Industrial and geographical mobility of workers during industry decline: Swedish and German shipbuilding industry 1970-2000

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Abstract
This paper follows the industry employment histories of all individuals at some point affiliated with the declining German and dismantling Swedish shipbuilding industry 1970-2000. We analyse the situation of the individual workers leaving shipbuilding through investigating to what extent they were employed at all, tended to move to related sectors inside or outside the region, and whether such moves were beneficial for the individuals. Combining insights from labor geography and redundancy studies with evolutionary economic geography, we find remarkably similar results for the West German and Swedish case. Our findings indicate a notable impact of the regional industry structure on the labor market outcomes for the workers leaving shipbuilding. This suggests that more attention should be devoted to the specific structures of the absorptive capacity of regional labor markets. The findings are discussed within the context of a mature industry.

Introduction

This article analyses the labor market outcomes of all workers at some point affiliated with the Swedish or West German shipbuilding industry during the period 1970-2000. In the early 1970s, Sweden and West Germany were among the most important shipbuilding nations in the world. In West Germany, the shipbuilding industry employed about 58,000 persons (1975), and in Sweden about 37,000.[1] After 1970, a cascade of closures reduced the number of employees drastically. Fragments of these industries do still remain, and most importantly so in West Germany with roughly 12,000 employees (2000). The downturn of shipbuilding posed enormous challenges to many industrial cities such as Gothenburg and Hamburg, as industrial dismantling sets off processes where redundant workers need to be shifted to jobs in other industries in the regional economy.

The encompassing literature on plant close-downs and worker displacement has conventionally focused on identifying the individual characteristics which affect the probability of workers to face unemployment or wage loss (Fallick 1996). But the impact on the regional economic environment on re-employment of displaced workers has of course not gone unnoticed (Pinch and Mason 1991, Bailey *et al.* 2012). In quantitative studies, unemployment rates of the local economy have repeatedly been found to affect the outcomes of displacement (Fallick 1996). More generally, Bluestone (1984) argued that the 'absorptive capacity' of the regional labor market was instrumental in creating opportunities for workers who lost their jobs as a consequence of de-industrialization. A similar line of argument was pursued by Shuttleworth *et al*. (2005) who showed the importance of regional demand side factors affecting the employability of workers exiting the shipbuilding industry in Northern Ireland.

There are important qualitative aspects to the absorptive capacity of regional labor markets. For example, recent arguments in the evolutionary economic geography suggest that labor mobility between related industries allows workers to use previously acquired skills to be re-used at least partially (Neffke and Henning 2013). Thus, successful re-allocation of workers from displacement may be especially alleviated in regions which host many of such related industries. This article brings together arguments from the labor geography, displacement and evolutionary economic geography literatures to study the propensity of individuals to leave the shipbuilding industry, take up new work, or become non-employed. We are especially interested in how the regional industry structure affected the outcomes for the individuals.

As a complement to the traditional way of relying on occupations and formal skill levels between former shipyard jobs and new workplaces to assess the matching quality, we use information about human capital similarities between industries to empirically verify whether the regional presence of related industries matter for the propensity of the individual to move, and the success when doing so. In comparison to most previous work this study expands the time frame and sample, and considers all employees affiliated with shipbuilding at some point during a 30-year period. While most previous work in this field has focused on the discrete event of closure (Pike, 2005), the dismantling process of shipbuilding in Sweden and West Germany was a process ranging over many years. Additionally, few quantitative studies have compared dismantling of industries and outcomes of redundancy processes in different countries. Comparing the outcomes between Sweden and West Germany allows us to initiate a discussion about the impacts of institutional differences.

[1] To derive comparable data between both countries all apprentices (< 18 years) are excluded from the West German data. In total (including all apprentices), the West German shipbuilding industry comprised in total 67,700 (1975) and 11,200 (2000), respectively.

Previous literature

The analysis of labor market outcomes after plant closures is a longstanding issue in the literature. The variation of theoretical and empirical approaches to approach the topic could be exemplified by a set of more general studies (Davis and Haltiwanger 1999, Fredriksen and Westergaard-Nielsen 2007), numerous investigations on plant-closures in mature industries (e.g. Pinch and Mason 1991, Bailey *et al.* 2012, Oesch and Baumann forthcoming), and studies of modern services (Dawley *et al.* 2014, Pike 2005). Especially interesting for this investigation are the case studies on the effects of the decline of the shipbuilding industry for Germany (e.g. Eichborn and Hassink 2005) and other countries (e.g. van Klink and de Langen 2000, Karlsen 2005, Shin and Hassink 2011). In addition, scholars have conducted more in-depth studies that investigated the nature of shipyard-closures, or the impact of such closures on workers labor market transitions, for example, Storrie (1993), Ohlsson and Storrie (2012) in Sweden, Heseler and Osterland (1983), Hien *et al.* (2007) in Germany, Tomaney *et al*. (1999) in Great Britain, Shuttleworth et al. (2005) in Northern Ireland and Holm et al. (2012) in Denmark.

The objective of many case studies on plant closures has been to investigate the characteristics and success of matching process of redundant worker's transition to other economic activities by using indicators such as re-employment rates or early retirement quotes (for shipbuilding, see for example Storrie 1993, Tomaney *et al*. 1999, Ohlsson and Storrie 2012). In the literature particularly concerned with displaced workers, individual factors such as tenure, age, education and occupation have repeatedly been found to affect the likelihood of being displaced, while non-employment after displacements is primarily experienced by those workers with longer tenures and higher wages (Fallick 1996). Moreover, the displacement process itself is often found to come with earning losses. For mature industries, the interacting specialization and age effects among redundant workers are particularly interesting. Previous studies highlight that an aging workforce is a typical feature of declining industries (e.g. Andersson and Lindmark 2008). The fact that longer tenured workers are less likely to leave their job may partly be explained by legal structures of some labor markets, and by the fact that older workers have accumulated sector-specific human capital that become a sunk-cost if they exit (Eriksson *et al*. 2008).

Some scholars have emphasized the gender perspective on displacements (Pinch and Mason 1991), and for example noted that women have a greater risk of withdrawing from the labor market in case of lay-offs and are more inclined to take up just any job due to gender relations in the household (Hanson and Pratt 1991). Institutional arrangements underlying industrial downsizing and plant closures, and how mature industries are regarded by policy, will differ between countries and regions. This can also be expected to affect the labor market outcomes of large-scale displacements and the pace of structural change. Indeed, Tomaney *et al.* (1999), Bailey *et al*. (2012) and Holm *et al.* (2012) argue that the organization of the redundancy process itself is highly important for the labor market outcomes of redundant workers.

Tomaney *et al*. (1999 pp. 406-407) summarize previous surveys on the effects of the closedowns of shipyards in particular. A large part of the workers who become redundant exit unemployment after a short while and are re-employed in other industries. Those who still remain unemployed after this initial period suffer a high risk of long-term unemployment. Low-skilled workers are typically hit hard by redundancies. Furthermore, many redundant workers are likely to accept a lower initial pay in their new employment. Moreover, the majority of ex-shipyard workers do not migrate to other regions after displacement, but they start to commute longer daily distances to work.

In the displacement literature, conditions in the surrounding regional economic environment, such as employment rates, have for a long time been acknowledged as important factors determining the outcomes of worker displacements (Fallick 1996). Primarily in the geographical labor literature, more detailed accounts of the role of the regional economic environments have been developed, especially in studies dealing with displacements from particular plants (Pinch and Mason 1991, Pike 2005, Shuttleworth *et al*. 2005, Bailey *et al.* 2012, Holm *et al*. 2012), and regional impacts of large-scale closures (Chapain and Murie 2008).

However, recent developments in the literature of evolutionary economic geography allow us to further qualify the notion of the 'absorptive capacity' of the regional labor market (Bluestone 1984). The absorptive capacity of the local labor market is highly important to the outcome of redundancy processes, because the geographical movement of individuals on the labor market and during industrial restructuring processes is constrained by place (regional) concerns due to economic, social and institutional reasons (Sjaastad 1962). Searching and finding a new job in other regions is time consuming, and related to monetary and social costs (van den Berg 1992). Rigby and Essletzbichler (2006) demonstrated that the same industry may have significant and persistent differences in production techniques across regions. When an individual moves and becomes detached from the regional knowledge structure and routines, parts of the human capital would be lost, and required to be built up again in a costly process (Fischer *et al.* 1998).

