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The unleashing of Creative Potential from Exiting Firms ? not really?

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Abstract

A growing literature sees labour mobility as a source of knowledge diffusion that benefits the receiving company. However, labour mobility is not necessarily a source of positive knowledge transfer, but also leads to destruction of knowledge. This paper explores what happens to the employees from failing companies and how their skills are being redeployed. It is based on four different cases of firm exit from the shipbuilding industry. The analysis is based on detailed micro data that allow us to follow the mobility of all the laid-off employees. The exit processes are quite diverse and so are the future employment careers of the redundant workers. The closure of each shipyard is described in detail and regression analysis is applied to each case in order to uncover factors that may lead to re-employment. We find that the workers end up in various industries partly depending on the regional industrial environment. The highly educated

workers are more successful, but most shipbuilders end up in a job with a significantly lower relative wage indicating that the employer does not value the specific skills very high. Additional education is only occasionally a success and it depends on the regional environment. Collaboration by the owners of the shipyard and local government to facilitate spin-offs, on the other hand, tends to be an effective way of ensuring that the workers made redundant by the shipyard?s closure find new jobs.

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The unleashing of Creative Potential from Exiting Firms … not really?

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1. Introduction

What happens with a large firm's knowledge when it exits? On the one hand knowledge embodied in firms is lost when firms exit. However, the skills, competences and knowledge embodied in the former employees are suddenly released and can become channels of knowledge transfer available for other firms that hire them (Hoetker and Agarwal, 2009). Furthermore, the laid off workers with entrepreneurial tendencies are free to found their own companies. In 1987 the shipyard in Aalborg, Denmark, with more than 3,000 employees closed down. This process of creative destruction does not imply that the knowledge was destroyed. 25 years later several companies can be traced back to the shipyard with a total employment close to that of the shipyard. The part of the old shipyard that used to make boilers was spun off in a separate company that grew to a multinational firm with 600 employees in Aalborg and 2,900 worldwide. Employees from the IT department founded a spinoff IT company mainly selling shipyard management systems. A windmill company was attracted to found a windmill wing company in Aalborg because of the workers with competences in making glass fibre boats. Today, they employ 1,200 workers. Therefore it seems that the diffusion of knowledge from the exiting firm helped other firms grow. This experience is in line with Buenstorf and Fornahl (2009) who find that the sudden decline of the IT firm Intershop in Jena, Germany, created several spinoffs that eight years later had more employees than the mother company. But does this tell the full story of the workers from defunct firm? It is not apparent from the success following the closure of Aalborg Shipyard (or Intershop) that the previous shipyard workers benefitted. Moreover we do not know if their specific knowledge and skills were applied in their new firm or if it just more general skills that are being used. That is if the labour mobility was a positive source of knowledge transfer. Only some relatively specific abilities of a few workers are strictly needed to set up the successful spin-offs. What happened to the rest of previous employees of these firms? Did their competences help change the local industries or did they have to adapt and take a job (if they could get one) that did not match their competences?

Employee mobility is an important channel of knowledge diffusion and knowledge spill-overs (Almeida and Kogut, 1999; Frenken et al., 2007). The recent literature analysing revealed skill relatedness between industries argues that there are positive effects on firms' productivity when firms hire employees from

related industries (Boschma et al., 2012; Neffke and Svensson Henning, 2010; Boschma et al. 2009). However, this literature only addresses the positive impacts of mobility of employees with a bachelor degree or higher, since these apparently are the only carriers of knowledge. In addition, the measure of revealed skill relatedness between industries is based on observed mobility between industries (Neffke and Svensson Henning, 2010). As a result they are likely to overestimate the effects of knowledge diffusion between industries and the relatedness for declining industries. Knowledge flows through mobility does not depend on whether it is voluntary or forced but the effect depends on the technological proximity between the industries.

In the past 30 years the Danish shipyard industry has been in general decline. From accounting for more than 18,000 full time equivalent employees in the early 1980s it accounted for less than 6,000 in 2007 (see Figure 1 in the following section). Many of the workers made redundant by this process of creative destruction had specialised abilities that made them difficult to employ elsewhere in the Danish economy. Even for workers with more general skills, the sheer scale of the closures meant that there were too many competing for relatively few jobs. Closure of a shipyard often entails thousands of lay-offs and sometimes took place in regions where there were not many other employment opportunities.

Reemploying the workers made redundant at the shipyards was both an opportunity and a challenge to the economy. It was an opportunity in the sense that a large amount of highly developed and specialised knowledge became available for other firms. But it was a challenge too, as worker adaptability may not be sufficient to exploit their knowledge. The result depends both on the exit strategies of the firm and the regional industry structure.

The purpose of this paper is to analyse the diffusion of knowledge through employee mobility after firm exit. The paper will focus on the laid off workers and investigate their re-employability and future relative earnings. The analysis is undertaken at the micro level looking at factors such as education, mobility and spin-off activity. The study will analyse decline of the Danish shipyard industry focusing on the closing down of four shipyards from 1987 to 2000. The analysis will be based on detailed individual-level register data that comprise all workers in the Danish labour market from 1980 to 2008.

This paper contributes to the literature on the effect on firm exit on knowledge diffusion by providing detailed evidence on how forced mobility destroys knowledge and makes competences obsolete, while the positive effects are rarer. It also adds to the discussion of industrial skill relatedness measured by labour mobility since mobility is sometimes forced and that the income of the Danish shipyard workers to a large extent declines in the new job. By using a linked employer-employee database on the individual level we are able to follow the laid-off workers that actually get a job and investigate the factors, such as education, gender, and age that characterise these workers. Furthermore, we assess the extent of knowledge transfer by analysing in which industries they get a job, the job level and how the new employer value the skills of the new employee by looking at the relative wage levels.

The paper is structured as follows: the decline of the Danish shipbuilding industry is described in the following section and Section 3 describes the processes of closing down four specific. Section 4 presents the worker level data and in Section 5 two sets of logistic regressions are carried out for each shipyard independently. The first set estimates the probability that a shipyard worker finds a new job while the

second set estimates the probability that the worker receives a higher relative wage in the new job compared to his relative wage at the shipyard. Section 6 concludes.

2. Knowledge diffusion in the shipyards' wake

The four large Danish shipyards that closed down are: Nakskov and Aalborg shipyards, which both closed down in 1987; Burmeister & Wain (B&W), which closed down in 1996; Danyard, which closed down in the year 2000. These closures are quite evident from the evolution of full time equivalent employment in the shipbuilding industry as presented in Figure 1. But the full impact is likely to be understated, as subcontractors are not taken into account.

The shipyards represent quite diverse narratives. Nakskov was located in a relatively marginal region on an island in the south of Denmark and local reemployment of the redundant workers is expected to have been very difficult. Aalborg is located in the fourth largest city of Denmark (which has the same name) and in geographical vicinity to Frederikshavn, where two major shipyards were located (one of them Danyard, the other one surviving past Danyard's closure in 2000). Thus there were both opportunities for other employment in the city but also a big opportunity for continuing to use the abilities in the same industry. Danyard played a large part in the unwinding of Aalborg and the heavy merger activity resulted in a large number of small temporary workplaces, which is also seen in Figure 1. B&W was located in central Copenhagen and thus it can be expected that there was a plethora of opportunities for the redundant workers to find alternative occupations. The last of these four shipyards to close down was Danyard and this case is expected to have more in common with the closure of Nakskov than with the other two. By the time Danyard closed down, the industry had all but vanished from the central city of the region, Aalborg, and being located in the very north of Denmark, it was a closure in a relatively marginal region. In the year 2000 there was still a second major shipyard in Frederikshavn but it was not capable of taking on much of the workforce from Danyard. In fact, it closed down just a few years later (as also evident in Figure 1).

