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The Aftermath of a Superstar Firm Collapse: Labor Market Trajectories and Entrepreneurship following Nokia's Decline[†]

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Abstract

The rapid decline of Nokia mobile phone operations in 2009–2012 left many high-skilled workers looking for new career paths. We use rich matched employer-employee data covering all Nokia workers and other individuals in Finland to study how this sudden labor market shock affected displaced workers. We find that workers displaced from Nokia experienced large and long-lasting losses in the labor market. They suffered large drops in earnings and were more likely to be unemployed than similar workers displaced from other firms even three years after the mass layoffs took place. These losses, however, were attenuated by an important increase in entrepreneurship. We find that a distinctively large share of the high-skilled Nokia workers established a new business after being displaced (9% compared to 3% for displaced workers from other firms). This effect was amplified by generous start-up grants provided by Nokia since 2011 as a part of Bridge, their global support program for displaced workers. The larger number of entrepreneurs does not seem to have resulted in lower entrepreneurial quality. The firms founded by former Nokia employees perform similarly to those founded by similar workers displaced from other firms or to all those established in Finland during the decline of Nokia. This result suggests that encouraging high-skilled displaced workers to become entrepreneurs can reduce the costs of mass layoffs, as it increases the number of established firms without significantly affecting their performance.

Keywords: mass layoffs, superstar firm, entrepreneurship, support programs.
JEL codes: J24; J63; J65; L26

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1 Introduction

Globalization and technological change have transformed the structure of many developed economies in recent decades (Autor, 2015). While traditional sectors—such as manufacturing—have experienced a decline, others—such as information technology—have seen rapid growth. Consequently, new superstar firms have emerged, with five out of the ten most valuable firms in the world currently belonging to the IT sector—i.e., Alphabet, Amazon, Apple, Meta, and Microsoft.

However, the success of these large multinational firms is not guaranteed. The IT sector has recently been under significant turmoil, and American tech giants—including Amazon, Meta, and Alphabet—cut more than 200,000 jobs between 2022 and 2023 (Economist, 2023). History has shown that innovations by competitors and poor management can lead market leaders to struggle and eventually lose their dominant position. Kodak, Blockbuster, and Yahoo are perhaps the most iconic examples of this phenomenon.[1] Despite the prominence of superstar firms and their crises in both the public and the scientific debates—see, for instance, Autor et al. (2020); De Loecker et al. (2020, 2022); Bloomberg (2018)—, there is little evidence on the consequences that mass layoffs affecting these firms have on their workers and on the economy. Superstar firms differ from those typically studied in the mass layoff literature. They typically employ a large share of highly educated individuals and offer a working experience that can greatly differ from that of smaller firms. Therefore, the consequences and types of support required by employees of superstar firms following mass layoffs are likely to be quite different from those of employees of other firms. Studying the post-layoff trajectories of these workers is key to understanding how to help them to transition to new productive activities and retain their talent in the economy.

This paper exploits detailed individual- and firm-level administrative data from Finland to investigate the consequences of the decline of Nokia—the global market leader in the mobile phone industry until 2009—on its displaced workers and on the creation of startups. We follow Nokia workers long before and after their displacement and compare their trajectories to a benchmark group of similar workers displaced from other firms at the same time and in the same labor markets.

[1] Kodak failed to keep its leading position in the photography industry when digital cameras were introduced. Blockbuster was not able to respond to the introduction of streaming video services. Yahoo lost the market for email and web search tools when Google started to offer these services free of charge.

To build the benchmark group, we rely on a coarsened exact matching (CEM) based on a rich set of background characteristics. This approach allows us to study changes in the income and employment status of displaced workers, including their likelihood of becoming entrepreneurs. We follow a similar approach to study the performance of firms created by workers displaced from Nokia. We compare them with firms created by displaced workers in the benchmark group and across the entire Finnish economy, focusing on key outcomes such as survival rates, revenue, number of employees, and productivity.

Nokia was the world leader in the mobile phone industry with a staggering 50 percent global market share at the end of 2007. At its peak, Nokia employed 130,000 people worldwide and over 23,000 people in Finland, where its headquarters and mobile phone development operations were located. The introduction of the iPhone in mid-2007 and the Android operating system in November 2007 started the decline of Nokia mobile phones. As a result, Nokia's stock price plunged from $40 to $12 within a year (see Figure I). Consequently, Nokia had to adjust its operations globally. This caused a series of mass layoffs in Finland. By 2012, the number of employees working at Nokia in Finland had fallen to roughly 5,000, and its stock price had plummeted to $5. Eventually, Nokia could not adapt to the new market conditions and sold its mobile phone manufacturing and development operations to Microsoft in 2014.

Two features make studying the decline of Nokia mobile phones particularly interesting. Firstly, it allows studying how the workers of a (former) superstar firm in the IT industry adapt to negative shocks in the labor market. Most of the existing evidence on mass layoffs comes from the manufacturing sector and shows that displaced workers face large and persistent losses in employment and earnings (Ruhm, 1991; Jacobson et al., 1993; Stevens, 1997). In contrast to manufacturing, the IT industry employs a large share of highly educated workers. In Nokia, for instance, roughly half of their workers had a tertiary education degree and worked either in management positions or in the design and development of hardware and software for their mobile phones. In addition, both the IT and mobile phone industries were still growing in developed countries when Nokia's decline began. Thus, the consequences of mass layoffs—especially when focusing on highly skilled workers—could be quite different in the manufacturing and IT sectors.

Secondly, the layoff policies that Nokia had in place offer a unique opportunity to understand

whether encouraging entrepreneurship among displaced workers compensates for some of the losses that mass layoffs impose on the economy and on the displaced workers themselves. Nokia offered generous severance payments to its displaced workers, and in 2011, it launched the Bridge program, which was designed to support its workers in transitioning to new productive activities through retraining, job-seeking activities, and connecting them with potential employers. Furthermore, the Bridge program offered start-up grants to workers interested in starting a new business after leaving Nokia.

It is unclear whether the firms started by workers displaced from Nokia—and potentially from other large international IT firms—are more or less likely to succeed than other start-ups established in Finland. On the one hand, their founders are highly educated and have experience in a large international firm, which might make them better entrepreneurs. On the other hand, these new firms were established once Nokia had lost its dominant position. Therefore, the experience and contacts developed at Nokia are not necessarily advantageous when establishing a start-up. However, if talented workers displaced from large multinational firms are more likely to start successful businesses than others, then encouraging them to become entrepreneurs might be an effective way of attenuating the costs of mass layoffs affecting these organizations.

Our main findings are threefold. Firstly, compared to the benchmark group, former Nokia employees experience larger losses in employment and earnings. They are approximately five percentage points (34%) more likely to be unemployed three years after displacement than similar workers displaced from other firms in the same labor markets and at the same time. They also suffer a drop in income 10% larger than workers in the benchmark group. These losses are more pronounced among low-skill individuals, but even high-skilled workers clearly struggle to recover from the negative shock. Despite working in Finland's flagship firm, former Nokia workers could not quickly transition to new productive activities after being laid off. We discuss potential drivers of these differences and conclude that over-optimism or higher reservation wages induced by additional liquidity immediately after layoffs do not play an important role in explaining them.

Secondly, we find that high-skilled workers displaced from Nokia are significantly more likely to start a new business than all workers displaced from other firms or low-skilled workers displaced from Nokia. Altogether, 9% of the high-skilled workers displaced from Nokia became entrepreneurs.

The difference relative to comparable workers displaced from other firms and low-skilled workers displaced from Nokia is stark, as only 3–4% of them started a new firm following the layoffs. Severance payments and the start-up grants offered through the Bridge program are likely to be important drivers of the increase we find in entrepreneurship. Indeed, the Bridge program increased the likelihood of establishing a startup by two percentage points (22.7%) among high-skilled workers. These results indicate that providing financial support for high-skilled workers increases their likelihood of starting a firm after mass layoffs.

Finally, we show that despite the increase in the number of entrepreneurs discussed above—something that, in theory, could have reduced their entrepreneurial quality—the performance of startups established by former Nokia workers is similar to the performance of startups established by workers displaced from other firms and all new firms established in Finland. The firms founded by workers displaced from Nokia are slightly less likely to survive compared to the firms in our comparison groups, but this lower survival rate is not enough to offset the larger number of firms founded by former Nokia workers. Eight years after being established, the firms are very similar in terms of revenue, number of employees, value-added per worker, and equity. These results suggest that supporting highly skilled displaced workers in starting new firms could attenuate the consequences of mass layoffs.

Our results contribute to two strands of literature. Firstly, we add to the literature on mass layoffs and plant closures by studying the consequences of these shocks on employees of a market leader firm in a growing industry. We find that even in this setting, the displaced workers experience large and persistent employment and income losses, similar to the ones that have been documented for other firms and industries (Ruhm, 1991; Jacobson et al., 1993; Davis and von Wachter, 2011). We add to this literature by showing that having work experience in a superstar firm such as Nokia does not seem to improve post-layoff trajectories. Indeed, workers displaced from Nokia seem to do even worse than similar workers displaced from other firms at the same time. In line with recent work by Blien et al. (2021) and Beuermann et al. (2024), we find that skills act as a protective factor against mass layoffs, as high-skill workers seem to do slightly better in transitioning into new productive activities after mass layoffs than low-skilled workers. Nevertheless, we find that even the high-skilled experience significant employment and earnings losses.

Secondly, our findings add to the literature on entry into entrepreneurship and the determinants of firm performance. As shown in the earlier literature (Babina, 2019; von Greiff, 2009; Hacamo and Kleiner, 2022; Roed and Skogstrom, 2014), we find that negative labor market shocks induce an increase in entrepreneurship. We add to this literature by showing that providing generous severance payments and start-up grants to laid-off workers further increases entry into entrepreneurship. This result aligns with the earlier evidence on the relevance of credit and liquidity constraints for entrepreneurship (Adelino et al., 2015; Brown and Earle, 2017; Evans and Leighton, 1989; Jensen et al., 2022; Schmalz et al., 2017), and the findings of recent papers by Hombert et al. (2020) and Gottlieb et al. (2021) which show that the provision of social security, such as unemployment insurance or extending paid and job-protected maternity leave, encourages entry into entrepreneurship. We show that severance payments and seed funding provided by the private sector also increased the number of new firms created by displaced workers. Interestingly, these new firms perform similarly to those created without additional financial support. This suggests that the workers induced to start a new firm are of similar quality as other entrepreneurs who did not receive additional support to start a firm. Thus, encouraging displaced workers to become entrepreneurs could be an effective way of helping at least some of them to cope with job loss.

Finally, our results add to a series of business articles that have described the Bridge program as a success story—see, for instance, Sucher and Winterberg (2015a,b). Our findings tone down the optimism of these studies by showing that although the Bridge Program helped displaced workers to some extent—e.g., increased entrepreneurship among high-skilled workers—it was not enough to offset the losses they experienced in the labor market. Indeed, we find that even after the Bridge Program was implemented, workers displaced from Nokia experienced larger employment and income losses than similar workers displaced from other firms.

The rest of the paper is organized into six sections. Section 2 describes the important features of the decline of Nokia mobile phones and mass layoffs in Finland. Section 3 describes the data and relevant definitions, and Section 4 presents our empirical methods. Sections 5 and 6 present our main results, and Section 7 concludes.

2 Nokia and Mass Layoffs

The Rise and Fall of Nokia Mobile Phones. In 1998, Nokia became the worldwide leader in mobile phone production. The company continued growing in the following years, and by 2007, it held 50% of the global mobile device market and reached a record capital valuation of USD 155 billion. At the end of 2007, Nokia had 112,262 workers worldwide and 23,015 workers in Finland, where its headquarters were located.

Nokia had a similar number of low—and high-skill workers in Finland. It employed some of the country's most talented engineers and ICT professionals but also had large mobile phone manufacturing facilities where most jobs were manual assembly line tasks. Development and management operations were located mainly in the Helsinki and Tampere regions, while manufacturing and assembling were concentrated in the Turku and Oulu regions.

Despite its success in the early 2000s, Nokia could not adapt to the new market conditions created by the launch of the first iPhone (June 2007) and the Android operating system (November 2007). Only three years after reaching its peak, Nokia's share in the global market for mobile devices fell below 20%, and its capital valuation plummeted to less than USD 20 billion.

The increased competition and the changes experienced in the mobile phone market due to the rapid development of smartphones by its competitors forced Nokia to reorganize its operations. In the spring of 2011, Nokia directors decided to close down Nokia's mobile phone development and manufacturing and join forces with Microsoft to develop new mobile phones. Nokia introduced the Microsoft operating system to its mobile phones in 2011, but this change did not revert its decline. Finally, Nokia sold its entire mobile phone business to Microsoft in 2014. These developments led to wide-scale downsizing worldwide and particularly in Finland, where a large share of Nokia's mobile phone development and manufacturing operations were located. At its peak, Nokia employed around 23,000 workers in Finland. By 2013, this number had dropped to around 5,000 workers.

Panel (a) of Figure I summarizes the development of Nokia's stock price (left-hand side y-axis) and its employees in Finland (right-hand side y-axis) between 2005 and 2019. The figure illustrates the rapid decline in the market value of Nokia after the introduction of Apple iPhone and Android

smartphones in 2007, from which it never recovered. After that, Nokia began to cut its workforce in Finland through several mass layoffs in its plants and development units. The most significant reductions took place during 2011 and 2012, but the first mass layoffs were conducted already in 2009.

Mass Layoffs Legislation in Finland. The Act on Co-operation within Undertakings in Finland (Act 334/2007) requires firms with more than 20 employees to start layoff negotiations if they plan to layoff workers on financial or productive grounds. As part of these negotiations, the employer and employee representatives are expected to agree on an action plan to manage the layoffs and to mitigate their consequences on the affected workers. The minimum duration of these negotiations is regulated by law. Depending on the size of the firm and of the number of workers potentially affected, the minimum duration ranges between two to eight weeks. As Nokia headquarters and many of its operations were located in Finland, it was subject to this legislation.

Panel (b) of Figure I illustrates the number of employees affected by layoff negotiations in different Nokia plants across Finland during 2009–2012. The figure highlights the seven major layoff negotiations. These events are the focus of our analyses and we describe them in more detail below.

Severance Payments and Bridge Program. Nokia workers who were affected by the layoff negotiations were typically granted generous severance payments if they voluntarily left the company before the negotiations ended. The severance payments amounted from 6 to up to 18 months' salary depending on the tenure of the worker at Nokia. As we show in detail in Section 5, this implies that displaced Nokia workers were often in a better financial position right after the layoffs compared to similar workers displaced from other firms in Finland.

In 2008, Nokia closed its mobile phone manufacturing plant in Bochum, Germany. This plant closure was controversial and generated a lot of public attention and large demonstrations, and even initiatives to boycott Nokia (Reuters, 2008). Thus, to better deal with the mass layoffs they were about to enact in Finland and elsewhere, in early 2011 Nokia board of directors approved the implementation of the so-called Bridge Program. This program was designed to support their workers in transitioning to new productive activities after the mass layoffs in various ways. In principle, all employees working in plants affected by mass layoffs were eligible to participate in

the program. Importantly, this program was introduced on top of the relatively generous severance payments and it was independent of tenure length.

The Bridge Program contemplated five paths to support employees whose jobs were at risk due to mass layoffs. Eligible employees were free to choose among these paths. The first path helped workers to apply for open vacancies within the Nokia Corporation. The second path focused instead on providing support to find a job outside Nokia. For this purpose, Nokia offered career coaching, organized job fairs, and created dedicated groups on online job search platforms like LinkedIn. The third path provided employees with support to start a new business. The fourth path provided employees with training opportunities, for example, offering extensive vocational training in the factories. Finally, the fifth path allowed employees to find their own way. It was designed to allow employees to propose solutions not included in the previous four paths, such as re-employment in non-profit organizations.

The third path—the support to start a new business—is particularly important for this study. In addition to providing information about starting a business and guidance in developing a business plan, Nokia connected their workers with local startup incubators and other potential partners. Also, a key part of this path was the financial support provided by Nokia for new businesses founded by their workers affected by layoffs. Through this unique program, Nokia offered start-up seed capital ranging from EUR 10,000 to 25,000 per individual owner. This funding was granted for up to four Nokia workers per new firm. To receive this startup funding, the employees had to prepare a business plan that was evaluated by the local Nokia Bridge team. According to Nokia, the size of the grant was mostly based on the perceived growth potential of the business. This means that larger financial support was given to firms that had the potential to grow—such as new tech or manufacturing firms—and less was given to firms that mainly employed the entrepreneur—such as small service sector businesses.

Nokia decided to fund the startup businesses of their workers affected by layoffs but did not aim at ownership or other official connections to these firms. Another requirement to receive this funding was that the new entrepreneurs signed a commitment to work full-time in their business for at least 12 months. As Nokia did not claim any ownership at the funded firms, the seed capital was directly paid to individuals and was considered taxable labor income. We discuss this in more detail in

Section 4.

According to Nokia, almost 18,000 employees participated in the Bridge Program globally and 5,000 in Finland. Most participants chose one of the first four paths, and according to Nokia reports, 60% of them had found their next career path by the end of their Nokia employment. Approximately 1,000 new firms were established globally through the program. In Finland, more than 400 new firms were established by 550 individual entrepreneurs. Of these Finnish firms, 40% were in the ICT sector, 30% in the professional services and consulting sector, and 30% in other areas (Nokia Oyj, 2014).[2]

Finally, in addition to severance payments and the Bridge program, employees laid off from Nokia were eligible for similar publicly-provided unemployment benefits and services as other laid-off workers in Finland. Most workers in Finland are eligible for earnings-related unemployment insurance benefits with a replacement rate of approximately 60–70% of the previous wage level for up to 500 unemployment days (in 2009–2012). Those who exhaust their earnings-related benefits or do not qualify for them receive flat-rate unemployment benefits, which the Social Insurance Institution of Finland pays indefinitely.[3] Instead of unemployment benefits, unemployed individuals planning to establish a new business without other startup funding, such as the Bridge program, can apply for startup grants from local employment offices. The size of this grant is similar to the flat-rate unemployment benefit (approximately 700 euros per month) and can be received for up to 12 months. Eligibility is subject to evaluation of the business plan and the availability of funds at the local employment office.

3 Data

We combine several firm- and individual-level data sets from Statistics Finland. These data contain unique individual and firm identifiers, which enable us to link them together. Below, we describe these data sets separately. Appendix A provides a detailed description of the key variables and definitions we use in our analysis.

[2]For more details of the Bridge Program and survey results from the participants, see Rönnqvist et al. (2015). Sucher and Winterberg (2015a,b) reflect the experiences of Nokia leaders on the implementation of the Bridge Program.

[3]Kyyrä et al. (2017) provide a description of the details of the Finnish unemployment insurance system.

Job Spell and Income Data. This dataset contains information on job spells at the daily level between January 2006 and December 2019. We link these data to annual income registers distinguishing between labor income, capital income, and income transfers and benefits. For all the variables in euros, we adjust prices to their 2021 level using the national consumer price index computed by Statistics Finland and winsorize them at the 1% level to avoid the potential effect of outliers. These data also contain information on workers' demographic and socioeconomic characteristics, including gender, age, education (highest degree), and place of residence.

