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# Industrial and geographical mobility of workers exiting the Swedish and West 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 industries 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. Drawing on recent research in especially Evolutionary Economic Geography and the impact of inter-industry relatedness on the prospects of regional economic change, we find remarkably similar results for the West German and Swedish case. Our findings indicate a notable impact of both geographical and industrial frictions of movement, and of the regional industry structure on the labor market outcomes for the workers leaving shipbuilding. These findings are discussed within the context of a mature industry in developed economies.

**Introduction**

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, most importantly so in West Germany with roughly 12,000 persons (2000). In Sweden, the industry employed about 4,500 persons in 2000.

This downturn posed enormous challenges to many shipbuilding cities such as Gothenburg and Hamburg. Numerous industrial regions in Europe, North America and other parts of the world had to tackle similar challenges with severe structural change caused by the dismantling of dominating mature industries (e.g. Birch *et al.* 2008). Industrial dismantling set off processes where redundant workers need to be shifted to jobs in other industries in the regional economy, otherwise they may face unemployment or may even be forced to leave the region. Current arguments in the Evolutionary Economic Geography (henceforth EEG) literature suggest that such a reallocation can be especially alleviated in regions which host many *related* industries where previously acquired skills of displaced workers can be readily used, or used in new combinations. The matching quality is decisive for the reallocation of the released human capital, as 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).

However, workers in very mature industries are faced with additional challenges. Achieving the desired move to related industries might be difficult if these related industries are also mature, and are also phasing out of the regional economy. For these workers, commuting longer distances to work or even leaving the region may be the only ways to obtain a new employment that matches their skills. Furthermore, institutional arrangements during industrial downsizing and plant closures, and how mature industries are regarded by policy, will differ between countries and regions. This can be expected to affect the labor market outcomes of large-scale displacements and the pace of structural change.

Using long-term employer-employee matched datasets, this paper analyses the labor market outcomes of all workers at some point affiliated with the Swedish or West German shipbuilding industries during the period 1970-2000. We are especially interested to investigate how geographical friction of movement, industry similarities and the regional industry structure affect the propensity of individuals to leave the shipbuilding industry at all, take on new work, or become non-employed. Moreover, we trace to what extent a move to related sectors, inside or outside the region, were beneficial for the individuals leaving the shipbuilding industry.

The analysis of labor market outcomes after plant closures is a longstanding issue in the literature, 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. Oesch and Baumann forthcoming, Bailey *et al.* 2012), and studies on modern services (Dawley et al. 2014). Moreover, there are several regional 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, there are more in-depth studies that investigated the nature of shipyard-closures, or the impact of such closures on workers labour market transitions (Storrie 1993, Ohlsson and Storrie 2012 (both Sweden), Heseler and

[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.

Osterland 1983, Hien *et al. 2007* (both Germany), Holm et al. 2012 (Denmark), Tomaney *et al*. 1999 (Great Britain)). Compared to these studies, this investigation especially elaborates on three dimensions which have been recently emphasized in EEG to affect the geographical distance and success of labor market moves: the friction of movement between industries, the friction of movement in space, and the regional industry structure.  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 verify empirically whether moves to related industries matter for the propensity of the individual to move, and the success when doing so. Defining *related* industries is however an obvious challenge in a cross-country study. Recent literature derives 'skill-relatedness' from the labor moves between sectors (Neffke and Henning 2013, Nikulainen and Pajarinen 2013). Making use of our unique longitudinal datasets, we define a number of industries persistently skill-related to shipbuilding in both countries, over time.

In comparison to most previous work this study also expands the time frame and sample, and considers all employees affiliated with shipbuilding at some point during a 30-year period. This makes it possible to distinguish between periods of acute crises to those of steadier decline. We furthermore compare the outcomes between two different countries, which allows us to discuss the impacts of institutional differences and discuss the wider generality of our findings.

