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Microclass immobility during industrialisation in the USA and Norway

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Abstract

The 'microclass' approach advocated by Grusky, Weeden and colleagues emphasises fine-grained occupational differences and their relevance to social reproduction and social mobility. Using recent developments in historical occupational classifications, we apply a microclass approach to the analysis of intergenerational social mobility using linked census data for Norway and the USA in the late 19th and early 20th century (1850-1910). We describe a procedure that offers an operationalization of microclass units for these datasets, and show how its application enables us to disentangle different forms of immobility which would not be distinguished in other approaches to analysis. Results suggest that microclass immobility is an important part of social reproduction in both Norway and the United States during the era of industrialisation. Both countries reveal a similar balance between 'big class' and 'microclass' immobility patterns. In Norway, the relative importance of microclasses in social reproduction regimes, when compared to the role of 'big class' structures, seems to decline very slightly over the course of industrialisation, but in the USA the relative importance of microclasses seems if anything to increase over the period.

Keywords

Microclasses; Social reproduction; Social mobility; HISCO; HISCLASS; Historical occupations.

1. Introduction

A presumption of any measure of social class is that there are clear boundaries between all classes that reflect important differences in social resources and in social outcomes, whilst there are few social differences between people who are within the same class. However, 'big class' schemes (i.e. those which define a small number of large social class categories) have been shown to depart from this presumption across a range of relevant measures (e.g. Prandy, 1990). Grusky and colleagues argue for a 'new class map', claiming that much smaller class categories are better able to effectively define shared and distinctive social experiences (Weeden and Grusky, 2005, 2012; Grusky et al., 2008; Jonsson et al., 2009). Their 'microclass' approach is designed to recognise large numbers of small social classes, the boundaries of which are largely defined by occupational institutionalisation. According to its advocates, the sociological theories and patterns that can be linked to microclasses are at least as substantial and interesting as are those linked to 'big classes'.

Grusky et al. (2008) and Jonsson et al. (2009) demonstrate how the analysis of microclasses is of particular relevance to understanding the intergenerational transmission of social inequality. They argue that occupations themselves form part of the reproduction process and, therefore, it is useful to establish whether meaningful intergenerational changes in social positions (i.e. social mobility) occur mostly between, or within, 'big classes'. In the microclass approach, different types of social mobility can be differentiated by defining and assessing the relative influence of those aggregate units or structures that subsume the (typically 100 or so) different microclasses. Grusky and colleagues explore aggregate units that they label mesoclasses (around 12 categories), macroclasses (around 6 categories), the manual/non-manual sectoral division (a dichotomy), and 'gradational exchange' (a unidimensional scale by which microclasses are arranged based on relative socio-economic advantage). For example, individuals could experience intergenerational social mobility between microclasses, but that mobility may or may not also involve a change in mesoclass category, in macroclass category, in manual/non-manual status, or in relative position in the gradational hierarchy. Grusky et al. (2008) and Jonsson et al. (2009) specify log-linear statistical models that are designed to assess the relative magnitudes of social mobility at these different levels for data from a number of contemporary societies. Broadly speaking, this is achieved by assessing how much of the statistical association between the microclass positions of parents and children can be attributed to intergenerational inheritance or 'immobility' at each of the different aggregate categories, and/or to relative associations in gradational positions.

Our study applies the analyses undertaken by Jonsson et al. (2009) and Grusky et al. (2008) to data from the late 19th century in Norway and the United States. Hitherto, literature on microclasses has focused upon 'industrialised' societies, often with the specific acknowledgement that the approach may not translate to non-industrialised societies (Weeden and Grusky, 2005; Grusky et al., 2008; Jonsson et al., 2009; Erikson et al., 2012; Weeden and Grusky, 2012). However, there is reason to think that the microclass approach might be an especially useful means of analysing social reproduction in societies at earlier stages of economic development. For example, social reproduction may have been much stronger in pre-industrial societies (e.g. Kerr et al., 1973[1960]; Blau and Duncan, 1967; Treiman, 1970) because many children learned their occupational skills from their father. This mechanism constitutes a transmission of human capital at the microclass level, which could be identified empirically through the relative importance of microclass transmission when compared to other forms of 'big class' transmission.

The aim of this article is to present a historical microclass scheme to analyze different forms of men's social reproduction in two industrialising countries. The operationalization of microclass measures is not trivial. After constructing such a scheme, we analyze different forms of intergenerational mobility in the USA and Norway in the decades before and after 1880. Previous studies portray high levels of social mobility in the USA in the 19th century, an era which has been described as the golden age of the American Dream (Long and Ferrie, 2013; see also Thernstorm, 1973; Grusky, 1986; Guest et al., 1989). For 19th century Norway, Chan et al. (2011) highlight evidence of an economic inequality structure comparable to that of many other societies at the time. A study on Norway by Torvanger (2000) suggested moderate and probably increasing levels of intergenerational vertical mobility over the 19th century, whilst a regional analysis of endogamy over the period 1750-1900 and using 'big class' categories suggested a decline in total endogamy but not in relative endogamy (Bull, 2005). Previous studies used 'big class' schemes and/or gradational measures, but in each case, it is possible that by decomposing patterns of intergenerational mobility between microclass and other levels of aggregation, a different characterisation of social reproduction during the 19th century may be supported.