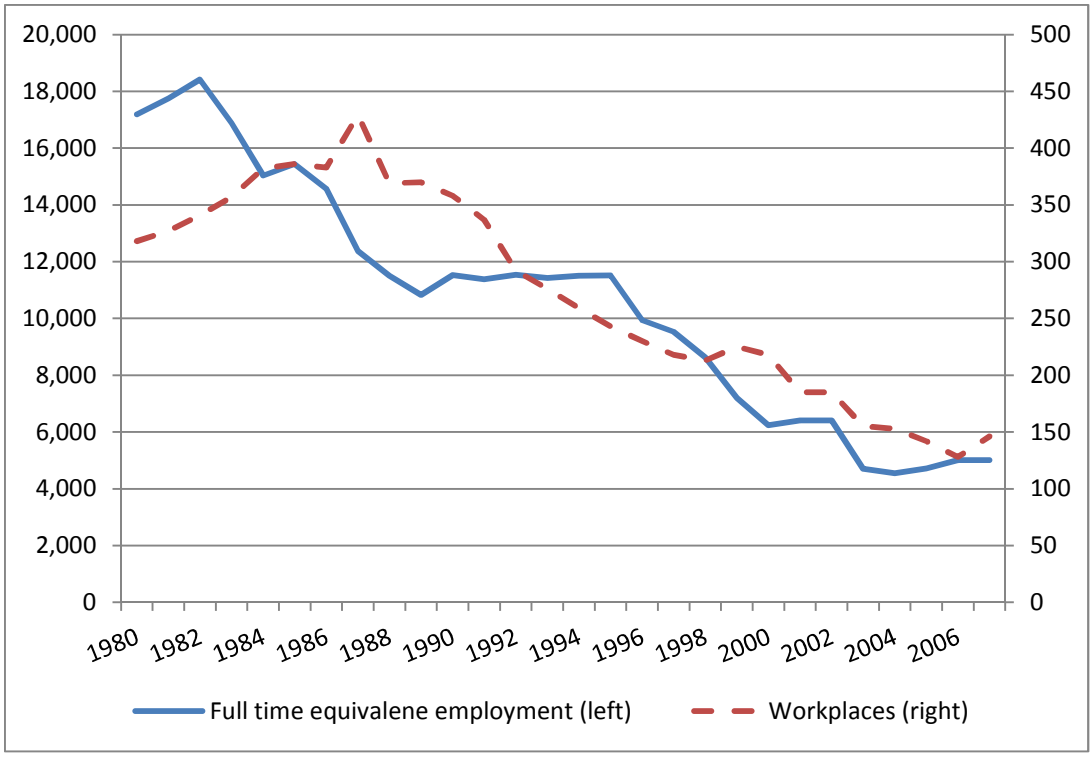

Figure 1: The Danish shipyard industry (NACE rev. 1 industry 351: "Manuf. and maint. of ships and boats")

When a worker unwillingly becomes unemployed he must find a new application for his abilities, adapt his repertoire to fit firms' demand or potentially create demand for his abilities. This last event could be an act of entrepreneurship or he could accept a job for which his fit is initially poor but where there is a possibility for adaptation; the better the expected fit of abilities and the new job, the higher the wages. Thus even when the initial fit is weak the worker may still receive a high income if the new employer expects his new skills to bring a competitive advantage to the firm. This is the classic case of knowledge transfer: the worker brings new abilities or even new types of abilities to the firm.

When a shipyard closes down a large number of people will be looking for a new job, and many of them will have relatively similar abilities. Thus they will be facing a situation of relative abundance of their abilities. Some of the laid off shipyard workers will probably find work based on expected future contributions and some will find new applications for their abilities as ship builders. The more general a worker's abilities are, the easier it is for the worker to find an application for it in the labour market and earn his due rent.

There will in general be a large number of workers that will have to adapt after the shipyard has closed down. They may take further training, they may move to another region or they may accept a lower wage in a job where their abilities go relatively unused. This waste of ability represents an economic waste and a question for policy makers is what to do to make workers more adaptable, for example by promoting vocational training, or to encourage firms to attempt to harness the available new abilities with knowledge spill-overs in mind. This later aim can be attempted by encouraging workplaces from the shipyard to be spun off to other firms. Or be encouraging entrepreneurship (by spin-off or not) among the workers.

3. The shipyards

The following sections describe the processes of closing down the four shipyards. The intention is to highlight the differences between the various processes as these are expected to contribute in explaining the differences in the results of the econometric analyses of Section 5. In the data a firm is identified as being closed down when it loses all, or practically all, of its employees. The descriptions of the shipyards will not be ordered chronologically. As the histories of Aalborg shipyard and Danyard are to some extent overlapping these will be handled in sequence. A caveat is needed with regards to the term "closed down": A firm is categorised as being closed down the first year in which the firm appears to have no or very few employees in the database. This may not be the year that the decision to close it down was taken or the year that it was legally closed down. The following descriptions are based on Olesen (forthcoming) where further information and analyses of the cases can be found. See also Poulsen and Sornn-Friese (2011).

Aalborg (1987)

Aalborg shipyard had a long history but focus here is on its closure in 1987. At this point it was owned by J. Lauritzen Holding (JLH) which also owned shipyards in Frederikshavn and Elsinore, as well as several other firms. The shipyard in Aalborg was a relatively large firm. It consisted of three separate divisions: offshore, boilers and the shipyard itself. It was not the only shipyard under JLH to be performing badly and the management at JLH decided to merge the three shipyards into one firm based in Frederikshavn. The new firm was to be called Danyard.

The offshore and shipyard divisions of Aalborg shipyard were merged and became parts of the new Danyard constellation. The boiler division of Aalborg shipyard was, however, separated out in two new firms and the firm Aalborg shipyard was transformed into a real-estate company under JLH. The real-estate company also acted as the mother firm of the two new boiler firms. The real estate company was set up with the aim of creating a business park. This was undertaken in collaboration with the local municipality and with Aalborg University and was somewhat successful in attracting new firms to the land and building of the old shipyard.

Thus in the sort run, it would seem that many of the activities undertaken by Aalborg shipyard carried on in the new ownership constellation. However the restructuring was accompanied by rationalisations so that many people did lose their jobs by the events of 1987. And no later than 1988 the management of Danyard decided to close down the shipyard in Elsinore as well as the production of steel ships in Aalborg and separate the remaining fiberglass ship construction activity out into a new firm, Danyard Aalborg, directly under JLH.

During the 1990s Danyard Aalborg moved back from being an independent firm under JLH to being a daughter company of Danyard. The production of boilers continued in Aalborg under varying ownership structures as well. And there was some success in attracting new firms to the old shipyard site.

Danyard (2000)

Danyard (located in Frederikshavn on the north eastern coast of Denmark) was a relatively specialised shipyard. This had become the norm in Europe – arguable as a consequence of low cost Asian shipyards focussing on more standardised ship designs. Danyard was specialised in producing cooling freighters and chemical tankers, while its daughter firm Danyard Aalborg was specialised in producing catamaran ferries

and military vessels. The chemical tankers were so specialised that the Danyard productionsite effectively included a pipeline factory. Danyard and Danyard Aalborg were separate firms and the analyses in the current paper concerns only Danyard. Danyard Aalborg was a relatively small firm with about 200 employees. It is not possible to follow Danyard Aalborg in the database. It ceased production in 2006 and was eventually closed down in 2009.

In the database Danyard closed down in the year 2000. However, the process of unwinding the firm goes back to 1996. The owner of the shipyard, JLH, started in that year to search for a firm to take over Danyard. In 1998 the attempt to sell the shipyard was given up, and instead the management began developing a closing strategy. It included the establishment of a repair shipyard and a business park, in an attempt to secure new jobs for the former shipyard employees. The business park was eventually established in the summer of 1999 as a daughter company of JLH. The continuation of a repair yard was, however, given up when the neighbouring Ørskov Christensen Steelshipyard decided to rent and later buy a considerable part of the Danyard site.

The business park was relatively successful in attracting firms and some of the activities from Danyard were also continued in the city, including pipeline production, which was spun off as Danyard Pipe. As with the closure of Aalborg, some of the relatively competitive elements of Danyard found their way into new firms. These were set up by former managers at Danyard. The same people also bought a majority of the shares in the daughter firm, Danyard Aalborg, and continued it.

