

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

The ability of the Danish economy to reemploy redundant ability after the closure of four major shipyards

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Abstract

This paper explores four different cases of firm exit from one industry: shipbuilding. 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 the success with which the abilities of the redundant workers were reapplied in the economy. It is found that having workers take additional education is only occasionally a success and the success 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 abilities made redundant by the shipyard's closure find new productive use.

Ability is inferred from remuneration and it is argued that workers that, after allowing for a period of adaptation, are able to match supersede their previous pay at the shipyard have found new productive use of their abilities and/or adapted their repertoire of abilities successfully. The results presented in the current paper are only the first, initial results and future research applying more advanced econometric techniques is expected to yield stronger results.

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. 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 competence?

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 human capital 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 after firm exit by investigating the future careers of those employees that re-entered the labour market following the exit. 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.

2. Knowledge diffusion in the shipyards' wake

In order to study the ability of the Danish economy to exploit the opportunities and overcome the challenges four instances of major shipyards closing down are studied. These are Nakskov and Aalborg shipyards, which both closed down in 1987, Burmeister & Wain (B&W), which closed down in 1996 and Danyard, which closed down in the year 2000. These closures are quite evident from the evolution of full time equivalent employment 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 human capital 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 abilities to find alternative applications. 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).

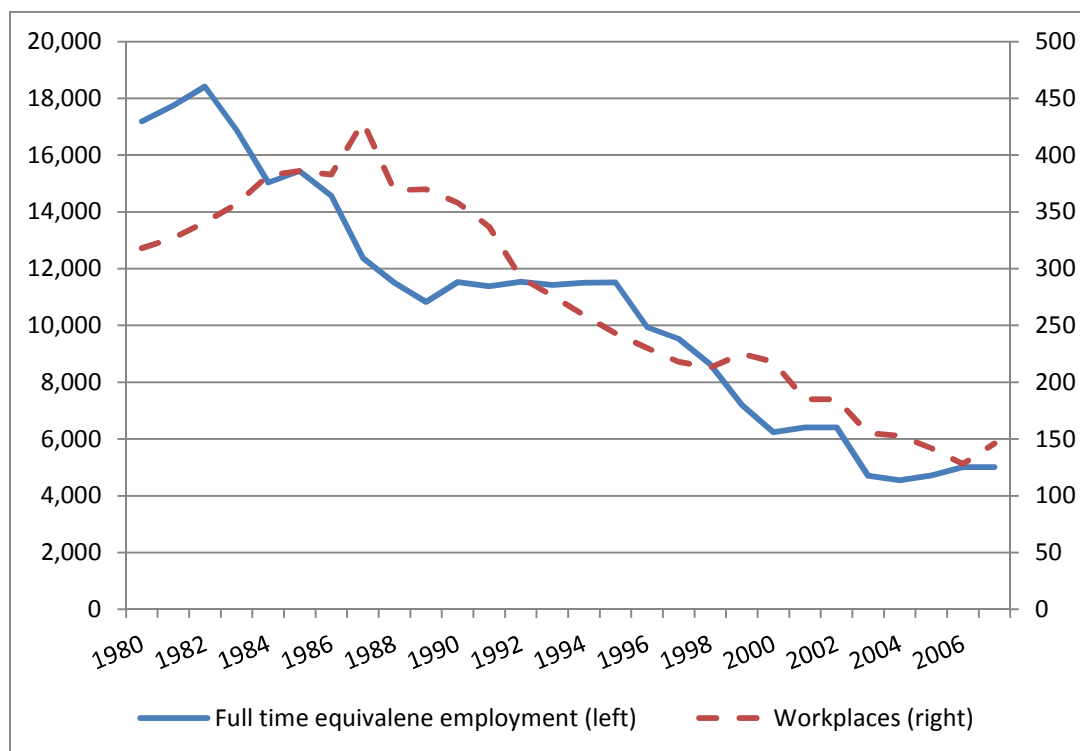


Figure 1: The Danish shipyard industry (NACE rev. 1 industry 351: “Manuf. and maint. of ships and boats”)

Under the assumption that labour markets are efficient and that workers' remuneration is generally monetary, the income of a worker can be used as an indicator of his ability. This contains both general and more specific abilities. The value in the labour market faced by the laid off shipyard workers depended on the specificity of their abilities and also on the relative scarcity of their abilities.