2. Trends in social reproduction during industrialisation

Grusky et al. (2008: 986) argue that parents may transmit skills, aptitudes, cultures and resources to children both within occupation-specific contexts, and in a broader manner that is not occupationally specific. The expectation is that the former patterns should influence a propensity for exact reproduction within microclasses, whilst the latter should also influence a propensity to reproduction, but in broader categories such as 'big classes' and not necessarily within microclasses. A hierarchical microclass scheme can therefore be used to disentangle those types of reproduction that are empirically linked to microclasses, and those more generic patterns that will be linked, for example, to 'big class' categories net of microclass reproduction. More generally, when considering historical trends in social reproduction, we can also examine and compare trends in both occupation-specific reproduction patterns, and those of a broader 'big class' nature, recognising that the two trends need not be related.

Most perspectives on intergenerational mobility during the era of industrialisation anticipate a decline in the specific experience of individuals following their father's work (Furstenberg, 1966; Treiman, 1970; Featherman and Hauser, 1978; Grusky, 1983; Grusky, 1986). This is partly driven by decline in the relative size of the agricultural sector (reducing the frequency of father-son inheritance of farming occupations), but occupational specialization and the appearance of new occupations might also make occupational inheritance outside of the agricultural sector increasingly uncommon over time (e.g. Treiman, 1970). Accordingly, most arguments suggest that social reproduction within microclasses should be expected to decline with industrialisation

During industrialisation the growing complexity of occupations and the need for specialist skills increased the importance of education and training and decreased opportunities for non-meritocratic job selection. In addition, during the 19th century, the development of railways, telephones, telegrams and a postal service in many countries increased opportunities for people to find out about, and travel towards, new positions in more distant locations (Zijdeman, 2009, 2010; Schulz et al., 2014; Knigge et al., 2014). These diminishing ascriptive, geographical and network constraints on seeking employment might allow individuals not only to acquire an occupation different from their father, but, with some luck and skills, to enter a higher relative position such as in a different meso- or macroclass: according to these processes, 'big class' social reproduction (net of microclass reproduction) might also be expected to decline as industrialisation expands. However, there are also reasons why industrialisation might not lead to a reduction in the influence of parents upon broader patterns of attainment. The growing importance of education, for instance, may simply mean that parents with more resources seek to provide their children with favourable support during, and outcomes from, education (e.g. Bowles and Gintis, 1976). Indeed, social reproduction theories suggest that those who hold the most advantageous positions are generally the best placed to adapt to new social patterns (e.g. Pareto, 1991 [1901]; Bourdieu, 1998). In this scenario, whilst microclass immobility might be declining with industrialisation, 'big class' immobility might concomitantly persevere.

3. Data

We obtained census data from the 19th and early 20th century for Norway and the United States from the North Atlantic Population Project (NAPP, see Minnesota Population Center, 2008). These data include identifiers that enable linkage over time between records for the same people from different census years. Because the censuses contain information on all household members, this supports intergenerational mobility analysis as we can link data from adults in one year to records on their parents (with whom they lived at an earlier point in time), or their children (with whom they live at present and who will be recorded as adults in a later census record). Previous research on intergenerational social mobility from the 19th century has often exploited register data such as for marriages and births (e.g. Maas and van Leeuwen, 2002; Miles, 1999), or genealogical data (e.g. Prandy and Bottero, 2000). The emergence of services supporting secondary access to census datasets from the 19th century offers an important new data source.

The NAPP data provides, for the United States, individuals from the 1880 census linked to 1% samples of the censuses for 1850, 1860, 1870, 1900, and 1910 (Ruggles et al., 2010). The Norwegian data links individuals from 1865 (Digital Archive et al., 2008a), 1875 (Norwegian Historical Data Center and Minnesota Population Center, 2008) and 1900 (Digital Archive et al., 2008b). In our analysis, for the USA we have taken either the son's occupation in 1880 and connected it to his father's occupation from 1850-1870; or we have linked a father's occupation in 1880 to a son's occupation in 1900-1910. For the Norwegian data, we began with samples of fathers in 1865, and sons in 1900, and connected these to the respective relatives from 1875 or the corresponding other time-point. When we have split our data by era, we have regarded those cases where the son's occupation was taken from 1880 or earlier as the earlier era, and those cases where the son's occupation was obtained in 1900 or 1910 as the later period. For operational and theoretical reasons, our analysis focuses only on the male population. Coverage and quality of data on female employment in the 19th century is limited, whilst we would anticipate very different social mechanisms to be involved in class reproduction involving women's occupations.

Our analytical sample is summarised in Table 1, covering 28,978 father-son combinations for the USA and 41,838 for Norway. The linked data includes 86,656 father-son combinations in the USA and 204,901 combinations in Norway for which a detailed occupational category was available for both the father and son. However, as discussed below, most of our analyses exclude all combinations that involved a job in agriculture or the military (78% of combinations from the USA and 80% of those from Norway).

Table 1 about here

Linked census data have two major attractions for intergenerational mobility research: first, a large volume of respondents can be easily studied; second, the occupations of both the parent and the child can be measured at an age of 'occupational maturity'. 'Occupational maturity' refers to the ages during which an adult would usually be in the main and most important occupation of their life course (e.g. Goldthorpe, 1980). In contemporary analysis the age of occupational maturity is often suggested to lie between around 35 and 60 years old. In the 19th century, adults probably reached occupational maturity at a younger age, such as 25 or 30 (cf. Miles, 1999; Schulz, 2013). However, if records from only a single census are used, most intergenerational father-son combinations that can be identified (i.e. fathers and sons living in the same household) will feature one or both adults outside of the age of occupational maturity (the same problem can also apply to intergenerational records derived from marriage registers – cf. Miles 1999, 16-7). In contrast, the use of linked census data ensures that records can be extracted for both fathers and sons from a time point when both are in their occupational maturity.

