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Exploring resilience of cooperatives in time of crisis

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Abstract

The cooperative working model, with its emphasis on member-ownership and stakeholder value, is often theorized to possess greater resilience during economic crises. This thesis quantitatively tests this assumption in the context of the COVID-19 pandemic in Finland. Using two official datasets from Statistics Finland covering enterprise counts (2013-2024) and key performance metrics (turnover, employees, salaries, 2018-2023), this study conducts a Difference-in-Differences event study to compare the performance of cooperative and non-cooperative enterprises before and after the pandemic shock. The results reveal a nuanced and divergent story. The analysis finds a statistically significant relative decline in the total number of cooperative enterprises in the post-pandemic period. In contrast, the analysis of performance metrics for the surviving firms found no statistically significant difference between cooperatives and non-cooperatives in terms of turnover, employment, or salaries. It is possible that the Finnish cooperative sector underwent a period of consolidation (a reduction in the number of active enterprises), while the more established cooperatives (often market leaders in their sectors) that remained demonstrated operational resilience on par with their non-cooperative counterparts, but a conclusive statement cannot be made as the performance models for turnover, employees, salaries, while well-specified, showed high variance in the data, suggesting diverse outcomes among the firms in both groups. This suggests that the resilience of cooperatives due to COVID crisis was multifaceted in Finland, demonstrating stability in the performance of surviving firms but a vulnerability to a reduction in the total number of enterprises.

Zusammenfassung

Das genossenschaftliche Geschäftsmodell, das auf Miteigentum der Mitglieder und dem Wert für die Stakeholder basiert, wird in der Theorie oft als widerstandsfähiger in Wirtschaftskrisen angesehen. Diese Arbeit überprüft diese Annahme quantitativ im Kontext der COVID-19-Pandemie in Finnland. Unter Verwendung zweier offizieller Datensätze von Statistics Finland, die den Unternehmensbestand (2013-2024) und zentrale Leistungsindikatoren (Umsatz, Beschäftigte, Gehälter, 2018-2023) abdecken, führt diese Studie eine Differenz-von-Differenzen-Ereignisstudie durch, um die Leistung von genossenschaftlichen und nicht-genossenschaftlichen Unternehmen vor und nach dem Pandemieschock zu vergleichen.

Die Ergebnisse zeigen ein nuanciertes und divergentes Bild. Die Analyse stellt einen statistisch signifikanten relativen Rückgang der Gesamtzahl der Genossenschaften in der Zeit nach der Pandemie fest. Im Gegensatz dazu ergab die Analyse der Leistungsindikatoren für die überlebenden Unternehmen keinen statistisch signifikanten Unterschied zwischen Genossenschaften und Nicht-Genossenschaften in Bezug auf Umsatz, Beschäftigung oder Gehälter. Es ist möglich, dass der finnische Genossenschaftssektor eine Phase der Konsolidierung (eine Reduzierung der Anzahl aktiver Unternehmen) durchlief, während die etablierteren Genossenschaften (oft Marktführer in ihren Sektoren), die verblieben, eine operative Resilienz auf Augenhöhe mit ihren nicht-genossenschaftlichen Pendants zeigten. Eine endgültige Aussage kann jedoch nicht getroffen werden, da die Leistungsmodelle für Umsatz, Beschäftigte und Gehälter zwar gut spezifiziert waren, aber eine hohe Varianz in den Daten aufwiesen, was auf unterschiedliche Ergebnisse unter den Unternehmen in beiden Gruppen hindeutet. Dies legt nahe, dass die Resilienz der Genossenschaften infolge der COVID-Krise in Finnland vielschichtig war und sich in der Stabilität der Leistung der überlebenden Unternehmen, aber auch in einer Anfälligkeit für eine Verringerung der Gesamtzahl der Unternehmen zeigte.

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Use of AI tools: While not perfect in their function, AI technologies such as Deepseek and Gemini were primarily used in this thesis to assist in data analysis and coding, especially in R, which made the research work more time-efficient.

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1 Introduction

Cooperatives are not new forms of work organizations. Initially gaining prominence as worker cooperatives during the first industrial revolution as a reaction to industrial capitalism, they have existed for over two hundred years. From their inception, cooperative enterprises have been observed in various forms – in historic revolutionary experiments such as the USSR, Socialist Yugoslavia, Anarchist Catalonia to international social movements - some alive till present day - such as Chiapas in Mexico or Rojava in Northeast Syria. In some form or another, cooperatives have existed throughout modern history. Now in the 21st century, they are making a resurgence. Worker Cooperative State of the Sector Report by Democracy at Work Institute, 2023 , functioning primarily in the United States, found that “estimated number of worker cooperatives grew by 20% over the last two years and tripled over the past decade”.

In EU Commission, 2004 - an official communication released in 2004 on the promotion of co-operative societies - showed official position of the European union on formation and promotion of cooperative enterprises. It acknowledged the renewed international interest in cooperative work structures and cited many reasons why the EU wants to help create and promote more cooperatives within the borders of its jurisdiction. Among many reasons mentioned included promoting social integration, solidarity-based growth, meeting community objectives such as employment in rural development (agriculture for example), social inclusion of diverse groups, diversity of enterprises other than traditional corporations, establishing a standardized recognition and regulatory framework for cooperatives across the EU, especially due to cooperatives having large sectorial impact in major EU economies such as 83% market share in Netherlands’ agriculture sector (Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, 2025), and much more.

One of the major claims made by EU communication and other cooperative research discussed in this paper can be summarized as - cooperatives are more stable/resilient in times of crisis than traditional businesses and can be used as a means to address current and future crises, hence this thesis will attempt to verify quantitatively and discuss in detail if such claims are actually true for one of the most recent economic crisis - the COVID pandemic. We do this by focusing on data from the Finnish cooperative sector, and conduct a difference-in-difference analysis comparing trends in performance of cooperative enterprises

to non-cooperatives due to COVID crisis.

The thesis is organized as follows: After Introduction chapter, we discuss background where we explore relevant context including what is described as a cooperative and it's historical legacy, motivation behind our research scope and gap in published research, why we focus on Finland, and some characteristics of Finnish cooperative sector. Then Methodology covers our data analysis methods, discussion on data and its source, difference in difference models and some data limitations. Following methodology, analysis and results chapter discusses the results and explore the key findings, and give analysis for possible future research, concluding the thesis.