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 spill-over: 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.

Section 3 introduces the shipyards while section 4 presents the worker level data. In section 5 a logistic regression is fit to each shipyard in order to estimate the probability that workers were able to apply their abilities or acquire new abilities and earn a higher income in the jobs they find after leaving the shipyard. The results are discussed in section 6.

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 later analyses. In the data a firm is identified as being closed down when it loses all, or practically all, of its employees. The description will not be chronological. 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

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.

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

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 production site 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 shipyards was given up, and instead the management began developing a closing strategy. It contained 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 who 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

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 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, especially by focussing vocational training on areas, where it was deemed possible to 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

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. As opposed to other Danish shipyards B&W continued building 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 length, dramatic and messy process where a lot of energy and resources was 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 desirable

locations in central Copenhagen but the lack of a zoning plan made development very difficult. In 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 do so for 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 paper 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.

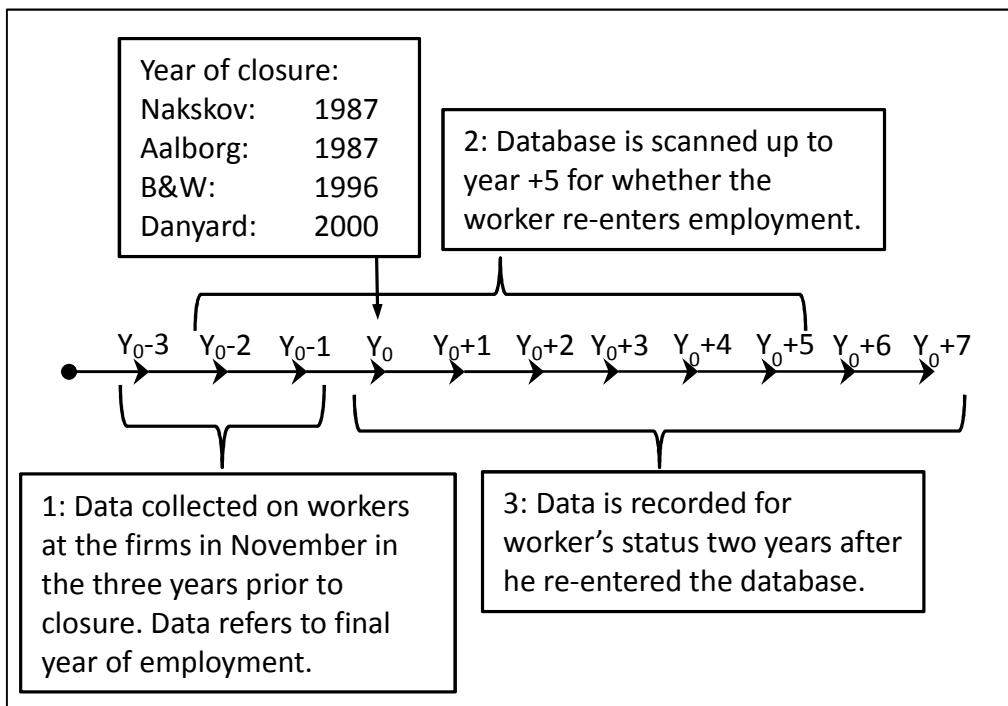


Figure 2: Data collection

As it is likely that workers started leaving the shipyards in the years prior to closure (this suspicion is also strengthened by Figure 1) it is necessary to include workers that left the shipyard at year -2 and -3. 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 two years after he re-entered employment (this year will thus be year 0 at the earliest and may be as late as year +7). The two additional years are included to allow for workers and employers to adapt and to clear the data for short unstable spells in employment. This data collection process is illustrated in Figure 2.