Firm Data. These data contain detailed information on the establishment dates of new firms and annual tax records and accounting information covering multiple measures of firm performance, including revenue, costs, value added, and the number of employees. This data set also contains unique identifiers of firm owners and their ownership shares and the firm's industry. This allows us to link newly established firms to displaced workers. In addition, for the purposes of this study, we received authorization from the Nokia Corporation to identify its parent company and all its plants in the data.

Layoff Negotiation Data. This dataset covers all layoff negotiations taking place in Finland between 2009 and 2012 and was built from the public records of the Central Organisation of Finnish Trade Unions (SAK). The data include information on starting dates, duration, affected plants, the potential number of affected workers, and the actual number of displaced workers after each layoff negotiation. These data allow us to identify workers affected by layoff negotiations initiated by Nokia and other Finnish firms during Nokia's decline. We use the latter information to define a benchmark group to compare the trajectories of workers displaced from Nokia with the trajectories of similar workers displaced from other firms at the same time and in the same labor markets in which Nokia layoffs took place.

3.1 Definitions

This section discusses the key definitions that we use in our analyses and describes the process that we follow to build the benchmark group against which we compare the trajectories of workers displaced from Nokia and the new firms that they established.

Layoff Negotiations. Nokia started several layoff negotiations after 2007. We focus on seven major layoff negotiations that affected plants located in four regions of Finland (Helsinki, Tampere, Turku, Oulu) between February 2009 and August 2012. Panel (b) of Figure I illustrates the timing and location of each negotiation, and shows that they altogether resulted in roughly 11,800 workers leaving Nokia. The latter negotiations in 2011–2012 were the ones affecting more workers. These negotiations lasted on average 59 days; the longest one was the negotiation preceding the mass layoffs affecting the Helsinki and Oulu regions in 2009 which lasted 91 days. As described in Section 2, the Bridge program was launched in early 2011. This means that many of the workers displaced from Nokia in the period that we study were eligible to participate in the program.

Displaced Workers. We define displaced workers as individuals who were employed in a firm three months before the end of a layoff negotiation, and who leave the firm in the 12 months following the end of the negotiations. This definition includes both workers who are forced to leave the firm and workers who leave the firm voluntarily. We cannot distinguish between these two situations in the data. According to the layoff negotiations data, none of the Nokia layoff negotiations lasted more than three months. Therefore, our definition of displaced workers guarantees that all of them were working at Nokia before the layoff negotiations were announced.

We proceed in a similar way to identify displaced workers from other firms. We focus on layoff negotiations affecting at least 5% of the firms' employee count and that were initiated within a two-month time window around a Nokia layoff negotiation. We can identify 340 layoff negotiations in 269 firms under these restrictions. As in the case of Nokia, most of these mass layoff negotiations lasted less than three months, as approximately 95% of them ended within this time window.[4]

New Firms. We define new firms as firms founded by at least one displaced worker between three months before and twelve months after the end of a layoff negotiation. This definition leaves out existing firms established by displaced workers earlier or later in their lives, as well as existing firms that displaced workers might join as new owners. With this definition, we identify 362 firms

[4] As a robustness check, we limit our sample to those individuals who were working in Nokia and the comparison firms 12 months before the end of layoff negotiations. This specification accounts for the possibility that some workers might have foreseen the layoffs and leave the firm ahead of time before the negotiations started. The results are similar in this specification compared to our baseline sample, as illustrated and discussed in more detail in Appendix C Table C.I.

founded by workers displaced from Nokia and 144 firms founded by workers in the benchmark group.

In our analysis, we define the first year of the firm as the year when they first file a tax report to the Tax Administration. We follow the development of the new firms founded by displaced workers irrespective if they later sell their ownership to, for example, outside investors. We follow the new firms as long as they are observable in the administrative data. Based on this definition, firms that do not survive after a certain period of time include those that go bankrupt, quit their business voluntarily or no longer operate in Finland.

Skill Groups. We classify workers as low or high skilled based on their level of education. Individuals who only completed secondary education are classified as low skilled, while those who completed a tertiary education degree are classified as high skilled. Out of the 11,800 workers displaced from Nokia, 48% were low skilled and 52% high skilled.

3.2 Descriptive Statistics

Figure II illustrates the evolution of the labor market status of workers displaced from Nokia by their skill group using monthly-level data constructed from the daily-level spell data. We divide labor market activities into six categories: employed by Nokia, employed by other firms, unemployed, entrepreneur, retired, student, and outside of the workforce.[5] In the figure, we follow the displaced workers from 24 months before to 36 months after the end of a layoff negotiation. We pool together all seven major layoff negotiations (see panel (b) in Figure I), and denote the end of each negotiation by month 0 in the figure. Following our definition for displacement, all of the workers in the figure were employed in Nokia three months before the end of layoff negotiations (denoted by month -3 in the figure).

In line with previous evidence—see for instance Davis and von Wachter (2011)—Figure II shows that displaced workers experience long-lasting effects on their labor market trajectories. More than a third of the low-skill workers leaving Nokia after mass layoff negotiations are either unemployed (25%) or outside of the labor force (12%) three years after the negotiations ended. High-skilled

[5] Appendix A provides more detailed definitions for each labor market status.

workers do slightly better, but still more than a fifth of them are unemployed (15%) or out of the labor force (6%) three years after the shock. Despite being among the most skilled workers in Finland and employed by the flagship firm of the country, they still appear to struggle to find new productive activities after being displaced.

Although the likelihood of finding new jobs explains some of the difference in unemployment and outside-of-labor-force rates between low- and high-skilled workers, more than a third of this gap is associated with differences in the probability of becoming an entrepreneur. Three years after the end of a layoff negotiation, high-skilled workers displaced from Nokia are three times more likely to be entrepreneurs than their former low-skilled colleagues (9% vs 3%).

The results discussed so far describe what happened to workers displaced from Nokia. However, from these figures it is difficult to know whether the consequences of losing their jobs were more or less severe than for similar workers displaced from other firms. As discussed in Section 2, most of the workers displaced from Nokia in the period that we study were eligible for the Bridge program. This program aimed to help displaced workers transition to new productive activities, which could have affected their labor market trajectories after the layoffs. In addition, as shown in columns (1)–(4) of Table I, which compares Nokia workers with other workers in Finland, Nokia employees—even those who were displaced—are, on average, positively selected (columns 1 and 2) compared to both other displaced workers (column 3) or with the overall population of Finnish workers (column 4). The table shows that workers displaced from Nokia are twice as likely to have attended tertiary education and between four to five times more likely to hold an ITC degree compared to other workers in Finland (see Section 3.1 for a detailed discussion of the sample construction of workers displaced from other firms). While still working at Nokia, they earned, on average, 33% more than other displaced workers and 85% more than the average Finnish worker. These findings are not surprising as Nokia was the flagship firm of Finland attracting some of the most talented workers in the country. Therefore, we need to consider this selection to gain a better understanding of the consequences of mass layoffs for workers displaced from Nokia.

4 Empirical Approach

This section starts by describing the benchmark group of displaced workers against which we compare workers displaced from Nokia. Most previous literature on mass layoffs and plant closures uses a group of non-displaced workers as a comparison group. We deviate from this approach because the main objective of this paper is not to confirm whether negative shocks in the labor market have long-lasting effects on labor market outcomes but rather to understand whether working in a superstar firm and counting with special support programs to deal with the layoffs—e.g., severance payments and Bridge program—make a difference in workers' outcomes. Thus, we define a benchmark group of similar workers displaced from other firms in the same labor markets and at the same time as the workers displaced from Nokia, and compare them using an event study approach that we describe in greater detail below.

Our benchmark group includes workers displaced from other firms within two months of each Nokia mass layoff negotiation. We rely on a coarsened exact matching (CEM) approach introduced in Iacus et al. (2012) to ensure that these benchmark workers are observably similar to the workers displaced from Nokia. We match workers based on four age groups—0-31, 32-39, 40-49, 50 and above—, gender, immigration status, level of education—no secondary education, secondary education (vocational or high school), tertiary education, doctoral degree—, field of specialization—business administration and law, ICT, engineering, other—, tenure quartiles recorded three months before the end of the mass layoff negotiations—with cutoffs at 726, 2416, and 5250 days—, and the counties in which workers lived at the end of the year preceding mass layoff negotiations.

Columns (4) and (5) of Table I show that matched workers displaced from Nokia and from other firms are very similar in terms of demographic characteristics, education, tenure, and the county of employment before layoffs. The only dimension in which we still find some difference is on average earnings before layoffs. Nokia workers had higher earnings than benchmark workers. This is likely to stem from Nokia—as a large multinational corporation—paying higher salaries than other local firms in Finland.[6]

[6]See Almeida (2007), Chen et al. (2011) and Girma et al. (2019) for evidence of multinational enterprises' wage premiums.

We use an event-study approach to compare the labor market trajectories of matched workers displaced from Nokia and other firms. To build the estimation sample, we link layoff negotiations affecting workers in the benchmark group with the closest layoff negotiation affecting Nokia workers. Thus, there is a benchmark group for each mass layoff negotiation affecting Nokia. To gain statistical power, we pool all these event waves together and estimate the following specification:

$$Y_{it} = \beta Nokia_i + \sum_{t=\tau_0}^{\tau_T} (\delta_t \times Nokia_i) + \mu_i + \mu_t + \varepsilon_{it}. \quad (1)$$

where Y_{it} is either an indicator of the labor market status—e.g., unemployed, employed, entrepreneur—or total income of an individual i affected by layoff negotiations at event time t. $Nokia_i$ indicates whether an individual affected by layoff negotiations was originally working in Nokia. μ_i and μ_t are individual and event-time fixed effects. The coefficients δ_t are the parameters of interest as they capture the difference in the outcome Y_{it} in period t between workers displaced from Nokia and workers displaced from other firms. We cluster standard errors at the level of the CEM-matching strata.

We use monthly-level data when studying changes in occupation status and define event-time — three months before the end of layoff negotiations—as a reference point. We observe these outcomes between 24 months before and 36 months after the end of a mass layoff negotiation. Thus, when studying these types of outcomes τ_0 is -24 and τ_T is 36.

We use annual data for studying changes in income. In this case, we define event time $t = -1$—the year before the end of layoff negotiations—as the reference point, but apply an otherwise similar approach following workers from three years before to six years after the end of a layoff negotiation. Thus, when studying changes in income τ_0 is -3 and τ_T is 5.

In Section 5, we show that before the beginning of the layoff negotiations, the outcomes of workers displaced from Nokia and from other firms follow very similar trends (i.e., δ_t coefficients are small and not statistically different from zero in that period). This result is comforting, as it suggests that our benchmark group is a reasonably good group against which to compare the outcomes of workers displaced from Nokia.

We also shed light on the effectiveness of the Bridge Program in helping displaced workers to

transition into new productive activities. As described in Section 2, the Bridge Program was launched in 2011 and most Nokia employees were eligible for it. However, there are still some workers who left Nokia before Bridge was in place. To study whether Bridge made a difference in the trajectories of workers displaced from Nokia, we use a triple-difference specification to compare the trajectories of matched workers displaced from Nokia and other firms before and after the Bridge program was implemented. Specifically, we estimate the following equation:

$$\begin{aligned} Y_{it} = {} & \beta_0 + \beta_1 Nokia_i + \beta_2 Post_{it} + \beta_3 Bridge_i \\ & + \beta_4 Nokia_i \times Post_{it} + \beta_5 Nokia_i \times Bridge_i + \beta_6 Post_{it} \times Bridge_i \\ & + \beta_7 Nokia_i \times Post_{it} \times Bridge_i + \mu_i + \varepsilon_{it} \end{aligned} \tag{2}$$

where Y_{it} again indicates the labor market status or the income of individual i at event time t, and $Nokia_i$ indicates whether individual i worked for Nokia before the layoff negotiations. $Post_{it}$ indicates periods after the end of the layoff negotiations, and $Bridge_i$ indicates whether the layoff negotiations took place after the implementation of the Bridge Program. We also include individual-level fixed effects denoted by μ_i. The parameters of interest here are β_4, which captures the difference in the change that Nokia and matched workers experience in outcome Y_{it} following the layoffs, and β_7, which captures how the implementation of the Bridge program changed the consequences of being displaced from Nokia relative to being displaced from other firms.

To understand how successful the firms established by former Nokia workers were, we compare them with two sets of firms. Firstly, we compare them with the 144 new startups established around the same time by benchmark workers displaced from other firms. In addition, we compare them to all 86,910 new firms established in Finland around the time the Nokia mass layoffs took place.

We observe the trajectories of these new firms over their first eight years after establishment. We focus on key firm-level outcomes, including firm survival, revenue (gross sales), value added (sales minus variable costs), number of employees, value added per employee as a measure of firm productivity, and equity. In addition, we analyze the distributions of these variables to investigate whether the groups differ in the number of particularly high or low-performing firms.

To explore whether firms established after the Bridge Program perform better than other firms, we use a difference-in-differences specification to compare the outcomes of firms founded by workers displaced from Nokia and other firms before and after the program's implementation. Specifically, we estimate the following equation:

$$Y_i = \gamma_0 + \gamma_1 Nokia_i + \gamma_2 Bridge_{it} + \gamma_3 Nokia_i \times Bridge_{it} + \mu_t + \varepsilon_{it} \quad (3)$$

where the outcome variable Y_i of the firm i is measured eight years after it was established. $Nokia_i$ indicates whether at least one of the firm's founders was displaced from Nokia, and $Bridge_{it}$ indicates if at least one of the founders was displaced after the Bridge program was in place, and μ_t are calendar year fixed effects. We use a similar specification to study whether some characteristics of the new firm or its founders are associated with better performance. Specifically, we study heterogeneity in startups' performance by industry—i.e., whether the startups' industry coincides with Nokia's industry—and by founders' skill level. When studying heterogeneity along these dimensions, we replace the $Bridge_{it}$ indicator for indicators that capture differences in the dimensions in which we are interested. We cluster standard errors at the firm level.

Online Appendix C presents the results of a large set of additional exercises that confirm that our findings are robust to variations of the main definitions introduced in this section. We show that building an independent benchmark group for each Nokia layoff negotiation wave (Table C.III) or including industry code as an additional matching variable (Table C.IV) do not change the main results of the paper. In addition, we show that our main results are robust to restricting our baseline sample to the first layoff negotiation that the Nokia and comparison group workers experience (Table C.II), and to restricting our baseline definition of displaced workers such that they are required to work in the firm for the 12 months prior the end of layoff negotiations instead of the three months that we use in our baseline specification (Table C.I).

5 Labor Market Trajectories of Displaced Workers

This section studies whether the labor market trajectories of workers displaced from Nokia differ from those of similar workers—similar in terms of age, gender, education, field of specialization,

and tenure—displaced around the same time from other firms operating in the same labor markets as Nokia (see Section 4 for further details). As discussed in Section 2, Nokia offered their displaced workers generous severance payments. In addition, in 2011, it launched Bridge, a program designed to support its displaced workers in transitioning to new productive activities. These features of Nokia and the experience of its workers in a large international firm could have given them an advantage in the labor market after mass layoffs.

Figure III summarizes the main results of this section by illustrating the levels and differences in three key labor market outcomes between workers displaced from Nokia and benchmark workers displaced from other firms: (1) probability of being unemployed, (2) probability of being employed in a new firm, and (3) total income.

We observe unemployment and employment spells at the monthly level from two years before to three years after the end of layoff negotiations (denoted by zero in the figure). Thus, panels (a) to (d) in Figure III illustrate the evolution of these outcomes at the monthly level between 24 months before to 36 months after the end of a mass layoff negotiation. In contrast, total income—which includes labor income, capital income, and transfers and benefits—is reported annually, and we observe it from three years before to five years after the end of layoff negotiations.[7] Consequently, panels (e) and (f) of Figure III illustrate the evolution of total income at the yearly level and for a longer period of time.

The panels on the left of Figure III illustrate the level of the outcome independently for workers displaced from Nokia and for benchmark workers displaced from other firms. The panels on the right illustrate differences between the two groups of workers by plotting the δ_t coefficients from equation (1). As shown in panels (a)–(d), both the probability of being unemployed and the probability of being employed in another firm start to increase once the layoff negotiations begin. The unemployment probability peaks 12 months after the negotiations end, and from then onward, it begins to decline. The peak at twelve months results from our definition of displaced workers (i.e., individuals working in a firm three months before a mass layoff negotiation ends and leaving it in the 12 months following the end of the negotiation). Despite following a similar general pattern, the unemployment rates after the end of layoff negotiations are always higher for the workers displaced

[7] See Online Appendix A for additional details on the definition of total income.

from Nokia. Three years after the negotiations ended, former Nokia workers are five percentage points (34%) more likely to be unemployed than similar workers displaced from other firms. As shown in panels (c) and (d) of Figure III, a large part of this difference is explained by other workers being faster at finding new jobs in other firms than former Nokia workers.

These differences also translate into large drops in total annual income, as illustrated in panels (e) and (f) of Figure III. Before the mass layoff negotiations, Nokia workers had higher levels of income. They also experience a large increase in their income in the year in which they leave Nokia. This confirms that, on average, Nokia offered larger severance payments for displaced workers than other Finnish firms. Nokia offered these payments already before the implementation of the Bridge program. Therefore, workers leaving Nokia experienced an increase in their earnings regardless of whether they left Nokia before or after Bridge. Once workers leave Nokia, their total income drops and does not recover. Five years after the negotiations ended, their income is similar to the income of benchmark workers displaced from other firms. Since Nokia workers originally had higher earnings than the benchmark workers displaced from other firms, this implies that they experienced a larger relative decline in their incomes.

The results discussed so far look at all displaced workers independently of their skill level. Table III presents the difference-in-differences estimates that summarize the event studies presented in Figure III (panel a), and expands them by presenting the estimates for low-skilled (panel b) and high-skilled (panel c) workers separately. There are no significant differences in changes in labor force participation after mass layoffs between workers displaced from Nokia and from other firms (column 1). However, as discussed above, after the layoffs workers displaced from Nokia are more likely to be unemployed and less likely to be employed than similar workers displaced from other firms (columns 2 and 3). These results, however, mask substantial heterogeneity. Firstly, the differences in post-layoff unemployment are mostly driven by low-skilled workers. Indeed, we do not find a statistically significant difference in unemployment when comparing high-skilled workers displaced from Nokia and from other firms. In addition, similarly as their low-skilled colleagues, high-skilled workers displaced from Nokia are also less likely than workers displaced from other firms to be employed following mass layoffs. Nevertheless, while in the case of low-skilled workers this difference is explained by former Nokia workers being more likely to be unemployed, in the

case of high-skilled workers it is explained by former Nokia workers being more likely to start their own firm (column 4). Despite not being more likely to be unemployed than similar workers displaced from other firms, high-skilled workers displaced from Nokia experience a larger drop in their total income. The difference in the drop they experience is even larger than the one we find when comparing changes in total income between low-skilled workers displaced from Nokia and from other firms (column 5). This result is in part explained by the existence of a generous social security system in Finland, but it also indicates that the new activities of the high-skilled workers displaced from Nokia were far from allowing them to recover their pre-layoffs income levels.