2 Background

As discussed in introduction, cooperatives have existed throughout modern history and for many reasons, major economies such as the European Union are trying to promote and facilitate their creation today, but before evaluating the claims made by reputable parties, it is also important to establish some background. While it might be expected to be known, it is unlikely that majority of population understand what is meant by a cooperative work organization and how they function. According to the founder of start.coop and research done by the organization, Thorpe, 2019 reported that “while 76 percent of people would be more likely to support a co-op, everything else being equal, only about 10 percent of people can accurately define it.” This was surprising. During work on this thesis, I spent considerable amount of time at the university, and while studying at an Economics department, I would expect my fellow master’s students to know what a cooperative is, it was rare to find someone who did. For example – In my Master’s conversatorium seminar, out of 18 participants, in an unofficial survey, only two somewhat knew what cooperatives were - which was surprising to observe at an Economics faculty, so we start with exploring something essential.

2.1 What are cooperatives?

The definition given by Committee for the Promotion and Advancement of Cooperatives - COPAC, 2025 captures cooperatives in very simple terms – Cooperatives are businesses owned and controlled by the very members they serve.

This structure has taken many forms throughout history but for simplicity a cooperative can be understood by looking at two dimensions of an organization – ownership and management. This can be further explored as a comparison to traditional companies. A traditional company/business has an ownership class which owns the organization (owners can be founders, shareholders in public market, venture capitalists, institutional investors such as hedge funds, big banks etc.) and then this owner class, which has the full decision-making power, decides to hire workers to work on their behalf. In this work arrangement, a worker class is created which rarely has any ownership stake. If they do have any ownership, in form of stock incentives for example, it is insignificant/negligible that serves primarily as a financial incentive/bonus. Lack of any ownership makes it so that the worker class do not have any significant

say in how the organization - they work in - should function. The ultimate authority resides with the owner class. As a world-renowned linguist and political speaker/writer, describes in his book: “it’s ridiculous to talk about freedom in a society dominated by huge corporations. What kind of freedom is there inside a corporation? They’re totalitarian institutions – you take orders from above and maybe give them to people below you. There’s about as much freedom as under Stalinism” (Chomsky, 1998, *The Common Good*, p. 19). What Chomsky is accurately pointing out is a two-tier hierarchical structure – an owner or a decision-making class which often does not work in the organization they own, and a worker class which works and keeps the organization running but has little to no ownership or decision-making power in the organization they run.

In contrast, cooperatives which historically started as worker cooperatives (a form of cooperative) - in very simple terms – were equally owned and collectively operated by the workers in them. Simply put, there was no owner class. The workers came together to form an economic organization which they owned and democratically/collectively made all decisions in. This could be done through democratic councils, or elected representatives, or any other way they choose to see fit. No matter the internal decision of the organization, democratic decision-making remained a central part of cooperatives as ownership remained collective. This people/community centered organizational structure is also why - EU Commission, 2004 mentions meeting positive goals such as social integration and inclusion of diverse groups, solidarity-based growth and other community/social goals mentioned in the introduction. Financially, any excess profit in a cooperative was either distributed to its members in an equitable way or was reinvested in functioning/growth of the cooperative. Since there was no owner class that collects dividends or giant bonuses, research such as Magne, 2017 has also found cooperatives having significantly lower wage inequality (top vs low management positions) compared to traditional firms due to their collective decision making and profit sharing.

While cooperatives initially started as worker cooperatives as reaction to industrial capitalism, with time diverse forms of cooperatives started to emerge. Few iterations would be consumer cooperatives - businesses owned by their customers - the consumers for their collective benefit; producer cooperatives – businesses owned by members who produce same type of goods (this is helpful for every participating member for pooling resources, processing, marketing etc. while accessing larger markets and reducing costs); platform or creative cooperatives – hybrid cooperatives started in the age of internet as a way for freelancers, artists, creative agents to come together to own and manage a platform collectively while helping independent members with an organization backing and social services such as health insurance which can be expensive for independent creators to attain. Today, cooperatives exist across the world in all major economics including modern European social democracies

such as Spain, Italy or Finland in vibrant and diverse forms.

2.2 Motivation

With some understanding of what cooperatives are, one shall ask - what is this study about and why it is conducted?

As observed, labor market interest in cooperatives is resurging, and governments recognizing interest in them and their benefits are trying to assist in their formation and survival. This study aims to explore and verify quantitatively whether claims made by official bodies and other researchers about cooperatives are valid. And while many aspects and benefits of cooperatives are much explored, this study will add to relatively less researched area on the matter – Survivability/resilience of cooperatives in time of economic crisis. Many literature have explored different areas of impact for cooperatives, and time and time again, they have found similar findings in certain areas. For ex – In a US national survey (How Economic Democracy Impacts Workers, Firms, and Communities - The census of individual workers in worker cooperatives) of 1,147 individual workers in 82 worker cooperatives, Schlachter and Prushinskaya, 2021 found members of cooperatives benefit materially and socially from the workplace democracy cooperatives provided them. Material effects were clear - “77 percent of firms surveyed had a 1:1 or 2:1 top-to-bottom pay ratio” not because of bottom pay being lower but top wages being lower. Workers reported earning higher wages and receiving better benefits at their cooperative than they did at their previous job. The study also found in non-financial impacts that workers in a cooperative experienced “high job satisfaction, autonomy, voice, and other non-financial aspects of job quality” and due to community-based structure, rate of political and civic participation was also higher compared to US overall among the surveyed. Kaswan, 2019 – an article aiming to explore happiness impact of cooperatives compared to traditional business and found similar results – reporting that “impact on workers is generally positive, mostly because of the establishment of democratic control, better working conditions and job security”. Such benefits of cooperatives (financial and non-financial) have been explored in many ways with different methodologies, and such results seem to verified over and over, but in comparison relatively fewer papers explore resilience aspect of cooperatives - especially during time of crisis, and ones that do found mixed results.

