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PRODUCTIVITY-ENHANCING REALLOCATION DURING THE COVID-19: EVIDENCE FROM ESTONIA

Master Thesis

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Tartu 2022

Abstract

In this master's thesis, the effects of the Covid-19 recession and the reallocation of production factors on productivity are studied based on Estonian firm-level data from 2006 to 2021. The effect of the Covid-19 recession is compared with the effect of the Great Recession. First, we analyze the contribution of firm exit and job reallocation to productivity growth at the macro level. The regression model is then estimated to ensure that our findings also hold at the micro-level. The results showed that higher productivity protected firms from the exit during the Great Recession at the aggregate level. The same result can be seen for the Covid-19 recession, but only in a milder form. At the micro-level, the relationship between productivity and firm exit became stronger during the Great Recession while weakened during the Covid-19 recession. Our findings suggest that even though reallocation boosted productivity during the Great Recession, the same cannot be observed during the Covid-19 recession.

JEL classification: E24, E32, L11, J6

Keywords: job creation, job destruction, productivity, Covid-19, job reallocation, Estonia

1 Introduction

Recessions differ in their nature and impact on the economy. Many authors raised the question of whether economic downturns have cleansing (the more productive firms survive, overall productivity can rise) or a scarring effect. (Caballero & Hammour, 1994; Davis & Von Wachter, 2011) At the beginning of the recession, the efficient economy first experienced job destruction, followed by a surge in job creation, according to Caballero & Hammour (1996). During the recession, the firm's dynamics are crucial to boosting the productivity reallocation period. In this process, resources are redistributed from low-productive to high-productive firms through firm entry and exit and the reassignment of inputs between active units. Economic downturns can hinder this process by encouraging the demolition of non-productive units (Schumpeter, 1939; Davis & Haltiwanger, 1992)

Given the importance of the reallocation process in aiding recovery and growth and the scarcity of firm-level studies on the influence on crisis or resource allocation, distinguishing between the scarring and cleansing character of crisis is vital (Hallward-Driemeier & Rijkers, 2013) . The adaptability of small businesses to the shock determines the pace of the near-term economic recovery and the long-term implications for potential output. The productivity of the firms will influence the type of resilience. (Andrews et al., 2021)

Our thesis aims to find out Covid-19's impact on productivity-boosting reallocation in Estonia to see if the cleansing hypothesis holds and compare the results to the Great Recession period. We consider the ongoing process of productivity-enhancing reallocation in Estonia and the contribution of firm exit to productivity growth through the size of share they captured in terms of employment. There are not many papers in the literature that analyzed the effects of Covid-19 based on panel data. Hence, with our master thesis, we want to contribute to the literature by analyzing the Covid-19 results based on the panel data and comparing its consequences on productivity-enhancing reallocation to the Great Recession results that have not been done yet.

Analyzing the Covid-19 consequences is interesting because of several reasons. The pandemic has noneconomic ground. After the Great Recession, it caused the most significant trouble for the different countries' economies and caused shocks in trade, supply chain, investment, demand, financial stability, and future economic development; The

pandemic is not officially finished yet. (Barua, 2020) Hence, the analysis of its consequences is reasonable and relevant since the evaluation of its results and used policies are still in the process.

The Covid-19 pandemic effects and its severe economic consequences were the biggest challenges for policymakers. Former top officials agreed that the priority should be to address public health requirements but added that with a harsh downturn on the horizon, governments should be prepared to invest considerable sums in protecting businesses and households. (Giles, Greeley, & Arnold, 2020) Covid-19's appearance unpredictably impacted the world's perspective(Ozili & Arun, 2020). Many European countries have turned to short-term compensation or furloughing plans to protect job matches during the pandemic and minimize the significant long-term repercussions of job destruction for workers and the economy (Adams-Prassl et al., 2020). These measures are not novel in concept; Comparable programs helped mitigate job losses during the Great Recession. (Giupponi & Landais, 2018) Still, it should be considered that the active labor market policies may prevent unproductive matches from dissolving and block the reallocation of employees to more productive uses (Bennedsen et al., 2020). Additionally, policy responses to the shock and inherited aspects of the policy environment can prolong the creation response and hinder recovery. (Barrero et al., 2020)

The Covid-19, because of its airborne transition and the policies against it, affected a lot the people's behavior and pushed societies to become more digital. Long before the Covid-19 pandemic, Estonia established a high digitalized society, including online learning in schools, electronic voting, digital government, and healthcare. (*How Estonia's digital society became a lifeline during COVID-19*, 2020) The unique character of the crisis and the high digitalization of Estonia, which can be considered as a better chance for productivity-enhancing reallocation, gave us the incentive to choose Estonia as our focus country and compare the last two main economic downturn consequences.

During the Covid 19, Estonia's GDP decreased less than other European countries. This is due to Estonia's effective Covid 19 response and the virus's mild impact on its neighbors and the main trade partners (Finland, Sweden, Latvia, and Lithuania). (Centre, 2020) Estonia's annual GDP growth rate was around 4 percent in 2019; it declined in 2020 to -3 percent. The more dramatic was the decrease during the Great

recession, as in 2007 GDP growth rate was roughly 8 percent, and it became -5 percent in 2008 and one year later -15 percent. (World Bank, 2020) Moreover, the unemployment rate rose from 4.45 percent in 2019 to 6.8 percent in 2020. The Great Recession had a more severe impact on the unemployment level. In 2007 unemployment rate in Estonia was around 5 percent, but it jumped to approximately 14 percent in 2009. (World Bank, 2020)

Our research is divided into two parts. As a first part, we begin with an aggregate perspective and decompose year-on-year changes in the population of firms, Employment, and Productivity into the contributions of firm dynamics (entry and exit) and job reallocation. With this aggregate decomposition, we compare the impact of the Great Recession and Covid-19 on productivity-enhancing reallocation. In the second part, we aim to look at the micro-level data. By constructing linear firm-level regressions (using both Multiple Linear Regression and Fixed Effects transformation), we want to investigate if the Covid-19 recession accelerated the productivity-enhancing allocations.

The rest of thesis is structured in the following way: Section 2 reviews the background literature about productivity reallocation and provides a general overview of the Covid-19 pandemic and the economic crisis caused by it. Section 3 describes the methodology we used for our calculations. Section 4 gives overview of the data. Section 5 provides macro-level firm growth, job, and productivity reallocation calculations. Section 6 provides the regression used for micro-level analysis and its results. Section 7 summarizes the thesis's findings and offers the main conclusions.

2 Background

2.1 Related Literature

Business cycles, which are considered "the normal working of the evolutionary mechanism" by Schumpeter (1991:350), are made up of cyclical ups and downs in broad measures of economic activity. The term "recession" generally refers to periods of weak economic activity where the duration, depth, and diffusion exceed the usual bounds. There can be various reasons for the business cycle to go into recession stage. However,

the importance of the costs associated with job loss suggests that the frictions associated with the job and worker reallocation play a significant role in business cycle fluctuations (Blanchard & Fischer, 1990). Shocks can be listed among the reasons why these fluctuations happen. There are views that a) allocative shocks have no significant short-run effects on aggregate employment; b) aggregate shocks primarily affect the first moment of the cross-sectional growth rate density but do not significantly alter its shape. As factor reallocation is costly, the first view concludes that reallocation activity is an essential propagation mechanism for business-cycle impulses. With the second view, it is found that allocative disturbances have disproportionately simultaneous effects on job destruction and, thus, reduce aggregate employment. (Davis & Haltiwanger, 1999)

The character of recessions and their impact on the economy differ. Several studies stress the *scarring effects* of recessions. According to Ouyang (2009), recessions hinder the development of potentially superior firms by destroying them in their infancy. He discovers that the recessions had a scarring effect resulting in lower average productivity during recessions in the US manufacturing firms. Huckfeldt (2022) found that the significant and long-term earnings losses caused by involuntary job displacement are concentrated among workers who change occupations after job displacement. According to his results, the occurrence and earnings cost of such occupation displacement increase during recessions.

Recessions generally lead to higher unemployment, earning losses, and lost opportunities. In terms of earning losses, it has been found that when long-tenured employees left troubled companies in the 1990-1991 recession of the US, their long-term losses averaged 25 percent per year. Furthermore, their losses accumulated before separation, were not limited to workers in a few industries, and were significant even for finding new jobs in similar firms. This evidence suggests that the earnings losses of displaced workers are primarily the result of the loss of some unidentified aspect of the employment relationship. (Jacobson et al., 1993) The analysis of the cross-sectional distribution of establishment growth rates and cross-sectional behaviour between worker and job flows suggests that hiring declines due to a drop in job creation rates and a significant drop in quit rates during a cyclical downturn. The actual procyclicality of quits, in other words, throws a wrench in the overall link between hiring and employment growth. It also aids in mod-

erating the cyclical discrepancies between job destruction and separations. There is also much evidence that other economic forces play a significant role in worker flows' cross-sectional and time-series behaviour. These forces include learning about match quality and the need for replacement hires, on-the-job search, "abandon ship" effect that results in higher quit rates at struggling employers, and strongly procyclical movements in quit rates even when the employer's growth rate is controlled for.(Davis, Faberman, & Haltiwanger, 2012) Davis and Wachter (2011) examine cyclical economic behaviour and the effects on individual workers' income, wealth, and anxiety levels. They found that the unemployment rate at the time of relocation strongly correlates with present-value losses. The economic recessions bring for workers to lose permanent jobs in the long term, which is a painful and costly process for each of them. Overall, the business cycle process causes people to lose their income and purchasing power.