It is not possible to track Ørskov in the database used for the analyses in this paper. It was closed down in 2003 but then re-emerged as a repair-yard.

Nakskov (1987)

Nakskov shipyard was located on the island of Lolland at the very south of Denmark. The location of the shipyard was at the bottom of a narrow fjord, thus the shipyard primarily produced relatively small ships and sections of steel bridges. It was owned by East Asiatic Company (EAC, known as ØK in Danish).

The shipyard was closed in 1987 but the events leading up to the closure go back some years. In 1976 a unique agreement was made that put wages at Nakskov 15% under the comparable wages at other Danish shipyards. This had a beneficial effect on cost competitiveness in the short run but it proved difficult to attract qualified workers and over the following years the shipyard saw declining productivity. In the early 1980s the shipyard encountered heavy losses and it was only saved thanks to a financial support from the EAC. In order to fill the empty order books the Danish parliament decided to let Nakskov build a number of new ferries for the state railway company. Nakskov was chosen for this order with the explicit intention of supporting employment on Lolland. This proved only to have a short term effect and while management attempted diversifying in to the offshore sector during the 1980s the firm had to close down production in december 1986.

As with JLH in the cases of Aalborg and Danyard, EAC made an effort to support the local community when winding down the shipyard. Concretely, EAC, in collaboration with a number of financial companies and institutions, established a foundation to finance business development on western Lolland. The foundation, Lalandia Invest, acted as an important investor in new business in the region and in attracting other companies to the region. The shipyard became a real-estate company but not with the explicit aim of

creating a business park, as was seen in the cases of Aalborg and Danyard. Local businessmen with finance from Lalandia Invest initiated new activities, among other things, a repair-yard at the old docks and a metal work subcontractor for the B&W shipyard in Copenhagen. Many of these activities, however, closed down in the 1990s. In 1995 EAC sold the site to the remaining leaseholders.

Already a few years before the shipyard closed down the local municipality had initiated an active policy for attracting firms from the rest of Denmark. Specifically, publicly funded vocational training was focussed in areas, where it was expected that an increased supply of skills would attract firms, and by setting up two offices with the explicit aim of aiding in the transfer of technological knowledge to local companies.

Burmeister & Wain (1996)

The Burmeister & Wain shipyard (B&W) was located in the centre of Copenhagen so even though it was a large workplace, it did not have as large an impact on regional employment as the closure of the other three shipyards analysed in the current paper. In contrast to other Danish shipyards B&W had continued to build bulkcarriers and product carriers and thus competed directly with the low cost Asian shipyards (the other exception being the Lindø shipyard). After 1980 B&W also stands out by having no other activities than ship building (Nakskov had bridges, Aalborg had boilers, Danyard had pipes). Thus, there were no specialised elements that could readily be continued in new firms or by other firms. Furthermore, B&W was not part of a large consortium which could support the yard in hard times, (which bot JLH and EAC could for their respective shipyards).

The shipyard was owned by B&W Holding which also owned the shipping company B&W Shipholding. B&W Shipholding mainly operated ships from the B&W shipyard. The ships were sold through the limited partnership market (kommanditselskab) which constituted an indirect form of state support as the buyers were allowed to defer income tax payments. The shipyard, however, by far constituted the lion's share of the B&W Group. When the shipyard went bankrupt in 1996 it was not just the shipyard but B&W Holding that was liquidated.

The management of B&W Holding was closely intertwined with management at the various firms under its control and the bankruptcy in 1996 was a lengthy, dramatic and messy process where a lot of energy and resources were devoted to infighting among managers, share owners, workers and creditors. Thus no focus was placed on the continuation of employment but, as with the other three shipyards described above, a real-estate company was set up to let the land and buildings. In the case of B&W this had been done already in 1985. The real-estate firm was initially sold off in 1985 and the shipyard then leased the land and buildings but it was bought back by B&W Holding only a few years later. After the bankruptcy the real-estate company became an independent firm. There were several ideas for development of the valuable locations in central Copenhagen but the lack of a zoning plan made development very difficult. As of spring 2012 the buildings of the shipyard site are still being leased without much change having taken place.

4. Data

The regression analyses of this paper are based on longitudinal registry data supplied by Statistics Denmark and should be interpreted in conjunction with the above descriptions of the four shipyards. The longitudinal registry data is taken from IDA, the integrated database for labour market research. It contains detailed information on each employed person in Denmark from 1980 onwards, including detailed

information on their workplace and firm of employment. Based on the descriptions of the shipyards it is relatively straightforward to identify the relevant firms and workplaces in the database even though the identification numbers are scrambled. It is not generally permitted to identify individual firms, workplaces or persons in the database but permission has been given to identify these four shipyards and their workplaces for this research. Individual persons are not identified.

The data on workers pertain to November but all four shipyards close down before November in the respective years. Thus, the last year in which information is available on the workforce of the shipyards is the year prior to closure. Throughout the analyses the year of closure will be referred to as year zero for any given shipyard and other years will be referred to with reference to this.

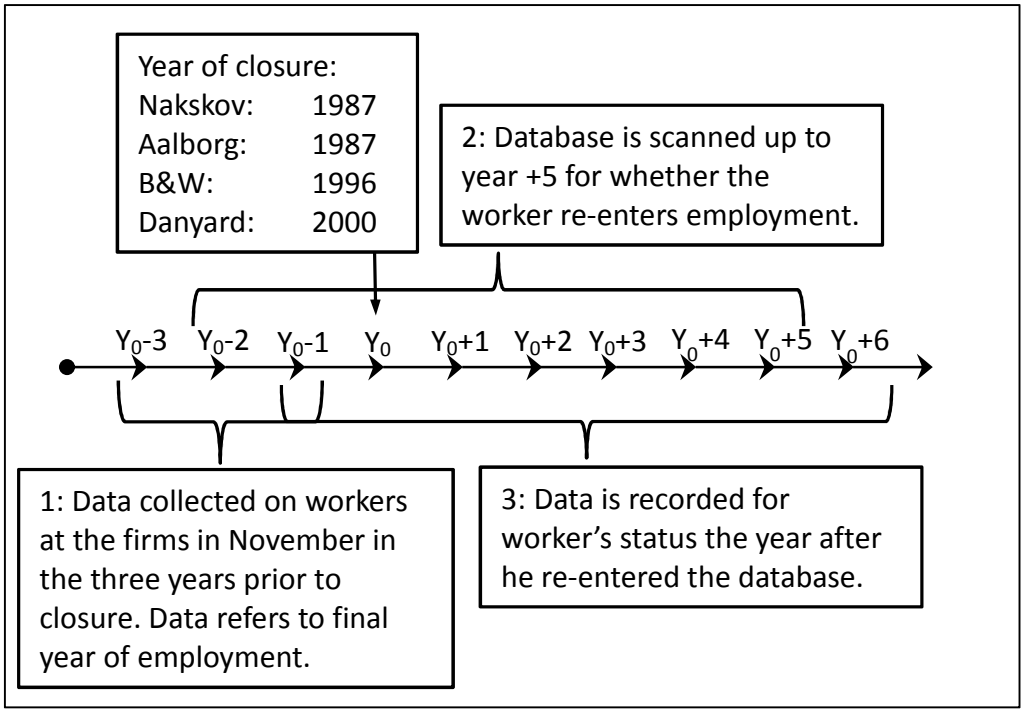

Figure 2: Data collection

As described above the closure of a shipyard was often a lengthy process. It is thus likely that workers started leaving the shipyards in the years prior to closure, (this suspicion is also strengthened by Figure 1) and it is necessary to include workers that left the shipyard more than just the year prior to closure. This is also indicated by Figure 2. This means that the set of workers analysed for any given shipyard contains anyone who had the shipyard as their primary workplace in the three years prior to closure. The data used for each worker pertains to the last year at which he was employed at the shipyard. For each worker the database is then scanned for the years -2 to +5 to find out when he re-entered employment and data is gathered on the worker's situation the year after he reappears in the database. A central variable in the following analyses is wage income and the first year in which a worker reappears in November he is likely to have low wage income because of a spell of unemployment. This data collection process is illustrated in Figure 2. The choice of years to include in data collection is partially based on practical concerns. The last year with comparable data is 2006 so year +6 is the maximum allowed for in the analysis of Danyard. Furthermore, it is the intention to include a variable for workers' tenure at the shipyard in the regressions

but this is complicated by the database only going back to 1980. Thus tenure will be a dummy indicating whether tenure exceeds the maximum or not. By collecting data on workers from year -3 onwards the maximum becomes 4 years. (Aalborg and Nakskov closed down in 1987 so data is collected from 1984 and thus there are workers for which maximum tenure is 4 years.)