According to these results, workers displaced from Nokia experienced larger losses than similar workers displaced from other firms. What could be behind these differences? Firstly, they do not seem to be driven by former Nokia workers having higher reservation wages induced by higher pre-layoff earnings and generous severance payments. It has been shown that additional financial security and higher reservation wages at job displacement can lead to better matches in the labor market (Ehrenberg and Oaxaca, 1976; Meyer, 1990; Centeno, 2004; Card et al., 2007; Schmieder et al., 2016). Nevertheless, although Nokia workers were in a better financial position than other displaced workers immediately after the layoffs, most of them still needed to generate earnings. As shown in Table I, the workers displaced from Nokia were, on average, 39 years old and had 1.5 children one year before the mass layoff negotiations ended. This means that most of them were still far from retirement. In addition, even though they had higher income levels than workers displaced from other firms before the mass layoffs (53,000 vs. 49,000 euros per year), most of them were not rich enough to totally stop working. If Nokia workers had accumulated enough assets to compensate for their earnings loss, we would not observe the pronounced drop in total income illustrated in panels (e) and (f) of Figure III. Also, the differences in unemployment between workers displaced from Nokia and other firms are particularly pronounced when focusing on low-skilled workers, a group of workers for whom generating earnings was particularly important. This suggests that although workers displaced from Nokia could have handled unemployment for a little bit longer than workers laid off from other firms, the large and persistent differences that we observe even three years after the mass layoff negotiations ended are not likely to be driven by a voluntary decision.

Secondly, differences in labor market trajectories of workers displaced from Nokia and from other firms do not seem to be driven either by the prestige of Nokia making displaced workers over-optimistic about their employment prospects. This could have explained some of the early differences, but the dramatic drops in total income experienced by workers displaced from Nokia would have likely made them to re-optimize very quickly.

An alternative hypothesis that could explain the persistent differences in unemployment and income drops is that the human capital and skills accumulated in Nokia were too specifically related to the ICT industry. The sudden increase in the supply of workers with this specific type of human capital might have made it more challenging for workers displaced from Nokia to find a new job. To assess the relevance of this hypothesis, in Online Appendix B, we replicate our main analyses using as a benchmark group only individuals who worked in similar occupations as the former Nokia workers. Although we end with a smaller sample size, we still find that workers displaced from Nokia were more likely to remain unemployed three years after the mass layoff negotiations ended and that they experienced larger income losses compared to the benchmark group. This suggests that the increase in the number of workers with a specific set of skills and experience in the ICT sector that followed Nokia's decline does not appear to drive the observed differences.

Considering the results above and that a large share of the workers displaced from Nokia were eligible for the Bridge program, the patterns described so far suggest that this support program was not very effective in helping Nokia workers to find new jobs and recover their original income levels. To study this in more detail, we estimate the triple-difference specification (2) through which we compare the labor market trajectories of workers displaced from Nokia before and after the implementation of Bridge relative to benchmark workers. The results of this exercise are presented in Table IV, and confirm that workers displaced from Nokia after Bridge do not do better than workers displaced from Nokia before Bridge in terms of labor force participation, unemployment, and total income. As shown in the table, this pattern remains even when we split the sample and look independently at what happens with low- and high-skilled workers. Overall, the evidence presented in this section contrasts with multiple reports—see, for instance, Ali-Yrkkö and Hermans (2004); Ali-Yrkkö et al. (2021, 2023); Rönnqvist et al. (2015)—that argue that the Bridge Program was very successful in helping workers displaced from Nokia in finding new productive activities.

6 Displaced Workers and New Firms

Section 5 shows that the workers displaced from Nokia struggled more than other displaced workers to find new productive activities, independent of whether or not the Bridge program was in place. In this section, we focus on entrepreneurial activity and show that a distinctively large share of the high-skilled workers displaced from Nokia established a startup following mass layoffs. This was true even before the Bridge program was implemented, but its implementation further increased the number of startups created by former Nokia employees. We conclude this section by showing that the firms created by workers displaced from Nokia perform similarly to firms created by other displaced workers and by other entrepreneurs in Finland. Even though there are more entrepreneurs among former Nokia employees, they do not seem to be of worse average quality than other entrepreneurs.

Figure IV illustrates the shares of workers displaced from Nokia and from other firms who established a startup after the layoffs. The panels on the left illustrate levels and the panels on the right illustrate the differences in these levels between former Nokia workers and workers in our benchmark group. Panels (a) and (b) focus on the full sample of displaced workers and show that while 6% of the workers displaced from Nokia started a new firm in the 12 months following the end of layoff negotiations, less than 4% of workers displaced from other firms did so. As shown in panels (c) and (d), this difference is completely driven by high-skilled individuals. Almost 10% of the high-skilled workers displaced from Nokia started a new firm following the layoffs. In contrast, only 4% of high-skilled workers displaced from other firms started a business. Panels (e) and (f) show that there are no significant differences in the probability that low-skilled workers displaced from Nokia and from other firms become entrepreneurs. Similarly as high-skilled workers displaced from other firms, roughly 4% of them become entrepreneurs following mass layoffs.

What is behind this increase in entrepreneurial activity among high-skilled workers displaced from Nokia? There is evidence that additional financial support after layoffs plays an important role in enabling workers to become entrepreneurs (see for instance Hombert et al., 2020; Gottlieb et al., 2021). Nokia offered generous severance payments to their employees, and the Bridge Program introduced additional financial support for its workers interested in becoming entrepreneurs (see

Section 2 for details).

Figure V confirms that severance payments and Bridge startup grants significantly increased the taxable income of workers displaced from Nokia relative to workers displaced from other firms immediately after the layoffs. Appendix Figure B.III shows that the differences in taxable income between these groups were even larger in the year of the layoffs once Bridge program was implemented. On average, workers displaced from Nokia experienced an increase of 17% in their taxable income immediately after leaving Nokia relative to benchmark displaced workers. As shown in panels (b) to (d) Figure V, there are some differences in the size of the increase by tenure, but even individuals who had worked for less than five years at Nokia when mass layoff negotiations started experienced sizeable increases in their taxable income once leaving Nokia.

To further study whether Bridge increased entrepreneurship, we estimate specification (2). The results of this exercise are presented in column (4) of Table IV. These results indicate that high-skilled workers displaced from Nokia before Bridge were 3.5 percentage points more likely to start a new firm than similar workers displaced from other firms (Nokia $\times$ Post). Once Bridge was implemented, this difference increased by an additional 1.9 percentage points (54%), reaching 5.4 percentage points. This increase is also illustrated in Online Appendix Figure B.II. Although the increase in entrepreneurship among workers displaced from Nokia following the implementation of Bridge is not precisely estimated, its magnitude is large and suggests that Bridge did increase the number of startups established by former Nokia employees.

The results discussed so far indicate that engaging in entrepreneurship after mass layoffs was much more common among Nokia workers than among workers in the benchmark group. Whether this is a positive or negative result depends greatly on the quality of these new entrepreneurs and on the performance of the firms they create. On the one hand, the additional financial support offered by Nokia might have attracted low-quality entrepreneurs who, without these resources, would not have been able to ensure funding for their endeavors. On the other hand, the additional resources might have encouraged potentially good entrepreneurs to take a risk that they otherwise would have been unwilling to take.

The results in Table II indicate that entrepreneurs with origins in Nokia are different from other

entrepreneurs. We compare them to individuals who become entrepreneurs after leaving other firms (column 2) and to all individuals starting a new firm in Finland within two months of a Nokia mass layoff negotiation (column 3). Former Nokia workers who start a new firm are slightly older and more likely to be married, to have children, and to be Finnish citizens than entrepreneurs displaced from other firms. They are also more likely to have worked in the Helsinki or Oulu regions, and before being displaced, they had higher earnings and a few extra years of tenure. Also, they are more educated and more likely to have an engineering or business degree. These differences are even more pronounced when comparing former Nokia workers to the full population of new entrepreneurs.

Thus, the workers displaced from Nokia who started new businesses are positively selected regarding education and pre-layoff earnings relative to other entrepreneurs in Finland. This positive selection could make them more likely to succeed as entrepreneurs (Queiro 2022). In addition, the additional funding they receive through severance payments and Bridge startup grants could further increase their chances of entrepreneurial success (see Aghion et al., 2014; Hurst and Lusardi, 2004, for evidence of the role of liquidity on firm performance). Next, to study whether the firms founded by former Nokia employees actually do better than firms in our benchmark groups, we compare them along multiple dimensions of firm performance.

Figure VI summarizes these results. We study how different measures of firm performance—survival rates, revenue, value added, the number of employees, productivity, and equity—evolve in the first eight years following their establishment. Panel (a) in the Figure shows that firms founded by former Nokia employees are around 10 percentage points (20%) more likely not to survive eight years after their establishment than firms in either of our comparison groups. Panels (b) to (f) focus on outcomes that are only observed for firms that survive each year. Considering the differences in survival rates, it is not surprising to find that in the years immediately following their establishment, firms founded by former Nokia employees have lower revenue (panel b) and value added (panel c) than firms in the comparison groups. Note, however, that revenue and value-added converge to the levels of other firm groups towards the end of our study period.

Differences in the number of employees are less apparent (panel d). The average number of employees does not significantly differ across the three firm groups at any point in time. After eight

years, the average firm remains relatively small, employing slightly more than four workers in all groups. This pattern suggests that the typical firm established by former Nokia workers—as well as the firms established by other displaced workers and by other Finnish entrepreneurs—did not become large businesses offering many jobs. Productivity (panel e)—measured by value added per worker—seems to be slightly higher for firms founded by workers displaced from Nokia and from other firms than for the average firm founded in Finland at that time. These differences are not always statistically significant, and as in the case of the other outcomes, they become smaller towards the end of the period we study.

Panel (f) of Figure VI shows that there is no significant difference in equity levels across firm groups. This finding is somewhat surprising given the generous financial resources provided by Nokia to its workers through severance payments and startup grants. This similarity in equity could explain why firms in all groups do not significantly differ in other key outcomes. It suggests that the other firm owners who did not receive additional start-up funding were able to acquire financial resources for their firms through other means.

We further investigate whether the startup grants offered by the Bridge program made a difference in terms of firm performance in Panel (a) of Tables V and VI. In the former table, the comparison group consists of firms established by workers displaced from other firms, and in the latter, the comparison group consists of all the firms founded in Finland around the same time as a mass layoff negotiation affecting Nokia. Independently of the comparison group, we find that the Bridge program did not improve the performance of the firms established by former Nokia employees. The estimates are not precisely estimated, but if anything, firms created by workers displaced from Nokia after Bridge perform worse than those created before Bridge relative to firms in the comparison groups.

The results discussed so far only look at averages, but this could be misleading. A few very successful firms could justify providing financial support to displaced workers interested in creating new businesses. To explore this possibility, in panels (b) and (c) of Tables V and VI, we study heterogeneity in startups' performance depending on their industry and on the skill level of their founders.

Working at Nokia could have increased its workers' skills and human capital mainly in sectors that specifically relate to ICT. Panel (b) of Tables V and VI presents the result of a difference-in-differences specification through which we study whether firms founded by former Nokia workers perform better in sectors related to Nokia core activities.[8] Although, on average, firms founded by workers displaced from Nokia have lower survival rates than firms in the comparison groups, these differences disappear when we focus on firms operating in the same industry as Nokia. These firms also seem to perform better than those in the comparison groups in the other measures of firm performance that we observe, but these differences are not precisely estimated.

Panel (c) of Tables V and VI study how firms' performance varies by founders' skills. The specification we estimate allows founders' skills to matter differently for firms founded by workers displaced from Nokia, from other firms, and by other Finnish entrepreneurs. Although not precisely estimated, the results in Table V suggest that startups established by high-skilled workers displaced from Nokia do better than startups established by low-skilled workers displaced from Nokia. Nevertheless, they seem to do worse than startups established by both low- and high-skilled workers displaced from other firms. Interestingly, the firms by high-skilled displaced workers seem to perform worse than those founded by low-skilled displaced workers, independently of the firm where they previously worked. These differences are not statistically significant but they suggest that being more educated does not necessarily indicate that these individuals establish more successful firms.

The results in Table VI tell a slightly different story. When we include all individuals establishing a startup near a mass layoff negotiation affecting Nokia in the analysis, the founders' skills become predictive of better startup performance in terms of value added, number of employees, and value-added per employee. Firms founded by workers displaced from Nokia are less likely to survive independently of the skills of their founders. There are no significant differences, however, in the other measures of firm performance that we study. When we focus exclusively on startups established by high-skilled individuals, the ones established by former Nokia employees seem to do slightly worse than other startups in the Finnish economy in terms of revenue and value-added per

[8] We classify as the Nokia core sector new firms that operate within the following sectors according to NACE-classification: 26 (manufacturing of computer, electronic and optical products), 61 (telecommunications), 62 (computer programming, consultancy and related activities) and 71 (architectural and engineering activities; technical testing and analysis).

worker; they do similarly in total value-added; and do slightly better in number of employees. As before, these differences are not statistically significant. In sum, our analysis indicates that there is no clear pattern of a positive or negative association between the skill level of entrepreneurs and business success.[9]

We conclude this section by studying whether workers displaced from Nokia established a few exceptionally (un)successful businesses that stand out from those in our comparison groups. To study this, in Figure VII, we plot the distributions of log revenue, log valued added, and number of employees for the three groups of firms that we study: those founded by workers displaced from Nokia, those founded by workers displaced from other firms, and those founded in Finland at the same time as the mass layoff negotiations that affected Nokia took place. We plot these distributions eight years after the establishment of the new firms—i.e., the last year in which we observe them in the data. The distributions of these three variables are very similar for all groups. Some of the firms founded by former Nokia workers do grow to be much bigger than the average values presented in Figure VI, but so do some of the new firms in our comparison groups. In terms of employees, less than 3% of the firms in each of these groups had more than 40 workers eight years after their establishment. Therefore, former Nokia workers do not seem to have established more firms with a large growth potential compared to either of the comparison groups. Overall, the start-ups of former Nokia workers perform similarly well compared to those established by the other displaced workers and by the average Finnish entrepreneur.

In summary, the results of this section suggest that the financial support offered by Nokia to its displaced workers increased the number of entrepreneurs and startups in the economy. Despite increasing the number of entrepreneurs—something that could have reduced their entrepreneurial quality—the startups established by former Nokia workers perform similarly well compared to those established by workers displaced from other firms and by the average entrepreneur in Finland regarding revenue, employees, and productivity. This result suggests that supporting displaced workers in establishing startups could help to attenuate the consequences of the negative labor market

[9]Note that all the analyses in columns (2) to (5) of Tables V and VI focus only on firms that we observe in our data eight years after their establishment. In Online Appendix C.5, we present an alternative version of the results in which we replace these outcomes with dummy variables that indicate whether a firm is in the top 25% of each performance measure. By defining these variables as zero for non-surviving firms, we run these regressions including all the firms in our sample. The results are qualitatively similar to the ones we present here.

shock for at least some of them. Encouraging entrepreneurship was not enough to compensate for the average income losses experienced by workers displaced from Nokia, but it helped some of these workers—especially the high-skilled ones—to find a new productive activity that also generated new jobs in the economy.

7 Conclusions

Superstar firms are not guaranteed to be successful forever. Innovations by competitors, poor management, and other shocks could result in their collapse—Blockbuster, Kodak, and Yahoo are iconic examples of this phenomenon. Despite the relevance of these firms, we still have little evidence of the consequences of their decline for the displaced workers and for the economy. In this paper, we exploit rich administrative data from Finland to study how the decline of Nokia–the global leader in the mobile phone industry until 2009–affected its displaced workers and the creation of new businesses.

Workers displaced from Nokia, independently of their skill level, struggled to transition into new jobs. Both low- and high-skilled workers displaced from Nokia were significantly less likely to find a new job following mass layoffs than similar workers displaced from other firms. However, these lower re-employment rates only translated into higher unemployment for low-skilled workers. High-skilled workers displaced from Nokia compensated for the lower re-employment rates by establishing their own businesses. Although starting a new business helped some of these high-skilled workers to avoid unemployment, they still experienced larger income losses after mass layoffs than high-skilled workers displaced from other firms.

Thus, these results suggest that while the experience and support offered by Nokia to its displaced workers did not give them a significant advantage in the labor market, it enabled some of them—especially those who are highly educated—to become entrepreneurs. Indeed, while more than 9% of high-skilled workers displaced from Nokia established a startup, less than 4% of high-skilled workers displaced from other firms did so. The generous severance payments and the startup grant offered by Nokia via the Bridge program seem to play an important role in explaining these differences in entrepreneurial activity.

Interestingly, the larger number of startups established by former Nokia employees does not seem to have dramatically affected their quality. We compare the startups established by workers displaced from Nokia with those established by workers displaced from other firms and with all startups established in Finland around the same time. We find a small difference in survival rates, but no significant differences in revenue, value added, number of employees, or equity eight years after their foundation. This result suggests that although encouraging entrepreneurship was not enough to compensate for the income losses experienced by workers displaced from Nokia, it helped some of these workers to engage in a new productive activity that also generated new jobs for the economy.

Is it worth encouraging displaced workers to start new businesses through startup grants? To shed some light on this question, we conduct a simple back-of-the-envelope calculation using our empirical estimates. According to Nokia, the total cost of the Bridge Program start-up grants in Finland was EUR 10.6 million. According to our estimates, the program increased entrepreneurship among high-skilled workers by 2 percentage-points relative to displaced workers from other firms. This implies that approximately 60 startups were created due to the program. Therefore, the cost of an additional firm was approximately 177,000 euros. These firms also generated new jobs. Since many of the new firms did not survive their first eight years, not all of these jobs are permanent. Combining our results on firms' survival rates and the number of employees, we can compute the total number of new months of employment created by these firms. For instance, in their first year, all the firms are active and have, on average, 1.2 employees. In their eighth year, only 40% of the firms are active and have, on average, 4.2 employees. Thus, while in the first year, the program generated 864 additional months of employment—i.e., $12 \times 1.2 \times 60 \times 1$—in the eighth year, it generated 1,200 additional months of employment—i.e., $12 \times 4.2 \times 60 \times 0.4$. In their first eight years, the additional firms established because of the Bridge program created 9,332 months of employment. Thus, each additional month of employment generated by Bridge cost EUR 1,136. Whether this makes the Bridge grants expensive or not depend on what the workers employed by these firms would have earned elsewhere, and on the effects that these additional months of employment had on the use of unemployment benefits among these workers.