Given this constrained mobility of individuals in geographical space, the qualitative dimensions of the regional industry structure can be assumed to have a decisive influence on the processes of labor re-allocation. A highly specialized regional economy runs the risk of limiting the number of potential employers (Krugman, 1993), although within-industry moves are often beneficial for the individuals (Fallick, 1996). In fact, Frenken et al. (2007) found that regional industrial diversity is shock absorbing and protects from unemployment due to portfolio effects. Similarly, thick urban labor markets are generally associated with an increase in the chances for workers to find new employment (Duranton and Puga 2004, Puga 2010). The changing of jobs between different industries often involves a certain degree of human capital destruction. This consequence of job switching is less prevalent when the skill distance between the old and new job is lower. Job moves between *skill-related* industries enable individuals to use parts of their acquired human capital also in their new job (Neffke and Henning 2013, also Poletaev and Robinson 2008, Nikulainen and Pajarinen 2013). Consequently, as demonstrated by Boschma *et al.* (2014), the possibility to find any job in any industry is greater in thick and diverse labor markets, while the quality of matching is greater in regions hosting industries that are related to each other.

For the region, a job switch between skill-related industries implies a regional re-use of important human capital resources present in the region (Neffke *et al.* 2014). The opportunity for workers to remain in the same region without being subject to major skill-destruction will impact the transformative capability of regional economies (Diodato and Weterings 2014), and thereby the adaptability and resilience of regional economies (Pike *et al.* 2010, Boschma 2014). In all, as indicated by Eriksson and Hane-Weijman (2015) in their study on of how regional economies in Sweden responded to recessions, the presence of related industries may be an essential qualitative part of the absorptive capacity of the regional labor market.

Shipbuilding in Sweden and West Germany

Table 1 shows the total number of employees in the shipbuilding industries in Germany and Sweden, as well as the most important shipbuilding cities in the two countries with their employment numbers and shipbuilding location coefficients at specific points in time. The location coefficients have been normalized and range between -1 and 1. In the 1970s in West Germany, Hamburg, Bremen, Bremerhaven and Kiel all featured location quotients far above 0, which indicates strong shipbuilding concentrations. In Sweden, Göteborg, Malmö, Uddevalla and Landskrona were the most important shipyard cities, also featuring high location coefficients.

From the 1970s onwards, increased global competition and the oil crises posed severe challenges for the West German and Swedish shipyards. Starting with the closure of the Rolandswerft in Bremen 1972 and Lindholmen in Gothenburg in 1976, even massive public support efforts in both countries during the 1970s and early 1980s could not prevent the list of shipyards closures becoming longer, and stretching in our investigated period to the closure of Schichau Seebeckwerft in Bremerhaven in 2009 (Table 2). An example of the dramatic policy measures implemented to alleviate the consequences of this crisis in Sweden was that in the late 1970s, several important Swedish shipyards were taken over by state-owned conglomerate Svenska Varv, with the idea to restructure the industry. After a short time of stability in the early 1980s, the remaining shipyards in Sweden were indeed technologically up to date and even started to diversify their production (SNA, 1997). But as state subsidies ended in 1985, Uddevalla shipyard was closed down almost immediately. Shortly after, in the end of the 1980s, Götaverken (Gothenburg) and Kockums (Malmö) seized production. In West Germany, the dismantling process was coined by the crises of five large shipyards specialized into building large tanker ships: Howaldtwerke (Hamburg and Kiel), Blohm+Voss (Hamburg), Bremer Vulkan and Unterweser AG (Bremen). The Krupp group has owned the largest shipyard Unterweser AG, and the owner sought to even strengthen its competitiveness with huge investments in the 1970s. Before the final closure of this shipyard in 1983, it was intended vainly to establish a new business activity with the construction of small individual ships. This reorientation was sustained by subsidies from the Federal State of Bremen and the national government (as was the closure process itself). In times of crisis, each of these shipyards was sustained individually by owners, regional and national institutions. For instance, the North-West German Federal States became owners of parts of local shipyards to secure jobs. In Germany, numerous repair facilities as well as some full-size shipyards (for example Meyer-Werft in Papenburg, ThyssenKrupp-Marinesystems in Kiel) still operate, in many cases successfully. Shipyards are even nowadays sustained with programmes and subsidies by public institutions. The Swedish shipyard industry is today vastly diminished and transformed, and consists of a few repair facilities and highly specialized shipyards for example geared towards advanced naval applications (SNA 1997).

While much of the industry dynamics in shipbuilding as well as the competition pressure in Sweden and West Germany were the same, the institutional differences concerning the management of the transformation process of shipbuilding differed (Heseler 1990). For example, active policies in combination with a duty to inform in time about the closure process alleviated the transition processes of redundant shipyard workers in Sweden. This was not the case in West Germany. Here, unemployment of shipyard workers was more likely and thereby crowding-out effects on local labor markets were more likely to operate, as the local labor market situation was less favorable than in the Swedish shipyard regions. In Sweden formal seniority rules were arranged by law while in West Germany, informal seniority rules played an important role. After accounting for our empirical effort, we will return to this important institutional issue.

Table 1: Development of employment in shipyards in Sweden (1970-2000) and in West Germany (1975-2000)

	Sweden	Göteborg	Malmö	Udde-valla	Helsingborg/ Landskrona	West Germany	Hamburg	Bremen	Bremer-haven	Kiel
Total number of employees										
1970	28,548	13,821	4,664	3,646	2,465	--	--	--	--	--
1975	37,276	15,604	5,943	4,512	3,468	57,909	15,354	11,198	9,694	10,632
1980	24,280	7,786	4,335	3,953	2,681	44,589	12,550	7,476	7,401	8,622
1985	13,763	5,725	2,661	2,369	224	32,370	8,689	3,816	7,299	6,306
1990	7,341	4,219	1,060	427	1,536	24,888	6,366	3,249	5,553	5,569
1995	6,193	3,984	1,137	478	944	15,360	1,794	2,700	3,647	4,463
2000	4,534	2,589	1,266	184	552	11,681	2,615	423	2,033	4,043
Average annual normalized location coefficient										
1970(75)-2000	--	0.36	0.15	0.41	0.19	--	0.70	0.76	0.93	0.89
1975-1980	--	0.61	0.44	0.80	0.54	--	0.71	0.85	0.92	0.87
1975-1990	--	0.55	0.36	0.69	0.36	--	0.71	0.82	0.93	0.88
1990-2000	--	0.04	-0.26	-0.12	-0.01	--	0.67	0.69	0.94	0.91

Source: Employment-History-Panel (EHP), Institute of Employment Research (IAB), Statistics Sweden (own elaborations).

Table 2: Closure of large shipyards in Sweden and West Germany

Year of closure	Shipyard	Region
Sweden		
1976	Lindholmen	Göteborg
1979	Eriksberg	Göteborg
1981	Öresund	Helsingborg/Landskrona
1985	Uddevalla	Uddevalla
1987	Kockums	Malmö
1989	Arendal	Göteborg
West Germany		
1962	Schlieker Werft	Hamburg
1966	Stülcken Werft	Hamburg
1972	Rolandswerft	Bremen
1983	AG Weser, Großwerft	Bremen
1986	Rickmers Werft	Bremerhaven
1995	Bremer Vulkan	Bremen
2009	Schichau Seebeckwerft	Bremerhaven

Data and estimation issues

The empirical analysis is based on two matched employer-employee datasets from West Germany (1975-2000) and Sweden (1970-2000). The West German dataset, the Employment History-Panel, is derived from the Institute of Employment Research (Bender *et al*. 2000). The Swedish dataset is obtained from Statistics Sweden. Due to limited data availability in Sweden before 1985, we study five-year outcomes of labor market moves. From our datasets, we select the individuals who are - for any of our observation years - affiliated with the shipbuilding industries. We define functional regions (local labor markets) according to the West German Standard Planning Regions (N=74) and the conventional Swedish A-regions (N=70). For each country, we construct an employer-employee dataset that includes all cohorts of shipbuilding employees (1970, 1975, 1980, 1985, 1990, 1995) and their subsequent employment histories. For legal reasons, we were not able to merge the Swedish and German datasets into one. Therefore, we conduct parallel sets of country analyses throughout the article. Apart from general descriptive measures, we make use of multinomial logistic regressions and ordinary least square (OLS) regressions for which two different dependent variables are created. A full list of variables, descriptives and correlations can be found in tables A1-A2.

