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Work Employment Society 2001 15: 511

DOI: 10.1177/09500170122119138

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OCCUPATIONAL STRATIFICATION

The Vertical Dimension of Occupational Segregation

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ABSTRACT This article presents a new approach to measuring the most important dimension of gender segregation – the vertical dimension – in quantitative survey data. This, in turn, allows for a reassessment of the view that high levels of gender segregation are synonymous with high levels of social inequality. In order to do this, the article also draws upon significant conceptual developments. ‘Segregation’ as it is commonly understood is named as ‘overall’ segregation, and is the resultant of two components, ‘horizontal’ and ‘vertical’ segregation, representing difference and inequality separately. This provides a clear approach to measurement. The argument is developed with a case study of the British labour force. The pattern of segregation, in terms of its overall level and its components, varies considerably across sections of the labour force. In terms of inequality, the vertical components measured indicate that British women working full-time are more advantaged than we would expect, and that women working in part-time manual occupations, though facing the greatest relative disadvantage in terms of pay, are actually slightly advantaged over men working in manual occupations in terms of social stratification. Although overall segregation has remained relatively unchanged over the five year period from 1991 to 1996, there have been some significant changes to its components within the various sections of the employed British labour force in that time. By looking at the various sections of the labour force, relative to the labour force as a whole, we can achieve a better understanding of how segregation operates with respect to gender inequalities.

Occupational gender segregation has generally been understood as a structure of gender inequality, and segregation indices have been used as direct measures of this inequality. Yet there are some awkward findings, such as the high segregation level in egalitarian Sweden and the positive relation across countries between the UN’s Gender Empowerment Measure and the level of segregation

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(Blackburn *et al.* 2000). The main purpose of this paper is to explore and explain the relationship between segregation and inequality. In order to do this we have clarified the conceptualisation and measurement of segregation by defining it as the resultant of vertical and horizontal segregation, where only the vertical dimension represents inequality, and by introducing mutually consistent ways of measuring these components. We go on to show the relative contributions of vertical and horizontal segregation to their resultant, 'overall' segregation, for the entire British labour market, and for sections of it, using the 1991 and 1996 Labour Force Surveys. Our findings contradict the usual assumptions about gender segregation and inequality and present a more comprehensive account. Particularly important are our findings that patterns of gender inequality are not as generally believed, and that high overall segregation does not always indicate high male advantage.

The concept of occupational gender segregation has been used extensively, and usefully, in literature exploring gender inequalities in employment (e.g. Hakim 1979, 1992, 1996; Charles 1992). However, the concept of segregation, as we see it, has often been confused with concentration, a different aspect of occupational patterning by gender. While concentration measures the proportion of one gender, usually women, in a single occupation, or set of occupations, segregation measures the tendency of men and women to be employed in different occupations from one another. When we say that '68 per cent of clerks in a given country are women', we are commenting on the concentration of women in a set of occupations. Segregation, however, measures the separation of women and men as a property of a labour force, or a definable section of one, such as all full-time workers. A key point to bear in mind is that, *unlike concentration measures*, segregation measures are symmetrical. That is, if men are segregated from women in an occupational structure, then women are segregated to the same extent from men. If all people were employed in the same occupation, there would be no segregation. On the other hand, if there were no occupations in which both women and men were employed there would be total segregation. For example, if all men were employed as widget makers and all women as widget cleaners, or at the opposite extreme, if each person in a labour force held a distinct occupation, there would be total segregation. In practice, of course, the degree of segregation lies between these extremes. Thus segregation indices used in empirical research range between 0 and 1 in representing the degree of segregation in a labour force, or specific section of one (often, but not necessarily, a national labour force), with 1 representing total segregation and 0 representing an unsegregated workforce.¹ While 'segregation' has often been used to include concentration (e.g. Anker, 1998), it is essential to recognise the narrower, more precise meaning for the following analyses.

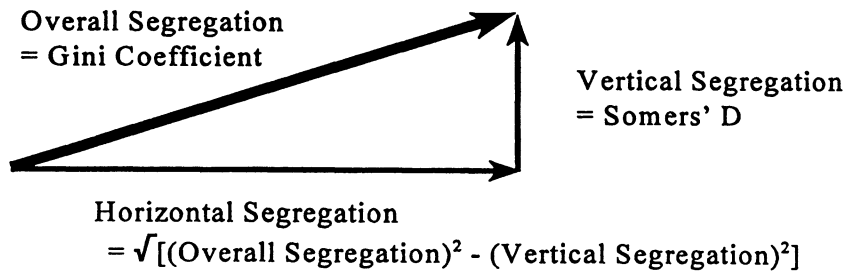
One of the difficulties in explaining occupational segregation has been the interpretation of concentration and segregation measures. James and Taeuber (1985) explained the distinction over fifteen years ago, yet the two concepts continue to be

confused in the literature (e.g. Walby mistakenly rejects the fact that segregation is symmetrical on the basis that similar concentration patterns in different occupations do not necessarily balance. Walby misses the point that concentration and segregation are distinct aspects of occupational patterning by gender² (1997:102–3)). Certainly if women are highly concentrated in low paid occupations, this indicates their disadvantage in the labour force. However, little more than their overrepresentation in such occupations can be explained by the measure of concentration. Hence, structural functionalism, human capital, rational choice, dual labour market, sociobiology and patriarchy theories have all been discussed in the literature to try and explain gendered concentration patterns in the workforce and to understand gender inequalities more generally (e.g. Parsons 1951; Dex 1988; Hakim 1998a; Barron and Norris 1976; Dumais *et al.* 1993; Walby 1990). Conventional measures of segregation, for example the Index of Dissimilarity (ID), used commonly in the United States, and our own Marginal Matching Coefficient (MM), have been criticised for not being able to measure vertical occupational segregation, which is critical in understanding gender inequalities (Hakim 1998a:7). While going further than measures of concentration alone, single index segregation measures still blur the distinctions between inequality and difference in gender studies.

The usual measurement of segregation is a measurement of what we refer to as *overall segregation*. We argue that this may be understood as the resultant of two orthogonal components, *horizontal segregation* and *vertical segregation*. The importance of identifying these components is not only theoretical as it has fundamental methodological significance. The vertical dimension is a direct measure of gender *inequality* in the distribution of women and men across occupations. The horizontal dimension, being orthogonal to the vertical, measures *difference* without inequality. It is evident that traditional measures of (overall) segregation entail a component of inequality but do not measure it directly, as they also are comprised of elements of difference (the horizontal component). The overall measure has sometimes been referred to as 'horizontal' (e.g. Hakim 1979; 1981), a practice which is apt to confuse, especially as it is then often used as a measure of (vertical) inequality. We stress that this is *not* our practice; we use the terms in their familiar mathematical and every-day sense. Although some analysts have conceptualised a vertical dimension, no one else has adopted this logical conceptualisation with a true horizontal dimension and overall resultant.

In attempting to clarify the conceptualisation and measurement of occupational gender segregation we have devised a way to measure vertical segregation in addition to overall segregation. From these measures, the horizontal component of occupational gender segregation can be deduced. Figure 1 shows the mathematical relations of the components of segregation, and how they are measured. Elsewhere, we have shown in some detail that the Gini Coefficient is a limiting case of Somers' D (Blackburn *et al.* 1994:415; Siltanen *et al.* 1995:92–3; and see Appendix). Thus, by using

Figure 1
The mathematical relationships of segregation components

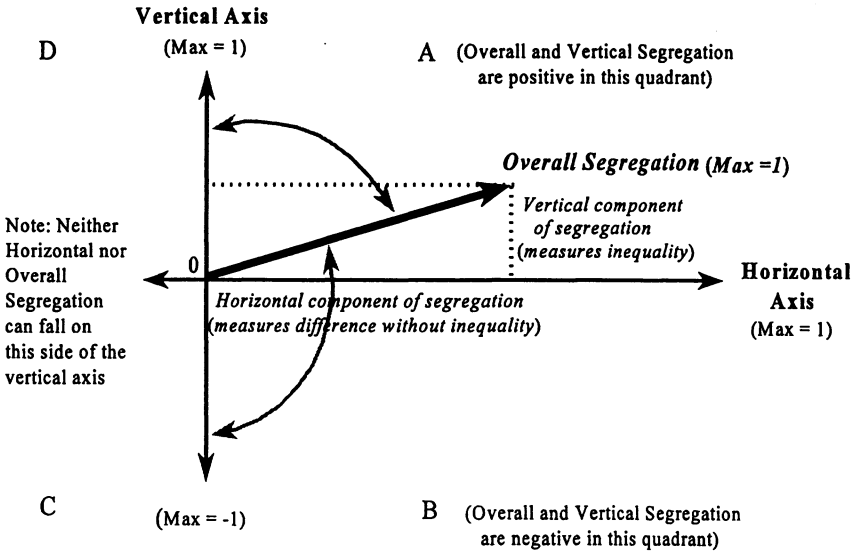


the Gini Coefficient to provide us with a measure of *overall* gender segregation and Somers' D to measure its *vertical* component, we have strictly comparable measures (both using the same statistic on the same set of occupations), so we can determine how much segregation is due to inequality. The vertical component of a segregation measure actually quantifies gender inequality, and so advances our understanding of gender and work. The procedure provides us with a knowledge of men and women's different representation in the occupational structure, *and* of women's situation relative to men, in the particular labour force being examined (Jarman *et al.* 1999; Blackburn *et al.* 2000).