Linked censuses have been criticised for being potentially biased (Xie and Killewald, 2013). In the NAPP data linkage project a statistically random criteria is used to determine whether a case might potentially be linked, but only a subset of those are successfully linked, and there may be biases in successful linkage. There could for example be an impact of literacy and wealth upon the accuracy and consistency of census records for individuals in different years, and all linkages necessarily apply to combinations of fathers and sons who live in the country in the relevant years (i.e. restricting coverage of families of immigrants and emigrants). Additionally, only a circumscribed range of ages might be represented in inter-generational records due to the limited age range during which most people are co-resident with their parents. For the USA for example, the 1,990 father-son links in our data that are contributed by sons sampled in 1880 who are linked to records on their fathers from 1850, could not involve sons younger than 30 in 1880 (i.e. not yet born in 1850), and is unlikely to involve many sons older than about 60 (i.e. aged 30 or more in 1850, so relatively unlikely to be co-resident in 1850 with their fathers). In order to assess possible biases that may apply to our analysis, Table 2 summarises the profiles of people in the linked samples, as fathers and as sons, in comparison to the profiles across the whole census (focusing upon 1875/1880 in this example). Generally speaking, the table suggests fairly similar profiles between those included in our linked sample, and the census respondents as a whole. Within the USA, we identified a small under-representation of non-white respondents and immigrants. Within Norway, married people were more likely to be linked, especially as fathers, whilst people who had servants were under-represented. Clearly the linked sample records are not identical in profile to the full census, a limitation that could influence the representative value of our analysis, however on balance we anticipate that the impact of bias in selection to the linked sample might not be too substantial.

Table 2 about here

4. Creating a historical microclass scheme

Microclass schemes usually feature about 100 different occupation-based categories. Microclass categories do still amalgamate occupations, but they are designed so that their incumbent occupations are very similar, share a number of important resources and circumstances, and will be likely to exhibit social closure. As mentioned above, a microclass scheme is hierarchically organised into aggregate units. Grusky et al. (2008) defined 'macroclasses' as aggregations of microclasses into 6 categories associated with major differences in occupational rewards, similar in character to classes in most existing 'big class' schemes. They also defined 'mesoclasses' as aggregations of around 12 categories, that can be understood as divisions within macroclasses according to industry groups and other features of employment relations.

In our analysis, we sought to develop a historical microclass scheme that would have a similar structure to those used for contemporary societies, and could be applied to the occupational data held on the datasets available from NAPP (see Minnesota Population Centre, 2008). Occupations in the NAPP data for the USA are coded to the 1950 US census code in all years. For Norway, occupations are coded into the NAPP-HISCO scheme. Using algorithms developed in previous research (Zijdeman, 2011), we recoded these into the five-digit occupational categories of the Historical International Standard Classification of Occupations (HISCO: van Leeuwen et al., 2004). Subsequently, HISCO units were used to derive a gradational measure of occupational advantage called HISCAM (Lambert et al., 2013), and the historical class measure HISCLASS (van Leeuwen and Maas, 2011). Both of these standardised measures informed decisions in defining the microclass scheme, and the HISCLASS measure was used as the foundation of 'macroclass' and 'mesoclass' schemes that are used in analysis below.

TABLE 3 about here

Our procedure for constructing microclasses, based upon the HISCO codes for occupations, is documented in full online (Griffiths, 2014). Table 3 summarises the microclasses that we defined, as well as indicating macroclass, mesoclass and HISCLASS categories that the microclasses fall into, and giving further summary data about the microclasses, such as the mean HISCAM score for occupations within the category[i]. The scheme shown is based upon a mapping between HISCO and microclass units (published as Griffiths, 2014) that is designed to optimise the relevance of microclass units for the time period covered by the NAPP datasets

The last important step in defining the scheme is specifying 'macroclass' and 'mesoclass' categories that constitute aggregations of the microclass units. The 12 HISCLASSes were used as the foundation of a 'macroclass' aggregation that resembles the macroclass categories used by Jonsson et al. (2009). Categories were defined for agricultural and military workers, then the remaining HISCLASS categories were collapsed into a 5-class structure by merging together professionals and managers of a similar level, and merging the semi- and un-skilled manual workers (see Table 3). Merging semi- and un-skilled manual workers may lead to a very broad aggregation, however this is comparable to other macroclass schemes (e.g. Jonsson et al., 2009), and, in the case of historical data coded to HISCO, it may in any case be a sensible strategy, because many occupational descriptions for workers in these categories do not feature details that enable a better disaggregation on the basis of skill level (for instance they are often labelled as 'labourers' with no further information). Finally, 'mesoclasses' are usually characterised as divisions within macroclasses by industrial sector (e.g. Gusky et al., 2008; Jonsson et al., 2009). Accordingly we defined mesoclasses for this exercise by identifying what we judged to be consequential divisions within macroclasses by the industry associated with the microclass. Our final scheme (see Table 3) comprises 64 microclasses, nested within 17 mesoclasses and 7 macroclasses. As mentioned elsewhere, most of our analysis proceeds on the population excluding agricultural and military workers – namely 56 microclasses, nested within 14 mesoclasses and 5 macroclasses.