First, we want to assess to what extent our independent variables impact the propensity of workers to stay in the shipbuilding industry, to leave for another industry, or to be not employed. We create therefore a dependent categorical variable (Status), which equals 1 if workers remain in the industry between two measurement periods (t_0 to t_{+5}), equals 2 if workers leave the industry, but is employed in another industry in t_{+5}, and 3 if the worker is not working in t_{+5}. For all categories, obvious retirees due to age (65 years or older) in t_{+5} are excluded.

Second, we study how regional and industrial features affect the success of the individual after he or she left the shipyard industry. For those who exit the shipyard industry to work in another industry, our second dependent variable therefore measures the change in wage that the worker receives in the new job, compared to the job in shipbuilding industry. Following Holm *et al.* (2012) we use the workers' relative wage to capture potential unobserved factors. We run separate regressions in each year on the entire national workforces in both countries. For each year, wage is regressed on individual characteristics (age, sex, and whether having an university degree or not), ten 1-digit sectors and regional fixed effects. The observed income is then divided with the fitted values of these regressions to calculate the relative wage for each worker. The dependent variable (HigherInc) is created by comparing relative wage in t_{+5} to that of t_0.

As independent variables, we first introduce conventional individual characteristics. Age dummies are included. For Germany, the dummy Academics is assigned to all individuals with a degree of a regular university or a university of applied sciences. Due to Swedish data restrictions, the Academics dummy variable equals one if the worker either has an occupation that requires a university diploma (prior to 1990), or at least has got a bachelor's degree (after 1990). To consider the impact of individuals acquiring a higher education (Holm *et al.* 2012), the dummy HigherEd equals one if Swedish individuals have *obtained* a Bachelor's degree (or an equivalent occupation) between two measurement points. Higher education is given for German employees if they obtained a certificate of vocational training or university. Lastly, we include a dummy variable for female.

The second group of independent variables concerns the regional destination of ex-shipyard workers. The first indicates whether they remain in the same region or leave for work in another region (NewReg). We also create regional dummies that decompose regional and skill-relatedness dimensions into four dummy variables that capture whether workers (i) remain within the same region and move to a related industry (SRegRel), (ii) remain within the region but move to a unrelated industry (SRegDiff), (iii) change region and move to a related industry (ORegRel), and finally, (iv) change region but move to a unrelated industry (ORegDiff). Remaining in the region but moving to a different but unrelated industry (SRegDiff) is used as the reference category in the OLS regressions estimating the wage equation.

The third group of independent variables addresses the regional industrial portfolio in terms of specialization, diversity and presence of related industries. Regional industry specialization is calculated according to the traditional location quotient of shipbuilding in the region (LQshp). We also include an indicator of regional diversity (Diversity) defined as the entropy (Jacquemin and Berry, 1979)[2]. Finally, a controller measuring the size of the region (RegSize) was included.

A great challenge is to identify which industries are related to shipbuilding. As we discussed above, people normally strive to minimize the destruction of human capital when they change jobs, and want to use previously acquired skills and experience also in their new position. Neffke and Henning (2013) argued that labor flows between industries, arising from job switches, is a clear indication of the degree to which industries are dependent on the same types of skills. They devised a quantitative strategy to derive the *skill relatedness* between industries in the economy by observing the flows of (skilled) labor between these industries as people change jobs. Importantly though, the observed flow needs to be compared to a baseline of expected flows to adjust for other factors other than relatedness that obviously will impact the size of the flows, for example the size of industries. This line of reasoning was further developed by Neffke *et al*. (2013) who designed a method to calculate expected flows (baseline) from the relative risks of cross-industry flows. In our case however, using the same labor mobility datasets of both countries to calculate the skill-relatedness to other industries, as then study the impacts of these labor flows, would run the risk of circular reasoning.

To remedy this potential problem, we identify those industries that are consistently skill-related to shipbuilding in both West Germany and Sweden during the observation period. We take it to be likely that these are persistently, or "generically", skill-related to shipbuilding over the period we study, but also across different institutional and national contexts. We first observe the real labor flows between all industry pairs in Germany and Sweden during our investigated period. Second, we establish expected baseline labor flows across all industry pairs by calculating relative risks (of flows) based on the overall shares of flows in the economy, according to the method by Neffke *et al*. (2013). Third, to obtain the measure of skill-relatedness between industries, we take the ratio between observed and expected baseline flows. Greater labor flows than expected is taken as an indicator of the industries being skill-related. To compare the industries related to shipbuilding in Germany and Sweden, we then identified the counterparts to the German codes in the Swedish dataset.[3] We then selected the industries that were related to shipbuilding in more than 10 years during the observation period in both Germany and Sweden. We consider these industries as being *generically skill-related* to shipbuilding (Table 3). The majority of skill-related industries to shipbuilding belong to the manufacturing sector, for example mechanical engineering and metal products, but also a few service industries.

[2] This was performed on the finest available division of industry codes in each economy. We used 302 three-digit-industries of the German System of Industrial Classification 1973, and the 183 Swedish 4-digit industries of the SNI69 system. The same industries were used for the relatedness calculations.
[3] We allowed one-to-many translations and dropped industries for which we could not find reasonable translations.

Table 3: generically related industries to shipbuilding

Manufacture of structural metal products
Manufacture of other equipment related to mechanical engineering
Manufacture of aircraft
Building and repairing of boats and yachts
Shipping agents
Sea and coastal water transport
Inland water transport

The degree of relative presence of related industries in each region is calculated using a location coefficient (LQrel) of skill-related industries j of the industry i (shipbuilding industry) with *emp_rel* as total employment in related industries *j* in region *r* or in all regions *total*.

$$LQrel_r = \frac{\frac{\sum emp\_rel_r}{\sum emp_r}}{\frac{\sum emp\_rel_{total}}{\sum emp_{total}}}$$

In the regressions, normalized values of the specialization measures (ranging between -1 and 1) are used to reduce the impact of a skewed distribution.

Results

Table 4 depicts the number of employees in shipbuilding at our benchmark points *t* and their whereabouts five years later, at t_{+5}.[4] In general, between 40 percent and 60 percent of the workforce stays in the shipbuilding industry at t_{+5}. These figures are lower for Sweden than for West Germany, because here the contraction was more gradual. 20 percent to 30 percent are not employed anymore at t_{+5}. This category captures all statuses beyond employment such as self-employment, further education, unemployment etc.[5] The quite small shares of workers moving to the related industries are not surprising given our strict definition of generically related industries. Most interesting are variations over time. In the most severe crisis period in Sweden, between 1985-1990, only 23 percent of those working in shipbuilding remained in the industry, and about 50 percent left for work in other industries. Meanwhile, 27 percent left to non-employment.

[4] The construction of our dataset allows for persons enter and exit the shipbuilding industry more than once during the study period. If we would restrict the sample to allow for one exit only, we are faced with the difficult choice to define the “right” exit. Nevertheless, the empirical consequences of our strategy are very limited. With our sample design, for Germany we find only 1,016 among 178,000 persons who re-entered shipbuilding. These returners are slightly younger and earn more than the rest of the sample. They are also slightly more likely to be academics and male. For the Swedish case, we find 28,144 among 117,401 who re-entered shipbuilding. The only striking dissimilarity in this group compared to the rest of the Swedish sample is that they tend to be slightly older. When we exclude the returners from the sample and run all regressions without the workers who re-entry shipbuilding, the results are identical to the ones accounted for in the article, both for both Germany and Sweden.

[5] For Germany, an employee is not reported anymore in the database in case of retirement. However, all retired former shipyard employees are assigned to the group of non-employed persons in table 4 and in the subsequent analysis.

Table 4: Number of employees in shipyard industry 1970-1995 and their status in t+5

Sweden							
	1970-1995	**1970**	**1975**	**1980**	**1985**	**1990**	**1995**
Total number of shipyard employees t0	117,401	28,548	37,276	24,280	13,763	7,341	6,193
In shipyard t5 (%)	47	61	46	40	23	55	52
Not in shipyard t5 (%)	30	19	32	30	50	19	29
related industry (t5) (%)	9	9	8	9	11	5	6
unrelated industry (t5) (%)	21	10	24	21	39	14	23
Not employed t5 (%)	16	11	14	22	22	21	12
Retired t5 (%)	7	9	8	8	5	5	7
West Germany							
	1975-1995	**1970**	**1975**	**1980**	**1985**	**1990**	**1995**
Total number of shipyard employees t0	178,251		54,558	44,890	34,422	26,863	17,518
In shipyard t5 (%)	59		65	57	59	52	59
Not in shipyard t5 (%)	16		16	12	15	21	18
related industry (t5) (%)	2		2	2	3	2	3
unrelated industry (t5) (%)	14		14	10	12	20	15
Not employed t5 (%)	25		19	31	26	27	23

Source: Employment-History-Panel, Statistics Sweden..