In using the Gini Coefficient to measure overall segregation we are moving away from the usual approaches, which use dichotomised measures such as the Index of Dissimilarity, the Sex Ratio, the WE index, or our preferred MM measure (see Siltanen *et al.* 1995; Blackburn *et al.* 1993, for detailed discussions of these measures).³ Silber (1989; 1992) has been unusual in that he has used the Gini Coefficient to measure overall segregation, and Lampard (1994) has also suggested this, but we had preferred not to do so because it gives disproportionate weight to occupations with extreme gender concentration. We preferred MM because (like the other dichotomy measures), as a measure internal to the data, it takes full account of degrees of concentration without any unwanted weightings (Blackburn *et al.* 1994). However, when we measure vertical segregation we introduce an external criterion, such as stratification, to measure inequality. This means that a dichotomy would suppress information (inequalities would be condensed into two groups), so a continuous measure is appropriate. For this we use Somers' D, and clearly it is now appropriate to use the corresponding continuous measure for overall segregation, i.e. the Gini Coefficient (see Appendix). The disadvantages of the Gini remain but are now far outweighed by the advantages.

Figure 2 presents a depiction of how overall segregation, as a resultant of its

Figure 2
The components of segregation



components can be conceptualised graphically. Thus our method allows for more detailed analysis of segregation that will, we hope, provide sounder ground upon which theories can be formulated and evaluated. We see that the horizontal and vertical axes intersect at the zero point to form four quadrants, A, B, C, and D. Overall segregation can never fall in quadrants C and D, but must remain within quadrants A and B, as the arcs in the figure indicate. This is because it is meaningless to think in terms of negative difference without inequality, as represented by horizontal segregation. If we assume that segregation operating in favour of men is represented by a positive sign,⁴ then when overall segregation falls in quadrant A the vertical component of segregation represents the degree of inequality operating to men's advantage. Overall segregation in this quadrant will also be positive since it contains the vertical component which gauges men's advantage over women (or women's disadvantage). Similarly if overall segregation falls in quadrant B, its vertical component represents the degree of inequality operating to the advantage of women; in this case the vertical component and overall segregation are both assigned a negative sign. Below we show how this conceptualisation of gender segregation can be used empirically to analyse inequality in labour forces. We have some interesting findings for Britain.

We have analysed data from the 1991 and 1996 British Labour Force Surveys to shed light on recent patterns of occupational gender segregation. Our findings reveal

patterns that could not be observed were it not for our ability to decompose segregation into its component dimensions. Indeed, in some ways our findings contradict conventional orthodox assumptions that underlie discussions in the literature. In particular we show that high levels of overall segregation do not always indicate high gender inequality. More surprisingly, we find that segregation does not entail male advantage in some areas.

Cross-National Variation and the Need for a Vertical Measure of Segregation

Before looking in detail at the dimensions of segregation in Britain, we set these in context with a brief look at some cross-national comparisons.⁵ While this analysis deals with overall segregation, the findings clearly indicate the need to take account of the vertical dimension.

It is generally believed in Britain and most, or even all, other countries that the level of gender segregation, and thus of occupational inequality, is high; but without comparative data it is not possible to give any real meaning to notions of high and low segregation. It is, therefore, necessary to have comparative analyses across countries. However, apart from the work of Rubery and Fagan (1995), Anker (1998) and ourselves (Jarman *et al.* 1999; Blackburn *et al.* 2000) little such comparative work has been done, or it has been confined to analyses using very few occupational categories (e.g. Charles 1992; Jacobs and Lim 1992; Blau and Hendricks 1979; and see Anker 1998 for a discussion of such measures). Almost all of this work has been confined to overall segregation, as measured by dichotomised indices, without directly addressing issues of inequality. Our research has also looked at cross-national variations in overall segregation, as a preliminary analysis of the differences across countries. However, drawing on data gathered by the ILO, we have been able to use more detailed sets of occupations than in previous research. Also, we have introduced a formula that standardises segregation measures,⁶ so that it compensates for the tendency for them to increase as the number of occupations in any given country's data set increases (Jarman *et al.* 1999). This allows for the making of direct and reasonably accurate comparisons of segregation levels in different countries, regardless of the number of categories in their occupational classification schemes.⁷ This has led to some notable results which clearly indicate the importance of measuring the vertical dimension.

An important finding in or comparative work has been the existence of a *positive* relationship between the level of segregation in different countries and their scores on UN measures of human development and gender equality – the Human Development Index, and particularly the Gender Empowerment Measure and the Gender Development Index (United Nations 1996). These measures do not measure vertical segregation directly, but as measures of the extent to which national labour

markets approach occupational gender equality, we may expect them to be strongly related to vertical segregation. The positive relationship between these measures and segregation appears to be a general pattern, but is particularly clear in industrial countries. Thus countries such as Sweden, Canada and the United Kingdom are found to have both high measures of segregation *and* high gender empowerment.⁸ These findings *directly contradict* traditional assumptions that gender segregation operates to the disadvantage of women and that it is a direct measure of inequality. They indicate a tendency for gender equality and segregation to exist together.

The only way to make sense of these findings is to consider the vertical and horizontal components of segregation. Only the vertical dimension measures gender inequality. Therefore we conclude that the countries with high gender empowerment have high horizontal components and relatively small vertical components of segregation. It would also appear to be the case that as overall segregation increases the horizontal component increases faster than the vertical one, or even that the vertical component declines. These findings are perhaps less surprising than they seem at first sight. High gender segregation means that some occupations, and their career structures, are dominated by women. Thus women have better chances of rising to high level occupations than if they are in gender-biased competition with men.

Vertical and Horizontal Segregation in Britain

To explore the contributions of the vertical and horizontal dimensions, we examine segregation in the British context, including recent changes. The Labour Force Surveys provided us with a detailed breakdown of the occupational distribution, by gender, for the years 1991 and 1996. Hence we had the gender distributions for 371 occupational categories (1990 Standard Occupational Classification) for the two years. Each occupational category was matched with relevant pay data, taken from the 1991 and 1996 New Earnings Surveys, and with a score from the Cambridge Scale of Social Stratification (Stewart *et al.* 1980; Prandy 1997), in order to measure vertical segregation. Obviously other types of inequality might be used, such as authority (Wright *et al.* 1995), but our two measures – which are positively related (product moment correlations of about 0.7) – cover the relevant possibilities well. To obtain a general measure of gender inequality we converted the pay and social stratification indicators to scaled values, ranging from 1–100, and added them together with equal weighting.⁹ To secure reasonably comparable distributions we followed the common practice of using the logs of the pay data (this, of course, made no difference to the ordering of occupation on pay alone). All measures of segregation and its components are on a scale from 0 to 1.

