Blue employment dynamics
Are maritime sectors different?

Alexandra Allard[a,b,c]

[a] *Örebro University*
[b] *Södertörn University*
[c] *Research Institute of Industrial Economics (IFN)*

Draft, 14 February 2025

Abstract

The blue economy has emerged as a key concept for driving innovation, stimulating economic growth, and creating employment opportunities, all while promoting sustainable use of maritime resources. However, the economic impact of the blue economy remains underexplored in empirical research. This paper examines employment dynamics in the Swedish blue economy, defined as maritime and maritime-related sectors. I mainly use corporate data from 1998 to 2020 from the Swedish House of Finance's Serrano database but incorporate information from other sources to simplify the identification of blue firms. Descriptive statistics, OLS regressions, and coarsened exact matching are used to estimate the effect on job flow variables. The results suggest that blue firms – i.e., firms in a maritime or maritime-related sector – have slightly higher employment growth, job creation, and job destruction than other firms when analyzed at the industry level.

Keywords: Blue economy; Living resources; Maritime freight transport; Coastal tourism; Maritime renewable energy; Employment dynamics; Job creation; Job destruction

JEL-codes: …

1. Introduction

The blue economy is expected to generate innovation, increase cash flow, and create work opportunities while promoting sustainable use of our maritime resources (Kathijotes, 2013). Such expectations have fueled an increasing interest in the blue economy concept in academia and policy (Mulazzani & Malorgio, 2017). Almost a decade ago, the OECD (2016) stated that ocean-based industries have the potential to outperform the global economy in terms of employment growth between 2010 and 2030 in a business-as-usual scenario. However, there is an absence of literature investigating the relationship between a firm being blue – i.e., being a part of the blue economy – and job creation. Against this backdrop, I will analyze employment dynamics in the Swedish blue economy, compared with non-blue Swedish sectors.

The blue economy concept has been increasingly popular during the last decade and has been defined and used in various ways (Lee et al., 2020). When defining the blue economy, it is common to either focus on activities that sustainably utilize maritime resources (e.g., Kathijotes, 2013; Potgieter, 2018) or include all marine and maritime-related sectors – sustainable or not. For example, the European Commission (2022) states that "[t]he EU's Blue Economy encompasses all sectoral and cross-sectoral economic activities related to the oceans, seas and coasts." However, even in the latter definition, these sectors are assumed to adopt more sustainable practices. In this paper, I will use the EU's definition, as this study focuses on comparing employment dynamics in different sectors and not on investigating the sustainability of these sectors.

In Sweden, the blue economy has been defined and framed in terms of included sectors by Statistics Sweden (2016) and the Swedish Agency for Marine and Water Management (2017). The total employment in Swedish maritime sectors has also been presented and briefly analyzed between 2007 and 2011 by Hanning et al. (2013) and between 2014 and 2019 by Svensson et al. (2017). The European Commission et al. (2022) annual blue economy report presents total employment in the blue economy sectors at the country level but omits employment dynamics.

There is a scarcity of previous studies looking at job creation in the blue economy, as the focus has often been on conceptualizing the blue economy (Bhattacharya & Dash, 2020). Nevertheless, there is also literature that focuses on success stories in the blue economy at the corporate (e.g., Frisk, 2012), sector, and country level (e.g., UNEP, 2015; Wenhai et al., 2019; Xie, 2022) or emphasizes the potential of the blue economy to boost economic development and job creation in developing countries (e.g., Hasan et al., 2018; Sarker et al., 2018). Despite these expectations, there is a notable gap in empirical research examining whether the blue economy delivers on these promises.

This study seeks to address this gap by analyzing employment dynamics in the Swedish blue economy – defined as maritime and maritime-related sectors – compared with non-blue sectors by examining 1,037,098 companies from 1998 to 2020. I use corporate data from the Swedish House of Finance's Serrano database, combined with data from the Research Institutes of Sweden (RISE), Swedish Maritime Technology Forum (SMTF), the Swedish Energy Agency, geographic data, and business associations.

The analysis starts with a descriptive analysis of the basic patterns of job flows, i.e., aggregated job creation, job destruction, job reallocation, and net job creation. These patterns are analyzed for the entire blue economy and on the industry level, compared to the entire non-blue economy or industry counterpart in the non-blue economy. The descriptive analysis is followed by a more systematic analysis, starting with an OLS model, where I include control variables for firm age, size, and industry.

To lower bias and increase efficiency in the model, I re-estimate the OLS model after matching blue and non-blue firms, using Coarsened Exact Matching (CEM). The population average treatment effect on the treated (PATT) measures the average effect of being blue and finds a positive and significant effect of being blue on employment growth, job creation, and/or job destruction for most industries. However, for the entire blue economy, and technology sector, the average effect of being blue on job creation and job destruction is negative. One possible explanation is that for technology, and the entire blue economy, there is a chance that matches are made between industries, as technology includes businesses from industries such as manufacturing, construction, and wholesale, retail, and repair. This is further supported by the OLS results, both for estimations made on unmatched and matched observation, which find that the three employment dynamic estimates – employment growth, job creation, and job destruction – are positive and significant when control variables for industry are included, but negative and significant when they are excluded.

The descriptive analysis showcases that the blue economy experiences greater employment volatility than the non-blue economy, possibly due to its smaller number of firms and employees, which may amplify the impact of individual businesses on job flows. This is particularly evident in the fishing sector, maritime transport, and maritime electricity generation, where job creation and destruction fluctuate more significantly. Factors such as firm size, age, and industry-specific structural changes contribute to these employment dynamics.

This paper proceeds as follows. Section 2 briefly presents policies and maritime strategies at the EU and Sweden levels. An overview of the Swedish blue economy and its sectors is provided in Section 3. Section 4 presents the relevant literature on job creation and destruction. Section 5 presents the data and relevant measurements. In Section 6, some basic patterns of job flow in blue and non-blue sectors are presented and discussed. The methodology is presented in Section 7. Section 8 presents and discusses the results of the regressions.

2. Political Objectives

In 2005, the EU published strategic objectives for 2005 to 2009. In these objectives, they assert the need "for an all-embracing maritime policy aimed at developing a thriving maritime economy and the full potential of sea-based activity in an environmentally sustainable manner." (European Commission, 2005, p. 9). Two years later, the European Commission (2007) published an integrated maritime policy for the EU, which partly focused on integrated policymaking, increased data and information, decreasing the environmental impact of shipping and fishing, encouraging multisectoral maritime clusters, increasing the quality and amount of maritime work opportunities, and promoting maritime and coastal tourism.

A few years later, the European Commission (2012) published a communication focusing on blue growth. They argue that the blue economy sectors are drivers of the economy because of their rapid technological progress and increased awareness about finite resources. This increased awareness has led to an increase in offshore renewable energy installations. It is also argued that seaborne transport should be favored because of lower emissions per tonne-kilometer (European Commission, 2012).

When defining the blue economy, the European Commission (2012) argues that although the blue sectors are independent, they rely on common skills and shared infrastructure. They further state the importance of investments directed toward maritime activities and encouraging maritime clusters, where companies, educational establishments, and researchers work together and reinforce each other.

A new policy document was published by the European Commission in 2014, focusing on innovation in the blue economy and how it can increase jobs and growth in maritime sectors. The document focuses on marine knowledge, research, and the required skills for the blue economy. To encourage research and reduce the skill gap in the blue economy, the Commission has, between 2007 and 2013, roughly contributed €350 million a year on average to maritime research. In the report, the Commission encourages blue economy stakeholders to apply for funding to establish maritime clusters (European Commission, 2014).

In 2015, the Swedish government adopted a strategy to promote maritime sectors, partly to reach the goal of the lowest unemployment rate in the EU by 2020 (Government Offices of Sweden, 2015). Even though the unemployment trend has been the opposite, it is interesting to examine the role of the blue economy in this development and whether the blue economy strategies have had any effect on job creation in the blue sectors.

The Swedish strategy focuses on ensuring competitive maritime industries, attractive coastal areas, and a balanced marine environment (Government Offices of Sweden, 2015). However, the strategy is presented as a vision and the desired direction to work, without quantitative goals (The Swedish Agency for Marine and Water Management, 2020). Some areas presented by the Government Offices of Sweden (2015) are promoting innovation, strategic partnerships, and accessible knowledge. The Swedish Government also wanted to simplify the process for maritime sectors to receive funding through the EU's integrated marine policy and increase international cooperation. At the time, the EU Strategy for the Baltic Sea Region (EUSBSR) had also resulted in several Swedish networks at local, regional, and national levels within maritime transport, safety, innovation, tourism, etc. (Government Offices of Sweden, 2015).

3. The Blue Economy

When the blue economy concept appeared, it focused on the sustainable utilization of our maritime resources. Since then, various definitions have been suggested, prioritizing different participants, problems, and solutions (Silver et al., 2015). One definition of the blue economy focuses on job opportunities within maritime sectors, which are changing and sharpened by new policies and strategies.

Frameworks and definitions presented by the European Commission et al. (2021), Statistics Sweden (2016), and the Government Offices of Sweden (2015) are used to define the included sectors in the Swedish blue economy. In the maritime industry, the Government Offices of Sweden (2015) include three types of corporations: (i) businesses directly relying on the ocean, called maritime corporations; (ii) businesses indirectly relying on the ocean, by selling goods or services to maritime corporations; and (iii) businesses indirectly relying on the ocean or large lakes through location, such as coastal tourism.

The Swedish blue economy can be divided into five main sectors: living resources, maritime freight transport, coastal tourism, maritime renewable energy, and maritime technology. These will all be discussed individually below. Table 1 lists the subcategories of each sector and its corresponding sector code, which will be explained in Section 5.1.

Table 1: The Swedish blue economy, with sector codes

Blue economy sectors	**Sector codes**
Living resources	
Fishing	03111, 03119, 03120
Aquaculture	03210, 03220
Processing of seafood products	10200
Distribution/retail of seafood products	47230
Maritime freight transport	
Freight transport	50201, 50202, 50401, 50402
Cargo and warehousing	52241
Support services, maritime transport	52220
Coastal tourism	
Accommodation	55101, 55103, 55201, 55202, 55300, 55900
Conference facility	55102
Restaurants	55101, 56100, 56300
Passenger transport	50101, 50102, 50301, 50302
Rental and leasing of ships and boats	77340
Maritime renewable energy	
Generation of electricity	35110
Maritime technology	
Shipbuilding and repair	30110, 30120, 33150
Distribution/retail of ships	47643
Water construction	42910

3.1. Living Resources

Among the blue economy living resource sectors, aquaculture is expected to expand the most. Between 2007 and 2012, food fish production in Swedish aquaculture increased from around 5,000 to approximately 12,500 (The Swedish Board of Agriculture, 2015). Further, leading up to 2015, aquaculture – including fish, shellfish, and algae – was the most rapidly growing part of the food industry (Government Offices of Sweden, 2015)

Two explanations exist for this change and why it is expected to continue. Firstly, the global demand for high-end protein products, such as high-quality fish, will increase as the global middle class grows, and with this evolution, dietary habits will change (OECD, 2016). Secondly, because of the existing problems with overfishing, the largest expansion is expected to occur in marine aquaculture (OECD, 2016).

3.2. Maritime Freight Transport

Over 90 percent of Swedish imports and exports are transported by sea (Government Offices of Sweden, 2015). Further, with a growing global population and economies, consumption and traded goods are expected to increase. This will, in turn, lead to a growing maritime freight transport sector (OECD, 2016). There have also been political attempts to increase maritime freight transport over the years. One example is the EU's strategic interest in short-sea shipping, which started in 2004 (European Commission, 2004). Part of this strategic interest has been the development of motorways of sea projects (Debyser, 2022).