Table 5 and 6 depict the results of the multinomial logit estimations on the determinants of staying in the shipbuilding industry, working in another industry (baseline) or not being employed in t_{+5}.[6] For each country, we estimate six models covering different variable sets and time periods: the whole period (1970-2000), the pre-crisis period in Sweden and early crisis period in Germany (1970-1980), the crisis period (1975-1990) and post-crisis period in Sweden but continued crisis in Germany (1990-2000).

We first investigate which factors explain the future position of the shipbuilding workers (table 5 and 6), with the workers occupied in a new sector in t_{+5} being the reference category. Controlling for individual and regional factors, the wage level of individuals positively affected their propensity to stay in the shipbuilding industry (upper panel). This pattern is very consistent for Sweden and West Germany, except in the last period 1990-2000. Younger people were more likely to leave the shipbuilding industry. Similar patterns between both countries are found for the qualification variables, too. Having an academic degree did not affect the propensity to leave the industry, except for the significant positive effect in West Germany from 1975-1980. However, those who obtained a higher education between t and t_{+5} have a significantly higher chance of leaving the industry. Moreover, the impact of the female variable differs between the countries. In Sweden, females are less likely to stay in the shipyard industry, while the results are more mixed (and usually non-significant) for West Germany. We will return to this question in the elaborations on our results.

[6] In all models cluster-robust standard errors at the regional level are reported to allow for intra-regional correlations (Cameron und Trivedi, 2005).

Turning instead to the issue of the impact of the regional economic structure on the mobility propensity, the location coefficient in the shipbuilding industry has a positive significant effect on worker's propensity to remain in the industry (LQshp). This result is not surprising, but nonetheless very consistent. A high (low) specialization of generically related industries indicates whether the shipbuilding industry is strongly (weakly) embedded in a regional economy (LQrel_n). In general, we find a negative impact on the probability of staying in the shipbuilding industry from such embeddedness. This pattern is very strong for West Germany throughout time, and quite strong for the model covering the entire period for Sweden. However, for the Swedish case, the effect wears off in the later periods, even though the negative signs remain. In the Swedish case regional diversity and size are basically not significant, while in West Germany, they are positively significant in most models, except for the negative coefficient 1990-2000.

The lower panels of tables 5 and 6 display the influence of individual and regional factors on the risk of becoming non-employed (at t_{+5}). Older shipyard workers ran a much higher risk of becoming non-employed, and those with a higher education or that take on a higher education run a far lower risk of unemployment in both countries. In West Germany, the females face a higher risk of non-employment after leaving shipbuilding, whereas this result is less consistent for Sweden.

When leaving (or being forced to leave) the dismantling shipbuilding industry, there is a much higher risk of becoming non-employed for a longer period in a specialized shipbuilding region, in West Germany as well as in Sweden. However, for the whole period, there is some evidence which suggest that a high regional specialization in related industries protects against unemployment in Sweden and West Germany (model 7000a). When individual control variables are introduced and periods are split, the significance is slightly weakened and becomes period-specific. For West Germany, it is weakly significant between 1975 and 1990, and for Sweden it is not significant during the worst period of close-downs 1975-1990.

The diversity of the regional industry structure has in most phases a negative but non-significant association with non-employment probabilities in Sweden, while it is positive significant in most periods in West Germany. There is a notable exception. Diversity has a strongly positive effect in Sweden in the period prior to the major close downs (1970-1980). For Sweden, diversity however decreases the risk of non-employment during 1975 to 1990 (weakly significant). Regional size has a positive impact on the unemployment probabilities in these two countries, except in the very last period in West Germany.

Table 5: Sweden - Multinomial logit models on the probability of remaining in shipbuilding, leaving for another industry (reference) or not working in t_{+5}. Coefficients and cluster robust SE:s are reported. Significant at 10% (*), 5% (**) and 1% (***) level.

Sweden	7000a	7000b	7000c	7080	7590	9000
1: Still employed in shipyards						
rw_t0log		0.570***	0.474***	0.418***	0.696***	0.094
		(0.084)	(0.104)	(0.080)	(0.117)	(0.242)
Age1834		-0.760***	-0.759***	-0.864***	-0.790***	-0.776***
		(0.091)	(0.094)	(0.121)	(0.111)	(0.110)
Age5065		0.350***	0.355***	0.348***	0.369***	0.255***
		(0.094)	(0.091)	(0.126)	(0.107)	(0.079)
Academics		0.086*	0.025	0.022	-0.008	-0.148
		(0.052)	(0.044)	(0.042)	(0.040)	(0.258)
HigherEd_t5		-0.304***	-0.327***	-0.369***	-0.717***	0.241*
		(0.106)	(0.090)	(0.048)	(0.075)	(0.145)
Female		-0.202***	-0.155**	-0.314***	-0.203**	-0.066
		(0.078)	(0.062)	(0.074)	(0.082)	(0.126)
LQshp_n	0.871***		0.836***	1.038***	0.546***	1.584***
	(0.188)		(0.197)	(0.207)	(0.191)	(0.500)
LQrel_n	-2.685**		-2.754**	-3.198**	-1.700	-4.524***
	(1.210)		(1.282)	(1.460)	(1.654)	(0.818)
Diversity	0.180		0.302	4.943***	-1.105	1.407*
	(1.041)		(1.104)	(1.683)	(1.286)	(0.792)
RegSize	0.211*		0.191	-0.022	0.111	-0.011
	(0.124)		(0.131)	(0.151)	(0.169)	(0.134)
Intercept	-2.469	1.473***	-2.494	-21.350***	2.380	-6.841*
	(5.744)	(0.255)	(6.126)	(8.024)	(6.862)	(3.896)
2: Working in other industry (reference)						
3: Not in work						
rw_t0log		0.888***	0.811***	0.406***	0.685***	2.021***
		(0.137)	(0.121)	(0.112)	(0.132)	(0.342)
Age1834		-0.200***	-0.183***	-0.161*	-0.280**	-0.244
		(0.065)	(0.065)	(0.086)	(0.117)	(0.150)
Age5065		1.454***	1.452***	1.474***	1.694***	0.816***
		(0.084)	(0.081)	(0.108)	(0.108)	(0.128)
Academics		-0.483***	-0.568***	-0.667***	-0.601***	0.227
		(0.125)	(0.112)	(0.113)	(0.115)	(0.223)
HigherEd_t5		-8.271***	-7.544***	-8.529***	-8.405***	-8.036***
		(0.537)	(0.533)	(0.594)	(0.571)	(0.489)
Female		0.176	0.198	0.344**	0.458***	-0.520*
		(0.112)	(0.122)	(0.149)	(0.115)	(0.280)
LQshp_n	0.673***		0.669***	0.736***	0.486***	1.169***
	(0.135)		(0.156)	(0.175)	(0.164)	(0.452)
LQrel_n	-1.503**		-1.611*	-1.978*	-0.825	-1.749*
	(0.756)		(0.870)	(1.027)	(1.087)	(0.901)
Diversity	-0.429		-0.319	2.693**	-1.280*	-0.570
	(0.638)		(0.720)	(1.138)	(0.819)	(0.946)
RegSize	0.320***		0.323***	0.191**	0.268**	0.180*
	(0.073)		(0.087)	(0.092)	(0.122)	(0.099)
Intercept	-2.989	-1.075***	-3.649	-15.943***	-1.545	-2.247
	(3.459)	(0.253)	(3.958)	(5.431)	(4.548)	(4.662)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
N	117,401	117,401	117,401	65,824	75,319	13,534
LL	-80.146.771	-78.386.669	-76731.1	-47.209.571	-51.356.513	-69.293.919
pseudo R^2	0.073	0.094	0.113	0.110	0.103	0.129

Table 6: West Germany - Multinomial logit models on the probability of remaining in shipyard, leaving for another industry (reference) or not working in t_{+5}. Coefficients and cluster robust SE:s are reported. Significant at 10% (*), 5% (**) and 1% (***) level.