On the other hand, stemming from the Schumpeterian process of creative destruction, recessions have been thought to have a *cleansing effect* by driving the exit of low-productivity enterprises and the reallocation of resources to higher-productivity ones. (Schumpeter, 1939). Pardo (2016) mentions two main explanations supporting the hypothesis of creative destruction during recessions. First, during a recession, company and production unit profitability suffers. In this challenging situation, the first companies or units to be impacted are the least productive ones, forced to reduce their workforce or close altogether. The overall level of productivity naturally rises as a result. Second, since unemployment is high during recessions and there is much-unused capital during a recession, the opportunity costs of productive factors are lower. In this situation, there are incentives to engage in riskier, potentially very productive activities that might not have been appealing during an expansionary period (due to production factors already being profitable in established activities). This incentive of starting a business may lead to higher levels of productivity over time. In general, enterprises undergoing continuous creative destruction can respond to demand fluctuations by increasing the rate of new production units or decreasing the rate at which obsolete units are destroyed. The critical question is which of these processes will be more intense throughout the economic cycle. One should be careful while estimating the result of recessions. Although it has a cleansing effect, meaning that the more productive firms survive, overall productivity

can rise; as it has many expenses, we cannot call it a "desirable" event (Caballero & Hammour, 1994).

Recent theoretical studies have suggested that the cleansing effect may be reversed by different factors, such as financial and labour market frictions. (Caballero & Hammour, 2005; Barlevy, 2003, 2002) In his paper, Barlevy (2002) claimed that while recessions speed up the destruction of less efficient job-worker matches, they also restrain the creation of the most efficient matches, considering how resources are distributed across the jobs that survive the cleansing. Even as the economy purges its worst matches, more workers are stuck in mediocrity because they are less likely to quit during a recession, resulting in fewer high-quality matches, which creates the *sullying effect*. Thus, the magnitude of the cleansing and sullying effects together determines the overall effect of recessions on allocative efficiency.

Whether recessions are cleansing or scarring, understanding how aggregate shocks affect the relationship between reallocation and productivity has crucial policy implications. Productivity is an essential indicator of the public finances' long-term viability (Bloom et al., 2020). Productivity refers to the amount of output achieved from a given set of inputs, meaning an output-input ratio (Syverson, 2011). If new ideas, technology breakthroughs, and organizational practices are involved, productivity means "working smarter" – not "working harder". Productivity allocation during the recession depends on the recession's character and economic condition during the pre-recession period. Minor business adaptations to the process will influence the near-term economic recovery and define the long-term implications for potential output. (Andrews, Charlton, & Moore, 2021) Manufacturers with higher productivity have a better chance of surviving than those with lower productivity. In addition, in general, it is assumed that reallocation is more productivity-enhancing in downturns than in normal times. (Syverson, 2011)

More recently, some papers have been focusing on analysing firm-level data on productivity and recessions. Using the firm-level data to examine the impact of the East Asian crisis on resource reallocation in the context of Indonesia, Hallward-Driemeier & Rijkers (2013) found that the data did not support the cleansing paradigm. Although productive firms lost fewer jobs on average, the relationship between productivity and employment growth remained weak. Rather than raising the productivity threshold for

survival, the crisis was more non-discriminatory in terms of the firms' productivity exit business. With the analysis of the cross-country firm-level data for 24 OECD countries, Andrews, Criscuolo, & Gal (2016) show that a particularly striking feature of the productivity slowdown is rising labour productivity at the global frontier coupled with increasing labour productivity divergence between the global frontier and laggard (non-frontier) firms, rather than lower productivity growth at the global frontier. The reason for this is that productivity at the global frontier is increasing. However, the productivity gap between the global frontier and lagging businesses is widening. Their findings show that, during the previous decade, both the pace of convergence and growth-enhancing reallocation has decreased. Focusing on firm-level effects of the Great Recession, Foster, Grim, & Haltiwanger (2016) analysed the microlevel data of the USA manufacturing sector. It was found that the productivity reallocation during the recession was less productivity-enhancing compared to other recession periods, such as the recession in the early 1980s. The authors showed that both job creation and job destruction fell sharply during the Great Recession, and there was no evidence of increased reallocation. Before the Great Recession, the marginal impact of the recession was positively correlated with the size of the economy's decline, but this was not the case during the Great Recession. In the case of Lithuania, Tarasonis & Perez (2021) discovered that reallocation increased productivity during the Great Recession. The analysis revealed that productivity protected firms from exiting, and the relationship between productivity and firm exit became stronger during the Great Recession. In addition, more productive firms experienced lower job losses during the economic downturn.

Covid-19 recession can be considered the most significant economic downturn since the Great Recession (Weder, 2020). An increasing number of recent papers on the economic implications of the Covid-19 pandemic have been published and continue to be added. The lockdowns and other measures implemented in early 2020 to prevent the Covid-19 pandemic pushed the global economy into another crisis. While demand for specific sectors, such as grocery shops, soared in the epidemic's early days, demand for other sectors, including air transportation and tourism, has decreased and became even close to zero. Simultaneously, many businesses have supply challenges as governments restrict non-essential industry activity. Workers from the industries from which telework-

ing was irrelevant are confined to their homes with decreased or overall cut income from work. (del Rio-Chanona et al., 2020) The nature of the Covid-19 shock was mitigated with a governmental reaction that favoured preservation, raising doubts about whether employment reallocation remained productivity-enhancing. While analysing the Covid-19 effects in Australia, New Zealand and the United Kingdom, Andrews, Charlton, & Moore (2021) found that the pandemic strengthened Australia's temporary labour reallocation-productivity link. However, there was a weakened relationship in New Zealand, which is explained by the design of job retention schemes.

The impact of the Covid-19 shock on small businesses is a significant policy point. Some studies on the Covid-19 effects suggest that business exit is at an all-time high or is likely to be at an all-time high. Strong, direct evidence of increased restaurant business closures and suggestive direct evidence for related industries, in general, was discovered. Some indirect indicators, such as Google Trends, minor business delinquencies and defaults, and retail vacancies, were rising (Crane et al., 2020). Many job losses in small businesses were caused by firms that went out of business entirely, though many of them later reopened. Firms already in poor condition were more likely to close and were less likely to reopen. Disadvantaged workers were more likely to be laid off and less likely to return - most laid-off workers expected to be recalled, which predicted rehiring. Covid-19 has been markedly different from other recessions in terms of its speed, the types of firms and workers affected, workers' beliefs about the recession's longevity and the likelihood of recall, as well as the nature and size of the policy response (Bartik et al., 2020).

In most OECD countries, job retention policies were the primary mechanisms used to mitigate the impact of the Covid-19 crisis on the labour market. During this period of shock, government initiatives aimed to keep working places and reduce the negative consequences of Covid-19. (OECD, 2021b) While updated employment laws slowed the rate of creative destruction during Covid-19, the type of the shock – that is, one in which being imaginative is a must – had an effect. This productivity-boosting impact is unlike the traditional Schumpeterian process of creative destruction, in which higher-productivity firms replace lower-productivity enterprises. Instead, a large portion of this is just the shrinkage of low productivity sectors more than high-productivity sectors and

the suffering of least productive firms within these sectors the most. Some industries, particularly service sectors such as accommodation or air traffic, experienced a significant decline compared to other industries.(Bloom et al., 2020) Because of the nature of the shock, the tech-savvy firms were more resilient, even after controlling the productivity and hence, resulted in the reallocation of labour to such firms (Andrews, Charlton, & Moore, 2021). Even during the pandemic, labour turnover fell in response to the pandemic, and job reallocation remained connected to firm productivity. Evidence from the industry-level analysis of different countries shows this pattern. (Bloom et al., 2020; Tarasonis & Perez, 2021; Andrews et al., 2021).

2.2 Pandemic Challenges of Economy

According to the World Health Organization (WHO), the first confirmed case of Covid-19 was detected in December 2019 in the Chinese province of Wuhan, and the disease was designated a worldwide emergency on January 30, 2020. As of March 31, 2020, the Covid-19 pandemic has spread to 199 nations and territories, resulting in 777,798 illnesses and 37,272 fatalities. (Ritchie et al., 2020) After the initial cases were confirmed in Wuhan, China became the pandemic's original epicentre. The virus then spread to numerous nations, including the United States, India, Brazil, and Singapore, impacting disproportionately low- and middle-income countries and individuals. (Kaye et al., 2021) The first case of the pandemic was documented in Estonia in February 2020.

