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Rethinking Deindustrialization

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Abstract

Manufacturing in high-income countries is on the decline and Denmark is no exception. Manufacturing employment and the number of firms have been shrinking as a share of the total and in absolute levels. This paper uses a rich linked employer-employee dataset to examine this decline from 1994 to 2007. We propose a different approach to analyze deindustrialization and generate a series of novel stylized facts about the evolution. While most of the decline can be attributed to firm exit and reduced employment at surviving manufacturers, we document that a non-negligible portion is due to firms switching industries, from manufacturing to services. We focus on this last group of firms before, during, and after their sector switch. Overall this is a group of small, highly productive, import intensive firms that grow rapidly in terms of value-added and sales after they switch. By 2007, employment at these former manufacturers equals 8.7 percent of manufacturing employment, accounting for half the decline in manufacturing employment. We focus on the composition of the workforce as firms make their transition. In addition, we identify two types of switchers: one group resembles traditional wholesalers and another group that retains and expands their R&D and technical capabilities. Our findings emphasize that the focus on employment at manufacturing firms overstates the loss in manufacturing-related capabilities that are actually retained in many firms that switch industries.

Keywords: manufacturing firms, industry switching, employment, skill composition, firm performance, job separation
JEL codes: D22; F61; L25

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1 Introduction

Manufacturing in high-income countries is on the decline and Denmark is no exception. Manufacturing employment peaked at well over half a million workers in 1986 and fell by over 40% over the next twenty six years, see Figure 1.¹ Similarly the number of manufacturing firms dropped in every year from 1988 to 2012 and the share of manufacturing in value-added fell from 18 to 11 percent from 1980 to 2012 (Statistics Denmark (2012)).² This trend has been a major concern for policy makers and has contributed to increasing fear of globalization in public opinion as the decline has coincided with increased offshoring by manufacturing firms and with the rise of China, India, and Eastern Europe in the global economy.

Deindustrialization is the subject of an enormous body of work offering explanations from differential productivity changes across sectors to comparative advantage and the emergence of China. Policy-makers devote enormous energy to developing proposals to stem or reverse this fall in manufacturing jobs. In particular there are worries about the consequences for individual employment and well-being of laid-off manufacturing workers as well as the prospects for continued long-term productivity growth. In the case of the workers, manufacturing is perceived to offer relatively high wages to workers with lower or middle level of education. In terms of growth, industrial sectors have long been among those with the highest growth rates of productivity. Deindustrialization is viewed as a threat both to the current standard of living and well as to future income levels. These concerns are at the heart of this paper and our attempt to rethink the process of deindustrialization.

In this paper, we ask two questions: are we measuring deindustrialization properly and what are the implications for understanding the future path of an advanced economy? We try to rethink deindustrialization by focusing less on the manufacturing label assigned to the firm and focusing more on the set of activities that are associated with manufacturing. To be engaged in the production of a good involves a wide range of tasks from design and engineering to finance and accounting to marketing and distribution in addition to the specific act of production or assembly. Firms that are considered to be manufacturers are likely performing most, if not all, of the tasks, but in particular they must be involved in the production process. Firms outside of manufacturing may, in fact, be doing every task associated with the creation and delivery of the product except the production process itself. We ask whether part of the loss of manufacturing is in fact due to the changing nature of firms and production and look at firms that remain in the manufacturing sector and, especially, those that switch out of manufacturing.

The basic premise of our analysis is quite simple. We ask whether firms that are leaving manufacturing for another industry are still performing many of the basic activities or tasks associated

¹These numbers reflect employment at manufacturing firms as defined in Section 2.

²Manufacturing employment as a share of total employment fell from over 20 percent to 15 percent from 1993 to 2007.

with manufacturing. Have they lost the capability to innovate and add value or is the only change at these switching firms the lack of production activity? Our findings emphasize that the focus on employment at manufacturing firms overstates the loss in manufacturing-related capabilities that are actually retained in many firms that switch industries.

We divide our analysis into five parts. First, we consider the aggregate implications if these firms are reclassified as manufacturing. Second, we ask which firms are most likely to switch out of manufacturing and how they performed in the years leading up to their switch. Third, we examine their post-switch performance including the evolution of their employment levels and composition, their productivity and output and their engagement in international markets. We try to distinguish between different types of switchers: those that have transformed themselves into traditional wholesalers, and those that have kept most of their manufacturing capabilities. Finally we track the employment and wage outcomes of workers at switching and exiting firms.

Switchers are small yet productive in the year they leave manufacturing and their post-switch performance is very strong. As a result, by the end of our sample in 2007, these former manufacturers are a sizable presence in the Danish economy. Employment at firms that have switched out of manufacturing equals 8.7 percent of total manufacturing employment, sales of switchers are 14.3 percent of those at continuing manufacturing firms, and switchers have higher value-added to sales ratios. Furthermore, we can clearly identify two types of firms among our switchers: on the one hand, there are firms that have stopped any involvement in manufacturing and are conducting the traditional activities of wholesalers. On the other hand, there is a group of firms that are still involved in some manufacturing activities, mostly focused on the design and distribution, but not in production. These firms have also upgraded their workforce and employ a larger proportion of high tech workers. In sum, some of these switching firms are no longer counted as manufacturers, but they retain many of the characteristics of producers, minus the production itself.

Compared to switchers, firms that have maintained their activities within the manufacturing industry have also evolved quite substantially, although not as dramatically as switchers. The share of workers involved in high tech activities has grown from 9.2% in 1994 to around 13% in 2007. Manufacturing in Denmark has definitely become more high tech as deindustrialization has proceeded. The share of sales workers has also risen, suggesting that this type of activity has also received more weight relative to traditional production tasks.

We look at the factors determining the switch, comparing the switchers, firms exiting (exiters) and firms continuing their activities in manufacturing (stayers). We find that switchers are on average more productive and smaller, have a more skilled workforce and are more import intensive than both exiters and stayers. After the switch, they become even more productive, skill intensive and import oriented.

Moving beyond the firm, we also consider the consequences for individual workers at firms

that switch out of manufacturing and those exiting entirely. While switching firms seem to thrive, it is possible that workers who lose their jobs around the switch fair poorly. We compare the wage trajectory of individuals losing their job in switchers compared to those losing their job as a consequence of firm exit. Individuals losing their jobs at switchers experience negative labor market outcomes in the first year after separation, both a higher probability of unemployment and a large wage loss. However, these negative effects dissipate quickly, and five years after losing their jobs, their labor market status is better than workers at ex-ante comparable firms that remain in manufacturing. This suggests that, in the Danish context, workers were not too badly hurt by the change in the economic environment, as individuals reallocated relatively smoothly to new sectors of activity.

We think of our empirical findings in terms of a conceptual framework based on Antràs and Helpman (2004) and Antràs and Chor (2013) to interpret our results. In this framework, firms differ in three attributes: design capability, production capability, and distribution/marketing capability. Until relatively recently, firms operated with strong complementarities between these three functions. When these three business functions can be unbundled, due to new outsourcing opportunities and the ICT revolution, firms decide which activities they should maintain within their boundaries and which ones they should outsource depending on their capabilities. In this framework switchers have strong capabilities in design and post-production activities, but not necessarily in production. The option to outsource the production process is therefore a way to focus on their core capabilities.

The decline in manufacturing employment in the industrialized world is not a new phenomenon and there are a raft of potential explanations ranging from productivity to globalization.³ Perhaps the most common is an argument based on the “relative productivity hypothesis”. Rowthorn and Ramaswamy (1999) argue that deindustrialization is explained by developments that are internal to an advanced economy stimulated primarily by faster growth in manufacturing productivity which, in turn, leads to relative price changes and shifts in the structure of the economy.⁴ An alternate hypothesis is that the manufacturing employment decline is primarily due to globalization and the rise of manufacturing in developing economies. Several recent contributions relate the decline of manufacturing employment to episodes of globalization and in particular the rise of China in the global economy. Pierce and Schott (2012) document the “swift decline” of US manufacturing after China’s entry into WTO and link the decline to changes in US trade policy that eliminated the threat of tariff hikes. Autor et al. (2013a) and Autor et al. (2013b) argue that the rise of imports from China explains both the decline in manufacturing employment in the US as well as poor subsequent outcomes for individual workers and local communities. Our paper does not focus on the potential explanations of deindustrialization but rather emphasizes a new aspect of the transition related to

³Rodrik (2016) documents that deindustrialization is occurring at earlier levels of development for some countries especially in Latin America.

⁴See also Nickell et al. (2008), Buera and Kaboski (2009) and Matsuyama (2009) for additional contributions.

the changing activities at firms that used to be considered manufacturers.

Our work is closely linked to a recent set of papers that focus on the evolution of the producing firm. Bernard and Fort (2013) examine the characteristics and prevalence of Factoryless Goods Producing firms (FGPFs) in the US. FGPFs are firms in the wholesale sector that perform activities related to the production of goods, both the design, R&D and engineering processes before production and the branding and distribution to customers after production.⁵ We document the prevalence of the switch from manufacturing to services and the evolution of firm performance and workforce composition during the transition. We also discuss the evolution of the workforce in firms that remain in manufacturing and how it contrasts with switchers and service firms. Our research provides systematic evidence about the way firms reorganize when they transition from manufacturing to services and how it affects their performance.