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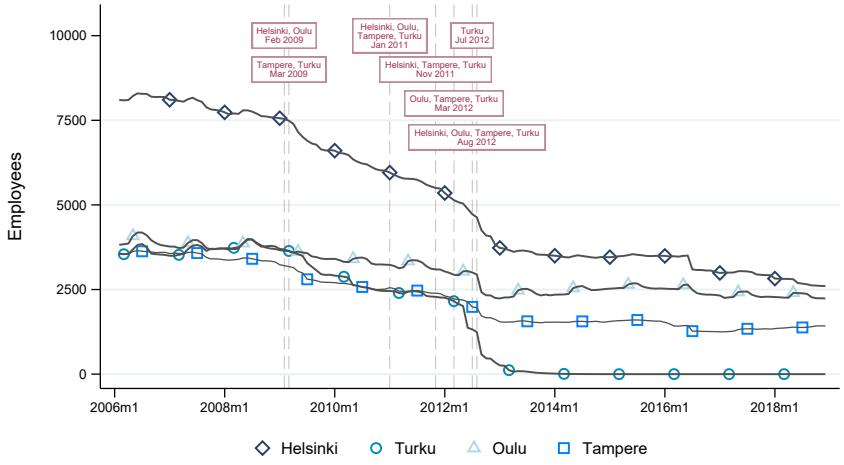
Figure I: Evolution of Nokia stock price and the number of employees in Finland, 2005–2019

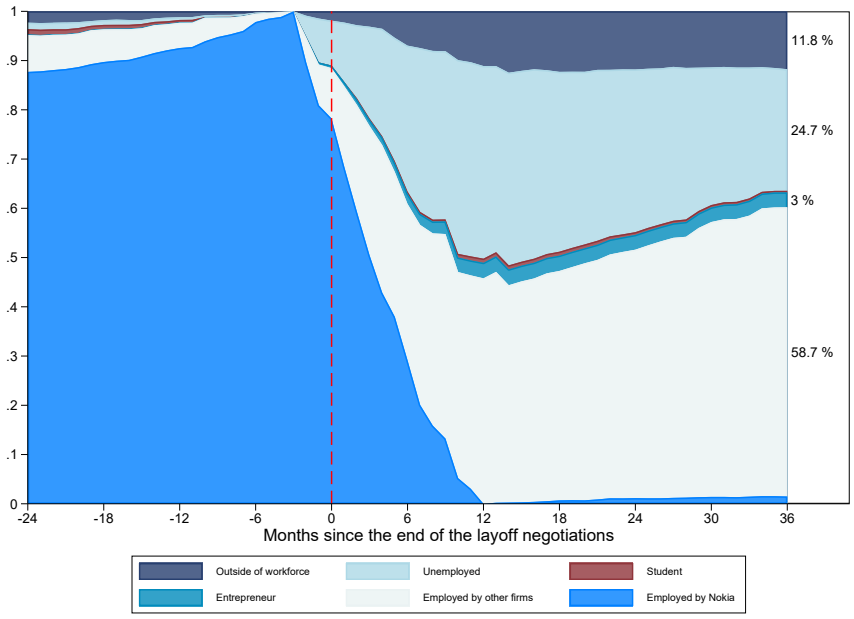
(a) Nokia stock price and the number of employees in Finland



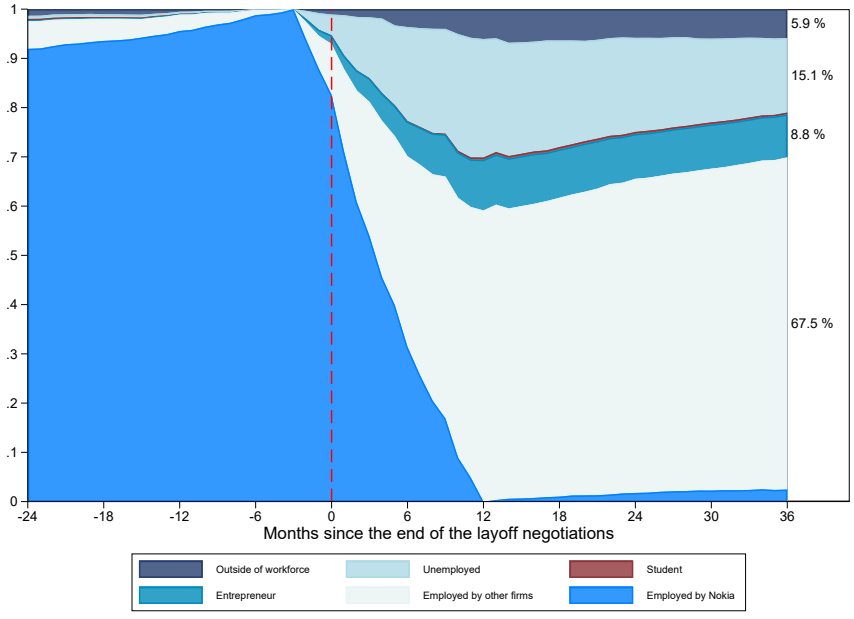
(b) Nokia employees affected by layoff negotiations in Finland

Notes: Panel (a) of the figure illustrates the evolution of the Nokia stock price in USD (left-hand side axis) and its number of workers in Finland (right-hand side axis) in 2005–2019. Red boxes highlight important events that affected Nokia: The launch of iPhone and Android operating system in June 2007 and September 2008, and Nokia adopting Windows Phone operating system and eventually selling its mobile phone operations to Microsoft in February 2011 and September 2013, respectively. The graph shows the rapid decline of Nokia's stock market valuation and its number of employees after the rapid development of smart phones by Nokia's competitors. Panel (b) of the figure illustrates the number of Nokia employees in Finland affected by layoff negotiations in the same period. Red boxes highlight the seven layoff negotiations that we consider in the analysis: Layoffs in Helsinki and Oulu regions in February 2009; Tampere and Turku in March 2009; Helsinki, Oulu, Tampere and Turku in January 2011; Helsinki, Tampere and Turku in November 2011, Oulu, Tampere and Turku in March 2012; Turku in July 2012; Helsinki, Oulu, Tampere and Turku in August 2012.

Figure II: Labor market trajectories of low- and high-skilled workers displaced from Nokia



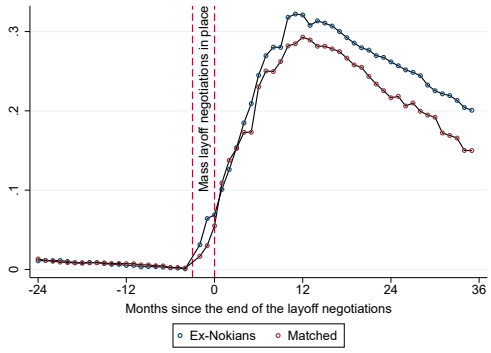
(a) Low-skilled workers



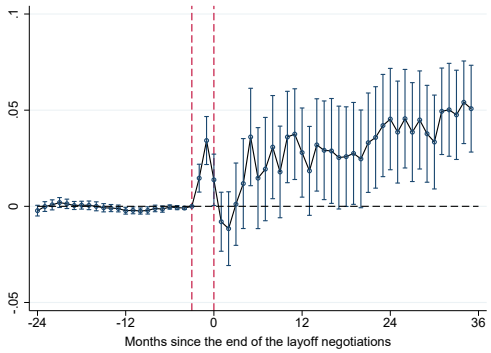
(b) High-skilled workers

Notes: The figure illustrates the labor market trajectories of individuals who were working for Nokia three months before a mass layoffs negotiation started and who were laid off from Nokia in the 12 months following the end of a mass layoff negotiation. Panel (a) focuses on low-skilled workers and Panel (b) on high-skilled workers. High-skilled workers correspond to individuals who completed some tertiary education degree; low-skilled workers correspond to the rest of the workers in our sample. We classify the labor market status of workers in six categories: outside of the workforce, unemployed, student, entrepreneur, employed by other firm than Nokia, and employed by Nokia. Online Appendix A discusses these definitions in detail.

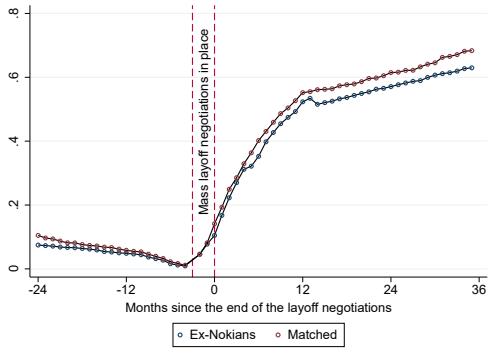
Figure III: Labor market trajectories of displaced workers



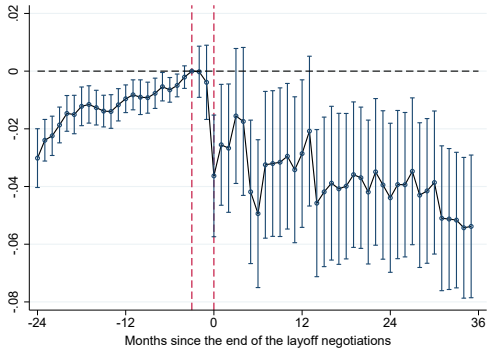
(a) Share unemployed



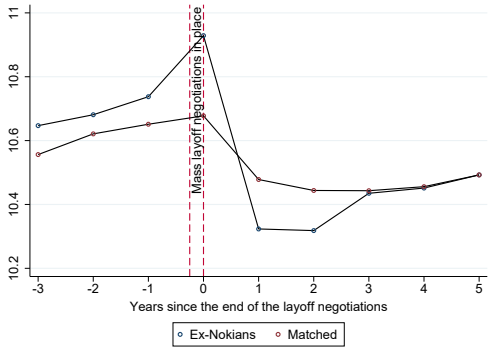
(b) Δ in share unemployed



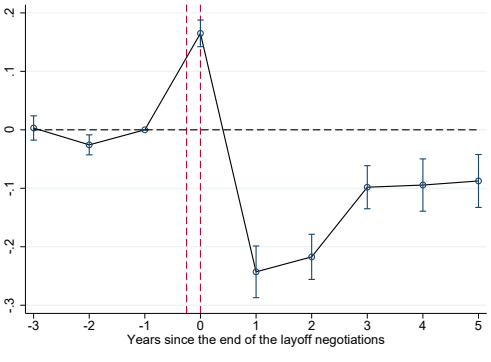
(c) Share working for another firm



(d) Δ in share working for another firm



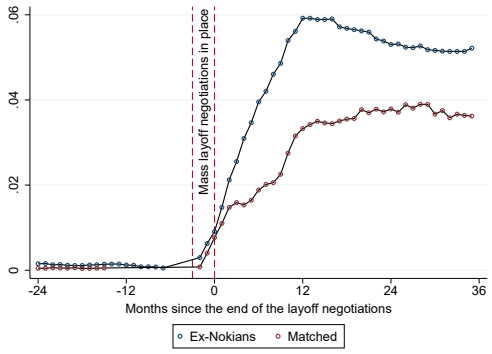
(e) Log Income



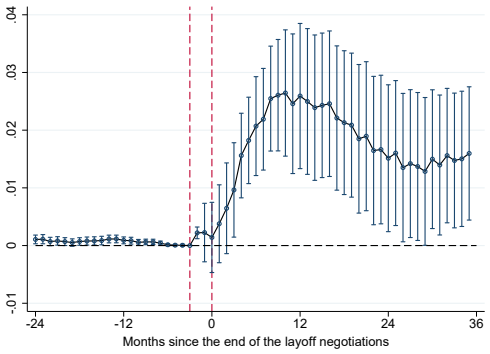
(f) Δ in Log Income

Notes: This figure illustrates the labor market trajectories of workers displaced from Nokia (Ex-Nokians) and of similar workers displaced from other firms around the same time (Matched). Panels in the left illustrate levels of unemployment (panel a), employment in a new firm (panel c), and log of total income (panel e) for each group of displaced workers. Panels in the right illustrate instead the difference in these levels. More specifically, they illustrate the δ_t coefficients and 95% confidence intervals obtained from estimating specification $Y_{it} = \beta Nokia_i + \sum_{t=\tau_0}^{\tau_T} (\delta_t \times Nokia_i) + \mu_i + \mu_t + \varepsilon_{it}$. We observe unemployment and employment relationships at the monthly level between 24 months before and 36 months after the end of a mass layoff negotiation. Thus, in panels (b) and (d) τ_0 is -24 and τ_T is 36. We observe total income for a longer period, but only at the annual level. Thus, in panel (f) τ_0 is -3 and τ_T is 5. Standard errors are clustered at the CEM-matching strata level. Online Appendix Figure B.I replicates theses results independently for low- and high-skilled workers.

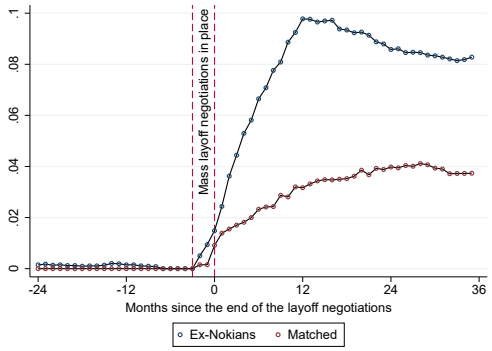
Figure IV: Entrepreneurship among displaced workers



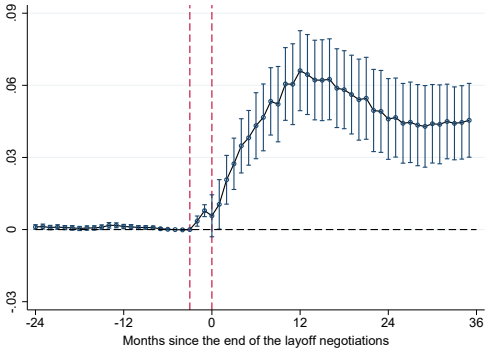
(a) Share of entrepreneurs



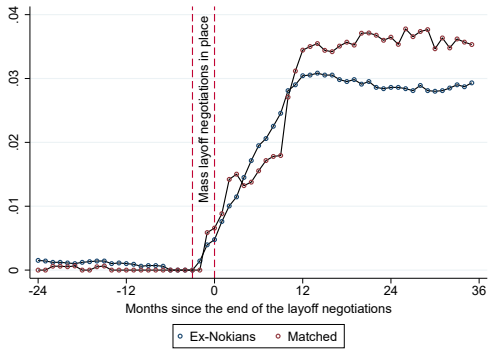
(b) Δ in share of entrepreneurs



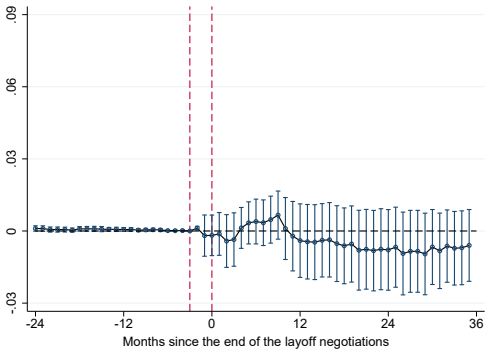
(c) Share of entrepreneurs (high-skilled)



(d) Δ in share of entrepreneurs (high-skilled)



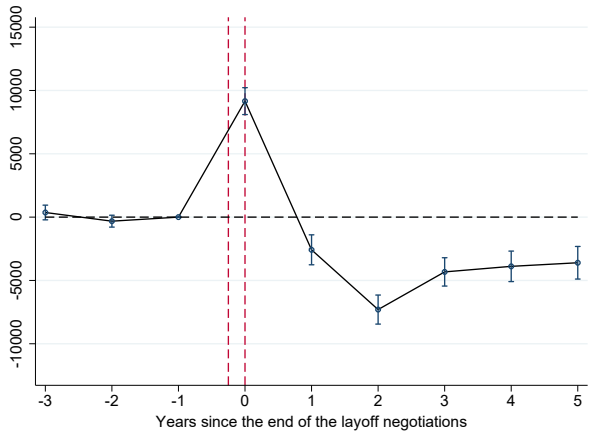
(e) Sh. of entrepreneurs (low-skilled)



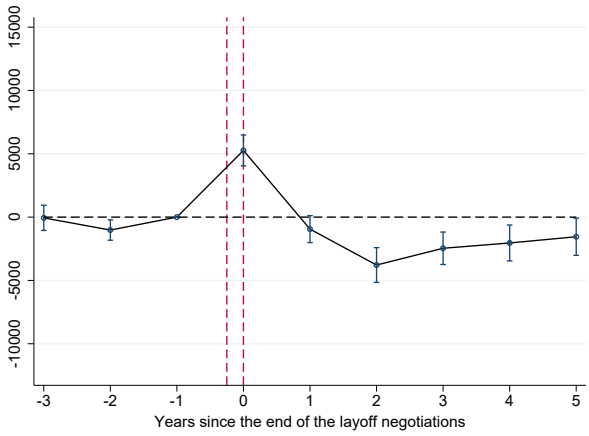
(f) Δ in share of entrepreneurs (low-skilled)

Notes: This figure illustrates the evolution of entrepreneurship among workers displaced from Nokia (Ex-Nokians) and among similar workers displaced from other firms around the same time (Matched). Panels in the left illustrate levels of entrepreneurship, while panels in the right illustrate the difference in these levels. Panels (a) and (b) study what happens in the full sample of displaced workers, panels (c) and (d) focus on high-skilled workers, and panels (e) and (f) focus on low-skilled workers. The figures in the right illustrate the δ_t coefficients and 95% confidence intervals obtained from estimating specification $Y_{it} = \beta Nokia_i + \sum_{t=-24}^{36} (\delta_t \times Nokia_i) + \mu_i + \mu_t + \varepsilon_{it}$. Standard errors are clustered at the CEM-matching strata level.