Covid-19 triggered a worldwide health disaster in human history (OECD, 2021b). The situation has arisen due to a policy of using containment measures to deal with a public health emergency. As a result, phrases like "throwing the global economy into an induced coma" or " into hibernation" have been used. (Borio, 2020;181-190) Christine Lagarde, President of the European Central Bank, after the two years of the pandemic, named Covid-19 a significant shock to the global economy that smacked economies in the face and made policymakers understand that, at least in the near term, health was far more important than the economy and finance. Furthermore, she outlined that, unlike during the Great Financial Crisis of 2008, there was a clear desire to focus on restoring health, securing income for people whenever possible, and attempting to cure the pandemic that

had just struck the planet. (*Christine Lagarde on how to address COVID-19, climate change and inequality*, n.d.) The influence on societies throughout the world has been profound and far-reaching. In the beginning, the virus was unknown, and restrictions were strict. The virus has a tremendous impact on economic activity in many countries. (OECD, 2021b)

When it comes to lockdowns, governments have adopted a variety of techniques, both in terms of the scope and severity of enforcement and the kind of measures deployed. Diagnostic tests, contact tracking, isolation, quarantine for infected persons, and, more crucially, measures to decrease mobility and generate social distancing have all been used (containment measures, hereafter). (Deb, Furceri, Ostry, & Tawk, 2022) People and the government have learned to live with the virus. Thus, habits have changed, and restrictions have become more focused. Overall, those actions gave some people the opportunity to return to work. However, some of the workers have continued to suffer. (OECD, 2021b) All those aspects related to the Covid -19 make the crisis unique and interesting its results to analyze.

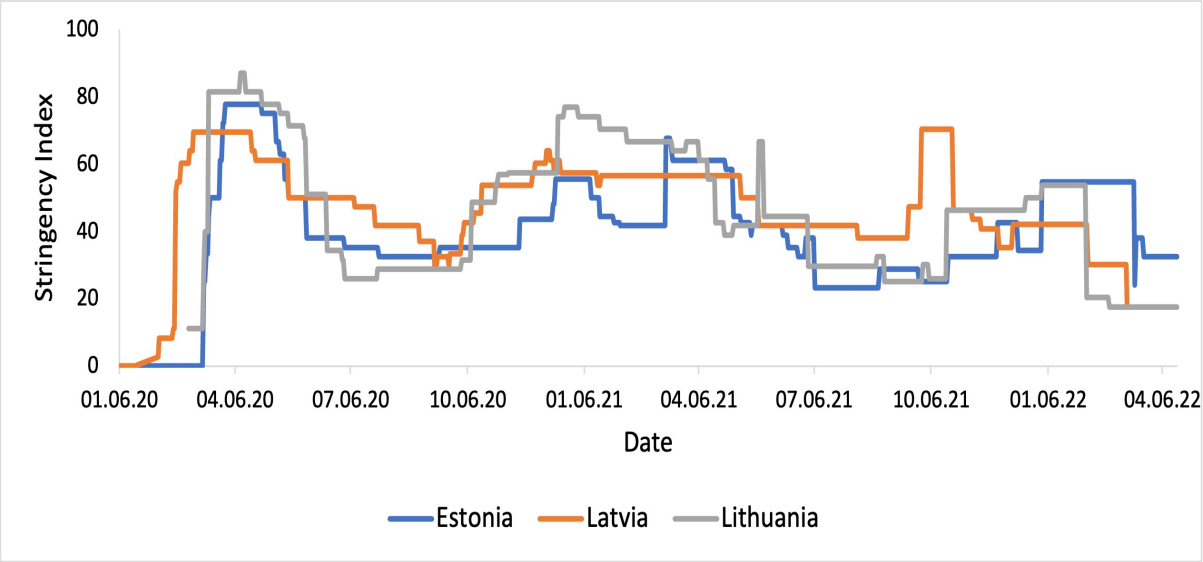
It should be outlined that Covid-19 had its evolution which can be mentioned that is country or region-specific. As is documented in the paper published by OECD (2021a), the OECD countries had the next evolution: Q1/Q2 2020 was the first phase of the crisis when restrictions were imposed. Q3, the restrictions were eased. Q4 of 2020 and Q1 of 2021, a new peak of cases was reached in many OECD countries. Q2/Q3 2021, the vaccination process was rolled out, which became the game-changer for dealing with a pandemic. The Oxford COVID-19 Government Reaction Tracker (OxCGRT) delivers a comprehensive collection of cross-national, longitudinal government response measures named the Covid-19 Stringency Index. As close, the index goes to 100, as strict are the country's restrictions. The Figure 1 describes the Stringency Index and its changes over the Covid-19 period in Estonia. We can observe strict measures at the pandemic beginning and its fluctuations according to the virus spread.

Generally, Covid-19 has caused output and employment reductions considerably more severe than those seen during the Great Recession. (Borio, 2020) Figure 2 describes the GDP growth rate before the crisis and how the trend changed. The GDP growth rate declined at the beginning of 2019 for Estonia and the Euro area and became roughly -5

percent and -8 percent, accordingly. The more severe was the Great Recession results for Estonia; the GDP growth rate became close to -15 percent.

The first accessible analyses on the pandemic's economic and employment impact seem to agree: the crises' impact is asymmetric, with the most vulnerable nations and sectors of the workforce bearing the brunt of the pandemic's impact. The consequences of the pandemic were more challenging for the labour markets that were more vulnerable before. (Fana, Torrejón Pérez, & Fernández-Macías, 2020)

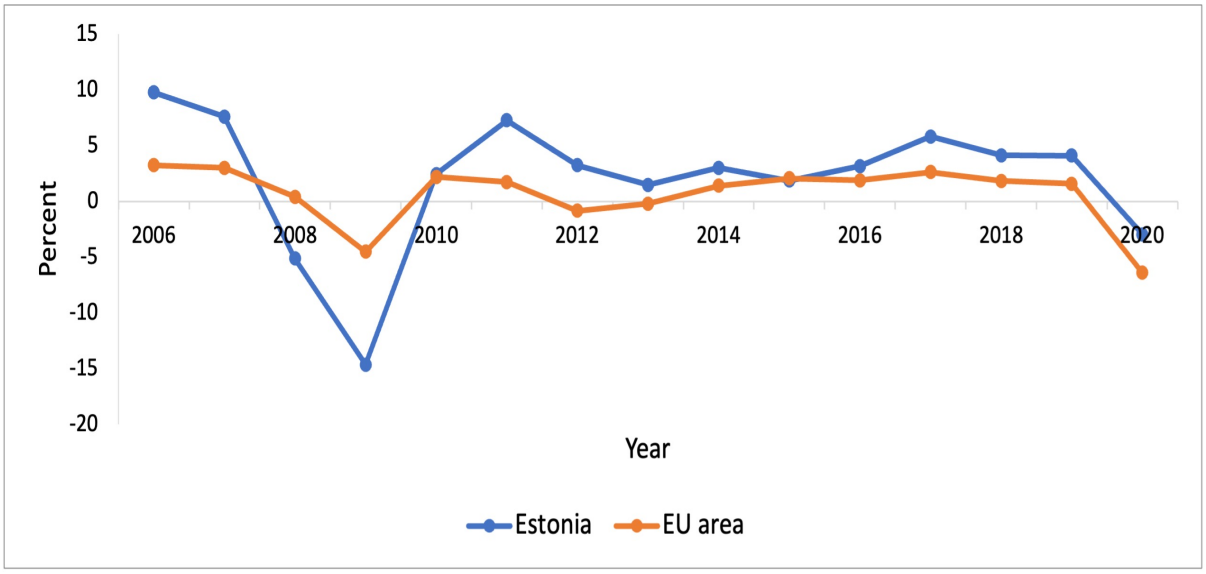
Figure 1: Stringency Index



Source: Hale et al. (2021). Official data collated by Our World in Data. Notes: The figure illustrates the level of Stringency Index quarterly for Estonia, Latvia and Lithuania from January 2020 to April 2022.