Our work is also related to a new literature that emphasizes job polarization and shrinking employment for occupations in the middle of the skill distribution.⁶ We find that firms switching out of manufacturing can be divided into two types, those that retain most of their manufacturing-related activities such as design, engineering and branding, and those that are more similar to traditional wholesalers making connections between customers and producers. The two types of firms have very different occupational structures with workers at the high and low end of the education distributions respectively. We contribute to a large body of research that follows workers following job displacement and massive layoffs due to firm exit.⁷ In contrast with this previous literature, we evaluate how the labor market outcome of individuals losing their job at switchers differs from those losing their jobs at exiters.

The rest of the paper is organized as follows. Section 2 describes the various datasets we combine for our analysis. Section 3 documents the aggregate evolution of the Danish manufacturing sector and the prevalence of switchers. Section 4 discusses the importance of switching firms and their performance relative to continuing manufacturers and firms that shut down operations entirely. Section 5 examines different types of switching firms and their post-switch outcomes. In section 6, we analyze the consequences for workers separated from switchers and exiting firms. Section 7 concludes.

⁵Fort (2014) looks inside the outsourcing decision and analyzes how technology affects firms' decisions to purchase contract manufacturing services. Crozet and Millet (2013) show that French firms in manufacturing industries have an increasing share of their revenues coming from services activities and also find an inverted U-shape relationship between "servitization" and firm's performance.

⁶See Goos and Manning (2007), Autor et al. (2003), Falvey et al. (2010) and Goos et al. (2014)

⁷See Jacobson et al. (1993), Anderson and Meyer (1994) and Davis and von Wachter (2011)).

2 Data

Our main dataset is the Integreret Database for Arbejdsmarkedsforskning (IDA) longitudinal database that provides detailed information about the population of Danish individuals aged between 15 and 74 over the period 1980-2013.⁸ For every year, it provides a snapshot of Danish individuals in November of each year. The dataset contains information on gender, age, tenure, wages (average hourly wage and wage in Danish kroner (DKK) in November of the year), socioeconomic status, occupation and education level (the highest diploma obtained by the individual).⁹

Workers are linked to the plant, and thus the firm, where they are employed. The dataset also provides a detailed code for the economic activity of the plant.¹⁰ Using this information, we are able to identify firms that have at least one establishment classified in a manufacturing industry, those with no manufacturing establishments, and those firms that switch from manufacturing to non-manufacturing.¹¹

The occupational code is the Danish version of the international standard classification of occupations (ISCO) defined by the International Labor Organization. In IDA, every worker is allocated an occupational code when working in a firm. Occupation is very rarely missing but can be “misclassified”.¹² On average 12% of workers in manufacturing are misclassified, while in non-manufacturing industries, the share of misclassified is 20%. The socioeconomic status variable is broader, identifying individuals not employed in firms, such as individuals in unemployment, early retirement, retirement, education, or out of the labor force.

We use the detailed information about workers to aggregate to the level of the firm in order to compute several variables that reflect the skills embedded in its workforce. We first define the number and share of workers for five different occupational categories: managers; tech workers (R&D workers and technicians), support activities, sales activities, and line workers. We further decompose line workers into two separate categories: those involved in transport and warehousing (line 1) and the others, mostly involved in the production process (line 2).¹³ Similarly, we define the share of white collar workers, blue collar workers, college educated workers and other education categories.

⁸The Danish data has been used extensively in labor economics since the 1980’s. For a description, see Eriksson and Westergaard-Nielsen (2009).

⁹One issue is that individuals can have multiple jobs. When this is the case, we only consider the main activity. Our detailed occupation variable (ISCO) is only available since 1991.

¹⁰Statistics Denmark classifies economic entities (plants and firms) in an industry according to the main activity. The main activity is the one that makes the largest contribution to value added. In practice, when it is not possible to determine the value added of the various activities the industry allocation can be based on other input-based indicators such as cost of employment or number of employees. It can also be based on output, such as production of goods and services, or sales of the product of the various activities.

¹¹We refer to non-manufacturing industries and service industries interchangeably throughout this paper as the large majority of switches are to service industries.

¹²This means that information about the type of job performed by workers is unavailable. This is often the case for newly hired workers.

¹³See Table A7 in the online appendix for the definition of these groups based on the ISCO code.

In our analysis, we devote particular attention to the tech workers as this is the best available proxy for high-skilled knowledge workers. We also use the socioeconomic status and occupational code to follow individuals after they lose their jobs, in order to observe how individuals reallocate in terms of occupation, industry together with their individual wage dynamics.

One difficulty is related to the several changes in the Danish industrial classification implemented in 1993, 2003 and 2007. The first and third reclassifications were substantial, moving from DB77 to DB93 (the Danish equivalents of the European classification NACE CLIO and NACE Rev. 1) and DB03 to DB07 (the equivalents of NACE Rev 1.1 and NACE Rev 2). The second change was less important and did not involve large modifications. Statistics Denmark made substantial efforts during these periods of industrial reclassification to properly assign plants and firms to their main industries using both the new and old activity codes. Nevertheless, because we want to focus on real switching behavior coming from a decision of the firm, and not on a statistical re-classification, we concentrate our analysis on the period 1993-2007. All our results are robust when we extend the period of analysis to the entire period (1980-2013).

We define five categories of firms: firms continuing in manufacturing between t and $t+1$ (continuers or stayers); firms exiting (observed in our dataset in t but no longer in $t+1$), switchers out of manufacturing (observed in manufacturing in t and out of manufacturing in $t+1$), switchers in manufacturing (observed out of manufacturing in t and in manufacturing in $t+1$) and new entrants (firms not observed in t but observed in $t+1$). We also perform some cleaning to get rid of firms that switch from one category to another several times in order to keep a consistent definition. Importantly for our analysis, we define a firm as being involved in manufacturing if at least one of its establishments is classified in manufacturing and at least 5% of the firm workforce is employed in manufacturing plants. This contrasts with official statistics that define a manufacturing firm as a firm having the highest proportion of its sales or workforce in manufacturing.

Our central dataset does not contain any information about accounting variables such as sales or value added, or about imports and exports. Therefore, we merge the IDA dataset with two other datasets: the VAT statistics dataset and the Foreign Trade dataset. We use this information to define simple measures of productivity (sales per worker and value added per worker) and trade orientation (export and import status, export share and import intensity).¹⁴

3 The Aggregate Evolution of Danish Manufacturing

The evolution of the Danish manufacturing sector over the last several decades is similar to the well-known path in other developed countries. The number of manufacturing firms peaks in the mid-1980s and continues to fall up to the present. The drop in manufacturing employment begins a few years later and proceeds gradually until the end of the 1990s when it accelerates noticeably.

¹⁴All nominal values are deflated using the consumer price index.

In contrast to manufacturing, both the number of firms and employment share in services and the public sector have risen steadily.

While the decline in manufacturing starts early and continues to the present, to avoid problems with the changes in the classification systems mentioned earlier, we focus for the remainder of the paper on the period from 1993-2007. In addition, for consistency, we tabulate up from the underlying establishment and firm data to create our own set of aggregates. Our measure of employment at manufacturing firms is consistently higher than the official statistics but the annual changes in the two series are highly correlated. From 1993-2007, the overall decrease in employment at firms in manufacturing is 66,434 (15 percent) in the official statistics and 51,365 (11 percent) in our tabulations.

The picture is somewhat different when we focus on value-added and productivity. While the manufacturing sector has had falling employment, both output and value-added remain roughly constant and even grow slightly. A simple measure of labor productivity, real value-added per worker, shows that average productivity growth in manufacturing has been higher than that in services throughout the sample period, see Figure 2.

3.1 Churning

The secular decline in firm numbers and employment in manufacturing has been accompanied by a large amount of churning in the sector throughout the period. Entry (firm birth) and exit (firm shutdown) are common. In any given year, 8-10 percent of current manufacturers shut down and a smaller number start operations. Net exit is significant in almost every year and, on average, reduces the number of manufacturing firms by 1.4 percent annually. These entry and exit rates are comparable to those for other advanced economies. A study by the OECD (2004) reports churning rates in manufacturing across European countries ranging from a low of just under 12 percent in Germany to highs well above 20 percent in the United Kingdom and France.¹⁵ Denmark's churning rate in manufacturing of 18 percent lies in the middle of the range and is similar to that of the US. Decker et al. (2014) report firm entry and exit rates around 10 percent for all sectors combined in the US in recent years. This churning results in a substantial turnover of active firms. In our data, of the 32,000+ distinct firms that are recorded as manufacturers at some point from 1993-2007, only 12,117 are active in the sector in 2007.

Manufacturing firms can leave the sector in one of two ways, through exit or by switching into a non-manufacturing sector. A firm is defined as "switching out" of manufacturing when it no longer reports any establishment in a manufacturing industry but continues operations in another sector. Industry switching is less common than firm entry and exit but occurs consistently over time. On average in each year, 1.6 percent of manufacturing firms permanently switch to a non-

¹⁵The churning rate is defined as the sum of the firm exit and entry rates.

manufacturing sector and 1.1 percent of non-manufacturing firms switch into manufacturing. The net switching out of manufacturing increases in the latter half of the sample just as the decline in manufacturing employment accelerates. From 2002-2007, 1,316 firms with 24,909 employees switch out of manufacturing to non-manufacturing. These firms account for almost 10 percent of the active manufacturing firms in 2002 and 42 percent of the job losses in manufacturing in the period. The cumulative number of firms that switch out of manufacturing from 1994-2007 is 3,030. Of those, 1,680 firms are still active in 2007, equivalent to 13.8 percent of the operating manufacturing firms.