Between 2010 and 2015, the total number of employees in Swedish maritime freight transports decreased while value-added simultaneously increased (Svensson et al., 2017). Svensson et al. (2017) argue that this decrease in employment is a result of rationalization and flagging out to increase companies' competitiveness.[1]

3.3. Coastal Tourism

A crucial area of Swedish coastal tourism, and Swedish tourism in general, is the Swedish Archipelago. Rytkönen et al. (2019) argue that the Stockholm Archipelago is central to attracting tourists to Stockholm, and public investments are directed to promote tourism further. The sustainable socio-economic development of the Swedish Archipelago has also been supported by policies, strategies, and directed projects (Rytkönen et al., 2019). For example, between 2012 and 2015, the Stockholm Archipelago and Bohuslän got resources and monetary funding to create more competitive tourism, especially coastal tourism, in a project focusing on developing and strengthening sustainable tourist destinations (The Swedish Agency for Economic and Regional Growth, 2017).

Changes in population demographics are expected to boost coastal tourism. According to the OECD (2016), the demand for holidays and retirement homes at coastal locations will increase due to an aging population and the growth of the middle class. Another anticipated effect of a growing middle class is an increasing demand for cruise tourism (OECD, 2016).

[1] Flagging out means that a ship is registered in a different country than its home country, for example, because the regulations, taxes, or labor laws there are more favorable.

3.4. Maritime Renewable Energy

According to the OECD (2016), several factors can boost the sector for ocean energy and offshore wind. One of these factors is international agreements supporting the transition to renewable energy, such as the Paris Agreement. Another factor is events of high oil and gas prices (OECD, 2016).

However, the marine renewable energy sector has also had difficulties. The growth of offshore renewable energy is disadvantaged by an existing skills shortage within the EU (European Commission et al., 2021). In the Swedish context, the Swedish armed forces have also been an obstacle to the expansion of offshore wind. According to Westander (2022), 89 percent of applications to build offshore wind were opposed by the Swedish armed forces between 2017 and March 2022.

3.5. Maritime Technology

The maritime technology sector is diverse (Statistics Sweden, 2016) and can be found in different blue and non-blue sectors. It can, therefore, be hard to capture these companies as one sector.

Developments in maritime technology are crucial to the growth of the blue economy. OECD (2016) argues that innovation and technological changes move fast within the blue economy sectors with the cross-fertilization of knowledge. Many innovations in maritime sectors stem from one another, and this cycle is expected to continue, triggering further technological change.[2] This cycle of technological change will, in turn, lead to improvements in cost structures, efficiency, and productivity (OECD, 2016), as well as increased cash flow and, in turn, new job opportunities (Kathijotes, 2013).

With the development of new technologies, jobs will be simultaneously created and destroyed (Mortensen & Pissarides, 1998). Schumpeter (1942) defines this as creative destruction. When technological knowledge increases, new methods and products are developed. Both can increase productivity, which allows for more produced output with less input, such as labor. However, new work opportunities will arise as new products are created and new markets open up (Huo, 2015). Thus, with technological advances within the blue economy, reallocation of work opportunities and an increase in employment are expected.

4. Job Creation and Destruction

There is a lack of literature investigating job creation and employment growth in the blue economy. Some reports, such as the European Commission et al. (2021), present statistics on the number of employees within the blue economy. However, firm characteristics that might affect the employment dynamics in the blue economy are overlooked.

[2] For example, companies in gas, oil, and seabed mining explore maritime robotics for subsea operations; biotechnology focusing on fish welfare and health are the foundation for aquaculture; and strides in maritime navigation and remote sensing improve several maritime fields, such as maritime safety, fisheries, and ocean observation (OECD, 2016).

More broadly, job creation and destruction research often focuses on firm size and age as key explanatory variables. Studies consistently show that small firms contribute disproportionately to employment growth, with Ayyagari et al. (2011), Hijzen et al. (2010), and Lawless (2014) reporting the highest job creation rates among firms with 250, 100, and 20 employees or less, respectively. Davis and Haltiwanger (1992) find that smaller firms experience higher job creation and destruction rates in the US manufacturing sector, leading to increased job reallocation. Similar patterns emerge in Sweden, where Heyman et al. (2018) observe that small and medium-sized firms account for most net job creation, particularly among young firms, aged three years or younger. In Kenya, Esaku (2020) finds job creation concentrated in young micro firms, while medium and large firms contribute more to job destruction.

Across 18 countries, Criscuolo et al. (2014) find that firms aged five years or younger drive employment growth, a trend supported by Ayyagari et al. (2011), Haltiwanger et al. (2013), and Lawless (2014). Haltiwanger et al. (2013) further emphasize that start-ups have a critical role in employment growth dynamics and that young firms exhibit more volatile behavior. In Sweden, Heyman et al. (2019) document a rise in start-up activity and job destruction among one- and two-year-old firms from 1990 to 2013, with job destruction surpassing job creation after 2005. Similarly, Eriksson and Hane-Weijman (2017) and Persson (2004) find that Swedish entrants face survival challenges, leading to high job destruction. Eriksson and Hane-Weijman (2017) further argue that stable job creation originates from incumbent firms rather than new entrants and is more pronounced in large, diversified regions. While some studies debate whether firm age is more influential than firm size, this discussion will not be the focus here.

Sectoral comparisons indicate higher job creation in service sectors. Hijzen et al. (2010) find that job destruction rates are similar across manufacturing and services. Nevertheless, job creation rates are higher in the service sector, leading to greater net job creation. Heyman et al. (2018) confirm similar trends in Sweden, where the service sector outperforms manufacturing in net job creation, with small and young firms playing a central role.

Previous research has explored other factors influencing job creation and destruction beyond firm size, age, and sector. For example, Lawless (2014) examines the role of firm ownership and finds slightly higher job creation among foreign-owned firms. Similarly, Esaku (2020) analyzes firm ownership along with productivity, capital intensity, and wage rate and finds that labor productivity and capital intensity sometimes have a significant negative effect on both employment growth and job destruction.

5. Data and Specifications

The analysis is based on corporate data from 1998 to 2020 from the Swedish House of Finance's Serrano database, which is based on the financial statements of Swedish companies.

5.1. The Swedish Blue Economy

Several steps are taken to identify blue businesses. In the first step, I use SNI-codes for blue sectors. The SNI-code presents the company's primary industry and is the standard for Swedish industry classifications. The SNI-codes are based on NACE Rev. 2, the industry standard classification system used by the EU. Identified SNI codes for the blue economy are shown in Table 1.

For some of these sector codes, only blue businesses, such as fishing or freight transport, are included. However, in other sectors, there is a mix of blue and non-blue companies, which is mainly true for coastal tourism and maritime renewable energy. For these sectors, other identifications had to be used.

For coastal tourism, I isolated accommodation establishments, conference facilities, and restaurants close to the coast or big lakes. Postal codes were collected, and 1,923 out of 10,481 postal codes were connected to the coast or one of Sweden's three largest lakes – Vänern, Vättern, and Mälare. The postal codes connected to the coast were identified using data over sea areas from Lantmäteriet, and the postal codes connected to lakes were identified using data from Natural Earth. Companies with the right postal codes – connected to the coast or lake – and relevant SNI-code – within accommodation or restaurants – were registered as coastal tourism businesses.[3]

To identify companies within maritime energy, I followed the same strategy as Statistics Sweden (2022) and used electricity certificate applications. The Swedish Energy Agency registers all applications for electricity certificates, which are certificates for renewable electricity production. These applications also include information on energy sources and organization numbers for organizations solely applying for certificates within maritime renewable energy – water, wave, and offshore wind – which was collected. These were further assessed, and businesses with codes other than those of the relevant sector were removed.[4]

However, maritime-related companies outside the SNI-codes identified so far also exist. For example, insurance companies focusing on boats or maritime transport registered under a sector code for other support services. To identify these companies, I gathered data on member companies in business associations within the marine sector. The included business associations are the Swedish Shipowners' Association, Maritimt Forum, the Swedish Confederation of Transport Enterprises, Sweboat, Föreningen Sveriges Varv (shipyards), Svenska Fiskhandelsförbundet (fish trade), Fiskbranschens riksförbund (seafood), and Matfiskodlarna (fish farmers).[5] The data gathered on member companies in Maritimt Forum include members in 2010, while the other business associations include members in 2022. Data on organization numbers have also been received from RISE and SMTF for active companies within maritime transport in 2017 and within maritime technology in 2019.

As I want to compare employment dynamics in similar industries – blue vs. non-blue – the higher industry definition in the SNI-codes will be used for some comparison. However, the industry division in the SNI-codes differs from the division previously presented. Table 2 shows the blue economy sectors at the SNI industry level.

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[3] Relevant SNI-codes for coastal tourism: 55101, 55102, 55103, 55201, 55202, 55300, 55900, 56100, & 56300.
[4] Relevant SNI-codes for maritime renewable energy: 35110
[5] As the Swedish Confederation of Transport Enterprises also includes companies from non-blue sectors, I have only included member companies within shipping and ports.

Table 2: Industry division in the Swedish blue economy sectors

Blue economy sectors	**Sector codes**
Agriculture, forestry, and fishing	A
Fishing	03111, 03119, 03120
Aquaculture	03210, 03220
Manufacturing	C
Processing of seafood products	10200
Shipbuilding and repair	30110, 30120, 33150
Electricity, gas, etc.	D
Generation of electricity	35110
Construction	F
Water construction	42910
Wholesale, retail, and repair	G
Distribution/retail of seafood products	47230
Distribution/retail of ships	47643
Transportation and storage	H
Passenger transport	50101, 50102, 50301, 50302
Freight transport	50201, 50202, 50401, 50402
Cargo and warehousing	52241
Support services, maritime transport	52220
Accommodation and food service	I
Accommodation	55101, 55103, 55201, 55202, 55300, 55900
Conference facility	55102
Restaurants	55101, 56100, 56300
Administrative and support service	N
Rental and leasing of ships and boats	77340

5.2. Measurement of Employment Growth

Following Davis and Haltiwanger (1992), employment growth at the company level is calculated by dividing the employment change by the average of the two periods:

$$g_{it} = \frac{E_{it} - E_{i,t-1}}{0.5(E_{it} + E_{i,t-1})} \qquad (1)$$

where E_{it} is total employment in firm i at time t.

By dividing with average employment, the growth rate is symmetric around zero and constrained between -2 and 2. This indicates that a firm enters (exits) the market when its employment growth equals 2 (-2).

5.1. Measurement of Job Creation and Destruction

The measurement of employment growth is also used to calculate job creation and destruction at the firm level. Job creation and destruction for firm i at time t:

$$JC_{it} = g_{it} \quad \text{for } g_{it} > 0 \tag{2}$$

$$JD_{it} = |g_{it}| \quad \text{for } g_{it} < 0 \tag{3}$$

Thus, job creation at the firm level equals positive employment growth, and job destruction is the absolute value of negative employment growth. It is possible to aggregate these measurements to sector level, but first, each company is weighted based on the number of employees, using the weight w_{it}:

$$w_{it} = \frac{(E_{it}+E_{i,t-1})}{\sum_{i\epsilon E_{jt}}(E_{it}+E_{i,t-1})} \tag{4}$$

where E_{jt} is the set of companies in sector j at time t.

Job creation (destruction) for sector j at time t is calculated by taking the sum of weighted employment growth for positive (negative) values of g_{it}:

$$JC_{jt} = \sum_{i\epsilon E_{jt}, g>0} w_{it} g_{it} \tag{5}$$

$$JD_{jt} = \sum_{i\epsilon E_{jt}, g<0} w_{it} |g_{it}| \tag{6}$$

Net job creation is the difference between job creation and destruction, $NJC_{jt} = JC_{jt} - JD_{jt}$, and job reallocation is the sum of job creation and destruction, $JR_{jt} = JC_{jt} + JD_{jt}$. One way to interpret job reallocation is as the maximum number of workers reallocated so that companies can adjust to changes in employment opportunities. Similarly, net job creation is the minimum worker reallocation.