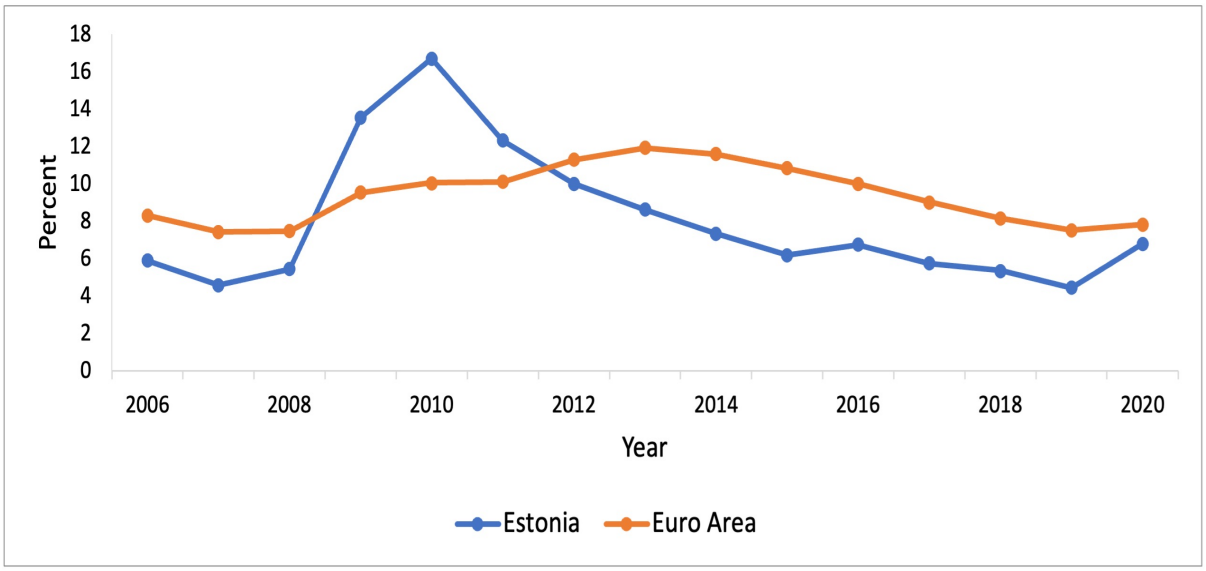
Figure 3 exhibits the total unemployment rate in the Euro area and Estonia. Based on the given data, the total labor force's unemployment share at the beginning of the Covid-19 crisis in the Euro area went up. From 2019 to 2020, we can observe a sharp increase in the unemployment rate in Estonia. From the given graphs, we can see that the restrictions were strict at the beginning of the crisis. (Stringency Index close to 80) Overall, based on the given graphs, we can say that Estonia coped with the Covid -19 crisis with fewer GDP and employment losses than during the Great Recession.

Figure 2: GDP Growth Rate



Source: World Bank. Notes: The figure illustrates the yearly real GDP growth in Estonia and the Euro area between 2006 and 2020.

Figure 3: Unemployment rate



Source: World Bank. Notes: The figure illustrates the yearly unemployment rate in Estonia and the Euro area between 2006 and 2020.

3 Methodology

This section introduces the main measures used in this paper to determine employment growth rate and productivity. The section also provides our empirical model and the

description of notions that we have used for these measurements.

3.1 Definitions

To derive the results and complete the analysis from the given data, we derive some variables with the following definitions: The firm exists if the firm's turnover, employment number, and total employee expenses are not missing and are positive. For firm status, we defined the dummy variables. Survivor (CO) is the firm that was active in t and t-1 period, exiter (EX) firm was active in (t-1) and is not active in period t, entrant (EN) - the firm which enters the market in period t.

In the literature on job dynamics, the definitions of gross and net job flows have become widely accepted (e.g., Davis & Haltiwanger (1999)). In an economy, gross job creation (pos) is the sum of all employment gains in all growing firms. We defined it as the sum of expanding survivors and entrance. Although gross job destruction (neg) is defined as all employment losses in all contracting firms, we represent it as the sum of shrinking survivors and exciters in our data. [1] These gross job flows are typically stated as rates by dividing them by the total number of jobs available in a given economy.

3.2 Employment Growth Rate

To define the changes in aggregate employment, we followed the influential work of Davis, Haltiwanger, & Schuh (1996). It should be outlined that Tarasonis & Perez (2021) was the cornerstone paper for our empirical part.

To indicate the changes in aggregate employment, we used:

$$\frac{\Delta N}{\bar{N}} = \sum_i s_{it} \frac{\Delta n_i}{\bar{n_i}} \tag{1}$$

where s_i shows the firm i's employment share at time t, $s_{it} > 0$ and the sum of s_i equals 1. The term firm-level employment refers to the average size of the firm over a given period n_{it}. Average employment for both aggregate and firm level average employment

[1] Table A.1 in the appendix describes the main variables used to define job creation and destruction.

stock is accordingly:

$$\bar{N} = 0.5(N_t + N_{t-1}) \tag{2}$$

$$\bar{n_i} = 0.5(n_{i,t} + n_{i,t-1}) \tag{3}$$

The employment growth rate is expressed as the ratio of the net change and the average employment stock. It lies in the interval [-2,2].[2] This measure of employment growth rate shares certain important aspects of log differences while also accommodating firm exit and entry in the distribution's endpoints, and it has become a standard in firm dynamics studies.

The net employment growth rate can be decomposed

$$\begin{aligned} \frac{\Delta N}{\bar{N}} &= \sum_{i \epsilon N^-} s_{it} \frac{\Delta n_i}{\bar{n_i}} + \sum_{i \epsilon N^+} s_{it} \frac{\Delta n_i}{\bar{n_i}} = \\ &= \sum_{i \epsilon CO^+} s_{it} \frac{\Delta n_i}{\bar{n_i}} + \sum_{i \epsilon EN^+} s_{it} \frac{\Delta n_i}{\bar{n_i}} + \sum_{i \epsilon CO^-} s_{it} \frac{\Delta n_i}{\bar{n_i}} + \sum_{i \epsilon EX^-} s_{it} \frac{\Delta n_i}{\bar{n_i}} \end{aligned} \tag{4}$$

The given formula provides the decomposition of the net employment growth rate into job creation (i.e., the total number of new jobs created by expanding enterprises *(N+)* between t-1 and t, calculated as the sum of expanding survivors plus entrants) and destruction (i.e., the sum of all employment losses in contracting firms *(N-)* between t-1 and t, calculated as the sum of the shrink of survivors plus exiters) and in turn that can be broken down into the contribution of survivors (i.e. firms survived between t-1 and t, *CO*), entrants (i.e. firms that entered the market between t-1 and t, *EN*), and exiters (i.e. firms that exited between t-1 and t, *EX*.)

3.3 Productivity

In general, the term "productivity" refers to the relationship between output and the associated inputs used in the manufacturing process (Syverson, 2011). Consequently, labour productivity is a metric of economic performance that compares the number of goods and services produced (output) to the number of hours worked to made those

[2] Unlike the conventional measure, which ranges from -1 to ∞, this measure of growth rate is symmetric around zero, being bounded in the interval [-2,2], allowing for symmetric treatment of employment expansions and contractions.

goods and services. There are various productivity measures, and the choice depends on the purpose of the productivity measurement and/or data availability. The number of goods and services produced (output) per hour worked is one of the most widely used productivity measures. This metric better grasps the use of labour inputs than output per employee. (Krugman, 1994) However, as we do not have available data for hours worked and part-time work in Estonia, which is relatively infrequent even among the females, productivity can be measured either as sales revenue or value-added per worker. We choose value-added over sales revenue because the latter is not perfectly measured. So, we define labour productivity as the ratio of value-added (sales minus intermediate inputs) to the number of workers. Using our computed labour productivity, aggregate productivity at time t, ϕ_t, is defined as the weighted average productivity

$$\Phi_t = \sum \omega_{it}\phi_{it} \tag{5}$$

where $\omega_{it} \geq 0$ sum to 1 and represents firm's employment shares. According to Olley & Pakes (1996), the aggregate productivity can be decomposed each period into the sum of average productivity and covariance between productivity and market shares

$$\Phi_t = \bar{\phi}_t + \sum_i (\omega_{it} - \bar{\omega}_t)(\phi_{it} - \bar{\phi}_t) = \bar{\phi}_t + cov(\omega_{it}, \phi_{it}) \tag{6}$$

where $\bar{\phi}_t = 1/n \sum_i \phi_{it}$ is the unweighted average of firm-level productivity and $\bar{\omega}_t$ is the average market share. Changes in productivity between two periods, $\Delta\Phi$, can thus be decomposed into two components:

$$\Delta\Phi = \Delta\bar{\phi} + \Delta cov \tag{7}$$

where $\Delta\bar{\phi}$ captures shifts in the productivity distribution (via changes in the first moment) and Δcov captures market share reallocation across firms via changes in the covariance.

Melitz & Polanec (2015) extends the Olley-Pakes method by accounting for the contributions of entry and exit to aggregate productivity changes; it also separates the contributions of firm-level productivity shifts and market share reallocations among surviving

firms. We use the following equation to incorporate firm entry and exit:

$$\begin{aligned}\Delta\Phi =&(\Phi_{CO,t} - \Phi_{CO,t-1}) + \omega_{EX,t-1}(\Phi_{CO,t-1} - \Phi_{EX,t-1}) + \omega_{EN,t}(\Phi_{EN,t} - \Phi_{CO,t-1}) = \\ =&\Delta\Phi_{CO} + \Delta cov_{CO} + \omega_{EX,t-1}(\Phi_{CO,t-1} - \Phi_{EX,t-1}) + \omega_{EN,t}(\Phi_{EN,t} - \Phi_{CO,t})\end{aligned} \tag{8}$$

In the first line the aggregate productivity change is decomposed for three groups: survivors, entrants, and exiters. Second line describe the contribution of the surviving firms. The term $\Phi_{CO,t}$ is labour productivity of survivors *(CO)*, whereas $\Phi_{EX,t-1}$ and $\Phi_{EN,t}$ stand for total productivity of exiters *(EX)* and entrants *(EN)*, respectively. The variable $\omega_{EX,t-1}$ represents the market share of exiters (measured in t-1), and $\omega_{EN,t}$ is the market share of entrants measured in t).