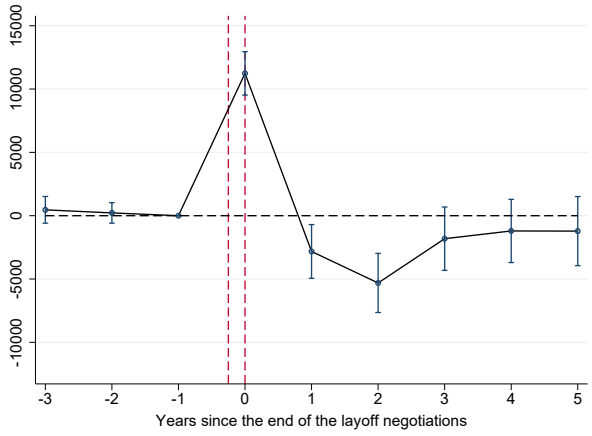
Figure V: Evolution of total annual income by tenure of displaced workers



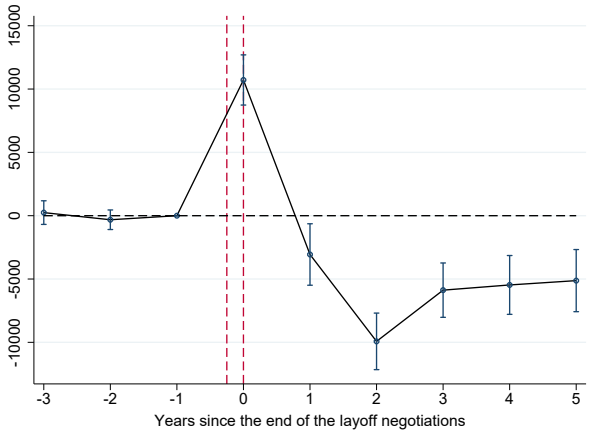
(a) All tenure groups



(b) Less than 5 years of tenure



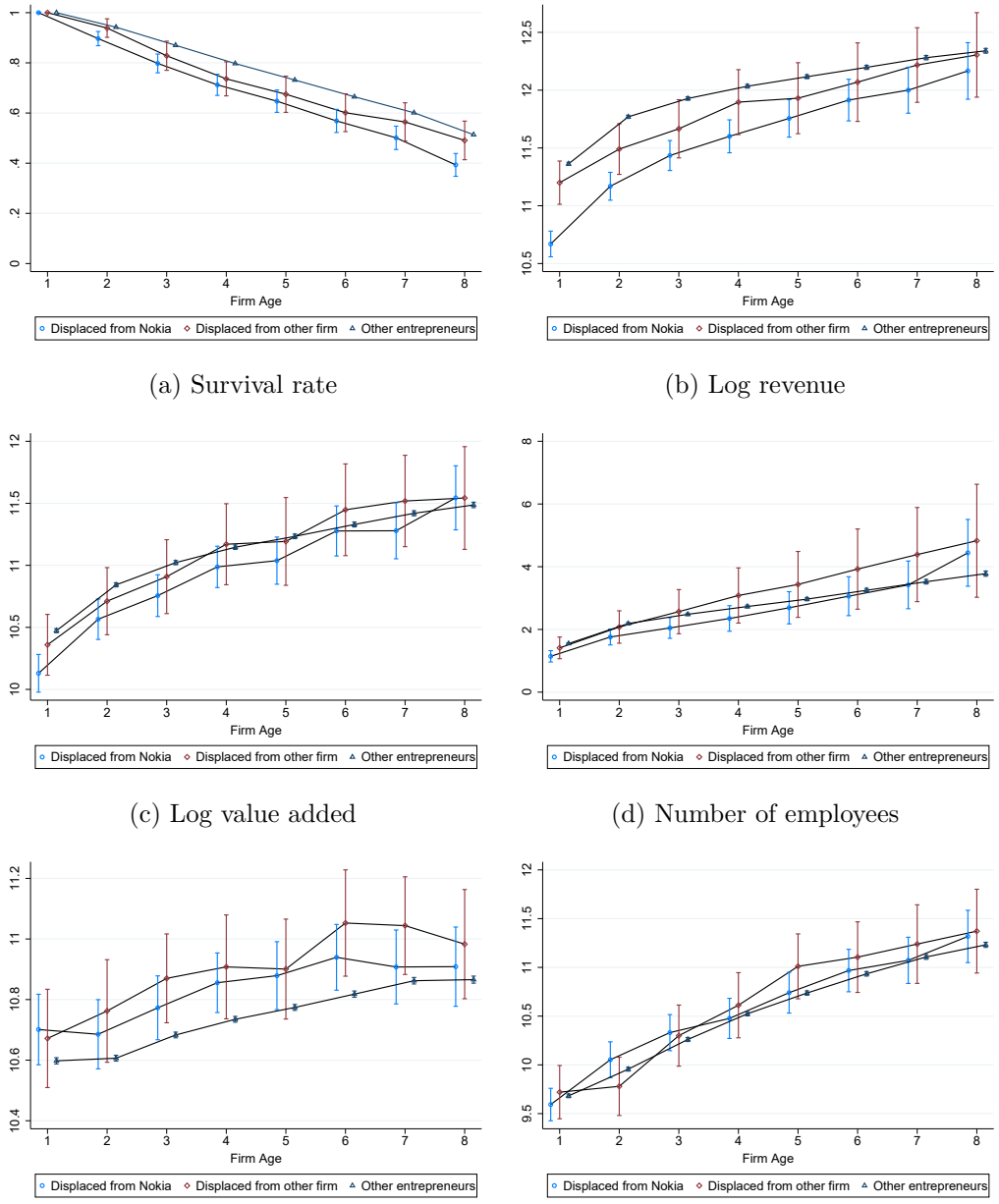
(c) 5-10 years of tenure



(d) Over 10 years of tenure

Notes: This figure illustrates differences in the evolution of total annual income in euros between workers displaced from Nokia and benchmark workers displaced from other firms at the same time. Each panel focus on a different sample of workers. Panel (a) illustrate these differences for all the displaced workers in our sample. Panels (b) to (d) focus on different subsamples defined by workers' tenure levels before the layoffs. Panel (b) focuses on workers with less than 5 years of tenure, panel (c) on workers with between 5 and 10 years of tenure, and panel (d) on workers with more than 10 years of tenure. Each graph plots δ_t coefficients and 95% confidence intervals obtained from estimating specification $Y_{it} = \beta Nokia_i + \sum_{t=-3}^{5} (\delta_t \times Nokia_i) + \mu_i + \mu_t + \varepsilon_{it}$ on the different samples of displaced workers studied in this figure. Standard errors are clustered at the CEM-matching strata level.

Figure VI: Performance of startups founded by workers displaced from Nokia and similar workers displaced from other firms, and all other star-ups founded in Finland



(a) Survival rate

(b) Log revenue

(c) Log value added

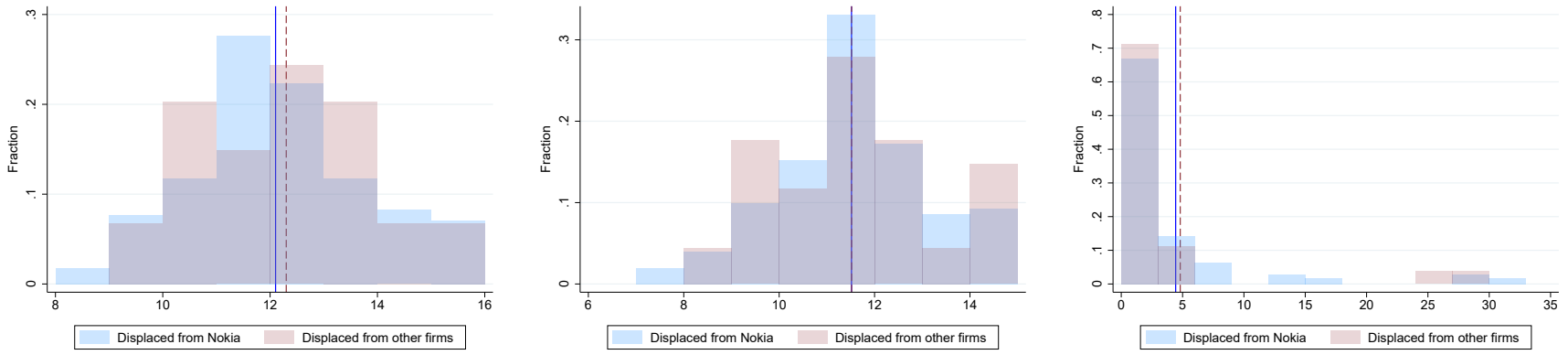
(d) Number of employees

(e) Log value added per employee

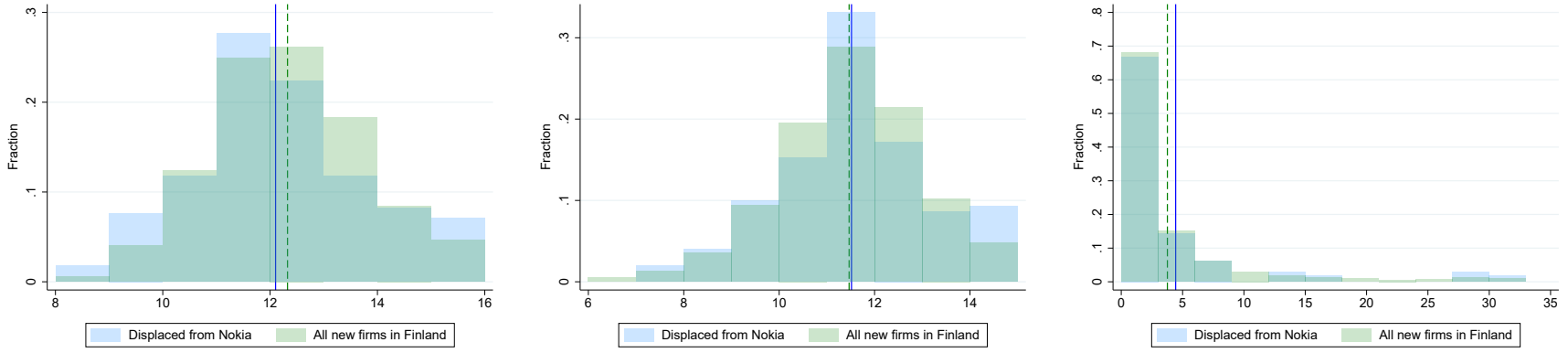
(f) Log equity

Notes: This figure plots the evolution of different measures of startups performance over their first 8 financial years. It distinguishes between three groups of firms: firms founded by workers displaced from Nokia, firms founded by similar workers displaced from other firms, and all other firms founded in Finland around the same time. Panel (a) illustrates cumulative firm survival rates, panel (b) log revenue, panel (c) log value-added, panel (d) number of employees, panel (e) log value-added per employee, and panel (f) log equity of the firm. Outcomes in panels (b) to (f) are only plotted for the subset of firms surviving in each period.

Figure VII: Distributions of firm performance measures



(a) Log-revenue (b) Log value-added (c) Number of employees



(d) Log-revenue (e) Log value-added (f) Number of employees

Notes: The figure illustrates the distributions of three measures of startups' performance eight years after their establishment. Panels at the top distinguish between startups founded by workers displaced from Nokia (blue bars) and by similar workers displaced from other firms (red bars), while panels on the bottom distinguish between startups founded by workers displaced from Nokia (blue bars) and all new startups founded in Finland around the same time (green bars). Panels (a) and (d) illustrate log revenues, panels (b) and (e) log value-added, and panels (c) and (f) the number of employees. The blue solid line, and the red and green dashed lines illustrate the mean of each variable for startups created by workers displaced from Nokia, and by entrepreneurs in our comparison groups.

Table I: Summary statistics

	Unmatched sample				CEM-matched sample	
	Workers staying at Nokia (1)	Workers displaced from Nokia (2)	Workers displaced from other firms (3)	All workers in Finland (2008-2012) (4)	Matched workers displaced from Nokia (5)	Matched workers displaced from other firms (6)
A. Demographic characteristics						
Age	40.40	39.50	41.25	39.48	39.43	39.77
Married	0.62	0.54	0.46	0.43	0.52	0.52
Number of Children	1.68	1.56	1.52	1.41	1.54	1.59
Native	0.93	0.92	0.97	0.93	0.96	0.96
Male	0.70	0.57	0.63	0.56	0.58	0.58
B. Labor market outcomes						
Total income (EUR)	65,692	54,699	42,330	33,281	53,538	48,826
Market income (EUR)	63,874	52,531	39,362	28,454	51,368	46,125
Capital Income (EUR)	1,199	1,013	842	1,052	1,002	861
Disposable income (EUR)	45,466	39,045	31,455	26,125	38,352	35,615
Benefits (EUR)	1,357	2,127	3,000	3,515	2,131	2,589
Tenure	11.47	10.38	9.17	6.42	10.17	9.96
C. Education						
Tertiary or above	0.61	0.46	0.23	0.20	0.43	0.43
Secondary degree	0.32	0.43	0.61	0.60	0.45	0.45
No degree	0.07	0.11	0.16	0.21	0.12	0.12
Engineering	0.32	0.27	0.36	0.24	0.29	0.29
Business, Admin. or Law	0.14	0.16	0.16	0.13	0.18	0.18
ICT	0.32	0.22	0.05	0.03	0.17	0.17
D. Region						
Helsinki	0.40	0.25	0.30	0.32	0.28	0.28
Oulu	0.25	0.12	0.08	0.07	0.11	0.11
Turku	0.09	0.42	0.10	0.09	0.43	0.43
Tampere	0.22	0.17	0.09	0.09	0.15	0.15
Unique individuals	16,178	11,837	20,879	2,546,540	9736	12,521
Observations	42,394	21,328	21,725	2,546,540	17,200	13,063

Notes: This table provides summary statistics for Nokia workers and other workers in Finland. Columns (1)–(4) focus on unmatched samples of workers who remained in Nokia after the layoff negotiations (column 1), who left Nokia after the layoff negotiations (column 2), who left other firms whose layoff negotiations took place within 2 months of a Nokia layoff negotiation (column 3), and all individuals who had employment spells between 2008–2012 in Finland (column 4). Columns (5) and (6) present summary statistics for our estimation sample, which consists of a CEM-matched group of workers displaced from Nokia and a benchmark group of workers displaced from other firms with similar characteristics as the former Nokia workers. The CEM-matching variables include gender, age, native and civil status, education (level, field, and high school diploma), tenure quartiles, and region of employment. The monthly statistics for the displaced workers are measured 12 months before the end of the layoff negotiations. Demographics, education, and income statistics reflect the individuals' annual information for the year preceding the end of the layoff negotiations, and tenure and region of employment are based on information collected three months before the end of the layoff negotiations, aligning with the timeline when individuals were observed working in a firm that was facing layoffs. The variables are described in detail in Online Appendix A.

Table II: Summary statistics - Entrepreneurs

	Entrepreneurs displaced from Nokia (1)	Entrepreneurs displaced from other firms (2)	All Entrepreneurs in Finland (3)
A. Demographic characteristics			
Age	39.95	36.90	38.93
Married	0.72	0.68	0.52
Children	1.99	1.79	1.75
Native	0.95	0.87	0.89
Male	0.84	0.89	0.70
B. Labor market outcomes			
Market income (EUR)	77,514	57,757	34,728
Disposable income (EUR)	54,562	44,274	34,369
Tenure	10.78	8.71	5.94
C. Education			
Tertiary or above	0.75	0.49	0.27
Secondary degree	0.19	0.42	0.53
No obesrved degree	0.06	0.08	0.20
Engineering	0.40	0.36	0.24
Bus., Admin or Law	0.12	0.06	0.16
ICT	0.24	0.23	0.04
D. Region			
Helsinki	0.40	0.28	0.33
Oulu	0.22	0.06	0.07
Turku	0.16	0.50	0.09
Tampere	0.20	0.16	0.09
Observations	882	232	86,910

Notes: This table presents summary statistics for different samples of entrepreneurs. Columns (1) and (2) focus on individuals in our matched sample of displaced workers who start a firm after leaving Nokia (column 1) or after leaving another firm (column 2). These samples include individuals leaving their firms after layoff negotiations and who appear as a (co-)founder of a newly established firm in the 12 months that follow the end of the layoff negotiation. Column (3) provides summary statistics for all entrepreneurs starting a firm at the same time as displaced workers in Finland. The monthly statistics for the displaced workers are measured 12 months before the end of the layoff negotiations. Demographics, education, and income statistics reflect the individuals' annual information for the year preceding the end of the layoff negotiations, and tenure and region of employment are based on information collected three months before the end of the layoff negotiations, aligning with the timeline when individuals were observed working in a firm that was facing layoffs. The variables are described in detail in Online Appendix A.

Table III: Layoffs and labor market trajectories of workers displaced from Nokia

	Outside the labor = 1 (1)	Unemployed force = 1 (2)	Employed = 1 (3)	Entrepreneur = 1 (4)	Log total income (5)
			A. All displaced workers		
Nokia	-0.004	-0.006	0.007	0.004	0.152***
	(0.011)	(0.012)	(0.015)	(0.006)	(0.041)
Post	0.084***	0.209***	-0.323***	0.031***	-0.111***
	(0.008)	(0.012)	(0.017)	(0.004)	(0.021)
Nokia × Post	-0.013*	0.029**	-0.033***	0.017***	-0.088***
	(0.005)	(0.010)	(0.010)	(0.005)	(0.014)
Observations	1,846,043	1,846,043	1,846,043	1,846,043	270,960
Outcome mean	0.015	0.012	0.971	0.002	10.688
			B. Low-skilled workers		
Nokia	-0.026	-0.003	0.011	0.018**	0.093
	(0.022)	(0.025)	(0.028)	(0.006)	(0.064)
Post	0.100***	0.254***	-0.384***	0.029***	-0.142***
	(0.011)	(0.016)	(0.023)	(0.006)	(0.029)
Nokia × Post	-0.011	0.038**	-0.022	-0.005	-0.064***
	(0.007)	(0.012)	(0.012)	(0.006)	(0.015)
Observations	1,191,696	1,191,696	1,191,696	1,191,696	174,721
Outcome mean	0.019	0.016	0.964	0.001	10.45
			C. High-skilled workers		
Nokia	0.013	0.018	-0.028	-0.003	0.108
	(0.024)	(0.021)	(0.032)	(0.011)	(0.072)
Post	0.062***	0.147***	-0.241***	0.032***	-0.069*
	(0.010)	(0.015)	(0.019)	(0.005)	(0.029)
Nokia × Post	-0.016	0.017	-0.048**	0.047***	-0.119***
	(0.008)	(0.016)	(0.016)	(0.007)	(0.027)
Observations	654,347	654,347	654,347	654,347	96,239
Outcome mean	0.009	0.007	0.982	0.002	11.01

Notes: The table reports the coefficients β_1, β_2 and β_3 from the difference-in-differences specification $Y_{it} = \beta_0 + \beta_1 Nokia_i + \beta_2 Post_{it} + \beta_3 Nokia_i \times Post_t + \mu_i + \varepsilon_{it}$. $Nokia_i$ is an indicator that takes value 1 if individual i worked for Nokia before the mass layoffs took place; $Post_t$ is an indicator that takes value 1 if the period t is a post mass layoff period; μ_i is an individual fixed effect. Standard errors clustered at the CEM-matching strata level are presented in parentheses. The coefficient β_3 captures the differential effect that mass layoff negotiations had for Nokia workers relative to displaced workers in the benchmark group. Columns (1) to (4) focus on changes in workers' employment status. Column (1) studies labor force participation, column (2) unemployment, column (3) employment, and column (4) entrepreneurship. Column (5) studies changes in total income. The results in Panel A look at all displaced workers, Panel B at low-skill workers, and Panel C at high-skill workers. Outcome means correspond to the mean of the outcome for workers displaced from Nokia before the layoff negotiations take place.