	Nakskov		Aalborg		B&W		Danyard	
Gross population	1382	100%	4599	100%	2042	100%	1376	100%
Returns to work	1149	83%	4267	93%	1743	85%	1247	91%
Net population	890	64%	3414	74%	1438	70%	1024	74%

Table 1: Number of workers and percentage of gross population

Table 1 shows the number of workers identified at each step of the algorithm illustrated in Figure 2. The number of workers identified as having worked at a shipyard in any of the three years prior to year zero is referred to as the gross population. As is seen, Aalborg was by a wide margin the largest shipyard by this measure. In the second step more than 80 per cent of workers reappear in the database again within 5 years of the shipyards' closure. For Aalborg and Danyard the number even exceeds 90 per cent. However, a number of workers are lost because they only reappear for a single year. Thus the net populations are 64-74 per cent of the gross population. Some of the workers that return to work but are not in the net population are excluded because they are not assigned to a workplace in the database.

Table 2 shows the distribution across sectors of the net populations. It is interesting to see how the high effort put into continuation of employment in the Aalborg case is evident in the large share of workers finding jobs in iron and metal manufacturing. And it is equally clear how the low focus on continuation of employment in the case of B&W coupled with the greater job opportunities in the city of Copenhagen meant that only one in four found job in iron and metal manufacturing. It is also interesting to notice that despite the differences between the Nakskov and Danyard cases the outcomes were largely the same, with the caveat that the net population constitutes a larger share of the gross population in the case of Danyard.

	Nakskov	Aalborg	B&W	Danyard
Primary	2.81%	1.08%	0.35%	2.15%
Business services	7.64%	6.71%	8.28%	9.67%
Finance and real-estate	1.57%	1.64%	3.89%	1.27%
Other Manufacturing	9.78%	6.47%	6.82%	5.57%
Iron and metal manufacturing	34.16%	53.49%	24.62%	45.80%
Personal services and other	3.37%	1.20%	6.75%	2.83%
Public, education, health and social services	9.89%	5.89%	10.78%	6.74%
Trade, hotels and restaurants	8.76%	6.00%	11.13%	6.05%
Transportation, mail and telecom.	7.08%	3.02%	11.34%	3.91%
Utilities and construction	14.94%	14.50%	16.06%	16.02%
Total	100.00%	100.00%	100.02%	100.01%

Table 2: Sectoral distribution of net population

In addition to industry variables workers are characterised according to ten variables: gender, age when leaving the shipyard, tenure at the shipyard, education when leaving the shipyard, a dummy indicating whether education is higher when he re-enters employment, a dummy indicating whether he works at a spin-off from the shipyard, a dummy indicating whether he has moved to a new municipality since leaving the shipyard, a continuous variable for the number of years passing from he leaves the shipyard till he re-enters employment and a continuous variable for his relative wage income the final year at the shipyard.

Age is categorised as less than 35 years, at least 35 and at most 50 years, and more than 50 years. As the database only goes back to 1980 the information on some workers will not allow for measuring tenure in excess of 4 years. Thus a dummy is used to indicate if workers had 4 or more years of tenure when leaving the shipyard. In the regressions there will be three categories of education: skilled, unskilled and higher education. But the data contains more detailed information and when determining whether a worker re-enters employment with a higher level of education distinction will be made between: primary school, high school, business college, professional education, 1-2 years tertiary, 3-4 years tertiary, 5-6 years tertiary and 7+ years tertiary, (i.e. research training).

Spin-offs

When a new workplace is added in the database it is possible to see whether it was spun off from an existing workplace. It is indicated to be have spun off if at least 30 per cent of employees have been transferred from another workplace. Such workplaces are sought for each shipyard in the bust year +/- 2 years. Spin-offs are only found in year 0 and year -1 except for Danyard, where there were also spin-offs in year -2. There are generally only a handful of spin-offs at each shipyard except for Aalborg, though these workplaces are concentrated under relatively few employers. Most of the spin-off workplaces close down within few years and are thus not in the data when workers' status is recorded.

It is therefor distinguished between whether workers work at spin-off workplaces or are working for spin-off firms. That is, firms to which the workplaces were spun out but which were not necessarily founded in the process. The firms may have existed prior to acquiring the new workplace.

Table 3 shows some discrepancy in the share or workers working at spin-off firms and plants. As only workers that can be assigned to a plant are included in the new population there are no missing data for

these variables. The roles of Danyard and Danyard Aalborg are clearly seen in the number for workers from Aalborg shipyard finding work at spin-offs. Similarly, the lack of focus on continuation is evident in the B&W numbers.

	Nakskov	Aalborg	B&W	Danyard
Spin-off plant	6.40%	3.28%	0.07%	6.15%
Spin-off firm	8.43%	25.13%	0.28%	6.15%
Distr. of spin-off firm jobs				
Business services	47%	11%	0%	25%
Finance and real-estate	0%	0%	0%	10%
Iron and metal manufacturing	23%	89%	100%	48%
Personal services and other	0%	0%	0%	2%
Utilities and construction	31%	0%	0%	16%

Table 3: Pct. of net population at spin-offs

Spin-offs are identified as firms, not workplaces, in the below analyses. The bottom part of Table 3 shows how the workers finding jobs at spin-offs are distributed among industries. The industries not represented in the table have zero spin-offs. The focus on continuation is clearly seen in Aalborg where almost all workers employed by spin-offs are in iron and metal manufacturing. For B&W there is only a handful of workers so too much emphasis should not be but on the fact that they are all in iron and metal too. It is interesting to see that in the cases of Nakskov and Danyard large shares went into business services and finance and real-estate. These are spin-offs in areas such as design, software and engineering.

Explanatory variables

Table 4 presents the frequencies for the remaining variables and mean and standard deviation for the duration of the unemployment spell. The top rows show some discrepancy in workforce composition among the shipyards. Nakskov had the lowest share of workers with higher education but also the lowest share of unskilled workers. Aalborg had the highest share of workers with higher education but a low share of skilled workers. B&W had the largest share of unskilled workers with almost than three tenths being unskilled. It could be suspected that the shipyards where the largest share of workers was unskilled would also be the shipyards where the largest share took new education and this is somewhat confirmed. The two shipyards where the largest share of workers acquires new education include B&W (5.63 per cent). But the share in Aalborg is practically the same (5.65 per cent). What Aalborg and B&W do have in common is that they are located in relatively large cities. This may also be a factor behind the large share of workers with higher education at these two shipyards.

With respect to age it is seen that there were relatively many older workers at Danyard, while the shares of young workers at Aalborg and B&W are relatively large. There may be an urbanisation effect affecting the age distributions at Aalborg and B&W.

Workers at B&W appear to have been more geographically mobile than workers at the other shipyards but this is most likely caused by municipalities in and around Copenhagen being relatively small. The workforce at Danyard appears to have been the least geographically mobile. The high mobility for workers from Nakskov is possibly a consequence of the low wages and overall meagre job prospects in the region.