Table 1 report totals for firms, employment, sales, value-added, exports and imports separately for manufacturing firms and current and former switchers in each year. There are many more firms in manufacturing, and they account for much more employment than switchers. Total employment at switchers is 36,951 compared to 425,298 workers at manufacturing firms in 2007 (8.6 percent).

Manufacturers account for more total sales, value-added, exports and imports. However, it is interesting to look at the evolution of these aggregate variables over time for each group. While overall manufacturing employment is declining, as noted earlier, in contrast employment at switchers is rising dramatically over the period. This rise in employment is due to both the increasing number of switching firms as well as an increase in employment per firm of 17 percent from 1994 to 2007.

Aggregate turnover at manufacturing firms increases 13 percent from 1994 to 2007 due to sales per firm that rise 42 percent from 33DKK million in 1994 to 47DKK million in 2007. Sales at switchers are increasing much faster due to an increasing number of firms and much faster growth of sales per firm; sales per firm more than doubles for switchers. By 2007, total turnover at switchers is 14.2 percent that of manufacturers.

Total value-added at manufacturing firms rises only 4.5 percent from 1994 to 2007. A decline in manufacturing firms is offset by a 31 percent increase in value-added per firm. For switchers, value-added rises at a comparable rate to sales. By 2007 firms that have switched out of manufacturing over the sample have total value-added equivalent to 9.3 percent of the total for firms in manufacturing.

Looking at trade orientation, we notice important differences between the two groups. Manufacturing firms are net exporters and the share of exports in turnover is increasing from 26% to almost 42%, while the share of imports in turnover increases from over the period from 13.5% to 19.5%. For switchers, it is the opposite. They are net importers, and the import share increases from 17% to 23%, while the export share decreases from 17% to 15%.

A Switching Example

From Compasses to Maps to E-publishing

Founded in 1775 as a supplier of magnetic compasses for sailing vessels, Iver C. Weilbach & Co. represents a classic example of a firm that switched out of manufacturing in recent years. For its first 100+ years the company focused on the production of magnetic compasses for wooden-hulled sailing vessels. As iron emerged as the preferred material for ship hulls, compasses needed regular on-board corrections and the company added a mix of maintenance services to its portfolio.

In the interwar period Weilbach entered the field of maritime publishing and started to provide sea charts for Danish merchant and fishing vessels, an activity that developed into its core line of business. With the advent of electronic navigation in the twentieth century, magnetic compasses gradually lost ground to gyro compasses and global positioning systems. Weilbach never engaged in the production of electronic navigational systems and continued to produce magnetic compasses until 2009-10 and employees of the company performed compass correction until the 1990s.

The compass manufacturing business is now completely shuttered, however, Iver C. Weilbach & Co. is not gone. In the twenty-first century, new technological developments in shipping have again changed the nature of Iver C. Weilbach & Co.'s business. The advent of electronic nautical charts and electronic publishing of maritime handbooks has provided a new opportunity. The company now offers both printed (sourced from other suppliers) and electronic nautical charts (produced in-house) and it is able to offer services and updates to the shipping companies on a 24/7 basis. The evolution of the business continues and includes the development of offshore software development in Bangladesh and the production of nautical data in Poland.

4 Switchers, Stayers and Exits

Table 2 compares switching and exiting firms to the pool of all continuing manufacturing firms. Switchers and exiters are considered two years before they switch or exit. The numbers represent coefficients from a regression of the (log) firm characteristic on dummy variables for switching and exiting firms two years before their change of status. Other controls include log employment and year-industry(2-digit) fixed effects. The baseline group consists of all manufacturing firms who do not exit or switch. There are large differences across the three groups. Continuing manufacturers employ more workers than switchers and are almost double the size of firms that will shut down. Switchers are more productive with higher sales per worker and value added per worker than either continuing manufacturers or, especially, exiting firms.

Switchers are also different in terms of their wage and employment structure relative to contin-

uing or exiting manufacturing firms. The share of medium and, especially, high education workers is higher at switchers, as is the share of white-collar workers. Perhaps unsurprisingly given the differences in employment composition, wages are also higher at these switching firms.

Looking across six occupation groups, we find substantial differences between switchers and the other two groups. Switchers, two years before they exit manufacturing, have a much lower share of blue-collar production workers. In contrast, the shares of managers, sales and support and tech workers are significantly higher.

We compare the occupational structure of switchers, manufacturing firms and service firms in Table 3. There are large differences in occupational structure between manufacturing and service firms. While the shares of managers and R&D/tech employees are very similar, the distribution of occupations across blue-collar production, support and sales are distinct. Service sector firms have far fewer blue-collar production workers and much higher shares of support and sales staff. None of these differences are particularly surprising but they serve as a reminder of what we would expect if switching firms are merely transforming themselves from typical manufacturing firms to service sector firms that focus on the intermediation of goods produced outside the firm to final customers.

In fact, the occupational structure of switchers is unlike the average firm in either sector. Before changing their industry, switchers are similar to, yet distinct from manufacturers. In some respects, they resemble the typical service sector firm as they employ a much smaller share of production workers and greater shares of support workers and sales staff. However unlike their service sector counterparts, these future switchers already have higher shares of managers and R&D/tech staff.

Over the course of the transition, the switchers dramatically change their occupational structure. In some dimensions, they become more like the typical service firm with far fewer production workers and increasing share of sales employment. However, in most respects they differ substantially from both manufacturing and service sectors firms. They have more than twice as many R&D/tech workers and almost twice as many managers. Switchers appear to be something apart from either sector, a form of hybrid between manufacturing and services.

4.1 Switching, Staying and Survival

We frame the switching decision as one related to expected future profits (in manufacturing or services) of the firm and comparative advantage in tasks. For current manufacturing firms, the decision to switch is in large part a decision about the expected comparative advantage of the firm going forward. During the period in question, firms are facing dramatic changes in the relative cost of locating activities outside the firm and outside the country. Both onshore and offshore outsourcing are on the rise and the lower cost of communications as well as increasing global linkages present opportunities for firms to split their activities across the borders of the firm as well as across national borders.

We would expect that firms with a comparative disadvantage in production would be the most likely to incur any fixed or sunk costs of outsourcing the production process. However, measuring such internal comparative disadvantage is difficult. Instead, we look at the determinants of switching relative to stayers, but also to exiters. We estimate a simple multinomial logit on the choice between continuing to produce in manufacturing, switching out to non-manufacturing activities, or ceasing operations. We ask whether firm characteristics such as size, productivity and trade status are systematically related to the probability of survival/switching after controlling for industry and year effects.

The results are reported in Table 4. The most striking result is the strong positive association of productivity with switching out of manufacturing. Switchers are significantly more productive than stayers who in turn are more productive than firms that exit entirely. This finding is at odds with a portrait of switchers as firms that are “failing” as manufacturers and can only survive as intermediaries between more efficient, lower cost producers and final customers. In terms of productivity, switchers are among the best firms rather than the worst.

Within the same industry, firm size as measured by log employment is positively and significantly correlated with the probability of staying and surviving in manufacturing. In contrast, size is negatively associated with exit and, in particular, switching out. This is in line with our previous observation that switchers are on average smaller. Firms with multiple establishments are more likely to switch out of manufacturing. This may be an artifact of the way in which switching is measured, as a firm only switches when all its establishments are classified as non-manufacturing.

Exporting itself is not significantly related with either switching out or shutting down. However among exporters, the greater the export intensity, the less likely the firm will switch out to non-manufacturing. From the perspective of within-firm comparative advantage, greater export intensity may indicate a relative capability of the firm in production activities.

The results for importing are comparably nuanced. The coefficient on the import dummy is positive and significant for exit, while it is close to zero and insignificant for switching out. However, import intensity gives the opposite sign, as manufacturing firms with low import intensity are more likely to stay, while intensive importers are more likely to switch out.

4.2 Post-Switching Performance

In this section, we examine the performance of switchers around the transition year. We compare switchers to non-switchers in their manufacturing industry (pre-switch industry) . Because we find such large differences in firm characteristics such as employment and productivity between switchers and continuing firms, we adopt a matching framework to develop a pool of comparable non-switching manufacturing firms to examine post-switch performance.

The average treatment of the treated has been computed using propensity score matching es-

timization techniques. The control group contains firms that are active in manufacturing and never switch out of manufacturing. The matching is done by 2-digit industry and includes a polynomial in value added per labor and firm size in $t-2$ (two years before the switch) and year fixed effects.¹⁶

The average treatment effect on the treated (ATT) results are shown in table 5. The relative evolution of switchers during and after their switch is quite dramatic. Employment levels fall in the years leading up to the switch while relative sales fall slightly, but sales per worker and value-added per worker surge. The decline in employment is concentrated in lower education blue collar workers, while highly educated white collar workers rise relative to their manufacturing counterparts. The shift away from production is evident in the shares of workers across occupation types. The share of managers, tech workers, and sales and support rise, offsetting the drop in production employment. Over the transition, switchers also change their international orientation away from their former peers. They start as less export intensive and more import intensive than other firms in their industry and those differences increase over the transition.

5 The Evolution of Switching Firms

In this section, we use detailed information on individual workers in Danish firms to examine the evolution of these switching firms around their transition dates. We consider the numbers and shares of different types of workers at switching firms before and after their exit from manufacturing. We first look at the overall evolution and then distinguish between various types of switchers.