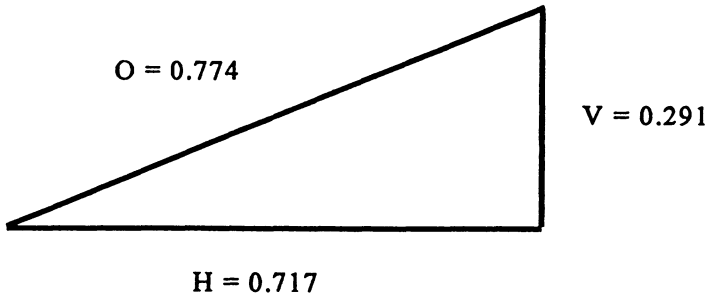
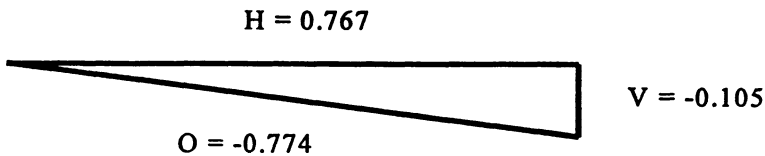
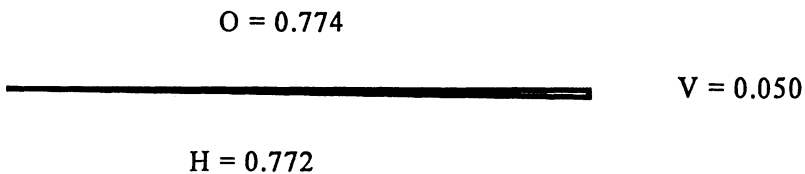
It needs to be clearly understood that these vertical measures are used as characteristics of occupations, and not of people. Thus we use the male values of the

Cambridge Scale and male rates of pay for the occupations. The choice of the male values does not entail any gender bias; they are chosen because the available data are better. The Cambridge Scale had more male occupational data available in its construction, and the NES earnings data for men are more detailed in that they cover more occupations.¹⁰ Apart from these considerations we believe that it would make little difference whether we used male, female or combined data. Two important points need to be recognised with regard to the earnings data. Firstly, the quality of such data is not particularly good for Britain since information is not available for all occupations. Thus, to match the complete information on gender, some occupations had to be allocated the average earnings for a larger category of which they were a part; there was no such problem with the Cambridge Scale, and the problem is appreciably reduced in the combined measure. Secondly, it is essential to keep in mind that gender differences in earnings in the following analysis are *not* differences in the actual earnings of men and women; they are differences following solely from the tendency for men and women to work in different occupations – which is what we are seeking to measure. Any differences due to discrimination in pay rates or to the tendency for women workers to be younger are not included here.

The detail of the Labour Force Surveys allowed us to explore further divisions in the occupational structure of Britain. As well as segregation in the total labour force, we explore gender differences among and between full-time and part-time workers, and manual and non-manual workers. Since men working part-time are a relatively small and atypical part of the labour force, we have analysed both full-time and part-time women in conjunction with all men. This gives a base for understanding the difference between the female full- and part-time sectors. It should be noted that when we measure segregation in a section of the labour force, for example among manual workers, the number of occupations is fewer than it is in the labour force as a whole. The tendency of segregation measures to increase slightly as the number of occupations used in the analysis increases means that our measures for the sectional analyses which follow actually underestimate segregation (when compared to the whole labour force) to a small extent, though this should not affect the patterns observed to such an extent as to be a problem.¹¹

In Figures 3 and 4 we present the findings for the British labour force for 1996 and 1991 respectively. The data represent all employed workers, including part-time and self-employed people, for those years. Looking, firstly, at the 1996 data in Figure 3, we see that when inequality is measured in terms of income, segregation has a modest, positive vertical component. This indicates a general disadvantage in terms of pay for women's occupations, relative to men's; that is to say, men tend to be employed in better-paying occupations, which is intuitively unsurprising. What is rather surprising is the vertical dimension's relatively small magnitude compared to the horizontal dimension of segregation. Thus, while overall segregation is measured at 0.774, which from our comparative research (Jarman *et al.* 1999; Blackburn *et al.*

Figure 3

British labour force 1996, components of segregation all workers in employment**(a) Vertical dimension: men's pay by occupation****(b) Vertical dimension: Cambridge Scale by occupation****(c) Vertical dimension: combined measure of men's pay and Cambridge Scale (equally weighted) by occupation**

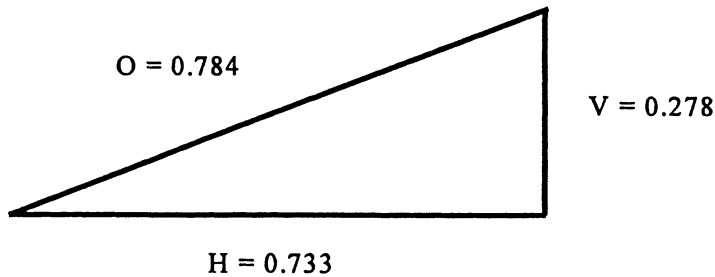
Note: O=Overall segregation, V=Vertical segregation, H=Horizontal segregation.

2000) we can interpret as being fairly large, we find that most of this is due to men and women being employed in 'horizontally' different occupations from one another (0.717) rather than to men being employed in better paying occupations (0.291).

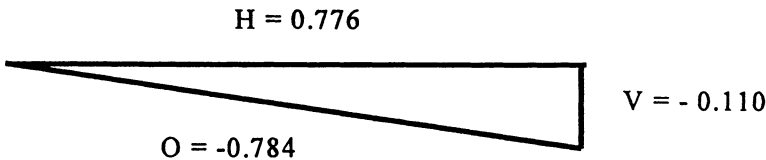
Even more surprising, are the findings on segregation measured in terms of social stratification.¹² While most of the segregation is again due to difference, the vertical component is actually *negative*. Recalling Figure 2, we have here a situation where segregation falls in quadrant B. Hence, in terms of social stratification, women

Figure 4
British labour force 1991, components of segregation all workers in employment

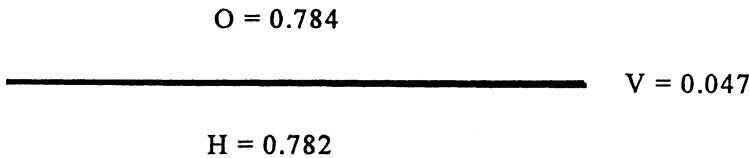
(a) Vertical dimension: men's pay by occupation



(b) Vertical dimension: Cambridge Scale by occupation



(c) Vertical dimension: combined measure of men's pay and Cambridge Scale (equally weighted) by occupation



Note: O=Overall segregation, V=Vertical segregation, H=Horizontal segregation.

are generally more advantaged in the labour force, though not by a large amount. Thus, we see that inequality in the labour market in one sense does not necessarily equate to inequality in other senses. When we consider the combined measure (part (c) of the figure), women's advantage in terms of social stratification tends to be outweighed by men's advantage in terms of pay, and we end up with a small positive value on the vertical dimension. Overall segregation is numerically the same however we measure the vertical component, but changes sign according to whether the advantage lies with men or women. It may seem a little strange that the same

degree of overall segregation can take both positive and negative signs, but this is purely a matter of the context, of how we are conceptualising the social advantage entailed in the segregation.

Figure 4 shows the levels of segregation five years earlier. Taken in conjunction with Figure 3 it gives an indication of how things are changing. We see that there has been little change in the segregation of the British labour force from 1991. This is what we might expect, and serves as a check on the reliability of our measures as well as indicating the direction of change. A slight decline occurred in overall and horizontal segregation, while vertical segregation increased. Inequality in terms of occupational pay has increased slightly, as has the combined measure, while vertical segregation as measured by social stratification has become slightly less negative, in all cases indicating a small loss of ground by women. This is as predicted (Blackburn *et al.* 2000), and as indicated above; as overall segregation declined the vertical component rose, though all changes were small.

We are not pitting earnings against stratification. Earnings are important as the basic economic form of occupational inequality, while the Cambridge Scale measures general social advantage, including more attractive jobs (in a broad sense), hierarchical patterns of social relationships, prestige, and so on. Different people in the labour market place different value on each of these – to some earnings are far more important than social advantage, and vice versa. Nor do we assume that people willingly choose (or are even in positions to choose) their occupations according to these criteria. We are simply presenting the measures, both separately and in an aggregate fashion, to illustrate how the vertical dimension can measure different conceptualisations of inequality, and to challenge empirically the belief that segregation level alone is indicative of women's inequality in the labour market.

One explanation for the difference between the pay and social stratification analyses above is that men are frequently employed in manual occupations with particular skills that are fairly well paid but have relatively low social standing (e.g. *Crane Operators* have a Cambridge Scale score of 8.29 and a mean weekly pay value of £411 for 1996) while women are often found in non-manual occupations that rate higher on social stratification scales but have relatively low pay (e.g. *Receptionists* have a Cambridge Scale score 38.79 but a mean weekly pay of only £139). While this contrast is fairly extreme, it is part of a general trend across the labour force which relates to traditional gender-typed work. Generally, however, there is a strong relationship between pay and stratification levels, particularly for each sex separately. The different distributions of men and women through the occupational structure, with many women concentrated in lower white-collar occupations, is partially responsible for the contrasting results. Another element of the explanation is that successful women tend to be in professional occupations, where their qualifications may help to guard against discrimination. On the other hand, top jobs in business and industry, which are more highly paid, are dominated by men. When

we examine segregation patterns in particular sections of the labour force we are better able to understand how inequality in the labour force, as a whole, is gendered.

