***	31.274 (10.657)**	1235	0.416
2	15.716 (0.944)***	0.284 (0.033)***	21.962 (0.861)***	1430	0.049
3	7.584 (0.566)***	0.597 (0.020)***	18.814 (1.147)***	1265	0.422
4	3.790 (0.531)***	0.745 (0.028)***	14.850 (1.433)***	1301	0.359
5	8.561 (0.603)***	0.214 (0.014)***	10.893 (0.752)***	1031	0.183
6	-18.962 (4.687)***	0.566 (0.037)***	-43.709 (10.347)***	800	0.230

Note: Each row displays estimated parameters from a separate AR(1) model of time-demeaned profit rates. The model is estimated for every sextile of the initial years' profit rate distribution. Firms are assigned to groups following their mean profit rate in the years 2005-2008. Observations are limited to firms reporting in accordance with IFRS. λ denotes the group-specific AR(1) coefficient, indicating short-run persistence of profit rates. $\hat{\pi}^*$ indicates the projected group-specific long-run differential of profit rates to the economy-wide mean profit rate. μ denotes the group-specific technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). Firms with higher initial rank in the profit rate distribution show higher projected long-run profit rates. Firms across all initial ranks demonstrate considerable short-run persistence of profit rates.

Source: LSEG 2026b; Destatis 2026a, own calculations

Table 10: Autoregression (Order 1) Results for Profit Rates, by Initial Rank, Only Firms Using HGB Reporting Standards

Initial Rank	μ	λ	$\hat{\pi}^*$	Obs.	Adj. R^2
1	6.455 (1.526)***	0.674 (0.066)***	19.807 (2.168)***	180	0.366
2	5.421 (1.153)***	0.695 (0.060)***	17.752 (2.386)***	188	0.412
3	4.571 (0.761)***	0.690 (0.044)***	14.728 (1.723)***	289	0.465
4	6.153 (0.474)***	0.508 (0.006)***	12.509 (0.965)***	366	0.955
5	3.583 (0.636)***	0.724 (0.038)***	12.984 (2.264)***	352	0.514
6	3.958 (1.124)***	0.515 (0.043)***	8.168 (2.369)***	304	0.321

Note: Each row displays estimated parameters from a separate AR(1) model of time-demeaned profit rates. The model is estimated for every sextile of the initial years' profit rate distribution. Firms are assigned to groups following their mean profit rate in the years 1991-1994. Observations are limited to firms reporting in accordance with HGB Standards. λ denotes the group-specific AR(1) coefficient, indicating short-run persistence of profit rates. $\hat{\pi}^*$ indicates the projected group-specific long-run differential of profit rates to the economy-wide mean profit rate. μ denotes the group-specific technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). Firms with higher initial rank in the profit rate distribution show higher projected long-run profit rates. Firms across all initial ranks demonstrate considerable short-run persistence of profit rates.

Source: LSEG 2026b; Destatis 2026a, own calculations

Table 11: Autoregression (Orders 1-30) Results for Incremental Profit Rates, Only Firms Using IFRS

Regressor	α	λ	Obs.	Adj. R^2
$\dot{\rho}_{i,t-1}$	3.659 (3.565)	0.002 (0.016)	3780	0.000
$\dot{\rho}_{i,t-2}$	7.279 (3.685)*	0.011 (0.016)	3572	0.000
$\dot{\rho}_{i,t-3}$	6.020 (3.817)	0.008 (0.016)	3429	0.000
$\dot{\rho}_{i,t-4}$	8.799 (3.888)*	0.013 (0.017)	3309	0.000
$\dot{\rho}_{i,t-5}$	5.341 (4.021)	-0.003 (0.017)	3142	0.000
$\dot{\rho}_{i,t-6}$	2.956 (4.030)	0.002 (0.016)	2977	0.000
$\dot{\rho}_{i,t-7}$	2.792 (4.373)	0.048 (0.017)**	2815	0.002
$\dot{\rho}_{i,t-8}$	8.727 (4.460).	0.010 (0.019)	2637	0.000
$\dot{\rho}_{i,t-9}$	8.585 (4.419).	-0.039 (0.018)*	2467	0.001
$\dot{\rho}_{i,t-10}$	11.625 (4.589)*	-0.013 (0.020)	2311	0.000
$\dot{\rho}_{i,t-11}$	8.391 (4.395).	-0.009 (0.019)	2229	0.000
$\dot{\rho}_{i,t-12}$	3.136 (5.080)	0.024 (0.023)	2052	0.000
$\dot{\rho}_{i,t-13}$	9.755 (4.622)*	-0.023 (0.020)	1879	0.000
$\dot{\rho}_{i,t-14}$	9.466 (5.100).	0.050 (0.022)*	1723	0.002
$\dot{\rho}_{i,t-15}$	13.596 (5.246)**	0.055 (0.024)*	1590	0.003
$\dot{\rho}_{i,t-16}$	6.998 (4.924)	-0.025 (0.021)	1482	0.000
$\dot{\rho}_{i,t-17}$	4.427 (4.489)	0.020 (0.020)	1310	0.000
$\dot{\rho}_{i,t-18}$	7.528 (5.424)	0.009 (0.027)	1154	-0.001
$\dot{\rho}_{i,t-19}$	11.413 (5.743)*	0.087 (0.027)**	1048	0.009
$\dot{\rho}_{i,t-20}$	7.901 (6.140)	0.014 (0.024)	925	-0.001
$\dot{\rho}_{i,t-21}$	13.112 (5.751)*	0.002 (0.025)	826	-0.001
$\dot{\rho}_{i,t-22}$	6.867 (6.906)	-0.021 (0.030)	714	-0.001
$\dot{\rho}_{i,t-23}$	6.585 (6.886)	0.003 (0.035)	616	-0.002
$\dot{\rho}_{i,t-24}$	7.823 (7.227)	0.038 (0.031)	509	0.001
$\dot{\rho}_{i,t-25}$	3.951 (7.616)	-0.022 (0.039)	393	-0.002
$\dot{\rho}_{i,t-26}$	5.812 (9.634)	0.043 (0.051)	317	-0.001
$\dot{\rho}_{i,t-27}$	7.813 (9.975)	0.038 (0.106)	266	-0.003
$\dot{\rho}_{i,t-28}$	9.187 (13.852)	0.066 (0.124)	203	-0.004
$\dot{\rho}_{i,t-29}$	11.172 (17.893)	-0.021 (0.170)	150	-0.007
$\dot{\rho}_{i,t-30}$	28.908 (18.863)	0.334 (0.189).	118	0.018

Note: Each row displays estimated parameters from a separate AR(n) model of time-demeaned incremental profit rates across all firms. Observations are limited to firms reporting in accordance with IFRS. λ indicates the average total autoregressive effect after n years, estimated by bivariate OLS regression of $\dot{\rho}_{i,t}$ on $\dot{\rho}_{i,t-n}$. α denotes the average technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. p<0.1, * p<0.05, ** p<0.01, *** p<0.001). The deviation of incremental profit rates from the mean shows little autocorrelation.

Source: LSEG 2026b; Destatis 2026a, own calculations

Table 12: Autoregression (Orders 1-30) Results for Incremental Profit Rates, Only Firms Using HGB Reporting Standards

Regressor	α	λ	Obs.	Adj. R^2
$\dot{\rho}_{i,t-1}$	-16.387 (6.421)*	-0.002 (0.026)	1540	-0.001
$\dot{\rho}_{i,t-2}$	-12.786 (6.662).	-0.045 (0.023).	1328	0.002
$\dot{\rho}_{i,t-3}$	-20.320 (7.529)**	0.034 (0.027)	1152	0.000
$\dot{\rho}_{i,t-4}$	-18.690 (7.443)*	-0.017 (0.029)	982	-0.001
$\dot{\rho}_{i,t-5}$	-2.914 (8.694)	-0.037 (0.034)	792	0.000
$\dot{\rho}_{i,t-6}$	-14.155 (9.857)	-0.024 (0.036)	669	-0.001
$\dot{\rho}_{i,t-7}$	-9.801 (11.303)	-0.050 (0.045)	560	0.000
$\dot{\rho}_{i,t-8}$	-15.429 (10.128)	0.033 (0.032)	470	0.000
$\dot{\rho}_{i,t-9}$	-13.906 (11.524)	-0.003 (0.036)	347	-0.003
$\dot{\rho}_{i,t-10}$	-10.158 (15.571)	0.002 (0.057)	280	-0.004
$\dot{\rho}_{i,t-11}$	-5.470 (17.339)	-0.122 (0.057)*	240	0.014
$\dot{\rho}_{i,t-12}$	-5.986 (21.624)	-0.049 (0.099)	187	-0.004
$\dot{\rho}_{i,t-13}$	26.149 (26.836)	-0.087 (0.097)	152	-0.001
$\dot{\rho}_{i,t-14}$	-5.085 (24.494)	-0.110 (0.085)	147	0.005
$\dot{\rho}_{i,t-15}$	2.089 (22.138)	-0.079 (0.077)	124	0.000
$\dot{\rho}_{i,t-16}$	-22.900 (28.648)	-0.017 (0.107)	103	-0.010
$\dot{\rho}_{i,t-17}$	11.258 (26.646)	0.005 (0.100)	86	-0.012
$\dot{\rho}_{i,t-18}$	-20.191 (27.303)	-0.286 (0.084)**	82	0.115
$\dot{\rho}_{i,t-19}$	-4.223 (21.599)	0.029 (0.106)	71	-0.013
$\dot{\rho}_{i,t-20}$	-54.863 (36.673)	0.081 (0.083)	67	-0.001
$\dot{\rho}_{i,t-21}$	22.755 (25.238)	0.065 (0.114)	59	-0.012
$\dot{\rho}_{i,t-22}$	-15.999 (36.357)	-0.051 (0.172)	49	-0.019
$\dot{\rho}_{i,t-23}$	-65.316 (48.699)	0.013 (0.142)	41	-0.025
$\dot{\rho}_{i,t-24}$	-62.384 (54.461)	0.005 (0.136)	36	-0.029
$\dot{\rho}_{i,t-25}$	-31.381 (58.291)	-0.490 (0.274).	30	0.070
$\dot{\rho}_{i,t-26}$	33.597 (59.917)	0.372 (0.843)	21	-0.042
$\dot{\rho}_{i,t-27}$	-21.064 (64.094)	-0.059 (0.151)	16	-0.060
$\dot{\rho}_{i,t-28}$	-18.756 (77.282)	-0.231 (0.376)	13	-0.055
$\dot{\rho}_{i,t-29}$	17.009 (68.143)	0.265 (0.291)	10	-0.020
$\dot{\rho}_{i,t-30}$	177.277 (96.961)	5.458 (3.320)	8	0.196

Note: Each row displays estimated parameters from a separate AR(n) model of time-demeaned incremental profit rates across all firms. Observations are limited to firms reporting in accordance with HGB Standards. λ indicates the average total autoregressive effect after n years, estimated by bivariate OLS regression of $\dot{\rho}_{i,t}$ on $\dot{\rho}_{i,t-n}$. α denotes the average technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). The deviation of incremental profit rates from the mean shows little autocorrelation.