6. Basic Patterns of Job Flow, Blue vs. Non-Blue

In this section, job flows – aggregated job creation, job destruction, job reallocation, and net job creation – are presented for the entire blue economy, compared to the entire non-blue economy. Similar comparisons are made for different blue industries compared to their counterpart in non-blue sectors. Figure 1 shows the aggregated employment dynamics for all blue firms and the aggregated numbers for all non-blue firms.

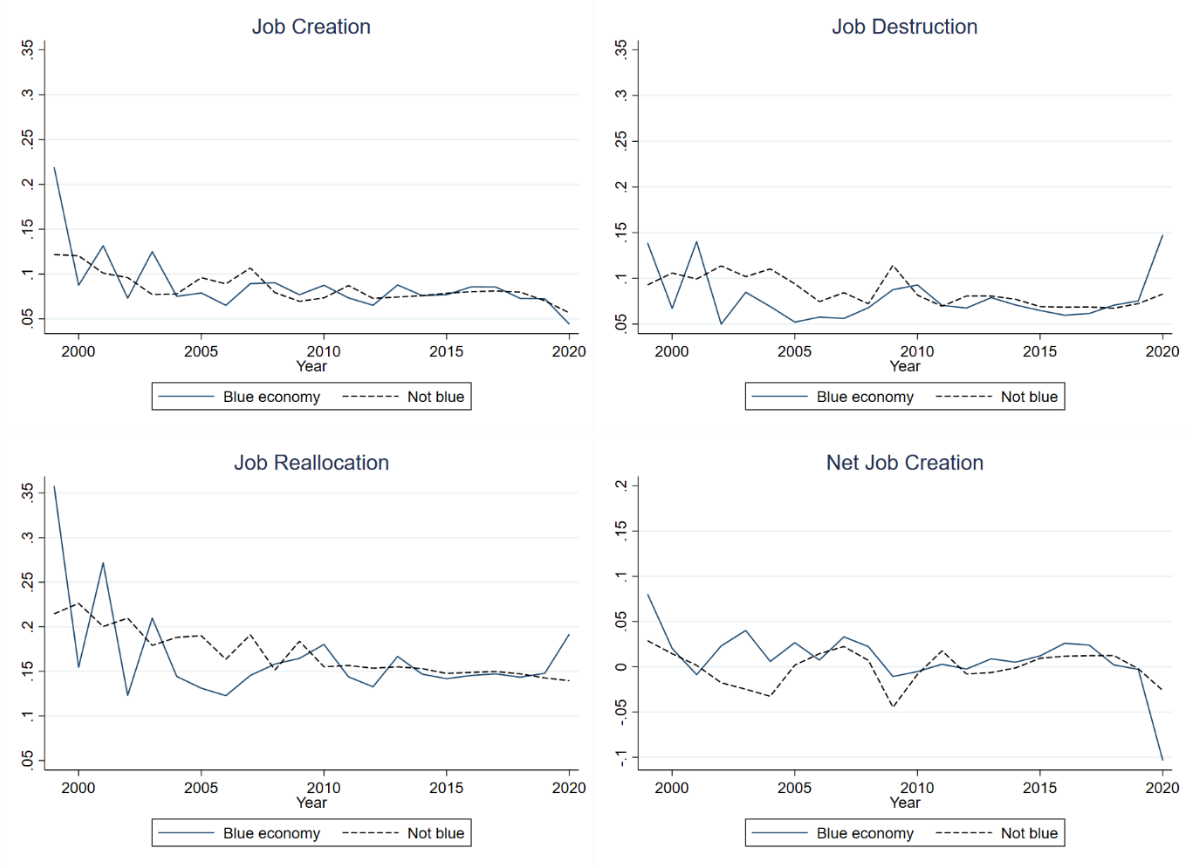

Figure 1: Employment dynamics in blue vs. non-blue firms

Figure 1 shows similar developments in the blue and non-blue sectors. However, the measurements seem less stable for the blue economy, especially for the years before 2005 and in 2020. The standard deviation for aggregated job flow – job creation, job destruction, net job creation, and job reallocation – is twice, or almost twice, as high for blue firms compared to non-blue (see Table 12, Appendix A). However, for job flow measurements at the firm level – employment growth, firm job creation, and firm job destruction – the standard deviation is similar for blue and non-blue firms. Thus, one reason for this volatility might be fewer companies and employees in the blue economy. Each company will, therefore, have a higher weight and, in turn, a higher impact on the total employment change in the blue economy.

The more volatile behavior before 2005 might also be explained by the fact that part of the data for the blue sectors is partly built on active business for later years (2010, 2017, 2019, and 2020). Depending on the age of these companies, there might be even fewer observations before 2005. The blue economy also has a marginally higher net job creation.

Looking at one industry at the time, Figure 2 shows the employment dynamics for fisheries compared to the employment dynamics for agriculture and forestry.

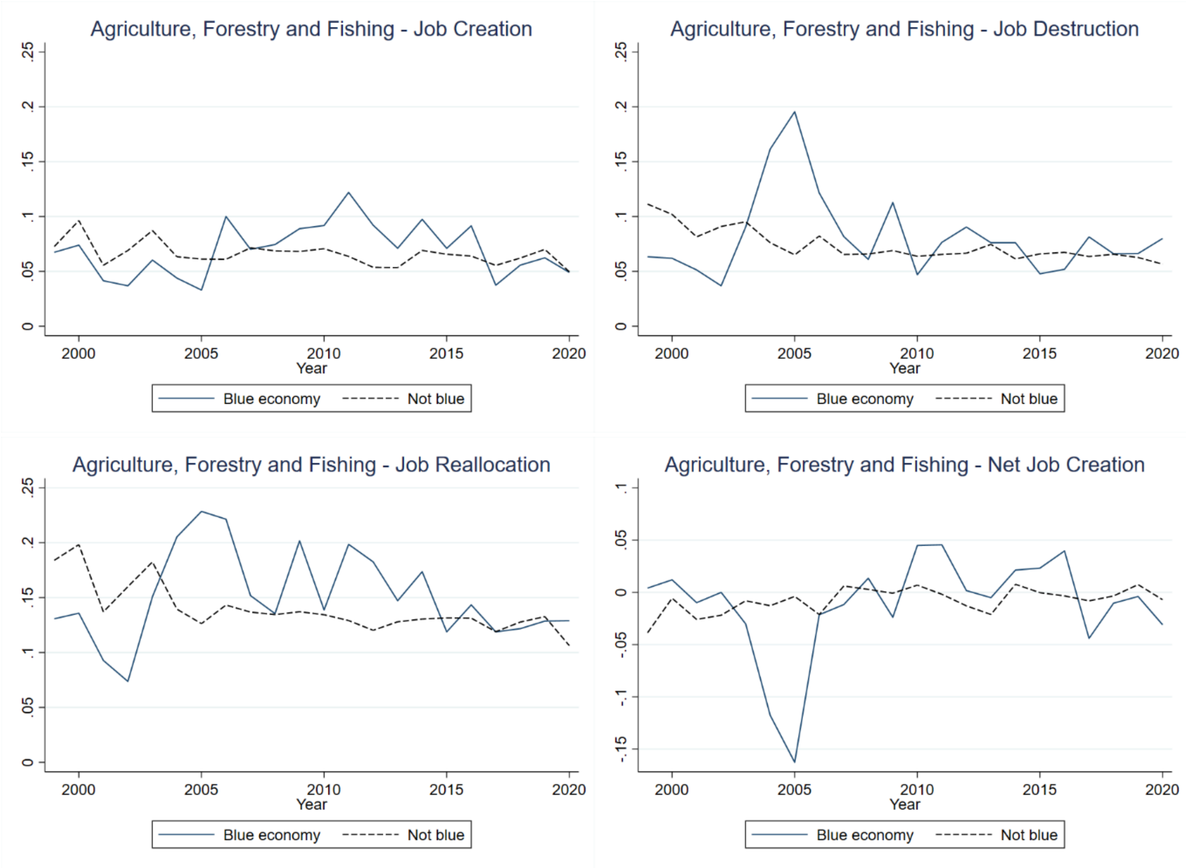

Figure 2: Employment dynamics in fishing vs. agriculture & forestry

As shown in Figure 2, the employment dynamics for the fishing sector have been more volatile than those for agriculture and forestry. This volatility is also seen in higher standard errors for job flow measurements in the fishing sector compared to agriculture and forestry (see Table 12, Appendix A). As for the whole blue economy, this might partly be due to the fewer companies within fishing.

Compared to agriculture and forestry, the fishing sector has also experienced a more rapid increase in young firms of five years or younger (see Figure 5 in Appendix B). Since 2005, there has been a faster increase in firms aged 0–1, and around 2009, firms aged 2–5 increased more rapidly. From these years, we can also see that job creation and net job creation are generally higher for the fishing sector. This is consistent with previous literature, which found that job creation originates from young firms (e.g., Ayyagari et al., 2011; Criscuolo et al., 2014; Heyman et al., 2018). The increase in job creation from 2005 to around 2012 is also consistent with the increased production of food fish in aquaculture for the same period.

Another firm characteristic that differentiates the fishing sector is that it only consists of smaller firms, with less than 50 employees (see Figure 6, Appendix B). Even though agriculture and forestry mainly consist of small firms, there are also some larger firms. The lack of large firms in the fishing sector might help to explain the less stable job flows. This would align with the findings of Haltiwanger et al. (2013), who argue that young firms exhibit more volatile behavior than mature firms. Thus, the combination of younger and smaller firms might help explain the more volatile behavior of the fishing sector.

Compared to other transport and storage sectors, maritime transport and storage have a higher job reallocation for almost the entire period. In contrast, the net job creation is lower (see Figure 7 in Appendix B). This trend in net job creation started in 2010. For the years 2010–2015, Svensson et al. (2017) find a decrease in employment in maritime transport as an effect of efforts to increase company competitiveness by flagging out and rationalization. This might explain the increased job destruction in maritime companies around 2010 and decreased net job creation for the same period.

The employment dynamics in coastal and non-coastal tourism follow similar paths (see Figure 10 in Appendix B). However, job creation, job reallocation, and net job creation are marginally higher for coastal firms. Changes in age and size groups for coastal and non-coastal tourism are relatively similar, with coastal tourism having a lower proportion of large firms before 2010 and a higher proportion of large firms after approximately 2016 (see Figures 11 and 12, Appendix B). Thus, firm age and size differences do not seem to explain the marginally higher job creation, job reallocation, and net job creation for this sector.

There are higher fluctuations in all four measurements for maritime electricity generation than in non-maritime electricity generation (see Figure 13, Appendix B, and Table 16, Appendix A). These fluctuations occur as spikes in job creation around 2000, 2011, 2013, and 2016 and around 2003 and 2016 for job destruction. For both maritime and non-maritime electricity generation, there was a decrease in the total number of companies in 2003 (see Figures 14 and 15 in Appendix B). These higher fluctuations might be explained by the fact that there are only 180 companies in maritime electricity generation and 2,054 companies in non-maritime electricity generation (see Table 11, Appendix A). Thus, the weights for the aggregated measurements will be higher for each firm in maritime electricity generation.

Overall, the employment dynamics in the blue economy exhibit greater volatility than the non-blue economy, mainly due to the smaller number of firms and employees, which amplifies the impact of individual businesses on overall job flows. This volatility is particularly evident in the fishing sector, which is comprised of only small firms and has experienced a rapid increase in young businesses, leading to higher job creation and net job creation. Similarly, maritime transport and storage show higher job reallocation but lower net job creation, particularly post-2010, due to structural changes such as company rationalization. Coastal tourism mirrors non-coastal tourism trends with marginally higher job creation and reallocation. Maritime electricity generation also experiences significant fluctuations, mainly due to the small number of firms in the sector. Overall, firm size and age contribute to employment instability in the blue economy, with younger and smaller firms demonstrating more erratic job flows. The following section builds on these insights by introducing the methodology used to analyze employment dynamics at the firm level systematically.