Women Working Full-Time or Part-Time

The growth of part-time work, and the large proportion of women employed in this sector, has always been seen as a significant source of gender inequalities in the labour market. There may be important advantages for women in only having to put up with unattractive jobs for a few hours a day, and fitting their employment around family commitments (Beynon and Blackburn 1972; Hakim 1996). However, women's participation in part-time work may also be an involuntary compromise for women who wish to work in full-time jobs, for example some young, single, educated women (Walsh 1999:195), and so in that sense may represent a disadvantage.¹³ Even for women who voluntarily 'choose' to work part-time so as to accommodate care-giving responsibilities, there are usually serious financial consequences in terms of lost income (for the family), pension eligibility and so on. As Walsh (1999:181) observes, there is some evidence of dualism in the part-time workforce, and 'secondary, 'bad' part-time jobs greatly outnumber 'retention' part-time jobs'; an observation that our data on the British labour force tends to support. Certainly, within the labour market, part-time women tend to have less attractive jobs.

In Table 1 we present our segregation results for 1991 and 1996, to explore the different situations of the full-time and part-time women workers in relation to the male labour force as they are changing. While examining these findings it is useful to keep in mind the findings for the labour force as a whole, that were presented in Figures 3 and 4, as well as the full-time and part-time comparison, and to remember that overall segregation measured in the smaller sections of the labour force will be slightly underestimated in comparison to that for the labour force as a whole, since it is based on fewer occupations.

Considering the segregation of full-time women from men in 1996, we see that as compared to the labour force as a whole there are a number of interesting differences. The magnitude of overall segregation is rather lower (0.738 against 0.774), and this is accompanied by an appreciably smaller disadvantage for women in terms of pay (0.105 compared to 0.291). The corresponding values of horizontal segregation (i.e. in figures a) are virtually the same. Thus we see that the decline in overall segregation is entirely due to the full-time women having better paying jobs than the part-time women, and so better than all women workers taken together. At the same time women's advantage over men, in terms of stratification, is larger in this portion of the labour force. This means that the horizontal component is necessarily lower. The combined measure shows that full-time women are in a position of general advantage over men in the labour force – the general disparity in earnings is more than offset by the relative advantage in terms of stratification level.

Table 1

Segregation components 1991 and 1996: full-time and part-time women, all men

	<i>Vertical Segregation Measures</i>					
	<i>Pay</i>		<i>Cambridge Scale</i>		<i>Combined</i>	
	<i>1991</i>	<i>1996</i>	<i>1991</i>	<i>1996</i>	<i>1991</i>	<i>1996</i>
Full-time women						
Vertical	0.134	0.105	-0.226	-0.225	-0.104	-0.115
Horizontal	0.735	0.731	0.712	0.703	0.740	0.729
Overall	0.747	0.738	-0.747	-0.738	-0.747	-0.738
Part-time women						
Vertical	0.468	0.515	0.042	0.040	0.245	0.248
Horizontal	0.723	0.681	0.860	0.853	0.825	0.817
Overall	0.861	0.854	0.861	0.854	0.861	0.854

As compared to our findings for this subset in 1991, there is a slight gain for full-time women on the vertical dimension of pay and no change in stratification, producing a small gain for women in the combined measure. Overall segregation has declined slightly. This indicates a slight movement towards gender equality in this period between men and women working full-time.

Turning to the analysis of women working part-time, we see results that at first glance appear to be more in line with conventional conceptualisations of occupational gender segregation. Overall segregation is high. On all three measures of the vertical dimension, segregation is operating in men's favour. In this portion of the labour market the pay gap between men and women is large, as we anticipated. It almost contributes to overall segregation to the same extent as the horizontal dimension does in 1996 (0.515 as compared to 0.681). In comparison to the segregation of full-time women and men (and thus in the labour force as a whole), the segregation of part-time women from men is appreciably greater, both overall and especially in terms of vertical disadvantage for women; for the Cambridge Scale and Combined measures it is not just the magnitude of the segregation but the different sign that is important – female advantage for full-time women but disadvantage for the part-time women. However, horizontal segregation is actually less when the vertical dimension is pay, though greater on the other two measures. Since 1991, in this part of the labour force, there has been a small decline in overall segregation, accompanied by a modest increase on the pay and combined dimensions, while the Cambridge Scale measure has declined very slightly. At both times men have a substantial advantage over part-time women in terms of the pay levels of their occupations, and we suspect that the actual pay gap is even greater since, to the limited extent that their occupations are the same, it appears (e.g. New Earnings

Survey) that part-time women are paid less than men. Men also have a slight advantage in terms of social stratification. In terms of inequality, we may conclude that women's high concentration in the part-time labour force contributes substantially to gender disparities in the labour force as a whole.¹⁴

Over the five years from 1991 to 1996 the position of women working full-time has been improving slightly in terms of pay, while static – or showing negligible decline – on stratification. For women working part-time the pattern is roughly the reverse. On pay they have been losing ground but, if anything, gained very slightly on stratification. Naturally we have to be very cautious about interpreting such tiny changes as those on stratification, which are certainly within what may be regarded as a reasonable margin of error. On the other hand they do fit with what appears to be divergent experiences of women working full-time or part-time.

Manual and Non-Manual Workers

Part of the reason for the patterns we have observed so far is the grouping of women at the middle stratification levels, that is to say in lower level white collar jobs. All stratification measures, whether intended to measure social status, goodness of the job or lifestyle, have a strong tendency to place non-manual jobs above manual ones. This means that many women are concentrated in the middle ranges of these measures, including the Cambridge Scale. For some years there has been a tendency for an increasing number of women to enter higher level non-manual occupations, but this has been matched by a growth in low level manual work.¹⁵ In the areas of female concentration at the lower levels in both manual and non-manual work the pay is relatively low. We now examine how these features of the occupational structure shape the patterns of segregation.

Table 2 shows our analysis of segregation in the British labour force for 1996 and 1991 when it is divided into manual and non-manual sectors.¹⁶ Looking first at non-manual workers, we see that there is lower segregation in this sector than in the labour force as a whole, but that advantage on the vertical measures lies clearly with men. The advantage, on all counts, represents a slight decline from 1991. Thus, as anticipated, for the non-manual workforce we witness segregation that operates in favour of men, but has been declining marginally over the 1990s.

Turning to segregation in the manual sector, we see in the 1996 data that there is a high level of overall segregation. However, what is really striking is the substantial advantage that men enjoy over women in terms of wages. For the first time we have a vertical component of segregation which is greater than its corresponding horizontal component. In contrast, the vertical component representing social stratification shows, somewhat surprisingly, a slight female advantage, but the combined measure shows the advantage lying slightly with men.

Comparing the 1996 data with the 1991 we see that there has been a large increase

Table 2

Segregation components 1991 and 1996: manual and non-manual workers

	<i>Vertical Segregation Measures</i>					
	<i>Pay</i>		<i>Cambridge Scale</i>		<i>Combined</i>	
	<i>1991</i>	<i>1996</i>	<i>1991</i>	<i>1996</i>	<i>1991</i>	<i>1996</i>
Non-manual						
Vertical	0.433	0.375	0.209	0.185	0.350	0.285
Horizontal	0.539	0.571	0.659	0.658	0.596	0.621
Overall	0.691	0.683	0.691	0.683	0.691	0.683
Manual						
Vertical	0.492	0.679	-0.007	-0.084	0.329	0.338
Horizontal	0.709	0.541	0.863	0.864	0.798	0.799
Overall	0.863	0.868	-0.863	-0.868	0.863	0.868

in the pay difference between the manual occupations of men and women in this short space of time. It is worth reminding ourselves that we are not talking about gender discrimination in pay within occupations; *this is a strong tendency for the male rates of pay to be lower in manual occupations where women are more concentrated*. There has actually been an increasing number of men, rather than women, in occupations with low wages (Low Pay Unit 1999), though women, especially those working part-time and in atypical jobs, still comprise the majority of the low paid (Thornley and Coffey 1999). It would appear, therefore, that the change is not so much due to the growth of low-paying jobs for women as to a movement towards equal pay, i.e. a trend of male wages declining to female levels in occupations where women predominate. This change in pay has been accompanied by a small decline in the stratification measure of vertical segregation, a change to women's advantage, while the combined measure showed a small increase. Overall segregation changed little between the two years.