3.4 Regression model

To investigate whether the link between economic crises and productivity reallocation holds at the micro-level, we estimate the following models:

$$y_{it} = \beta_1 p_{it-1} + \beta_2 p_{it-1} GR + \beta_3 x_{it-1} + \beta_4 x_{it-1} GR + \delta_s + \delta_t + \epsilon_{it} \tag{9}$$

$$y_{it} = \beta_1 p_{it-1} + \beta_2 p_{it-1} C19 + \beta_3 x_{it-1} + \beta_4 x_{it-1} C19 + \delta_s + \delta_t + \epsilon_{it} \tag{10}$$

where y_{it} is the dummy variable for the exit rate and indicates the dependent variable of interest for firm i at time t. p_{it-1} is our firm-level measure labour productivity. GR and $C19$ are indicator variables, which represent the Great Recession years of 2008-2010 and the Covid-19 year of 2020 respectively. x_{it-1} are firm-level factors that refer to the firm's size, age, ownership, turnover and exporting activities. The genuine industry and year fixed effects are denoted by δ_s and δ_t, respectively, and and the error term is denoted by ϵ_{it}.

4 Data

The data we use for our analysis is firm-level data collected by the Estonian Business Registry. Estonian Business Registry includes financial data on balance sheets, profit

and loss accounts, and cash flow statements for the population of Estonian enterprises. Additionally, it contains general information on businesses, such as 5-digit industry classification codes, ownership, staff numbers, and industry turnover (for some years). (Masso, Eamets, & Philips, 2004a,b). Firms from all economic sectors are required to submit annual reports by June 30th of the following year, and data for specific years are generally available by December of the following year. This database offers information on all Estonian firms that are formally registered.

Estonian Business Registry contains information about the firms operating between 1995 and 2021. Because the main interest of our study is the Great Recession and Covid-19, our analysis covers the period from 2006 to 2020. In the given period, the database comprises 83,134 distinct business registry numbers. One of the possible problems in our data is to overestimate the exit(entry) rate of the firms because of the spurious exit due to the removal of firms without economic activity from the Business Registry. To avoid this problem, we calculate the firms' exit(entry) rate according to the firm's first(last) occurrences in our data.

Figure A.1 in the Appendix visualizes changes in the total number of firms in Estonia over the year. As we can see, the total number of business entities has a positive trend over the years. During the Great Recession, the total number of firms was steady. Additionally, the growth of the total number of firms was more rapid from 2016 to 2020. However, we can see a declining number of firms in 2020, which can be mentioned because of the pandemic.

The data includes small businesses as well. Table A.2 in the appendix shows the distribution of enterprises by the number of employees and their respective employment shares.

Our data does not differentiate between part-time, full-time, and overtime work, as full-time work is a norm in Estonia and part-time is infrequent, around 7-9 percent in 1995-2021, according to Statistics Estonia (*Part-time employment decreased in the second quarter / Statistikaamet*, 2021). Figure A.2 in the Appendix provides the average firm size (by the number of employees) in Estonia. It shows us the change in the average firm size of manufacturing, service, and overall, across different sectors. As expected, the average size of manufacturing firms is much bigger than service firms. Additionally, we

can notice the decreasing trend in the average firm size across the economy over the year.

As an industry classification we used the Estonian EMTAK code.[3] Indeed, considering the size of the country we assumed rational to use two-digit EMTAK 2008 code based on NACE Rev.2.

The number of employees in a company is the primary variable in our analysis. We can only see the growth or reduction in the overall number of employees in the accessible data, but no information on how many people were employed and fired for a year. This would be possible when using the matched employer-employee data. Additionally, because of our data limitations, we cannot provide the results of how the individual employees moved across the sectors or firms. We need to use the matched employer-employee data to analyze if the person left one sector(firm) and entered another sector(firm). Nonetheless, the latter cannot be used over the Internet. Therefore, we only observe whether firm-level employment increased or decreased without determining between firms' employment reallocations.

5 Productivity Reallocation at Macro Level

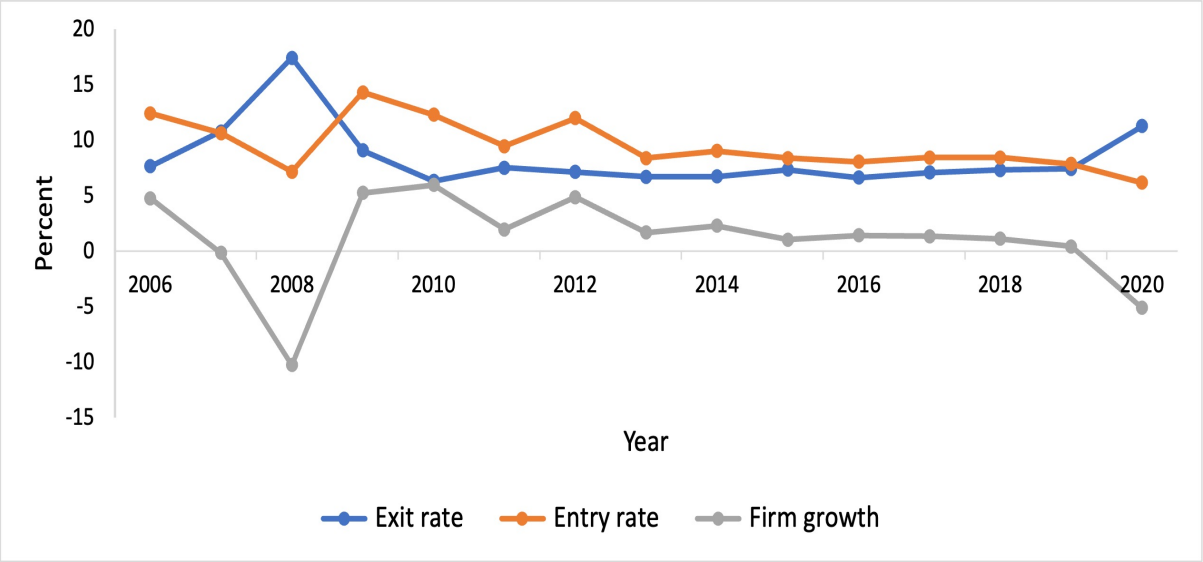
5.1 Firm Dynamics and Employment Growth

We calculate the firms' exit and entry rate as the relative change to the population of existing firms between the two consecutive years. From the given results of the entry and exit rates difference, we derive the overall firms' numbers growth rate over the whole period (2006 - 2020). The firms' exit, entry, and net firm entry rates since 2006 are depicted in Figure 4. The average entry rate over the given period is roughly 10 percent, while the average exit rate is 8 percent. Firms' exit rate peaked during the Great Recession in 2008, however the increase of firms' exit rate was not as severe for 2020. The firms' exit rate hike shows the accelerated reallocation during both economic downturns.

We continue to examine the empirical findings with measures of job reallocation (job creation and destruction) over the period, focusing on the Great Recession and Covid-19.

[3]EMTAK is a classification of economic activities in Estonia administered by the Center of Registers and Information Systems under the Ministry of Justice of Estonia. EMTAK is the Estonian national version of the internationally harmonized classification NACE.

Figure 4: Firm dynamics, 2006-2020

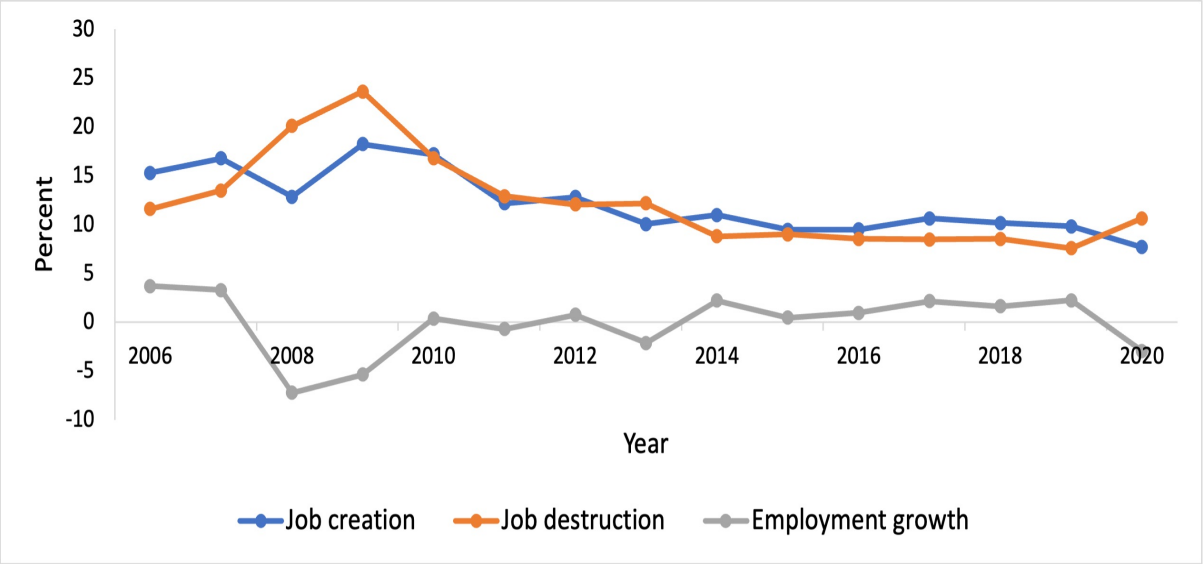


Notes: The figure illustrates the rate of increase in the number of firms and the entry and exit rates between 2006 and 2020. Rates are calculated as relative changes to the average firm stock between $t-1$ and t.