West Germany	**7000a**	**7000b**	**7000c**	**7080**	**7590**	**9000**
1: Still employed in shipyards						
rw_t0log		1.537***	1.369***	2.134***	1.686***	0.404
		(0.281)	(0.291)	(0.127)	(0.165)	(0.634)
Age1834		-0.873***	-0.872***	-1.323***	-1.095***	-0.305*
		(0.081)	(0.073)	(0.073)	(0.069)	(0.173)
Age5065		0.420***	0.415***	1.050***	0.621***	0.316***
		(0.084)	(0.073)	(0.059)	(0.071)	(0.085)
Academics		-0.063	0.024	0.658***	0.279	-0.271
		(0.232)	(0.280)	(0.243)	(0.196)	(0.442)
HigherEd_t5		-1.810***	-1.714***	-1.860***	-1.796***	-1.470***
		(0.146)	(0.130)	(0.212)	(0.168)	(0.332)
Female		-0.118	-0.139	0.141	0.041	-0.505***
		(0.092)	(0.096)	(0.094)	(0.078)	(0.153)
LQshp_n	2.621***		2.527***	2.864***	2.713***	1.984***
	(0.305)		(0.311)	(0.292)	(0.261)	(0.680)
LQrel_n	-2.277***		-2.224***	-2.278***	-2.350***	-2.797**
	(0.652)		(0.629)	(0.430)	(0.526)	(1.166)
Diversity	2.488***		2.410***	2.080***	3.292***	0.752
	(0.761)		(0.746)	(0.481)	(0.636)	(0.988)
RegSize	0.322***		0.241**	0.663***	0.560***	-0.591***
	(0.102)		(0.096)	(0.078)	(0.099)	(0.213)
Intercept	-15.949***	1.787***	-14.101***	-17.743***	-22.359***	4.051
	(4.667)	(0.174)	(4.535)	(3.030)	(4.142)	(7.097)
2: Working in other industry (reference)						
3: Not in work						
rw_t0log		-0.131	-0.332	0.458***	-0.030	-1.165**
		(0.205)	(0.220)	(0.162)	(0.197)	(0.543)
Age1834		-0.529***	-0.493***	-0.733***	-0.652***	-0.133
		(0.053)	(0.060)	(0.071)	(0.075)	(0.144)
Age5065		2.451***	2.462***	2.616***	2.583***	2.592***
		(0.132)	(0.122)	(0.059)	(0.129)	(0.063)
Academics		-0.984***	-0.966***	-0.606***	-0.750***	-1.206***
		(0.271)	(0.307)	(0.213)	(0.205)	(0.387)
HigherEd_t5		-21.443***	-20.108***	-20.454***	-20.412***	-17.884***
		(0.405)	(0.429)	(0.464)	(0.441)	(0.566)
Female		0.450***	0.404***	0.670***	0.549***	0.167
		(0.116)	(0.115)	(0.101)	(0.081)	(0.179)
LQshp_n	2.207***		2.112***	3.074***	2.315***	1.666***
	(0.233)		(0.255)	(0.743)	(0.348)	(0.410)
LQrel_n	-1.163**		-0.946	-2.411*	-1.240*	-0.994
	(0.568)		(0.651)	(1.265)	(0.697)	(0.821)
Diversity	1.260**		1.161*	2.664**	1.966***	-0.135
	(0.560)		(0.665)	(1.304)	(0.624)	(1.053)
RegSize	0.284***		0.205**	0.824***	0.527***	-0.495***
	(0.077)		(0.093)	(0.243)	(0.099)	(0.165)
Intercept	-10.727***	-0.086	-9.491**	-24.496***	-17.359***	5.191
	(3.505)	(0.187)	(4.257)	(9.462)	(4.268)	(6.756)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
N	178,218	176,723	176,723	53,950	132,644	44,079
LL	-160.642.277	-145.124.472	-1,39E+08	-40.045.022	-101.298.438	-35.909.780
pseudo R^2	0.049	0.133	0.168	0.166	0.176	0.184

The second set of regressions concerns the success of workers leaving the shipbuilding industry in terms of change in (relative) wages between the old job in shipbuilding and the new job. We, thus, only include the reference group from the previous multinomial logistic models (those who left shipbuilding to work in other industries, tables 7 and 8). The results indicate that those with higher wages will experience a negative effect on their wage change. Young people benefited from a more positive increase in relative wages, and the older part of the workforce had even a negative change. In West Germany, there is a strong and consistent education premium in relative wage change, whereas this is largely absent in Sweden for those already in possession of a higher education. In turn, the Swedish data shows extra benefits to those that obtain a higher education between t and t_{+5}. Females have a stronger relative wage increase in West Germany, and in the early period (1970-80) in Sweden.

We also consider how wage increases with regional and industrial mobility of workers. For the entire period in West Germany, moving to other regions (Newreg) was not beneficial for the period as a whole, but there was a positive effect until 1990. In Sweden this overall effect is also moderate, except for the crisis period 1975-1990. A positive effect of remaining in the same region is mainly attributed to West German workers ending up with new jobs in related industries (SRegRel). In Sweden this positive effect is observed only for the period 1970 to 1980, then it turns non-significant (but still positive) in the following period, and the very end (1990- 2000) this effect is even negative. In West Germany, there are also clear positive effects from moving to (generically) related industries in other regions (ORegRel), whereas moving to unrelated industries in other regions is again positive only up till 1990, and then less so than a move to related industries. The positive impact of moving to a new region in Sweden during 1975-1990 pertains primarily from the move to related industries, even if there is also a positive effect on the wage change from moving to unrelated industries.

Table 7: Sweden - OLS regressions on relative wage increase for workers leaving the shipbuilding industry. Coefficients and cluster robust SE.S at regional level are reported. Significant at 10% (*), 5% (**) and 1% (***) level.

Sweden	**7000a**	**7000b**	**7080a**	**7080b**	**7590a**	**7590b**	**9000a**	**9000b**
rw_t0log	-0.379***	-0.379***	-0.336***	-0.336***	-0.378***	-0.378***	-0.351***	-0.363***
	(0.015)	(0.015)	(0.016)	(0.016)	(0.018)	(0.018)	(0.012)	(0.012)
Age1834	0.026***	0.025***	0.027***	0.028***	0.023***	0.023***	0.047***	0.044**
	(0.005)	(0.005)	(0.006)	(0.006)	(0.005)	(0.005)	(0.018)	(0.018)
Age5065	-0.009	-0.009	-0.004	-0.004	-0.010	-0.010	0.002	0.008
	(0.006)	(0.006)	(0.008)	(0.008)	(0.007)	(0.007)	(0.023)	(0.025)
Academics	0.006	0.005	0.010	0.009	0.001	0.000	0.034*	0.032
	(0.011)	(0.010)	(0.008)	(0.008)	(0.011)	(0.011)	(0.020)	(0.020)
HigherEd_t5	0.064***	0.064***	0.057***	0.056***	0.065***	0.065***	0.034*	0.033*
	(0.007)	(0.007)	(0.008)	(0.007)	(0.006)	(0.006)	(0.017)	(0.017)
Female	0.016**	0.016**	0.011***	0.012***	0.004	0.005	0.046	0.034
	(0.007)	(0.007)	(0.004)	(0.004)	(0.007)	(0.006)	(0.031)	(0.031)
NewReg_t5	0.022*		0.015		0.026***		-0.005	
	(0.011)		(0.013)		(0.009)		(0.022)	
SRegRel_t5c		-0.002		0.012***		0.007		-0.087**
		(0.006)		(0.002)		(0.004)		(0.032)
ORegRel_t5c		0.020		0.022		0.032***		-0.089*
		(0.012)		(0.016)		(0.007)		(0.032)
ORegDiff_t5		0.025*		0.021		0.028**		-0.005
		(0.013)		(0.014)		(0.011)		(0.027)
RegSize	0.007***	0.007***	0.010***	0.011***	0.008**	0.007**	-0.002	0.003
	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.008)	(0.009)
Intercept	-0.111***	-0.111***	-0.151***	-0.159***	-0.127***	-0.127***	-0.019	-0.054
	(0.028)	(0.029)	(0.035)	(0.034)	(0.035)	(0.034)	(0.113)	(0.114)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	33,343	33,343	16,043	16,043	24,943	24,943	3,190	3,190
R^2	0.184	0.184	0.201	0.202	0.197	0.197	0.116	0.130

Table 8: West Germany - OLS regressions on relative wage increase for workers leaving the shipbuilding industry. Coefficients and cluster robust SE:s at regional level are reported. Significant at 10% (*), 5% (**) and 1% (***) level.