There are various reasons for excluding respondents from agricultural or military microclasses. People in military positions often have atypical intergenerational profiles, especially when measured longitudinally due to temporal variation in military recruitment. For agriculture, an empirical problem in both societies is that the agricultural sector is so large that its inclusion heavily shapes resulting statistics, detracting attention from patterns of social reproduction across the rest of the population. This is important because people in agriculture also have distinctively high occupational inheritance (for example microclass immobility for the later period of 55% for Norway and 48% for the USA, compared to 33% and 32% respectively for the remaining population – see Table 4), and occupational inheritance in agriculture is also shaped by other non-standard factors, such as geographical context, and variations in social norms such as concerning patrilineal inheritance. Thus, this paper explores social reproduction in non-agricultural and non-military employment during the development of industrialised societies. The difference between the trends in our subsample and in the whole employment sector are discussed briefly in section 5.

5. Patterns of social reproduction during industrialisation in Norway and the USA

Table 4 shows selected 'total mobility' percentages, i.e. the percentage of sons in a different category to their father. For example, in Norway in the early period (1865-1875), 15% of all adult males were in a different manual/non-manual category to their father, whilst a further 19% were in a different macroclass but were in the same manual/non-manual category. In both Norway and the USA there is evidence of more intergenerational mobility in the later than the earlier period. For completeness the table also indicates levels of mobility between HISCO units as well as between microclasses. This indicates that the bulk of father-son transitions that are stable within their microclass are also stable within their HISCO units. For example, in Norway in the early period, 45% of father-son combinations are stable within HISCO units and a further 5% are stable within microclasses but not within HISCO units – put differently, 50% are stable within microclasses, most of those being stable within HISCO units. Aside from the apparent change in levels of mobility between the early and late periods, three further points are notable from Table 4. Firstly, a large proportion of 'immobility' in all samples is at the occupational level (i.e. involving stability in HISCO or stability in microclass – the cumulative sum of the percentages in rows 5 and 6). Second, there is a spread of experiences across the samples in the extent or 'range' of mobility - some combinations involve a long range transition such as between manual and non-manual sectors, whilst other combinations involve mobility in a smaller scale, such as mobility between different microclasses whilst staying within the same mesoclasses. Lastly, there are variations over time and between societies in the relative volumes of mobility at different levels, suggesting that a microclass analysis that disaggregates mobility patterns might reveal interesting variations over the course of industrialisation and between the two countries.

Table 4 about here

Table 4 takes no account of changes in the 'marginal' distribution of jobs between the fathers' and sons' generations, and between countries and time periods. Log-linear models are widely used to address this challenge in intergenerational social mobility research (Grusky, 1986; Guest et al., 1989; van Leeuwen and Maas, 1991; Long and Ferrie, 2013). Conveniently, these also allow the estimation of parameters that describe the distinctive influence upon reproduction associated with micro-, meso- and macroclasses (e.g. Jonsson et al., 2009). We estimated and compared different log-linear models with lEM (Vermunt, 1997), using a similar range of models as reported by Jonsson et al. (2009).

Table 5 shows the results of log-linear analyses for father-son occupational combinations in Norway and the USA. By comparing the fit of the different models, it is possible to draw conclusions about the relative influence of the different 'types' of intergenerational (im)mobility (e.g. macroclass, microclass, etc) that are allowed for in alternative models. The fit of the different models can be described by several different statistics. The likelihood ratio statistic (L2) is a direct measure of the extent to which the model accurately predicts the occurrence of cases (the smaller the value the better the prediction). The 'dissimilarity index' (Δ) reports the percentage of cases in a table which would need to be reassigned to equal the model's expected number of cases for each cell – it can also be read as a summary of the extent to which the father-son distribution is empirically associated net of the forms of mobility that are allowed for in the parameters of any given model. The Bayesian Information Criterion (BIC) assesses the 'parsimony' of each model, namely the extent to which the model explains patterns in the data without using an excessive number of extra model parameters - a lower value of BIC usually indicates a more parsimonious model (e.g. Raftery, 1995). Table 5 also reports the 'degrees of freedom' for each model – this is a number of relevance to further statistical calculations that reduces by one for every additional parameter that it estimated in the corresponding model.