Source: LSEG 2026b; Destatis 2026a, own calculations

Table 13: Autoregression (Orders 1) Results for Incremental Profit Rates, by Initial Rank, Only Firms Using IFRS

Initial Rank	μ	λ	$\dot{\rho}^*$	Obs.	Adj. R^2
1	52.105 (15.092)***	-0.007 (0.048)	51.761 (14.558)***	502	-0.002
2	11.788 (4.854)*	-0.028 (0.033)	11.466 (4.685)*	603	0.000
3	9.624 (6.979)	-0.026 (0.046)	9.381 (6.780)	523	-0.001
4	2.984 (5.242)	-0.105 (0.036)**	2.699 (4.739)	622	0.012
5	-0.782 (8.360)	0.004 (0.037)	-0.785 (8.395)	510	-0.002
6	-47.805 (12.899)***	0.104 (0.053)*	-53.366 (14.896)***	491	0.006

Note: Each row displays estimated parameters from a separate AR(1) model of time-demeaned incremental profit rates. The model is estimated for every sextile of the initial years' incremental profit rate distribution. Firms are assigned to groups following their mean incremental profit rate in the years 2007-2010. Observations are limited to firms reporting in accordance with IFRS. λ denotes the group-specific AR(1) coefficient, indicating short-run persistence of incremental profit rates. $\dot{\rho}^*$ indicates the projected group-specific long-run differential of incremental profit rates to the economy-wide mean incremental profit rate. μ denotes the group-specific technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. p<0.1, * p<0.05, ** p<0.01, *** p<0.001). Firms with higher initial incremental profit rates tend to have higher projected incremental profit rates in the long-run. In the short run incremental profit rates show little persistence, pointing to high volatility.

Source: LSEG 2026b; Destatis 2026a, own calculations

Table 14: Autoregression (Orders 1) Results for Incremental Profit Rates, by Initial Rank, Only Firms Using HGB Reporting Standards

Initial Rank	μ	λ	$\dot{\rho}^*$	Obs.	Adj. R^2
1	88.311 (29.773)**	-0.222 (0.097)*	72.279 (23.244)**	75	0.053
2	3.068 (10.752)	-0.115 (0.166)	2.751 (9.596)	105	-0.005
3	-2.290 (9.856)	-0.528 (0.193)**	-1.499 (6.466)	112	0.055
4	-17.906 (6.352)**	-0.193 (0.065)**	-15.015 (5.363)**	148	0.051
5	-24.089 (16.250)	-0.101 (0.097)	-21.879 (14.637)	175	0.001
6	-43.893 (17.495)*	0.074 (0.158)	-47.377 (18.679)*	142	-0.006

Note: Each row displays estimated parameters from a separate AR(1) model of time-demeaned incremental profit rates. The model is estimated for every sextile of the initial years' incremental profit rate distribution. Firms are assigned to groups following their mean incremental profit rate in the years 1992-1995. Observations are limited to firms reporting in accordance with HGB standards. λ denotes the group-specific AR(1) coefficient, indicating short-run persistence of incremental profit rates. $\dot{\rho}^*$ indicates the projected group-specific long-run differential of incremental profit rates to the economy-wide mean incremental profit rate. μ denotes the group-specific technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. p<0.1, * p<0.05, ** p<0.01, *** p<0.001). Firms with higher initial incremental profit rates tend to have higher projected incremental profit rates in the long-run. In the short run incremental profit rates show little persistence, pointing to high volatility.

Source: LSEG 2026b; Destatis 2026a, own calculations

3.2 Acquisitions

Table 16: Autoregression (Orders 1) Results for Incremental Profit Rates, by Initial Rank, No Acquisitions

Initial Rank	μ	λ	$\dot{\rho}^*$	Obs.	Adj. R^2
1	11.845 (10.712)	0.053 (0.077)	12.508 (11.214)	157	-0.003
2	4.005 (10.349)	-0.140 (0.092)	3.513 (9.075)	157	0.008
3	5.116 (9.715)	0.051 (0.061)	5.392 (10.218)	220	-0.001
4	2.380 (16.355)	0.901 (0.160)***	23.949 (164.584)	133	0.189
5	-12.991 (20.037)	0.011 (0.103)	-13.137 (20.155)	138	-0.007
6	1.421 (26.032)	-0.022 (0.128)	1.391 (25.480)	141	-0.007

Note: Each row displays estimated parameters from a separate AR(1) model of time-demeaned incremental profit rates. The model is estimated for every sextile of the initial years' incremental profit rate distribution. Firms are assigned to groups following their mean incremental profit rate in the years 1991-1994. λ denotes the group-specific AR(1) coefficient, indicating short-run persistence of incremental profit rates. $\dot{\rho}^*$ indicates the projected group-specific long-run differential of incremental profit rates to the economy-wide mean incremental profit rate. μ denotes the group-specific technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). Firms with higher initial incremental profit rate tend to have higher projected incremental profit rates in the long-run. In the short run incremental profit rates show little persistence, pointing to high volatility.

Source: LSEG 2026b; Destatis 2026a, own calculations

Table 15: Autoregression (Orders 1-30) Results for Inc. Profit Rates, No Acquisitions

Regressor	α	λ	Obs.	Adj. R^2
$\dot{\rho}_{i,t-1}$	-0.089 (3.870)	0.007 (0.016)	4440	0.000
$\dot{\rho}_{i,t-2}$	2.152 (4.050)	-0.010 (0.015)	3892	0.000
$\dot{\rho}_{i,t-3}$	2.372 (4.310)	0.015 (0.016)	3608	0.000
$\dot{\rho}_{i,t-4}$	3.370 (4.138)	0.008 (0.016)	3345	0.000
$\dot{\rho}_{i,t-5}$	1.874 (4.327)	-0.026 (0.017)	3001	0.000
$\dot{\rho}_{i,t-6}$	-2.816 (4.691)	-0.002 (0.017)	2724	0.000
$\dot{\rho}_{i,t-7}$	-0.884 (5.227)	0.040 (0.019)*	2478	0.001
$\dot{\rho}_{i,t-8}$	7.498 (5.244)	0.013 (0.020)	2231	0.000
$\dot{\rho}_{i,t-9}$	8.214 (5.174)	-0.025 (0.019)	1998	0.000
$\dot{\rho}_{i,t-10}$	16.792 (5.756)**	0.002 (0.022)	1791	-0.001
$\dot{\rho}_{i,t-11}$	10.778 (5.440)*	-0.047 (0.021)*	1678	0.002
$\dot{\rho}_{i,t-12}$	5.699 (6.611)	-0.027 (0.028)	1466	0.000
$\dot{\rho}_{i,t-13}$	9.462 (5.877)	-0.037 (0.022).	1282	0.001
$\dot{\rho}_{i,t-14}$	5.149 (6.520)	0.040 (0.026)	1134	0.001
$\dot{\rho}_{i,t-15}$	15.271 (6.588)*	0.011 (0.027)	1010	-0.001
$\dot{\rho}_{i,t-16}$	7.047 (6.635)	0.002 (0.025)	890	-0.001
$\dot{\rho}_{i,t-17}$	0.348 (6.736)	0.032 (0.027)	735	0.001
$\dot{\rho}_{i,t-18}$	1.842 (8.150)	-0.059 (0.031).	592	0.004
$\dot{\rho}_{i,t-19}$	10.639 (8.561)	0.096 (0.032)**	502	0.016
$\dot{\rho}_{i,t-20}$	-3.754 (10.229)	0.037 (0.031)	456	0.001
$\dot{\rho}_{i,t-21}$	14.251 (9.250)	0.005 (0.031)	393	-0.002
$\dot{\rho}_{i,t-22}$	2.946 (9.467)	-0.044 (0.031)	316	0.003
$\dot{\rho}_{i,t-23}$	12.270 (14.497)	0.023 (0.059)	269	-0.003
$\dot{\rho}_{i,t-24}$	11.584 (14.758)	0.031 (0.048)	232	-0.002
$\dot{\rho}_{i,t-25}$	-14.428 (17.028)	-0.075 (0.066)	186	0.002
$\dot{\rho}_{i,t-26}$	8.235 (18.202)	0.041 (0.078)	151	-0.005
$\dot{\rho}_{i,t-27}$	13.356 (18.892)	-0.007 (0.100)	134	-0.008
$\dot{\rho}_{i,t-28}$	21.454 (27.147)	-0.094 (0.203)	94	-0.008
$\dot{\rho}_{i,t-29}$	31.747 (34.250)	0.133 (0.290)	68	-0.012
$\dot{\rho}_{i,t-30}$	14.418 (34.404)	-0.263 (0.430)	57	-0.011

Note: Each row displays estimated parameters from a separate AR(n) model of time-demeaned incremental profit rates across all firms. λ indicates the average total autoregressive effect after n years, estimated by bivariate OLS regression of $\dot{\rho}_{i,t}$ on $\dot{\rho}_{i,t-n}$. α denotes the average technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. p<0.1, * p<0.05, ** p<0.01, *** p<0.001). The deviation of incremental profit rates from the mean shows little autocorrelation.