	Nakskov	Aalborg	B&W	Danyard
Education				
Unskilled	23.26%	27.01%	29.76%	28.52%
Skilled	68.99%	56.59%	56.47%	61.91%
Higer	6.74%	15.20%	11.82%	7.81%
Missing	1.01%	1.20%	1.95%	1.76%
Increased education				
No	95.28%	93.15%	92.42%	95.61%
Yes	3.71%	5.65%	5.63%	2.64%
Missing	1.01%	1.20%	1.95%	1.76%
Age				
< 35 years	43.15%	52.23%	49.51%	32.91%
>= 35 and < 50	41.91%	36.85%	35.26%	46.68%
>= 50	14.94%	10.93%	8.97%	20.41%
Missing	0.00%	0.00%	0.00%	0.00%
Moved				
No	87.19%	90.22%	85.95%	93.55%
Yes	12.81%	9.78%	14.05%	6.45%
Missing	0.00%	0.00%	0.00%	0.00%
Tenure				
< 4 years	63.37%	73.55%	43.95%	38.09%
>= 4 years	36.63%	25.10%	56.05%	61.91%
Missing	0.00%	1.35%	0.00%	0.00%
Gender				
Men	95.51%	92.36%	95.13%	94.92%
Women	4.83%	7.82%	4.87%	5.08%
Missing	0.00%	0.00%	0.00%	0.00%
Years before re-entering				
Mean	1.73	1.23	1.82	1.50
Standard deviation	1.16	0.66	1.25	0.97

Table 4: Other variables

There is a large discrepancy in the number of workers with four or more years of tenure. At Nakskov and Aalborg there were only 37 and 25 per cent respectably while at B&W and Danyard more than half of the workforce had at least 4 years of tenure when it left the shipyard. Lastly, Table 4 shows that most workers at the shipyards were men.

Even if workers move directly into a new job after leaving the shipyard it will seem in the data as if they re-entered employment after one year. Keeping this in mind it is not surprising that the mean number of years before re-entering employment is greater than one. It is, however, interesting to note the differences: workers from Aalborg had on average the shortest spells of unemployment by this measure while workers from Danyard are second. These two shipyards also exhibit low standard deviations.

It is not possible to identify ownership structures in the database and thus the various companies held by e.g. JLH cannot be tracked. When big holding companies such as JLH reorganise their firms they may create several temporary workplaces and move workers among them technically. This is quite evident from the fact that 25 per cent of workers from Aalborg that re-enter employment work at spin-off firms (which can be expected to be owned by JLH, e.g. Danyard or Danyard Aalborg) but only few work at spin-off plants, cf. Table 3. The tenure variable in the database refers to the workplace of the worker and the manoeuvres of holding companies have the result that the longest observed tenure among the shipyards is only eight years, which is unreasonably low. For this reason the firm based spin-off variable is used in the regressions. The tenure variable is included but it must be interpreted with care. The use of a dummy indicating whether tenure exceeds 4 years or not means that this caveat has minor importance.

Dependent variables

Two sets of regressions will be presented. The first set will aim to uncover what characterised workers that managed to re-enter employment. The second set will explore what characterised workers that managed to increase their relative wage income in the new job compared to their relative wage income at the shipyard. The dependent variable of the first set of regressions is a dummy indicating whether workers managed to find a new job. The frequency of this dummy has already been presented in Table 1. The dependent variable in the second set is a dummy indicating whether the workers earn more or less in their new jobs compared to their last year of employment at the shipyard.

A worker's earnings is his yearly wage income. As mentioned, the data in IDA refers to the final week of November and data on workers are collected for the second year in which they are re-employed. However, there is no guarantee that the wage income of a given worker reflects wages earned by one year of full time employment in his current position. But IDA also contains a variable describing workers' employment as a share of hypothetical yearly full time hours. Thus the wage income of a worker whose employment amounts to less than full time employment is inflated accordingly. To measure the relative performance of the shipyard workers it is necessary to compare them to other workers with similar characteristics. Thus all wage incomes are expressed relative to the income that a person receives on average based on a number of relevant characteristics. In practice, a regression has been performed for the entire population of wage earners in Denmark where wage income is regresses on age (three categories cf. above), gender, education (ten categories), industry (ten categories), a dummy for part time contracts and a dummy for the Copenhagen region. The regressions are performed independently for each year. They each have 2 to 2.5 million observations, a coefficient of determination of 0.5 +/- 0.1 and the groups of regressors are consistently significant. Wage income is expressed relative to fitted values from these regressions. Thus if a worker has a relative wage income of 1.1 then his wage is ten per cent higher than his age, gender, education, industry, contract and location merits. In relatively extreme cases the fitted wage may be negative. For example for a less than 35 years old, female, agricultural, part time worker outside of Copenhagen with at most primary schooling.

Figures 3-6 plot the densities of the distributions of relative wages at the shipyards. They are constructed as kernel density estimates. Each figure contains three densities: one for worker at the shipyard who do not re-enter employment after the shipyard has closed down, one for workers that do re-enter and one for wages in the new jobs of those that re-entered. The figures also contain summary statistics. In all four cases there is a tendency for workers who manage to find a new job to have higher relative wages than those

that do not. The tendency is strongest for B&W and Nakskov and relatively weak for Aalborg. The mean worker who do not find a new job was earning slightly less than his characteristics would indicate (relative wage income less than one) while the average worker who finds a new job was earning slightly more (relative wage income greater than one). This indicates that the workers re-entering employment had skills that are not captured by the estimates of average wages.

It is also interesting to note that wage incomes in the new jobs were generally lower than the jobs at the shipyards. Labour unions were traditionally strong at the shipyards but the decline of income cannot be blamed on unions inflating shipyard pay. Mean relative wage income for shipyard workers hardly exceeds 1.

The second set of regressions aims to explain what characterised workers that managed to achieve an increase in relative wage income after the closure of the shipyard. The dependent variable is a dummy indicating whether the worker received a higher relative wage income in the new job or not. The frequency of thus dummy is described by table 5.

	Nakskov	Aalborg	B&W	Danyard
Growth in relative wage income	41.12%	41.42%	32.82%	28.32%
Missing	2.81%	9.52%	2.16%	1.66%

Table 5: Share of workers experiencing wage growth

Table 5 shows the share of re-entering workers that receive a higher relative wage in their new job. It also shows the share of re-entering workers for whom this information is not available. (For the total number of re-entering workers see Table 1). As was also seen from Figure 3-6 most workers received a lower relative wage in their new job. There are especially many workers with lower relative wage income in the cases of B&W and Danyard.

5. Regression results

The first model estimated in this paper is the following:

$$Logit(pJob_i) = \beta_0 + \widehat{\beta_1}'\widehat{Age}_i + \widehat{\beta_2}'\widehat{Education}_i + \beta_3 Gender_i + \beta_4 Tenure_i + \beta_5 rWage_i + \epsilon_i$$

$pJob_i$ is the probability that worker i finds a new job. The right hand side is condensed by the use of hats for vectors. $\widehat{Age}_i$ is a vector of two dummies for the age categories. There are also two dummies for education when leaving the shipyard. The middle category is used fore reference in both cases, cf. Table 4. The gender dummy is one if the worker is male and the tenure dummy is 1 if he had four or more years of tenure at the shipyard. $rWage_i$ is the relative wage income that the worker received in his final year at the shipyard. ϵ_i is a classic error term The model is estimated independently for the four shipyards and the results are presented in Table 6.

In general it seems that younger workers had a greater probability of getting a new job. Those less than 35 years old have significantly better odds than those in the 35-50 interval and those above 50 years of age have significantly lower odds at most shipyards. An interesting exception is Aalborg where the youngest workers and the eldest all had lowers odds than the middle group.

Regarding education the story is similarly uniform: in general workers with more education had significantly better odds of finding a new job. The exception is Danyard where education seems to not have played a role.