Table 5 about here

Table 5 begins with the independence model (1). This model controls for marginal distributions (i.e. the total number of fathers' and sons' jobs in each country and time period) but it features no parameters at all that recognise social structural influences upon father-son combinations. Subsequent models introduce parameters that represent structural patterns to the distribution of father-son combinations, and we see that every alternative model is a better fit to the data than model (1), evidenced by lower BIC values and smaller likelihood ratio statistics. First, model (2) introduces the HISCAM score. This gradational association captures some of the empirical pattern in father-son distributions and is incorporated in all subsequent models. Models (3) to (5) then add 'immobility' parameters for structures to father-son associations that apply in addition to the HISCAM term. Allowing for microclass immobility brings a very substantial improvement in model fit (model 3), but allowing for broader patterns of mesoclass and macroclass immobility over-and-above microclass mobility also bring improvements in model fit. This suggests that immobility around microclasses, mesoclasses and macroclasses are all independently influential parts of the social reproduction regimes within the data. Models (6) to (8) summarise the improvements to fit associated with adding more parameters for 'big class' units but not for microclasses. There are improvements to fit associated with allowing for manual/non-manual, macroclass, and mesoclass, immobility patterns (over and above the gradational parameter). This suggests that each of these structures makes a distinctive contribution to social reproduction, though it is evident that the total model fit is not as favourable as when microclass immobility is explicitly modelled – put differently, to ignore fine-grained occupational-level immobility patterns (as social mobility studies have often done in the past) would be to neglect a substantial part of the father-son reproduction regime in the late nineteenth century. Finally, models (9) to (12) compare permutations of model parameters that allow both for microclass immobility parameters, and other 'big class' level parameters. Allowing for every single type of measured 'big class' immobility, as in model (12), provides the best fitting statistical model and this model is also evaluated as the most parsimonious model according to the BIC statistic: conventionally we would take model (12) as evidence that every single parameter included in the model is worth taking account of – the gradational parameter, microclass immobility parameters, and further parameters for immobility in mesoclasses, macroclasses, and the manual/non-manual division. There is nevertheless a slight nuance to the results from models (9) to (12) – figures such as the likelihood ratio statistic and the dissimilarity index help us to see that the lion's share in improvement in model fit is achieved by model (9). Adding the further parameters for macroclass, mesoclass or both in models (10)-(12) does bring an improvement in fit over (9), but we could argue that the scale of improvement is quite slight. Again expressed differently, additional macroclass and mesoclass parameters do improve the model fit, but their relative importance to the mobility regime (net of the effects of microclasses, the gradational parameter and the manual/non-manual division) is minimal.

Table 5 demonstrates that microclass immobility is an important part of the mobility regime in the USA and Norway in the late 19th century, but it does not allow us to explore variations between countries or time periods. Table 6 provides comparisons between some of the same models as were described in Table 5, but now split between countries and time periods, and focusing only on the parsimony statistic BIC. As a heuristic we present percentages that emphasise the relative reduction in the BIC value between the independence model (with no controls) and the full model (with all possible parameters available to us). The three key points here are, first, that in all situations, the parameters in model (3) capture the lion's share of the model improvement - modelling both the gradational parameter and the microclass immobility parameters make important contributions to describing social reproduction. Second, in both Norway and the USA, there is a very slight reduction in the relative explanatory influence of microclass mobility in the later period compared to the earlier period – although in both time periods, microclasses are an important part of the story. Third, there are small variations over time and between countries in the extent to which adding mesoclass and/or macroclass terms further reduces the BIC statistic (over-and-above controls for microclass immobility and the gradational parameter). In Norway , there is a pattern whereby modelling the 'big class' structures do not add anything important in the early period, but they do improve model parsimony in the later period (just as they are reported to do in contemporary microclass studies in other societies such as reported by Jonsson et al. 2009). This pattern of change over time in Norway suggests that, net of the declining role of microclass inheritance during industrialisation, the influence of inheritance at the 'big class' level might have actually increased slightly in the period. In the USA by contrast, there is no discernible difference between the time points: the additional explanatory role of 'big classes' net of microclasses and the gradational parameter is negligible in both time points. In summary, this evidence suggests that social reproduction processes were mainly about occupations, rather than 'big classes', in the later

19th century, and that the separable influence of 'big class' boundaries (as also reported for contemporary data) may have developed at different points in different Western nations.

Table 6 about here

As sensitivity checks we repeated the comparisons shown in Table 6 in two other scenarios – for the same range of models but without the gradational parameter HISCAM; and for the same range of models whilst including occupations in farming and the military (see appendix tables A1 and A2). Excluding the HISCAM parameter, the parameters for 'big class' immobility at the macroclass level did improve model fit, but only with a small effect in the USA. These patterns might suggest a relatively 'open' society in the USA in both periods: we could infer that those who avoid exact microclass inheritance may, thereafter, be relatively unencumbered by other aspects of their parental background. For Norway by contrast, models without the gradational parameter show, in both periods, a relatively greater influence of other 'big class' parameters (macroclass and mesoclass). In this case, the macroclass and mesoclass structures probably substitute for the pattern of social influence that was otherwise captured by the gradational parameter: in Norway, broader social structures still have an influence upon outcomes in both periods, net of microclass reproduction. Lastly, the patterns in both societies change again when we include data from the agricultural and military sectors. In these models, the additional aggregate level structures of macroclass and mesoclass are indeed associated with substantial improvements in model fit. It is likely that these results reflect the relatively trivial but substantial occurrence of non-microclass inheritance within farming and military sectors (for example, a father-son transition from 'farmer' to 'farm worker', which involves microclass mobility but mesoclass immobility).

Jonsson et al. (2009) highlight that, since microclass immobility is an important aspect of intergenerational associations, it is possible that estimates of 'big class' influences that ignore microclasses are misleading, because they may be very different from the equivalent effects if microclass immobility were controlled for - that is, without controls, they may just be '...microclass inheritance in disguise' (Jonsson et al., 2009: 1007). In Figure 1 we summarise the extent of the difference between various 'big class' parameters with and without controlling for microclass structures, also incorporating an evaluation of change over time and between countries.