Source: LSEG 2026b; Destatis 2026a, own calculations

Table 17: Autoregression (Order 1) Results for Incremental Profit Rates, by Percentiles of Firm Size, No Acquisitions

Percentiles	μ	λ	$\dot{\rho}^*$	Obs.	Adj. R^2
100	13.222 (40.980)	-0.017 (0.126)	12.998 (40.177)	69	-0.015
96-99	-14.677 (12.285)	0.058 (0.059)	-15.588 (13.019)	218	0.000
91-95	-2.236 (9.931)	0.020 (0.058)	-2.282 (10.158)	284	-0.003
81-90	10.157 (7.910)	0.056 (0.045)	10.759 (8.335)	739	0.001
51-80	6.645 (5.516)	0.092 (0.029)**	7.318 (6.055)	1560	0.006
1-50	-12.147 (8.167)	-0.034 (0.025)	-11.742 (7.896)	1570	0.001

Note: Each row displays estimated parameters from a separate AR(1) model of time-demeaned incremental profit rates. The model is estimated for different percentiles of the distribution of firm size, measured by a firm's average net sales (price-adjusted) over all years observed. λ denotes the group-specific AR(1) coefficient, indicating short-run persistence of incremental profit rates. $\dot{\rho}^*$ indicates the projected group-specific long-run differential of incremental profit rates to the economy-wide mean incremental profit rate. μ denotes the group-specific technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). In no group of firm size incremental profit rates show significant persistence in the long run. Significant short-run persistence of incremental profit rates is found for only the 51st to 80th percentile of firm size, and even then at a very low level.

Source: LSEG 2026b; Destatis 2026a, own calculations

Table 18: Autoregression (Order 1) Results for Incremental Profit Rates, by Economic Sector, No Acquisitions

Sector	μ	λ	$\dot{\rho}^*$	Obs.	Adj. R^2
Agriculture ¹	69.422 (38.136).	0.005 (0.091)	69.755 (36.948).	48	-0.022
Mining	82.814 (50.102)	-0.090 (0.160)	75.943 (46.280)	40	-0.018
Construction	0.165 (10.643)	0.124 (0.048)*	0.189 (12.152)	87	0.061
Manufacturing	-1.677 (4.506)	0.031 (0.024)	-1.732 (4.654)	2335	0.000
TransComm ²	1.740 (14.854)	0.046 (0.052)	1.825 (15.575)	384	-0.001
Retail	-12.244 (14.229)	-0.095 (0.067)	-11.179 (12.962)	167	0.006
Wholesale	16.766 (12.695)	-0.038 (0.068)	16.145 (12.149)	201	-0.003
Services	-4.450 (9.752)	-0.014 (0.030)	-4.386 (9.620)	1178	-0.001

Note: Each row displays estimated parameters from a separate AR(1) model of time-demeaned incremental profit rates. The model is estimated by economic sector, indicated by the SIC-division of a firm's primary field of operations. λ denotes the sector-specific AR(1) coefficient, indicating short-run persistence of incremental profit rates. $\dot{\rho}^*$ indicates the projected sector-specific long-run differential of incremental profit rates to the economy-wide mean incremental profit rate. μ denotes the sector-specific technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). In no sector the incremental profit rates of firms show significant persistence, neither in the short run nor in the long run.

¹ Agriculture, Forestry and Fishing

² Transportation, Communication, Electric, Gas and Sanitary Service

Source: LSEG 2026b; Destatis 2026a, own calculations

3.3 Firm Size Measured as Average Operating Capital

Table 19: Autoregression (Order 1) Results for Profit Rates, by Percentiles of Firm Size Measured as Average Operating Capital

Perc.	μ	λ	$\dot{\pi}^*$	Obs.	Adj. R^2
100	8.614 (1.224)***	0.486 (0.072)***	16.757 (0.961)***	126	0.263
96-99	6.405 (0.707)***	0.651 (0.037)***	18.332 (0.906)***	397	0.443
91-95	9.744 (0.860)***	0.504 (0.037)***	19.651 (1.077)***	514	0.263
81-90	5.618 (0.578)***	0.693 (0.021)***	18.294 (1.480)***	1084	0.499
51-80	4.118 (0.899)***	0.658 (0.015)***	12.033 (2.579)***	2815	0.407
1-50	-6.486 (1.859)***	0.664 (0.014)***	-19.332 (5.522)***	3464	0.387

Note: Each row displays estimated parameters from a separate AR(1) model of time-demeaned profit rates. The model is estimated for different percentiles (perc.) of the distribution of firm size, measured by a firm's average operating capital (price-adjusted) over all years observed. λ denotes the group-specific AR(1) coefficient, indicating short-run persistence of profit rates. $\dot{\pi}^*$ indicates the projected group-specific long-run differential of profit rates to the economy-wide mean profit rate. μ denotes the group-specific technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). Larger firms generally have higher projected profit rates in the long-run, yet for the largest five percent of firms the difference to smaller firms decreases again. In the short run firms across all initial ranks show considerable persistence of profit rates.

Source: LSEG 2026b; Destatis 2026a, own calculations

Table 20: Autoregression (Order 1) Results for Incremental Profit Rates, by Percentiles of Firm Size Measured as Average Operating Capital

Perc.	μ	λ	$\dot{\rho}^*$	Obs.	Adj. R^2
100	-14.748 (14.282)	-0.023 (0.131)	-14.412 (13.981)	63	-0.016
96-99	4.578 (9.789)	0.262 (0.104)*	6.205 (13.157)	190	0.027
91-95	18.245 (11.240)	0.022 (0.064)	18.653 (11.345)	258	-0.003
81-90	12.191 (8.550)	0.034 (0.044)	12.615 (8.812)	542	-0.001
51-80	8.918 (5.173)	-0.017 (0.028)	8.773 (5.068)	1240	-0.001
1-50	-13.275 (10.405)	0.053 (0.030)	-14.018 (10.999)	1060	0.002

Note: Each row displays estimated parameters from a separate AR(1)-model of time-demeaned incremental profit rates. The model is estimated for different percentiles (perc.) of the distribution of firm size, measured by a firm's average operating capital (price-adjusted) over all years observed. λ denotes the group-specific AR(1) coefficient, indicating short-run persistence of incremental profit rates. $\dot{\rho}^*$ indicates the projected group-specific long-run differential of incremental profit rates to the economy-wide mean incremental profit rate. μ denotes the group-specific technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). In no group of firm size incremental profit rates show significant persistence in the long run. Significant short-run persistence of incremental profit rates is found for only the 96th to 99th percentile of firm size.

Source: LSEG 2026b; Destatis 2026a, own calculations

Table 21: Autoregression (Order 1) Results for Profit Rates, by Firm Size Measured as Average Operating Capital Under Different Functional Forms

	<i>Dependent variable: $\dot{\pi}_{i,t}$</i>			
	(1)	(2)	(3)	(4)
$\dot{\pi}_{i,t-1}$	0.622*** (0.007)	0.621*** (0.007)	0.622*** (0.007)	0.621*** (0.007)
$\overline{CAP}_i$	0.068 (0.037)	0.272** (0.105)	0.071 (0.065)	0.274* (0.117)
$\overline{CAP}_i^2$		-0.001* (0.001)		-0.001* (0.001)
$\overline{CAP}_i * \dot{\pi}_{i,t-1}$			-0.0002 (0.003)	-0.0001 (0.003)
Constant	0.671 (0.749)	0.317 (0.768)	0.671 (0.749)	0.317 (0.768)
Observations	13,160	13,160	13,160	13,160
R ²	0.379	0.379	0.379	0.379
Adjusted R ²	0.379	0.379	0.379	0.379
Residual Std. Error	83.962	83.952	83.966	83.955
F Statistic	4,009.484***	2,675.093***	2,672.787***	2,006.168***

Note: $\dot{\pi}_{i,t}$ indicates the time-demeaned profit rate of firm i in period t. $\overline{CAP}$ denotes average operating capital, measured in billion euros (price-adjusted). α denotes the technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. p<0.1, * p<0.05, ** p<0.01, *** p<0.001).

Source: LSEG 2026b; Destatis 2026a, own calculations

Appendix

Table 22: Autoregression (Order 1) Results for Incremental Profit Rates, by Firm Size Measured as Average Operating Capital Under Different Functional Forms

	<i>Dependent variable: $\dot{\rho}_{i,t}$</i>			
	(1)	(2)	(3)	(4)
$\dot{\rho}_{i,t-1}$	−0.002 (0.013)	−0.002 (0.013)	−0.001 (0.013)	−0.001 (0.013)
$\overline{CAP}_i$	−0.111 (0.134)	−0.003 (0.406)	−0.112 (0.134)	−0.003 (0.406)
$\overline{CAP}_i^2$		−0.001 (0.002)		−0.001 (0.002)
$\overline{CAP}_i * \dot{\rho}_{i,t-1}$			−0.0005 (0.002)	−0.001 (0.002)
Constant	−0.041 (3.212)	−0.279 (3.321)	−0.030 (3.213)	−0.271 (3.322)
Observations	5,766	5,766	5,766	5,766
R ²	0.0001	0.0001	0.0001	0.0002
Adjusted R ²	−0.0002	−0.0004	−0.0004	−0.001
Residual Std. Error	236.852	236.871	236.871	236.890
F Statistic	0.350	0.260	0.262	0.217

Note: $\dot{\rho}_{i,t}$ indicates the time-demeaned profit rate of firm i in period t. $\overline{CAP}$ denotes average operating capital, measured in billion euros (price-adjusted). α denotes the technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. p<0.1, * p<0.05, ** p<0.01, *** p<0.001).

Source: LSEG 2026b; Destatis 2026a, own calculations

3.4 Firm Size Under Different Functional Forms

Table 23: Autoregression (Order 1) Results for Profit Rates, by Firm Size under Different Functional Forms

	<i>Dependent variable: $\dot{\pi}_{i,t}$</i>			
	(1)	(2)	(3)	(4)
$\dot{\pi}_{i,t-1}$	0.621*** (0.007)	0.621*** (0.007)	0.621*** (0.007)	0.621*** (0.007)
$\overline{NSL}_i$	0.111* (0.051)	0.369** (0.125)	0.078 (0.086)	0.340* (0.145)
$\overline{NSL}_i^2$		-0.002* (0.001)		-0.002* (0.001)
$\overline{NSL}_i * \dot{\pi}_{i,t-1}$			0.002 (0.004)	0.002 (0.004)
α	0.571 (0.754)	0.169 (0.774)	0.567 (0.754)	0.168 (0.774)
Observations	13,160	13,160	13,160	13,160
R ²	0.379	0.379	0.379	0.379
Adjusted R ²	0.379	0.379	0.379	0.379
Residual Std. Error	83.958	83.945	83.961	83.948
F Statistic	4,010.557***	2,676.257***	2,673.625***	2,007.100***

Note: $\dot{\pi}_{i,t}$ indicates the time-demeaned profit rate of firm i in period t. $\overline{NSL}$ denotes average net sales, measured in billion euros (price-adjusted). α denotes the technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. p<0.1, * p<0.05, ** p<0.01, *** p<0.001).