	Nakskov		Aalborg		B&W		Danyard	
Gross population	1382	100%	4599	100%	2042	100%	1376	100%
Returns to work	1155	84%	4260	93%	1733	85%	1244	90%
Net population	877	63%	3307	72%	1438	70%	991	72%

Table 1: Number of workers and percentage of gross population

Table 1 shows the number of workers identified at the various steps 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 appear in the database again within 5 years of the shipyards' closure. For Aalborg and Danyard the number even exceeds 90 per cent. However, as it is required that the workers also appear in the database two years after their initial appearance the net population available for regression analysis is somewhat smaller. The net population constitutes just above 70 per cent of the gross population for all shipyards except for Nakskov where it is only 63 per cent. 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.

	Nakskov	Aalborg	B&W	Danyard
Primary	2.39%	0.94%	0.42%	3.43%
Business services	9.01%	7.08%	9.46%	8.38%
Finance and real-estate	1.48%	2.42%	4.10%	1.82%
Other Manufacturing	8.78%	6.77%	6.68%	7.57%
Iron and metal manufacturing	40.14%	52.95%	25.03%	44.70%
Personal services and other	3.08%	1.48%	5.15%	3.43%
Public, education, health and social services	7.64%	6.44%	11.27%	6.96%
Trade, hotels and restaurants	8.67%	6.20%	11.20%	5.75%
Transportation, mail and telecom.	6.39%	3.45%	11.82%	3.33%
Utilities and construction	12.43%	12.28%	14.88%	14.63%
Total number of workers	877	3307	1438	991

Table 2: Sectoral distribution of net population

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 equally clear, how the low focus 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, except for the net population constituting a larger share of the gross population in the case of Danyard.

In addition to an indicator for the industry in which workers find employment they are characterised according to seven variables: sex, age when leaving the shipyard, tenure at the shipyard, education when re-entering employment, a dummy indicating whether this education is higher than the education they had when they left the shipyard, a dummy indicating whether they work at a spin-off from the shipyard and a dummy indicating whether they have moved to a new municipality since leaving 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 has 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 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 is 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 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 expanding by the new workplace.

	Nakskov	Aalborg	B&W	Danyard
Spin-off plant	6.27%	2.99%	0.00%	4.74%
Spin-off firm	7.53%	24.98%	0.07%	4.14%

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

Table 3 shows some discrepancy in the share of 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. Similarly, the lack of focus on continuation is evident in the B&W numbers.

Explanatory variables

Table 4 presents the frequencies for the remaining variables. 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 the lowest share of skilled workers and Danyard had the largest share of unskilled workers with more than one in four 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. However this is not the case. In fact, the two shipyards with the largest share of workers with higher education, Aalborg and B&W, are also the shipyards where larger shares of workers take new education (6.5 and 7.2 per cent respectively).

With respect to age it is seen that there were relatively many older workers at Danyard while the workers at Aalborg were relatively young. Workers also seem to have been slightly younger at B&W compared to Nakskov. 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.

	Nakskov	Aalborg	B&W	Danyard
Education				
Unskilled	19.61%	21.68%	22.95%	26.74%
Skilled	71.95%	60.72%	62.45%	62.56%
Higher	7.30%	16.51%	13.00%	9.28%
Missing	1.14%	1.09%	1.60%	1.41%
Increased education				
No	95.44%	92.35%	91.10%	95.06%
Yes	3.42%	6.53%	7.23%	3.33%
Missing	1.14%	1.12%	1.67%	1.61%
Age				
< 35 years	43.44%	52.86%	50.14%	33.50%
>= 35 and < 50	44.01%	37.59%	36.02%	46.72%
>= 50	12.54%	9.56%	13.84%	19.78%
Missing	0.00%	0.00%	0.00%	0.00%
Moved				
No	84.15%	88.66%	81.78%	91.22%
Yes	15.85%	11.34%	18.22%	8.78%
Missing	0.00%	0.00%	0.00%	0.00%
Tenure				
< 4 years	62.14%	73.06%	44.99%	38.35%
>= 4 years	37.86%	25.70%	55.01%	61.65%
Missing	0.00%	0.00%	0.00%	0.00%
Sex				
Men	95.10%	92.32%	95.13%	94.75%
Women	4.90%	7.68%	4.87%	5.25%
Missing	0.00%	0.00%	0.00%	0.00%

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 38 and 26 per cent respectively 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.