7. Methodology

In this section, I turn to a more systematic analysis. The primary objective is to isolate the effect, if any, of being blue. When estimating employment growth, job creation, and/or job destruction, the most common explanatory variables are size and age, and they are usually captured by dummies (e.g., Esaku, 2020; Heyman et al., 2019), and in some papers, industry dummies are included as well (e.g., Ayyagari et al., 2011; Baldwin et al., 1998). In line with this approach, I estimate the following OLS regressions:

$$y_{it} = \beta_0 + \beta_1 BE_{it} + \beta_2 AGE_{it} + \beta_3 SIZE_{it} + \varepsilon_{it} \quad (7)$$

$$y_{it} = \beta_0 + \beta_1 BE_{it} + \beta_2 AGE_{it} + \beta_3 SIZE_{it} + \beta_4 IND_{it} + \varepsilon_{it} \quad (8)$$

where y_{it} represents g_{it}, JC_{it}, or JD_{it} for firm i at time t. *AGE*, *SIZE*, *IND*, and *BE* signify dummies for size, age, industry, and being blue, respectively. I have created five age groups and five size groups. The age groups are 0–1 year old, 2–5 years, 6–10 years, 11–20 years, and more than 20 years (reference category). The size groups are fewer than 10 employees, 10–49 employees, 50–199 employees, 200–499 employees, and 500 or more employees (reference category). There are also 21 industries in the data, so 20 are included as dummies, and industry S – other service activities – is the reference category.

However, if the data is unbalanced, estimations of the mean are likely biased. One way to lower the bias, decrease the model dependence, and increase efficiency is to match the data before estimating the effects (Blackwell et al., 2009). Thus, I will re-estimate the regressions after matching blue and non-blue observations using Coarsened Exact Matching (CEM). CEM is a matching method in which exact matches are done on temporary coarsened data (Blackwell et al., 2009). As I want to match variables that affect entrepreneurs' decision to start a blue instead of a non-blue business and the following employment growth, I match on starting year, sector, firm ownership, and municipality.[6]

Using a matching method also let me investigate the effect of being blue in technology. Maritime technology, not defined as a uniform sector, can be matched with similar companies in relevant sectors.

Without a too comprehensive estimation, it is hard to say whether the decision to enter a blue sector, taken by entrepreneurs establishing firms, affects employment outcomes or if the outcome depends on other factors. One way to do this is by measuring the average effect of being blue after matching relevant factors. This is done through the population average treatment effect on the treated (PATT), where the "treatment" in this case is to be blue:

[6] The municipality is coarsened into nine groups defined by the Swedish Association of Local Authorities and Regions: larger cities, with at least 200,000 residents in the largest urban area; commuting municipalities near larger cities; medium-sized towns, with at least 50,000 residents and 40,000 residents in the largest urban area; commuting municipality near medium-sized towns; low-commuting municipality near medium-sized towns; small towns, with 15,000 to 40,000 residents in the largest urban area; commuting municipality near a small town; rural municipality, with less than 15,000 residents in the largest urban area; and rural municipality with a visitor industry (The Swedish Association of Local Authorities and Regions, 2016).

$$PATT = \frac{1}{N_T} \sum_{i \epsilon \tau^*} TE_i \quad (9)$$

where TE_i is the effect of being blue for firm i, τ^* is the set of indexes for blue firms in the whole population, and $N_T = \#\tau^*$ (Iacus et al., 2008).

8. Results and Discussion

Table 3 shows the results from the pooled OLS. Estimation (2), (4), and (6) include industry dummies, while estimation (1), (3), and (5) does not. Since there are 20 industry dummies, the estimates for those variables are found in Appendix C.

Table 3: Results from pooled OLS estimations

Explanatory variables	Employment Growth (1)	Employment Growth (2)	Job Creation (3)	Job Creation (4)	Job Destruction (5)	Job Destruction (6)
BE	-0.004***	0.019***	-0.050**	0.039***	-0.099**	0.011*
	(0.001)	(0.001)	(0.005)	(0.005)	(0.005)	(0.006)
AGE 0–1	0.154***	0.154***	0.522***	0.498***	0.204***	0.167***
	(0.001)	(0.001)	(0.004)	(0.004)	(0.007)	(0.006)
AGE 2–5	0.058***	0.058***	0.205***	0.182***	0.202***	0.152***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
AGE 6–10	0.014***	0.013***	0.065***	0.042***	0.095***	0.060***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
AGE 11–20	0.008***	0.007***	0.019***	0.005**	0.021***	0.004**
	(<0.001)	(<0.001)	(0.002)	(0.002)	(0.002)	(0.002)
SIZE <10	-0.137**	-0.143**	0.572***	0.553***	0.965***	0.921***
	(0.003)	(0.003)	(0.006)	(0.007)	(0.003)	(0.005)
SIZE 10–49	-0.001	-0.001	0.019***	0.035***	0.055***	0.057***
	(0.003)	(0.003)	(0.006)	(0.007)	(0.003)	(0.005)
SIZE 50–199	0.006	0.005	-0.001	0.005	0.024***	0.019***
	(0.004)	(0.004)	(0.006)	(0.007)	(0.003)	(0.005)
SIZE 200–499	0.007	0.007	0.009	0.007	0.018***	0.010*
	(0.004)	(0.004)	(0.007)	(0.008)	(0.003)	(0.006)
Industry dummies	No	Yes	No	Yes	No	Yes
Constant	0.064***	0.052***	0.169***	0.269***	0.069***	0.548***
	(0.003)	(0.003)	(0.006)	(0.010)	(0.003)	(0.007)
Observations	9,107,900	9,107,900	1,040,556	1,040,556	1,050,795	1,050,795
Adjusted R^2	0.010	0.011	0.213	0.249	0.231	0.265

Notes: ***, **, and * indicate significant p-values at the 1 %, 5 %, and 10 % level, respectively. Standard errors are presented in parentheses.

As shown in Table 3, the effect of being blue is positive for employment dynamic estimates when controlling for industry and negative otherwise. This could indicate that blue firms operate within sectors with less employment growth, job creation, and job destruction, but within those sectors, being blue has a positive effect on all three measurements. As blue firms both have a higher job creation and destruction, it is likely that these sectors also have a higher job reallocation, which is consistent with the patterns shown for the individual blue sectors in Figures 2, 7, 10, and 13 (see Section 6 and Appendix B).

Regarding firm age, the youngest firms have the largest effect on employment growth, job creation, and job destruction. Firms aged 11–20 years have a positive effect on the three measurements compared to the reference group of firms aged 20 years or older. This pattern continues for employment growth and job creation, and as the firm age decreases, the significantly positive impact on job creation and employment growth increases. This is also true for job destruction. However, the difference in impact between firms ages 0–1 and 2–5 is minimal. This is in line with previous findings arguing that entrants and very young firms have a low probability of surviving (Eriksson & Hane-Weijman, 2017; Heyman et al., 2019; Persson, 2004).

The effect of firm size on job creation and destruction is positive and increases with decreasing firm size. This is also in line with previous literature, which finds that job creation and destruction are highest in small firms (e.g., Davis & Haltiwanger, 1992; Lawless, 2014). One finding that is less consistent with previous literature is the fact that small firms have a negative effect on employment growth. However, this effect is only significant for firms with less than 10 employees. Thus, these contradicting results might be explained by the fact that I have a lower employee limit for small firms compared to studies such as Ayyagari et al. (2011), Hijzen et al. (2010), and Lawless (2014).

Table 4 shows the average effect of being blue, according to PATT. For most industries, being blue has a positive and significant effect on employment growth, job creation, and/or job destruction. This is in line with the results from the pooled OLS when controlling for industry. The effect on firm job creation and destruction is also generally higher for the industries in Table 4 than for the pooled OLS in Table 3. This might indicate that the effect of being blue on job creation and destruction is even higher when companies are similar. However, employment growth is approximately the same for the PATT score of the industries and the pooled OLS in Table 3, indicating that net job creation is more stable, while job reallocation likely increases.

Table 4: PATT: Average effect of being blue

	Agriculture, Forestry, & Fishing	Transportation & Storage	Tourism	Electricity, gas, steam, etc.	Technology	All
Employment Growth	-0.004 (0.006)	0.016*** (0.003)	0.015*** (0.003)	0.021*** (0.007)	0.062*** (0.004)	0.003** (0.001)
Firm Job Creation	0.259*** (0.048)	0.183*** (0.022)	-0.002 (0.009)	0.504*** (0.097)	-0.045* (0.025)	-0.044*** (0.007)
Firm Job Destruction	0.231*** (0.042)	0.054** (0.025)	-0.035*** (0.010)	0.296** (0.115)	-0.280*** (0.029)	-0.107*** (0.008)

Notes: ***, **, and * indicate significant p-values at the 1 %, 5 %, and 10 % level, respectively. Standard errors are presented in parentheses.

The industries that deviate from this pattern are tourism, technology, and agriculture, forestry, and fishing. The effect on employment growth is insignificant when comparing fishing with agriculture and forestry. This might be because net job creation is higher in fishing for approximately half the period. In comparison, forestry and agriculture have a higher net job creation for the other half (see Figure 2, Section 6). For the tourism sector and technology, the effect on job creation and job destruction is negative. However, only job destruction is significant for both sectors, as the effect of being blue in tourism is insignificant for job creation.

The estimates for the entire dataset also differ from the pattern seen when looking at the industries individually. However, the estimates for job creation and destruction are similar to those before controlling for industry in the pooled OLS in Table 3. Thus, there might still be some industry effects that are not controlled for when only looking at the average effects. For the first four sectors – agricultural, forestry, and fishing; transportation and storage; tourism; and electricity, gas, steam etc. – the industry effect is automatically controlled for. However, for the last industry – technology – and all firms, there is a chance that matches are made between industries, as technology includes businesses from industries such as manufacturing, construction, and wholesale, retail, and repair.

Table 5 shows the results from the pooled OLS when matched observations are used. Estimation (2), (4), and (6) include industry dummies, while estimation (1), (3), and (5) does not.

Table 5: Pooled OLS, after matching

Explanatory variables	Employment Growth		Job Creation		Job Destruction	
	(1)	(2)	(3)	(4)	(5)	(6)
BE	-0.006**	0.019***	-0.049**	0.037***	-0.082**	0.01*
	(0.001)	(0.002)	(0.005)	(0.005)	(0.005)	(0.006)
AGE 0–1	0.173***	0.174***	0.502***	0.501***	0.154***	0.157***
	(0.001)	(0.001)	(0.007)	(0.007)	(0.009)	(0.009)
AGE 2–5	0.071***	0.072***	0.174***	0.173***	0.150***	0.145***
	(0.001)	(0.001)	(0.006)	(0.006)	(0.006)	(0.006)
AGE 6–10	0.020***	0.02***	0.049***	0.047***	0.065***	0.059***
	(0.001)	(0.001)	(0.006)	(0.007)	(0.006)	(0.006)
AGE 11–20	0.009***	0.011***	-0.004	0.007	<0.001	0.004
	(0.001)	(0.001)	(0.006)	(0.006)	(0.005)	(0.006)
SIZE <10	-0.173**	-0.179**	0.534***	0.532***	0.963***	0.932***
	(0.025)	(0.026)	(0.047)	(0.048)	(0.009)	(0.011)
SIZE 10–49	-0.041	-0.038	-0.023	0.014***	0.069***	0.075***
	(0.025)	(0.026)	(0.047)	(0.048)	(0.008)	(0.011)
SIZE 50–199	-0.037	-0.036	-0.052	-0.038	0.036***	0.026
	(0.026)	(0.024)	(0.047)	(0.051)	(0.010)	(0.017)
SIZE 200–499	-0.006	-0.005	-0.011	0.004	0.017*	0.015
	(0.024)	(0.024)	(0.046)	(0.049)	(0.009)	(0.013)
Industry dummies	No	Yes	No	Yes	No	Yes
Constant	0.010***	0.12***	0.227***	0.112**	0.075***	0.548***
	(0.001)	(0.027)	(0.046)	(0.050)	(0.008)	(0.007)
Observations	7,565,436	7,565,436	960,179	960,179	942,526	942,526
Adjusted	0.010	0.011	0.211	0.248	0.227	0.252

Notes: ***, **, and * indicate significant p-values at the 1 %, 5 %, and 10 % level, respectively. Standard errors are presented in parentheses.