Source: LSEG 2026b; Destatis 2026a, own calculations

Appendix

Table 24: Autoregression (Order 1) Results for Incremental Profit Rates, by Firm Size under Different Functional Forms

	<i>Dependent variable: $\dot{\rho}_{i,t}$</i>			
	(1)	(2)	(3)	(4)
$\dot{\rho}_{i,t-1}$	−0.002 (0.013)	−0.002 (0.013)	−0.002 (0.013)	−0.002 (0.013)
$\overline{NSL}_i$	−0.105 (0.193)	−0.046 (0.485)	−0.104 (0.193)	−0.046 (0.485)
$\overline{NSL}_i^2$		−0.001 (0.004)		−0.001 (0.004)
$\overline{NSL}_i * \dot{\rho}_{i,t-1}$			0.0002 (0.002)	0.0002 (0.002)
α	−0.203 (3.236)	−0.320 (3.352)	−0.206 (3.236)	−0.321 (3.352)
Observations	5,766	5,766	5,766	5,766
R ²	0.0001	0.0001	0.0001	0.0001
Adjusted R ²	−0.0003	−0.0005	−0.0005	−0.001
Residual Std. Error	236.860	236.881	236.881	236.901
F Statistic	0.157	0.110	0.108	0.085

Note: $\dot{\rho}_{i,t}$ indicates the time-demeaned profit rate of firm i in period t. $\overline{NSL}$ denotes average net sales, measured in billion euros (price-adjusted). α denotes the technical intercept. Stars indicate statistical significance (. p<0.1, * p<0.05, ** p<0.01, *** p<0.001).

Source: LSEG 2026b; Destatis 2026a, own calculations

3.5 Gross Intangibles

Table 25: Autoregression (Orders 1-18) Results for Profit Rates, Using Gross Intangible Assets

Regressor	α	λ	Obs.	Adj. R^2
$\dot{\pi}_{i,t-1}$	0.239 (0.824)	0.673 (0.009)***	8400	0.401
$\dot{\pi}_{i,t-2}$	1.001 (0.961)	0.554 (0.011)***	7660	0.257
$\dot{\pi}_{i,t-3}$	2.133 (1.018)*	0.503 (0.012)***	6959	0.199
$\dot{\pi}_{i,t-4}$	2.996 (1.090)**	0.456 (0.013)***	6299	0.157
$\dot{\pi}_{i,t-5}$	4.316 (1.142)***	0.402 (0.015)***	5670	0.119
$\dot{\pi}_{i,t-6}$	5.876 (1.184)***	0.418 (0.015)***	5067	0.126
$\dot{\pi}_{i,t-7}$	7.632 (1.208)***	0.330 (0.017)***	4503	0.074
$\dot{\pi}_{i,t-8}$	9.725 (1.234)***	0.234 (0.018)***	3985	0.039
$\dot{\pi}_{i,t-9}$	10.499 (1.216)***	0.228 (0.019)***	3500	0.041
$\dot{\pi}_{i,t-10}$	12.163 (1.149)***	0.190 (0.019)***	3040	0.033
$\dot{\pi}_{i,t-11}$	12.857 (1.111)***	0.256 (0.020)***	2607	0.058
$\dot{\pi}_{i,t-12}$	12.739 (1.182)***	0.170 (0.022)***	2206	0.026
$\dot{\pi}_{i,t-13}$	12.959 (1.231)***	0.127 (0.022)***	1829	0.018
$\dot{\pi}_{i,t-14}$	11.872 (1.358)***	0.102 (0.023)***	1476	0.012
$\dot{\pi}_{i,t-15}$	10.712 (1.679)***	0.114 (0.030)***	1143	0.011
$\dot{\pi}_{i,t-16}$	8.835 (2.170)***	0.189 (0.038)***	823	0.028
$\dot{\pi}_{i,t-17}$	0.067 (3.332)	0.957 (0.128)***	519	0.096
$\dot{\pi}_{i,t-18}$	12.150 (3.635)***	-0.020 (0.169)	240	-0.004

Note: Each row displays estimated parameters from a separate AR(n) model of time-demeaned profit rates across all firms. λ indicates the average total autoregressive effect after n years, estimated by bivariate OLS regression of $\dot{\pi}_{i,t}$ on $\dot{\pi}_{i,t-n}$. α denotes the average technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. p<0.1, * p<0.05, ** p<0.01, *** p<0.001). Additionally, the number of observations (Obs.) and adjusted R^2 (Adj. R^2), as measure of explained variance, are given for every model. Profit rate deviations from the mean show significant positive autocorrelation up until the 17th period.

Source: LSEG 2026b; Destatis 2026a, own calculations

Table 26: Autoregression (Order 1) Results for Profit Rates, by Initial Rank, Using Gross Intangible Assets

Initial Rank	μ	λ	$\hat{\pi}^*$	Obs.	Adj. R^2
1	9.572 (1.323)***	0.588 (0.018)***	23.208 (3.016)***	1316	0.454
2	-15.440 (1.291)***	1.776 (0.055)***	19.906 (1.039)***	1466	0.419
3	6.488 (0.811)***	0.594 (0.031)***	15.986 (1.612)***	1302	0.215
4	10.707 (0.968)***	0.170 (0.027)***	12.897 (1.096)***	1321	0.028
5	-2.601 (1.307)*	1.064 (0.048)***	40.919 (33.271)	990	0.327
6	-28.783 (5.996)***	0.473 (0.036)***	-54.624 (10.920)***	800	0.179

Note: Each row displays estimated parameters from a separate AR(1) model of time-demeaned profit rates. The model is estimated for every sextile of the initial years' profit rate distribution. Firms are assigned to groups following their mean profit rate in the years 2006-2009. λ denotes the group-specific AR(1) coefficient, indicating short-run persistence of profit rates. $\hat{\pi}^*$ indicates the projected group-specific long-run differential of profit rates to the economy-wide mean profit rate. μ denotes the group-specific technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). Firms with higher initial rank in the profit rate distribution have higher projected profit rates in the long-run. In the short run firms across all initial ranks show considerable persistence of profit rates. For the initially second-ranked and fifth-ranked group the differences to the mean are even self-reinforcing, implying that the projected long-run profit rate differential for the two groups is no meaningful estimate.

Source: LSEG 2026b; Destatis 2026a, own calculations

Table 27: Autoregression (Orders 1) Results for Incremental Profit Rates, by Initial Rank, Using Gross Intangible Assets

Initial Rank	μ	λ	$\hat{\rho}^*$	Obs.	Adj. R^2
1	27.209 (15.798).	-0.008 (0.045)	26.993 (15.477).	436	-0.002
2	9.744 (8.021)	0.022 (0.042)	9.968 (8.179)	611	-0.001
3	6.351 (8.335)	-0.061 (0.053)	5.986 (7.823)	476	0.001
4	9.838 (8.033)	0.032 (0.066)	10.158 (8.242)	467	-0.002
5	-4.469 (6.722)	0.055 (0.042)	-4.730 (7.146)	444	0.002
6	-37.173 (16.368)*	-0.047 (0.053)	-35.510 (15.559)*	311	-0.001

Note: Each row displays estimated parameters from a separate AR(1) model of time-demeaned incremental profit rates. The model is estimated for every sextile of the initial distribution of incremental profit rates. Firms are assigned to groups following their mean incremental profit rate in the years 2008-2011. λ denotes the group-specific AR(1) coefficient, indicating short-run persistence of incremental profit rates. $\hat{\rho}^*$ indicates the projected group-specific long-run differential of incremental profit rates to the economy-wide mean incremental profit rate. μ denotes the group-specific technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). Firms with higher initial incremental profit rate tend to have higher projected incremental profit rates in the long-run. In the short run incremental profit rates show little persistence, pointing to high volatility.

Source: LSEG 2026b; Destatis 2026a, own calculations

Table 28: Autoregression (Orders 1-15) Results for Incremental Profit Rates, Using Gross Intangible Assets

Regressor	α	λ	Obs.	Adj. R^2
$\dot{\rho}_{i,t-1}$	2.200 (4.185)	0.038 (0.017)*	3353	0.001
$\dot{\rho}_{i,t-2}$	1.358 (4.428)	-0.019 (0.017)	3045	0.000
$\dot{\rho}_{i,t-3}$	6.787 (4.800)	0.013 (0.019)	2735	0.000
$\dot{\rho}_{i,t-4}$	8.154 (4.931).	-0.055 (0.020)**	2428	0.003
$\dot{\rho}_{i,t-5}$	5.733 (5.153)	-0.010 (0.020)	2117	0.000
$\dot{\rho}_{i,t-6}$	8.364 (5.523)	0.033 (0.022)	1901	0.001
$\dot{\rho}_{i,t-7}$	6.549 (6.199)	-0.049 (0.025).	1641	0.002
$\dot{\rho}_{i,t-8}$	9.025 (6.584)	-0.007 (0.026)	1383	-0.001
$\dot{\rho}_{i,t-9}$	10.692 (7.176)	-0.065 (0.026)*	1148	0.004
$\dot{\rho}_{i,t-10}$	16.681 (6.748)*	-0.010 (0.024)	963	-0.001
$\dot{\rho}_{i,t-11}$	13.670 (8.254).	0.009 (0.029)	831	-0.001
$\dot{\rho}_{i,t-12}$	17.159 (10.723)	0.033 (0.038)	610	0.000
$\dot{\rho}_{i,t-13}$	6.948 (11.407)	0.034 (0.036)	460	0.000
$\dot{\rho}_{i,t-14}$	-4.242 (15.726)	0.005 (0.049)	290	-0.003
$\dot{\rho}_{i,t-15}$	-27.128 (19.427)	-0.008 (0.051)	136	-0.007

Note: Each row displays estimated parameters from a separate AR(n) model of time-demeaned incremental profit rates across all firms. λ indicates the average total autoregressive effect after n years, estimated by bivariate OLS regression of $\dot{\rho}_{i,t}$ on $\dot{\rho}_{i,t-n}$. α denotes the average technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. p<0.1, * p<0.05, ** p<0.01, *** p<0.001). The deviation of incremental profit rates from the mean shows little autocorrelation.

Source: LSEG 2026b; Destatis 2026a, own calculations

3.6 Only Full Observations

To check whether a different selection of firms and years causes the remarkable differences in the autoregression results between profit rates and incremental profit rates, all models for profit rates are re-estimated on the sample used for calculating the regressions of incremental profit rates. The sample is nearly identical with the sample used for incremental profit rates, since there only 100 firm-year-observations in the trimmed sample, for which only incremental profit rates could be calculated.