	Nakskov			Aalborg			B&W			Danyard		
	Estimate	S.E.		Estimate	S.E.		Estimate	S.E.		Estimate	S.E.	
Intercept	-0.155	0.255		0.597	0.148	***	0.137	0.209		0.454	0.257	*
Age less than 35 years	0.392	0.169	**	-0.227	0.095	**	0.670	0.152	***	0.162	0.183	
Age at least 50 years	-2.007	0.158	***	-1.567	0.104	***	-1.759	0.136	***	-1.498	0.157	***
Unskilled	-0.533	0.146	***	-0.680	0.085	***	-0.325	0.121	***	-0.119	0.149	
Higher education	0.545	0.313	*	0.863	0.151	***	0.390	0.209	*	0.372	0.272	
Male	-1.157	0.294	***	-0.075	0.167		-0.375	0.260		-0.580	0.286	**
Tenure at least 4 years	0.091	0.151		-0.349	0.087	***	0.522	0.134	***	0.349	0.150	**
Previous relative wage income	1.499	0.271	***	1.134	0.128	***	0.903	0.188	***	0.937	0.236	***
N	1382			4126			1978			1346		
Successes	880			3077			1409			1006		
Missing	23			467			64			30		
-2 Log L (intercept only)	1763.9(1425.9)			4678.4(4084.4)			2373.8(1988.7)			1521.4(1371.2)		

Independent logistic regressions. Asterisks denote the level of significance: *: 10% **: 5% ***: 1%. Dependent variable is 1 if the worker re-entered employment in the 6 years following the shipyard's closure.

Table 6: Regression results for returning to employment

Men either had weaker odds than women of getting a new job (Nakskov and Danyard) or there was no significant difference (Aalborg and B&W). Having tenure in excess of four years has different effect. It has no effect in the case of Nakskov, a negative effect in the case of Aalborg and a positive effect in the cases of B&W and Danyard. Lastly, it is found that higher relative wage at the shipyard increases the likelihood of getting a new job.

The differences across the shipyards may be caused by differences in the processes of closing them down or in differences over time and space. The fact that men were relatively worse off than women in Nakskov and Danyard but not in Aalborg and B&W is likely to be caused by the latter two being located in larger cities. The lack of an effect of education with Danyard, however, may very well be a consequence of policies and actions by the regional government and JLH.

The heavy spin-off activity in the case of Aalborg seems to have benefitted middle age workers to an extent that young workers were significantly less likely to find a new job.

The second set of regressions is performed to discover which factors were associated with increased relative wage. The regressions contain the same explanatory variables as the first set but also some additional ones. There are three new dummies: $\Delta Education_i$ is one if the worker has increased his level of education. $\Delta Municipality_i$ is one if the residence of the worker is in a new municipality and $Spin_i$ is one if the worker works at a spin-off. The vector $\widehat{Industry_i}$ contains nine industry dummies. The reference industry is finance and real-estate, cf. Table 2. The final regressor, $Unemp_i$, is the number of years that has passed from the worker left the shipyard until he re-entered the database. It is thus equal to one even if the worker entered a new job immediately after leaving the shipyard. The dependent variable is the Logit of the probability that worker i receives a higher relative wage in his new job, $p\Delta Wage_i$. v_i is a classic error term.

$$Logit(p\Delta Wage_i) = \alpha_0 + \widehat{\alpha_1}'\widehat{Age}_i + \widehat{\alpha_2}'\widehat{Education}_i + \alpha_3\Delta Education_i + \alpha_4\Delta Municipality_i$$

$$+\alpha_5 Spin_i + \alpha_6 Gender_i + \widehat{\alpha_7}'\widehat{Industry}_i + \alpha_8 Tenure_i + \alpha_9 Unemp_i + \alpha_{10} rWage_i + \upsilon_i$$

Table 7 presents the result of estimating the second set of regressions. Using the population of workers that re-entered employment and did not drop out again after the first year, and for whom data is available for all controls, it is explored what characterised workers that managed to get an increase in relative wage income.

	Nakskov			Aalborg			B&W			Danyard		
	Estimate	S.E.		Estimate	S.E.		Estimate	S.E.		Estimate	S.E.	
Intercept	3.265	0.894	***	1.824	0.399	***	1.445	0.620	**	2.106	1.176	*
Age less than 35 years	0.577	0.204	***	0.695	0.094	***	0.542	0.165	***	0.661	0.205	***
Age at least 50 years	-0.380	0.254		-0.866	0.143	***	-0.563	0.227	**	-0.290	0.226	
Unskilled	0.456	0.213	**	0.057	0.102		0.524	0.161	***	0.372	0.197	*
Higher education	-0.437	0.427	***	0.586	0.119	***	0.341	0.227		0.220	0.322	
New education	0.650	0.714		0.746	0.397	*	0.376	0.357		0.223	0.545	
Moved	0.075	0.267	*	0.147	0.149		0.213	0.190		0.067	0.345	
Spin-off firm	1.195	0.351	***	0.186	0.106	*	0.388	1.179		0.337	0.343	
Male	0.208	0.450		0.272	0.164	*	0.661	0.295	**	1.648	0.372	***
Primary	1.335	0.900		1.495	0.572	***	2.280	1.316	*	2.909	1.234	**
Other Manufacturing	0.421	0.797		0.434	0.377		1.391	0.580	**	0.983	1.137	
Metal and iron manuf	1.420	0.763	*	0.859	0.349	**	1.340	0.539	**	1.116	1.092	
Utilities and construction	1.526	0.779	*	0.878	0.357	**	2.365	0.545	***	1.716	1.101	
Trade, hotels and restaur.	1.366	0.797	*	0.791	0.381	**	1.422	0.558	**	0.439	1.145	
Transportation and com.	0.334	0.818		-0.105	0.425		1.506	0.560	***	1.071	1.157	
Business services	1.131	0.830		0.453	0.382		1.494	0.582	**	0.626	1.122	
Public, health, edu and social	1.054	0.789		0.208	0.386		1.440	0.561	**	0.546	1.139	
Personal services	0.697	0.884		1.124	0.536	**	1.801	0.572	***	0.871	1.203	
Tenure at least 4 years	-0.240	0.187		0.210	0.096	**	-0.347	0.148	**	-0.278	0.180	
No. years before re-entering	-0.212	0.074	***	-0.169	0.068	**	-0.365	0.066	***	-0.174	0.091	*
Previous relative wage income	-4.658	0.519	***	-2.744	0.178	***	-3.298	0.317	***	-4.105	0.410	***
N	856			3011			1379			989		
Successes	362			1379			459			284		
Missing	34			403			59			35		
-2 Log L (intercept only)	1166.2(927.9)			4152.8(3668.2)			1754.6(1405.5)			1186.0(950.7)		

Independent logistic regressions. Asterisks denote the level of significance: *: 10% **: 5% ***: 1%. Dependent variable is 1 if the relative wage income of a worker is higher at his first job after the shipyard closed down compared to his last year at the shipyard.

Table 7: Regression results for increased relative wage income

It seems that age mattered a lot in the cases of Aalborg and B&W and less so in the cases of Danyard and Nakskov. For all four cases younger workers had a greater probability of increasing their income bur only for the former two did the eldest workers have significantly lower odds of increasing their income. Having more education generally decreases the probability of increased income but it varies whether workers with higher education are distinguished for high odds or unskilled workers are distinguished for low odds. And for Aalborg, higher education has the opposite effect: it is associated with an increased probability of getting a higher income. Taking a new education increased the probability of increasing income in the case of Aalborg while moving away from the municipality had a positive effect in the case of Nakskov. Finding a

job at a spin-off has a positive effect in Nakskov and Aalborg while there is generally a positive effect of being male.

There are a number of significant industry controls and they are all positive indicating that workers entering into the reference industry, finance and real-estate, tend to have low odds of increased income. For Danyard the industry controls are generally not significant, for B&W they generally are significant and for Aalborg and Nakskov there is a certain set that is significant. In general, it seems that entering into metal and iron manufacturing (but not other manufacturing), utilities and construction, trade, hotels and restaurants or the primary sector are the choices associated with the greatest odds of increased relative wage income.

Having at least for years of tenure is positive for Aalborg and negative for B&W. A longer time span between leaving the shipyard and finding a new job is negatively associated with future increased income and higher relative wage income while at the shipyard means a lower probability of getting an increased relative wage income.