Summarising the information from Table 2, we see the tendency for men and women to work in different occupations from each other is far stronger in the manual sector. Men are advantaged in the non-manual labour force in terms of both stratification and pay, though the advantage is declining; in the manual sector men enjoy a substantial and increasing advantage in terms of income, countered by a very slight disadvantage in terms of social stratification.

Finer Occupational Divisions: Manual and Non-Manual by Full-Time and Part-Time

In order to explain further the variable structure of segregation throughout the labour force, we combine the manual/non-manual and full-time/part-time

Table 3

Vertical segregation 1991 and 1996: full-time and part-time women and all men by non-manual and manual status

	<i>Vertical Segregation Measures</i>					
	<i>Pay</i>		<i>Cambridge Scale</i>		<i>Combined</i>	
	<i>1991</i>	<i>1996</i>	<i>1991</i>	<i>1996</i>	<i>1991</i>	<i>1996</i>
Full-time women						
<i>non-manual</i>						
Vertical	0.352	0.268	0.122	0.082	0.267	0.179
Horizontal	0.550	0.580	0.641	0.633	0.596	0.613
Overall	0.653	0.639	0.653	0.639	0.653	0.639
<i>manual</i>						
Vertical	0.364	0.530	-0.094	-0.142	-0.169	0.187
Horizontal	0.728	0.644	0.809	0.822	0.796	0.813
Overall	0.814	0.834	-0.814	-0.834	-0.814	0.834
Part-time women						
<i>non-manual</i>						
Vertical	0.574	0.542	0.357	0.346	0.494	0.450
Horizontal	0.550	0.582	0.710	0.717	0.622	0.656
Overall	0.795	0.796	0.795	0.796	0.795	0.796
<i>manual</i>						
Vertical	0.588	0.779	0.058	-0.045	0.494	0.441
Horizontal	0.702	0.469	0.914	0.908	0.771	0.795
Overall	0.916	0.909	0.916	-0.909	0.916	0.909

divisions. In this way we can obtain a fuller picture of how gendered processes are operating in sections of the labour force and contributing to the patterns in the whole. The results are shown in Table 3.

Considering first the sector of full-time women and all men, among non-manual workers the pattern is essentially as we might expect. The levels of the three vertical measures lie between those in the separate analyses for full-time women (Table 1) and non-manual workers (Table 2), with a mild decline from 1991. Not surprisingly, this is the group with the lowest level of overall segregation, falling from 0.653 in 1991 to 0.639 in 1996. In keeping with this, horizontal segregation levels are much the same as for all non-manual workers. Turning to the results for full-time women and all men among manual workers, there is a rise over the five years in the magnitude (ignoring sign) of overall segregation and a mixed pattern on the vertical measures. We again find that the segregation levels lie between those found in separate analyses (Tables 1 and 2). This applies to overall segregation and to the vertical and horizontal components.

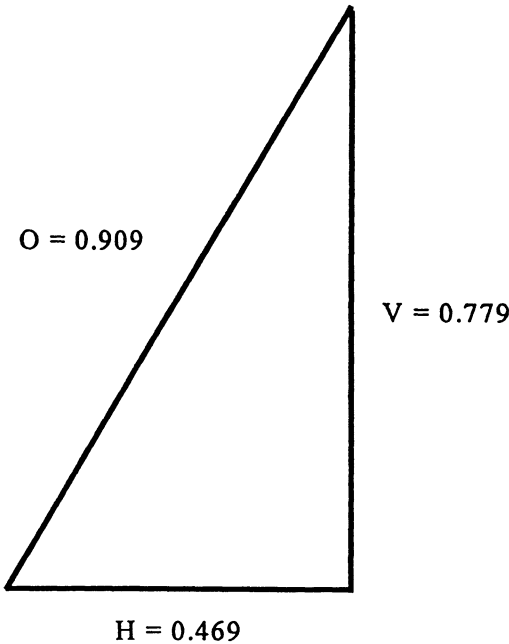
Looking at the non-manual part-time analyses, we see again, as for the separate analyses of these groupings, the sort of picture that we would expect according to conventional theories on gender segregation. In the non-manual sector, men enjoy a substantial advantage over part-time women, in terms of both pay and social stratification. There has been a slight decline in the magnitude of male advantage between 1991 and 1996, though the differential remains substantial. At the same time horizontal segregation increased a little while there is a negligible rise in overall segregation.

Considering the segregation levels among the sector of manual workers covering men and part-time women, we see that the levels of overall segregation are extremely high, and despite a small decline to 1996 the level remains higher than in any other part of the labour force we have considered. To illustrate the striking results for 1996 we repeat them graphically in Figure 5. Part-time women are very heavily concentrated in occupations where there are few men. The patterns are essentially the same as we observed for all manual workers, except that overall segregation is higher and male advantage is greater. Once again we see a rather surprisingly low level of vertical segregation in terms of social stratification, though not quite as low as for all manual workers. It shows a small advantage to men in 1991 which has become a slight advantage to women by 1996. At the same time the vertical component of segregation in terms of pay has increased substantially. At 0.779 it is far higher than in any other part of the labour force, showing a huge advantage to men. This vertical component is so large that it is accompanied by the lowest level of horizontal segregation we have found, despite the fact that overall segregation – the resultant of the vertical and horizontal components – is only a little below the 1991 level and much higher than in any other overall measure. Despite this, the resultant of the changes in the pay and stratification measures is a drop in the combined measure of vertical segregation.

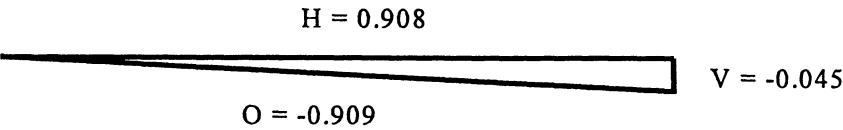
To be clear why we get these patterns in the various sections of the labour force we need to recognise the divergent patterns from the complete labour force. When we consider full-time women the levels of vertical and overall segregation are lower than for all workers while for part-time women they are higher. For non-manual workers the overall measure is also down but for manual workers it is higher, while for both manual and non-manual workers the vertical measures are higher than for all workers. Not surprisingly the vertical and overall levels are higher for the part-time manual women. The part-time non-manual differ from all workers in the manner of all part-time workers, though appreciably more down on the Cambridge Scale, while the full-time manual and non-manual sectors are marginally more like the total manual and non-manual sectors respectively. Whether the social differences should be seen as operating at the level of broader areas (e.g. manual vs non-manual) or in more finely defined sectors (full-time manual, etc.) is not clear. There is, however, a general consistency between the levels.

Figure 5
British labour force 1996, components of segregation part-time manual women and all manual men

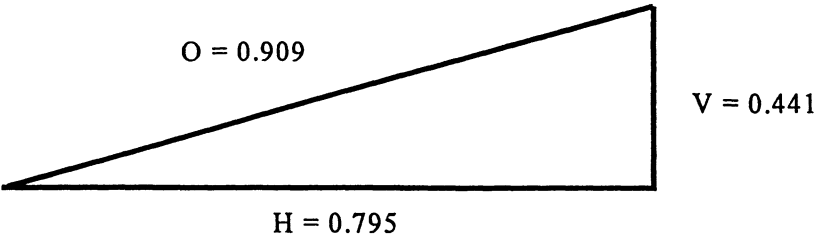
(a) Vertical dimension: men's pay by occupation



(b) Vertical dimension: Cambridge Scale by occupation



(c) Vertical dimension: combined measure of men's pay and Cambridge Scale (equally weighted) by occupation



Note: O = Overall segregation, V = Vertical segregation, H = Horizontal segregation.

Conclusion

We see clearly the importance of breaking down overall segregation into its vertical and horizontal components. We also see the gain in understanding that results from looking at the segregation patterns by sectors and sub-sections of the labour force. Not only do we find quite different levels of overall segregation and differences in the relative contributions from the vertical and horizontal components, but also different trends in the change over time.