Compared to the average effect of being blue shown in Table 4, employment growth becomes negative when including control variables for firm age and size, as shown in Table 5. However, when industries are also controlled for, the three employment dynamic estimates—employment growth, job creation, and job destruction—are positive and significant. These are similar to the results in the Pooled OLS before matching in Table 3.

The age and size effects after matching, shown in Table 5, are similar to those before matching, shown in Table 3, but are not as significant. For example,

This is also true for the age and size effects. For example, most age groups have a positive and significant effect on the three employment dynamics estimates compared to the reference group of firms aged 20 years or older. As the firms get younger, the difference between the reference groups increases. However, the estimates for the age group 11–20 years are now insignificant for job creation and job destruction.

Firms with less than 10 employees still have a negative effect, compared with the reference group of 500 employees or more, on employment growth and a positive effect on job creation and job destruction. However, the estimates for size groups 6–10 and 11–20 sometimes become insignificant after matching, as shown in Figure 5. As one of the matching variables is registration year, some age and size effects might decrease after matching. However, this matching is done by cohorts and not exact registration year, leading the effect of very young firms to continue to be significantly positive.

9. Conclusion

This section evaluates the broader policy implications of the findings by considering how blue economy strategies at the EU and national levels align with observed employment dynamics. Since EU and Swedish policies have prioritized the blue economy as a vehicle for job creation and economic growth, assessing whether these objectives are met is central.

In this paper, I present a descriptive analysis of aggregated job flows – industry job creation, industry job destruction, job reallocation, and net job creation – and a more systematic analysis of employment dynamics on the firm level – employment growth, firm job creation, and firm job destruction. The descriptive analysis showcases a marginally positive effect of being blue on most job flow measurements. However, there are differences between industries, where transportation and storage, for example, have a lower net job creation for blue firms. In contrast, others, such as tourism, have a lower job destruction. For most industries, the blue economy experiences greater employment volatility than the non-blue economy, possibly due to its smaller number of firms and employees, which may amplify the impact of individual businesses on job flows. This is particularly evident in the fishing sector, maritime transport, and maritime electricity generation, where job creation and destruction fluctuate more significantly. Factors such as firm size, age, and industry-specific structural changes contribute to these employment dynamics.

Moving on to job flow measurements at the firm level, the estimated average effect of being blue is positive for employment growth, firm job creation, and/or firm job destruction for most industries. However, when including all matched companies, being blue has a negative effect on both firm job creation and destruction but a low positive effect on employment growth. One possible explanation is that for technology, and thus all blue firms, there is a chance that matches are made between industries, as technology includes businesses from industries such as manufacturing, construction, and wholesale, retail, and repair. This is further supported by the OLS results, which find that blue firms have a positive and significant effect on employment growth, firm job creation, and firm job destruction when controlling for industry. However, when control variables for industries are excluded, the effect of being blue becomes negative, suggesting that blue firms tend to operate in sectors with lower employment growth but have a more substantial internal job flow.

Firm age also plays a significant role, with firms within age groups 0–1 year and 2–5 years having a positive and significant effect on employment growth, firm job creation, and firm job destruction in all estimations, a pattern consistent with previous literature. Thus, following the recommendation by Eriksson and Hane-Weijman (2017), I would argue that it is important to focus on the survival of start-ups when creating policies.

This study provides new empirical insights into the employment dynamics of the blue economy. The findings suggest that policies to foster blue economy development should be tailored to sector-specific conditions to maximize job creation potential. Further research is needed to understand the long-term sustainability of employment trends in blue industries, ensuring that economic growth aligns with environmental and social objectives.

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Appendix A: Data Appendix

Table 6: Number of always blue, never blue, and mixed companies in each industry

	Industry	*BE*	*Not BE*	*Mixed*	*Total*
A	Agriculture, forestry, and fishing	703	16,787	8	17,498
B	Mining and quarrying	8	1,153	0	1,161
C	Manufacturing	2,246	61,681	139	64,066
D	Electricity, gas, steam, and air conditioning supply	181	2,786	23	2,990
	Generation of electricity	180	2,054	23	2,257
E	Water supply; sewerage, waste management, and remediation activities	4	2,129	0	2,133
F	Construction	247	105,467	31	105,745
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	1,718	178,639	164	180,521
H	Transportation and storage	2,160	35,317	80	37,557
I	Accommodation and food service activities	5,356	32,034	7,978	45,368
	Accommodation and restaurants	5,356	30,599	7,978	43,933
J	Information and communication	26	70,892	0	70,918
K	Financial and insurance activities	36	50,821	0	50,857
L	Real estate activities	85	96,255	0	96,340
M	Professional, scientific and technical activities	233	210,695	0	210,928
N	Administrative and support service activities	180	45,609	4	45,793
O	Public administration and defense; compulsory social security	0	229	0	229
P	Education	15	16,824	0	16,839
Q	Human health and social work activities	3	33,419	0	33,422
R	Arts, entertainment, and recreation	24	21,154	0	21,178
S	Other service activities	4	18,891	0	18,895
T	Activities of households as employers; undifferentiated goods- and services producing activities of households for own use	0	2	0	2
U	Activities of extraterritorial organizations and bodies	0	4	0	4
	Total	12,679	1,022,348	8,426	1,037,098

Table 7: Descriptive statistics for job flow measurements

	Blue firms	Non-blue firms

	Mean	Standard deviation	Min	Max	Mean	Standard deviation	Min	Max
g_{it}	-0.030	0.571	-2	2	-0.033	0.525	-2	2
JC_{it}	0.593	0.667	<0.001	2	0.654	0.698	<0.001	2
JD_{it}	0.793	0.757	<0.001	2	0.936	0.799	<0.001	2
JC_{jt}	0.088	0.035	0.044	0.219	0.085	0.016	0.057	0.122
JD_{jt}	0.079	0.028	0.050	0.148	0.056	0.016	0.067	0.114
NJC_{jt}	0.009	0.032	-0.104	0.226	-0.001	0.019	-0.050	0.148
JR_{jt}	0.169	0.054	0.123	0.358	0.170	0.026	0.140	0.226

Table 8: Descriptive statistics for job flow measurements, fishing vs. agriculture & forestry

	Blue firms				Non-blue firms			
	Mean	Standard deviation	Min	Max	Mean	Standard deviation	Min	Max
g_{it}	-0.031	0.561	-2	2	-0.030	0.481	-2	2
JC_{it}	0.889	0.775	0.025	2	0.615	0.649	0.001	2
JD_{it}	1.062	0.786	0.024	2	0.825	0.736	0.006	2
JC_{jt}	0.070	0.024	0.033	0.122	0.066	0.011	0.050	0.096
JD_{jt}	0.082	0.038	0.037	0.196	0.074	0.014	0.057	0.111
NJC_{jt}	-0.012	0.048	-0.163	0.046	-0.008	0.012	-0.039	0.008
JR_{jt}	0.151	0.041	0.074	0.229	0.140	0.022	0.106	0.198

Table 9: Descriptive statistics for job flow measurements, transportation & storage

	Blue firms				Non-blue firms			
	Mean	Standard deviation	Min	Max	Mean	Standard deviation	Min	Max
g_{it}	-0.028	0.526	-2	2	-0.044	0.526	-2	2
JC_{it}	0.629	0.727	0.002	2	0.470	0.545	<0.001	2
JD_{it}	0.773	0.785	0.002	2	0.752	0.733	0.001	2
JC_{jt}	0.080	0.067	0.024	0.325	0.089	0.051	0.050	0.239
JD_{jt}	0.086	0.048	0.038	0.248	0.076	0.039	0.050	0.242
NJC_{jt}	-0.006	0.069	-0.132	0.239	0.012	0.044	-0.032	0.177
JR_{jt}	0.166	0.094	0.088	0.446	0.165	0.080	0.118	0.481

Table 10: Descriptive statistics for job flow measurements, accommodation & food services

	Blue firms				Non-blue firms			

	Mean	Standard deviation	Min	Max	Mean	Standard deviation	Min	Max
g_{it}	-0.045	0.622	-2	2	-0.059	0.623	-2	2
JC_{it}	0.595	0.655	0.004	2	0.600	0.657	0.002	2
JD_{it}	0.809	0.754	0.002	2	0.849	0.758	0.002	2
JC_{jt}	0.099	0.017	0.052	0.124	0.086	0.014	0.042	0.109
JD_{jt}	0.096	0.031	0.061	0.197	0.098	0.034	0.068	0.232
NJC_{jt}	0.003	0.045	-0.145	0.052	-0.012	0.046	-0.190	0.024
JR_{jt}	0.195	0.021	0.163	0.249	0.185	0.025	0.161	0.274

Table 11: Descriptive statistics for dependent variables, electricity, gas, steam, etc.

	Blue firms				Non-blue firms			
	Mean	Standard deviation	Min	Max	Mean	Standard deviation	Min	Max
g_{it}	0.019	0.454	-2	2	0.003	0.402	-2	2
JC_{it}	0.948	0.852	0.006	2	0.464	0.678	0.001	2
JD_{it}	0.903	0.849	0.005	2	0.596	0.761	0.001	2
JC_{jt}	0.102	0.144	0.007	0.582	0.065	0.026	0.038	0.153
JD_{jt}	0.065	0.099	0.004	0.428	0.056	0.035	0.022	0.153
NJC_{jt}	0.037	0.170	-0.357	0.574	0.009	0.027	-0.075	0.037
JR_{jt}	0.167	0.179	0.024	0.589	0.121	0.057	0.068	0.288