Table 29: Autoregression (Order 1) Results for Profit Rates, by Initial Rank, Only Full Observations

Initial Rank	μ	λ	$\hat{\pi}^*$	Obs.	Adj. R^2
1	5.378 (1.057)***	0.626 (0.051)***	14.393 (1.951)***	305	0.333
2	4.387 (0.661)***	0.582 (0.045)***	10.486 (1.142)***	345	0.329
3	4.159 (0.659)***	0.521 (0.049)***	8.685 (1.140)***	323	0.260
4	2.529 (0.819)**	0.611 (0.042)***	6.501 (1.993)**	483	0.300
5	3.257 (0.594)***	0.408 (0.042)***	5.502 (0.960)***	492	0.160
6	4.099 (0.710)***	0.420 (0.044)***	7.061 (1.179)***	429	0.174

Note: Each row displays estimated parameters from a separate AR(1) model of time-demeaned profit rates. The model is estimated for every sextile of the initial years' profit rate distribution. Firms are assigned to groups following their mean profit rate in the years 1991-1994. Observations are limited to firm-year combinations for which also incremental profit rates are observed. λ denotes the group-specific AR(1) coefficient, indicating short-run persistence of profit rates. $\hat{\pi}^*$ indicates the projected group-specific long-run differential of profit rates to the economy-wide mean profit rate. μ denotes the group-specific technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). Firms with higher initial rank in the profit rate distribution show higher persistence of profit rates both in the short-run and in the long-run.

Source: LSEG 2026b; Destatis 2026a, own calculations

Table 30: Summary Statistics for Firms with Both Observed Profit Rates and Observed Incremental Profit Rates

Variable	Mean	SD	Min	p1	p25	Median	p75	p99	Max
Net Sales	4105.62	16871.28	0.00	0.60	62.73	237.62	1194.63	79502.03	271648.69
Average Net Sales	4105.13	15824.33	0.00	1.67	74.92	253.56	1220.54	73786.06	244707.20
Gross Operating Profit	216.98	1187.57	-13362.34	-539.85	-0.84	6.52	48.07	6519.35	18857.05
Gross Property, Plant and Equipment	3813.05	17334.76	0.00	0.17	21.81	126.74	689.07	100931.26	253900.54
Inventories	529.36	2510.50	0.00	0.00	3.07	28.69	145.99	10418.99	46910.88
Trade Receivables Net	691.97	3489.38	0.00	0.04	8.09	35.63	173.50	13144.98	89658.05
Net Intangible Assets	988.53	5635.17	-458.70	0.00	2.70	16.80	108.01	21528.79	119469.51
Net Goodwill	694.61	3027.76	-483.78	0.00	1.82	14.10	94.94	17061.38	55061.71
Δ Gross Operating Profit	2.72	552.48	-14644.74	-947.37	-4.56	0.43	7.57	1031.49	16999.33
Δ Gross Property, Plant and Equipment	206.84	1672.56	-35131.87	-606.56	0.27	6.01	42.39	5471.32	53656.37
Δ Inventories	19.01	354.79	-7379.00	-354.09	-0.50	0.30	7.00	752.15	15508.00
Δ Trade Receivables Net	24.47	914.11	-35877.00	-491.22	-1.26	0.79	9.27	1197.38	33609.38
Δ Net Intangible Assets	79.15	1399.65	-36065.77	-660.97	-0.81	0.05	4.57	2199.53	60080.02
Δ Net Goodwill	50.16	798.84	-15104.89	-528.62	-0.34	0.00	2.62	1797.56	28935.30
Operating Capital	5140.42	23991.21	0.00	0.61	46.03	210.18	1070.50	124007.90	366680.86
Δ Operating Capital	502.85	3083.36	0.00	0.09	6.37	25.31	123.09	10285.76	138720.64
Profit Rate	-3.42	74.14	-1439.03	-245.24	-1.22	4.02	10.35	88.56	214.49
Incremental Profit Rate	5.14	264.32	-2396.22	-975.03	-26.62	3.30	35.37	942.50	2337.54

Note: All variables, except the profit rate and the incremental profit rate, are given in million euros, price-adjusted with deflators from the Statistisches Bundesamt (Destatis 2026a). For NSL, GOP and Δ GOP, as measures related to income, the general GDP-deflator is used. $\overline{NSL}$ represent mean price-adjusted NSL per firm. GPPE and Δ GPPE are deflated by the gross fixed capital formation deflator. INV, TRN, NIA, NGW, Δ INV, Δ TRN, Δ NIA and Δ NGW are price-adjusted by the gross capital deflator. Changes express price-adjusted nominal changes. All deflators are calculated as chain indices with 2020 as year of reference (Destatis 2026a). Operating capital is the sum of deflated GPPE, INV, TRN and NIA minus deflated NGW. Δ Operating capital is the change in nominal operating capital deflated by the gross capital formation deflator. The profit rate is the ratio of GOP to CAP, the incremental profit rate the ratio of Δ GOP to one-year-lagged Δ CAP, both given in percentiles.

Source: LSEG 2026b; Destatis 2026a, own calculations

Table 31: Autoregressions (Order 1-30) Results for Profit Rates, Only Full Observations

Regressor	α	λ	Obs.	Adj. R^2
$\dot{\pi}_{i,t-1}$	1.190 (0.613).	0.569 (0.010)***	7612	0.296
$\dot{\pi}_{i,t-2}$	3.230 (0.594)***	0.364 (0.011)***	6853	0.135
$\dot{\pi}_{i,t-3}$	4.253 (0.620)***	0.274 (0.013)***	6149	0.063
$\dot{\pi}_{i,t-4}$	5.670 (0.620)***	0.166 (0.013)***	5500	0.027
$\dot{\pi}_{i,t-5}$	6.574 (0.621)***	0.144 (0.013)***	4892	0.023
$\dot{\pi}_{i,t-6}$	7.717 (0.621)***	0.143 (0.014)***	4337	0.025
$\dot{\pi}_{i,t-7}$	9.519 (0.428)***	0.095 (0.010)***	3835	0.024
$\dot{\pi}_{i,t-8}$	10.127 (0.404)***	0.056 (0.009)***	3384	0.011
$\dot{\pi}_{i,t-9}$	9.934 (0.426)***	0.079 (0.011)***	2963	0.018
$\dot{\pi}_{i,t-10}$	10.186 (0.452)***	0.060 (0.011)***	2583	0.011
$\dot{\pi}_{i,t-11}$	10.350 (0.488)***	0.076 (0.015)***	2238	0.011
$\dot{\pi}_{i,t-12}$	11.262 (0.522)***	0.007 (0.016)	1928	0.000
$\dot{\pi}_{i,t-13}$	11.366 (0.582)***	0.011 (0.019)	1648	0.000
$\dot{\pi}_{i,t-14}$	11.394 (0.652)***	0.017 (0.021)	1404	0.000
$\dot{\pi}_{i,t-15}$	11.400 (0.757)***	0.020 (0.028)	1183	0.000
$\dot{\pi}_{i,t-16}$	10.451 (0.605)***	0.194 (0.029)***	983	0.041
$\dot{\pi}_{i,t-17}$	11.203 (0.697)***	0.145 (0.034)***	815	0.021
$\dot{\pi}_{i,t-18}$	11.681 (0.799)***	0.134 (0.039)***	664	0.016
$\dot{\pi}_{i,t-19}$	11.449 (0.968)***	0.142 (0.050)**	529	0.013
$\dot{\pi}_{i,t-20}$	11.960 (1.171)***	0.081 (0.065)	417	0.001
$\dot{\pi}_{i,t-21}$	13.333 (0.901)***	0.033 (0.055)	319	-0.002
$\dot{\pi}_{i,t-22}$	14.431 (0.683)***	0.020 (0.051)	235	-0.004
$\dot{\pi}_{i,t-23}$	14.053 (0.622)***	0.062 (0.064)	172	0.000
$\dot{\pi}_{i,t-24}$	14.386 (0.746)***	0.058 (0.090)	126	-0.005
$\dot{\pi}_{i,t-25}$	13.484 (0.873)***	0.173 (0.115)	91	0.014
$\dot{\pi}_{i,t-26}$	13.549 (1.084)***	0.098 (0.138)	62	-0.008
$\dot{\pi}_{i,t-27}$	13.160 (1.413)***	0.187 (0.186)	41	0.000
$\dot{\pi}_{i,t-28}$	12.698 (2.050)***	0.086 (0.251)	25	-0.038
$\dot{\pi}_{i,t-29}$	13.498 (2.006)***	0.007 (0.229)	16	-0.071
$\dot{\pi}_{i,t-30}$	15.339 (4.698)*	0.006 (0.542)	8	-0.167

Note: Each row displays estimated parameters from a separate AR(n) model of time-demeaned profit rates across all firms. Observations are limited to firm-year combinations for which also incremental profit rates are observed. λ indicates the average total autoregressive effect after n years, estimated by bivariate OLS regression of $\dot{\pi}_{i,t}$ on $\dot{\pi}_{i,t-n}$. α denotes the average technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. p<0.1, * p<0.05, ** p<0.01, *** p<0.001). Additionally, the number of observations (Obs.) and adjusted R^2 (Adj. R^2), as measure of explained variance, are given for every model. Profit rate deviations from the mean show significant positive autocorrelation up until the 11th period and in the 16th to 19th period.

Source: LSEG 2026b; Destatis 2026a, own calculations

Table 32: Autoregression (Order 1) Results for Profit Rates, by Percentiles, Only Full Observations

Perc.	μ	λ	$\hat{\pi}^*$	Obs.	Adj. R^2
100	3.490 (0.812)***	0.578 (0.067)***	8.262 (1.604)***	154	0.327
96-99	5.042 (0.632)***	0.533 (0.036)***	10.799 (1.131)***	550	0.282
91-95	4.485 (0.572)***	0.620 (0.019)***	11.795 (1.467)***	529	0.663
81-90	3.822 (0.482)***	0.595 (0.025)***	9.440 (1.058)***	1213	0.326
51-80	6.073 (0.429)***	0.438 (0.015)***	10.806 (0.711)***	2507	0.254
1-50	-5.078 (1.698)**	0.563 (0.017)***	-11.629 (3.861)**	2659	0.280

Note: Each row displays estimated parameters from a separate AR(1) model of time-demeaned profit rates. The model is estimated for different percentiles (perc.) of the distribution of firm size, measured by a firm's average net sales (price-adjusted) over all years observed. Observations are limited to firm-year combinations for which also incremental profit rates are observed. λ denotes the group-specific AR(1) coefficient, indicating short-run persistence of profit rates. $\hat{\pi}^*$ indicates the projected group-specific long-run differential of profit rates to the economy-wide mean profit rate. μ denotes the group-specific technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). Larger firms show higher persistence of profit rates both in the short-run and in the long-run.