There was a small decline in overall segregation from 1991 to 1996. As this is a relatively short period over which to make observations it would be surprising if there were a dramatic change. It is, nevertheless, worth noting that the decline did not occur throughout the labour force. For example, in three of the eight sections considered, overall segregation actually increased marginally. Even in this short time period there was a large change in the components of segregation in the manual sector, when the vertical dimension is measured by pay. Vertical segregation increased by 38 per cent and horizontal segregation fell by 24 per cent, while overall segregation declined by less than 1 per cent. This was not so much a widening of the gender gap as a narrowing, in the sense of a decline in male wages in occupations where women predominate.

The prime theoretical significance of this research relates not simply to the levels of segregation, but the relevance of this for gender inequality. The tendency to treat the level of overall segregation (usually referred to simply as 'segregation' or even as 'horizontal segregation') as a measure of gender inequality is fundamentally mistaken, as we have argued elsewhere (Blackburn and Jarman 1997; Blackburn *et al.* 2000), and have demonstrated here. It is vertical segregation only that is of concern in relation to inequality. It is time that segregation research moved on, to focus on the structure of inequality, which can be illuminated by examining vertical segregation. Policy decisions should also be informed by empirical evidence and a proper theoretical understanding, if they are ever to diminish inequalities in the labour market.

Earlier, we pointed out that an increase in overall segregation is not necessarily indicative of increased gender inequality operating to the advantage of men, and that it is often found to have the exact opposite relationship. The relationship between inequality and overall segregation depends on the relative contributions of the vertical and horizontal components.¹⁷ Our examination of the various sections of the labour force shows countervailing trends in this respect. There are three logical possibilities. The most obvious one is that a decline in overall segregation represents a decline in the operation of gender-biased criteria for occupational placement, and so a decline in vertical segregation relative to the horizontal component; conversely an increase in overall segregation is accompanied by a proportionate or greater increase on the vertical dimension. It is important to note that changes of this type

are roughly in keeping with the usual interpretation of changes in overall segregation as changes in inequality. More interesting is the reverse pattern where overall and vertical segregation vary in opposite directions. Mathematically this appears unlikely, and it is certainly contrary to the assumption that overall segregation measures, or at least varies with inequality. However, this does appear to be the position cross-nationally, where female empowerment is positively correlated with overall segregation (Blackburn *et al.* 2000). This is the case because high levels of segregation reduce the opportunities for gender discrimination in careers. A third possibility is a combination of the other two; as overall segregation increases the vertical component increases but less than the horizontal component, so that the ratio of vertical to horizontal decreases, and vice versa. This might be thought of as the marginal area of uncertainty between the two alternatives, and it is interesting that there were no such marginal cases in our analysis.¹⁸ It is possible for the two main trends to be operating simultaneously in different sectors or even the same sector. For instance, a movement towards greater equality may reduce vertical segregation, and consequently, overall segregation; at the same time, a reduction in overall segregation (possibly due to egalitarian effects) may widen male career opportunities and increase vertical segregation.

General patterns that hold across labour forces do not necessarily hold within particular sections of a labour force because the findings in sections, such as those presented in Table 1, may aggregate to produce the findings at a more general level, as in Figure 3. Any difference between the smaller sections' results means they are not directly comparable with the findings at the higher level, of which they are components. Nevertheless, it is instructive to look at the various patterns we have analysed.

What is particularly surprising is the mixed picture that emerges. We see a consistent trend for inequality to vary directly with segregation only in the analyses of non-manual workers covering all women and full-time women, where overall and all three measures of vertical segregation decline together. It is not surprising that women have been gaining ground in the non-manual sector, as their greater educational attainments have led to expanding professional employment. On the other hand, only in the analysis involving part-time non-manual women do we find the opposite trend, where increasing overall segregation is accompanied by declines on all the vertical measures. Thus there are contrasting processes in the full-time and part-time sections of the non-manual workforce, with the full-time having the greater effect on the whole non-manual sector. In all the other sections of the labour force we see a mixed pattern, where pay and stratification, despite being quite strongly related, have changed on different principles with one increasing and the other decreasing as the overall measure rose and fell. Perhaps the most reliable is the analysis of the entire labour force where we see the second pattern (i.e. a negative relation between declining overall (and horizontal) segregation and rises on the

vertical measures), as was expected on the basis of the relation between gender empowerment and segregation across countries (Blackburn *et al.* 2000). The one thing that all this shows very clearly is that overall segregation can never be relied upon as an indicator of gender inequality.

When we compare sections of the British labour market, we find that in every section apart from all full-time workers the vertical segregation is greater than in the labour market as a whole. Apart from this the differences are much as we might expect. Part-time women are appreciably more segregated from men, overall, than are full-time women. They are also disadvantaged vertically whereas the full-time women are, if anything, advantaged, due to their greater concentration in non-manual work (though the advantage disappears when manual and non-manual sectors are considered separately). The position is not so clear cut, however, when we compare the segregation for manual and non-manual workers. Overall segregation is higher among manual workers, as is segregation to men's advantage on the vertical dimension of pay, but on stratification the relative male advantage is greater in the non-manual sector, while on the combined measure there has been a small shift of relative male advantage from non-manual to manual.

What has been additionally surprising in this study is the relatively small vertical component of gender segregation – Britain is not exceptionally gender-egalitarian. On all measures, apart from manual pay (all manual and part-time manual workers), the inequality component (vertical) is less than the difference component (horizontal), and usually quite substantially less. The results of the social stratification scale findings are particularly surprising as they run counter to the observed advantage men tend to enjoy in terms of pay, and counter to many previous assumptions about gender inequality.¹⁹ To a considerable extent, particularly when women work full-time though certainly not in all sections of the labour market, we have seen that women have a modest advantage in terms of social stratification. This serves to make conclusions about gender advantage, generally, more uncertain. The total pattern is certainly quite different from what one would expect from orthodox accounts of gender inequality and segregation.

With continuing research we hope to untangle the effects and circumstances of gender segregation so that the debate can advance further. The method that we have introduced here, considering the components of segregation in conceptual terms of inequality and difference, and estimating and comparing their values in mathematical/empirical terms, now allows us to explore occupational gender segregation in new ways. This method allows us to now measure concepts such as vertical and horizontal segregation, and to seek explanations for their values within theoretical frameworks and, perhaps, to generate new and/or alternative theories as to why occupational segregation has operated and changed as it has. In the future we intend to conduct analyses on census data, both past and present, from various countries, to see how the components of segregation have changed over time, and

whether such changes support or challenge theories that were put forward over the period. For example, we are currently measuring segregation components for Britain from census data from 1971 onward, to explain broader trends in the gendering of occupations over the past three decades. We plan to replicate the current analysis, in the Canadian context, where occupational pay data is almost as complete for women as it is for men, to see whether patterns of segregation differ when occupations are ordered on a hierarchy based on women's pay from how they are patterned when based on men's pay. Moreover, our method is not confined to measuring the component of segregation on the bases of pay and stratification scales, so we would expect that it should serve as a useful tool for researchers to explore patterns of gender segregation based on other continuous measures of inequality that may be applied to occupational classification systems.

Appendix: Solving the Measurement Problems

When we began research on segregation we found there were a variety of measures being used, so it seemed desirable to examine their properties and see how they were related (see Blackburn *et al.* 1990; Blackburn *et al.* 1994:413–5; Siltanen *et al.* 1995; ch. 4, for details). Siltanen (1990) had already noted that Hakim's Sex Ratio could be seen as having a 'male' version which showed the opposite trend over time to her 'female' version. We found that Hakim's Sex Ratio was a simple difference of proportions in a 2×2 table, divided by a factor entailing the proportion of the labour force who were women; the 'male' version was the same difference of proportions with men replacing women in the weighting. This 2×2 table we have named the Basic Segregation Table.

Similar examination of the structures of formulae enabled us to see that the Index of Dissimilarity, which for forty years had been represented by a long, complicated formula, could also be represented by a set of differences of proportions, and then that these could be represented by just one difference of proportions. The Index of Dissimilarity is the other difference of proportions in the Basic Segregation Table. Long complicated formulae can make it difficult for the human brain to perceive mathematical relationships, and also introduce a greater possibility of computational error. In our work on segregation, for example, the original formula for the Index of Dissimilarity would have had over 1000 terms in one instance (Jarman *et al.* 1999), so we chose to work with the more elegant and simpler formula of the differences in proportions in the Basic Segregation Table. Furthermore, we found that all the main segregation measures used in biology and social science could be represented as weighted or unweighted relations of the table. To overcome problems with these measures we introduced MM, the Marginal Matching coefficient, derived from a modified, symmetrical segregation table. However, all these measures were based on a dichotomy (male and female occupations in gender segregation) which

was fine for measuring overall segregation without loss of information, but not for vertical segregation. Vertical segregation brings in an *external* measure, such as money or stratification, which is essentially continuous but can be treated as a set of ordered categories. Therefore, we needed to find *strictly comparable measures* of overall and vertical segregation for ordered categories.