Figure 1 about here

The bars in Figure 1 show the model based log odds parameters for remaining in the appropriate 'big class' category first when we do not control for microclass inheritance, then second when we do (as indicated in the Figure, some models also feature other controls for other intermediate structural inheritances). Just as Jonsson et al. (2009) reported for contemporary societies, we see for the USA and Norway in the nineteenth century that there are many instances when the parameters without microclass controls are much bigger than they are after taking account of microclass structure. Moreover, in many instances the log odds of remaining in the 'big class' category are even reversed after microclass controls - in those cases with negative values, we are seeing that it is actually less likely that a father and son will share the same big class position, after controlling for the microclass immobility propensity (in contrast, the model without microclass controls always shows an increased probability). In terms of trends over time and between countries we see a further interesting pattern: in Norway, the distorting effect of not controlling for microclass inheritance seems to be rather stable over time, but in the USA, the distorting effect seems, if anything, to have grown bigger in the later period. Our conclusion here is that microclass inheritance matters across all the societies, but its impact upon making appropriate statements about 'big class' patterns did if anything increase through time in the USA.

7. Discussion

This paper explored a microclass analysis of 19th century social mobility data. Such analysis has only become plausible in recent years, due to the development of historical occupational unit groups (van Leeuwen et al., 2004), stratification scales (Lambert et al., 2013) and big class schemes (van Leeuwen and Maas, 2011), and has been aided by the development of linked census datasets (Norwegian

Historical Data Centre and the Minnesota Population Center, 2008; Ruggles et al., 2010). We have demonstrated that it is feasible to construct a microclass scheme for historical societies, and identified ways in which such a scheme can aid our understanding of late 19th century mobility patterns. Just as has been shown in studies using data from the 20th century, our empirical results show that patterns of immobility linked to microclasses are a substantial part of the social reproduction regime in the era 1850-1910, and that accounting for microclasses leads to different conclusions about social reproduction patterns.

According to our data social reproduction regimes seem to change very slightly over the course of the industrialisation period within Norway and the USA. Whilst theories might anticipate a decline in occupation-specific inheritance, microclass immobility was a strong pattern throughout the period. The total volume of microclass immobility does decline in the era (e.g. Table 4) - as predicted by theories of modernisation - but the relative importance of microclass immobility to social reproduction regimes is only fractionally diminished over the period concerned (e.g. Table 6). Indeed, in the USA, the impact of ignoring microclass structures might if anything be greater in the later period (e.g. Figure 1). In Norway by contrast, there is a slight trend whereby ‘big class’ parameters are more substantial in the later period – suggesting that relatively more social transmission operated through broader forces than occupation-specific inheritance (e.g. Table 6).

Our analysis focussed strategically upon non-agricultural (and non-military) occupations and stronger patterns of change over time are evident if these groups are included. However the integration of agricultural jobs in stratification analyses is challenging because only broad characterisations are available for different jobs that involve vast numbers of people (e.g. ‘farmers’ versus ‘farm workers’). Previous discussions of the trade-off between ‘big class’ and microclass patterns in social reproduction concentrate on modern societies with smaller agricultural sectors, and analysis of the non-agricultural 19th century population seems a fairer and more interesting point of comparison. Our analysis was also restricted to male employment and it would be interesting to look at the microclass mobility of women (cf. Van Leeuwen and Zijdeman, 2014). We could also emphasise that the microclass scheme that we generated for this analysis, and make available for others to use, is itself only one plausible realisation in the microclass research agenda.

Our scheme still includes some very small, and some very large, microclasses, and alternative researchers may produce refined or alternative microclass schemes for comparable periods. Nevertheless it is apparent to us that adding microclass schemes and model parameters to the analysis of data from industrial societies can lead to interesting and consequential alternative insights into social reproduction in the era.

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Table 1: No. of father-sons combinations used from the historical censuses for USA and Norway

USA	1880 sons	1880 fathers	Norway	1875 sons	1900 sons
1850 fathers	1,990				
1860 fathers	4,093		1865 fathers	10,113	14,663
1870 fathers	6,835		1875 fathers		17,062
1900 sons		9,628			
1910 sons		6,432			

Table 2 Distribution of adult males in the linked sample of the historical censuses for the USA and Norway as compared to that in the whole census

	USA 1880			Norway 1875		
	All	Links as sons	Links as fathers	All	Link as sons	Links as fathers
Age	41.7	42.6	41.5	41.9	43.1	39.2
Born in country	61%	72%	65%	92%	95%	95%
Rural	49%	49%	49%	39%	40%	38%
Married	80%		76%	70%	75%	82%
Literate	98%	95%	94%			
White	90%	93%	95%			
Minority religion				1.1%	1.0%	0.9%
Servants				35%	25%	28%
Cases	4,042,589	31,552	22,383	42,212	10,321	7,169

