Deciphering Sex Segregation

Vertical and Horizontal Inequalities in Ten National Labor Markets

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ABSTRACT
Scholars and policy-makers increasingly treat occupational sex segregation as a generic indicator of female economic disadvantage. This view is difficult to reconcile with evidence that levels of sex segregation are lower in reputably 'gender-traditional' countries such as Italy, Japan, and Portugal than in 'progressive' Sweden and the United States. Understanding such seemingly anomalous patterns requires a two-dimensional conceptualization of occupational sex segregation – in particular, an analytical distinction between vertical and horizontal gender inequalities. Based on data from 10 industrialized countries, claims regarding (1) the hybrid nature of sex segregation and (2) the cultural and structural factors that influence its various components are empirically assessed. Results confirm that unequal distributions across the manual–non-manual divide ('horizontal segregation') and status differentials within these sectors ('vertical segregation') together account for a considerable share of occupational gender inequality. Gender-egalitarian cultural norms are associated with lower levels of vertical segregation in the non-manual sector, while postindustrial economic structures coincide with greater horizontal segregation (and more vertical segregation of non-manual occupations). The complex horizontal and vertical dynamics revealed here cast further doubt on unidimensional conceptualizations of sex segregation. They also provide the key for deciphering some long-standing empirical puzzles in the field.

KEYWORDS: culture, gender, inequality, international, labor market, segregation

In recent decades, scholars and policy-makers have devoted increasing attention to the uneven distribution of women and men across occupations (i.e. 'occupational sex segregation'). Underlying the growing interest is a long-standing commitment to improving women's economic status, combined with mounting evidence that gender-typical employment has deleterious economic consequences for women (e.g. Birkelund, 1992; England, 1992; Cotter et al., 1997; Jacobs, 2003). Invoking universalistic ideals and citing a 'wastage' of female human-capital resources, feminist interest groups, national governments, and international organizations of all sorts have developed countless programs and initiatives aimed at integrating women into traditionally male domains (see,

e.g., Ramirez, 1987; Berkovitch, 1999; Bradley and Charles, forthcoming).

Against this social and cultural backdrop, it is not surprising that scholars tend to treat occupational sex segregation as a generic indicator of gender inequality in the labor market and that they typically adopt a modernist, evolutionary paradigm when considering variability in sex segregation across time and space. Segregation is accordingly conceptualized in unidimensional terms, as a quantity that rises or falls depending upon the level of social or cultural modernity in any given national or historical context. In comparative studies, this evolutionary understanding is reflected in the widespread use of summary sex-segregation indices, with historical change in these index values (or the

absence of such change) treated as an indicator of women's progress toward economic equality (Gross, 1968; England, 1981; Jacobs, 1989, 2003; Nermo, 1996).

In light of dramatic change on other common measures of 'women's status' (e.g. female participation in higher education, the labor market, and the polity), scholars have been perplexed by the relative stability of segregation-index scores in the United States since the turn of the last century. They have likewise been surprised by a series of findings suggesting higher overall levels of sex segregation in Scandinavian societies, which are widely admired for their gender-egalitarian policies and attitudes, than in more 'gender-traditional' countries, such as Italy, Portugal, and Spain (see, e.g. Roos, 1985; Charles, 1992; Jacobs and Lim, 1992; Rosenfeld and Kalleberg, 1991; Jonung, 1998; Melkas and Anker, 2001; Nermo, 2000).

The key to understanding these puzzles lies in rejection of the conventional unidimensional approach and in making the analytical distinction between two forms of distributional inequality: 'horizontal segregation' (i.e. gender differences in distribution across the manual/non-manual divide), and 'vertical segregation' (i.e. differences in the social status associated with men's and women's occupations within the manual and non-manual sectors).

In this article, data from 10 industrialized societies are used to assess empirical support for a more nuanced two-dimensional understanding of occupational sex segregation. A new conceptual framework for understanding the nature and genesis of sex segregation is presented in the following section. The subsequent empirical analyses are divided into two major sections, with the first exploring the descriptive contours of horizontal and vertical segregation, and the second modeling effects of key covariates on cross-national variability in vertical and horizontal segregation. Findings confirm that distributions of men and women across occupations represent the interaction of horizontal and vertical dynamics, and that these inequality dimensions are influenced in specific, non-uniform ways by modern cultural and structural forces.