Appendix B: Figures of Job Flow, Age, and Size

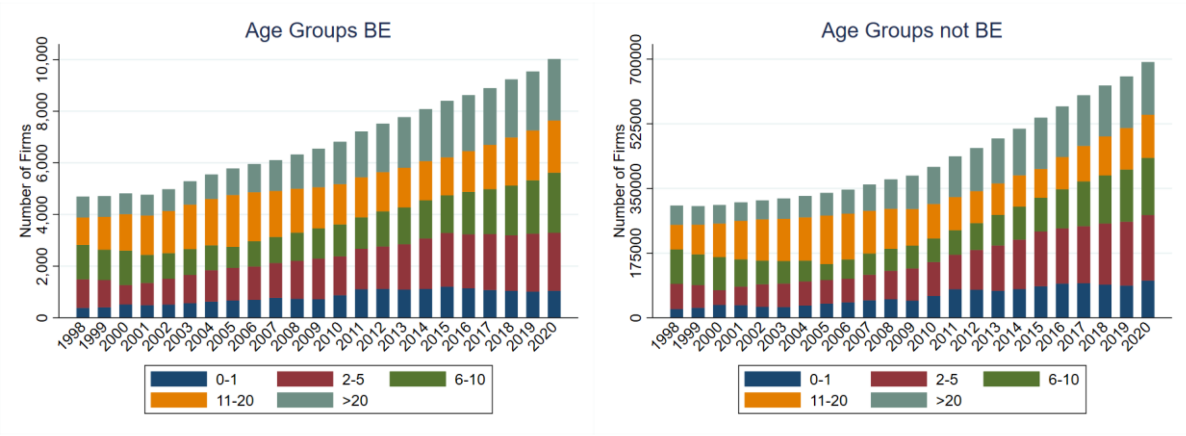

Figure 3: Firm age in blue vs. non-blue firms

Figure 4: Firm size in blue vs. non-blue firms

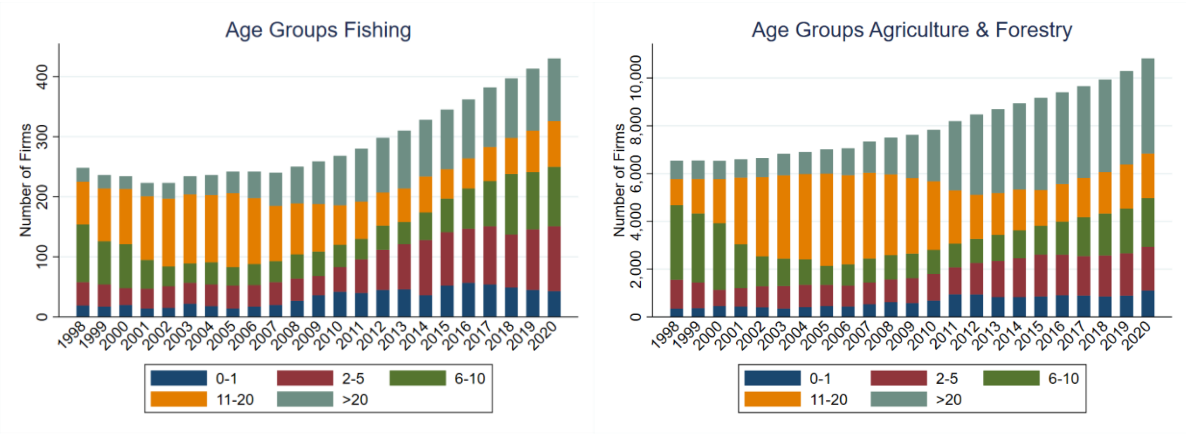

Figure 5: Firm age in fishing vs. agriculture & forestry

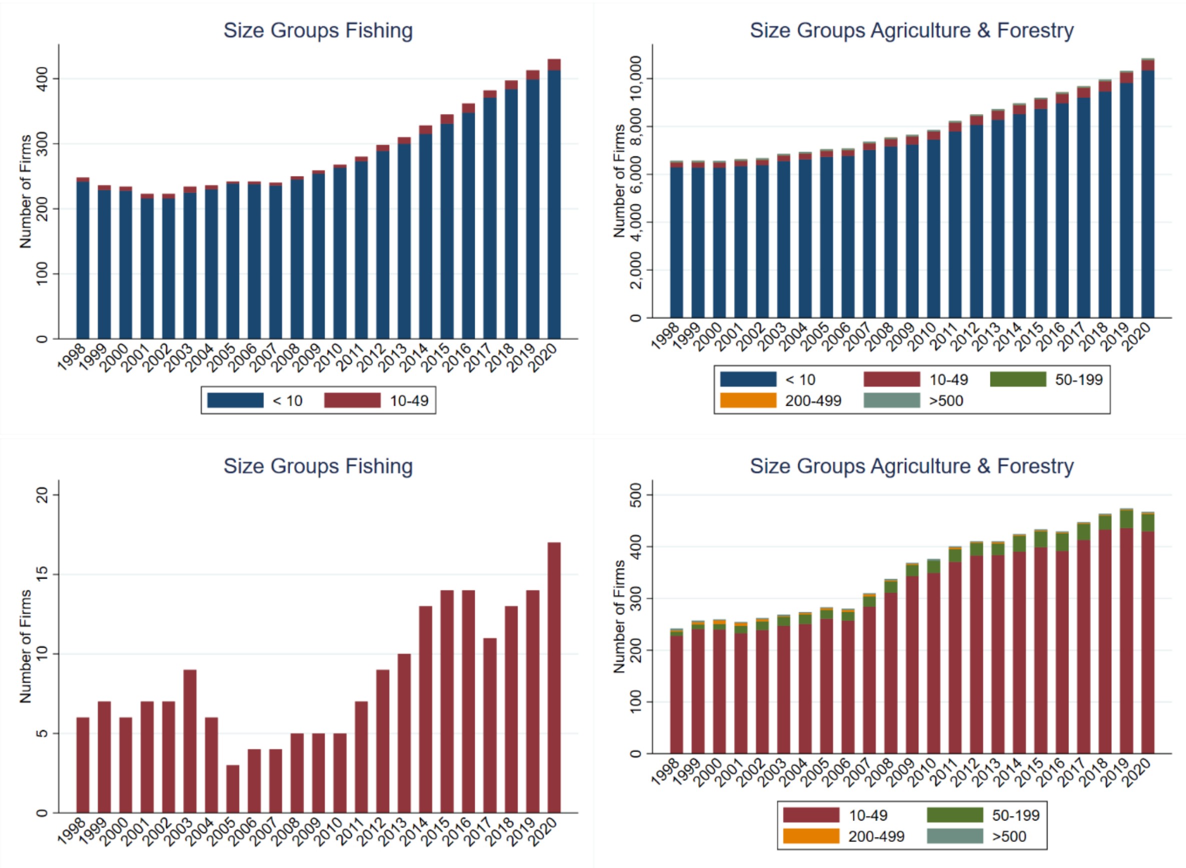

Figure 6:Firm size in fishing vs. agriculture & forestry

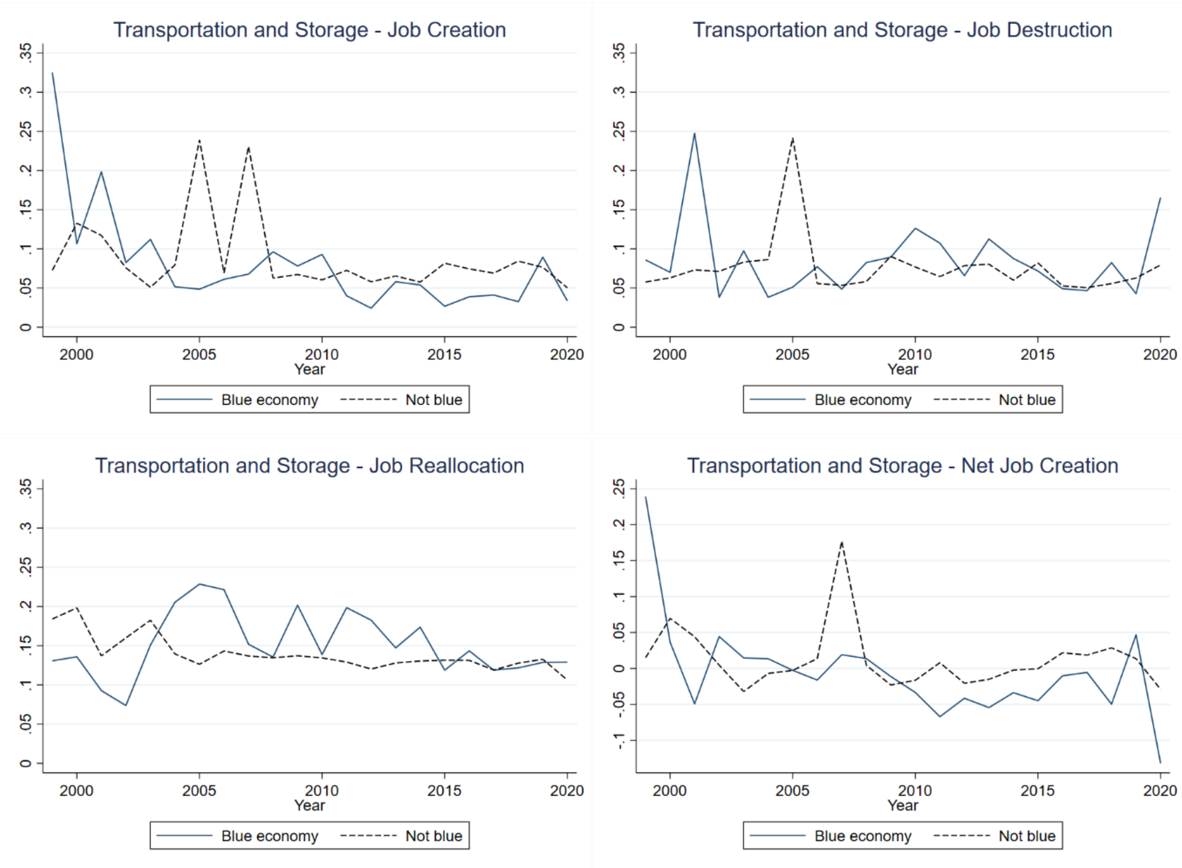

Figure 7: Employment dynamics in transportation & storage, blue vs. non-blue firms