Birchall and Ketilson, 2009 by International Labour Organization found that financial cooperatives (including credit unions and cooperative banks) remained financially sound during the financial crisis of 2008-09, while many investor-owned banks required public bailouts. Consumer cooperatives reported increased turnover and in the fallout of such economic turmoil, the worker cooperative model was chosen by many as response to new economic realities as their member-focused structure contributed to long-term stability &

resilience. On the other hand, research papers such as Costa et al., 2023 (The performance of cooperative Vs capitalistic micro firms in the pandemic), which focuses on the most recent global economic crisis – COVID-19 (which this study will also focus on) found that Italian micro cooperatives were more severely affected than capitalist micro enterprises due to the pandemic, both in terms of number of cooperative enterprises and economic performance. In contrast, articles like Merrien et al., 2023 reaffirmed resilience potential of cooperatives finding that cooperatives resisted COVID crises better than conventional businesses in Canada. 2023 Canadian article does mention some limitations as the survey only counted for first 18 months of pandemic and did not consider any sectorial/industry specific effects. Tambunan, 2021, that had similar survey limitations, looked at impact of the COVID-19 pandemic on cooperatives in Indonesia found that cooperatives suffered from decreased turnover, reduced saving, increase in number of loan applications, decline in volume of secondary activities, and decline in number of members. During literature review, few more literature were found that aimed to explore the effect on cooperatives of global pandemic from other parts of the world - some quantitative ones mentioned above, but majority were found to be qualitative in nature maybe due to lack of reputable data or in general due to recency of the global pandemic, but as EU Commission, 2004 and many cooperative organizations have made an interesting claim about resilience of cooperatives in time of crisis, the question this study asks is - can such claims be verified quantitatively, and can some contribution be made to this already mixed area of research on cooperatives. With such motivation, this paper will conduct an event study to explore and verify resilience claims of cooperative sector in Finland with event being COVID-19 pandemic.

2.3 Research Gap

To best of my knowledge, no published quantitative study (peer-reviewed or otherwise) has directly analyzed the effect of COVID-19 on the Finnish cooperative sector, and most available work is either very broad in its scope, speculative or does not make a quantitative assessment of cooperatives specifically. The closest literature found that references impact of COVID-19 pandemic in Finland on economic organizations are - State of Health in the EU Finland Country Health Profile by OECD/European Observatory on Health Systems and Policies, 2021 which primarily focus on health reporting and the pandemic but indirectly mentions economic support schemes, and a qualitative Master thesis in business management from Tampere University of Applied Sciences (Li, 2022) which attempts to analyze “management strategies of Finnish companies during the COVID-19 pandemic” but neither of them isolates the cooperative sector nor conducts a detailed quantitative analysis making this study the first of its kind at submission. The novelty of this study is further highlighted as COVID-19 is a

very recent global crisis, and hence there is a clear research gap in this area from other parts of the world as shown above.

2.4 Finnish Cooperative Sector

Before exploring the data and methods used in the study, it is also imperative to understand – Why Finland, and what are some characteristics of Finnish’ cooperative sector? This can be summarized in three points.

Firstly, Finland - one of the major EU economies - has a robust cooperative sector. According to Pellervo, 2025 – a confederation, central service, forum and lobbying organization for all Finnish cooperatives or “co-operative society” the official legal designation for cooperatives – Finnish cooperatives have almost 7 million memberships with Finnish population of 5.6 million (signifying individual memberships in multiple cooperatives). And around 80% of Finns are members of at least one cooperative. Finnish cooperative sector is a mix with all kind of cooperatives – consumer cooperatives, producer cooperatives, workers cooperatives etc. In every instance being owned equally by hundreds to millions of individuals (depending on size of cooperative). And even though total number of cooperatives in Finland might be lower compared to traditional companies, they are often leaders in multiple sectors. For instance - According to ICA-EURICSE, 2023 - World-Cooperative-Monitor, the OP Financial Group is Finland’s largest financial services group and world’s tenth largest financial cooperative institution by turnover. It is entirely owned by its member cooperative banks, which are themselves owned by their customers, making the entire structure a community-owned financial institution. Simultaneously, S Group is Finland’s largest retail institution which has 19 regional cooperatives and a central organization SOK – which is again a consumer/community owned cooperative. For understanding further what kind of underlying institutions our data represents, we can look at how one of the largest cooperative in Finland works - S Group: One can become S group cooperative equal member/owner after identity verification and by paying a membership fee which is currently €100. This is refundable when one wants to leave the cooperative, but as a member owner, one receives special benefits and discounts with purchases and cash bonus (upto 5% depending on one’s concentrated purchases in S Group) possibly in their S-bank account S Group, 2025 . The cooperative may also pay interest on the membership fee, which is decided annually by the S Group elected representative council that serves as the main decision-making body. S Group’ councils of Representatives are elected every four years by cooperative members and all members aged 15 or over are entitled to vote in the elections, and members who are 18+ and live the area of their regional cooperative can also run for membership in the Council S Group Membership, 2025 . In this arrangement, S group with its 2.6 million members-owners paid total 453

million Euros in bonus and 2 million in total interest to its members with average Co-op member benefits at 202 €/member in 2024 – including all monetary benefits. To document the diversity of Finnish cooperatives, some other prominent examples would be the Lilith worker Cooperative Lilith, 2025 . Lilith is the largest worker and creative cooperative in Finland, which has over 500 members who own and directly work in it. Initially started by group of musicians and music producers, Lilith cooperative now has members who cover extremely diverse area of creative fields – even expanding into comics, journalism, film, TV and much more. Unlike the consumer cooperatives discussed before - to highlight the difference from largest cooperatives in Finland, one cannot simply be a passive member of Lilith co-op by buying a membership. Being a member of worker cooperative means not only you equally own the organization but also directly work and democratically manage the organization. Lilith is a good modern example of first form of worker cooperatives that started during the industrial revolution.

Second, even though interest in cooperatives maybe resurging, they still remain a smaller proportion among all business organizations, hence reputable/official data that isolates co-operatives as legal form is rare to come across or in cases of countries it exist, is either self-collected by researchers or paid/expensive to access. In case of Finland, this is not the case. The Finnish ministry of Finance, under its administrative sector, runs an independent national statistical institute – Statistics Finland, 2025. An impartial central database that aims to process and provide data from many official sources such as government and business registers for free. Additionally due to recency of the global pandemic, many countries simply do not have good quality data available for cooperatives let alone freely, but in case of Finland, the data is up to date and available till end of 2023-2024 depending on the database. So, using such a resource that provides data from official sources served to counteract problems of bad data and issues regarding access to data on cooperatives mentioned above.

Lastly, as mentioned in section 1.3, there is a clear research gap in research for cooperatives that look at resilience aspect in times of crisis - especially a more recent one, and since no quantitative study exist presently to best of my knowledge that focuses on Finland, this study primarily focuses there.