5.1 Overall evolution

Figure 3 shows the evolution of the workforce at both switching firms and the control group of non-switching manufacturing firms for the 5 year period centered around the switch date.¹⁷

The switchers show a noticeable decline in employment in the years leading up to the switch and a small growth in employment afterwards. While the numbers of both white and blue collar workers are declining, the drop is particularly pronounced for blue collar workers. After the switch, the rise in employment at switchers is concentrated in the white collar workforce. Over the entire transition period, the share of white collar workers increases from 46 to 60 percent of the workforce at switching firms. In contrast, the white collar share at non-switchers increases by just one percent. In addition to the changing composition, there is dramatic turnover in workers for switchers. All firms naturally have workers arrive and depart in every year. However, this process is much more

¹⁶We use the `pscore` and `psmatch2` stata commands, and identify the 5 closest neighbors to our treated firms. As the estimated densities of the balancing score have poor overlap in some industries, we impose the following conditions to obtain the best possible matches: joint support, trim by dropping 5% of the treatment observations with the lowest the `pscore` density and `caliper(0.05)` leaving us with controls relatively close to the treated in terms of support. The balancing property was achieved in every case. All standard errors have been bootstrapped with 250 replications.

¹⁷The firms in the control group are selected using the algorithm described in Section 4.2.

active at these switching firms. Two years after the switch, more than 53 percent of the workforce is new at switchers, hired in years t through $t+2$. The comparable statistic for non-switchers is under 42 percent.

The pattern of educational attainment of the workforce at switchers is similar. Low education and medium education workers are reduced before the switch out, and while all categories of workers increase after the transition, the growth is largest for high education workers. The share of high education workers rises from 4.4 to 9.0 percent of the workforce; at non-switching firms, the share is unchanged.

Figure 4 examines the types of activities performed at switching firms from 1994 to 2007. All firms that will switch out of manufacturing are included in every year, whether or not they have already made the industry change. The decline in overall employment starts with the recession in the early part of the 2000's, but the more noticeable change is in the composition of employment across function. Both types of line workers (production and non-production) contract sharply in levels and as a share of employment at these firms. In contrast, sales and tech workers rise both in levels and shares. These firms are clearly changing their activities away from production.

5.2 Identifying Types of Switchers

We next try to identify whether some of these firms are still involved in some aspect of the manufacturing process even after switching industry. We adopt two different approaches to distinguish between types of firms. First, we look at the destination industries of switching firms. Second, we group firms by their pre-switch levels of high tech employment.

5.2.1 Types by destination

Figure 5 examines whether there are important differences across firms according to their destination industry. There are at least two possible types of firms that leave manufacturing. The first type transits from a set of production-based activities towards pure intermediation. These firms use their knowledge of suppliers and customers to become traditional wholesalers who match buyers and producers.

A second possible category is a firm that no longer undertakes production of the goods but still is involved in design and engineering, supervision of third party production (inside or outside the country) and branding, marketing and distribution. These FGPFs have many of the same capabilities and activities as traditional manufacturing firms but no longer directly control the assembly and processing activities in-house. Bernard and Fort (2013) document the extent of these types of firms in the wholesale sector in the US and find that a substantial number of firms and workers are employed at FGPs.

We do not have data on any pre-production and post-production activities at the switching

firms, nor do we know whether they are engaged in hiring contract manufacturing services. Instead, we use indirect ways to identify different types of switchers. We start by dividing the switching firms by destination sector. We assume that firms ending up in the wholesale sector are more likely to be closer to traditional wholesalers, the evidence of Bernard and Fort (2013) notwithstanding, while switching firms that move to Computer and R&D sectors or Other Business Activities are more likely to still be engaged in manufacturing-like activities.

Figure 5 shows big differences in the levels and shares of different functions across switching firms in these destination sectors. Firms that move to Wholesale see drops in blue collar workers (Line 1 and Line 2) but increasing shares of sales and support staff, with little change in the share of tech workers. On the other hand, firms that move either to Computer and R&D or to Other Business Activities show large increases in the share of tech workers. This evidence suggests that the narrative about firms that leave manufacturing includes at least two different stories. In one, the manufacturing-related capabilities are indeed declining as the firms become more like traditional wholesale firms. The other path is one of continuing activity related to manufacturing in spite of the absence of the manufacturing processes themselves.

5.2.2 Types by initial conditions in workforce composition

Another way to distinguish between firm types is to look at their initial stock of knowledge workers, i.e. technical and R&D workers. We focus on the subset of surviving switchers at the end of our period of analysis. We then define high tech firms as those firms that have a share of high tech workers above the 75th percentile two years before switching (the cutoff is above 8%). Those firms represent about a quarter of our sample, but they also employ about half of the workers (see Figure 6). We can also see that these firms experience a large increase in the number and share of high tech workers. Figure 7 shows the composition of the workforce by type of firm. We observe that high tech switchers are much larger than low tech firms. Both types have a large decline in employment the year before and during the industry change (especially getting rid of blue-collar production workers), but start growing again afterwards. However, for high tech firms, the share of tech workers increases (the stock remains constant) dramatically, from 19% to 27%; while sales and support activities gain in relative terms for low tech firms.

6 Worker outcomes

Deindustrialization by definition involves a decline in the size and relative importance of the manufacturing sector. We have shown that this process of declining manufacturing is not simply about the shrinking or shutdown of manufacturing firms but also includes an important component of reorganization of activities in firms that leave manufacturing for service sectors. A question remains what happens to the labor market outcomes of the workers themselves.

In this section, we focus on outcomes for individual workers, in particular, workers that are separated from employment at manufacturing firms that switch and at firms that exit manufacturing entirely. We consider outcomes for the five years after the job separation for workers that leave switchers just before the sectoral transition as well as for workers that are laid off from manufacturing plants that shut down entirely. There is a well-known potential problem in comparing employment paths of workers laid off in a mass firing (exiting manufacturing) with those individuals laid off from continuing firms (switchers), see Gibbons and Katz (1991). A priori we might expect workers separated from switchers to have worse post-layoff employment outcomes as they could be perceived by the market to be lower quality workers at those firms.¹⁸

The first year after separation yields very different results for layoffs from switchers and exits largely in line with expectations. Laid-off workers from switchers are much more likely to be unemployed or out of the labor market (17.5 percent) than are workers from exiting manufacturers (12.0 percent).

The situation five years after separation is dramatically different. Five years out, fewer than one third of these workers are employed in manufacturing. They are also much more likely to be employed in the service sector and less likely to be employed in manufacturing. This suggests that workers losing their jobs from switchers already had skills (or were performing tasks) more adapted to the changing nature of the economic environment, characterized by the increased relative share of services.

For the wage evolution, rather than look at the absolute evolution over time, we analyze the relative wage change of individuals losing their job during a switch-out or an exit compared with a control group of workers not losing their job in firms that remain in manufacturing. This is similar approach to what is typically done in the literature on mass layoffs (see e.g. Jacobson et al., 1993 and von Wachter et al., 2009). To identify workers in this control group, we use workers employed in the firm-level control groups for switchers and exiters discussed previously and consider workers who remain employed in these firms.

We use a log difference in wages over several time periods (between 1 and 5 years) and identify the wage changes relative to those for stayers in the control groups. Specifically we estimate a simple regression in first differences:

$$\Delta \log W_{i,t=0 \rightarrow t=j} = \alpha SO_i^{t=1} + \varepsilon_{it}$$

for $j=1, \dots, 4$ and where $SO_i^{t=1}$ indicates a dummy for whether the individual works for a firm that switches out in $t=1$. Workers leaving switching firms and workers continuing in switching firms are compared to workers who remain at relevant control group of continuing manufacturers. We also

¹⁸See Frederiksen and Westergaard-Nielsen (2007) and Frederiksen et al. (2013).

estimate a similar regression for workers at exiting firms:

$$\Delta \log W_{i,t=0 \rightarrow t=j} = \alpha \text{Exit}_i^{t=1} + \varepsilon_{it}$$

and compare their wage trajectories to those for workers at control group of continuing manufacturing firms..

Results are shown in Figure 8. Individuals losing their job at switchers have a big relative loss one year after the switch, equivalent to 38 percent of the previous wage. However, the wages quickly recover and end up catching up outperforming stayers in the longer run. Individuals losing their job because of firm exit see substantial but lower wage declines in the first year after the shutdown (14 percent). Finally, we also look at individuals who keep their jobs at switchers relative to those who keep their jobs at the control group of continuing manufacturers. While they do not differ in terms of wage trajectory in the short run, individuals who remain on the job at switchers experience a faster wage growth over longer horizons. This may reflect the better overall performance of switching firms

7 Conclusions

This paper has documented a new set of facts about the process of deindustrialization in advanced economies. The well-documented decline in manufacturing employment is not simply a story of disappearing industries and failing firms. An important piece of the evolution of modern advanced economies involves the transition of some firms from manufacturing to services, as well as the evolution of continuing manufacturing firms towards more service-like enterprises. This part of the deindustrialization story raises important questions for several dimensions of economic policy.

Manufacturing has a long history as a driver of economic growth and aggregate economic performance. As a sector with relatively high productivity growth rates over many decades, manufacturing is perceived by policy-makers to be the engine of the modern economy and as a result essential to prospects for long-run real growth and rising welfare. In turn, the focus of industrial policy is usually an attempt to retain or bring back the manufacturing sector. Examples of this type of policy are widespread. Presidential politics in the United States often focuses on the depth of support for manufacturing and policy areas from direct subsidies to trade to taxes are often designed to enhance opportunities for manufacturing firms. In 2012, France went so far as to create a position titled “le ministère du Redressement productif”, or Minister of Industrial Recovery. In Denmark, the government launched a Strategy for Denmark as a Production Country, with the aim of ensuring that Denmark will continue to be an attractive location for production. This strategy involves targeting the adoption of advanced production technologies and ensuring that workers have the right skills to match with this technology (Danish Government (2014)). In every case, these policies have focused on manufacturing itself.