We rely on the net employment growth decomposition presented in the Section 3.2. Figure 5 describes net employment growth rates. The employment growth followed a similar pattern as the firms' dynamics. The large employment losses observed during the Great Recession resulted from decreased job creation and almost doubled job destruction, while the employment losses during the Covid -19 are not as sharp. The high digitalization of the country, the ability of businesses to adapt to the Covid reality (*How Estonia's digital society became a lifeline during COVID-19*, 2020), and the virus' mild influence on its main partners (Finland, Sweden, Latvia, and Lithuania) can be the reasons behind these results.

Figure 6 illustrates the job creation and the job destruction as a decomposition of survivors, entrants and exiters. In 2008 there was a sharp decrease in job creation mainly because of decreased number of entrants; However, survivors' number was steadier. In 2009 we can observe signs of the cleansing effects of the Great Recession, as the increased number of entrants, close to 12 percent, and decreased number of survivors, around 6 percent. During the Covid-19, job creation decreased, driven by both decreased number of survivors and fewer entrants. Overall, the results from the Covid-19 do not support the cleansing hypothesis. The nature of the Covid-19 shock can explain the results; different

Figure 5: Net employment growth, 2006-2020



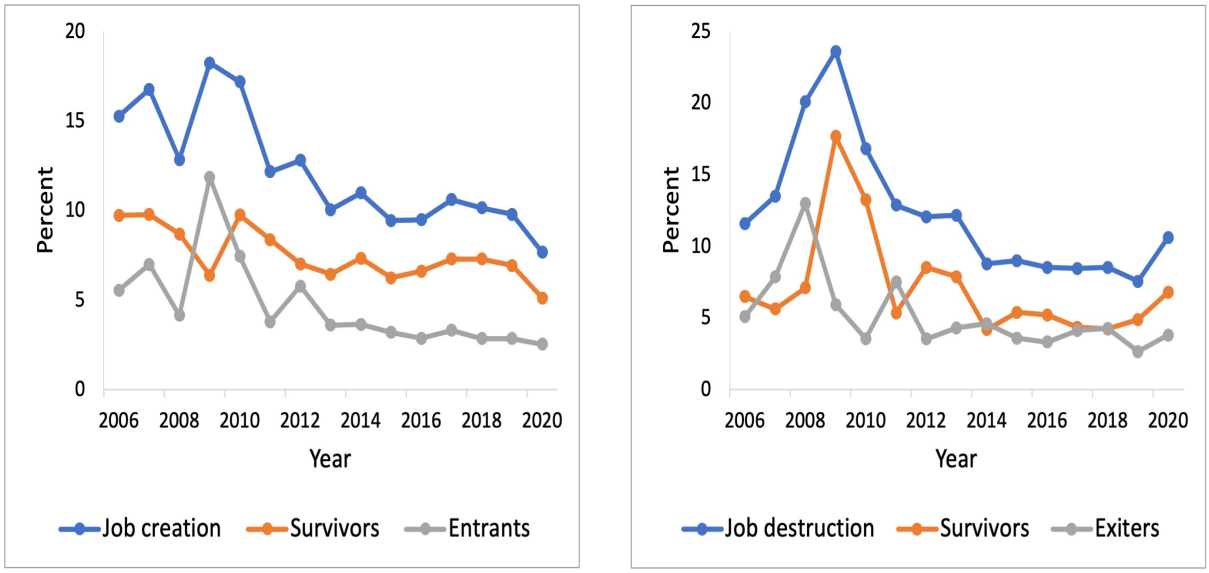
Notes: The figure illustrates net employment change rate and its components (job creation and job destruction) between 2006 and 2020. Rates are calculated as relative changes to the average employment stock between $t-1$ and t.

industries were affected differently (del Rio-Chanona et al., 2020), and the job retention schemes were used actively (Bennedsen et al., 2020; Davis & Von Wachter, 2011)

5.2 Productivity Growth

Figure 7 describes within and between productivity from 2006 till 2021. Within productivity growth, measured as the change in unweighted average labour productivity, whereas, between productivity growth is the change in productivity as a result of market share reallocation across firms. Within and between components are calculated over survivors. We base our calculations on the productivity decomposition described in Section 3.3.

Figure 6: Job reallocation, 2006-2020

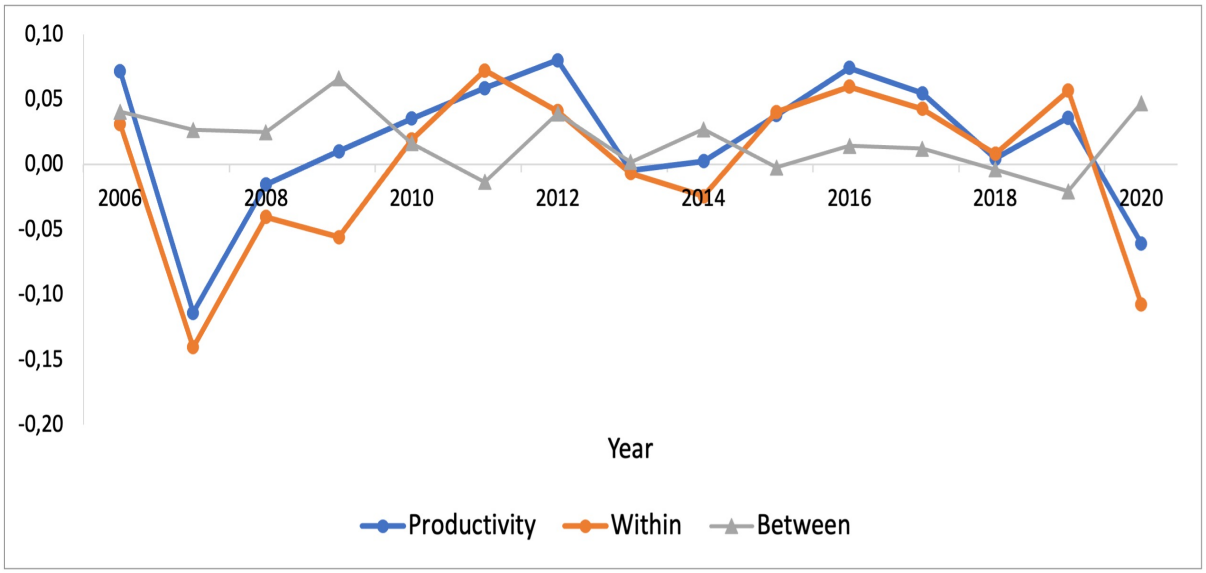


(a) Job creation

(b) Job destruction

Notes: The figure illustrates the job creation and job destruction rates between 2006 and 2020. Survivors are the firms that were active in t and $t-1$ period, exiter are the firms that were active in $t-1$ and is not active in period t, entrants are the firms that enter the market in period t. Rates are calculated as relative changes to the average employment stock between $t-1$ and t.

Figure 7: Productivity growth decomposition, 2006-2020



Notes: The figure illustrates productivity and its components from 2006 to 2020. Within productivity growth is the change in the unweighted average labour productivity. Between productivity growth is the change in productivity due to market share reallocation across firms. Within and between components are calculated over survivors.

The results from the Great Recession are consistent with the cleansing paradigm. Decreasing within term in 2009 suggests us that the firms that were less productive experienced the reduction of the market share as well.

Overall, we see that productivity and its components fluctuate from year to year. The Great Recession is associated with a significant increase in the contributions of the between term. During this economic downturn, the within component, on the other hand, had a negative contribution. An increase in the contribution of the between component, combined with the slight fall in the within term, suggests that the reallocation of employment shares was in favour of the most productive units and that the Great Recession's negative impact on productivity was mitigated. Our findings support the cleansing hypothesis when considering the Great Recession. During the Covid-19 period, while within component showed a significant fall, between component exhibited a jump from a negative value to the positive value of 0.05. The jump in the contribution of between component, combined with the negative contribution of the within term, suggests that reallocating employment shares in favour of the most productive units mitigated the negative impact of Covid-19, even if the mitigation was minimal.

6 Productivity Reallocation at Micro Level

The previous section analysed productivity reallocation in the Estonian economy and showed that Covid-19 did not have cleansing effects. This section will investigate the productivity reallocation at the micro-level and see whether the cleansing hypothesis holds here.