Deciphering sex segregation

Conventional understandings of sex segregation correspond to what might be termed 'evolutionary' accounts of social stratification. These include modernization and other functionalist theories, which treat ascriptive inequalities (e.g. those deriving from class, race, or gender distinctions) as traditional artifacts that are gradually eliminated with the replacement of traditional with modern values (Kerr et al., 1960; Goode, 1963; Parsons, 1970). They also include neoinstitutionalist accounts. These cite different evolutionary mechanisms (i.e. emergent world-cultural principles of justice and progress, rather than economic or organizational exigencies) but also suggest steadily declining ascriptive-based inequality as universalistic values diffuse and delegitimize particularistic ones (Ramirez, 1987; Meyer, 2001). Some early feminist accounts, namely those treating women's economic position as a function of the degree to which patriarchal relations are entrenched in a particular context, have an evolutionary character as well (e.g. Hartmann, 1981; Huber, 1988). In all cases, gender inequality is understood in unidimensional terms, supporting scholars' focus on the *overall extent* of sex segregation, rather than on its varied components and their differential responsiveness to egalitarian forces.

While these diverse accounts share an assumption that segregation can be represented in unidimensional terms, they vary in their perspectives on historical change and variability. Those who see segregation as persistent or ubiquitous tend to emphasize the strength and durability of patriarchal norms and institutions (Hartmann, 1981; Chafetz, 1988; Ridgeway, 1997; Williams, 2000), while those who see segregation as relatively weak or declining in strength point to the gradual displacement of traditional norms and ideologies with universalistic ones, the diffusion of bureaucratic forms of organization, or the discrimination-eroding effects of the competitive market (Goode, 1963; Ramirez, 1987; see also Jackson, 1998). These discrepant accounts are typically evaluated by examining variability on unidimensional *indices* of segregation. In this sense, there has been a close correspondence between evolutionary conceptualizations and the methodologies that have to date been adopted to describe and compare sex segregation (see Grusky and Charles, 1998).

While there can be little doubt that gender-egalitarian principles and discourse are on the rise in industrialized societies, standard theorizing regarding the impact of these principles on occupational sex segregation is inadequate for

many reasons. Most fundamentally, it is inadequate because two separate dynamics in fact underlie variability in sex segregation. Horizontal segregation refers to segregation across the manual–non-manual divide, specifically women's underrepresentation in manual occupations (e.g. manufacturing, craft) and their overrepresentation in non-manual occupations (e.g. semiprofessional, clerical, sales, service). Vertical segregation refers to hierarchical inequality, specifically men's domination of the highest-status occupations within the manual and non-manual sectors of the economy (see Charles and Grusky, 1995; Grusky and Charles, 1998).[1]

Although distinct vertical and horizontal dimensions of labor market gender inequality have been recognized by some scholars in recent years (e.g. Hakim, 1996; Semyonov and Jones, 1999; Blackburn et al., 2001, 2002), such multidimensionality has not typically been explored in a cross-national comparative context (cf. Blackburn et al., 2000). Moreover, when multiple segregation dimensions have been distinguished empirically, horizontal segregation has not been conceptualized independently; rather it is defined as the residual association between occupation and sex once gender differences in occupational income (or other vertical indices) are taken into account.[2]

Horizontal and vertical segregation are best understood as principally cultural phenomena, reflecting the influence of two deeply-rooted ideological tenets. The first, *gender essentialism*, represents women as more competent than men in service, nurturance, and social interaction (e.g. Epstein, 1999; Gerson, 2002), while the second, *male primacy*, represents men as more status worthy than women and accordingly more appropriate for positions of authority and domination (e.g. Ridgeway, 1997; Bourdieu, 2001). Although biological differences between the sexes (e.g. women's reproductive role, men's greater physical strength) may have contributed to the initial development of these principles, they have subsequently become ideologically and institutionally entrenched and have taken on a life of their own (e.g. Firestone, 1970; Chafetz, 1988; Collins et al., 1993; Huber, 1999).[3] In the following sections, these two dimensions of sex segregation are examined in turn.