Source: LSEG 2026b; Destatis 2026a, own calculations

Table 33: Autoregression (Order 1) Results for Profit Rates, by Economic Sector, Only Full Observations

Sector	μ	λ	$\hat{\pi}^*$	Obs.	Adj. R^2
Agriculture ¹	4.833 (1.543)**	0.441 (0.099)***	8.642 (2.792)**	61	0.239
Mining	1.507 (2.951)	0.451 (0.038)***	2.743 (5.409)	67	0.678
Construction	0.900 (1.800)	0.330 (0.067)***	1.342 (2.665)	143	0.139
Manufacturing	2.582 (0.495)***	0.513 (0.013)***	5.307 (1.007)***	4064	0.285
TransComm ²	1.744 (1.383)	0.531 (0.031)***	3.716 (2.949)	626	0.325
Retail	2.957 (0.739)***	0.622 (0.041)***	7.813 (1.789)***	336	0.407
Wholesale	4.346 (1.375)**	0.284 (0.016)***	6.072 (1.930)**	292	0.511
Services	-1.918 (2.005)	0.624 (0.021)***	-5.104 (5.333)	2023	0.300

Note: Each row displays estimated parameters from a separate AR(1) model of time-demeaned profit rates. The model is estimated by economic sector, indicated by the SIC-division of a firm's primary field of operations. Observations are limited to firm-year combinations for which also incremental profit rates are observed. λ denotes the sector-specific AR(1) coefficient, indicating short-run persistence of profit rates. $\hat{\pi}^*$ indicates the projected sector-specific long-run differential of profit rates to the economy-wide mean profit rate. μ denotes the sector-specific technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). In the short-run profit rates appear stable for all sectors but construction. The predicted long-run profit rate differential to the economy-wide mean is particularly high for firms in the retail, agriculture, construction and manufacturing sector and particularly low for firms in the service sector.

¹ Agriculture, Forestry and Fishing

² Transportation, Communication, Electric, Gas and Sanitary Service

Source: LSEG 2026b; Destatis 2026a, own calculations

3.7 Outliers

Figure 5: Evolution of Profit Rates, Including Outliers

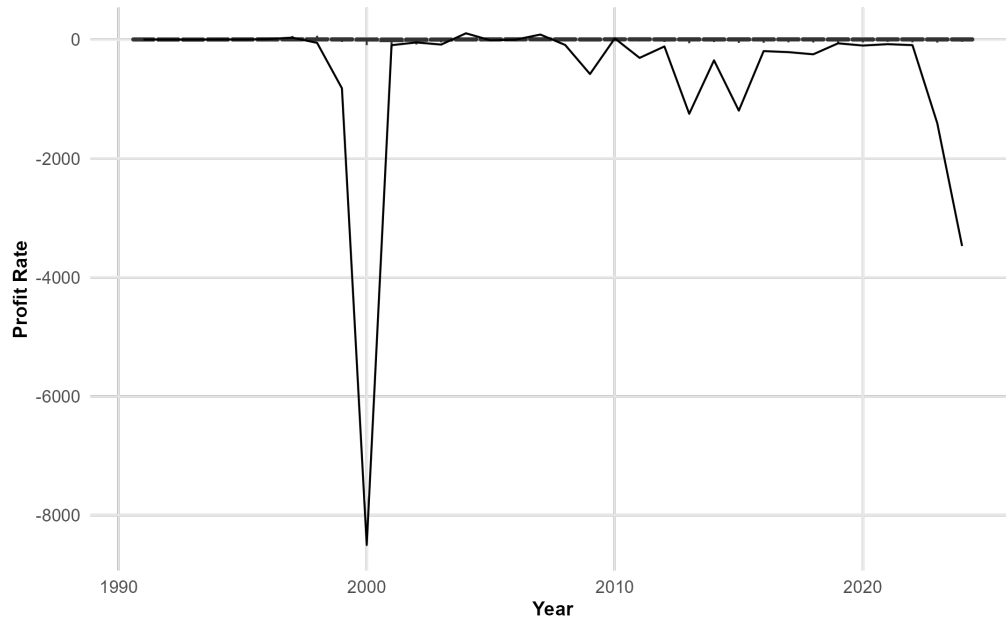
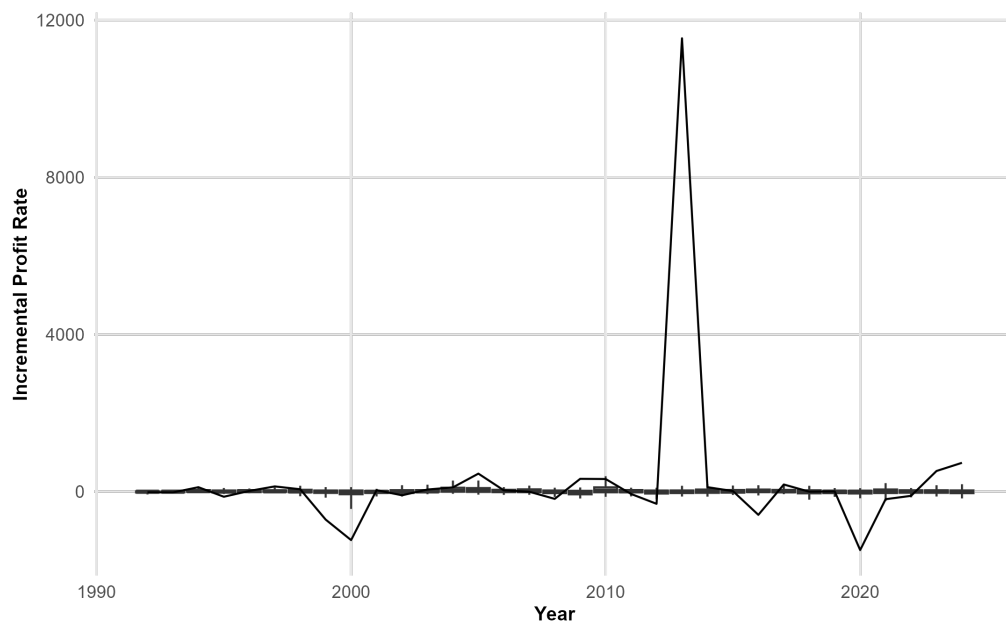


Figure 6: Evolution of Incremental Profit Rates, Including Outliers



Note: Distribution of (incremental) profit rates in every year indicated by a boxplot. The thick central line represents the median, the box the central 50 percent and the whiskers the central 80 percent of the distribution. The continuous line indicates the arithmetic mean of the distribution in every year.

Source: LSEG 2026b; Destatis 2026a, own calculations

Table 34: Summary Statistics for Firms with Observed Profit Rates, Including Outliers

Variable		Mean	SD	Min	p1	p25	Median	p75	p99	Max
Net Sales	(NSL)	3382.73	15000.63	-13.07	0.01	36.53	153.38	793.14	74979.44	271648.69
Gross Operating Profit	(GOP)	167.62	1056.24	-13362.34	-500.74	-1.88	2.81	26.16	5249.47	21373.52
Gross Property, Plant and Equipment	(GPPE)	3234.74	15514.35	0.00	0.07	12.43	89.26	527.51	85050.98	253900.54
Inventories	(INV)	430.88	2175.34	-0.20	0.00	1.12	17.17	94.56	8798.73	46910.88
Trade Receivables Net	(TRN)	585.92	3210.44	0.00	0.01	5.19	23.65	126.85	11585.30	89658.05
Net Intangible Assets	(NIA)	797.54	4918.77	-458.70	0.00	1.30	10.47	64.95	16860.78	119469.51
Net Goodwill	(NGW)	628.35	2875.99	-483.78	0.00	1.11	10.75	68.55	15911.80	55061.71
Operating Capital	(CAP)	4084.75	20713.79	0.00	0.04	20.63	123.57	675.24	95493.45	366680.86
Profit Rate		-596.26	33593.01	-3670733.92	-1665.49	-4.56	2.97	9.89	215.33	72491.66

Note: All variables, except the profit rate, are given in million euros, price-adjusted with deflators from the Statistisches Bundesamt (Destatis 2026a). For NSL, GOP, as measures related to income, the general GDP-deflator is used. GPPE is deflated by the gross fixed capital formation deflator. INV, TRN, NIA and NGW are price-adjusted by the gross capital deflator. All deflators are calculated as chain indices with 2020 as year of reference (Destatis 2026a). Operating capital is the sum of deflated GPPE, INV, TRN and NIA minus deflated NGW. The profit rate is the ratio of GOP to CAP, given in percentiles.

Source: LSEG 2026b; Destatis 2026a, own calculations

Table 35: Summary Statistics for Firms with Observed Incremental Profit Rates, Including Outliers

Variable	Mean	SD	Min	p1	p25	Median	p75	p99	Max
Net Sales	4000.51	16646.18	0.00	0.14	56.61	225.07	1126.99	78782.19	271648.69
Δ Gross Operating Profit	3.05	561.73	-14644.74	-950.62	-4.52	0.43	7.40	1032.02	16999.33
Δ Gross Property, Plant and Equipment	198.00	1801.85	-59877.47	-605.43	0.24	5.78	41.88	5458.79	53656.37
Δ Inventories	16.59	392.01	-16265.00	-349.18	-0.48	0.24	6.61	743.80	15508.00
Δ Trade Receivables Net	19.78	985.00	-35877.00	-484.65	-1.23	0.74	8.98	1160.20	33609.38
Δ Net Intangible Assets	72.61	1443.32	-38860.34	-659.04	-0.79	0.05	4.40	2134.63	60080.02
Δ Net Goodwill	47.52	807.71	-15104.89	-528.62	-0.33	0.00	2.53	1766.18	28935.30
Δ Operating Capital	495.75	3057.46	0.00	0.07	5.99	24.61	120.36	10279.53	138720.64
Incremental Profit Rate	304.60	36750.41	-527962.60	-2397.42	-28.34	3.35	37.13	2345.18	3351547.52

Note: All variables, except the incremental profit rate, are given in million euros, price-adjusted with deflators from the Statistisches Bundesamt (Destatis 2026a). For NSL, Δ GOP, as measures related to income, the general GDP-deflator is used. GPPE is deflated by the gross fixed capital formation deflator. Δ INV, Δ TRN, Δ NIA and Δ NGW are price-adjusted by the gross capital deflator. Changes express price-adjusted nominal changes. All deflators are calculated as chain indices with 2020 as year of reference (Destatis 2026a). Δ Operating capital is deflated by the gross capital formation deflator. The incremental profit rate is the ratio of Δ GOP to one-year-lagged Δ CAP, given in percentiles.