Our findings do nothing to diminish the role and importance of manufacturing. However, they raise questions about the evolution of the advanced economies and the nature of activities done by firms in a modern economy. We find that there exist service sector firms that still perform many of the high value-added activities of a typical traditional manufacturing firm. The dominant focus on manufacturing misses an important part of the production economy.

It is universally agreed that economic policies that promote long-run productivity growth are in the national interest. What is less well understood is what exact form those policies should take and which industries and firms they should target. In this paper, we argue that there is a set of firms in the service sector that have the capabilities to produce innovation and productivity growth. Policies that favor “production”, i.e. manufacturing, are going to miss this growing and important set of firms and may bias firms towards retaining less efficient production activities.

Analyzing the evolution of these switching firms provides insight into a broader set of trends in advanced economies. Comparative advantage in assembly and production has shifted abroad due to the increased integration of Eastern Europe, China and India into the global economy as well as the advent of advanced low-cost communication technologies. However, the movement of these firms out of manufacturing does not signal the end of their ability to innovate and increase value-added. Design, R&D and post-production activities in many cases remain in the home country and these firms grow and prosper after making the transition out of manufacturing.

Turning our attention to the workers themselves, we find important results that can inform policy. As has been documented in many other countries, workers separated from either exiting firms or from switchers, have relatively bad short-term labor market outcomes: their wages are lower and they are more likely to be unemployed or out of the labor force. However, we find that the long-term prospects, especially for workers separated from switchers, are relatively good. Wages have recovered and labor force engagement has rebounded. The positive longer term outcomes are in contrast to recent research on the US and elsewhere, see Autor et al. (2013b). One possible reason lies in the contrasting support given to Danish workers relative to that in other countries. Eriksson (2012) argues that a key feature of the Danish labour market is its so-called flexicurity, the coexistence of flexibility (low adjustment costs for both employers and employees) and security (owing to a developed social safety net with high coverage and high replacement ratios). These policies may provide a template for other countries who are facing similar transitions in their industrial and firm structure. More research is needed to compare and contrast the outcomes for workers in Denmark with those in other countries.

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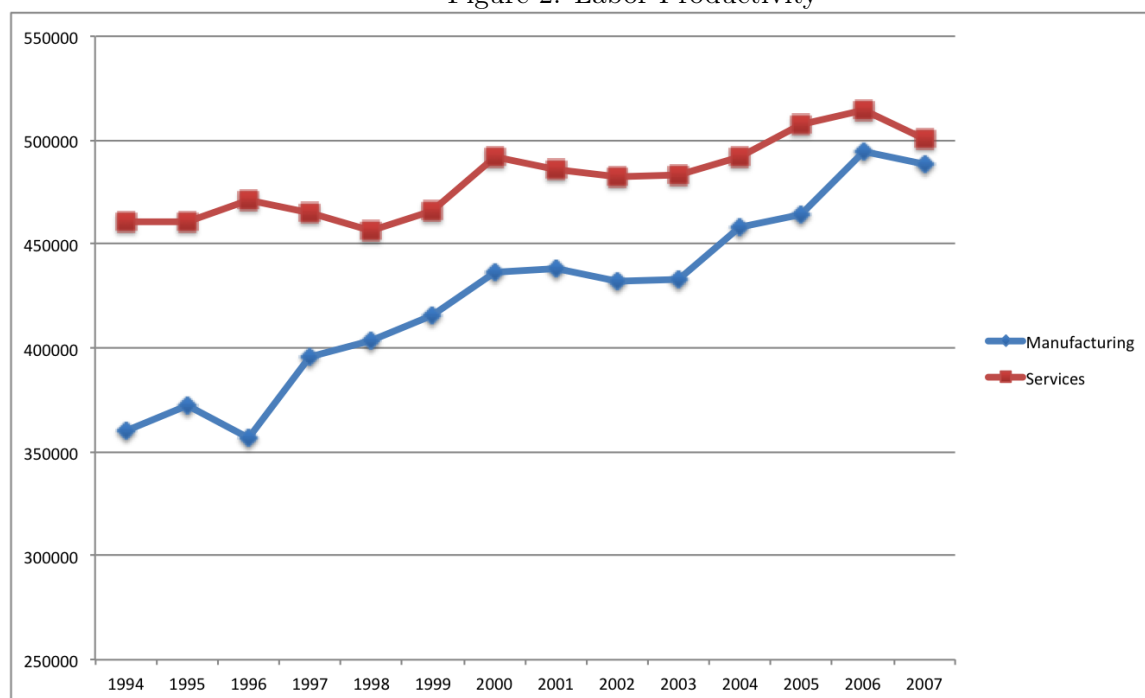
Figure 1: Manufacturing Firms and Workers over time



Note: The vertical lines indicates the start and end years of our sample for examining sector switching.

Source: Statistics Denmark and authors' own calculations.

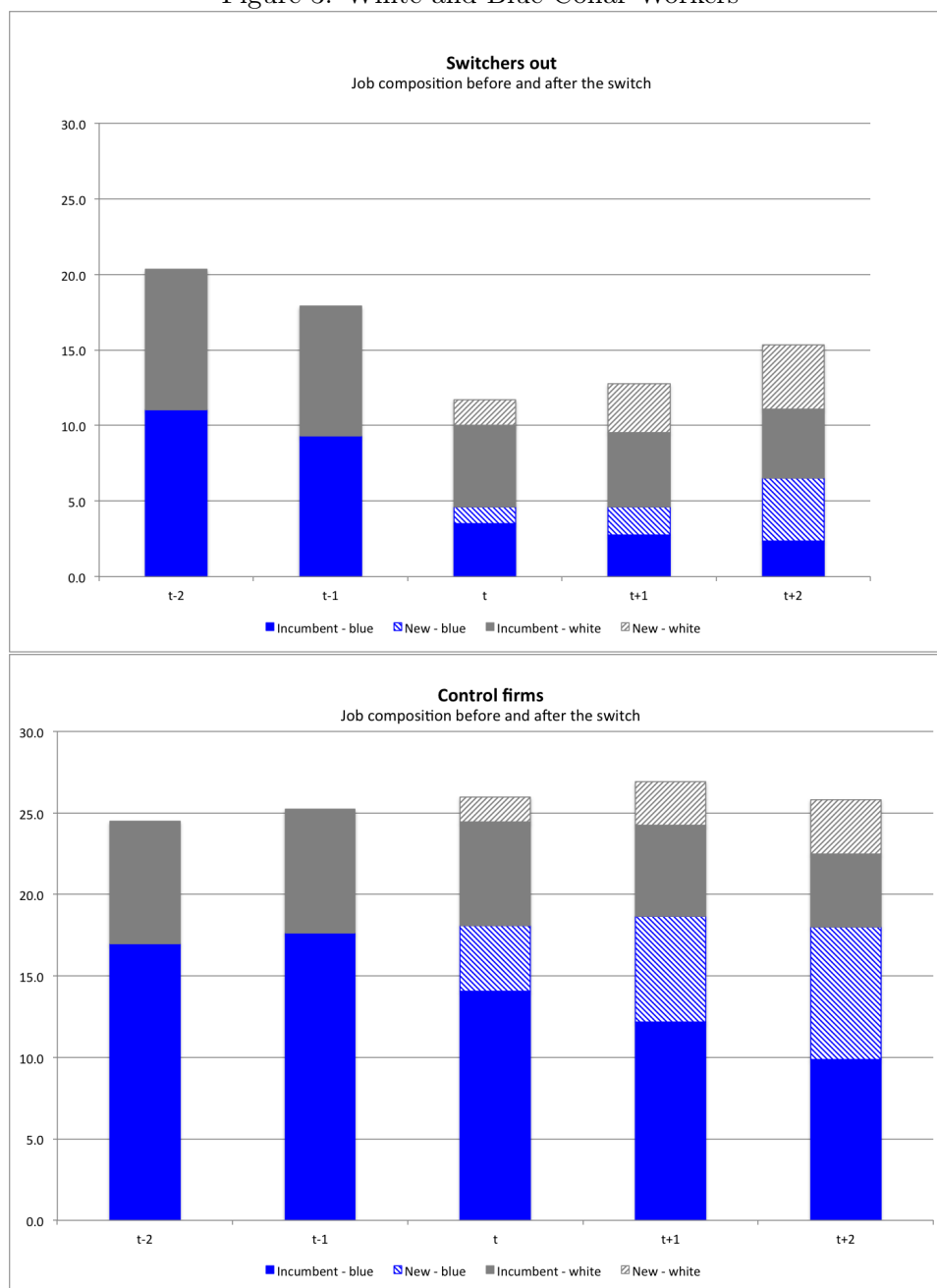
Figure 2: Labor Productivity



Note: Labor productivity is given by value-added per worker. The lines represent sector averages. Value-added is deflated by the CPI.