**Theoretical** b**ackground**

The objective of many case studies on plant closures has been to study the characteristics and success of the matching process of redundant worker's transition to other economic activities by using conventional indicators such as re-employment rates, or early retirement quotes at a particular time after displacement (for shipbuilding, see for example Storrie 1993, Tomaney *et al*. 1999, Ohlsson and Storrie 2012). Recently, the skill match has been frequently studied by comparing wage and qualification levels as well as occupations between former and new jobs (Holm et al. 2012). Tomaney *et al*. (1999 pp. 406-407), summarize previous surveys on the effects of the closedowns of shipyards in a number of stylized facts. A large part of the workers who become redundant exit unemployment after a short while and enter other activities. 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. The majority of ex-shipyard workers do not migrate to other regions after displacement, but they start to commute longer daily distances to work. A selection effect coins these labour market transitions, as there is a bias regarding which workers stay until the very shutdown of an unsuccessful plant, as opposed to those leaving earlier (SOU 1998:21). Individuals with a better position in such plants have more attractive exit opportunities ahead of closure, and quit earlier. There are also interacting specialization and age effects among redundant workers. In fact, previous studies highlight that an aging workforce is a strong determinant of declining industries (e.g. Andersson and Lindmark 2008). This is partly due to the fact that young people are more likely to find other employment opportunities, but also that older workers have accumulated a more sector-specific human capital that become a sunk-cost if they move (Eriksson *et al*. 2008). Moreover, Tomaney *et al.* (1999), Bailey *et al*. (2012) and Holm *et al.* (2012) all argue that the organization of the redundancy process itself is highly important for the labor market outcomes of the redundant workers.

Recently the regional and EEG literatures have added to this discussion, and especially qualified three factors that are likely to affect the scope and constraints of labor market moves by individuals in the process of industrial restructuring: the friction of movement between industries, the friction of movement in space and the characteristics of the regional economic structure. As these aspects will limit the propensity for individuals who leave industries to find new adequate jobs that match their skills, these factors also constrain the regional ability to overcome crisis.

*The friction of movement between industries*

Recent contributions underline the fact that labor market flows are far from random over the industry spectrum (Maliranta and Nikulainen 2008, Neffke and Henning 2013). Neffke and Henning (2013) reasoned that individuals are likely to move between related industries, i.e. industries that share dependence on the same types of skills. By such moves between *skill-related* industries, individuals are able to use parts of their achieved human capital also in their new job. This also implies that the common dependence on productive resources between industries can be tracked through flows of labor between industries (Neffke *et al*. 2014). While the changing of jobs between different industries often involves a certain degree of human capital destruction, the consequences of changing jobs are mediated when the skill distance between the old and new job is lower (Poletaev and Robinson 2008).

A new stream of studies indicates that skill linkages between old and new work in regions have implications for regional diversification. Neffke *et al.* (2011) and Boschma *et al.* (2012) both find that regional diversification is considerably more likely to take place in industries that are strongly related to the present industry portfolio, than just any industries. On a broader scale, recent research finds that related knowledge added to the knowledge portfolio of firms contributes more positively to productivity than unrelated knowledge, and that regional labor mobility between related industries has a positive productivity growth impact (Boschma *et al*. 2014).

In all, this means that movements between related industries may entail two important dimensions for our study. For the individual displaced shipyard employee, we can expect that a move between related industries is a desirable loss-minimizing strategy. Neffke and Henning (2013) argued that when a large part of the human capital can be re-used in new combinations, the individual will be highly valued by the new employer, which also results in a comparatively higher wage. For the region, a related move in addition implies a regional re-use of important human capital resources present in the region (Neffke *et al.* 2014).

*The friction of movement in space*

The stylized facts of labor displacement suggest that job flows have a predominantly regional character. The 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). Individuals performing regional moves are often in their early career stages before having established themselves on the labor market, while when established, the majority of employees tend to a large extent to remain within the same local labor market (e.g. Lundholm 2007 for Sweden, Niebuhr *et al.* 2012 for Germany). This is not surprising, as searching and finding a new job in other regions is time consuming, and related to monetary and social costs (van den Berg 1992).

For instance, established local social networks have to be abandoned. These make in particular employees with families reluctant to move.

Adding to these practical concerns, individual social networks, which often have a local bias, are a vital source of information about job opportunities (e.g. Granovetter 1973). In fact, one might argue that region-specific knowledge will develop in some places, or at least that differences in regional routines will emerge. Rigby and Essletzbichler (2006) demonstrated that the same industry may have significant and persistent differences in production techniques across regions. If this somehow is a reflection of variations in the characteristics of regional knowledge, this implies that an individual leaving the region for a job in another region often would need to adapt to new circumstances. When an individual in this sense becomes detached from its regional knowledge structure and 'how things are done' (routines), parts of the human capital would be lost, and required to be built up again in a costly process (Fischer *et al.* 1998). These become a sunk cost and a barrier to moving, and thus also to regional economic change.