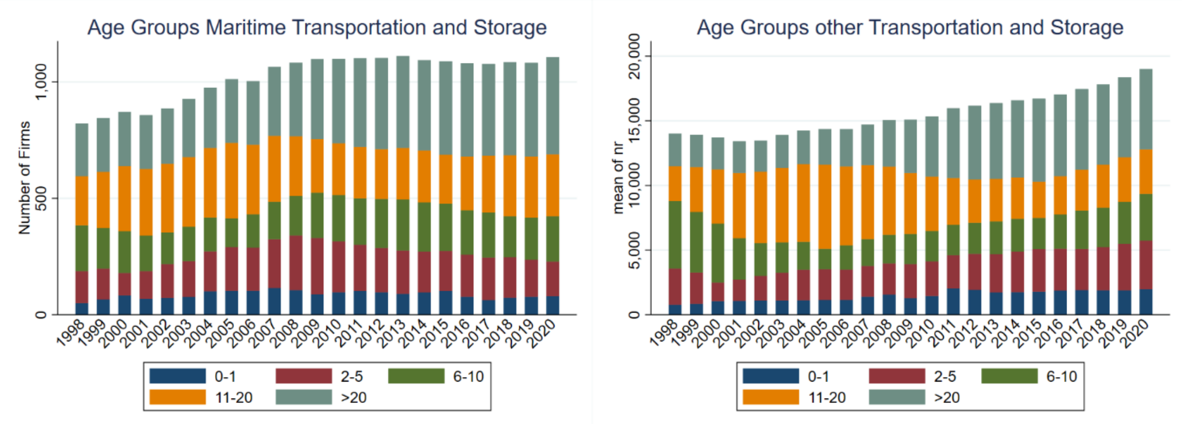

Figure 8: Firm age in transportation & storage, blue vs. non-blue firms

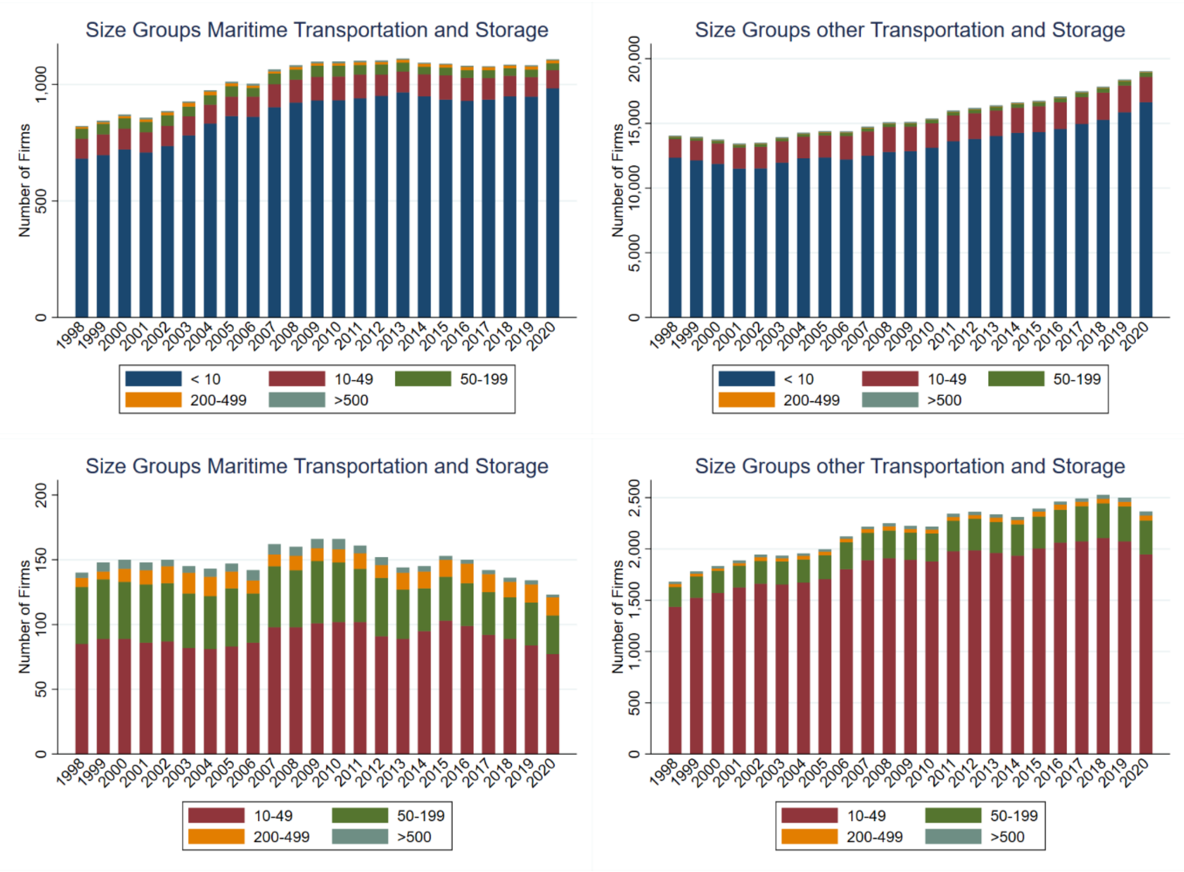

Figure 9: Firm size in transportation & storage, blue vs. non-blue

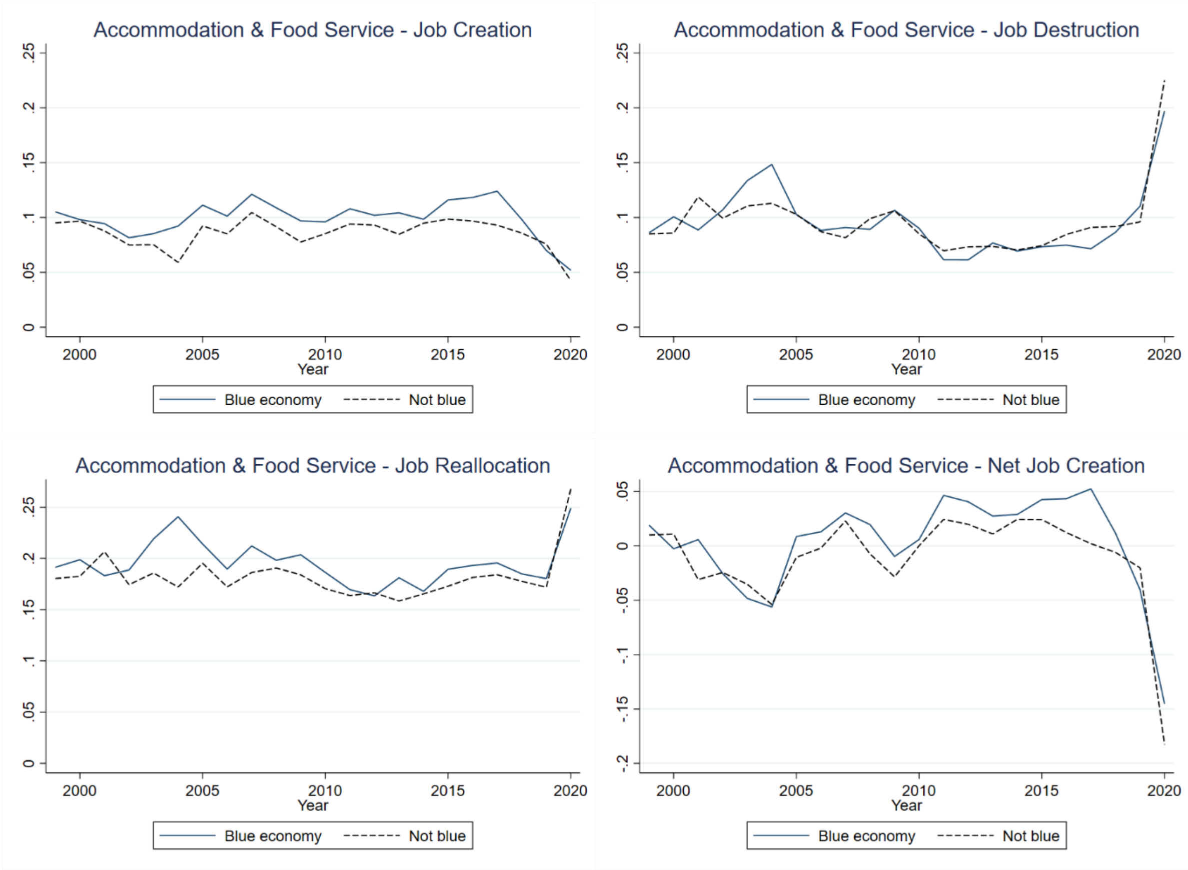

Figure 10: Employment dynamics in tourism, blue vs. non-blue firms

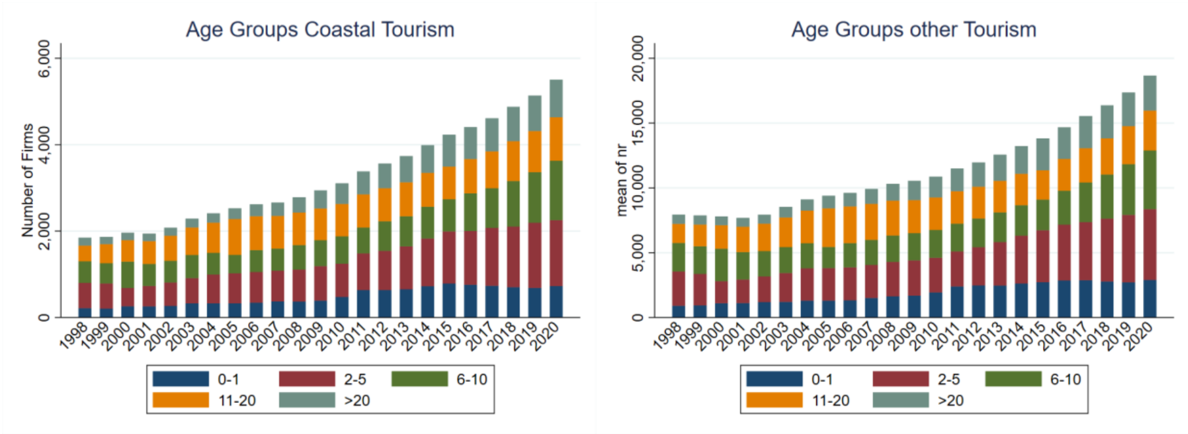

Figure 11: Firm age in tourism, blue vs. non-blue firms

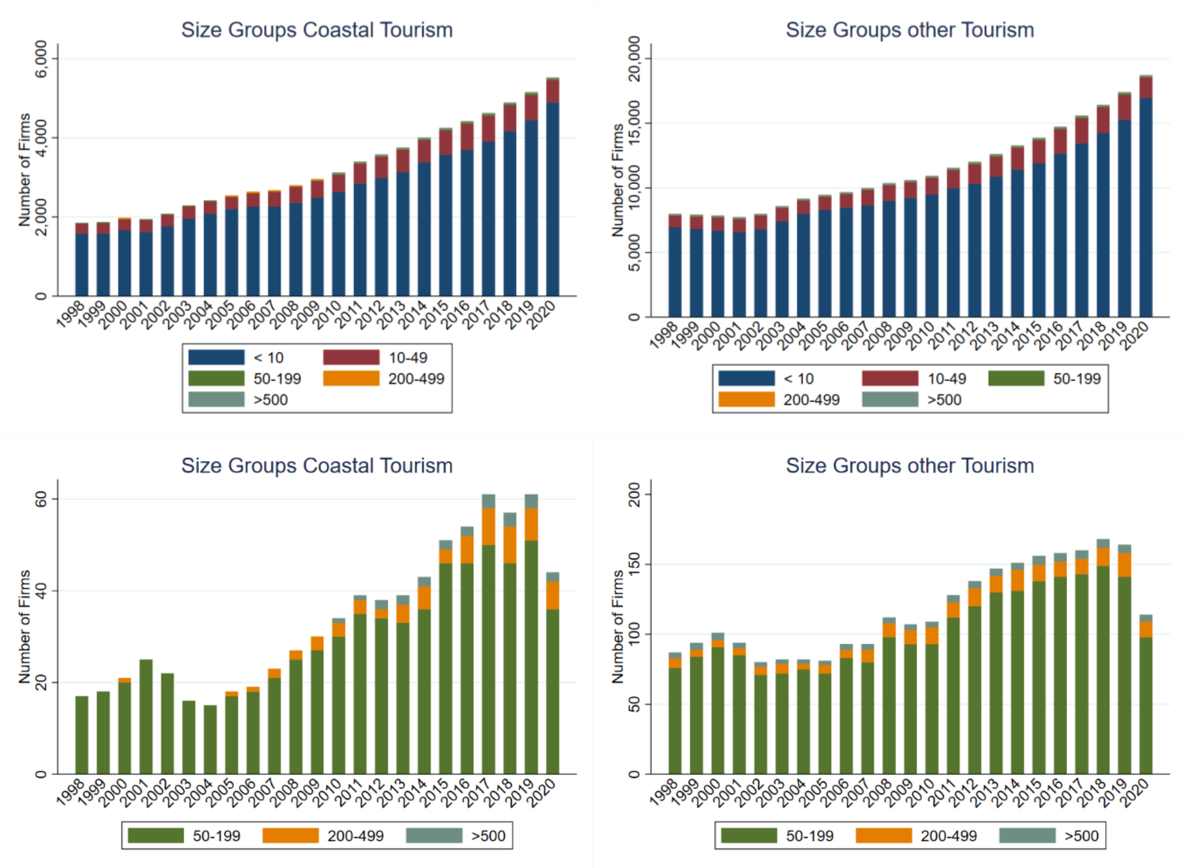

Figure 12: Firm size in tourism, blue vs. non-blue firms

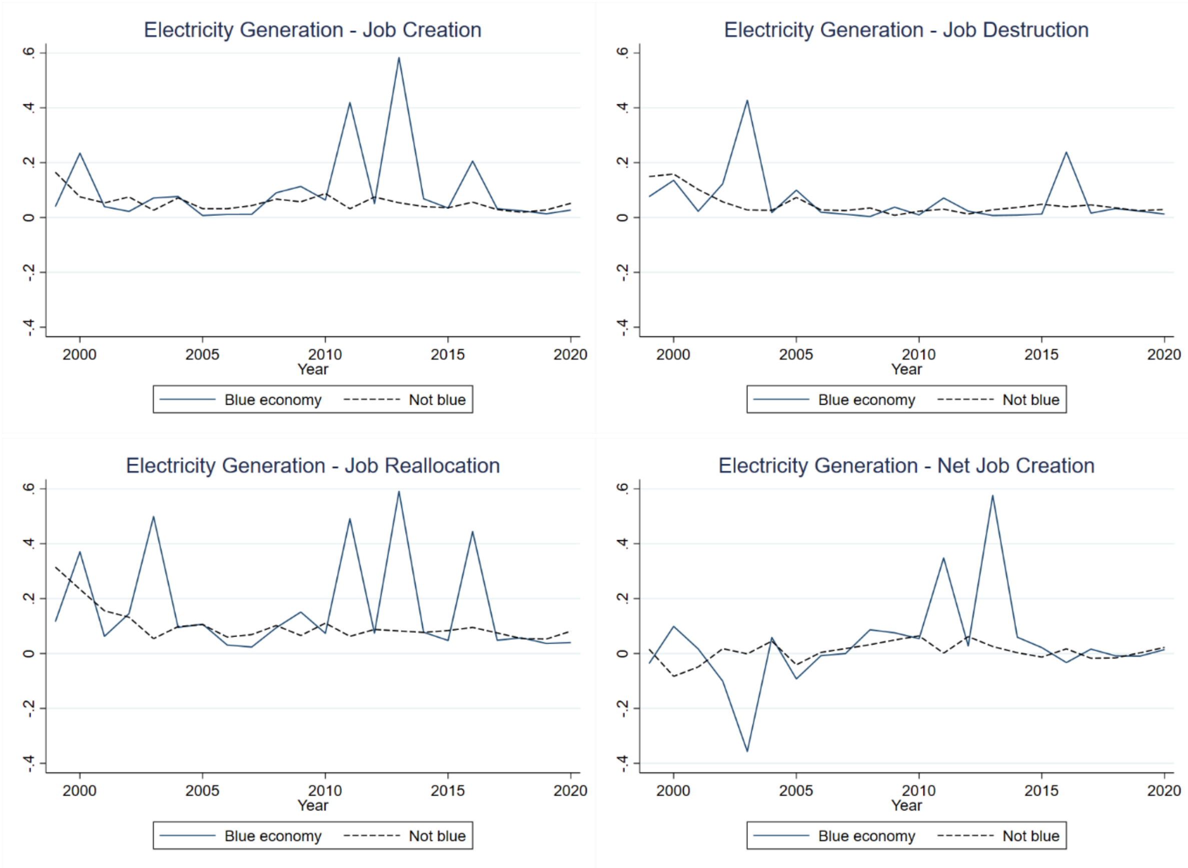

Figure 13: Employment dynamics in the generation of electricity, blue vs. non-blue firms

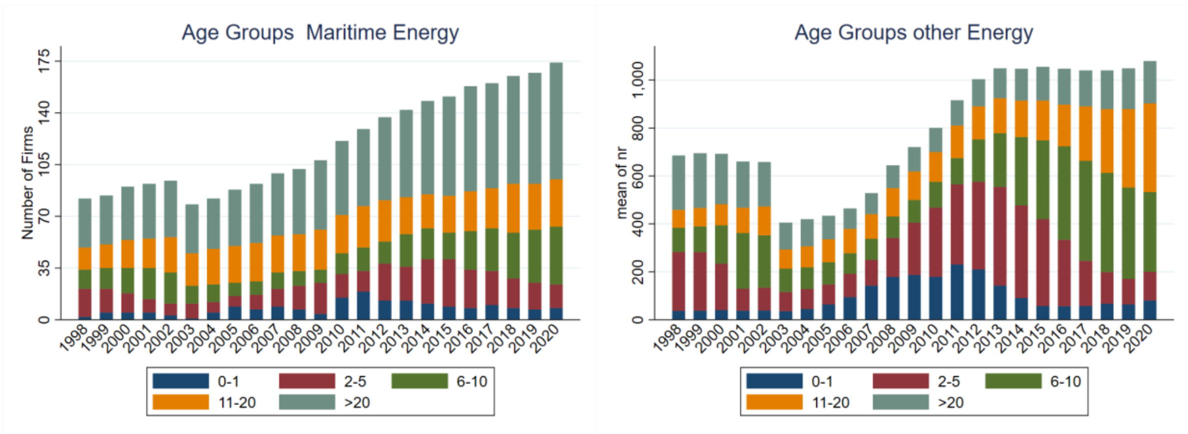

Figure 14: Firm age in the generation of electricity, blue vs. non-blue firms

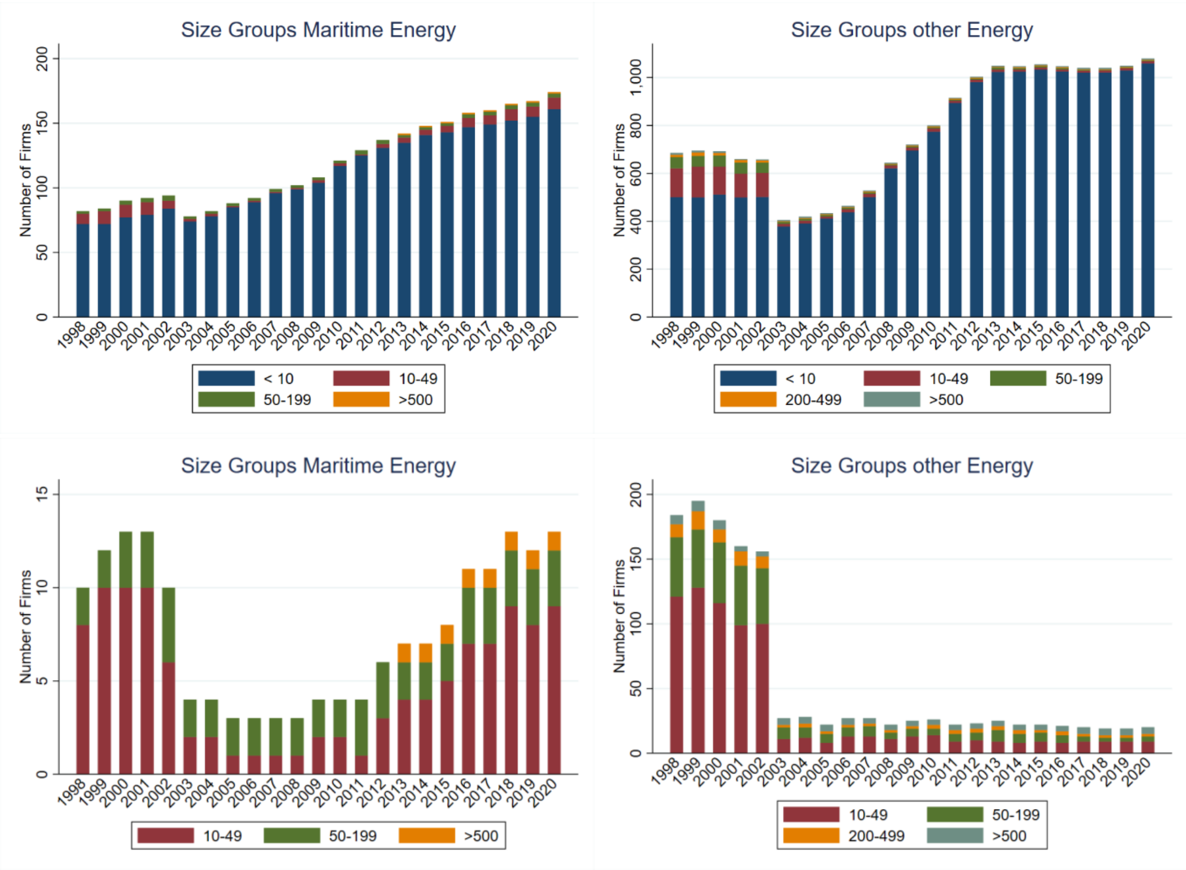

Figure 15: Firm size in the generation of electricity, blue vs. non-blue firms

Appendix C: Pooled OLS Estimations

Table 12: Results from pooled OLS estimations, with industry dummies

	Employment Growth		Firm Job Creation		Firm Job Destruction	
Explanatory variables	(1)	(2)	(3)	(4)	(5)	(6)
BE	-0.004***	0.019***	-0.050***	0.039***	-0.099***	0.011*
	(0.001)	(0.001)	(0.005)	(0.005)	(0.005)	(0.006)
AGE 0-1	0.154***	0.154***	0.522***	0.498***	0.204***	0.167***
	(0.001)	(0.001)	(0.004)	(0.004)	(0.007)	(0.006)
AGE 2-5	0.058***	0.058***	0.205***	0.182***	0.202***	0.152***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
AGE 6-10	0.014***	0.013***	0.065***	0.042***	0.095***	0.060***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
AGE 11-20	0.008***	0.007***	0.019***	0.005**	0.021***	0.004**
	(<0.001)	(<0.001)	(0.002)	(0.002)	(0.002)	(0.002)
SIZE <10	-0.137***	-0.143***	0.572***	0.553***	0.965***	0.921***
	(0.003)	(0.003)	(0.006)	(0.007)	(0.003)	(0.005)
SIZE 10-49	-0.001	-0.001	0.019***	0.035***	0.055***	0.057***
	(0.003)	(0.003)	(0.006)	(0.007)	(0.003)	(0.005)
SIZE 50-199	0.006	0.005	-0.001	0.005	0.024***	0.019***
	(0.004)	(0.004)	(0.006)	(0.007)	(0.003)	(0.005)
SIZE 200-499	0.007	0.007	0.009	0.007	0.018***	0.010*
	(0.004)	(0.004)	(0.007)	(0.008)	(0.003)	(0.006)