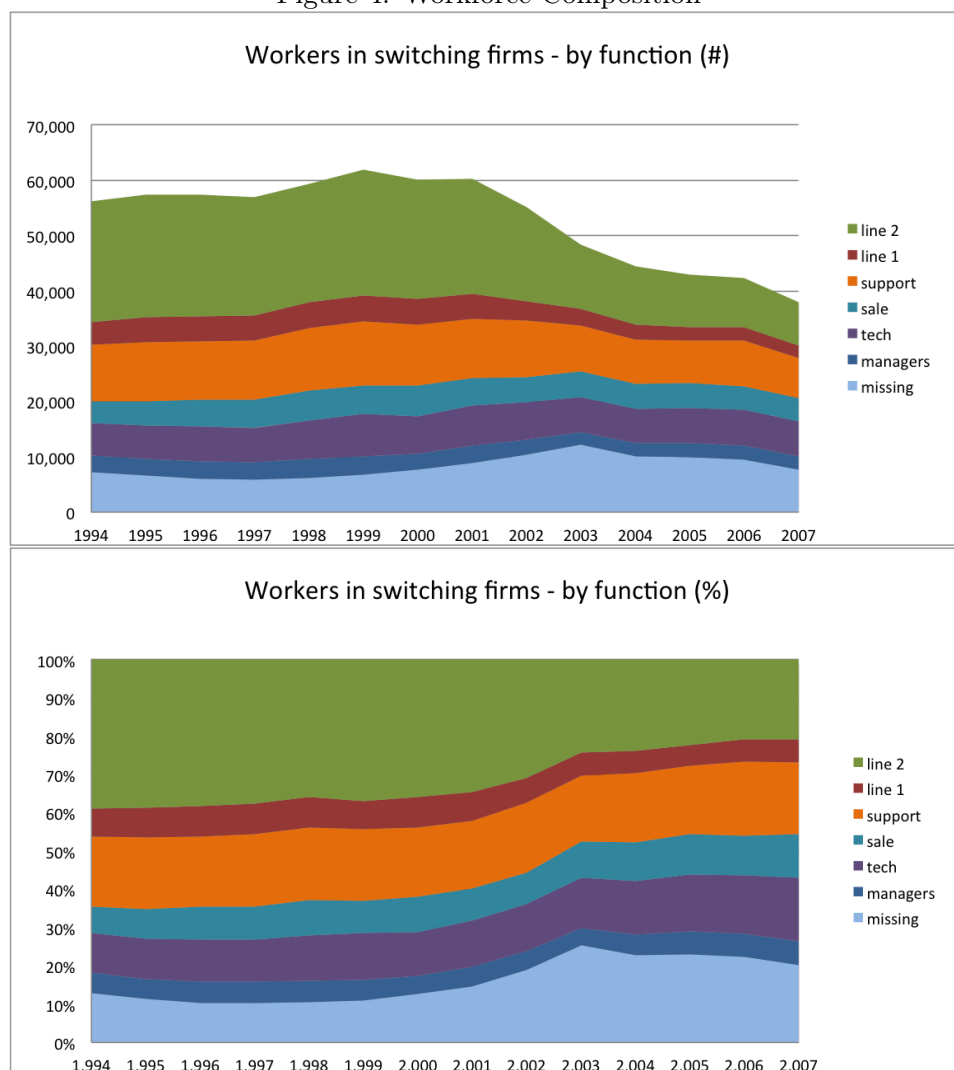
Source: Statistics Denmark and authors' own calculations.

Figure 3: White and Blue Collar Workers



Note: The upper panel reports average employment at switchers for the years before, during, and after leaving manufacturing. Employment is divided into blue collar and white collar workers and further separated into continuing workers who stay after the switch and new workers who arrive after the switch. The bottom panel gives the same averages for matched continuing manufacturing firms over comparable five year intervals. Source: Authors' own calculations.

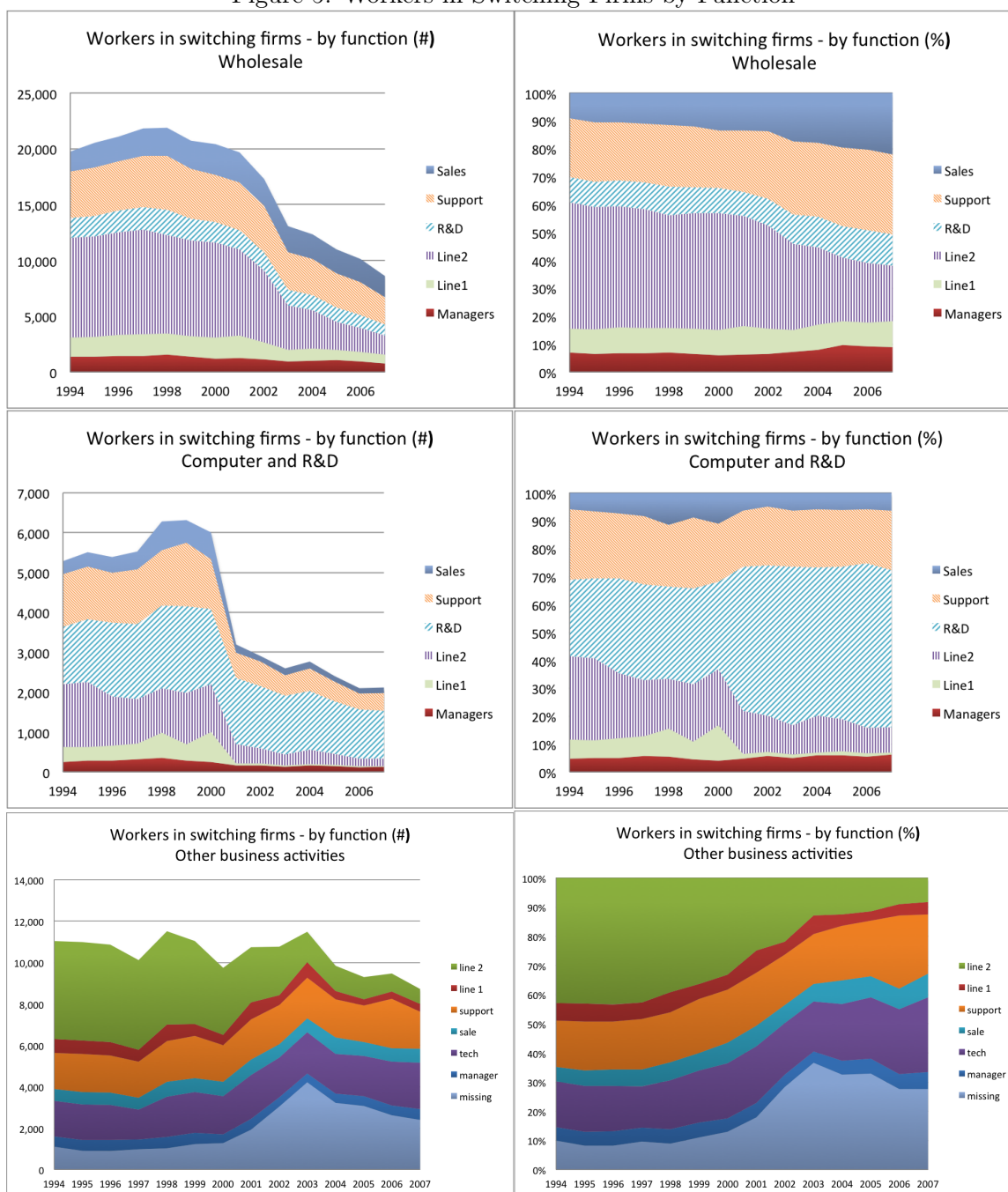
Figure 4: Workforce Composition



Note: The upper panel reports average employment by occupation at all switching in every year. Line 1 refers to blue-collar workers not involved in production. Line 2 refers to blue-collar workers involved in production. Firms are included both before, during and after the year that they switch. The bottom panel reports the same numbers as a share of employment.

Source: Authors' own calculations.