One measure based on ordered categories had been used for overall segregation, namely the Gini Coefficient (Silber 1989, Lampard 1994). This is a measure that has long proved useful to economists and can be represented as the area subtended by a Lorenz curve. A sensible starting point, therefore, was to consider the Gini Coefficient. Although it has a tendency to overweight the extreme component values (occupations with high proportions of one sex, like underground mining occupations) it is otherwise very suitable. There are several formulae that can be used to express the Gini Coefficient, all of which are quite complicated. Trying to simplify the mathematics, the breakthrough came when we found it could be expressed as a form of Somers' D, as shown below. In fact it is the maximum value of D for a 2xn table; in this case involving 2 genders and n occupations, with occupations ordered from most female to most male. A strictly comparable vertical dimension can, therefore, be measured by Somers' D when the occupations are ordered according to the desirability of the occupations (money, scale value, etc.). The maximum vertical value occurs when the vertical scale values coincide with the order of gender concentration, when all segregation is vertical.

Mathematical proof

The most useful equation for analysing the Gini Coefficient proved to be

$$G = \sum_{i=2}^n \left[\sum_{t=1}^{i-1} F_t / F \sum_{t=1}^i M_t / M - \sum_{t=1}^i F_t / F \sum_{t=1}^{i-1} M_t / M \right]$$

Where there are n occupations, i denotes the ith occupation and t denotes an occupation included in the cumulative total. F_t and M_t denote respectively the number of women and men in occupation t, and similarly F_i and M_i denote women and men in occupation i, while F and M denote the total numbers of women and men in the labour force ($\sum F_i$ and $\sum M_i$). This may be written

$$\begin{aligned} G &= (1/FM) \sum_{i=2}^n \left[\sum_{t=1}^{i-1} F_t \left(\sum_{t=1}^i M_t + M_i \right) - \left(\sum_{t=1}^{i-1} F_t + F_i \right) \sum_{t=1}^{i-1} M_t \right] \\ &= (1/FM) \sum_{i=2}^n \left[M_i \sum_{t=1}^{i-1} F_t - F_i \sum_{t=1}^{i-1} M_t \right] \end{aligned}$$

This may seem complicated but can be looked at in terms of ordering pairs of men and women by the femaleness/maleness of their occupations. Since the occupations are ordered in declining proportions of women, where a woman is in occupation i and a man is in occupation $i+j$ ($1 \leq j \leq n-i$) the woman is in the occupation with the higher proportion of women and the man is in the male 'male' occupation; this pair are said to 'consistently' ordered (here the ordering is consistent with segregation). Similarly, where a man is in occupation i and a woman in occupation $i+j$ they form an 'inconsistently' ordered pair. (Pairs of men and women in the same occupation are ignored.) We follow the usual convention that P represents the number of all pairs 'consistently' ordered and Q represents the number of 'inconsistent' pairs. In this case, P includes all pairs of a man and a woman where the occupation of the woman has a higher proportion of workers who are women than does the man's occupation; Q includes pairs where the reverse holds.

Thus

$$P = \sum_{i=2}^n \{M_i \sum_1^{i-1} F_i\} \text{ and } Q = \sum_{i=2}^n \{F_i \sum_1^{i-1} M_i\}$$

Therefore we now have

$$G = \frac{P-Q}{FM}$$

This is Somers' D where the 'independent' variable has only two values, here male and female. (The result holds, of course, for any other variables related by the Gini Coefficient.) Importantly it is the maximum value of D for the set of occupational gender distributions, due to the ordering by the female:male ratio.²⁰

Therefore Somers' D , with occupations ordered along the vertical dimension, provides the appropriate vertical measure to correspond to G as the measure of overall segregation.

NOTES

1. See Blackburn and Jarman (1997) and Jarman *et al.* (1999) for more technical discussions of segregation and concentration. Some segregation measures (including SR, WE, IP) are weighted by other factors, but the essential component ranges from 0 to 1.
2. She also confuses overall segregation with its vertical component.
3. There have also been attempts to use log linear analyses (e.g. Grusky and Charles 1998; Weeden 1998), but these are inappropriate for measuring segregation (Blackburn *et al.* 1995).
4. The choice of sign is arbitrary. In keeping with usual assumptions that segregation operates to the advantage of men we have chosen to indicate this with a positive sign.
5. For a full discussion of these cross-national comparisons see Jarman *et al.* (1999) and Blackburn *et al.* (2000).

6. The relevant equation to standardise the segregation measure to a notational set of 200 occupations for any country i is: $MM_{200i} = MM_{200E} \times Mm_{ni} / MM_{nE}$; where MM_{ni} is the observed value of the segregation measure MM in country i , and where the data set has n occupations and MM_{nE} is the expected value for n occupations, determined by the formula $MM_{nE} = 1 - 1/(1 + 0.6(\log_{10}n)^{0.93})$. Of course, this does not control for different classifications of occupations, but this problem declines with increased numbers of occupations. We have excluded countries with less than 20 occupations or very different schemes (most classification schemes are quite similar in basic conception). See Jarman *et al.* (1999) for a discussion of data quality.
7. Anker (1998) has also been concerned with the need to standardise, though his approach is rather different.
8. These findings are in keeping with some recent 'anomalous' findings of other researchers on gender segregation (e.g. Anker 1998; Jacobs and Lim 1992). Allmond and Rubery (1998:685) point out that, looking at the pattern from the other perspective, some developed countries which have relatively low occupational segregation levels (e.g. USA), also have higher levels of inequality by sex, for example in terms of the pay gap. To our knowledge, there has been no attempt to explain such patterns of occupational segregation empirically by measuring the components of segregation, as we do in this paper.
9. Since there is no definitive reason to prioritise one rather than the other, we use equal weighting and equalised scales.
10. As we are using the Gini Coefficient and Somers' D for our estimations of overall and vertical segregation, it is not the value *per se* of pay per occupation that matters, but the ordering of occupations on a hierarchy from lowest paid to highest pay (or vice versa), taken into consideration with the male and female concentration per occupation. Since the male pay values are available for far more occupations in the NES than are female pay values, we used male pay values to form the occupational hierarchy. Since the participation levels of males and females in each occupation remains unchanged, we suspect that it would make little difference whether male, female or combined pay data were used, as generally most occupations that are found to be at the top of the hierarchy based on male pay data would also be found at the top of the hierarchy based on female pay data, though the ordering of occupations might differ slightly. It would be desirable to confirm this, were pay data as complete for women as for men, and we intend to investigate this in further research in the Canadian context, where we have recently obtained pay data for women that is virtually as detailed as it is for men.
11. We are currently developing a measure to standardise this measure of segregation to account for the number of occupations in the analysis, similar to the procedure we have used to standardise MM when seeking to measure overall segregation alone (Jarman *et al.* 1999).
12. As the result is contrary to conventional assumptions it may be tempting to assume that it is because the Cambridge Scale is a defective measure. This is not so. Like all constructed measures, the Scale cannot be regarded as perfect. However it is highly correlated with other scales (including non-British) and class categoric measures, and almost invariably explains more of the variance of related variables (see Stewart *et al.* 1980; Prandy 1997). Better vertical measures might give slightly different, and possibly even a little higher values, but the basic pattern of results would remain.
13. Crompton and Harris (1998a; 1998b; 1998c) argue that there has been a neglect in the literature of investigation into the employment/family interface with respect to particular occupations or employment situations, and the women construct their 'work-life

- biographies' in terms of the opportunities and constraints with which they are faced, and implicitly, those which they perceive that they face. See, for example, their debate with Hakim (1998b), who argues for a preference theory model to explain women's various experiences in choosing between or combining work-life and domestic-life, and so often between full-time or part-time work, in the *British Journal of Sociology*, 49, 1.
14. Preliminary analysis suggests that, as anticipated, part-time men are also substantially disadvantaged.
 15. To some extent employment of women and men in low level manual jobs has been limited by the tendency for unemployment to be concentrated there, thus creating an illusion of net occupational gains, particularly for women.
 16. To divide the labour force into these sectors we have followed the convention of government statistics, as for example in the New Earnings Survey.
 17. In looking at the relationship between changes in overall and vertical segregation, there are two ways in which we can interpret changes to negative values (advantage with women). As overall segregation gets numerically greater (more negative), the vertical component becomes numerically greater (more negative) in the first possibility, and numerically less (less negative or even positive) in the second case. Women gain relative to men in the first case and lose in the second, as the vertical component becomes more or less negative respectively (the opposite pattern applies, of course, as overall segregation becomes less negative). We have considered the first (women gain from greater overall segregation) because we are interested in the traditional and still basically dominant pattern of male advantage. Somewhat surprisingly the choice makes no relevant difference to the argument; consistent patterns are unchanged, and mixed patterns remain mixed.
 18. The possibilities are described as though segregation is positive; where it is negative the division by the horizontal component applies to the second instead of the first case.
 19. Hakim (1998a) has appreciated that segregation patterns differ from what is usually assumed, in the sort of way we have demonstrated, although her actual analysis focuses on concentration.
 20. We may note that in a 2×2 table D and G necessarily coincide. In the appropriate tables they are equal to MM and ID.