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 these reasons the firm based spin-off variable is used in the regressions and the tenure variable is left out. The spin-off variable is excluded from the model for B&W as it pertains to just one worker.

Dependent variable

The dependent variable of the regression models is a dummy indicating whether workers earn more or less in their new job compared to their last year of employment at the shipyard. The database contains several measures of income and the following presents descriptive statistics on three of them: yearly taxable income, yearly wage income and an estimate of hourly wage supplied in the database by Statistics Denmark. The hourly wage estimate is missing for 10-20 per cent of observations. All incomes are deflated/inflated to year zero for the shipyard in question with the consumer price index.

	Nakskov	Aalborg	B&W	Danyard
Growth in				
Taxable income	51.20%	52.62%	33.59%	31.08%
Wage income	56.21%	55.00%	34.42%	32.29%
Hourly wage	54.62%	48.84%	32.55%	32.19%
Missing (hourly wage)	10.95%	18.84%	9.46%	10.39%

Table 5: Workers with income growth

Regardless of the chosen measure of income the data tells the same story: workers from the shipyards had difficulties maintaining their material standard of living after leaving the shipyards. Two years after re-entering the labour market only half of the workers from Nakskov and Aalborg have an income that is greater than their former income from the shipyard. And for B&W and Danyard it is even fewer: two years after re-entering the labour market only one in three earn an income that is greater than what he earned at the shipyard.

As the three measures of income tell roughly the same story only taxable income will be used in the regressions. There are no missing values for this variable while the missing values for the estimated hourly wage tend to correlate with specific industries and therefore interpretation of regression results would have to be careful. The benefit of taxable income over wage income is that the former also captures income earned from firm ownership and thus provides for a more consistent treatment of potential entrepreneurship among the workers.

5. Regression results

The model estimated in this paper is the following:

$$\text{Logit}(pInc_i) = \beta_0 + \widehat{\beta}_1' \widehat{Age}_i + \widehat{\beta}_2' \widehat{Education}_i + \beta_3 \Delta Education_i + \beta_4 \Delta Municipality_i + \beta_5 Spin_i + \beta_6 Sex_i + \widehat{\beta}_7' \widehat{Industry}_i + \beta_8 \log(Wage_{Yard})_i + \varepsilon_i$$

$pInc_i$ is the probability of the yearly real taxable income of worker i being higher than his yearly real taxable income was at the shipyard. His last year at the shipyard is compared to his status two years after re-entering employment. The right hand side is condensed by the use of hats for vectors. There are three categories for age in the last year of employment at the shipyard and also for education in at two years after re-entering. The middle category is used for reference in both cases, cf. Table 4. The following four variables of the model are dummies indicating whether worker i has re-entered with a higher education, moved to another municipality, worked at a spin-off firm and whether i is male. There are nine industry dummies and the reference industry is finance and real-estate, cf. Table 2. The final regressor is the logarithm of i 's real taxable income 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.