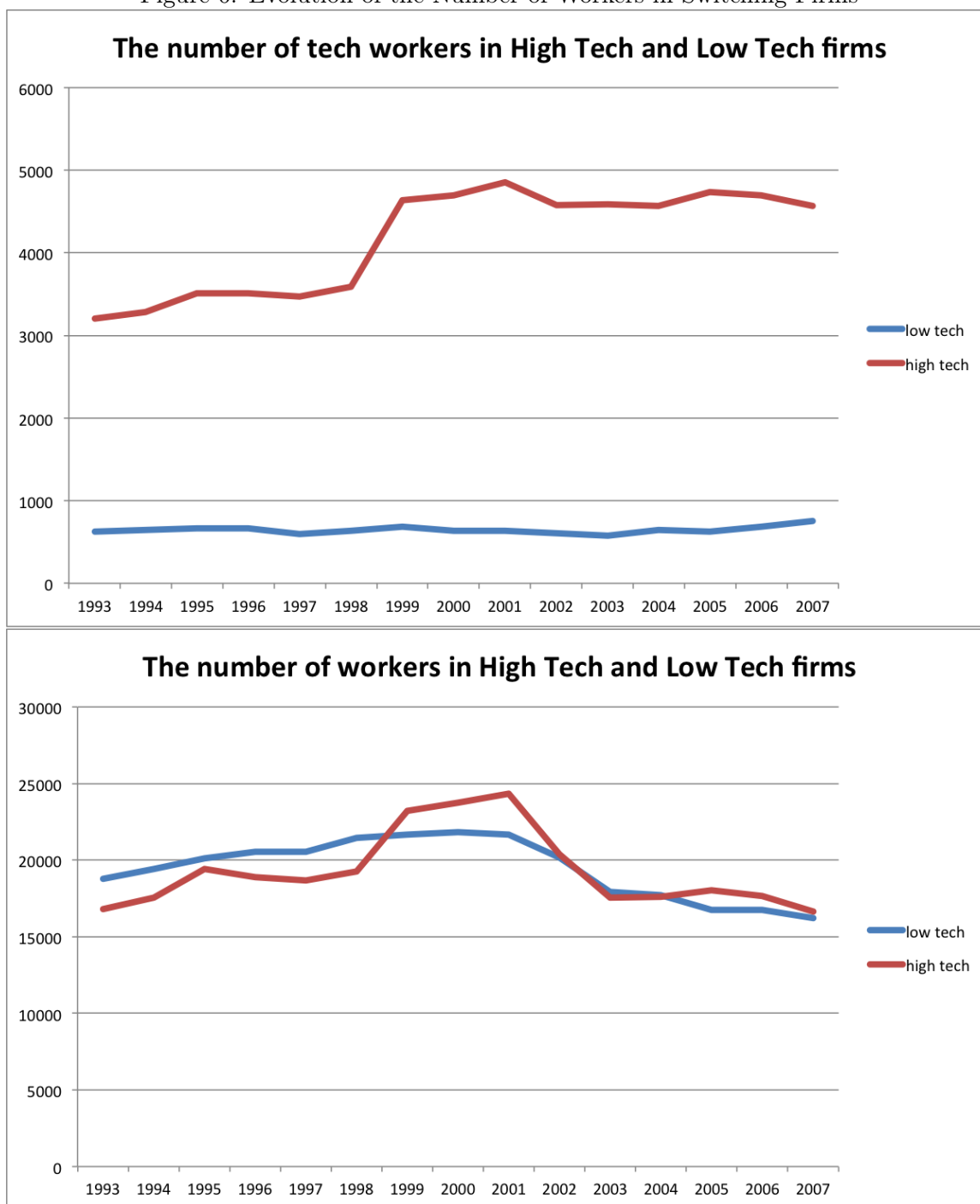
Figure 5: Workers in Switching Firms by Function



Note: The left hand panels report average employment by occupation at all switching firms in every year for firms that switch to specific service industries: Wholesale, Computer and R&D, and Other Business Activities. Firms are included both before, during and after the year that they switch. Line 1 refers to blue-collar workers not involved in production. Line 2 refers to blue-collar workers involved in production. The bottom panel reports the same numbers as a share of employment.

Source: Authors' own calculations.

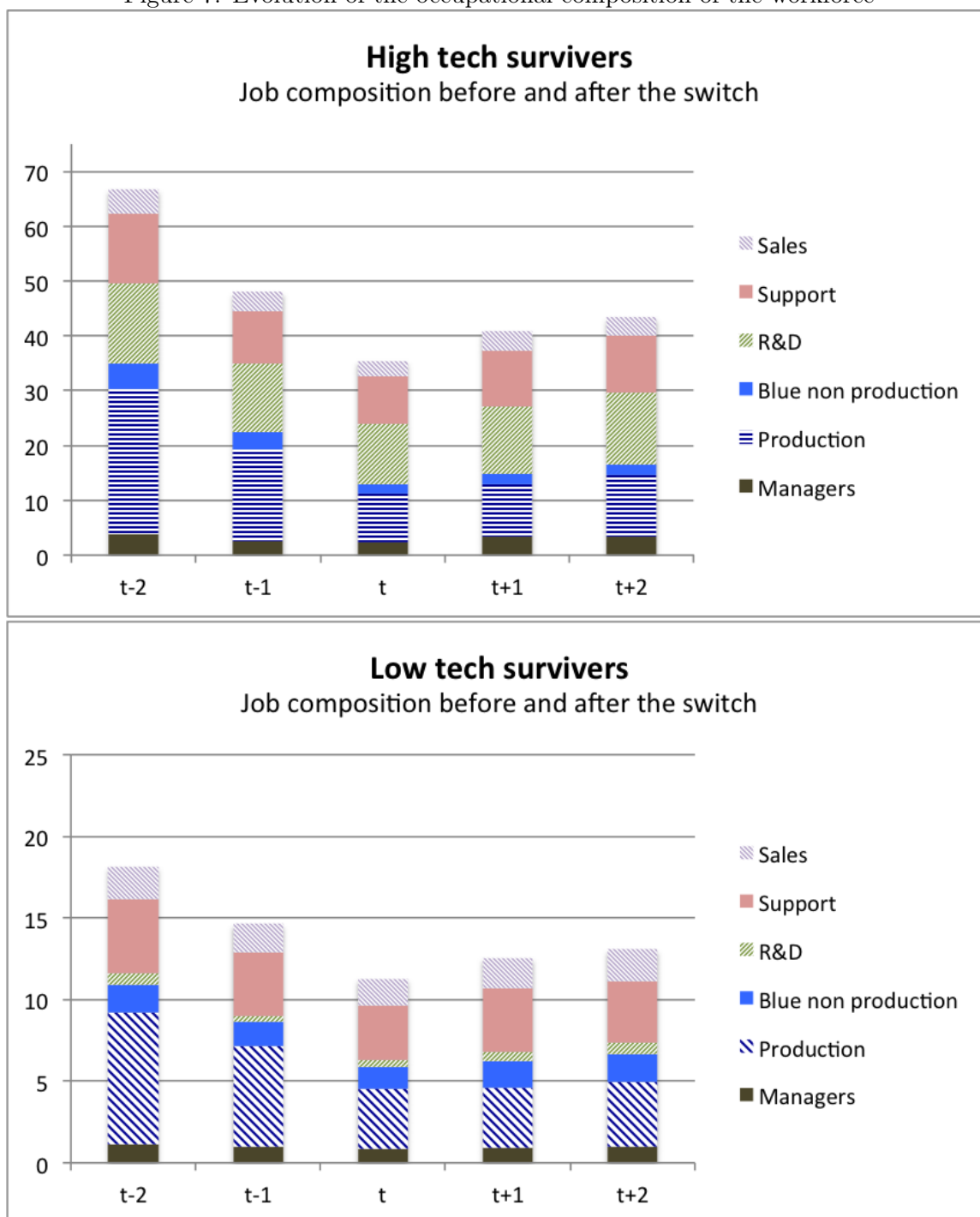
Figure 6: Evolution of the Number of Workers in Switching Firms



Note: The upper panel reports total employment at high tech switchers (top quartile of R&D/tech employment shares among switchers) and low tech switchers (remaining firms) for all years before, during, and after leaving manufacturing. The bottom panel gives the total R&D/tech workers at the same two groups of firms.

Source: Authors' own calculations.

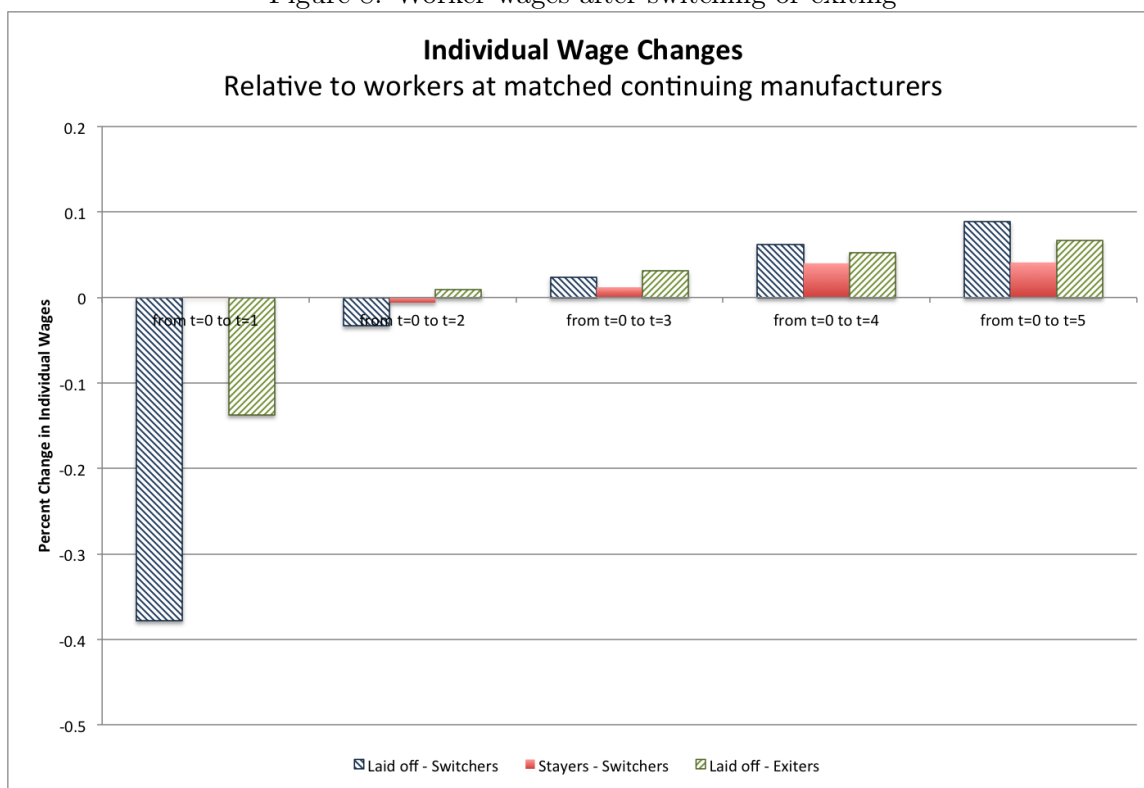
Figure 7: Evolution of the occupational composition of the workforce



Note: The upper panel reports average employment at high-tech switchers (top quartile of R&D/tech employment shares among switchers) for the years before, during, and after leaving manufacturing. Employment is divided into six occupation categories. The bottom panel gives the same averages for low tech switchers.