Source: LSEG 2026b; Destatis 2026a, own calculations

Figure 7: Evolution of Profit Rates, Winsorized Data

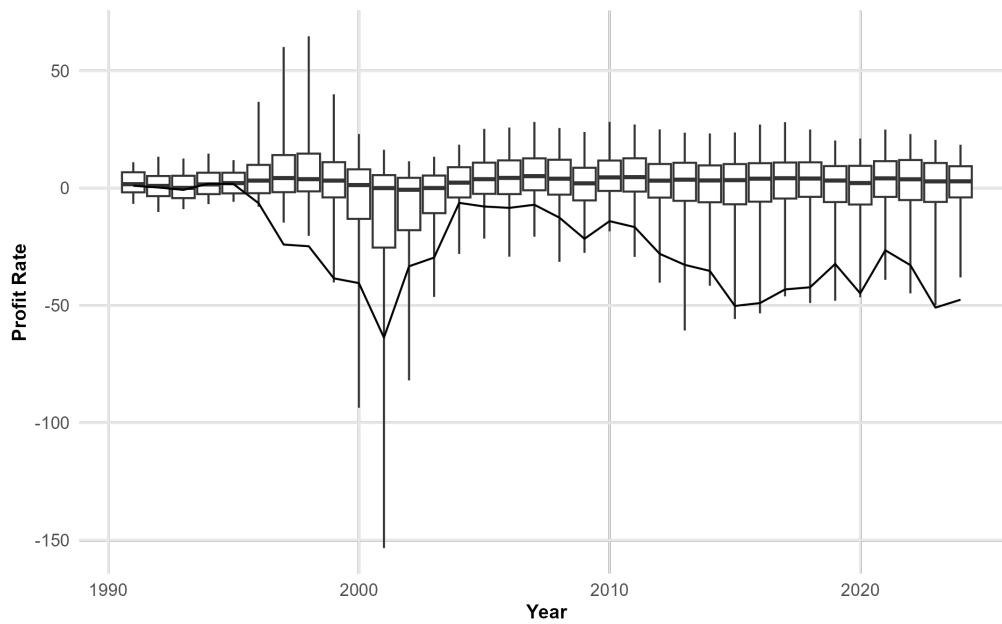
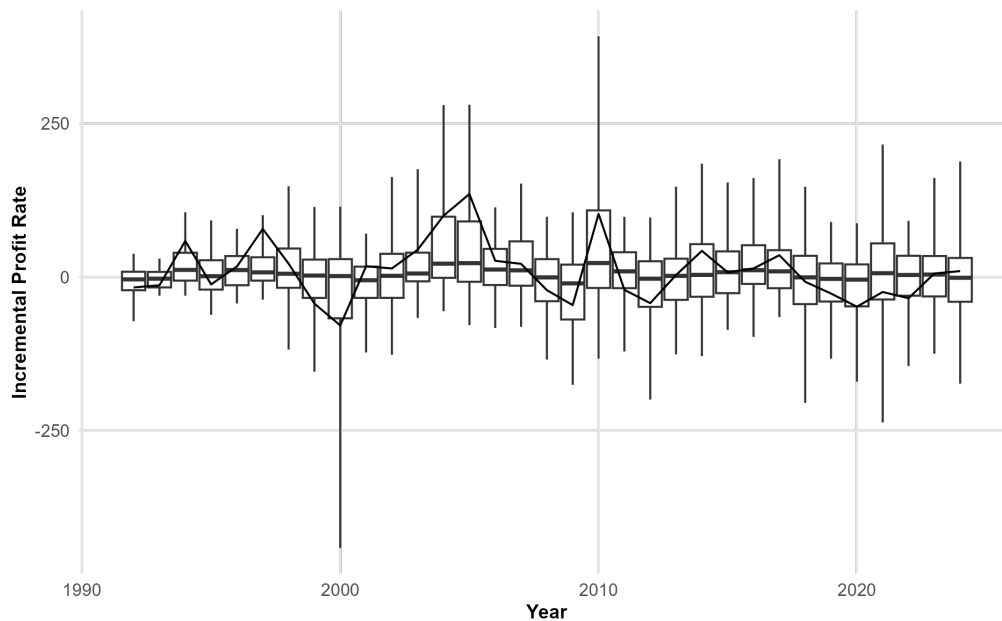


Figure 8: Evolution of Incremental Profit Rates, Winsorized Data



Note: Distribution of winsorized (incremental) profit rates in every year indicated by a boxplot. The thick central line represents the median, the box the central 50 percent and the whiskers the central 80 percent of the distribution. The continuous line indicates the arithmetic mean of the distribution in every year.

Source: LSEG 2026b; Destatis 2026a, own calculations

Table 36: Autoregression (Orders 1-30) Results for Profit Rates, Winsorized Data

Regressor	α	λ	Obs.	Adj. R^2
$\dot{\pi}_{i,t-1}$	1.980 (1.284)	0.609 (0.007)***	13469	0.376
$\dot{\pi}_{i,t-2}$	4.577 (1.395)**	0.474 (0.008)***	12617	0.231
$\dot{\pi}_{i,t-3}$	7.626 (1.450)***	0.358 (0.008)***	11795	0.138
$\dot{\pi}_{i,t-4}$	9.117 (1.494)***	0.325 (0.009)***	10996	0.110
$\dot{\pi}_{i,t-5}$	10.298 (1.548)***	0.304 (0.009)***	10229	0.092
$\dot{\pi}_{i,t-6}$	11.643 (1.597)***	0.285 (0.010)***	9492	0.081
$\dot{\pi}_{i,t-7}$	12.149 (1.687)***	0.269 (0.011)***	8784	0.064
$\dot{\pi}_{i,t-8}$	14.176 (1.761)***	0.219 (0.012)***	8106	0.039
$\dot{\pi}_{i,t-9}$	15.802 (1.791)***	0.209 (0.012)***	7458	0.036
$\dot{\pi}_{i,t-10}$	17.340 (1.847)***	0.199 (0.013)***	6832	0.031
$\dot{\pi}_{i,t-11}$	19.407 (1.907)***	0.130 (0.014)***	6242	0.013
$\dot{\pi}_{i,t-12}$	21.623 (1.948)***	0.101 (0.016)***	5686	0.007
$\dot{\pi}_{i,t-13}$	23.015 (2.022)***	0.098 (0.016)***	5168	0.007
$\dot{\pi}_{i,t-14}$	25.758 (2.086)***	0.042 (0.017)*	4690	0.001
$\dot{\pi}_{i,t-15}$	29.308 (2.030)***	0.013 (0.017)	4240	0.000
$\dot{\pi}_{i,t-16}$	30.837 (2.137)***	0.007 (0.017)	3810	0.000
$\dot{\pi}_{i,t-17}$	31.473 (2.283)***	0.018 (0.018)	3412	0.000
$\dot{\pi}_{i,t-18}$	33.273 (2.326)***	0.005 (0.018)	3039	0.000
$\dot{\pi}_{i,t-19}$	34.628 (2.337)***	0.013 (0.018)	2688	0.000
$\dot{\pi}_{i,t-20}$	36.754 (2.359)***	0.012 (0.019)	2364	0.000
$\dot{\pi}_{i,t-21}$	38.080 (2.436)***	0.012 (0.018)	2060	0.000
$\dot{\pi}_{i,t-22}$	38.694 (2.624)***	0.017 (0.019)	1775	0.000
$\dot{\pi}_{i,t-23}$	40.772 (2.717)***	-0.007 (0.020)	1508	-0.001
$\dot{\pi}_{i,t-24}$	39.651 (3.195)***	0.005 (0.024)	1268	-0.001
$\dot{\pi}_{i,t-25}$	39.130 (3.511)***	-0.019 (0.026)	1041	0.000
$\dot{\pi}_{i,t-26}$	38.367 (3.815)***	-0.026 (0.026)	840	0.000
$\dot{\pi}_{i,t-27}$	38.748 (3.878)***	-0.020 (0.030)	652	-0.001
$\dot{\pi}_{i,t-28}$	37.115 (4.904)***	-0.027 (0.060)	498	-0.002
$\dot{\pi}_{i,t-29}$	39.780 (4.787)***	-0.156 (0.399)	375	-0.002
$\dot{\pi}_{i,t-30}$	37.050 (6.287)***	0.069 (0.488)	284	-0.003

Note: Each row displays estimated parameters from a separate AR(n) model of time-demeaned profit rates across all firms. λ indicates the average total autoregressive effect after n years, estimated by bivariate OLS regression of $\dot{\pi}_{i,t}$ on $\dot{\pi}_{i,t-n}$. α denotes the average technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. p<0.1, * p<0.05, ** p<0.01, *** p<0.001). Additionally, the number of observations (Obs.) and adjusted R^2 (Adj. R^2), as measure of explained variance, are given for every model. Profit rate deviations from the mean show significant positive autocorrelation up until the 14th period.

Source: LSEG 2026b; Destatis 2026a, own calculations

Table 37: Autoregression (Order 1) Results for Profit Rates, by Initial Rank, Winsorized Data

Initial Rank	α	λ	$\dot{\pi}^*$	Obs.	Adj. R^2
1	14.952 (1.869)***	0.604 (0.042)***	37.771 (2.735)***	402	0.341
2	12.752 (1.034)***	0.634 (0.028)***	34.825 (1.567)***	777	0.402
3	11.456 (1.010)***	0.647 (0.026)***	32.486 (2.031)***	884	0.419
4	0.200 (2.243)	0.977 (0.034)***	8.854 (95.025)	810	0.506
5	6.644 (2.372)**	0.708 (0.026)***	22.748 (8.002)**	752	0.499
6	17.781 (3.989)***	0.165 (0.052)**	21.297 (4.588)***	647	0.014

Note: Each row displays estimated parameters from a separate AR(1) model of time-demeaned profit rates. The model is estimated for every sextile of the initial years' profit rate distribution. Firms are assigned to groups following their mean profit rate in the years 1991-1994. λ denotes the group-specific AR(1) coefficient, indicating short-run persistence of profit rates. $\dot{\pi}^*$ indicates the projected group-specific long-run differential of profit rates to the economy-wide mean profit rate. μ denotes the group-specific technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). Firms with higher initial rank in the profit rate distribution show higher persistence of profit rates both in the short-run and in the long-run.