Table IV: Layoffs and labor market trajectories of workers displaced from Nokia before vs. after Bridge program

	Outside the labor = 1 (1)	Unemployed force = 1 (2)	Employed = 1 (3)	Entrepreneur = 1 (4)	Log total income (5)
		A. All displaced workers			
Nokia × Post	0.008	-0.027*	-0.001	0.020**	-0.096***
	(0.008)	(0.012)	(0.015)	(0.006)	(0.027)
Nokia × Post × Bridge	-0.021*	0.078***	-0.056**	-0.000	-0.029
	(0.009)	(0.019)	(0.021)	(0.009)	(0.029)
Observations	1,846,043	1,846,043	1,846,043	1,846,043	270,960
Outcome mean	0.015	0.012	0.971	0.001	10.69
		B. Low-skilled workers			
Nokia × Post	0.025*	-0.016	-0.013	0.003	-0.097***
	(0.011)	(0.015)	(0.020)	(0.008)	(0.028)
Nokia × Post × Bridge	-0.032*	0.072***	-0.033	-0.007	-0.009
	(0.014)	(0.021)	(0.026)	(0.011)	(0.039)
Observations	1,191,696	1,191,696	1,191,696	1,191,696	174,721
Outcome mean	0.020	0.016	0.964	0.001	10.45
		C. High-skilled workers			
Nokia × Post	0.000	-0.018	-0.017	0.035***	-0.110**
	(0.009)	(0.021)	(0.023)	(0.008)	(0.039)
Nokia × Post × Bridge	-0.024*	0.051	-0.046	0.019	-0.038
	(0.011)	(0.034)	(0.034)	(0.014)	(0.044)
Observations	654,347	654,347	654,347	654,347	96,239
Outcome mean	0.009	0.007	0.982	0.002	11.01

Notes: The table reports coefficients β_5 and β_7 from the triple-difference specification $Y_{it} = \beta_0 + \beta_1 Nokia_i + \beta_2 Bridge_i + \beta_3 Post_t + \beta_4 Nokia_i \times Bridge_i + \beta_5 Nokia_i \times Post_t + \beta_6 Bridge_i \times Post_t + \beta_7 Nokia_i \times Bridge_i \times Post_t + \mu_i + \varepsilon_{it}$. $Nokia_i$ is an indicator that takes value 1 if individual i worked for Nokia before the mass layoffs took place; $Post_t$ is an indicator that takes value 1 if the period t is a post mass layoff period; $Bridge_i$ is an indicator that takes value 1 if individual i was displaced once the Bridge program was already in place; μ_i is an individual fixed effect. Standard errors clustered at the CEM-matching strata level are presented in parentheses. The coefficient β_7 captures the differential effect that mass layoff negotiations had for Nokia workers relative to displaced workers in the benchmark group after the Bridge program was implemented. Columns (1) to (4) focus on changes in workers' employment status. Column (1) studies labor force participation, column (2) unemployment, column (3) employment, and column (4) entrepreneurship. Column (5) studies changes in total income. The results in Panel A look at all displaced workers, Panel B at low-skill workers, and Panel C at high-skill workers. Outcome means correspond to the mean of the outcome for workers displaced from Nokia before the layoff negotiations take place.

Table V: Performance of start-ups founded by workers displaced from Nokia and from other firms

	Survived = 1 (1)	Log Revenue (2)	Log value added (3)	Number of employees (4)	Log value added per employee (5)
	A. Heterogeneity by Bridge availability				
Nokia = 1	0.006	-0.036	-0.022	-0.857	-0.082
	(0.061)	(0.293)	(0.323)	(1.250)	(0.141)
Bridge = 1	-0.029	0.403	0.162	0.706	-0.223
	(0.085)	(0.440)	(0.486)	(2.090)	(0.229)
Nokia × Bridge	-0.157	-0.588	-0.218	-0.031	0.069
	(0.097)	(0.465)	(0.513)	(2.240)	(0.252)
Observations	608	244	219	255	218
Outcome mean	0.500	12.193	11.457	4.622	11.055
	B. Heterogeneity by startup industry				
Nokia = 1	-0.169^{***}	-0.336	-0.200	-1.990	-0.075
	(0.047)	(0.270)	(0.291)	(1.230)	(0.144)
Nokia core industry = 1	0.565^{***}	-0.192	0.112	-0.893	0.064
	(0.041)	(0.533)	(0.587)	(2.117)	(0.221)
Nokia × Nokia core industry	0.169^{***}	0.294	0.164	3.247	0.007
	(0.047)	(0.604)	(0.657)	(2.394)	(0.266)
Observations	608	244	219	255	218
Outcome mean	0.435	12.366	11.510	5.157	10.953
	C. Heterogeneity by startup founder skills				
Nokia = 1	-0.127	-0.514	-0.137	-0.930	-0.057
	(0.074)	(0.419)	(0.380)	(1.763)	(0.170)
High-skill founder = 1	-0.080	-0.230	-0.164	-0.568	-0.176
	(0.078)	(0.373)	(0.444)	(1.797)	(0.202)
Nokia × High-skill founder	0.066	0.433	0.111	0.350	0.077
	(0.096)	(0.0527)	(0.539)	(2.214)	(0.252)
Observations	608	244	219	255	218
Outcome mean	0.531	12.421	11.578	5.137	11.045

Notes: This table studies how the performance of startups founded by workers displaced from Nokia and from other firms varies depending on whether the firm was founded before or after Bridge program was implemented (Panel A), whether the startups' industry coincides with Nokia's industry (Panel B), and whether at least one of the startups' founders was a high-skilled individual (Panel C). To study this heterogeneity, we rely on the following specification: $Y_{it} = \gamma_0 + \gamma_1 Nokia_i + \gamma_2 X_{it} + \gamma_3 Nokia_i \times X_i + \mu_t + \varepsilon_{it}$. $Nokia_i$ indicates whether the founders of startup i worked for Nokia before mass layoffs; X_i indicates whether Bridge was available when the founders of startup i were laid off in Panel A, whether startup i's industry coincides with Nokia's industry in Panel B, and whether at least one of the founders of startup i is a high-skilled individual in Panel C; μ_t is a calendar year fixed effect and is included in all regressions, except from the one presented in column (1). Standard errors clustered at the firm level are presented in parentheses. The outcomes correspond to different measures of startup performance observed eight years after their establishment. Column (1) focuses on the probability of surviving, column (2) on log revenue, column (3) on log value added, column (4) on the number of employees, and column (5) on log value-added per employee. Outcomes in columns (2) to (5) are only observed for surviving firms. Outcome means correspond to startup firms founded by displaced workers in the benchmark group before Bridge was established (Panel A), in industries that do not coincide with Nokia's industry (Panel B), and by low-skilled individuals (Panel C).

Table VI: Performance of startups founded by workers displaced from Nokia and all startups in Finland

	Survived = 1 (1)	Log Revenue (2)	Log value added (3)	Number of employees (4)	Log value added per employee (5)
	A. Heterogeneity by Bridge availability				
Nokia = 1	-0.061	0.046	0.252	0.826	0.133
	(0.038)	(0.173)	(0.174)	(0.716)	(0.087)
Bridge = 1	-0.104***	0.688***	0.602***	1.462***	-0.015
	(0.005)	(0.046)	(0.051)	(0.143)	(0.031)
Nokia × Bridge	-0.082	-0.441	-0.315	-0.136	-0.163
	(0.047)	(0.279)	(0.277)	(1.089)	(0.144)
Observations	37258	18262	16964	19243	16657
Outcome mean	0.567	12281	11414	3632	10850
	B. Heterogeneity by startup industry				
Nokia = 1	-0.230***	-0.275	-0.082	-0.377	0.040
	(0.023)	(0.178)	(0.171)	(0.571)	(0.095)
Nokia core industry	0.504***	-0.029	0.276***	0.837***	0.182***
	(0.003)	(0.041)	(0.043)	(0.179)	(0.021)
Nokia × Nokia core industry	0.230***	0.200	0.109	1.797	-0.111
	(0.023)	(0.281)	(0.280)	(1.137)	(0.144)
Observations	37258	18262	16964	19243	16657
Outcome mean	0.544	12.327	11.443	3.692	10.836
	C. Heterogeneity by startup founder skill				
Nokia = 1	-0.114*	-0.350	0.153	1.020	0.210
	(0.048)	(0.344)	(0.271)	(1.215)	(0.124)
High-skill founder = 1	0.000	-0.023	0.111***	0.250**	0.202***
	(0.005)	(0.024)	(0.025)	(0.092)	(0.014)
Nokia × High-skill founder	-0.014	0.210	-0.166	-0.523	-0.302*
	(0.055)	(0.374)	(0.314)	(1.358)	(0.150)
Observations	37258	18262	16964	19243	16657
Outcome mean	0.518	12.336	11.428	3.670	10.777

Notes: This table studies how the performance of startups founded by workers displaced from Nokia and all new startups in Finland varies depending on whether the firm was founded before or after Bridge program was implemented (Panel A), whether the startups' industry coincides with Nokia's industry (Panel B), and whether at least one of the startups' founders was a high-skilled individual (Panel C). To study this heterogeneity, we rely on the following specification: $Y_{it} = \gamma_0 + \gamma_1 Nokia_i + \gamma_2 X_{it} + \gamma_3 Nokia_i \times X_i + \mu_t + \varepsilon_{it}$. $Nokia_i$ indicates whether the founders of startup i worked for Nokia before mass layoffs; X_i indicates whether Bridge was available when the founders of startup i were laid off in Panel A, whether startup i's industry coincides with Nokia's industry in Panel B, and whether at least one of the founders of startup i is a high-skilled individual in Panel C; μ_t is a calendar year fixed effect and is included in all regressions, except from the one presented in column (1). Standard errors clustered at the firm level are presented in parentheses. The outcomes correspond to different measures of startup performance observed eight years after their establishment. Column (1) focuses on the probability of surviving, column (2) on log revenue, column (3) on log value added, column (4) on number of employees, and column (5) on log value-added per employee. Outcomes in columns (2) to (5) are only observed for surviving firms. Outcome means correspond to new startups in Finland founded before Bridge was established (Panel A), in industries that do not coincide with Nokia's industry (Panel B), and by low-skilled individuals (Panel C).

The Aftermath of a Superstar Firm Collapse: Labor Market Trajectories and Entrepreneurship following Nokia's Decline

Online Appendix

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Latest Version

Contents

A Definitions

A.1 Labor market status of displaced workers

Employed by other firms. We define a laid-off worker being employed by another firm after the layoffs if the person has an active employment spell based on the employment spell data, where we are able to identify the individual, the employer, and the starting and ending month of each employment spell.

Employed by Nokia. We define a laid-off worker being employed by Nokia after the layoffs if the person has an active employment spell based on the employment spell data and Nokia is defined as the employer in this data.

Entrepreneur. Entrepreneur status is based on data on new firm registrations and the founders of new firms. We can identify establishment dates of the new firms, which we use to define the first month of entrepreneurship. A firm is considered to be closed if the firm has not filed an annual report in that year. In that case, the potential entrepreneurship spell ends at the end of the year of last filed annual report.

Unemployed: We define an individual as unemployed if she/he has an active unemployment spell based on the unemployment spell data including information on the starting and ending dates of all unemployment spells. If we observe a simultaneous unemployment and employment spell, that individual is defined as employed. Similarly, in the case of simultaneous entrepreneurial status and unemployment spells the individuals are defined as entrepreneurs. In the Finnish system, individuals are allowed to work temporarily or part-time during an unemployment benefit spell, but earnings reduce the received unemployment benefits.

Student. We define an individual as a student after the layoffs if she/he is observed to be enrolled in an educational institute.

Outside of the labor force. We define individuals as outside of the labor force if we cannot assign them to any of the above labor market status definitions. This group includes those who are retired.

If we are unable to define a status based on spell or firm registry data, we define a person's labor market status in the following way: We assign a status based on a specific income source exceeding

70% of the annual taxable labor income. For example, if received unemployment benefits exceed 70% of annual taxable labor income, then that person is defined to be unemployed during the months in which we were unable to define any other status.

A.2 Variables

Total income. Total income is defined as the sum of taxable labor and capital income. Taxable labor income includes wages and salaries and received income transfers and benefits. All income information is observed at an annual level.[10]

Market income. Market income is defined as total income excluding income transfers and benefits.

Capital income. Capital income includes the capital income components of total income, such as rental income, capital gains, dividends and entrepreneurial income.

Disposable income. Disposable income is defined as total income minus taxes.

Received benefits. Received income transfers and benefits include all received income transfers and social benefits. The most common benefits in the data include unemployment benefits and means-tested housing allowances.

Age. Age is measured in years. In the CEM-matching procedure, we use four age groups: 0–31, 32–39, 40–49 and 50 and over. These cutoffs are based on the 25th, 50th and 75th percentiles in the data, respectively.

Marital status. Marital status (married/not married) is based on the information from Statistics Finland, and reflects the situation at the end of each year.

Number of children. Number of children is based on the information from Statistics Finland. The number of children reflects the situation at the end of the year.

Gender. Statistics Finland classifies gender into two categories, males and females. This information is registered at the end of the calendar year.

Immigration status. Native status is based on information of the country of birth from Statistics Finland. Natives are defined as those with Finland as their country of birth.

Tenure. Tenure of the displaced worker is computed from data on employment spells, and mea-

[10] All income variables are winsorized at the 1% level in the population and inflation-adjusted to year 2021 euros.

sures the time worked in the firm before displacement. We match the displaced workers based on four tenure groups, where the cutoffs are 726, 2416 and 5250 days based on the 25th, 50th and 75th percentiles points in the data, respectively.

Graduation from high school. High-school graduation indicates whether an individual has graduated from high school (in secondary education).

Education level. Education level indicates the level of education of the individual at the end of the year. In the matching procedure, we group education into four categories: no secondary education degree, secondary education, tertiary education and doctoral degree. We include those with a missing education information in the data in the first group with no secondary degree.

High-skilled and low-skilled workers. We define those with tertiary education or a doctoral degree as a high-skilled worker, and others as low-skilled workers.

Field of education. Field of education is based on the ISCED 2011 (International Standard Classification of Education) classification. We use 1-digit level classification to define individuals with a degree in the following fields: Business administration (04, Business, administration and law), ICT (06, Information and Communication Technologies), and Engineering (07, Engineering, manufacturing and construction) and others.

Region of residence. Region is recorded at the NUTS 3-level and is based on the information of residence at the end of the calendar year. There are 19 NUTS 3 -level regions in Finland.

Occupation. The occupation of a worker is based on 3-digit International Standard Classification of Occupations (ISCO) used by Statistics Finland. This information is used to conduct a heterogeneity analysis by occupation groups described in more detail in Appendix B.

Firm survival. Firm survival measures the time a firm is observed to be operational based on annual reporting data. Survival is based on the time between firm's first and last observed annual report. A firm is considered to be in operation as long as the firm has filed an annual tax report.

Revenue. Firm revenue is comprised of sales of products and services. Discounts, value-added tax and other direct taxes based on sales volume are deducted from revenue.

Value added. Firm value added is defined as revenue minus costs and personnel expenses (wages and salaries).

Number of employees. The number of employees of a firm is defined as the number of full-time equivalent personnel in the firm, measured at the end of each year.

Value added per worker. Value added per worker is defined as value added divided by the number of workers, and is used as a measure of firm productivity.

Equity. Firm-level equity contains all equity items in total, including retained earnings and capital assets invested in the firm.

Nokia core sector. We define the sector of the firm based on the NACE-classification used by Statistics Finland. We classify as the Nokia core sector new firms that operate within the following sectors: 26 (manufacturing of computer, electronic and optical products), 61 (telecommunications), 62 (computer programming, consultancy and related activities) and 71 (architectural and engineering activities; technical testing and analysis).

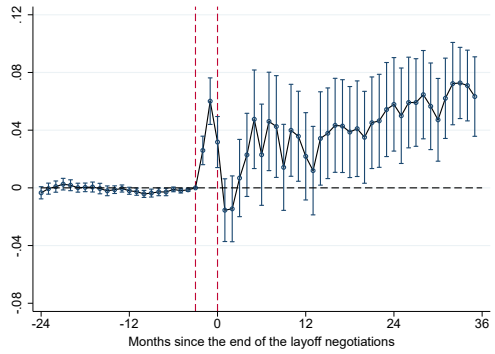
B Heterogeneity

B.1 Education level and the Bridge program

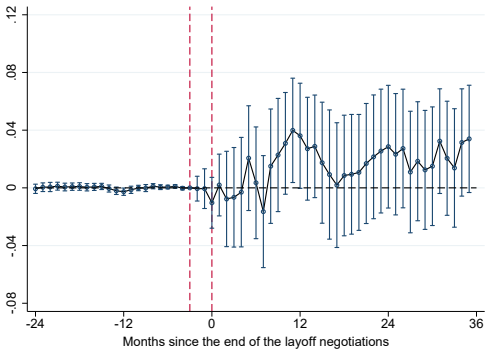
Figure B.I shows the differences in labor market trajectories of former Nokia workers and the comparison group of the matched displaced workers from other firms by skill level. The figure shows that both low and high-skilled Nokia workers faced similar challenges in recovering from the layoffs. Both of these groups were more likely to be unemployed and less likely to be employed by other firms after the layoffs than other similar workers displaced from other firms. Additionally, the income shocks after displacement relative to the other displaced workers are of similar magnitude and around 10% after 3–5 years since the Nokia layoffs for both skill groups.

Figure B.II shows the differences in the likelihood of entrepreneurship between former Nokia workers and the matched group of other displaced workers divided between high- and low-skilled workers and by the period before and after the implementation of the Bridge program. The figure shows that the likelihood of entrepreneurship increased after the implementation of the Bridge program among the high-skilled (left-hand side graph), but there is no observable change in entrepreneurship among low-skilled former Nokia workers (right-hand side graph.)