6.1 The destruction margin: Firm exit

We begin by discussing the destruction margin. The estimates of our benchmark specification for studying the link between productivity and firm exit and the impact of the Great Recession and Covid-19 recession on this link are presented in Table 1. Our findings are consistent with a large body of literature indicating a negative relationship between firm-level productivity and exit during Great Recession. We find direct evidence of the cleansing hypothesis during Great Recession: productive advantages protected

Table 1: Firm exit and productivity

	FE	MLR
	All firms	All firms
Productivity	-0.0328***	-0.0332***
	(-43.11)	(-43.22)
Productivity x GR	-0.0130***	-0.0135***
	(-7.50)	(-7.76)
Observations	218,073	218,073
R-squared	0.034	0.047
Industry FE	Yes	Yes
Year FE	Yes	Yes

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(a) Great Recession

	FE	MLR
	All firms	All firms
Productivity	-0.0356***	-0.0361***
	(-49.77)	(-49.82)
Productivity x C19	0.0102***	0.0097***
	(3.49)	(3.33)
Observations	218,073	218,073
R-squared	0.035	0.048
Industry FE	Yes	Yes
Year FE	Yes	Yes

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(b) Covid-19

Notes: Productivity is the firm-level productivity based on value-added. GR is an indicator variable for the Great Recession period, 2008-2010. C19 is an indicator variable for the Covid-19 year of 2020. All specifications include as controls indicators for firm's size, age, ownership, exporter status along with their interaction with GR and C19.

firms from being eliminated. We do not observe the same result for Covid-19 recession. While this link between firm exits and productivity levels strengthened during the Great Recession, it was weakened during Covid-19.

We proceed with our analysis by classifying industries into manufacturing and service sectors, as service sectors declined significantly more than other industries during the Covid-19 recession. (Bloom et al., 2020) We re-estimate our benchmark specification for each sector. Our findings show that the link between productivity and firm exit is similar across industries. Table 2 shows a strengthened relationship between productivity and reallocation during the Great Recession, but the opposite holds for the Covid-19 recession.

We also look at how the Great Recession and Covid-19 affected productivity-boosting reallocation in low, moderate, and highly concentrated markets. We define product and labour market concentration using the Herfindahl–Hirschman Index (HHI) and distinguish between highly (HHI$\geq$0.25), moderate (0.15$<$HHI$<$0.25), and low (HHI$\leq$0.15) concentrated industries.[4] Table 3 shows the results of our benchmark model for each classification separately. According to our results, the protective power of productivity was more considerable in low concentrated industries during the Great Recession, both in terms of product-market concentration and labour-market concentration. The relationship between productivity and reallocation has weakened in the product-market concentration for firms in the moderately concentrated industry, but the opposite is true in the labour-market concentration. For highly concentrated industries, the protective power of productivity still holds for the product-market concentration. We observe a strengthened relationship in highly concentrated industries of labour-market concentration, but the coefficients are not significant. We see the weakened relationship between productivity and reallocation in low concentrated firms in terms of product-market concentration and labour-market concentration during Covid-19 recession. For moderately and highly concentrated industries the strengthened relationship is observed in product-market concentration, but the same does not hold for labour-market concentration.

[4]The classification is made according to the U.S. Department of Justice and FTC, Horizontal Merger Guidelines § 5.3 (2010)

Table 2: Firm exit and productivity: Sectors

	Manufacturing	Service
Productivity	-0.0327***	-0.0343***
	(-14.97)	(-34.72)
Productivity x GR	-0.0010***	-0.0138***
	(-1.93)	(-6.17)
Observations	123,114	30,692
R-squared	0.044	0.052
Industry FE	Yes	Yes
Year FE	Yes	Yes

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(a) Great Recession

	Manufacturing	Service
Productivity	-0.0347***	-0.0371***
	(-16.88)	(-39.79)
Productivity x C19	0.0069***	0.0081***
	(0.78)	(2.22)
Observations	123,114	30,692
R-squared	0.045	0.052
Industry FE	Yes	Yes
Year FE	Yes	Yes

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(b) Covid-19

Notes: Productivity is the firm-level productivity based on value-added. GR is an indicator variable for the Great Recession period, 2008-2010. C19 is an indicator variable for the Covid-19 year of 2020. All specifications include as controls indicators for firm's size, age, ownership, exporter status along with their interaction with GR and C19.

Table 3: Firm exit and productivity: Market concentration

	Product Market			Labour Market		
	HHI≤0.15	0.15<HHI<0.25	HHI≥0.25	HHI≤0.15	0.15<HHI<0.25	HHI≥0.25
Productivity	-0.0335***	-0.0214***	-0.0304***	-0.0335***	-0.0259***	-0.0128
	(-43.00)	(-3.90)	(-3.97)	(-43.11)	(-3.74)	(-1.60)
Productivity x GR	-0.0147***	0.0029	0.0091	-0.0131***	-0.0441**	-0.0257
	(-8.26)	(0.29)	(0.64)	(-7.43)	(-2.83)	(-1.30)
Observations	211,280	3,872	2,921	214,005	2,266	1.802
R-squared	0.048	0.077	0.079	0.048	0.075	0.101
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(a) Great Recession

	Product Market			Labour Market		
	HHI≤0.15	0.15<HHI<0.25	HHI≥0.25	HHI≤0.15	0.15<HHI<0.25	HHI≥0.25
Productivity	-0.0366***	-0.0211***	-0.0267***	-0.0363***	-0.0365***	-0.0164*
	(-49.67)	(-4.41)	(-3.80)	(-49.57)	(-5.56)	(-2.16)
Productivity x C19	0.0107***	-0.0029	-0.0212	0.00972***	0.0186	0.0010
	(3.59)	(-0.19)	(-0.97)	(3.30)	(0.81)	(0.03)
Observations	211,280	3,872	2,921	214,005	2,266	1.802
R-squared	0.048	0.079	0.075	0.048	0.073	0.105
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(b) Covid-19

Notes: Productivity is the firm-level productivity based on value-added. GR is an indicator variable for the Great Recession period, 2008-2010. C19 is an indicator variable for the Covid-19 year of 2020. Product market uses sales to calculate the HHI. Labor market uses employment to compute the HHI. Highly concentrated are industries with a HHI above 0.25. Low concentrated are industries with a HHI below 0.15. Moderately concentrated are industries with a HHI between 0.15 and 0.25. All specifications include the same set of controls as Table 1.

6.2 The creation margin: Firm entry

To assess the potential contribution of new firm entry to productivity, we investigate where newly created firms fall in the productivity distribution and whether this relationship changed during the Great Recession and Covid-19. Table 4 summarizes our findings. We find that the positive correlation between productivity and firm entry becomes negative when interacting with the Great Recession and the Covid-19 recession dummy period. New entrants were less productive during economic downturns on average than during regular times.

7 Conclusion

Whether the economic crisis has cleansing or scarring effects is always an actual topic in economics. It can be outlined that crises are periods of significant movements and reallocations. We provide the empirical analyses of the prior two recessions of the last twenty years, Great Recession and Covid-19 recession, using the firm-level data from Estonia. Firstly, we provide our empirical results using the productivity decomposition methods and analyzing the contribution of firm exit and job reallocation to productivity growth at the macro level. Then we continue the research at the micro-level, using both Multiple Linear Regression and Fixed Effects transformation.

Using Estonian firm-level data from 2006 to 2020 (technically 2021) to examine the impact of the Great Recession and The Covid-19 recession, our thesis rejects the hypothesis that the crisis unequivocally improved the reallocation process. More precisely, our macro-level findings suggest that the Great Recession had signs of cleansing effects. The job reallocation increased with a significant increase in the contributions of the between-term productivity reallocation. However, during this economic downturn, the within a component of productivity reallocation had a negative contribution. That can result from decreased demand and turnover, or simply production resources were used less efficiently. However, there was no evidence of the cleansing effects of the Covid-19 recession. That can be explained for different reasons: the character of the virus, policies against the pandemic, and time limitations of our data, as technically, we analyzed only the first year of the pandemic.

Table 4: Firm entry and productivity

	FE	OLS
	All firms	All firms
Productivity	0.0140***	0.0160***
	(28.56)	(32.14)
Productivity x GR	-0.0027*	-0.0041***
	(-2.43)	(-3.66)
Observations	218,073	218,073
R-squared	0.129	0.131
Industry FE	Yes	Yes
Year FE	Yes	Yes

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(a) Great Recession

	FE	OLS
	All firms	All firms
Productivity	0.0140***	0.0160***
	(30.30)	(34.08)
Productivity x C19	-0.0087***	-0.0103***
	(-4.66)	(-5.44)
Observations	218,073	218,073
R-squared	0.130	0.131
Industry FE	Yes	Yes
Year FE	Yes	Yes

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(b) Covid-19

Notes: Productivity is the firm-level productivity based on value-added. GR is an indicator variable for the Great Recession period, 2008-2010. C19 is an indicator variable for the Covid-19 year of 2020.

It can be outlined that our results from decompositions and the regression analysis, in general, are in line with one another. Our micro-level analyses found direct evidence of the cleansing hypothesis during the Great recession, as the higher level of productivity protected firms from being eliminated. Nonetheless, we do not observe the same results for the Covid-19 recession. Moreover, the link between the firm's exit and productivity levels weakened during the pandemic.

To examine the heterogeneity of our results, we proceed with our analysis separately for the manufacturing and service sector, reasoning that Covid-19 has a sectoral character. (Bloom et al., 2020; Lu et al., 2021) Our results for both industries were consistent with general findings. During the Great Recession, the link between productivity and reallocation strengthened, but the opposite result was shown for the Covid-19. Additionally, we examine our results for low, medium, and highly concentrated industries. The protective power and productivity differ between the industry concentration, market type, and recessions.