*The regional industry structure*

Given the structures to labor market movements imposed by industry relatedness and geographical space, we may also expect that inter-regional labor mobility patterns (job moves after displacement) will be affected not only by the general state of the regional economy, but also by the variety and association between industries present in the region. Regional industrial diversity often is thought of as shock absorbing, protecting from unemployment due to portfolio effects (e.g., Frenken, Van Oort and Verburg, 2007), while specialization limit the number of potential employers (Krugman, 1993). However, recent research has also found that 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). According to the literature taking an interest in matching economies (Duranton and Puga 2004, Puga 2010), thick urban labor markets are generally associated with an increase in the chances for workers to find new employment. However, as demonstrated by Boschma *et al.* (2014) in an empirical study of Swedish regions, the chances to find *any job* is greater in thick and diverse labor markets while the *quality* of matching is greater in regions with concentrations of skill-related industries. This matching is essential to achieve production complementarities and regional renewal. The argument extends the traditional Marshallian notion of intra-industry pooling and matching as a source of agglomeration economies by showing that pooling can work across sectors if they rely on similar (i.e., related) sets of skills. Thus, the effects of the job change is expected to be greater in regions with a concentration of skill-related industries, since the transfer of human capital is facilitated as compared to moving to completely unrelated sectors in the region.

**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.

-TABLE 1: Development of employment in shipbuilding and major shipyard cities in Sweden (1970-2000) and in West Germany-

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 shipbuilding 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 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. As a contrast, 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, Table 1).

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

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) compared shipyard closure processes and outcomes between selected cases in West Germany, Sweden, US and Great Britain. Heseler identified considerable institutional differences affecting the outcomes. 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 comparative empirical effort, we will return to this important institutional issue.

## Data and estimation issues

*Data*

Our empirical analysis is based on two matched employer-employee datasets from West Germany (1975-2000) and Sweden (1970-2000). An advantage of both databases is that job moves of individuals between industries and regions can be observed over these long time periods. The West

German dataset is derived from the Institute of Employment Research (IAB) Employment History-Panel (EHP, Bender *et al*., 2000). The Swedish dataset is obtained from Statistics Sweden. Because of sampling restrictions (the Swedish data prior to 1985 is only available in five-year intervals), we study five-year outcomes of labor market move throughout the article. From our datasets, we select the individuals who for any of our observation years are 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).

As we for legal reasons were not able to merge the Swedish and German datasets into one, we always conduct parallel sets of country analyses, using as similar definitions and methods as possible. In all, for each country, we construct an employer-employee dataset that includes all cohorts of shipbuilding employees (1970, 1975, 1980, 1985, 1990, 1995), their subsequent employment histories as well as auxiliary information.

*Variables*

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 stay in the shipbuilding industry, leave for another industry, or become out of work. We therefore create 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, since previous studies have shown that displaced workers tend to receive relatively lower wage in their new job, 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, rather than observed wage, to capture potential unobserved factors (such as informal human capital). First, 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 (Federal states in Germany and A-regions in Sweden) 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 $t_0$ (in 2010 price levels by means of a consumer price-index deflator for each economy). This change in relative wage indicates not only the success of the transition for the individual, but also if the worker has skills or human capital that could be transferred to, and become productive in, a new sector with different types of routines (Nelson and Winter, 1992).

As for the independent variables, we first introduce individual characteristics that can be taken to influence the individual's whereabouts after leaving shipbuilding, and the wage change (c.f., Bailey *et al*, 2012). Age dummies are included, and we also try to reflect a formal skill component. 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, where education is missing for some years and occupations in others, 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). As noted by Holm *et al.* (2012), also achieving a higher education may influence the relative wage increase for people leaving the industry. To consider this, 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, since women have a greater risk of withdrawing from the labour market in case of lay-offs and are more inclined to take on just any job due to gender relations in the household (Hanson and Pratt, 1991), 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) (Woods and Roberts 2011). We also include an indicator of regional diversity (Diversity) defined as the 4-digit entropy (Jacquemin and Berry, 1979)[2]. Finally, a controller measuring the size of the region (RegSize) was included to account for potential regional characteristics not captured in the other regional variables. Industry-specialization, related specialization (see below) and diversity were included in the multinominal logit model only since they would cause endogeneity when estimated together with the different industry destinations, but regional size was also included as a controller in the OLS model.

A great challenge is to identify which industries are *related* to shipbuilding. Neffke and Henning (2013) devised a method to derive the skill relatedness between industries in the economy by analyzing flows of (skilled) labor between these industries, in reference to a baseline of expected values. They argued that the flow of labor between industries, adjusted for an expected flow (given for example by the size of the industries), is a clear indication of the degree to which industries are dependent on the same types of skills in their production. 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 well as then studying the impacts of these labor flows, would run the risk of circular reasoning causing endogeneity problems. Moreover, little is known about how national specificities, for example labor market institutions or specific national skill specializations, affect the relatedness patterns in different countries on detailed industry level. To remedy this problem, we identify those industries that are consistently skill-related to shipbuilding in both West Germany and Sweden during the

[2] This is performed on the finest available division of industry codes in each economy. For Germany that is 3-digit level and for Sweden the 4-digit level.