3 Methodology

Data used in this study comes from two official Statistics Finland databases – “11zm – Enterprise openings and closures by legal form and industry, 2013Q1-2024Q4” and “13w6 – Enterprises by industry and legal form (legal unit), 2018-2023”. For convenience purposes, I will refer to them as “11zm” – first database and “13w6” – Second database from now on.

First database 11zm takes quarterly enterprise openings and closures to provide a key variable that this study will explore first – “Stock of enterprises” which basically represents total number of active enterprises at a given point in time. This database provides stock numbers by different industry or sectors and NACE code classifications – Agriculture, manufacturing, wholesale and retail, education etc., legal form – Sole proprietor, General partnership, Limited Partnership, Limited company, Co-operative society, Government enterprise etc., on quarterly basis. Naturally, we are interested in isolating “Co-operative society” and see the effect on stock of enterprises due to COVID-19 pandemic and study the resilience of cooperatives in comparison to non-cooperatives. In simple terms, if number of cooperatives went up or down in comparison to non-cooperatives after the pandemic hits, a correlational statement may be made about their resilience by looking at the survivability of cooperatives. Naturally, the stock does not represent the full picture either. As discussed earlier, cooperatives are concentrated/market leaders in certain industries in Finland, so simply analyzing the stock of enterprises going up or down after the pandemic can’t be used to make a comprehensive statement. For instance – if the number of cooperatives trend went up after start of pandemic, it could also signify breakup of larger coops into smaller and does not necessarily mean that new cooperatives were founded (assumed strength). Similarly, if number of cooperatives went down when COVID-19 hit, it could be that smaller cooperatives were absorbed into larger ones, leading to no material effect in terms of employed population or performance metrics such as turnover so one can’t assume that cooperatives started failing (assumed weakness) when pandemic hit. Such nuances will be further discussed in “Analysis and Results” section but still the stock does serve as a good starting point to understand the nature of cooperative sector in terms of raw numbers. It also resembles the study methodology of working paper Costa et al., 2023 which aims to explore similar effect of COVID-19 but focuses on Italian micro cooperatives.

Second database 13w6 will serve to add nuance and help us analyze performance metrics other than stock. 13w6 focus on key variables such as Turnover, number of personnel or employed, and wages and salaries sum. This is available on yearly basis from 2018 to 2023 in same categorical variation as 11zm – sorted by industries/sectors and legal form as 11zm.

Since our goal is to look at the effect on resilience of cooperatives due to COVID-19 pandemic, the most appropriate tool will be a difference in difference event analysis for co-operatives vs non-cooperatives with event being the COVID-19 pandemic. For this purpose, two panels were created for each database to serve our DID (difference in difference) models - ran and results achieved in R programming language. Additionally, since sectorial categorization is available, further analysis was conducted by not only looking at total coops vs non coops, but comparing most prominent cooperative sectors in Finland to non-cooperatives. To avoid arbitrariness in the selection of certain sectors for the focus of our data analysis, top cooperative sectors in terms of stock, turnover, number of employees and salaries sum were sorted and sectorial results for these prominent sectors were shown from our DID analysis.

In this data analysis, the goal is to exhaust all publicly available data on Finnish economic organizations to study the impact of COVID-19 pandemic on cooperatives in comparison to their non-cooperative counterparts and see if the claim made by EU Commission, 2004, cooperative organizations, and many other papers mentioned in section 1 is consistent in case of Finland.

3.1 Model

As discussed above, to study the impact of the COVID-19 pandemic on cooperative versus non-cooperative enterprises, this study employs a Difference-in-Differences (DID) event study methodology. A standard DID model can effectively estimate the average effect across the entire sample; however, such an approach may hide significant variations across different economic sectors. As also discussed in section 1.4, the presence/concentration of cooperatives varies substantially by industry, so a more nuanced analysis is required.

Therefore, this thesis adopts a two-model DID strategy. In this approach, we estimate both the overall average effect and the sector-specific net effects for key cooperative sectors of the Finnish economy. This is done for all four variables available - Stock of enterprise, turnover, number of employees, and Salaries sum from both databases.

3.1.1 Model A: Total DID Effect

The first model is specified to calculate the total average treatment effect on the treated - cooperatives across all sectors. This provides a single, aggregate measure of the relative performance of cooperatives during the crisis. The model is specified for:

First database 11zm (focusing on stock of enterprises) as -

$$\log(\text{Count}_{ist} + 0.5) = \beta_0 + \delta(\text{CoopDummy}_i \times \text{PostCovid}_t) + \alpha_s + \tau_q + (\theta_s \times \text{TimeTrend}_t) + \epsilon_{ist} \quad (3.1)$$

Second database (focusing on turnover, employees, and salaries sum) as -

$$\log(Y_{it} + 1) = \beta_0 + \delta(\text{CoopDummy}_i \times \text{PostCovid}_t) + \alpha_s + (\theta_s \times \text{TimeTrend}_t) + \epsilon_{it} \quad (3.2)$$

The main coefficient, delta represents the average Cooperative vs. Non-Cooperative difference. The model includes several crucial controls: alpha accounts for the fact that sectors are different sizes at baseline, while (theta x TimeTrend) accounts for each sector's unique growth trend over time. For the Enterprise Count data - only for first database, the model also includes tau to control for regular, quarterly seasonality within a year.

3.1.2 Model B: Sector-Specific Net Effects

To calculate the direct cooperative vs. non-cooperative comparison within specific industries, a second, more detailed interaction model is used.

First Database:

$$\begin{aligned} \log(\text{Count}_{ist} + 0.5) &= \beta_0 + \delta_{\text{base}}(\text{CoopDummy}_i \times \text{PostCovid}_t) \\ &+ \sum_j \gamma_j (\text{CoopDummy}_i \times \text{PostCovid}_t \times \text{Sector}_j) \\ &+ \alpha_s + \tau_q + (\theta_s \times \text{TimeTrend}_t) + \epsilon_{ist} \end{aligned} \quad (3.3)$$

Second Database:

$$\begin{aligned} \log(Y_{it} + 1) &= \beta_0 + \delta_{\text{base}}(\text{CoopDummy}_i \times \text{PostCovid}_t) \\ &+ \sum_j \gamma_j (\text{CoopDummy}_i \times \text{PostCovid}_t \times \text{Sector}_j) \\ &+ \alpha_s + (\theta_s \times \text{TimeTrend}_t) + \epsilon_{it} \end{aligned} \quad (3.4)$$

Net sector-specific DID effect is calculated as -

$$\text{Net Effect}_j = \delta_{\text{base}} + \gamma_j \quad (3.5)$$

The second, more detailed model is used to calculate the specific, standalone DID effect

within each individual sector. It works in two steps: first, it estimates a 'Baseline Effect' (delta base) for a reference sector (Agriculture). Second, it estimates an 'Interaction Effect' (gamma) for every other sector, which measures how much that sector's result differs from the baseline. Then we calculate the final 'Net Effect' for each top sector by summing these two coefficients (delta base plus gamma), which gives the direct Co-op vs. Non-Co-op comparison for that specific industry, while controlling for alpha and TimeTrend in same way as the total DID equation before.