Table 3 The historical microclass scheme

Macroclass *(HISCLASS categories in brackets)*	Mesoclass	Microclass	Mean HISCAM	Cases (Norway)	Cases (USA)
Professionals (1,2)	Higher professionals	Lawyers	99	1,206	1,269
		Health Profs	97	1,431	2,777
		Teachers	80	3,203	2,086
		Architects and engineers	86	647	252,
		Other higher	88	369	241
	Higher managers	Government managers	93	128	918
		Business managers	84	1,416	350
Lower professionals (3,4)	Lower professionals	Artists	61	797	637
		Bookkeepers	71	576	896
		Sales profs	73	1,541	208
		Proprietors	64	11,588	13,575
		Workers in religion	97	1,361	1,301
		Police officers	52	1,036	2656
		Other lower profs.	69	758	178
	Lower managers	Government Lower managers	74	1,364	1,155
		Business lower managers & supervisors	71	2,040	754
		Ship's officers	66	8,016	410
Lower non-manual workers (5)	Clerks	Clerks	71	3,407	882
		Stock clerks	67	413	3,436
	Other non-manual	Watchmen and janitors	62	905	212
		Other non-manual workers	60	2,542	433
Skilled manual (6,7)	Makers and operators	Plumbers	56	182	235
		Joiners	55	13,996	6,330
		Sheet metal workers	54	1,056	572
		Other makers and operators	64	4,866	1,788
	Artisans	Printers	59	944	591
		Tailors	55	5,017	1,633
		Shoemakers	53	6,564	943
		Cabinetmakers	55	243	482
		Cartwrights	55	240	556
		Coopers	51	1,634	1,257
		Blacksmiths	52	3,646	2,469
		Stonemasons	55	404	1,338
		Other artisans	67	640	326
	Food producers	Bakers	57	1,938	295
		Butchers	59	593	759
		Other food producers	58	71	719
Semi and unskilled manual (9,11)	Construction semi-skilled	Stone cutters	60	899	248
		Metal processors	60	501	626
		Construction	54	4,280	442
		Miners	47	1,299	2,255

		Sawyers	50	4,851	261
		Painters	53	1,643	1,425
	Personal or Service	Barbers	55	140	449
		Domestic servants	58	3,496	925
		Messengers	54	845	112
		Other service	70	420	731
	Transport	Brakemen	49	91	301
		Seaman	53	6,020	578
		Train guards	61	161	217
		Motor vehicle drivers	61	3,017	1,974
	Other semi-skilled	Stationary engine operators	60	362	129
		Textile workers	56	2,802	219
		Other lower	60	2,795	10,402
	Unskilled	Labourers	47	7,087	6,112
		Other unskilled	55	6,716	565
Working in agriculture *(8,10,12)*	Farmers and fishermen	Farmers, including managers	52	238,774	83,899
		Farm workers	50	11,911	9,914
		Fishermen	52	32,497	471
	Non-farming agricultural workers	Loggers	55	3,829	390
		Gardeners	55	285	340
		Other agricultural workers	59	596	
Military	Military	Officers	95	948	
		Other ranks	52	1,311	205

Table 4: Intergenerational patterns (%) for adult men in the USA (1850-1880; 1880-1930) and Norway (1865-1875; 1865/75-1900)

		Norway		USA
	Early	Later	Early	Later
Intergenerational mobility across….				
(1) Manual/non-manual division	15	22	21	29
(2) Macroclass but not (1)	19	25	21	23
(3) Mesoclass but not (2)	12	14	9	11
(4) Microclass but not (3)	5	6	4	5
(5) HISCO unit but not (4)	5	5	1	1
No mobility				
(6) Intergenerationally stable	45	28	45	31
N	10,113	31,725	12,918	16,060

Source: NAPP linked datasets, excluding combinations where the father or son worked in agriculture or the military.

Table 5: Model fit statistics for log-linear models of father-son microclasses (USA and Norway linked census). N=70816.

Model used, and its immobility parameters	L2	df	Δ	BIC L2
1. Independence model	123,408	12,100	.434	-11,723
2. (1) + HISCAM	104,733	12,099	.413	-30,387
3. (2) + microclass	26,919	12,043	.202	-107,575
4. (2) + microclass, mesoclass	26,483	12,029	.199	-107,854
5. (2) + microclass, mesoclass, macroclass	26,097	12,024	.197	-108,185
6. (2) + manual	95,072	12,097	.392	-40,025
7. (2) + manual, macroclass,	84,650	12,092	.387	-50,392
8. (2) + manual, macroclass, mesoclass	59,965	12,078	.330	-74,920
9. (2) + manual, microclass	24,428	12,043	.190	-110,066
10. (2) + manual, macroclass, microclass	24,256	12,038	.188	-110,182
11. (2) + manual, mesoclass, microclass	24,215	12,029	.188	-110,123
12. Full model = (1) + HISCAM, manual, macroclass, mescoclass and microclass	23,959	12,022	.187	-110,301