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 (we use 302 three-digit-industries of the German System of Industrial Classification 1973, and the 183 Swedish 4-digit industries of the SNI69 system). 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, we take the ratio between observed and predicted (or expected) flows. This means that 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 reasonable counterparts to the German codes in the Swedish dataset by comparing the description of the industries. We allowed one-to-many translations and drop those for which we cannot find reasonable translations. We then selected, for each country separately, the industries that were related to shipbuilding in more than 10 years during the observation period. After having matched the industry classifications, we obtain a list of consistently related industries to shipbuilding over time in both economies. We consider these as being 'generically skill-related' industries to shipbuilding (Table 3). The results broadly correspond to intuitive expectations. The majority of skill-related industries to shipbuilding belong to the manufacturing sector, for example mechanical engineering and steel structures. We also find strong and consistent relatedness links to industries that are not considered as related in the national standard classification systems, such as technical consultancy and ship transport agents.

-Table 3: generically related industries to shipbuilding-

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 (LQship_n, LQrel_n).

**Results**

Table 4 depicts the number of employees in shipbuilding at our benchmark points *t* and their whereabouts five years later, at $t_{+5}$. 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. The quite small shares of workers moving to the "related" industries are not surprising, given our conservative definition of only a few 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.

-TABLE 4: number of workers employed in shipbuilding industry and their status in t+5-

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 $t_{+5}$. In all models cluster-robust standard errors at the regional level are reported to allow for intra-regional correlations (Cameron und Trivedi, 2005). 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, upper panels), 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 affect their propensity to stay in the shipbuilding industry. This pattern is very consistent for Sweden and West Germany, except in the last period 1990-2000. As expected, younger people were more likely to leave the shipbuilding industry, as suggested by both age variables for Sweden as well as West Germany. 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 obtain a higher education between t and $t_{+5}$ have a significantly higher chance of leaving the industry. Moreover, the impact of our 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.

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 for Sweden and West Germany. 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 stable 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 specialization of 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 even not significant during the worst period of close-downs 1975-1990.

The effects of diversity and regional size yield some initially surprising results. 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. We will return to these results in the discussion below.

-tables 5 and 6: multinominal logits-

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 for 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 for moving to unrelated industries.

-tables 7 and 8: OLS on wage change-

**Elaboration**

The investigations of the aspects that are emphasized in EEG recently about the frictions of labor market movement - industry, space and regional industry structure - add a lot to our understanding of how individual fortunes during industry restructuring are linked to the regional potential for structural change. In reality, these dimensions are intertwined. Indeed, regional change often has a conservative bias, when existing regional resources find new applications. EEG has recently explained this in terms of branching processes from old to new production (Frenken and Boschma 2007, Boschma and Frenken 2011), or in terms of regional path dependency (Martin and Sunley 2010). True structural change, that is change in the underlying resource base of regions, is a much slower process than industrial change in terms of the fluctuations of individual industries (Neffke *et al*. 2014). We believe that one of the main reasons for this resides in the interactions between spatial friction of movement, industrial friction of movement and the present industry structure. Regional specialization is actually also found in the skills of the individuals working in the region – they are geared towards particular industries and the more specialized the worker, the more hesitant he or she will be leaving the industry.

Our findings corroborate previous research findings that older workers will be negatively affected by leaving their industry. More skilled workers, regarding for a moment 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. This tendency is strengthened by opportunities in the regional structure. The presence of a strong specialization in shipbuilding made people stay in the industry, rather than going elsewhere, even during decline.

Especially for the West German case, the presence of a related regional specialization was quite important in providing opportunities for displaced shipyard workers. The impact of related specialization implies that presence of skill-related industries in the region offer options to move to new sectors with a high matching quality (Boschma *et al.*, 2014). To some extent, it also protects against unemployment. Therefore, the presence of related industries seems to be a vital aspect of providing both individual opportunities, as well as opportunities for regional incremental change for the region (Diodato and Weterings, 2014).

Our results suggest that leaving for other regions is mostly attractive during years of severe crises, but there is no conclusive evidence concerning the interaction between regional and industrial mobility. While in West Germany moving to related industries is better than moving to unrelated, it seems of little importance if this takes place within or between regions. For the Swedish case, the findings also imply this, although the outcomes are slightly less conclusive for the different periods.

There is one particular qualification for the Swedish case. Moving to related industries is associated with a negative change in relative wage in the later study period (1990–2000). In fact, specialized workers in mature industries are sometimes faced with a special 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 were 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 throughout the investigated period.