Source: LSEG 2026b; Destatis 2026a, own calculations

Table 38: Autoregression (Orders 1) Results for Incremental Profit Rates, by Initial Rank, Winsorized Data

Initial Rank	α	λ	$\dot{\rho}^*$	Obs.	Adj. R^2
1	38.438 (16.457)*	-0.061 (0.051)	36.219 (15.292)*	145	0.003
2	0.241 (6.667)	0.009 (0.041)	0.243 (6.728)	270	-0.004
3	13.389 (6.360)*	-0.026 (0.038)	13.046 (6.198)*	296	-0.002
4	-6.847 (14.183)	0.001 (0.054)	-6.852 (14.209)	418	-0.002
5	-11.896 (8.686)	0.032 (0.054)	-12.292 (8.967)	414	-0.002
6	-28.046 (23.241)	-0.048 (0.080)	-26.755 (22.172)	308	-0.002

Note: Each row displays estimated parameters from a separate AR(1) model of time-demeaned incremental profit rates. The model is estimated for every sextile of the initial years' incremental profit rate distribution. Firms are assigned to groups following their mean incremental profit rate in the years 1992-1995. λ denotes the group-specific AR(1) coefficient, indicating short-run persistence of incremental profit rates. $\dot{\rho}^*$ indicates the projected group-specific long-run differential of incremental profit rates to the economy-wide mean incremental profit rate. μ denotes the group-specific technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). Firms with higher initial incremental profit rate tend to have higher projected incremental profit rates in the long-run. In the short run incremental profit rates show little persistence, pointing to high volatility.

Source: LSEG 2026b; Destatis 2026a, own calculations

Table 39: Autoregression (Orders 1-30) Results for Incremental Profit Rates, Winsorized Data

Regressor	α	λ	Obs.	Adj. R^2
$\dot{\rho}_{i,t-1}$	-3.772 (4.756)	-0.001 (0.012)	5922	0.000
$\dot{\rho}_{i,t-2}$	-0.335 (4.921)	-0.007 (0.013)	5350	0.000
$\dot{\rho}_{i,t-3}$	0.224 (5.277)	-0.033 (0.014)*	4949	0.001
$\dot{\rho}_{i,t-4}$	4.490 (5.307)	-0.047 (0.014)***	4602	0.002
$\dot{\rho}_{i,t-5}$	6.639 (5.387)	0.011 (0.014)	4190	0.000
$\dot{\rho}_{i,t-6}$	-0.224 (5.590)	-0.011 (0.014)	3877	0.000
$\dot{\rho}_{i,t-7}$	2.285 (5.512)	0.005 (0.014)	3572	0.000
$\dot{\rho}_{i,t-8}$	5.389 (5.787)	-0.045 (0.016)**	3269	0.002
$\dot{\rho}_{i,t-9}$	5.202 (6.128)	-0.014 (0.017)	2952	0.000
$\dot{\rho}_{i,t-10}$	6.165 (6.697)	0.000 (0.019)	2706	0.000
$\dot{\rho}_{i,t-11}$	7.423 (6.431)	-0.020 (0.018)	2552	0.000
$\dot{\rho}_{i,t-12}$	1.198 (7.107)	0.015 (0.021)	2313	0.000
$\dot{\rho}_{i,t-13}$	14.347 (7.174)*	-0.025 (0.021)	2098	0.000
$\dot{\rho}_{i,t-14}$	5.773 (7.588)	0.026 (0.021)	1923	0.000
$\dot{\rho}_{i,t-15}$	17.645 (7.984)*	0.039 (0.023).	1766	0.001
$\dot{\rho}_{i,t-16}$	6.089 (7.250)	-0.015 (0.022)	1623	0.000
$\dot{\rho}_{i,t-17}$	10.023 (6.635)	0.031 (0.018).	1431	0.001
$\dot{\rho}_{i,t-18}$	3.202 (8.013)	0.036 (0.023)	1258	0.001
$\dot{\rho}_{i,t-19}$	11.895 (7.295)	0.012 (0.022)	1136	-0.001
$\dot{\rho}_{i,t-20}$	0.488 (9.435)	-0.005 (0.026)	1013	-0.001
$\dot{\rho}_{i,t-21}$	15.204 (8.861).	-0.001 (0.026)	902	-0.001
$\dot{\rho}_{i,t-22}$	-6.463 (10.649)	-0.006 (0.034)	778	-0.001
$\dot{\rho}_{i,t-23}$	-3.591 (10.886)	0.015 (0.042)	666	-0.001
$\dot{\rho}_{i,t-24}$	-5.641 (12.275)	0.010 (0.040)	557	-0.002
$\dot{\rho}_{i,t-25}$	-12.864 (16.409)	-0.198 (0.058)***	434	0.024
$\dot{\rho}_{i,t-26}$	-23.419 (18.162)	0.021 (0.082)	345	-0.003
$\dot{\rho}_{i,t-27}$	-10.393 (21.015)	0.034 (0.153)	288	-0.003
$\dot{\rho}_{i,t-28}$	-10.157 (25.409)	-0.015 (0.101)	222	-0.004
$\dot{\rho}_{i,t-29}$	18.107 (26.394)	0.004 (0.093)	164	-0.006
$\dot{\rho}_{i,t-30}$	44.378 (25.759).	0.036 (0.114)	128	-0.007

Note: Each row displays estimated parameters from a separate AR(n) model of time-demeaned incremental profit rates across all firms. λ indicates the average total autoregressive effect after n years, estimated by bivariate OLS regression of $\dot{\rho}_{i,t}$ on $\dot{\rho}_{i,t-n}$. α denotes the average technical intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). The deviation of incremental profit rates from the mean shows little autocorrelation.

Source: LSEG 2026b; Destatis 2026a, own calculations

3.8 Temporal Relation of Profit Change and Investment

Table 40: Regression Results of Current Operating Profit Change on Operating Capital Change Lagged by 0 to 30 Years

Regressor	α	β	Obs	Adj. R^2
$\Delta CAP_{i,t}$	0.017 (0.006)**	0.012 (0.002)***	9060	0.004
$\Delta CAP_{i,t-1}$	-0.002 (0.006)	0.010 (0.002)***	8661	0.003
$\Delta CAP_{i,t-2}$	0.005 (0.007)	0.011 (0.003)***	8116	0.002
$\Delta CAP_{i,t-3}$	0.005 (0.007)	0.037 (0.003)***	7554	0.027
$\Delta CAP_{i,t-4}$	-0.001 (0.007)	0.037 (0.003)***	7042	0.027
$\Delta CAP_{i,t-5}$	0.012 (0.008)	0.014 (0.003)***	6630	0.004
$\Delta CAP_{i,t-6}$	0.015 (0.008).	0.018 (0.003)***	6122	0.006
$\Delta CAP_{i,t-7}$	0.014 (0.008)	0.022 (0.003)***	5660	0.009
$\Delta CAP_{i,t-8}$	0.004 (0.009)	0.018 (0.003)***	5231	0.006
$\Delta CAP_{i,t-9}$	0.017 (0.010).	0.000 (0.003)	4804	0.000
$\Delta CAP_{i,t-10}$	0.021 (0.010)*	0.010 (0.003)**	4394	0.002
$\Delta CAP_{i,t-11}$	0.010 (0.011)	0.000 (0.000)***	4023	0.033
$\Delta CAP_{i,t-12}$	0.018 (0.012)	0.000 (0.000)	3719	0.000
$\Delta CAP_{i,t-13}$	0.030 (0.015)*	0.000 (0.000)***	3405	0.009
$\Delta CAP_{i,t-14}$	0.019 (0.017)	0.000 (0.000)***	3089	0.006
$\Delta CAP_{i,t-15}$	0.003 (0.019)	0.000 (0.000)***	2781	0.008
$\Delta CAP_{i,t-16}$	0.025 (0.018)	0.000 (0.000)***	2579	0.012
$\Delta CAP_{i,t-17}$	0.002 (0.021)	0.000 (0.000).	2303	0.001
$\Delta CAP_{i,t-18}$	0.019 (0.023)	0.000 (0.000).	2038	0.001
$\Delta CAP_{i,t-19}$	0.029 (0.026)	0.000 (0.000)	1793	0.000
$\Delta CAP_{i,t-20}$	0.009 (0.028)	0.000 (0.000).	1581	0.002
$\Delta CAP_{i,t-21}$	0.024 (0.031)	0.000 (0.000)	1400	0.000
$\Delta CAP_{i,t-22}$	0.007 (0.037)	0.000 (0.000)	1257	-0.001
$\Delta CAP_{i,t-23}$	-0.047 (0.040)	0.000 (0.000)***	1102	0.100
$\Delta CAP_{i,t-24}$	0.039 (0.049)	0.000 (0.000)	927	-0.001
$\Delta CAP_{i,t-25}$	0.045 (0.058)	0.000 (0.000)	760	-0.001
$\Delta CAP_{i,t-26}$	-0.030 (0.072)	0.000 (0.000)*	606	0.007
$\Delta CAP_{i,t-27}$	0.048 (0.090)	0.000 (0.000)	480	0.000
$\Delta CAP_{i,t-28}$	0.003 (0.113)	0.000 (0.000)	377	0.001
$\Delta CAP_{i,t-29}$	0.115 (0.133)	0.000 (0.000)	304	0.001
$\Delta CAP_{i,t-30}$	0.016 (0.164)	0.000 (0.000)**	229	0.037

Note: Each row displays estimated parameters from a separate OLS regression model of the annual change in gross operating profit of firm i in period t ($\Delta GOP_{i,t}$) on the change in operating capital of firm i in period $t-j$ ($\Delta CAP_{i,t-j}$), both measured in billion euros (price-adjusted). β indicates the average regression coefficient of $\Delta CAP_{i,t-j}$ across all firms in the sample. α denotes the average intercept. Standard errors are given in parenthesis. Stars indicate statistical significance (. $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). Observations (Obs.) and adjusted R^2 (Adj. R^2), as measure of explained variance, are given for every model. The current operating profit change is positively correlated with operating capital investment from multiple previous years. The correlation is highest after four and five years. *Source:* LSEG 2026b; Destatis 2026a, own calculations