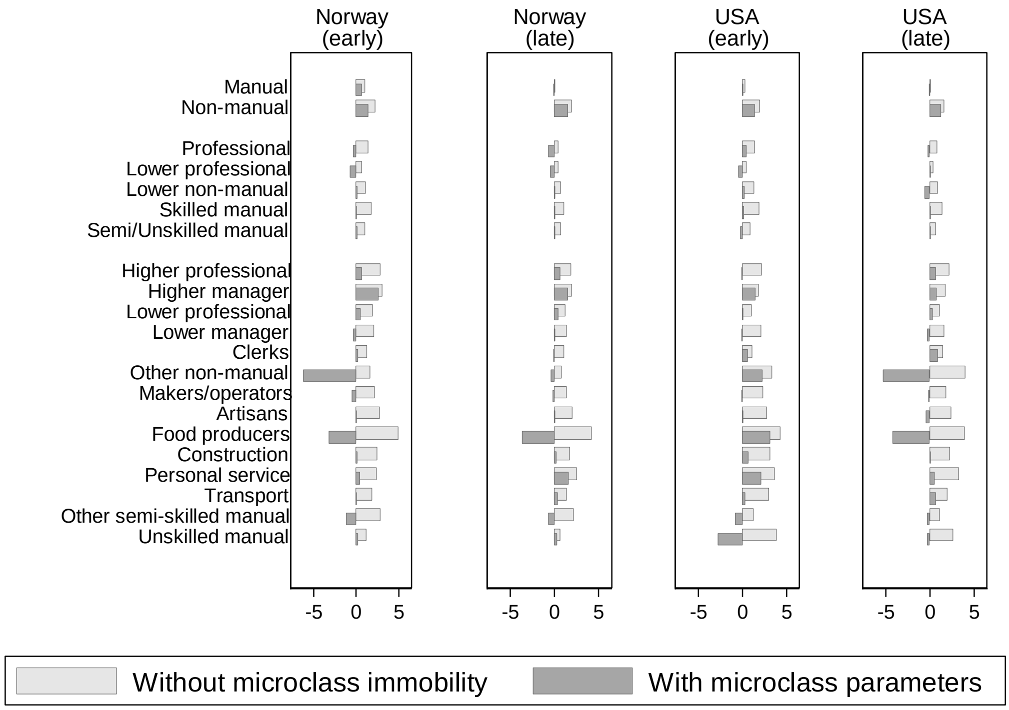
L2 = Likelihood ratio chi-squared statistic. Df = model degrees of freedom. Δ = dissimilarity index. BIC L2 = Bayesian Information Criteria based upon L2 statistic. All models feature main effects for the country, era, and father or son microclass category, and all interactions between father category, country and era, and between son category, country and era.

Table 6: Model fit statistics (BIC L2) for selected models*, by nation and time period

	Norway early	Norway late	USA early	USA late
1. Independence model (excluding all controls)	-27,180	-48,286	-26,845	-21,096
2. (1) + HISCAM	-22,955	-39,308	-22,597	-17,780
12. Full model	-3,212	-7,502	-3,459	-3,473
Percent of the BIC reduction between (1) and (12) that is achieved by this model				
2. (1) + HISCAM	18.1%	22.5%	18.8%	19.7%
3. (2) + microclass	96.2%	95.5%	97.4%	97.1%
4. (2) + microclass, mesoclass	96.1%	95.8%	97.1%	96.5%
5. (2) + microclass, mesoclass, macroclass	96.3%	96.5%	97.0%	96.7%

*Data and model numbers as per Table 5.

Figure 1: Immobility parameters for 'big class' categories with and without controlling for microclass mobility



Figures show the log-odds parameter for immobility within the category. Top panel: log odds for immobility in manual or in non-manual status. Medium panel: immobility in macroclass net of manual/non-manual immobility. Lower panel: immobility in mesoclass net of manual/non-manual and macroclass immobility.

Table A1: Model fit statistics for selected models (as Table 5) but without the gradational parameter (HISCAM)

Without HISCAM	Norway Early	Norway late	USA early	USA late
1. Independence model (excluding all controls)	-27,180	-48,286	-26,845	-21,096
12b. Full model (manual, macroclass, mescoclass and microclass)	-3,293	-11,342	-3,470	-3,518
Percent of the BIC reduction between (1) and (12b) that is achieved by this model				
3b. (1) + microclass	94.1%	89.9%	95.7%	94.2%
4b. (1) + microclass, mesoclass	94.2%	91.1%	95.6%	94.0%
5b. (1) + microclass, mesoclass, macroclass	94.7%	92.2%	95.8%	94.6%

Table A2: Model fit statistics for selected models (as table 5), including farming and military occupations

Without Farmers	Norway Early	Norway late	USA early	USA late
1. Independence model (excluding all controls)	-53,693	-118,316	-46,562	-38,999
2. (1) + HISCAM	-45,816	-97,027	-40,859	-34,175
12. Full model (HISCAM, manual, macroclass, mescoclass and microclass)	-6,395	-15,230	-6,334	-6,111
Percent of the BIC reduction between (1) and (12) that is achieved by this model				
2. (1) + HISCAM	17.0%	20.9%	14.5%	15.1%
3. (2) + microclass	90.5%	86.9%	94.3%	90.3%
4. (2) + microclass, mesoclass	96.4%	97.0%	98.5%	98.1%
5. (12) + microclass, mesoclass, macroclass	96.7%	97.8%	98.4%	98.1%

[i] In summary, the microclasses were calculated iteratively. We began with an algorithm that was written for a previous research endeavour (Griffiths, 2012) which sought to assign HISCO categories into an existing microclass scheme from analysis of the 20th century. However, a contemporary microclass scheme is not necessarily optimal for data from the period concerned. On inspection, we judged that there were anomalies in the relation between some HISCO units, their microclasses, and their HISCLASS categories, and we also noted that many microclasses as defined by the algorithm were either very small, with few incumbents, or very large, with incumbents from several very populous occupations. Subsequently, the initial allocation was reviewed. We created some separate or 'miscellaneous' categories designed to accommodate those cases that we felt were anomalous after the initial algorithm. Additionally, we expanded or contracted a number of the categories if we observed very few records, or very many records, in the NAPP data (here we used the principle that we would aggregate categories, unless there were compelling substantive reasons not to, if there were fewer than 300 cases overall or fewer than 30 cases in any nation or period; and in similar ways we would disaggregate categories if there was a plausible option to do so and if there were over 10,000 cases in the microclass).