West Germany	**7000a**	**7000b**	**7080a**	**7080b**	**7590a**	**7590b**	**9000a**	**9000b**
rw_t0log	-0.596***	-0.605***	-0.702***	-0.713***	-0.651***	-0.664***	-0.458***	-0.460***
	(0.020)	(0.019)	(0.031)	(0.029)	(0.018)	(0.016)	(0.030)	(0.029)
Age1834	0.122***	0.123***	0.130***	0.130***	0.135***	0.137***	0.088***	0.088***
	(0.004)	(0.004)	(0.006)	(0.006)	(0.006)	(0.006)	(0.010)	(0.010)
Age5065	-0.045***	-0.041***	-0.114***	-0.111***	-0.077***	-0.074***	-0.032*	-0.030*
	(0.014)	(0.014)	(0.018)	(0.018)	(0.008)	(0.008)	(0.018)	(0.017)
Academics	0.160***	0.155***	0.065***	0.056***	0.081***	0.073***	0.243***	0.240***
	(0.023)	(0.023)	(0.010)	(0.008)	(0.009)	(0.009)	(0.018)	(0.019)
HigherEd_t5	0.009	0.008	0.029***	0.028***	0.006	0.005	0.052**	0.053**
	(0.010)	(0.010)	(0.008)	(0.008)	(0.009)	(0.009)	(0.022)	(0.022)
Female	0.048***	0.052***	0.037**	0.038**	0.042**	0.046**	0.057***	0.060***
	(0.012)	(0.011)	(0.018)	(0.018)	(0.019)	(0.018)	(0.009)	(0.007)
NewReg_t5	0.021		0.039***		0.028**		0.010	
	(0.014)		(0.014)		(0.013)		(0.019)	
SRegRel_t5c		0.092***		0.072***		0.101***		0.091**
		(0.020)		(0.010)		(0.013)		(0.041)
ORegRel_t5c		0.093***		0.093***		0.095***		0.104***
		(0.014)		(0.018)		(0.013)		(0.020)
ORegDiff_t5		0.022		0.039**		0.032**		0.008
		(0.015)		(0.016)		(0.015)		(0.020)
RegSize	0.021***	0.024***	0.021***	0.019***	0.013**	0.014**	0.033**	0.040**
	(0.006)	(0.008)	(0.005)	(0.005)	(0.006)	(0.007)	(0.014)	(0.017)
Intercept	-0.245***	-0.297***	-0.255***	-0.237***	-0.151**	-0.184**	-0.408**	-0.504**
	(0.073)	(0.095)	(0.058)	(0.063)	(0.074)	(0.079)	(0.177)	(0.220)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	27,558	27,558	8,705	8,705	18,979	18,979	8,579	8,579
R^2	0.307	0.321	0.331	0.340	0.336	0.353	0.277	0.288

Reflections and conclusions

We have attempted to bring together insights from labor geography, displacement studies and evolutionary economic geography to analyze the impact of individual and regional factors for the labor market situations of employees in the dismantling West German and Swedish shipbuilding industry during 1970-2000. Especially, we have ventured to give a more detailed account of the regional absorptive capacity of regional labor markets, than what has been done in most previous studies.

For individual characteristics, our results recall many findings previously described in the literature. Older workers will be more negatively affected by leaving their industry, and will hesitate to do so. In addition, more skilled workers, regarding relative wage level controlled for a number of features as a broad indication for skill, will tend to cling on to their industry even during decline. However, an important point in our study is that the industrial non-mobility of workers is strengthened by the demand-side of the local labor market, conceptualized as opportunities in the regional industrial structure. The presence of a strong specialization in shipbuilding made people stay in the industry as long as possible, rather than going elsewhere, even during industrial decline. But especially for the West German case, the presence of a related regional specialization was important in providing opportunities for exiting shipyard workers. Presence of skill-related industries in the region offer options to move to new sectors with a high matching quality (also Boschma *et al.*, 2014). Thereby, this kind of labor mobility presents opportunities for incremental change of the regional industry structure (Diodato and Weterings, 2014). We believe that the productive re-allocation of redundant staff between declining to growing industries, thereby achieving a re-use and re-combination of existing region-specific human capital, could be one of the most important empirical drivers behind regional resilience (Pike *et al.* 2010, Martin and Sunley 2014, Boschma 2014, Eriksson and Hane-Weijman 2015).

Table 9: Related (generic) employment in Sweden (1970-2000) and in West Germany (1975-2000)

	Sweden	Göteborg	Malmö	Udde-valla	Helsingborg/ Landskrona	West Germany	Hamburg	Bremen	Bremer-haven	Kiel
Total number of employees										
1970	227,699	28,120	13,625	2,079	5,900	--	--	--	--	--
1975	251,198	26,590	13,761	3,053	6,379	459,284	52,496	21,073	8,090	6,123
1980	243,304	26,137	14,757	2,588	6,553	481,645	53,808	19,977	9,222	6,612
1985	237,251	27,722	14,644	2,164	5,688	445,093	40,606	15,853	8,855	6,346
1990	192,744	19,440	8,744	2,781	5,450	494,984	37,298	14,587	9,816	6,518
1995	171,218	18,438	8,761	1,729	4,405	450,035	35,621	11,320	8,331	5,278
2000	170,258	17,110	9,905	1,822	4,986	459,179	33,789	9,712	7,803	4,422
Average annual normalized location coefficient										
1970(75)-2000	--	0.13	0.01	-0.12	0.02	--	0.42	0.45	0.55	0.10
1975-1980	--	0.06	- 0.01	-0.15	-0.02	--	0.50	0.54	0.52	0.13
1975-1990	--	0.07	0.01	-0.09	0.02	--	0.45	0.55	0.55	0.14
1990-2000	--	0.21	0.04	-0.10	0.06	--	0.38	0.38	0.55	0.05

Source: Employment-History-Panel , Statistics Sweden.

Because we are concerned with a mature industry, there is an important qualification to our results for the Swedish case in particular. Moving to related industries is associated with a negative change in relative wage in the later study period (1990–2000). Specialized workers in mature industries are sometimes faced with a major predicament, as related industries themselves may also deteriorate. This is exactly what happened in the major Swedish shipbuilding regions, and it became especially obvious in our last estimation period (Table 9). Hence, opportunities to move to related industries in the same region became limited towards the end of our investigated period, even if we do find some overall evidence that related structures gave some protection against unemployment itself. In Germany, the story is different. Even though the number of employees in generically related industries to shipbuilding decreased in many of the major shipbuilding cities, employment in those industries on national level stayed rather constant. In this respect, the overall structural change of the Swedish and German regions impact quite differently on the labor market outcomes of ex-shipyard workers.

In periods of real crises, the propensity to move to just any industry in just any region increases. During the most intense crisis period in Sweden, regional industrial diversity decreased the risk of unemployment. Diversity seem to protect from unemployment during radical change (Frenken *et al.* 2007). By contrast, steady decline of industries is a 'normal business' for regions and gives time for normal adjustment mechanisms to operate, where resources are transferred from old to new industries in the region. In general however, neither regional diversity nor regional size were particularly efficient in promoting the exit from shipbuilding into other industries, nor protecting against non-employment. While this outcome may again underline the argument about the importance of regional quality of the matching processes, we have to keep in mind that the estimates concern a period where many large shipbuilding city regions were subject to considerable economic stress and, in many cases, a loss of inhabitants. Considering that mature industries are largely dependent on a quite specialized labor force and knowledge circulation within the industry, it is perhaps not that surprising that workers from mature industries do not necessarily fare that well in dense urban areas (Neffke *et al.* 2011).

Overall, despite considerable institutional differences between these two countries in handling large scale redundancies of shipyards (Heseler 1990), the final labor market outcomes in the countries were not that different. With respect to re-employment rates and unemployment after leaving the shipbuilding industry, the Swedish shipyard workers performed only a little bit better than the West German ones. In our estimations, some interesting differences could however be observed. One of the most interesting pertains to the gender structures on the labor market. Swedish female workers might have had access to a larger number of jobs on a labor market that was marked by high female participation rates by international standards. A much weaker integration of female employees on the West German labor market and stagnating employment growth in shipyard regions hampered obviously women to leave shipbuilding, though these effects are insignificant. This however changed in the most recent period (1990-2000), when female labor market integration and regional labor market conditions improved.