	Nakskov			Aalborg			Danyard			B&W		
	Estimate	S.E.		Estimate	S.E.		Estimate	S.E.		Estimate	S.E.	
Intercept	41.242	4.329	***	29.183	1.820	***	44.696	4.734	***	38.840	3.546	***
Age less than 35 years	0.082	0.175		0.225	0.088	**	0.204	0.181		0.286	0.147	*
Age at least 50 years	0.031	0.253		-0.502	0.148	***	-0.681	0.251	***	-0.316	0.230	
Unskilled	-0.180	0.199		-0.195	0.098	**	-0.082	0.189		-0.158	0.159	
Higher education	1.580	0.380	***	1.324	0.128	***	1.231	0.343	***	1.693	0.230	***
New education	1.235	0.799		0.834	0.235	***	0.447	0.541		1.101	0.321	***
Moved	0.430	0.234	*	0.075	0.134		0.365	0.303		-0.067	0.172	
Spin-off firm	1.292	0.370	***	0.853	0.105	***	0.687	0.369	*	.	.	
Male	-0.467	0.374		-0.220	0.162		-0.372	0.394		-0.134	0.308	
Primary	-1.128	0.826		-1.744	0.545	***	2.234	1.150	*	-0.317	1.153	
Other Manufacturing	-0.009	0.691		-0.180	0.296		1.620	1.102		0.522	0.431	
Metal and iron manuf	0.746	0.654		-0.104	0.264		1.684	1.071		0.481	0.376	
Utilities and construction	-0.299	0.676		-0.354	0.278		1.586	1.084		0.579	0.390	
Trade, hotels and restaur.	-0.079	0.691		-0.391	0.300		0.877	1.126		0.003	0.408	
Transportation and com.	-0.175	0.707		-0.432	0.334		1.774	1.151		0.588	0.400	
Business services	0.704	0.721		0.341	0.303		2.650	1.098	**	0.413	0.425	
Public, health, edu and social	-0.458	0.699		-0.851	0.301	***	0.489	1.135		-0.602	0.429	
Personal services	0.021	0.779		-0.738	0.437	*	0.500	1.186		0.316	0.456	
Log previous taxable income	-3.535	0.364	***	-2.486	0.152	***	-3.868	0.376	***	-3.292	0.288	***
N	863			3262			969			1413		
Successes	438			1717			299			475		
Missing	14			45			22			25		

Independent logistic regressions. Asterisks denote the level of significance: *: 10% **: 5% ***: 1%. Dependent variable is 1 if the real taxable income of a worker is higher two years after he re-entered employment compared to his last year at the shipyard. The spin-off variable is excluded from the regression for B&W as only 1 worker was employed at a spin-off.

Table 6: Regression results for increased yearly real taxable income

It seems that age mattered a lot in the case of Aalborg and less so in the cases of Danyard and B&W. For all three cases younger workers had a greater probability of increasing their income. Having a higher

education unanimously increases the probability of increased income and in the case of Aalborg the unskilled were also significantly less likely to increase income compared to skilled workers. Taking a new education increased the probability of increasing income in the cases of Aalborg and B&W 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 while there is no effect of sex. The industry controls are mostly not significant while there is a negative effect of the income that the worker had when at the shipyard.

The effect of age is not surprising but there will be some missing variable bias in this estimate as tenure was left out due to low data quality. A similar caveat applies to the estimates of the effect of education. The fact that worker with a higher education – i.e. at least one year tertiary education – have greater probability of receiving a higher income in his new job was also to be expected. And this variable probably also captures some effects of occupation categories at the shipyard. It is more surprising that skilled and unskilled workers were equally likely to get a higher income in their new jobs, except for the Aalborg case. It would seem that there are no specific abilities of the skilled workers that were in demand.

Taking a new education had a positive effect in the Aalborg and B&W cases. This could very well be associated with the location of these two shipyards in more urban areas and thus workers having more diverse job opportunities. 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, however, the results indicate that there is no specific industry in which the abilities of former shipyard workers are particularly valuable.

The negative effect of prior income 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. Discussion

The analysis presented in this paper is very preliminary and suffers from a number of problems. Future research needs to analyse the database more meticulously in order to construct indicators for tenure and occupation. There may also be endogeneity issues in the models: taking a new education or moving to another municipality are not random treatments. This can be dealt with by more advanced econometric techniques. Lastly, the workers that never re-enter employment need to be analysed as well, although this is difficult as only data on employed individuals is available.

With these caveats in mind there are, however, still some very interesting results to draw from the analysis. The regression results do correspond well with the histories of the specific shipyards. And, as preliminary though the results may be, 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.

All in all a relatively large share of the workers from the shipyards experienced their income to decline after the shipyard closed down. Neither they nor the economy managed to adapt. It is no big surprise that

younger and more educated people found it easier to adapt than others while the specific competencies of skilled and unskilled workers alike did not create much value in their new applications.

These initial results are interesting on their own and future analysis of these unique cases can be expected to yield further lessons.

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