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

Overall, the results obtained for Sweden and West Germany are surprisingly similar, but some important differences could also be observed. One of the more 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 compared to 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.

Despite considerable institutional differences between these two countries in handling large scale redundancies of shipyards, in Heseler's case studies, 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. While some of our estimates do vary between these two countries in their significance, the overall patterns and signs point to similar conclusions for both.

Most surprising, 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 (as opposed to just any job matching), we have to keep in mind that the estimates concern a time where big shipbuilding city regions (e.g. Hamburg, Bremen, Gothenburg and Malmö) were subject to considerable economic stress and 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 fair that well in dense urban areas. This has obvious geographical consequences, as the mature industries often rely on benefits created by specialized regional cross-industry structures that change over time. Nevertheless, the diverging effect for West Germany where regional diversity decreased unemployment risks of ex-shipyard workers in most periods might be explained with the ongoing specialization of large shipbuilding cities in other manufacturing industries offering adequate jobs.

**Final reflections**

In the beginning of this article, we organized the theoretical discussions around three different themes highlighted in recent regional research, taken to constrain the movements of individuals in the economy and thereby also limiting the transformative capability of regions: friction of movements in space, friction of movements between industries, and the surrounding industry structure. These dimensions contribute to our understanding of which people left the declining shipbuilding industries, and with what economic consequences. Some of our results are not unexpected per se, but corroborate findings of earlier case studies and single country studies. Extending the period of study to the entire declining period of a specific industry, and making a comparison between two countries, our results point to the fact that presence of generically related industries in the region served the workers with decent exit opportunities, and protected against unemployment. In Germany employees moving to related industries in other regions were actually also quite successful. In periods of real crises, the propensity to move to just any industry in just any region of course increases. During the most intense crisis period in Sweden, regional industrial diversity decreased the risk of unemployment. Hence, diversity indeed protects from unemployment during radical change (Frenken, van Oort and Verburg, 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. We see this transfer as a prime mechanism behind the resilience of regions (Boschma 2014).

Many regions throughout the world face similar challenges to those that some German and Swedish shipbuilding cities once did. The frictions of individual's movements in space, between industries and the regional industry structures will be central ingredients in determining the outcomes of these transformation processes. As most people will prefer not to move to other cities and as more specialized workers will try to cling on to their industries even during severe decline, a central determinant will be how regions are able to accommodate existing (embodied) skills in related, but not the same, activities. Existing regional related industries will be vital in creating opportunities for exiting workers. In cases such as in Sweden with also downsizing related industries, things will turn problematic for the region, as the redundant employees may need to enter unrelated industries and face skill destruction, or even leave the region. The German case provides evidence that moves to related industries in other regions were beneficial. While the declining regions may be then subject of 'brain drain' which may impede their potential for renewal, it might provide prospects for the individuals during industrial turmoil. Thus, what is best for the individual worker is not necessarily align with the future prospects of declining regions.

Taking the research agenda on labor mobility in mature industries further, broadening the industry coverage would provide a test as to whether the findings obtained here are particular for the shipbuilding industry, or have a greater relevance. Then, further methodological advances in defining "generically related" industries is required. A suggested next step is therefore to probe even deeper into the frictions to labor mobility caused by space, industry specificities and the regional industry structures.

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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 |

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 |

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 (EHP), Institute of Employment Research (IAB).

5: Sweden - Multinomial logit models on the probability of remaining in shipbuilding, leaving for another industry (reference) or not working in $t_{+5}$. Coeffiencents 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 |
| _Iyear* | 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-sq | 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 $t_{+5}$. Coeffiencents 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) | -1166 |
| 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*** | 4051 |
| | -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) | -1053 |
| 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 |
| _Iyear* | 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-sq | 0.049 | 0.133 | 0.168 | 0.166 | 0.176 | 0.184 |

Table 7: Sweden - OLS regressions on relative wage increase for workers leaving the shipyard industry. Coeffiencents 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) |
| _Iyear* | 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-sq | 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 Swedish shipbuilding industry. Coeffiencents 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) |
| _Iyear* | 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-sq | 0.307 | 0.321 | 0.331 | 0.340 | 0.336 | 0.353 | 0.277 | 0.288 |

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 (EHP), Institute of Employment Research (IAB).

Table A1: Variable definitions and descriptives

| | | Sweden | | | West Germany | | |
|---|---|---|---|---|---|---|---|
| **Variable** | **Definition** | **Mean** | **Min** | **Max** | **Mean** | **Min** | **Max** |
| *Dependent variables* | | | | | | | |
| Status | Categorical variable on labour 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 |