Just as the results of Boschma and Capone (2014) suggest that institutional variations associated with varieties of capitalism may influence diversification paths of countries, more detailed comparative studies on labor mobility patterns in different countries can shed light on of the most important mechanisms for regional resilience in various policy contexts. With the increasing availability of individual level register data, this is a challenging but not impossible task. Indeed, many regions throughout the world face and are going to face similar challenges to those that some German and

Swedish shipbuilding cities once did. The specific components of the regional industry structure: same industries, related industries and industrial diversification, are important aspects of the absorptive capacity (Bluestone 1984) and the demand side of the regional labor market (Shuttleworth *et al*. 2005) in different phases of industry development.

References

Andersson L F, Lindmark M (2008). Is Structural Change Speeding Up? The Case of Sweden, 1850-2000. *Scandinavian Economic History Review*, 56: 192-208.

Bailey D, Chapain C, de Reuter A (2012). Employment outcomes and plant closures in a post-industrial city: an analysis of the labour market outcomes of MG Rover workers three years on. *Urban Studies*, 49: 1595-1612.

Bender S, Haas A, Klose C (2000). IAB Employment Subsample 1975-1995. *Schmollers Jahrbuch* 120: 649-662.

Bluestone B (1984). Is Deindustrialization a Myth? Capital Mobility versus Absorptive Capacity in the U.S. Economy. *Annals of the American Academy of Political and Social Science* 475: 39-51.

Boschma R (2014). Towards an evolutionary perspective on regional resilience. Papers in Evolutionary Economic Geography 14.09. Utrecht University, Urban and regional research centre Utrecht.

Boschma R, Capone G (2014). Institutions and Diversification: Related versus Unrelated Diversification in a Varieties of Capitalism framework. Working paper: Papers in Evolutionary Economic Geography # 14.21, Urban and Regional research centre Utrecht.

Boschma R, Eriksson R H, Lindgren U (2014). Labor market externalities and regional growth in Sweden. The importance of labor mobility between related industries. *Regional Studies* 48(10): 1669-1690.

Boschma R, Minondo A, Navarro M (2012). The Emergence of New Industries at the Regional Level in Spain: A Proximity Approach Based on Product Relatedness. *Economic Geography* 89: 29-51.

Cameron A C, Trivedi P K (2005). *Microeconometrics Using Stata*. Revised edition. College Station, Texas: Stata Press.

Chapain C, Murie A (2008). The impact of factory closure on local communities and economies: the case of the MH Rover Longbridge closure in Birmingham. *Policy Studies* 29(3): 305-317.

Davis S J, Haltiwanger J (1999). Gross job flows. In: Ashenfelter O, Card D (eds.), *Handbook of Labor Economics* (edition 1). North-Holland: Elsevier, pp. 2711-2805.

Dawley S, Marshall JN, Pike A, Pollard J, Tomaney J. (2014) Continuity and Evolution in an Old Industrial Region: The Labour Market Dynamics of the Rise and Fall of Northern Rock. *Regional Studies* 48: 154-172.

Diodato D, Weterings, A (2014). The Resilience of Regional Labour Markets to Economic Shocks: Exporing the Role of Interactions among Firms and Workers, *Journal of Economic Geography*, online advanced access: doi:10.1093/jeg/lbu030

Duranton G, Puga D (2004). Micro-Foundations of Urban Agglomeration Economies. In: Henderson, J V, Thisse J V (eds). *Handbook of Regional and Urban Economics* (edition 1), volume 4. North-Holland: Elsevier, pp. 2063-2117.

Eich-Born M, Hassink, R (2005). On the battle between shipbuilding regions in Germany and South Korea, *Environment and Planning A* 37: 635 – 656.

Eriksson R, Lindgren U, Malmberg G (2008). Agglomeration mobility: effects of localisation, urbanisation, and scale on job changes, *Environment and Planning A* 40: 2419-2434.

Eriksson, R.H., Hane-Weijman, E. (2015). How do regional economies respond to crises? The geography of job creation and destruction in Sweden (1990-2010). *European Urban and Regional Studies*, DOI: 10.1177/0969776415604016

Fallick, B C (1996). A review of the recent empirical literature on displaced workers. *Industrial and Labor Relations Review* 50(1): 5-16.

Fischer P A, Holm E, Malmberg G, Straubhaar T (1998). Why do people stay? The Insider- advantages Approach: Empirical Evidence from Swedish Labour Markets. Discussion Paper 1952, Centre for Economic Policy Research (CEPR), London.

Fredriksen, L., Westergaard-Nielsen, N. (2007) Where did they go? Modelling transitions out of jobs. *Labour Economics* 14: 811-828

Frenken K, Van Oort F, Verburg T, (2007) Related variety, unrelated variety and regional economic growth. *Regional Studies* 41, 685–697.

Hanson S, Pratt G. (1991) Job Search and the Occupational Segregation of Women. *Annals of the Association of American Geographers* 81: 229-253.

Heseler H (1990). Die Arbeitsmarktfolgen von Betriebsschließungen. Erfahrungen im internationalen Vergleich. *Mitteilungen aus der Arbeitsmarkt- und Berufsforschung* 23: 410-421.

Heseler H, Osterland M (1983) Betriebsstillegung und lokaler Arbeitsmarkt. *Mitteilungen aus der Arbeitsmarkt- und Berufsforschung* 19: 233-242.

Hien H, Spalek R, Joussen R, Funk G, von Schilling R, Helmert U (2007): Ein neuer Anfang wars am Ende nicht. Zehn Jahre Vulkan-Pleite: Was ist aus den Menschen geworden? Hamburg: VSA.

Holm J R, Ostergaard C R, Olesen T R (2012). The unleashing of Creative Potential from Exiting Firms? Not really?. Paper presented at the DRUID 2012 Conference, Copenhagen.

Jacquemin A P, Berry C H. (1979) Entropy measure of diversification and corporate growth. *Journal of Industrial Economics* 27: 359–369.

Karlsen, A (2005). The dynamics of regional specialization and cluster formation: dividing trajectories of maritime industries in two Norwegian regions. *Entrepreneurship & Regional Development* 17: 313-338.

Krugman, P.R. (1993) Lessons of Massachusetts for EMU, in Torres, F, Giavazzi, F. (Eds.) *Adjustment and Growth in the European Monetary Union*, pp. 241–269. Cambridge: Cambridge University Press.

Maliranta M, Nikulainen T (2008). Labour flow paths as industry linkages: a perspective on clusters and industry life cycles. Discussion paper no. 1168, The Research Institute of the Finnish Economy.

Neffke F, Henning M (2013). Skill relatedness and firm diversification. *Strategic Management Journal* 34: 297-316.

Neffke F, Henning M, Boschma R (2011). How Do Regions Diversify Over Time? Industry Relatedness and the Development of New Growth Paths in Regions. *Economic Geography* 87: 237-265.

Neffke F, Henning M, Boschma R, Olander L-O, Lundquist K-J (2011). The Dynamics of Agglomeration Externalities along the Life Cycle of Industries. Regional Studies 45 (1), pp. 49-65.

Neffke F, Hidalgo C, Otto A, Weyh A (2013). Inter-industry labor flows. mimeo.

Nikulainen T, Pajarinen M (2013). Industry restructuring in the ICT sector – What does labor mobility tell us about skill relatedness and knowledge spillovers?. ETLA Working Papers No 17, The Research Institute of the Finnish Economy.

Martin R, Sunley P (2014). On the notion of regional economic resilience: conceptualization and explanation. *Journal of Economic Geography*, advance access, doi:10.1093/jeg/lbu015.

Oesch D, Baumann I (forthcoming). Smooth transition or permanent exit? Evidence on job prospects of displaced industrial workers. Forthcoming in Socio-Economic Review.

Ohlsson H, Storrie D (2012). Long-term effects of public policy for displaced workers in Sweden. *International Journal of Manpower* 33(5): 514-538.

Pike A (2005). Building a Geographical Political Economy of Closure: The Case of R&DCo in North East England. *Antipode* 37(1): 93-115.

Pike A, Dawley S, Tomaney J (2010). Reilience, adaption and adaptability. *Cambridge Journal of Regions, Economy and Society* 3: 59-70.

Pinch S, Mason C (1991). Redundancy in an Expanding Labour Market: A Case-study of Displaced Workers from Two Manufacturing Plants in Southampton. *Urban Studies* 28(5): 735-757.