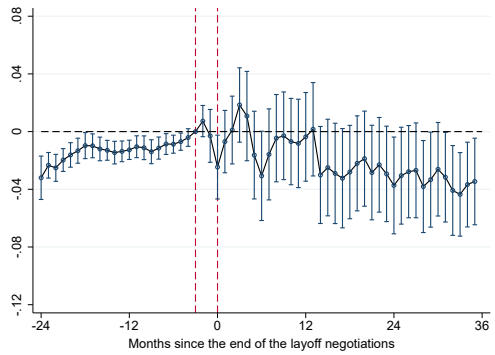
Figure B.I: Labor market trajectories by skill level



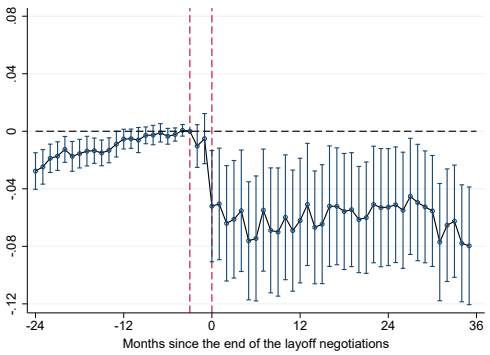
(a) Δ in share unemployed (low skilled)



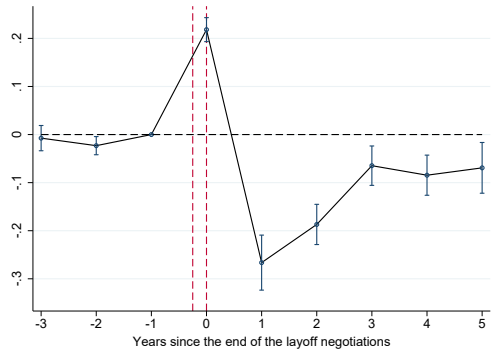
(b) Δ in share unemployed (high skilled)



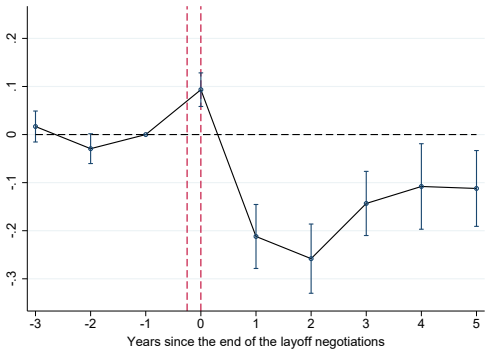
(c) Δ in sh. working for another firm (low skilled)



(d) Δ in sh. working for another firm (high skilled)



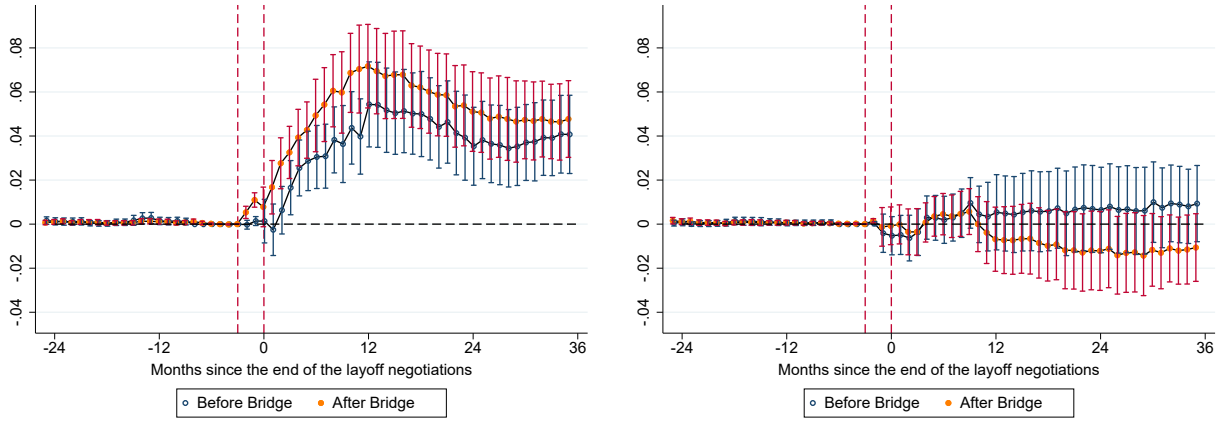
(e) Δ in Log Income (low skilled)



(f) Δ in Log Income (high skilled)

Notes: This figure illustrates differences in labor market trajectories between workers displaced from Nokia and benchmark workers displaced from other firms around the same time. Panels in the left illustrate the difference in levels of unemployment (panel a), employment in a new firm (panel c), and log of total income (panel e) for low-skilled workers. Panels in the right focus on high-skilled workers. More specifically, all panels illustrate the δ_t coefficients and 95% confidence intervals obtained from estimating specification $Y_{it} = \beta Nokia_i + \sum_{t=\tau_0}^{\tau_T} (\delta_t \times Nokia_i) + \mu_i + \mu_t + \varepsilon_{it}$. We observe unemployment and employment relationships at the monthly level between 24 months before and 36 months after the end of a mass layoff negotiation. Thus, in panels (a) to (d) τ_0 is -24 and τ_T is 36. We observe total income for a longer period, but only at the annual level. Thus, in panels (e) and (f) τ_0 is -3 and τ_T is 5. Standard errors are clustered at the CEM-matching strata level.

Figure B.II: Entrepreneurship before and after Bridge Program



(a) Δ in share of entrepreneurs (high skilled)

(b) Δ in share of entrepreneurs (low skilled)

Notes: This figure illustrates differences in the evolution of entrepreneurship between workers displaced from Nokia and benchmark workers displaced from other firms at the same time before and after the Bridge Program. Panel (a) illustrates these differences for the displaced high-skilled workers in our sample, and panel (b) focuses on low-skilled workers. More specifically, they illustrate the $\delta_{t,before}$ and the $\delta_{t,after}$ coefficients and 95% confidence intervals obtained from estimating specification $Y_{it} = \beta_1 Nokia_i + \beta_2 Bridge_i + \beta_3 Nokia_i \times Bridge_i + \sum_{t=-24}^{36} [\delta_{t,before} \times Nokia_i \times I(Bridge_i = 0)] + \sum_{t=-24}^{36} [\delta_{t,after} \times Nokia_i \times I(Bridge_i = 1)] + \mu_i + \mu_t + \varepsilon_{it}$. $Nokia_i$ is an indicator that takes value 1 if individual i worked for Nokia before the mass layoffs took place; $I(Bridge_i = 0)$ is an indicator that takes value 1 if individual i was displaced before the Bridge program was in place; $I(Bridge_i = 1)$ is an indicator that takes value 1 if individual i was displaced once the Bridge program was already in place; μ_i and μ_t are individual and event-time fixed effects. Standard errors are clustered at the CEM-matching strata level.

B.2 Occupation groups

Table B.I shows the triple-difference results by occupation groups. We divide our sample by occupation code the year prior to the end of the layoff negotiations into two groups: Nokia-specific occupations and other occupations based on International Standard Classification of occupations. An occupation is defined to be Nokia-specific if it fulfills the following criteria: Based on a t-test, the share of individuals in a certain occupation is larger among Nokia workers at the 99% level, and the share of individuals in this occupation among former Nokia workers is at least twice as large as the share among the displaced matched workers. This results with 12 Nokia-specific occupations that cover approximately 52% of the observations among displaced former Nokia workers and 11% of the matched displaced workers from other firms. Individuals with no registered information on occupation are dropped from this analyses as we are unable to assign them to either of these categories. This restriction drops approximately 6% of the individuals from this analysis.

The table shows that the negative labor market effects in terms of unemployment, employment and income were slightly smaller for those working in Nokia-specific occupations than those working under other occupation codes in Nokia. However, increase in entrepreneurship relative to the matched group of other displaced workers is larger among non-Nokia specific occupations than in Nokia-specific occupations.

Table B.I: Triple-difference estimates - Heterogeneity by Nokia-specific occupations

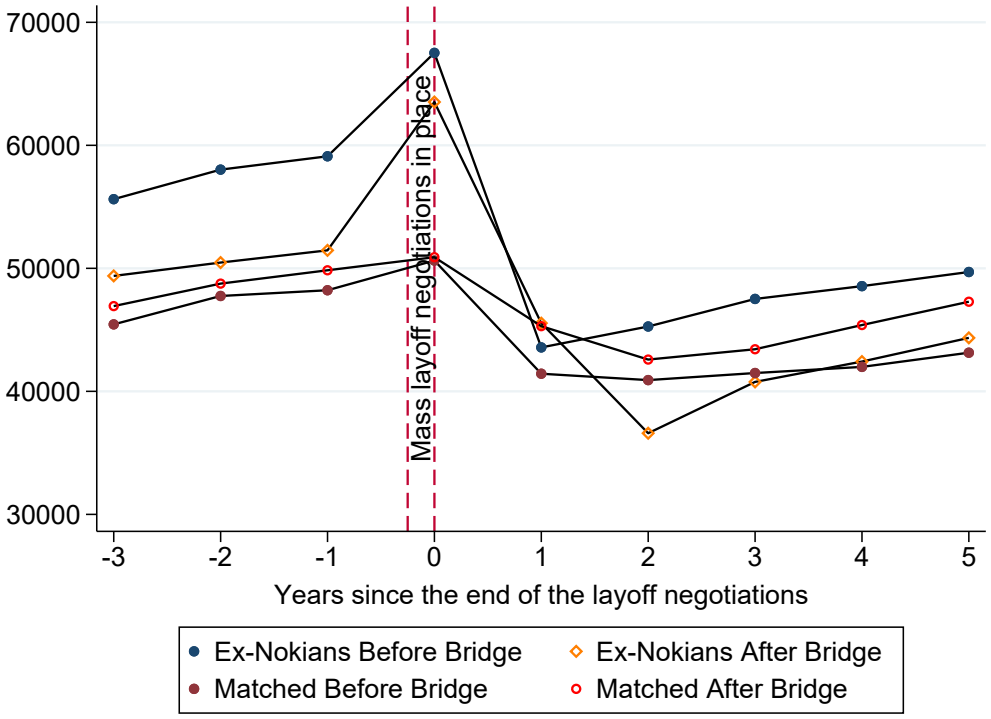
	Outside the labor = 1 (1)	Unemployed force = 1 (2)	Employed = 1 (3)	Entrepreneur = 1 (4)	Log total income (5)
			A. All displaced workers		
Nokia × Post	-0.027*	0.008	-0.001	0.020**	-0.096***
	(0.012)	(0.008)	(0.015)	(0.006)	(0.023)
Nokia × Post × Bridge	0.078***	-0.021*	-0.056**	-0.000	-0.029
	(0.019)	(0.009)	(0.021)	(0.009)	(0.029)
Observations	1,846,043	1,846,043	1,846,043	1,846,043	270,960
Outcome mean	0.012	0.015	0.971	0.001	10.69
			B. Nokia-specific occupations		
Nokia × Post	-0.009	-0.027	0.039	-0.003	-0.059
	(0.032)	(0.022)	(0.047)	(0.021)	(0.054)
Nokia × Post × Bridge	-0.005	0.011	-0.023	0.017	0.007
	(0.047)	(0.025)	(0.053)	(0.026)	(0.059)
Observations	609,512	609,512	609,512	609,512	89,601
Outcome mean	0.011	0.006	0.982	0.001	10.762
			C. Other occupations		
Nokia × Post	-0.024	0.013	-0.009	0.020**	-0.096***
	(0.013)	(0.008)	(0.016)	(0.007)	(0.026)
Nokia × Post × Bridge	0.074***	-0.032**	-0.037	-0.005	-0.012
	(0.020)	(0.011)	(0.022)	(0.009)	(0.035)
Observations	1,128,927	1,128,927	1,128,927	1,128,927	165,776
Outcome mean	0.009	0.011	0.979	0.001	10.695

Notes: The table reports coefficients β_5 and β_7 from the triple differences specification $Y_{it} = \beta_0 + \beta_1 Nokia_i + \beta_2 Bridge_i + \beta_3 Post_t + \beta_4 Nokia_i \times Bridge_i + \beta_5 Nokia_i \times Post_t + \beta_6 Bridge_i \times Post_t + \beta_7 Nokia_i \times Bridge_i \times Post_t + \mu_i + \varepsilon_{it}$. $Nokia_i$ is an indicator that takes value 1 if individual i worked for Nokia before the mass layoffs took place; $Post_t$ is an indicator that takes value 1 if the period t is a post mass layoff period; $Bridge_i$ is an indicator that takes value 1 if individual i was displaced once the Bridge program was already in place; μ_i is an individual fixed effect. Standard errors clustered at the CEM-matching strata level are presented in parentheses. The coefficient β_7 captures the differential effect that mass layoff negotiations had for Nokia workers relative to displaced workers in the benchmark group after the Bridge program was implemented. Columns (1) to (4) focus on changes in workers' employment status. Column (1) studies labor force participation, column (2) unemployment, column (3) employment, and column (4) entrepreneurship. Column (5) studies changes in total income. The results in Panel A look at all displaced workers, Panel B at workers in Nokia-specific occupations, and Panel C at workers in other occupations. Outcome means correspond to the mean of the outcome for workers displaced from Nokia before the layoff negotiations take place. * p<0.05, ** p<0.01, and *** p<0.001.

B.3 Income development before and after the Bridge Program

Nokia offered generous severance packages to the workers leaving Nokia due to the layoff negotiations. As illustrated in Figure B.III, an increase in total income in the year of the layoff negotiations is evident for Nokia workers both before and after the Bridge Program. In contrast, for workers displaced from other firms, we do not observe a similar increase in total income. We observe an average increase of 21% in the year in which individuals leave Nokia. While the increases in total income are of a similar magnitude in absolute terms (EUR 8,400 and 12,100 euros for before and after Bridge, respectively), the relative increase in income is slightly lower for the displaced in the pre-Bridge period (14%) than for those displaced after the Bridge Program (23%).

Figure B.III: Total income of workers displaced from Nokia and other firms before and after the Bridge Program.



Notes: This figure illustrates the evolution of total annual income in euros among workers displaced from Nokia (Ex-Nokians) and among similar workers displaced from other firms around the same time (Matched) before and after the Bridge Program. Before Bridge corresponds to individuals who were displaced before the Bridge program was in place, and after Bridge to workers displaced once the Bridge was already in place. Figure illustrates the evolution of total incomes from three years before to five years after the end of the layoff negotiations.

C Robustness checks

This section presents robustness checks on the choices regarding our key definitions and the matching procedure. The results of these robustness checks illustrate that our main findings and implications are robust to altering these choices.

C.1 Restricting displaced workers to be employed 12 months before the layoff negotiations ended

In our baseline analysis in the main text, the estimation sample consists of displaced individuals who we define as individuals who were employed in a firm three months before the end of a layoff negotiation, and who are not employed in the firm 12 months after the end of the layoff negotiations. Requiring individuals to be employed three months before the end of the layoff negotiations raises a potential concern that we might leave out individuals who foresee the upcoming layoff negotiations and leave the firm voluntarily before that. This could be important as early leaving may be correlated with individual ability, and comparisons between all ability types of non-displaced to lower ability displaced workers could introduce a selection bias. However, in our analysis we compare displaced workers from Nokia to other similar displaced workers from other firms, which to some degree alleviates the concerns of selection bias from early leavers compared to the traditional approaches in the plant closure literature. However, some additional concerns could arise if we expect that displaced Nokia workers leave the firm earlier or later than the displaced workers from other firms. One such reason could be the severance payments from Nokia, which could incentivize individuals to stay in Nokia until the layoff negotiations have started, but this channel might not be relevant in other firms that do not offer similar severance payments.

We conduct an additional triple-difference analysis for an alternative sample of individuals who were employed 12 months before the end of the layoff negotiations instead of the three months used in the main estimation sample. Table C.I presents the results using this sample. Comparing the labor market results presented in columns (1)–(3) to those from the main estimation sample (Table IV in the main text), we observe that the estimates are qualitatively similar but somewhat larger. For example, using the alternative low-skilled sample, the results in panel (b) indicate that

before Bridge the low-skilled displaced former Nokia workers are less likely to unemployed, but more likely to be unemployed after the Bridge program. As in our main results, the overall higher unemployment for displaced Nokia workers seem to be driven by individuals displaced after the Bridge program was in place. Results on income and entrepreneurship presented in columns (4) and (5) are similar to those in our baseline analysis. However, when using the alternative sample the effect of Bridge program on entrepreneurship for high-skilled workers is larger and statistically significant.

Table C.I: Triple-difference estimates – Alternative definition for a displaced worker

	Outside the labor = 1 (1)	Unemployed force = 1 (2)	Employed = 1 (3)	Entrepreneur = 1 (4)	Log total income (5)
			A. All displaced workers		
Nokia × Post	-0.052***	-0.006	0.048**	0.010	-0.090***
	(0.012)	(0.007)	(0.015)	(0.007)	(0.024)
Nokia × Post × Bridge	0.074***	-0.006	-0.078***	0.010	-0.018
	(0.022)	(0.010)	(0.023)	(0.009)	(0.031)
Observations	2,195,207	2,195,207	2,195,207	2,195,207	321,364
Outcome mean	0.025	0.025	0.945	0.005	10.670
			B. Low-skilled workers		
Nokia × Post	-0.056***	0.003	0.056**	-0.003	-0.038
	(0.013)	(0.012)	(0.019)	(0.010)	(0.031)
Nokia × Post × Bridge	0.104***	-0.005	-0.098***	-0.001	-0.082
	(0.019)	(0.015)	(0.027)	(0.013)	(0.046)
Observations	1,349,930	1,349,930	1,349,930	1,349,930	197,175
Outcome mean	0.029	0.035	0.933	0.003	10.387
			C. High-skilled workers		
Nokia × Post	-0.037	-0.010	0.024	0.023**	-0.150***
	(0.020)	(0.008)	(0.023)	(0.008)	(0.039)
Nokia × Post × Bridge	0.019	-0.016	-0.031	0.027*	0.054
	(0.041)	(0.012)	(0.037)	(0.012)	(0.042)
Observations	845,277	845,277	845,277	845,277	124,189
Outcome mean	0.020	0.013	0.960	0.008	11.003

Notes: The table reports coefficients β_5 and β_7 from the triple-difference specification $Y_{it} = \beta_0 + \beta_1 Nokia_i + \beta_2 Bridge_i + \beta_3 Post_t + \beta_4 Nokia_i \times Bridge_i + \beta_5 Nokia_i \times Post_t + \beta_6 Bridge_i \times Post_t + \beta_7 Nokia_i \times Bridge_i \times Post_t + \mu_i + \varepsilon_{it}$ by using an alternative definition for a displaced worker that requires the worker to work in the firm 12 months before the end of the layoff negotiations. $Nokia_i$ is an indicator that takes value 1 if individual i worked for Nokia before the mass layoffs took place; $Post_t$ is an indicator that takes value 1 if the period t is a post mass layoff period; $Bridge_i$ is an indicator that takes value 1 if individual i was displaced once the Bridge program was already in place; μ_i is an individual fixed effect. Standard errors clustered at the CEM-matching strata level are presented in parentheses. The coefficient β_7 captures the differential effect that mass layoff negotiations had for Nokia workers relative to displaced workers in the benchmark group after the Bridge program was implemented. Columns (1) to (4) focus on changes in workers' employment status. Column (1) studies labor force participation, column (2) unemployment, column (3) employment, and column (4) entrepreneurship. Column (5) studies changes in total income. The results in Panel A look at all displaced workers, Panel B at low-skill workers, and Panel C at high-skill workers. Outcome means correspond to the mean of the outcome for workers displaced from Nokia before the layoff negotiations take place. * p<0.05, ** p<0.01, and *** p<0.001.

C.2 Main results with a sample of first layoff negotiations

In our baseline analysis, we pool together the subsamples of different layoff negotiations, meaning that individuals can participate in more than one layoff event. As a robustness check, we conduct the analysis by restricting the sample to individuals' first observed layoff negotiation. We use an otherwise identical procedure and variables in CEM-matching as in the main analysis. This additional restriction decreases the sample size to 9725 individuals displaced from Nokia and 12,384 individuals displaced from other firms.

Table C.II presents the results from the triple-difference estimation. Focusing on the first layoff negotiation yields largely similar results compared the baseline results (Table IV in the main text). While the results regarding employment and unemployment are largely in line with the main results for the high-skilled workers, for the low-skilled Nokia workers before Bridge we find a slightly lower probability of being employed in another firm.