REFERENCES

- Allmond, P. and Rubery, J. (1998) 'The Gender Impact of Recent European Trends in Wage Determination', *Work, Employment & Society*, 12, 4, 675–93.
- Anker, R. (1998) *Gender and Jobs, Sex Segregation of Occupations in the World*, Geneva: International Labour Office.
- Barron, R. and Norris, G. (1976) 'Sexual Divisions in the Dual Labour Market' in D. L. Barker and S. Allen (eds.), *Dependence and Exploitation in Work and Marriage*, London: Longman.
- Beynon, H. and Blackburn, R. M. (1972) *Perceptions of Work*, London: Cambridge University Press.
- Blackburn, R. M., Siltanen, J. and Jarman, J. (1990) 'Measuring Occupational Gender Segregation', *Working Paper* no. 3 (first edition), Cambridge: University of Cambridge, Sociological Research Group.
- Blackburn, R. M., Jarman, J. and Siltanen, J. (1993) 'The Analysis of Occupational Gender Segregation Over Time and Place: Considerations of Measurement and Some New Evidence', *Work, Employment & Society*, 7, 3, 335–62.
- Blackburn, R. M., Jarman, J. and Siltanen, J. (1994) 'Measuring Occupational Gender Segregation: A Reply to Lampard', *Work, Employment & Society*, 8, 3, 413–19.

- Blackburn, R. M., Jarman, J. and Siltanen, J. (1995) 'The Measurement of Occupational Gender Segregation: Current Problems and a New Approach', *Journal of the Royal Statistical Society*, 158, part 2, 319–31.
- Blackburn, R. M. and Jarman, J. (1997) 'Occupational Gender Segregation', *Social Research Update*, 16, Spring. Also available at <http://www.soc.surrey.ac.uk/sru/SRU16/SRU16.html>.
- Blackburn, R. M., Jarman, J. and Brooks, B. (2000) 'The Puzzle of Gender Segregation and Inequality: a Cross-National Analysis', *European Sociological Review*, 16, 2, 119–35.
- Blau, F. D. and Hendricks, W. E. (1979) 'Occupational Segregation by Sex: Trends and Prospects', *The Journal of Human Resources*, 14, 2, 197–210.
- Charles, M. (1992) 'Accounting for Cross-National Variation in Occupational Sex Segregation', *American Sociological Review*, 57, 4, 483–502.
- Crompton, R. and Harris, F. (1998a) 'Explaining Women's Employment Patterns: "Orientations to Work" Revisited', *British Journal of Sociology*, 49, 1, 118–36.
- Crompton, R. and Harris, F. (1998b) 'A Reply to Hakim', *British Journal of Sociology*, 49, 1, 144–9.
- Crompton, R. and Harris, F. (1998c) 'Gender Relations and Employment: The Impact of Occupation', *Work, Employment & Society*, 12, 2, 297–315.
- Dex, S. (1988) 'Gender and the Labour Market' in D. Gallie (ed.), *Employment In Britain*, Oxford: Basil Blackwell.
- Dumais, L., Messing, K., Seifert, A. M., Courville, J. and Vezina, N. (1993) 'Make Me A Cake As Fast As You Can: Forces For and Against Change in the Sexual Division of Labour at an Industrial Bakery', *Work, Employment & Society*, 7, 3, 363–82.
- Grusky, D. and Charles, M. (1998) 'The Past, Present, and Future of Sex Segregation Methodology', *Demography*, 35, 4, 497–504.
- Hakim, C. (1979) 'Occupational Segregation: A Comparative Study of the Degree and Pattern of the Differentiation between Men and Women's Work in Britain, the United States and Other Countries', *Research Paper No. 9*. London: Department of Employment.
- Hakim, C. (1981) 'Job Segregation: Trends in the 1970s', *Employment Gazette*, December, 521–9.
- Hakim, C. (1992) 'Explaining Trends in Occupational Segregation: the Measurement, Causes and Consequences of the Sexual Division of Labour', *European Sociological Review*, 8, 2, 127–52.
- Hakim, C. (1996) *Female Heterogeneity and the Polarisation of Women's Employment*, London: Athlone.
- Hakim, C. (1998a) *Social Change and Innovation in the Labour Market*, Oxford: Oxford University Press.
- Hakim, C. (1998b) 'Developing a Sociology for the Twenty-First Century: Preference Theory', *British Journal of Sociology*, 49, 1 137–43.
- Jacobs, J. and Lim, S. (1992) 'Trends in Occupational and Industrial Sex Segregation in 56 Countries: 1960–80', *Work and Occupations*, 19, 4 450–86.
- James, D. R. and Taeuber, K. E. (1985) 'Measures of Segregation' in N. B. Tuma (ed.), *Sociological Methodology*, San Francisco: Jossey-Bass.
- Jarman, J., Blackburn, R. M., Brooks, B. and Dermott, E. (1999) 'Gender Differences at Work: International Variations in Overall Occupational Gender Segregation', *Sociological Research Online*, 4, 1, March; <http://www.socresonline.org.uk>.
- Lampard, R. (1994) 'Comment On Blackburn, Jarman and Siltanen: Marginal Matching and the Gini Coefficient', *Work, Employment & Society*, 8, 3, 407–11.
- Low Pay Unit (1999) 'Distant Decency', *The New Review of the Low Pay Unit*, 55, Jan./Feb., 11.
- Parsons, T. (1951) *The Social System*, New York: Free Press.
- Prandy, K. (1997) 'Cambridge Scale Scores for Census Classifications 1961–91', *Working Paper*, no. 26, Cambridge: University of Cambridge, Sociological Research Group.

- Rubery, J. and Fagan, C. (1995) 'Gender Segregation in Societal Context', *Work, Employment & Society*, 9, 2, 213–40.
- Silber, J. (1989) 'On the Measurement Of Employment Segregation', *Economics Letters*, 30, 237–43.
- Silber, J. (1992) 'Occupational Segregation Indices in the Multidimensional Case: A Note', *The Economic Record*, 68, 202, 276–7.
- Siltanen, J. (1990) 'Social Change and the Measurement of Occupational Segregation by Sex: An Assessment of the Sex Ratio Index', *Work, Employment & Society*, 4, 1, 1–29.
- Siltanen, J., Jarman, J. and Blackburn, R. M. (1995) *Gender Inequality in the Labour Market: Occupational Concentration and Segregation*, Geneva: International Labour Office.
- Stewart, A., Prandy, K. and Blackburn, R. M. (1980) *Social Stratification & Occupations*, London: Macmillan.
- Thornley, C. and Coffey, D. (1999) 'The Low Pay Commission in Context', *Work, Employment & Society*, 13, 3, 525–38.
- United Nations (1996) *Human Development Report 1996*, Oxford, New York: Oxford University Press for the United Nations Development Programme.
- Walby, S. (1990) *Theorizing Patriarchy*, Oxford: Basil Blackwell.
- Walby, S. (1997) *Gender Transformations*, London: Routledge.
- Walsh, J. (1999) 'Myths and Counter-Myths: An Analysis of Part-Time Female Employees and their Orientations to Work and Working Hours', *Work, Employment & Society*, 13, 2, 179–203.
- Weeden, K. (1998) 'Revisiting Occupational Sex Segregation in the United States, 1910–1990: Results from a Log-Linear Approach', *Demography*, 35, 4, 475–87.
- Wright, E. O., Baxter, J. and Birkelund, G. (1995) 'The Gender Gap in Workplace Authority: A Cross-National Study', *American Sociological Review*, 60, June, 407–35.

Accepted November 2000

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