Additionally, to examine the impact of the firm entry on productivity, we looked at where newly founded firms lie in the productivity distribution and if this relationship altered during the Great Recession and Covid-19. According to our findings, newly founded enterprises are less productive during the economic downturns on average than during regular times.

We only investigate whether firm-level employment increased or decreased without determining which firms' employment reallocations differed. Besides, the pandemic is not officially over. Many economic policymakers still are dealing with its spillovers. Hence the reallocation process is still in progress. Our analysis covers the results of the first year of the pandemic.

With this thesis, we tried to make a small contribution to the knowledge in the field by analyzing Covid-19 results and understanding how the recession affects productivity reallocation. The final results of Covid-19 on the economy would be a worthwhile subject of future research as without officially ending the pandemic, a new war shock has already reached Europe.

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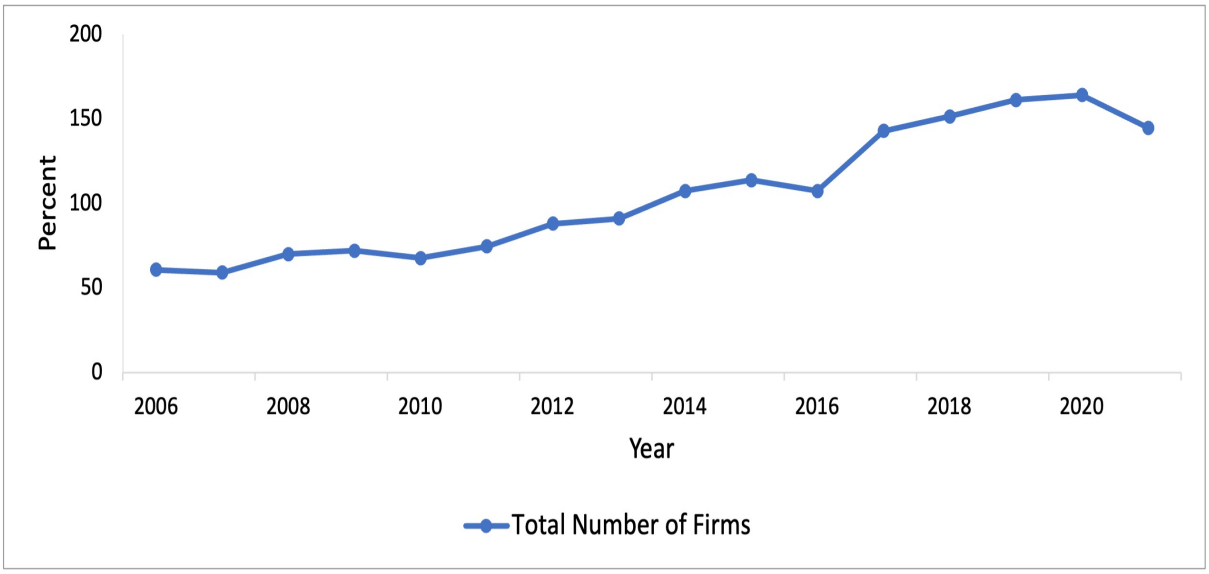
A Additional tables and figures

Table A.1: Job creation and job destruction components

Year	Expanded Survivors	Entry	Shrinking Survivors	Exit
1996	11,191	100,546	-9,305	-19,886
1997	24,173	67,862	-19,745	-15,801
1998	20,813	32,588	-21,271	-24,255
1999	23,040	29,386	-24,998	-18,680
2000	28,698	29,331	-22,337	-21,839
2001	35,663	22,644	-25,025	-16,499
2002	34,006	23,431	-27,941	-16,269
2003	29,899	16,126	-21,645	-14,218
2004	40,642	16,818	-22,095	-14,759
2005	37,064	22,848	-22,673	-13,340
2006	35,961	20,497	-24,007	-18,831
2007	37,533	26,832	-21,598	-30,190
2008	29,335	13,984	-23,975	-43,779
2009	17,838	33,132	-49,370	-16,607
2010	30,726	23,447	-41,813	-11,192
2011	27,906	12,663	-17,900	-25,047
2012	24,870	20,473	-30,197	-12,528
2013	23,328.55	13,058	-28,513	-15,585
2014	24,309.6	12,109	-13,912.15	-15,217
2015	22,669	11,593	-19,610	-13,057
2016	22,851	9,869	-17,980	-11,441
2017	25,263	11,500	-15,047	-14,284
2018	28,304	11,086	-16,471	-16,607
2019	27,663	11,390	-19,534	-10,625
2020	19,205	9,539	-25,539	-14,310

Source: Estonian Business Registry database, authors' calculations.

Figure A.1: Total number of active firms



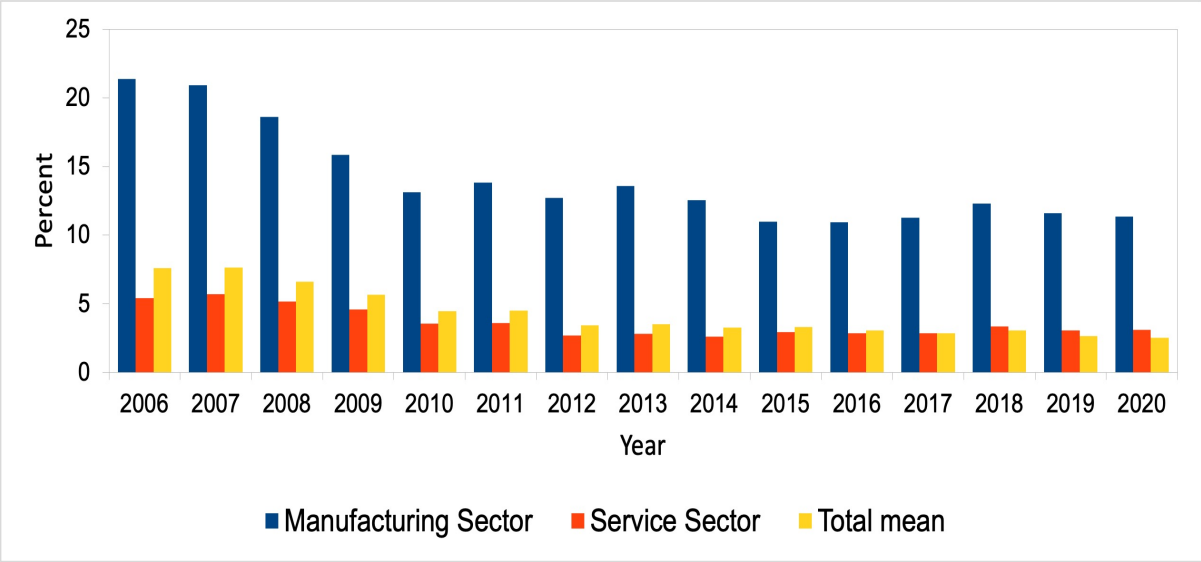
Source: Estonian Business Registry database, authors' calculations.

Table A.2: Distribution of observations across employers' size classes (all years)

Number of employees	Frequency	Percentage	Cumulative percentage
0	90,898	50.37	50.37
1-9	783,827	43.43	93.8
10-49	9,197	5.10	98.9
50-249	17,346	0.96	99.86
250-10000	2,501	0.14	100
Total	1,804,624	100	

Source: Estonian Business Registry database, authors' calculations.

Figure A.2: Average Firm Size



Source: Estonian Business Registry database, authors' calculations.

Resümee

TOOTMISTEGURITE REALLOKATSIOONI ROLL TOOTLIKKUSE KASVUS EESTIS COVID-19 MAJANDUSLANGUSE AJAL

Nana Magaldadze Leyla Hasanova

Käesolevas magistritöös on ettevõtte-tasandi andmete põhjal uuritud tootmistegurite reallokatsiooni mõju tootlikkusele Eestis aastatel 2006–2021, kus Covid-19 majanduslanguse mõju võrreldakse suure majanduslanguse mõjuga aastal 2008-2009. Esiteks analüüsime töös ettevõtete lõpetamise ja alustamise ning töökohtade ümberpaiknemise panust tootlikkuse kasvu makrotasandil. Seejärel hinnatakse regressioonimudelit kontrollimaks, kas samasugused tulemused kehtivad ka mikrotasandil. Tulemused näitasid, et ettevõtte kõrgem tootlikkus kaitses ettevõtteid suure majanduslanguse ajal tegevuse lõpetamise eest. Sama tulemust võib näha ka Covid-19 majanduslanguse puhul, kuid üksnes nõrgemal kujul. Mikrotasandil muutus tootlikkuse ja ettevõtte tegevuse lõpetamise vaheline seos tugevamaks suure majanduslanguse ajal, samas kui nõrgenes Covid-19 majanduslanguse ajal. Meie tulemused näitavad, et kuigi tootmistegurite reallokatsioon panustas tootlikkuse kasvu suure majanduslanguse ajal, ei saa seda täheldada Covid-19 majanduslanguse ajal.

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