The effect of age is not surprising but there will be some missing variable bias in this estimate as the tenure variable may not capture the effect of experience sufficiently. Taking a new education only had a positive effect in the Aalborg case. This could very well be associated with the location of the shipyard in a more urban area and thus workers having more diverse job opportunities. This would, however, suggest that the effect should also be positive for B&W; which it is not. Moving to another municipality is only significant in the Nakskov case and can be explained by the unique Nakskov wage agreement depressing wages at other workplaces near the shipyard too. The positive effect of being employed at a spin-off indicates that working at a spin-off allowed the workers to utilize their skills and earn the corresponding rents. In general the results indicate that the industry effects are substantial. The estimates are of a magnitude which entails that the choice of industry is more important for future income than e.g. gender, age or education.

The negatives effect of prior income and of tenure means that workers with high incomes while they were at the shipyard have relatively low probabilities of earning such a high income in their new jobs. This could mean that they had developed very specific abilities that were valuable at the shipyard but difficult to apply later on.

6. Conclusion

The analyses of this paper have explored what happened to the workers that lost their jobs when the four Danish shipyards closed down. The analyses thus implicitly also explore what happened to the skills that were made redundant by the closure of the shipyards. The analysis reveals that the mobility of the laid-off workers destroys knowledge and makes their competences obsolete. The workers end up in a broad set of industries that does not appear to be related to their previous work experiences. Furthermore, the lower wages indicate that the receiving firms did not value the transferred specific knowledge and skills very highly.

The starting point is Figures 3-6. They illustrate that workers' wage income relative to what can be expected from their age, gender, education, location, type of contract and industry differs among those that managed to find a new job and those that did not. On average those that managed to find a new job

had a relative wage greater than one at the shipyard implying that they had other qualities meriting a higher wage. Those that did not manage to find a new job on average earned less than could be expected. However, these averages mask great diversity among workers and thus regression analysis was applied to find out what exactly made a worker re-employable. It was found that younger, more educated female workers had a greater probability of finding a new job.

Figures 3-6 also show that the workers, who found a new job and, on average, had a relative wage greater than one generally experienced a decrease in relative wages. This indicates that the characteristics that merited paying them relatively high wages were of less use in the new jobs. But again this aggregate outcome masks great diversity at the individual level. Thus a second set of regressions was applied to explore what characterised workers that received an increase in relative wage income after the closure of the shipyard. It was found that unskilled workers had relatively high odds of experiencing an increase in relative wage income. This is interesting, as these workers were found to have relatively low odds of finding a new job in the first place in the first set of regressions. Similarly, it was found that while women have greater odds of finding a new job, those men that do manage to find a new job have greater odds of increasing their relative wage income compared to women.

The four shipyards were closed down through different processes, were located in different regions and closed down in different years. Thus there is some discrepancy to the effects across the years; especially with respect to the effects on future wage income of moving residence, acquiring higher education and working for a spin-off firm. The regression results correspond well with the histories of the specific shipyards; and it is interesting to see that the effect of taking new education depends on the urbanisation of the region while spin-offs are a source of high income jobs that allow workers to re-apply their abilities. This is an important lesson for policy.

It was also found that the major determinant of future earnings is the industry in which the worker finds his new job. The reference industry in the regressions was finance and real-estate and the odds of increased relative wage income were found to be higher in several other industries. This most likely reflects the fact that the shipyards were all transformed to real-estate companies after closure and the few workers who found job in finance and real-estate are most likely caretakers and the like at these new real-estate firms. Jobs in the primary sectors, in closely related manufacturing industries (but not manufacturing in general), in utilities and construction, and in trade, hotels and restaurants are jobs associated with increased odds of receiving an increased relative wage income. The increased income for workers finding jobs in closely related manufacturing industries may indicate that the workers from the shipyards were able to re-employ their abilities and receive a corresponding income. But it is doubtful that abilities from the shipyards should generate income in the primary, utility/construction and trade/hotel/restaurant sectors. Thus there must be other factors explaining the positive effect of finding a job in these industries and it cannot be ruled out that these factors also explain the positive effect of related manufacturing. That is, it is quite likely that there is an underlying factor affecting future pay which is unrelated to knowledge transfers.

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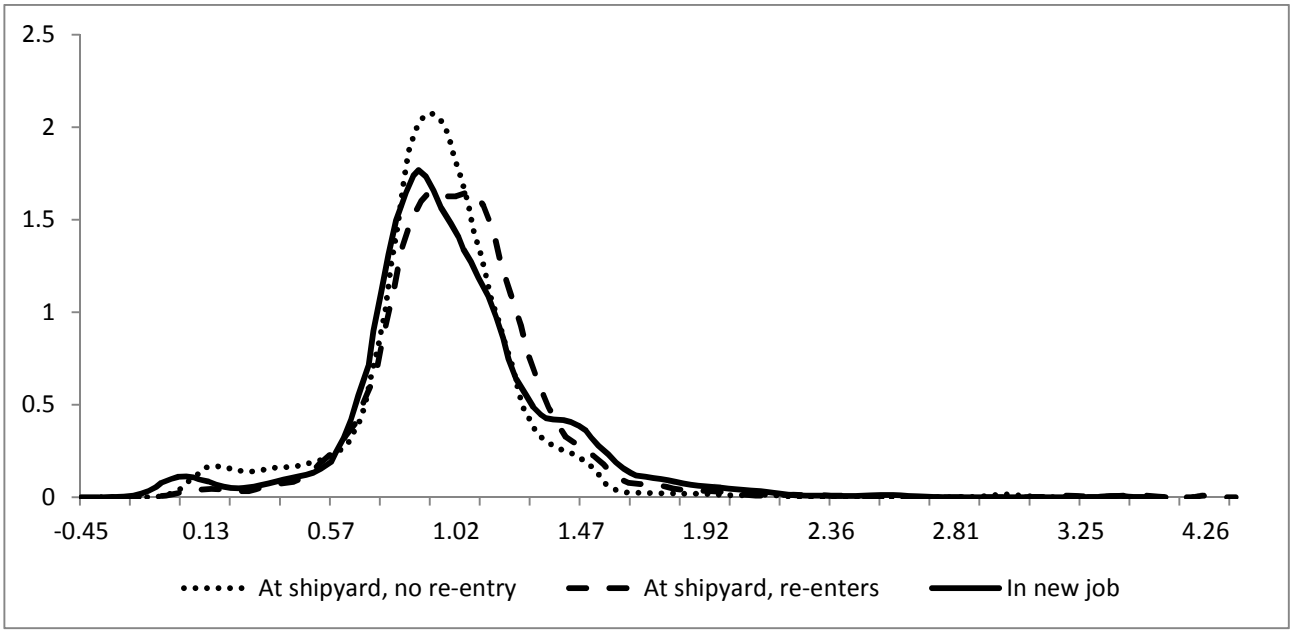
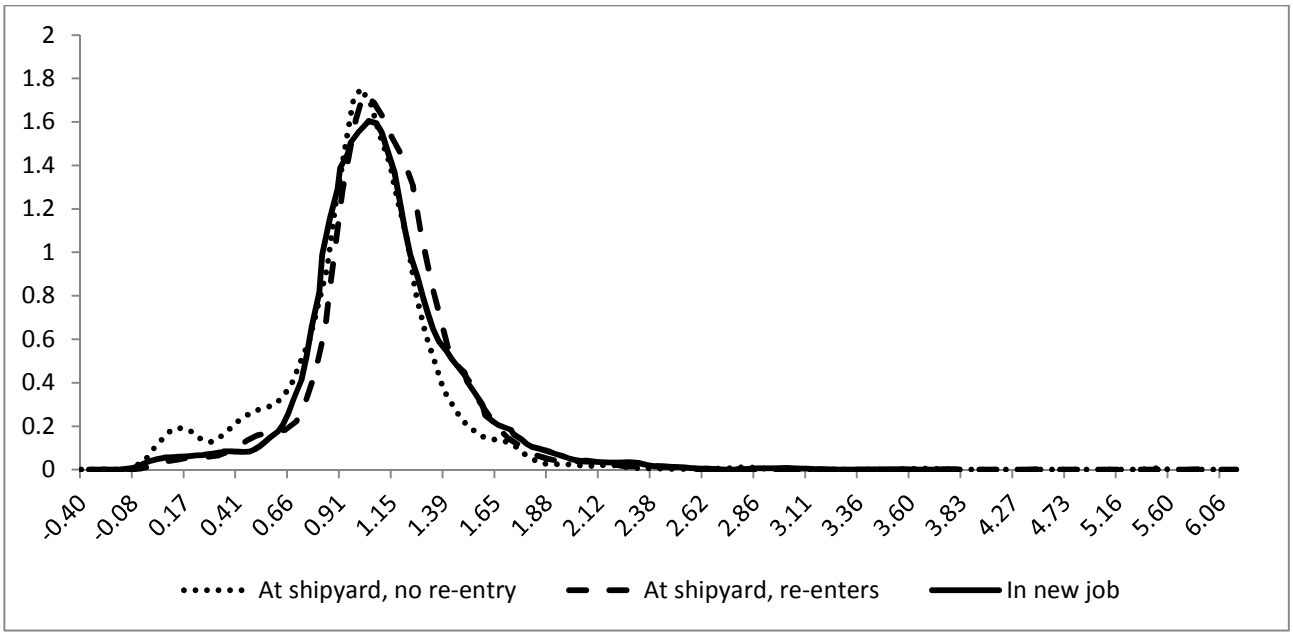