Horizontal segregation

Horizontal segregation is maintained and reproduced in large part because non-manual occupations involve tasks (e.g. personal service, nurturance, interpersonal interaction) that are widely regarded as prototypically female, while manual occupations embody characteristics (e.g. strenuousness, physicality, interaction with things) regarded as prototypically male.[4] The linkage between horizontal segregation and these gender-essentialist beliefs arises through several intermediary mechanisms, which are elaborated in Charles and Grusky (in press). These include individual and institutional discrimination (Bielby and Baron, 1986; Reskin and Roos, 1990; Reskin, 2000; Fiske, 1998), internalized preferences and self-evaluations (Parsons and Bales, 1955; Chodorow, 1978; Hakim, 2000; Bourdieu, 2001; Correll, 2001), and expected sanctions (Goffman, 1977; Kanter, 1977; Fenstermaker and West, 2002).[5]

Gender-essentialist ideologies have effects on the occupational structure that are extremely durable, even in the most egalitarian cultural contexts. Although universalistic mandates for equality are difficult to reconcile with blatant male bias in hiring and promotion, the commitment to procedural equality (i.e. 'equal opportunity') does little to change the fact that the individuals at the center of liberal theory are fundamentally 'gendered'. Modern principles of equality have in this sense proven to be quite compatible with at least some essentialist representations of gender difference (see, e.g. Berkovitch, 1999; Elvin-Nowak and Thomsson, 2001; Charles and Bradley, 2002).[6] Stereotypes defining service-oriented work as female and blue-collar work as male therefore have real staying power, influencing labor processes, employment relations, and recruitment practices even in cultural contexts where hierarchical inequalities must be justified in universalistic (i.e. gender-neutral) terms.

Horizontal segregation is likely to be exacerbated, moreover, by processes of post-industrial economic restructuring.[7] During the second half of the 20th century in most industrialized countries, expansion of service industries and the rationalization of economic production have prompted massive flows of middle-class wives and mothers into paid employment and into the non-manual sector – especially into the lower non-manual sector. The mechanisms underlying this effect include: (1) changes in the industrial composition of occupations in favor of industries with functional or symbolic similarities to traditionally female domestic activities, (2) organizational adaptations (e.g. part-time, flexible scheduling)

in the lower non-manual sector that make such work increasingly attractive to women with substantial domestic responsibilities, and (3) increased rationalization and bureaucratization of non-manual work, which creates new opportunities for women at the bottom and top of the white-collar hierarchy (for more on these structural effects, see Oppenheimer, 1973; Charles, 1992, 1998; Esping-Anderson, 1999; Charles and Grusky, in press).

Vertical segregation

Within the manual and non-manual sectors, men's overrepresentation in the highest-status occupations can again be understood in principally cultural terms. But now, the relevant cultural principle is that of 'male primacy', a widespread cultural belief that men are more status worthy than women and accordingly more appropriate for positions of authority and domination. As has long been observed by scholars of social inequality, ideologies of difference (i.e. gender essentialism) are very often converted into ideologies of hierarchy (i.e. male primacy),[8] with members of both dominant and subordinate groups generally agreeing that the former is more status worthy than the latter. Despite the rise of universalistic ideals in industrialized societies, deeply rooted and widely shared cultural beliefs continue to define men's traits as more valuable than women's and men as generally more competent than women (Deaux and Kite, 1987; Ridgeway, 1997).

The cultural value of male primacy is converted into vertical segregation through mechanisms analogous to those generating horizontal segregation: discrimination, internalized self-evaluations, and expected sanctions (see Charles and Grusky, in press).[9] In addition, some women may self-select out of high-status positions, because these are too demanding or time-consuming to be compatible with the heavy domestic responsibilities that they expect to assume (e.g. Becker, 1985; Hakim, 1996).

As liberal norms of equality become more pervasive and deeply rooted, men's and women's educational, familial, and labor market choices, and employers' decisions about hiring, placement, and promotion are influenced less often and to a lesser degree by norms of male primacy. Gender egalitarian cultural principles undermine vertical segregation by reducing discrimination (and expectations thereof), by affecting women's self-evaluations, and by supporting structural changes, such as

state-provided childcare and family-friendly workplaces, that render work and family obligations more compatible (see Charles and Grusky, in press).