Table C.II: Triple-difference estimates – a sample of first layoff negotiations

	Outside the labor = 1 (1)	Unemployed force = 1 (2)	Employed = 1 (3)	Entrepreneur = 1 (4)	Log total income (5)
			A. All displaced workers		
Nokia × Post	-0.010	0.012	-0.025	0.023***	-0.133***
	(0.011)	(0.006)	(0.013)	(0.005)	(0.021)
Nokia × Bridge × Post	0.037*	-0.039***	0.000	0.002	0.048
	(0.019)	(0.009)	(0.020)	(0.008)	(0.029)
Observations	1,348,649	1,348,649	1,348,649	1,348,649	197,898
Outcome mean	0.008	0.020	0.971	0.001	10.726
			B. Low-skilled workers		
Nokia × Post	0.001	0.028**	-0.038**	0.009	-0.144***
	(0.012)	(0.009)	(0.014)	(0.006)	(0.023)
Nokia × Bridge × Post	0.018	-0.050***	0.039	-0.007	0.102**
	(0.019)	(0.013)	(0.023)	(0.009)	(0.038)
Observations	867,847	867,847	867,847	867,847	127,180
Outcome mean	0.008	0.020	0.971	0.001	10.450
			C. High-skilled workers		
Nokia × Post	-0.016	-0.000	-0.019	0.035***	-0.126***
	(0.020)	(0.009)	(0.022)	(0.008)	(0.036)
Nokia × Bridge × Post	0.047	-0.032**	-0.031	0.015	-0.008
	(0.032)	(0.011)	(0.032)	(0.012)	(0.042)
Observations	480,802	480,802	480,802	480,802	70,718
Outcome mean	0.008	0.020	0.971	0.001	11.015

Notes: The table reports coefficients β_5 and β_7 from the triple differences specification $Y_{it} = \beta_0 + \beta_1 Nokia_i + \beta_2 Bridge_i + \beta_3 Post_t + \beta_4 Nokia_i \times Bridge_i + \beta_5 Nokia_i \times Post_t + \beta_6 Bridge_i \times Post_t + \beta_7 Nokia_i \times Bridge_i \times Post_t + \mu_i + \varepsilon_{it}$ using a sample of the first layoff negotiation observed for an individual. $Nokia_i$ is an indicator that takes value 1 if individual i worked for Nokia before the mass layoffs took place; $Post_t$ is an indicator that takes value 1 if the period t is a post mass layoff period; $Bridge_i$ is an indicator that takes value 1 if individual i was displaced once the Bridge program was already in place; μ_i is an individual fixed effect. Standard errors clustered at the CEM-matching strata level are presented in parentheses. The coefficient β_7 captures the differential effect that mass layoff negotiations had for Nokia workers relative to displaced workers in the benchmark group after the Bridge program was implemented. Columns (1) to (4) focus on changes in workers' employment status. Column (1) studies labor force participation, column (2) unemployment, column (3) employment, and column (4) entrepreneurship. Column (5) studies changes in total income. The results in Panel A look at all displaced workers, Panel B at low-skill workers, and Panel C at high-skill workers. Outcome means correspond to the mean of the outcome for workers displaced from Nokia before the layoff negotiations take place. * p<0.05; ** p<0.01, and *** p<0.001.

C.3 Main results with including layoff negotiation wave in CEM-matching

Our baseline matching procedure matches together Nokia workers and workers from other firms from different layoff negotiation waves. The benefit of relaxing the requirement of matching individuals strictly within the same waves is that it increases our sample size. One of the main concerns from matching between events is that these events are subject to different macroeconomic conditions. However, this concern is mitigated by the fact that all the layoff events are relatively close to each other. The first considered layoff negotiation in Nokia took place in February 2009 and the last one in August 2012. In addition, we do not include a full set of layoff negotiations from other firms but restrict the layoff negotiations to those that took place within a two month window from the corresponding layoff negotiation in Nokia.

To alleviate potential concerns related to the layoff negotiation waves, we conduct the baseline analysis using an alternative specification for CEM-matching where we additionally require that matches are from the same layoff negotiation wave. However, it is important to note that the sample size for this analysis is over 50% smaller than in our baseline analysis.

Overall, the results are relatively robust to this restriction in matching. The triple-difference estimates when using this sample and weighting procedure are presented in Table C.III. We find similar results for this analysis compared to our baseline estimates in Table IV in the main text, especially in terms of the negative effect on income for displaced Nokia workers relative to other firms, higher entrepreneurship for high-skilled Nokia workers, and higher unemployment driven by the low-skilled displaced Nokia workers during the Bridge program.

Table C.III: Triple-differences estimates when including layoff negotiation wave in CEM-matching

	Outside the labor = 1 (1)	Unemployed force = 1 (2)	Employed = 1 (3)	Entrepreneur = 1 (4)	Log total income (5)
			A. All displaced workers		
Nokia × Post	0.014	0.007	-0.038***	0.017***	-0.154***
	(0.009)	(0.007)	(0.010)	(0.005)	(0.019)
Nokia × Bridge × Post	0.046*	-0.024**	-0.025	0.004	0.039
	(0.018)	(0.009)	(0.019)	(0.009)	(0.027)
Observations	884,927	884,927	884,927	884,927	129,801
Outcome mean	0.011	0.022	0.965	0.002	10.640
			B. Low-skilled workers		
Nokia × Post	0.009	0.003	-0.025	0.013**	-0.144***
	(0.012)	(0.010)	(0.013)	(0.005)	(0.022)
Nokia × Bridge × Post	0.066***	-0.026	-0.022	-0.018	0.048
	(0.019)	(0.014)	(0.022)	(0.010)	(0.035)
Observations	572,058	572,058	572,058	572,058	83,782
Outcome mean	0.014	0.029	0.955	0.002	10.388
			C. High-skilled workers		
Nokia × Post	0.020	0.012	-0.055***	0.023*	-0.167***
	(0.013)	(0.007)	(0.015)	(0.009)	(0.031)
Nokia × Bridge × Post	0.016	-0.020	-0.035	0.039**	0.024
	(0.035)	(0.012)	(0.034)	(0.013)	(0.044)
Observations	312,869	312,869	312,869	312,869	46,019
Outcome mean	0.006	0.012	0.980	0.002	11.001

Notes: The table reports coefficients β_5 and β_7 from the triple differences specification $Y_{it} = \beta_0 + \beta_1 Nokia_i + \beta_2 Bridge_i + \beta_3 Post_t + \beta_4 Nokia_i \times Bridge_i + \beta_5 Nokia_i \times Post_t + \beta_6 Bridge_i \times Post_t + \beta_7 Nokia_i \times Bridge_i \times Post_t + \mu_i + \varepsilon_{it}$ when including the layoff negotiation wave in the CEM-mathing procedure as an additional variable. $Nokia_i$ is an indicator that takes value 1 if individual i worked for Nokia before the mass layoffs took place; $Post_t$ is an indicator that takes value 1 if the period t is a post mass layoff period; $Bridge_i$ is an indicator that takes value 1 if individual i was displaced once the Bridge program was already in place; μ_i is an individual fixed effect. Standard errors clustered at the CEM-matching strata level are presented in parentheses. The coefficient β_7 captures the differential effect that mass layoff negotiations had for Nokia workers relative to displaced workers in the benchmark group after the Bridge program was implemented. Columns (1) to (4) focus on changes in workers' employment status. Column (1) studies labor force participation, column (2) unemployment, column (3) employment, and column (4) entrepreneurship. Column (5) studies changes in total income. The results in Panel A look at all displaced workers, Panel B at low-skill workers, and Panel C at high-skill workers. Outcome means correspond to the mean of the outcome for workers displaced from Nokia before the layoff negotiations take place. * p<0.05; ** p<0.01, and *** p<0.001.

C.4 Main results when including industry codes in CEM-matching

Our baseline matching procedure does not include industry code as a matching variable. Consequently, our analysis could be affected by potential differences between the industries of workers in Nokia and other firms facing layoff negotiations. However, even though our main matching procedure does not specifically match on industry, some of the other included variables, such as the level and field of education, are likely to be correlated with industry. Hence, we do not expect this to be a major issue in our analysis. To further examine this, we conduct a robustness check where we include industry code in the CEM-matching procedure by using 1-digit-level NACE industry codes. This additional matching criteria decreases our sample size to 14,731 person $\times$ layoff wave observations from Nokia and 8101 from other firms.

The results from the triple-difference estimations when using this alternative CEM-specification are presented in Table C.IV. Overall, the results regarding unemployment, entrepreneurship and incomes are very similar to our baseline results in Table IV in the main text. One caveat of this robustness check is that we are required to conduct the matching on a relatively coarse level of industry classification. If we were to use 2-digit NACE-classifications we would end up with little to no matched individuals in the benchmark group.

Table C.IV: Triple-difference estimates when including industry code in CEM-matching

	Outside the labor = 1 (1)	Unemployed force = 1 (2)	Employed = 1 (3)	Entrepreneur = 1 (4)	Log total income (5)
			A. All displaced workers		
Nokia × Post	-0.037**	0.010	-0.001	0.029***	-0.082**
	(0.014)	(0.009)	(0.018)	(0.006)	(0.025)
Nokia × Bridge × Postt	0.102***	-0.014	-0.077**	-0.010	-0.033
	(0.021)	(0.011)	(0.024)	(0.009)	(0.034)
Observations	1,392,752	1,392,752	1,392,752	1,392,752	204,455
Outcome mean	0.013	0.016	0.970	0.002	10.650
			B. Low-skilled workers		
Nokia × Post	-0.040*	0.026*	0.002	0.011	-0.070*
	(0.018)	(0.013)	(0.021)	(0.007)	(0.029)
Nokia × Bridge × Post	0.079**	-0.026	-0.043	-0.010	-0.032
	(0.026)	(0.016)	(0.030)	(0.011)	(0.044)
Observations	941,352	941,352	941,352	941,352	138,069
Outcome mean	0.016	0.020	0.963	0.001	10.432
			C. High-skilled workers		
Nokia × Post	0.010	0.004	-0.062**	0.047***	-0.137**
	(0.015)	(0.010)	(0.023)	(0.009)	(0.049)
Nokia × Bridge × Post	0.064*	-0.021	-0.048	0.005	0.004
	(0.025)	(0.013)	(0.029)	(0.013)	(0.057)
Observations	451,400	451,400	451,400	451,400	66,386
Outcome mean	0.007	0.010	0.981	0.002	11.002

Notes: The table reports coefficients β_5 and β_7 from the triple differences specification $Y_{it} = \beta_0 + \beta_1 Nokia_i + \beta_2 Bridge_i + \beta_3 Post_t + \beta_4 Nokia_i \times Bridge_i + \beta_5 Nokia_i \times Post_t + \beta_6 Bridge_i \times Post_t + \beta_7 Nokia_i \times Bridge_i \times Post_t + \mu_i + \varepsilon_{it}$ when including 1-digit industry code in the CEM-matching procedure. $Nokia_i$ is an indicator that takes value 1 if individual i worked for Nokia before the mass layoffs took place; $Post_t$ is an indicator that takes value 1 if the period t is a post mass layoff period; $Bridge_i$ is an indicator that takes value 1 if individual i was displaced once the Bridge program was already in place; μ_i is an individual fixed effect. Standard errors clustered at the CEM-matching strata level are presented in parentheses. The coefficient β_7 captures the differential effect that mass layoff negotiations had for Nokia workers relative to displaced workers in the benchmark group after the Bridge program was implemented. Columns (1) to (4) focus on changes in workers' employment status. Column (1) studies labor force participation, column (2) unemployment, column (3) employment, and column (4) entrepreneurship. Column (5) studies changes in total income. The results in Panel A look at all displaced workers, Panel B at low-skill workers, and Panel C at high-skill workers. Outcome means correspond to the mean of the outcome for workers displaced from Nokia before the layoff negotiations take place.

C.5 Performance of startups: Probability of being in the top 25% of firms.

In the analysis on the performance of startups founded by workers displaced from Nokia, we focus only on firms that we observe in our data eight years after their establishment. This implies that our results on revenue, value added, the number of employees and productivity are conditional on the survival of the firm. To take into account the role of survival, we conduct an alternative analysis where firm performance is measured as belonging to the top 25% of the distribution of startups in each outcome.

Tables C.V and C.VI present the results of an alternative version of Tables V and VI, where we replace the original outcomes with dummy variables that indicate whether a firm is in the top 25% of each performance measure. By defining these variables as zero for non-surviving firms, we are able to run these regressions including all firms in our sample.

The results are relatively similar to the ones presented in the main analysis. As in the main analysis, most of the estimates are statistically insignificant. Focusing on the differences between the results, results in panel (a) of Table C.V suggests that firms founded by displaced workers from Nokia once the Bridge program was already in place, are less likely to be among the top 25% of the firms in terms of value added per employee compared to the comparison group of startups founded by workers displaced from other firms. In Table C.VI, the comparison group consists of all the firms founded in Finland around the same time as mass layoff negotiations affecting Nokia took place. The results for this analysis are also similar to the ones we present in the main text.

Table C.V: Performance of startups founded by workers displaced from Nokia and from other firms

	Survived = 1 (1)	Log Revenue (2)	Log value added (3)	Number of employees (4)	Log value added per employee (5)
	A. Heterogeneity by Bridge availability				
Nokia = 1	0.006	0.011	0.012	0.034	0.052
	(0.061)	(0.049)	(0.051)	(0.049)	(0.054)
Bridge = 1	-0.029	0.101	0.096	0.151	0.166
	(0.085)	(0.084)	(0.092)	(0.089)	(0.088)
Nokia × Bridge	-0.157	-0.095	-0.154	-0.158	-0.180*
	(0.097)	(0.079)	(0.083)	(0.082)	(0.085)
Observations	608	607	607	607	607
Outcome mean	0.500	0.205	0.223	0.188	0.268
	B. Heterogeneity by startup industry				
Nokia = 1	-0.169***	-0.035	-0.057	-0.047	-0.032
	(0.047)	(0.041)	(0.043)	(0.041)	(0.046)
Nokia core industry = 1	0.565***	0.107	0.167	0.148	0.011
	(0.041)	(0.100)	(0.106)	(0.101)	(0.102)
Nokia × Nokia core industry	0.169***	-0.039	-0.083	-0.033	0.032
	(0.047)	(0.107)	(0.113)	(0.109)	(0.110)
Observations	608	607	607	607	607
Outcome mean	0.435	0.201	0.223	0.201	0.273
	C. Heterogeneity by startup founder skills				
Nokia = 1	-0.127	-0.089	-0.126*	-0.117	-0.115
	(0.074)	(0.060)	(0.062)	(0.062)	(0.066)
High-skill founder = 1	-0.080	-0.066	-0.094	-0.115	-0.110
	(0.078)	(0.065)	(0.067)	(0.064)	(0.070)
Nokia × High-skill founder	0.066	0.106	0.132	0.158*	0.166*
	(0.096)	(0.076)	(0.079)	(0.076)	(0.083)
Observations	608	607	607	607	607
Outcome mean	0.531	0.247	0.284	0.272	0.333

Notes: This table studies how the performance of startups founded by workers displaced from Nokia and from other firms varies depending on whether the firm was founded before or after Bridge was available (Panel A), whether the startups' industry coincides with Nokia's industry (Panel B), and whether at least one of the startups' founders was a high skill individual (Panel C). To study this heterogeneity, we rely on the following specification: $Y_{it} = \gamma_0 + \gamma_1 Nokia_i + \gamma_2 X_{it} + \gamma_3 Nokia_i \times X_i + \mu_t + \varepsilon_{it}$. $Nokia_i$ indicates whether the founders of startup i worked for Nokia before mass layoffs; X_i indicates whether Bridge was available when the founders of startup i were laid off in Panel A, whether startup i's industry coincides with Nokia's industry in Panel B, and whether at least one of the founders of startup i is a high skill individual in Panel C; μ_t is a calendar year fixed effect and is included in all regressions, except from the one presented in column (1). Standard errors clustered at the firm level are presented in parentheses. The outcomes correspond to different measures of startup performance observed eight years after their foundation. Column (1) focuses on the probability of surviving, column (2) on log revenue, column (3) on log value-added, column (4) on number of employees, and column (5) on log value-added per employee. Outcomes in columns (2) to (5) are dummy variables that indicate whether a startup is in the top 25% of each performance measure. The outcome is defined as zero for firms that do not survive for eight years. Outcome means correspond to startup firms founded by displaced workers in the benchmark group before Bridge was established (Panel A), in industries that do not coincide with Nokia's industry (Panel B), and by low-skilled individuals (Panel C).

Table C.VI: Performance of startups founded by workers displaced from Nokia and all startups in Finland

	Survived = 1 (1)	Log Revenue (2)	Log value added (3)	Number of employees (4)	Log value added per employee (5)
	A. Heterogeneity by Bridge availability				
Nokia = 1	-0.061	-0.051	-0.023	-0.037	0.038
	(0.038)	(0.031)	(0.032)	(0.031)	(0.035)
Bridge	-0.104***	0.100***	0.092***	0.104***	0.069***
	(0.005)	(0.007)	(0.007)	(0.007)	(0.007)
Nokia × Bridge	-0.082	-0.021	-0.050	-0.022	-0.085*
	(0.047)	(0.038)	(0.039)	(0.038)	(0.041)
Observations	37258	37256	37256	37256	37256
Outcome mean	0.567	0.267	0.266	0.264	0.273
	B. Heterogeneity by startup industry				
Nokia = 1	-0.230***	-0.090***	-0.083***	-0.094***	-0.023
	(0.023)	(0.021)	(0.022)	(0.021)	(0.024)
Nokia core industry = 1	0.504***	-0.015	0.030***	0.001	0.080***
	(0.003)	(0.008)	(0.008)	(0.008)	(0.009)
Nokia × Nokia core industry	0.230***	0.082*	0.056	0.114**	-0.040
	(0.023)	(0.038)	(0.039)	(0.039)	(0.041)
Observations	37258	37256	37256	37256	37256
Outcome mean	0.544	0.253	0.249	0.251	0.244
	C. Heterogeneity by startup founder skill				
Nokia = 1	-0.114*	-0.098**	-0.083*	-0.097**	-0.037
	(0.048)	(0.035)	(0.036)	(0.036)	(0.038)
High-skill founder = 1	0.000	-0.002	0.011*	-0.021***	0.044***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Nokia × High-skill founder	-0.014	0.047	0.035	0.072	0.009
	(0.055)	(0.041)	(0.042)	(0.042)	(0.044)
Observations	37258	37256	37256	37256	37256
Outcome mean	0.518	0.257	0.252	0.264	0.239

Notes: This table studies how the performance of startups founded by workers displaced from Nokia and all new startups in Finland varies depending on whether the firm was founded before or after Bridge was available (Panel A), on whether the startups' industry coincides with Nokia's industry (Panel B), and on whether at least one of the startups' founders was a high skill individual (Panel C). To study this heterogeneity, we rely on the following specification: $Y_{it} = \gamma_0 + \gamma_1 Nokia_i + \gamma_2 X_{it} + \gamma_3 Nokia_i \times X_i + \mu_t + \varepsilon_{it}$. $Nokia_i$ indicates whether the founders of startup i worked for Nokia before mass layoffs; X_i indicates whether Bridge was available when the founders of startup i were laid off in Panel A, whether startup i's industry coincides with Nokia's industry in Panel B, and whether at least one of the founders of startup i is a high skill individual in Panel C; μ_t is a calendar year fixed effect and is included in all regressions, except from the one presented in column (1). Standard errors clustered at the firm level are presented in parentheses. The outcomes correspond to different measures of startup performance observed eight years after their foundation. Column (1) focuses on the probability of surviving, column (2) on log revenue, column (3) on log value-added, column (4) on number of employees, and column (5) on log value-added per employee. Outcomes in columns (2) to (5) are dummy variables that indicate whether a startup is in the top 25% of each performance measure. The outcome is defined as zero for firms that do not survive for eight years. Outcome means correspond to new startups in Finland founded before Bridge was established (Panel A), in industries that do not coincide with Nokia's industry (Panel B), and by low-skilled individuals (Panel C).