Source: Authors' own calculations.

Figure 8: Worker wages after switching or exiting



Note: The columns represent the cumulative change in wages for (i) workers that leave switching firms, (ii) workers that stay at switching firms, and (iii) workers that leave manufacturing firms that shut down. All the wage change are relative to control groups as defined in Section 4.2.

Source: Authors' own calculations.

Table 1: Aggregates for All Manufacturing and Switching Firms

All Manufacturing						
year	# firms	Employment	Value-Added	Turnover	Exports	Imports
1994	15,250	499,865	167,377	507,723	132,191	68,918
1995	14,934	503,814	162,617	510,082	139,666	72,502
1996	14,627	495,376	171,772	502,922	145,954	73,052
1997	14,384	503,117	169,809	511,263	151,665	78,198
1998	14,175	505,565	160,341	479,351	154,511	77,279
1999	14,075	489,859	166,552	483,248	178,085	77,981
2000	13,778	486,438	167,130	501,913	208,092	93,017
2001	13,423	484,449	171,567	528,513	218,740	94,054
2002	12,908	460,600	166,642	511,419	217,094	93,269
2003	12,623	428,457	159,337	482,014	210,803	87,852
2004	12,431	413,128	161,222	492,860	211,748	88,768
2005	12,234	406,810	160,910	507,438	220,629	92,952
2006	12,167	413,184	167,193	541,681	233,648	106,612
2007	12,117	425,298	175,144	575,571	241,299	112,188

Switchers						
year	# firms	Employment	Value-Added	Turnover	Exports	Imports
1994	206	3,918	1,348	4,615	782	773
1995	393	7,099	2,302	9,098	1,645	2,306
1996	583	10,791	3,279	13,102	2,575	3,128
1997	719	14,470	6,096	21,318	5,243	4,476
1998	876	18,696	9,956	29,296	6,040	5,859
1999	957	18,869	9,312	28,971	6,322	6,008
2000	1,026	23,377	7,734	38,760	6,830	8,211
2001	1,167	25,718	8,468	43,609	7,503	8,881
2002	1,320	27,642	8,493	49,669	12,215	13,305
2003	1,388	32,321	10,981	59,206	11,194	13,794
2004	1,449	32,761	12,961	61,770	12,192	14,961
2005	1,471	35,879	13,793	77,119	18,004	21,155
2006	1,500	37,631	14,502	80,862	14,190	19,610
2007	1,680	36,951	16,412	81,639	12,185	18,633

Note: Manufacturing firms are defined as the sum of stayers, entrants and firms switching into manufacturing and switchers are defined as firms permanently switching out of manufacturing. Value added and turnover are obtained from the VAT statistics (after merging). Export and imports are obtained from the customs data (after merging). Sales, value added, exports and imports are in millions DKK in real terms, deflated using the CPI index with baseline in 1995

Table 2: Firm Characteristics - differentials between switchers, exiters, and stayers in manufacturing

	Switching out	Exiting
Employment	-0.326***	-0.566***
Value added per worker	0.025*	-0.126***
Sales per worker	0.182***	-0.095***
Export share (%)	-0.007	-0.028***
Import intensity (%)	0.077***	-0.006**
<i>Skills and wages</i>		
Share of low educated workers (%)	-0.043***	0.007***
Share of medium educated workers (%)	0.019***	-0.008***
Share of high educated workers (%)	0.024***	0.001
Share of white-collar workers (%)	0.152***	-0.002
Average wage	0.093***	-0.010***
Wage bill share (high education)	0.028***	0.001
Wage bill share (white collar)	0.156***	-0.003
<i>Occupations</i>		
Share of managers (%)	0.020***	-0.003**
Share of tech workers (%)	0.029***	0.005***
Share of production workers (%)	-0.159***	-0.002
Share of blue non production workers (%)	0.007**	0.001
Share of support workers (%)	0.076***	-0.004*
Share of sales workers (%)	0.027***	0.004***
Observations (min/max)	63,488/157,205	63,488/157,205

Note: These are coefficients from a regression of the (log) firm characteristic on dummy variables for switching and exiting firms two years before their change of status (respectively). Other controls include log employment, year-industry(2digit) fixed effects. The baseline group consists of all manufacturing firms who do not exit or switch. Value added per worker, sales per worker, sales and wages are in DKK, all have been deflated using the CPI index with 1995 as the base year. Blue-collar and white-collar groups are constructed according to workers' occupation code (ISCO code). ***/**/* indicates statistical significance at the 1%/5%/10% respectively.

Table 3: Occupational Structure in 1994 and 2007: Manufacturing, Services, Switchers

Manufacturing								
	# firms	# workers	Managers	Line1	Line2	R&D	Support	Sales
1994	14,754	467,382	4.7%	6.6%	58.0%	9.2%	16.7%	4.8%
2007	11,808	403,829	4.3%	7.3%	51.4%	12.9%	16.9%	7.3%

Services								
	# firms	# workers	Managers	Line1	Line2	R&D	Support	Sales
1994	76,846	861,056	5.7%	11.4%	20.9%	8.8%	38.0%	15.2%
2007	97,972	1,115,350	4.1%	10.8%	18.6%	11.6%	34.0%	21.0%

Switchers								
	# firms	# workers	Managers	Line1	Line2	R&D	Support	Sales
1994	1702	57,680	6.0%	8.2%	44.3%	11.9%	22.2%	7.4%
2007	1628	34,478	8.1%	7.4%	25.3%	22.1%	24.3%	12.8%

Note: Manufacturing (services) includes all firms in manufacturing (services) in the year. Switchers includes all past, current and future switching firms: future switchers in 1994 and past switchers in 2007. Line 1 refers to blue-collar workers not involved in production. Line 2 refers to blue-collar workers involved in production.

Table 4: Multinomial Logit

Baseline: stayer	Exiter		Switcher	
	coef	dy/dx	coef	dy/dx
Log labor productivity in $t - 1$	-0.061*** (0.009)	-0.007*** (0.001)	0.120*** (0.015)	0.004*** (0.0005)
Log employment in $t - 1$	-0.425*** (0.007)	-0.045*** (0.0007)	-0.197*** (0.010)	-0.003*** (0.0003)
Multi-establishments firm	0.411*** (0.031)	0.043*** (0.003)	0.276*** (0.045)	0.006*** (0.001)
Exporter in $t - 1$	0.003 (0.022)	0.0004 (0.002)	-0.011 (0.033)	-0.0003 (0.001)
Importer in $t - 1$	0.070*** (0.023)	0.007*** (0.002)	0.016 (0.035)	0.0009 (0.001)
Export share in $t - 1$	-0.037 (0.048)	-0.002 (0.005)	-0.407*** (0.069)	-0.012*** (0.002)
Import share in $t - 1$	-0.002 (0.078)	-0.007 (0.008)	1.106*** (0.090)	0.034*** (0.003)
Year dummies	YES			
Sector dummies	YES			
Predicted probability	0.089		0.017	
N	155,257			

Note: Multinomial logit analysis, coefficients and marginal effects are reported with standard errors in parentheses. This specification excludes firms in industries 16, 23 and 37. ***/**/* indicates statistical significance at the 1%/5%/10% respectively.

Table 5: Performance of switchers OUT before and after the switch (level analysis)

	Switching out of manufacturing			
	in t-1	in t	in t+1	in t+2
Employment	-0.048***	-0.283***	-0.307***	-0.306***
Value added per worker	0.054***	0.122***	0.103***	0.112***
Sales per worker	0.234***	0.384***	0.402***	0.402***
Sales	0.194***	0.164***	0.148***	0.154***
Export share	-0.037***	-0.070***	-0.097***	-0.086***
Import intensity	0.093***	0.100***	0.109***	0.112***
Skills and Wages				
low education	-0.039***	-0.053***	-0.052***	-0.052***
medium education	0.011***	0.021***	0.017***	0.012***
high education	0.029***	0.032***	0.035***	0.040***
Share of white collar workers	0.158***	0.194***	0.259***	0.265***
Average wage	0.089***	0.098***	0.108***	0.094***
Share of wages - high education	0.031***	0.034***	0.037***	0.042***
Share of wages -white collar	0.165***	0.196***	0.263***	0.274***
Share of tech workers	0.032***	0.034***	0.052***	0.051***
Share of production workers	-0.163***	-0.231***	-0.286***	-0.304***
# treated	1,818	1,818	1,307	1,134
# matched controls	8,454	8,454	6,102	5,250

Note: The average treatment on the treated has been computed using propensity score matching estimation techniques. The control group is firms that are active in manufacturing and never switch out of manufacturing. We use the `pscore` and `psmatch2` stata commands, and identify the 5 closest neighbors to the treated firms. As the estimated densities of the balancing score have poor overlap in some industries, we impose the following conditions to obtain the best matches possible: joint support, trim by dropping 5% of the treatment observations at which the `pscore` density of the control observations is the lowest and caliper (0.05) so that we only match treated with controls relatively close to them on the support. The matching is done separately for switchers out and exits, by 2-digit industry and includes a polynomial in value added per labor and firm size in t-2 (two years before the switch), and year fixed effects. The balancing property was achieved in every case. All standard errors have been bootstrapped with 250 replications. ***/**/* indicates significance at the 1%/5%/10% level.

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