Table 3.1: Definition of Variables and Coefficients from All Models

Symbol	Explanation
$\log(Y_{it} + 1)$	The outcome for annual data (Turnover, etc.), transformed by its logarithm.
$\log(\text{Count}_{ist} + 0.5)$	The outcome for quarterly data (Enterprise Count), transformed by its logarithm.
β_0	The intercept, representing the model's baseline starting point.
δ	The main DID coefficient, representing the total average effect across all sectors.
δ_{base}	The baseline DID effect for the reference sector in the sector-specific model.
Coop_Dummy_i	An indicator variable that equals 1 for a cooperative, and 0 otherwise.
Post_Covid_t	An indicator variable that equals 1 for the post COVID period.
α_s	Sector Fixed Effects, which control for time-invariant differences between sectors.
τ_q	Quarter Fixed Effects, which control for seasonal patterns in the quarterly data (only for first database).
θ_s	Represents the unique, underlying time trend for each individual sector.
γ_j	The interaction term for a specific sector j in the Net Effect model.
ϵ_{ist}	The error term, representing all other unmeasured factors.

3.2 Sector considerations -Prominent cooperative sectors

While total cooperative vs non-cooperative DID effect can be easily calculated for stock, turnover, employees and salaries, we still have to choose the sectors of interest in our analysis that we apply our model to. To avoid arbitrariness in the choice, following criteria was used. We look at top five sectors by each variable of interest. In simple words - data is sorted to see top five cooperative sectors by turnover, employees, salaries and stock, and all the unique sector entries on our lists are selected to create a prominent cooperative sector list so we can focus only on those sectors for our sectorial DID analysis.

Using this criteria, we will focus our sectorial DID analysis on these prominent coop-

erative sectors - G Wholesale and retail trade (abbreviated - Retail), C Manufacturing, N Administrative and support service activities (Administrative), M Professional, scientific and technical activities (Professional), E Water supply; sewerage, waste management and remediation activities (Water Supply), and K Financial and insurance activities (Financial) and show only these sectors in DID results - eliminating arbitrary selection and focusing only on the most relevant/important cooperative sectors. For Example - Largest retail institution of Finland - S Group is part of the "Retail" sector. As discussed earlier, this exercise also reinforces our understanding that even though the number of retail cooperatives is lower, they can be seen dominating in terms of turnover, employees and salaries sum - highlighting sector leadership/concentration in Finland. Here are the results of this exercise visually:

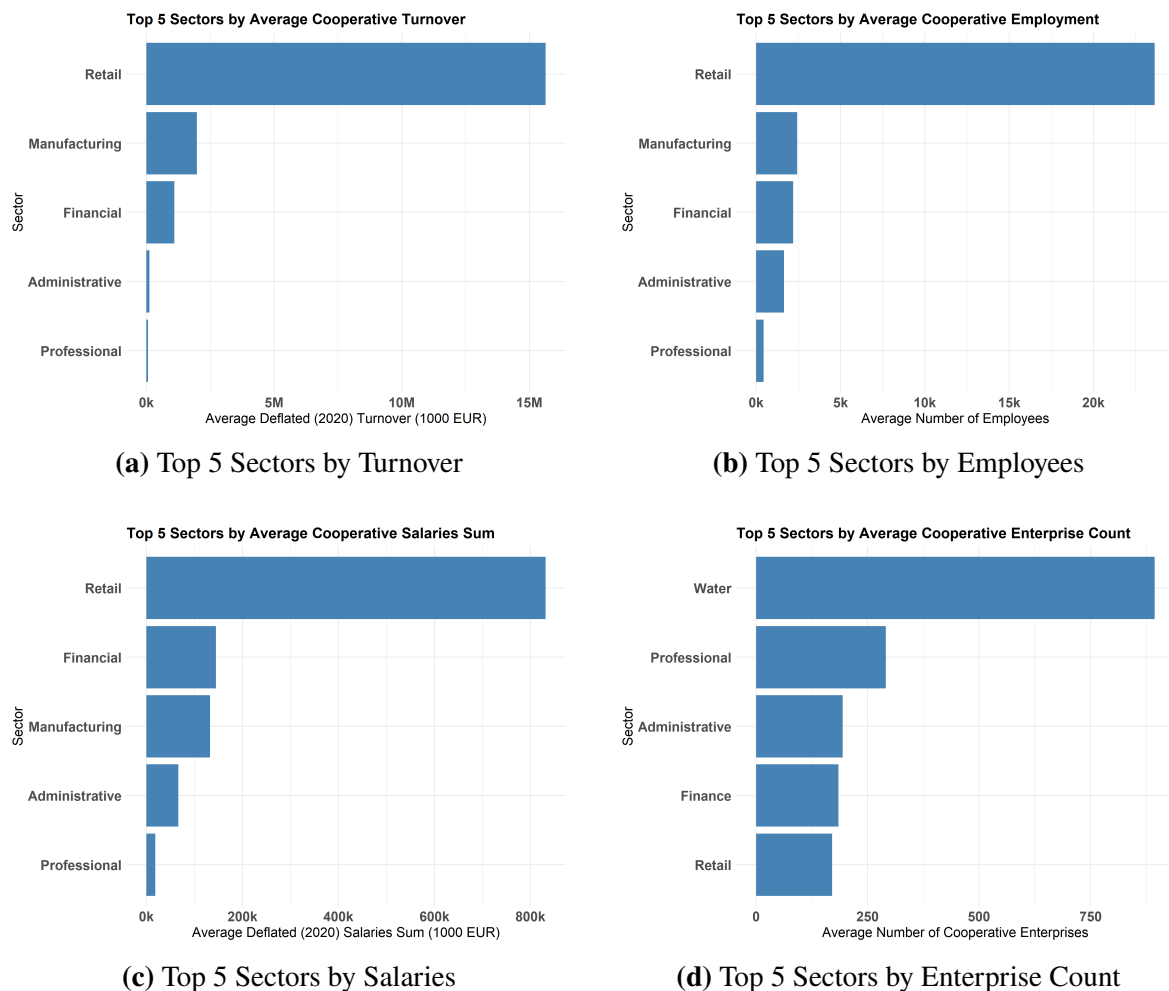


Figure 3.1: Top 5 Sectors by Cooperative Presence Across Different Metrics

3.3 Data limitations

Before discussing our results, it is important to highlight some limitations in this data analysis which is largely focused on incomplete data. Firstly, the first database 11zm is missing enterprise stock numbers for the last three quarters of 2017. The reason for this was due to revisions in the source data. This resulted in unusually large fluctuations in these quarters, especially incorrectly high numbers of enterprise closures which were not genuine - via direct communication with a Statistics Finland representative. Since there was no certainty how many companies actually ceased operations, and according to Statistics Finland representative, the official numbers are not available for these quarters, the data for these quarters was imputed through a simple imputation in our created panel. The differences between imputed and non-imputed data are minor, and it is not expected to affect the overall results. This was done for maintaining completeness. Additionally, in our second database 13w6, turnover data for Financial and insurance services (NACE code K) is missing for first three (2018-2020) out of six years of data points, and since missing data points included an important time frame right before our COVID-19 treatment for DID and since data before 2018 is not available, this data could not simply be imputed. Hence, only for turnover analysis, Financial and insurance services (K) is completely removed from both data analysis (total and sectorial). In direct communication with Statistics Finland, the reason given for this was - turnover data on financial and insurance activities was only added after 2020 to the structural business and financial statement statistics as part of the implementation of the new EU Regulation on European business statistics (EBS). Due to this, data before 2020 is missing and data cannot be provided even on request. In DID focusing on other variables - employees, salaries sum, and stock, industry K is fully included and no other significant data quality issues exist in other areas.

4 Analysis and Results

In this chapter, we will discuss the results and observations of our data analysis. We first look at cooperative vs non-cooperative trend charts for each of our variables - Stock of enterprises, turnover, number of employees and Salaries sum. While using these trend charts as visual references, we move to difference-in-difference results and see what the results simply represent numerically. Discussion section acknowledges and address highlights and limitations of our results, while the section key findings try to give empirical analysis and some possible inferences that can be made from our results. It shows a nuanced and multifaceted picture about cooperative resilience in Finland due to COVID crisis. We conclude this chapter with possible future areas of research with complete view of the thesis and data analysis results.

4.1 Parallel and overall trends

First we look at total cooperative vs non-cooperative trends based on stock, turnover, employees and salaries sum which also aim to show parallel trends before our treatment - 2020 Q1 for stock (due to sectorial data availability), and 2020 for turnover, employees and salaries sum due to yearly data availability. Since the difference in scale of cooperatives vs non-cooperatives are significant. For example - Total cooperative stock at any point in our data is only in few thousands while non-cooperatives (mainly dominated by Limited company - traditional corporation legal designation in Finland) is in hundreds of thousands, raw counts would make cooperatives invisible on the chart, so a standardized index was developed to compare the trends of cooperatives and non-cooperatives on a common scale. The index shows the relative change in the number of enterprises over time, with the base period (2021 Q1) as the reference point (index=1). So the index allows us to see the percentage change over time for each group on a comparable scale to base period. This is done to show them in a presentable manner centered around the period when we want to see the treatment effect - COVID. The same method is used for turnover, employees, and salaries sum:

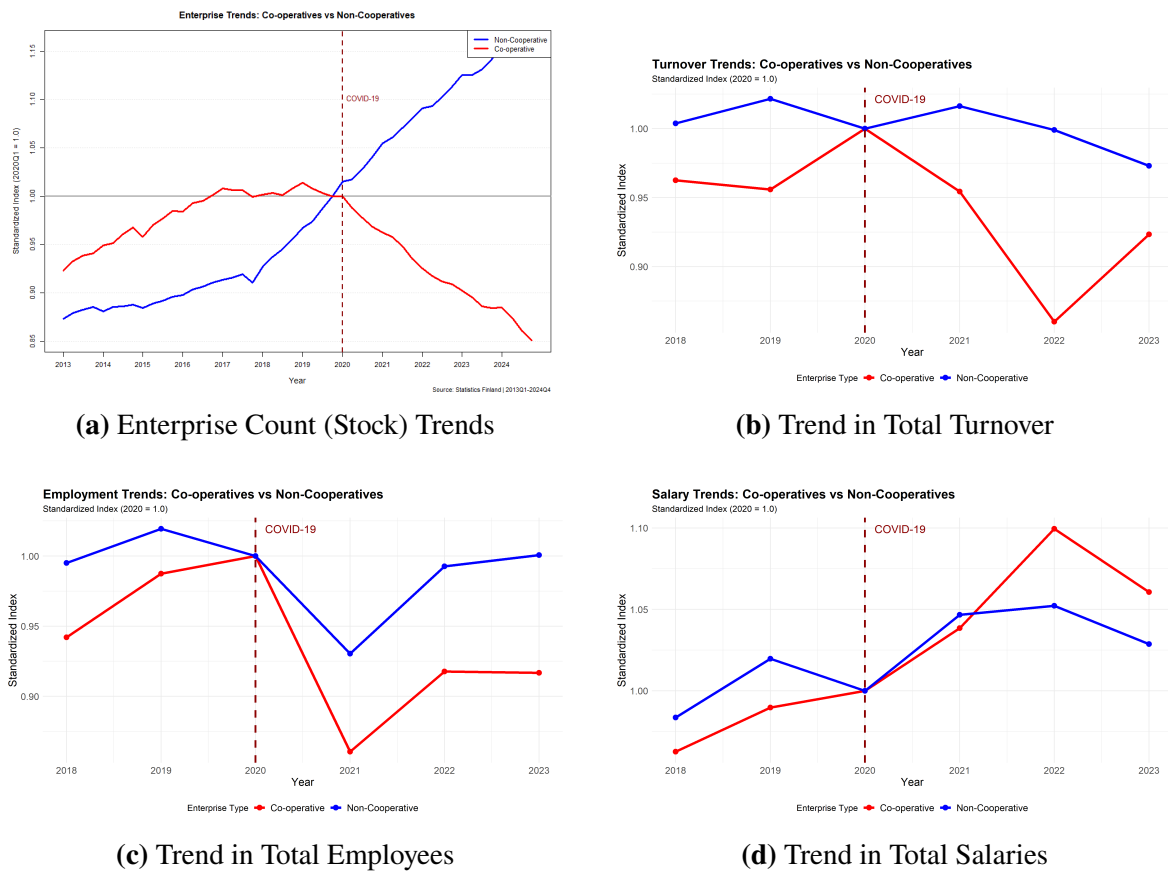


Figure 4.1: Comparative Trends of Cooperative vs. Non-Cooperative Enterprises

4.2 Results

Here are the DID results for stock of enterprises total and our prominent sectors of interest using the models and data discussed above:

Table 4.1: DID Results for Log Enterprise Count

Variable	Coefficient	Std. Error	p-value
Total DID Effect (Average)	-0.272	(0.074)	<0.001 ***
Net DID Effect: Retail	-0.179	(0.016)	<0.001 ***
Net DID Effect: Manufacturing	-0.219	(0.023)	<0.001 ***
Net DID Effect: Finance	-0.603	(0.038)	<0.001 ***
Net DID Effect: Administrative	-0.329	(0.025)	<0.001 ***
Net DID Effect: Professional	-0.399	(0.030)	<0.001 ***
Net DID Effect: Water Supply	-0.177	(0.012)	<0.001 ***
Observations	1,980		
R-squared	0.9453		
Adj. R-squared	0.9439		
F-statistic	680.90		

Significance: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

As we see, Total DID Coefficient is **-0.272**, which is statistically significant with a very high F-statistic and $p < 0.001$. This result indicates that, on average, the number of cooperative enterprises saw a statistically significant decline relative to the number of non-cooperative enterprises during the post-COVID period in Finland. The magnitude of this effect is approximately a **23.8%** ($(\exp(-0.272) - 1) \times 100$) relative decrease in number of cooperatives as compared to non-cooperatives. This trend is clearly visible in cooperative vs non-cooperative enterprise trend chart above.

The results for the individual sectors show that this negative effect was widespread, statistically significant, and varied somewhat in magnitude across sectors. The Financial and insurance sector was by far the most affected. It had a Net DID Effect of -0.603 which indicates that the number of cooperative enterprises in the financial sector saw a very sharp relative decline of approximately 45.3% compared to their non-cooperative counterparts. A point of note - this is relative decline compared to non-cooperatives, which means if Financial non-cooperatives grew post-COVID, the relative difference would be larger as shown with the Financial coefficient. Sectors like retail (-0.179) and Water Supply (-0.177) were the least affected in terms of raw enterprise numbers.

But as discussed earlier, the stock of enterprises does not represent the full picture. Cooperatives are concentrated/market leaders in certain industries in Finland, so simply analyzing the cooperative stock of enterprise going up or down in comparison to non-cooperatives after the pandemic will only show an incomplete picture.

Here are the DID results for variables - turnover, employees, and salaries sum for total and our prominent sectors of interest:

Table 4.2: DID Results for Log Turnover

Variable	Coefficient	Std. Error	p-value
Total DID Effect (Average)	-0.071	(0.382)	0.853
Net DID Effect: Retail	0.072	(0.642)	0.912
Net DID Effect: Manufacturing	0.091	(1.061)	0.932
Net DID Effect: Administrative	-0.598	(0.828)	0.476
Net DID Effect: Professional	0.242	(0.818)	0.769
Net DID Effect: Water Supply	0.054	(0.939)	0.955
Observations	529		
R-squared	0.3401		
Adj. R-squared	0.2975		
F-statistic	7.99		
Significance: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$			

For turnover, The total coefficient of **-0.071**, which suggests a minor relative decrease for cooperatives on average compared to non-cooperatives, but with a p-value of 0.853, this result is statistically insignificant. The analysis for individual sectors confirms this finding as

well. Although some coefficients are positive (e.g., +0.091 for Manufacturing) and some are negative (e.g., -0.598 for Administrative), every single sector has a high p-value. This means that in no specific sector was there a statistically detectable difference in turnover performance between cooperatives and non-cooperatives. The F-statistic of 7.99 is significant, indicating that the model is overall statistically significant and well-specified such as control variables (sector differences, time trends) being valid, and even explains a portion of the variation in turnover, but due to high p value, there is no statistical evidence to suggest that cooperatives were more or less resilient than non-cooperative firms during the COVID-19 pandemic.

Table 4.3: DID Results for Log Employees

Variable	Coefficient	Std. Error	p-value
Total DID Effect (Average)	0.308	(0.371)	0.407
Net DID Effect: Retail	0.058	(0.614)	0.926
Net DID Effect: Manufacturing	0.253	(0.936)	0.789
Net DID Effect: Financial	1.187	(1.416)	0.408
Net DID Effect: Administrative	-0.285	(0.960)	0.769
Net DID Effect: Professional	0.131	(0.860)	0.880
Net DID Effect: Water Supply	0.046	(0.813)	0.955
Observations	648		
R-squared	0.3117		
Adj. R-squared	0.2688		
F-statistic	7.26		
<i>Significance: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$</i>			

Similarly, Employees analysis finds no statistically significant evidence that employment levels at cooperatives changed differently than at non-cooperatives during the post-COVID period. The F-statistic of 7.26 is highly significant, with the total coefficient of **+0.308** suggesting a relative increase in employment for cooperatives. However, the p-value of 0.407 shows this result is not statistically significant again. The sector-specific results align with the overall finding as well.

In the same way, Salaries results find no statistically significant evidence that the sum of wages and salaries paid by cooperatives changed differently than at non-cooperatives during the post-COVID period. The F-statistic of 4.11 is statistically significant, but with R-squared of 0.2112 indicating the model only explains about 21% of the variation in log-salaries. The coefficient of **+0.176** suggests a potential relative increase for cooperatives, but again the p-value of 0.627 being very high suggests the effect is statistically insignificant. Statistical insignificance is also seen in Net DID effects of our prominent sectors in terms of salaries sum.