Agriculture, forestry, and fishing		0.034***		-0.173***		-0.595***
		(0.001)		(0.009)		(0.007)
Mining and quarrying		0.036***		-0.113***		-0.591***
		(0.004)		(0.021)		(0.021)
Manufacturing		-0.001		-0.188***		-0.553***
		(0.001)		(0.007)		(0.005)
Electricity, gas, etc.		0.047***		-0.020		-0.394***
		(0.002)		(0.015)		(0.014)
Water supply, sewerage, waste management, etc.		0.025***		-0.157***		-0.533***
		(0.004)		(0.012)		(0.015)
Construction		0.021***		-0.210***		-0.575***
		(0.001)		(0.007)		(0.005)
Wholesale, retail, and repair		0.009***		-0.146***		-0.475***
		(0.001)		(0.007)		(0.005)
Transportation and storage		0.004***		-0.202***		-0.552***
		(0.001)		(0.007)		(0.005)
Accommodation and food service		-0.024***		-0.175***		-0.537***
		(0.001)		(0.008)		(0.005)
Information and communication		0.016***		0.012		-0.339***
		(0.001)		(0.008)		(0.005)
Financial and insurance activities		0.047***		0.278***		-0.154***
		(0.001)		(0.010)		(0.007)
Real estate activities		0.048***		0.214***		-0.193***
		(0.001)		(0.009)		(0.006)
Professional, scientific, and technical activities		0.027***		0.095***		-0.278***
		(0.001)		(0.007)		(0.005)
Administrative and support service		0.018***		-0.072***		-0.457***
		(0.001)		(0.008)		(0.006)

Public administration, defense, etc.		0.066***		0.057		-0.444***
		(0.021)		(0.065)		(0.071)
Education		0.022***		-0.048***		-0.410***
		(0.001)		(0.009)		(0.008)
Human health and social work activities		0.021***		-0.019**		-0.388***
		(0.001)		(0.008)		(0.006)
Arts, entertainment, and recreation		0.031***		0.095***		-0.360***
		(0.001)		(0.008)		(0.008)
Activities of households as employers etc.		0.009***		-		-
		(<0.001)				
Extraterritorial organizations and bodies		0.316		0.929***		0.531***
		(0.285)		(0.176)		(0.005)
Constant	0.064***	0.052***	0.169***	0.269***	0.069***	0.548***
	(0.003)	(0.003)	(0.006)	(0.010)	(0.003)	(0.007)
Observations	9,107,900	9,107,900	1,040,556	1,040,556	1,050,795	1,050,795
Adjusted R^2	0.010	0.011	0.213	0.249	0.231	0.265

Notes: ***, **, and * indicate significant p-values at the 1 %, 5 %, and 10 % level, respectively. Standard errors are presented in parentheses.