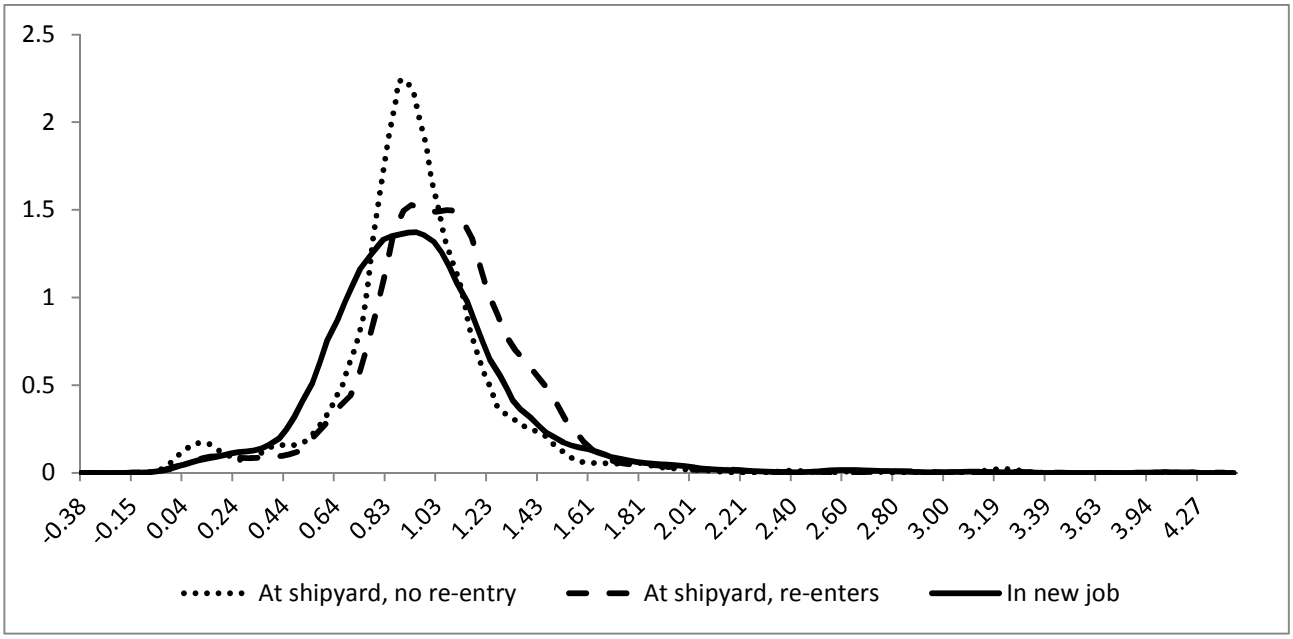
	At shipyard, no re-entry	At shipyard, re-enters	In new job
Median	0.95	1.02	0.96
Mean	0.95	1.04	1.01
Std.dev	0.29	0.32	0.34
Skewness	0.38	2.70	0.75

Figure 3: The distribution of relative wage income at Nakskov



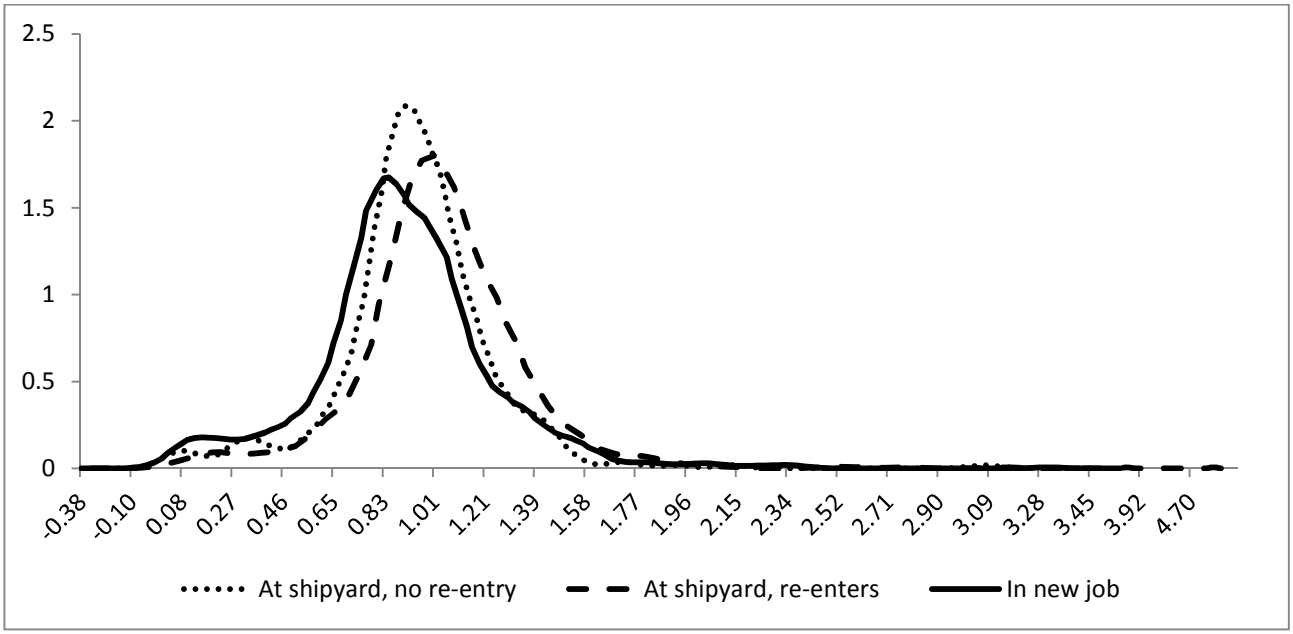
	At shipyard, no re-entry	At shipyard, re-enters	In new job
Median	1.01	1.10	1.07
Mean	1.00	1.12	1.10
Std.dev	0.38	0.34	0.35
Skewness	1.85	2.29	0.77

Figure 4: The distribution of relative wage income at Aalborg



	At shipyard, no re-entry	At shipyard, re-enters	In new job
Median	0.93	1.04	0.93
Mean	0.94	1.05	0.95
Std.dev	0.33	0.33	0.36
Skewness	1.35	1.16	1.56

Figure 5: The distribution of relative wage income at B&W



	At shipyard, no re-entry	At shipyard, re-enters	In new job
Median	0.95	1.03	0.89
Mean	0.95	1.05	0.91
Std.dev	0.29	0.34	0.34
Skewness	0.86	2.45	0.69

Figure 6: The distribution of relative wage income at Danyard