Table 4.4: DID Results for Log Salaries

Variable	Coefficient	Std. Error	p-value
Total DID Effect (Average)	0.176	(0.363)	0.627
Net DID Effect: Retail	0.116	(0.635)	0.856
Net DID Effect: Manufacturing	0.184	(1.031)	0.860
Net DID Effect: Financial	-0.186	(2.072)	0.929
Net DID Effect: Administrative	-0.462	(0.972)	0.638
Net DID Effect: Professional	0.116	(0.970)	0.905
Net DID Effect: Water Supply	0.093	(0.943)	0.922
Observations	557		
R-squared	0.2112		
Adj. R-squared	0.1598		
F-statistic	4.11		

*Significance: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$*

4.3 Discussion

A key point of discussion that needs to be addressed is high standard error and p-values in results of second database 13w6 - turnover, employees and salaries sum. A high standard error is the statistical reason why we have a high p-value. As we know, p-value which is calculated from t-statistic, which is calculated by standard error. So, the direct relationship is: High standard error gives Low t-statistic which gives High p-value. There can be few explanations and possible reasons why we see this in our second database results:

1- High Variability (Heterogeneity): Firstly, in our publicly available database, there are only six data points for six years per sector and legal form, and even after direct request to Statistics Finland, this is the full extent of publicly available data on Finnish economic enterprises and cooperatives, so the analysis could not be further expanded. Additionally, since our database only includes aggregate sector-level data, and cannot distinguish individual firms underlying, there is a good possibility of internal variation or heterogeneity that can be inferred. The standard error, in simple terms, measures how noisy or unstable that sequence of numbers is. If the data points jump around a lot from year to year, the model concludes that the trend is not very smooth or predictable. This unpredictability is what the model registers as a high standard error and hence high p-value. This is not a conclusive statement, but a likely scenario. Inclusion of firm-level control variables for Finnish cooperatives can serve as further determinants for resilience. Unfortunately, firm-level cooperative data might neither be easily or freely available nor likely to be in the future. As discussed in part one of the thesis, due to collective nature of cooperative ownership or in other words, no obligation to release internal data as public traditional companies do, it is unlikely for cooperatives to publish confidential financial data openly. And creating or collecting original firm-wide data will be beyond the limitations of a Master thesis due to obvious resources/scope reasons.

2- A True Null Effect: This is the most direct interpretation. Results may be accurately showing that there was simply no systematic difference in performance between cooperatives and non-cooperatives due to COVID pandemic in Finland. This could also be indicating that cooperative legal form, in itself, was not a primary determinant of performance resilience during the COVID crisis in Finland. It is likely that factors common to all firms such as industry-specific shocks, management quality, access to capital before and after crisis, pre-crisis financial health etc. may be more important than the legal structure of the enterprise. This finding itself challenges the common assumption that the cooperative model inherently provides superior resilience in time of crisis.

4.4 Key findings

Despite the points in discussion above, the empirical analysis, utilizing a DID methodology across two distinct datasets, reveals a nuanced narrative. The central finding is a clear divergence between the impact on the quantity of cooperative enterprises and the performance of those that remained operational due to COVID-19 shock. First, the analysis of the enterprise stock data shows a statistically significant relative decline in the number of active cooperatives compared to non-cooperative firms in the post-COVID period. This average total effect was a relative decrease of approximately 23.8%, but was not uniform across sectors. The effect was particularly severe in the Financial sector, which saw a relative decline of roughly 45.3% while sectors like retail and water supply, while also declining in numbers, were least affected. As mentioned in the methodology section, this does not mean a decline in numbers mean weakness in these sectors but could also mean consolidation.

In contrast, the analysis of performance metrics (Turnover, Employees, and Salaries) found no statistically significant difference between cooperatives and non-cooperatives. Despite testing the average effect and the net effects within top sectors, the DID coefficients were consistently insignificant with high p-values. The large standard errors suggest that while individual firms' performances may vary greatly, there was no systematic, detectable advantage or disadvantage attributable to the cooperative legal form in terms of these key metrics.

This dual finding - a significant drop in the number of firms but stable performance among the survivors - could also suggest a narrative of consolidation rather than collapse. Since we cannot conclude that the COVID-19 crisis had systemically weakened the operational performance of the average established cooperative relative to its peers, the economic shock may have acted as a cleansing or consolidating event, where smaller, newer, or less financially stable cooperatives were more likely to cease operations or the working cooperative members were consolidated in larger ones. This would lead to the observed drop in the total enterprise count, while the more established cooperatives that remained were resilient enough to main-

tain their performance levels. So in the context of the Finnish cooperative economy during this crisis, resilience may not manifest as an ability to prevent all closures, but rather as the stability of the core, established enterprises that forms the backbone of their sector.

4.5 Future Research

Since this study is subject to some limitations, this provide clear directions for future research:

1- Aggregate Data: As mentioned in the Discussion section, this study analysis relies on data aggregated at the Sector-Legal-form level. Future research using firm-level micro-data would allow for a more granular and powerful analysis, which is beyond the scope of a Master' thesis due to reasons mentioned earlier, but would be a powerful next step to address issues such as heterogeneity.

2- Resilience criteria: This study focused on resilience using quantitative data analysis. It does not capture other facets of cooperative resilience, such as member engagement, community support, or long-term strategic, psychological, and societal impacts that are better explored through qualitative methods. This is an important point for future cooperative research as some sociological/societal impacts are difficult to capture in quantitative aspects, and due to standards/requirements for Master' thesis at an Economics faculty being limited to quantitative methods, the central analysis of this thesis is limited to quantitative research.

5 Conclusion

This thesis tries to contribute a nuanced, data-driven perspective to the discussion on cooperative resilience. The primary finding is that the COVID-19 pandemic was associated with a significant relative decline in the total number of cooperative enterprises in Finland. However, for the cooperatives that continued to operate, their performance in terms of turnover, employment, and salaries was not statistically distinguishable from their non-cooperative counterparts. This suggests that the cooperative sector may have also undergone a period of consolidation; the core enterprises within it may have demonstrated a notable level of operational stability. The resilience of the cooperative model, therefore, appears to be a complex issue, likely influenced more by firm- and sector-specific characteristics than by legal form alone. In terms of policy advice, while European and Finnish authorities enforce promotion of cooperative enterprises on paper, they must look further in this area if they wish to actually help sustain and boost the resilience of cooperative enterprises, financially and otherwise.

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