Poletaev M, Robinson C. (2008). Human capital specificity: evidence from the dictionary of occupational titles and displaced worker surveys. *Journal of Labor Economics* 26: 387–420.

Puga D (2010). The magnitude and causes of agglomeration economies. *Journal of Regional Science* 50: 203-219.

Rigby D L, Essletzbichler J (2006). Technological variety, technological change and a geography of production techniques. *Journal of Economic Geography* 6: 45-70.

Shin D H, Hassink R. (2011). Cluster Life Cycles: The Case of the Shipbuilding Industry Cluster in South Korea*. Regional Studies* 45: 1387-1402.

Sjastaad L A (1962). The Costs and Returns of Human Migration. *The Journal of Political Economy* 70: 80-93.

Shuttleworth I, Tyler P, McKinstry D (2005). Redundancy, readjustment, and employability: what can we learn from the 2000 Harland & Wolff redundancy? *Environment and Planning A* 37:1651-1668.

SNA (1997). *National Atlas of Sweden: Manufacturing and Service*. Stockholm: Kartförlaget.

SOU 2008:21. Permanent förändring. Globalisering, strukturomvandling och sysselsättningsdynamik. Bilaga 7 till Långtidsutredningen 2008.

Storrie D W (1993). The anatomy of a large Swedish plant closure. Ekonomiska studier utgivna av Nationalekonomiska institutionen, Handelshögskolan vid Göteborgs universitet. Doctoral thesis.

Tomaney J, Pike A, Cornford J (1999). Plant Closure and the Local Economy: The Case of Swan Hunter on Tyneside. *Regional Studies* 33: 401-411.

van den Berg G J (1992). A Structural Dynamic Analysis of Job Turnover and the Costs Associated with Moving to Another Job. *Economic Journal* 102: 1116-1133.

van Klink A, de Langen P (2001). Cycles in industrial clusters. The case of the shipbuilding industry in the northern Netherlands. *Tijdschrift voor Economische en Sociale Geographie* 92: 449-463.

Table A1: Variable definitions and descriptives

		Sweden			West Germany		
Variable	**Definition**	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**
Dependent variables							
Status	Categorical variable on labor market status t_{+5}. Equals 1 if working in Shipyard industry, 2 if working in another industry and 3 if not being employed	1.70	1.00	3.00	1.67	1.00	3.00
HigherInc	log difference between relative wages rw_t_5 minus rw_t_0	-0.01	-1.82	2.27	0.05	-2.01	2.08
Independent variables							
LQshp_n	Normalized Location quotient: Regional industry specialization (log)	0.45	-0.99	0.86	0.77	-1.0	0.95
Lqrel_n	Normalized Location quotient: Regional related specialization (log)	-0.01	-0.65	0.58	0.29	-0.66	0.59
Diversity	Normalized regional diversity	0.61	0.53	0.63	0.66	0.64	0.68
RegSize	Total number of workers in region (log)	11.85	9.24	13.84	12.2	10.8	13.9
NewReg	Dummy =1 if leaving shipbuilding and working in other region in t_{+5}	0.17	0.00	1.00	0,24	0.00	1.00
SRegRel	Dummy =1 if leaving shipbuilding and working in same region in skill-related industry in t_{+5}	0.24	0.00	1.00	0.19	0.00	1.00
SRegDiff	Dummy =1 if leaving shipbuilding and working in same region in unrelated industry in t_{+5}	0.57	0.00	1.00	0.11	0.00	1.00
ORegRel	Dummy =1 if leaving shipbuilding and working in other region in skill-related industry in t_{+5}	0.05	0.00	1.00	0.01	0.00	1.00
ORegDiff	Dummy =1 if leaving shipbuilding and working in other region in unrelated industry in t_{+5}	0.14	0.00	1.00	0.02	0.00	1.00
Control variables							
rw_t_0	Relative wage (observed/predicted income) in t_0	1.01	0.35	10.6	1.04	0.14	6.26
Age1834	Dummy =1 if age of worker is less than 35 years	0.41	0.00	1.00	0.30	0.00	1.00
Age3549	Dummy =1 if age of worker is between 35 and 49 (baseline)	0.36	0.00	1.00	0.43	0.00	1.00
Age5065	Dummy =1 if age of worker is 50 or above	0.23	0.00	1.00	0.27	0.00	1.00
Academics	Dummy =1 if worker has a Bachelors degree or has an occupation requiring at least 3 years university schooling.	0.17	0.00	1.00	0.05	0.00	1.00
HigherEd	Dummy =1 if worker completed an university diploma in t_{+5} (Swe) and/or vocational training (Ger)	0.06	0.00	1.00	0.02	0.00	1.00
Female	Dummy =1 if worker is female	0.06	0.00	1.00	0.06	0.00	1.00

Table A2: Correlation matrix between variables included in regressions

Sweden	Status	HigherInc	rw_t_0	LQshp_n	LQrel_n	Diversity	RegSize	NewReg	SRegRel	SRegDiff	ORegRel	Age1834	Age5065	Academics	HigherEd	Female
Status	1.00															
HigherInc	-0.10	1.00														
rw_t_0	-0.01	-0.20	1.00													
LQshp_n	-0.12	0.01	0.08	1.00												
LQrel_n	0.06	0.02	0.01	0.05	1.00											
Diversity	-0.16	0.03	-0.02	0.01	0.15	1.00										
RegSize	-0.17	0.01	0.01	0.01	0.43	0.07	1.00									
NewReg	0.24	-0.03	0.03	0.01	-0.02	-0.02	-0.07	1.00								
SRegRel	0.36	0.00	-0.02	-0.07	0.08	-0.07	0.01	-0.10	1.00							
ORegRel	0.69	-0.07	-0.02	-0.09	0.06	-0.01	0.01	-0.17	-0.18	1.00						
ORegDiff	0.16	-0.02	0.01	0.01	-0.02	-0.03	-0.04	0.50	-0.05	-0.08	1.00					
Age1834	0.15	-0.01	0.00	-0.05	-0.04	-0.03	-0.05	0.14	0.01	0.11	0.07	1.00				
Age5065	-0.08	-0.06	0.03	0.02	0.03	0.07	0.02	-0.09	-0.01	-0.06	-0.05	-0.38	1.00			
Academics	-0.04	0.01	-0.03	0.04	0.04	0.01	0.07	0.02	0.01	-0.07	0.00	-0.10	0.04	1.00		
HigherEd	0.01	0.02	0.12	0.06	0.00	0.06	0.00	0.03	0.00	0.00	0.01	0.03	-0.01	-0.13	1.00	
Female	0.03	0.00	0.00	0.02	0.05	0.02	0.01	-0.01	-0.02	0.06	-0.02	0.05	-0.07	-0.02	0.01	1.00
West Germany																
Status	1.00															
HigherInc	0.00	1.00														
rw_t_0	0.08	-0.30	1.00													
LQshp_n	0.27	0.00	0.05	1.00												
LQrel_n	0.04	-0.02	0.01	0.39	1.00											
Diversity	0.06	-0.02	-0.02	0.14	0.45	1.00										
RegSize	0.00	0.01	0.00	-0.16	0.30	-0.22	1.00									

NewReg	-0.29	0.00	-0.03	-0.34	-0.09	-0.03	-0.02	1.00								
SRegRel	-0.32	0.01	-0.01	-0.02	0.05	0.04	-0.01	-0.03	1.00							
ORegRel	-0.13	0.00	-0.01	-0.11	-0.02	-0.01	-0.01	0.37	-0.01	1.00						
ORegDiff	-0.30	0.00	-0.03	-0.37	-0.12	-0.05	-0.01	0.83	-0.02	-0.01	1.00					
Age1834	-0.20	-0.01	0.07	-0.07	-0.05	0.02	-0.07	0.07	0.05	0.03	0.08	1.00				
Age5065	0.10	0.03	-0.02	0.03	0.00	-0.02	0.02	-0.05	-0.04	-0.02	-0.04	-0.32	1.00			
Academics	-0.01	0.08	-0.11	-0.02	0.02	-0.04	0.06	0.04	0.01	0.02	0.02	-0.05	0.02	1.00		
HigherEd	-0.16	-0.01	-0.03	-0.07	0.01	0.00	0.00	0.08	0.06	0.04	0.07	0.05	-0.04	0.02	1.00	
Female	-0.05	0.07	-0.09	-0.01	0.00	-0.03	0.01	0.00	-0.01	0.00	0.01	0.08	-0.03	-0.02	0.01	1.00