These gender-egalitarian pressures do not operate evenly throughout the occupational structure, however. Their impact is most apparent in the *non-manual* sector, due in part to the public visibility and intrinsically more meritocratic cultures of professional and managerial occupations. Because qualification for elite non-manual jobs can often be demonstrated on the basis of formal educational credentials, processes governing allocation to these positions are more strictly meritocratic. Many would-be incumbents of professional and managerial occupations are furthermore highly educated and strongly committed to a labor force career. Women who fall into this category have more at stake in pushing for equal opportunity than do those who view their market roles as secondary (see Hakim (1996) on female labor force heterogeneity).

Egalitarian cultural shifts very often coincide with postindustrial restructuring of the economy. The effect of service-sector expansion and economic rationalization on *horizontal* segregation has been discussed previously. Since structurally induced increases in horizontal segregation occur largely through feminization of the *lower* non-manual sector (e.g. sales, service, clerical occupations), postindustrialism is also likely to generate higher levels of *vertical* segregation within the non-manual sector. This vertical effect partly reflects changes in the nature of the female labor force, as it grows and comes to include a larger share of women who view their market role as subordinate to their domestic one.[10]

The preceding discussion suggests that conventional unidimensional conceptualizations of sex segregation are insufficient because: (1) horizontal segregation is more resistant than vertical segregation to modern universalistic pressures, (2) culturally induced declines in vertical segregation are not across-the-board but rather are concentrated in the non-manual sector, and (3) horizontal segregation and non-manual-vertical segregation may in fact be exacerbated by processes of postindustrial economic restructuring.

The conventional view of sex segregation is also problematic because gender regimes evolve in fundamentally different ways at the aggregate and disaggregate occupational levels. The fore-

going principles of vertical and horizontal segregation speak principally to segregation across *major occupational groups* (e.g. professional, service, manufacturing, craft). When the focus shifts to variability at the level of *specific occupations* (e.g. lawyer, waitress, riveter, jeweler), a host of idiosyncratic institutional forces come into play. Contextual variability in the gender composition of detailed categories may, for example, be influenced by differences in the timing of occupational expansion, the task content of occupations, or the 'woman-friendliness' of the owners, unions, and managers involved in occupational staffing and recruitment. The evolution of sex segregation at the disaggregate level thus proceeds by a wholly different institutional logic that produces idiosyncratic and irregular patterns of cross-national and historical variability (see Grusky and Charles, 1998, 2001; Weeden, 1998). The macro-level regularities discussed above overlay such micro-level particularities.

In the remainder of this article, detailed occupational data from 10 advanced industrial labor markets are used to formally test the foregoing arguments. The descriptive and explanatory analyses, respectively seek to address the following two questions:

1. To what extent can distributional inequalities between men and women in advanced industrial labor markets be described with reference to vertical and horizontal inequality dimensions?
2. To what extent can variability across countries in levels and patterns of horizontal and vertical segregation be attributed to international differences in gender-egalitarian cultural norms and economic structures?

Data and methods

Analyses presented here are based on a new archive of high-quality data on occupational distributions in 10 countries: Belgium, France, Germany, Italy, Portugal, Sweden, Switzerland, United Kingdom, United States, and Japan. This represents a regionally, culturally, and socially diverse set of industrialized countries with market-based economies. Data are organized in the form of a three-dimensional, 1280-cell matrix (64 occupations, by 2 sexes, by 10 countries). The occupational classification employed, which comprises 64 detailed categories distributed across 9 aggregate occupational groups, is

more detailed and cross-nationally harmonized than those available for previous comparative research (see Appendix 1 for sample characteristics, Appendix 2 for occupational classification).

In keeping with the foregoing claim that the vertical and horizontal dynamics of sex segregation play out across aggregate ('major'), rather than 'detailed', occupational categories, horizontal and vertical inequality dimensions are here defined at the level of nine major occupational categories: managers, professionals, associate professionals, clerical workers, service/sales workers, agricultural workers, craft workers, operatives, and laborers. Results of other analyses show no meaningful improvement in fit when vertical and horizontal distinctions are defined at the detailed occupational level (Charles and Grusky, in press).

Vertical inequality is measured based on major-category values of an internationally standardized socio-economic index (SEI) published by Ganzeboom and Treiman (1996). Scores represent weighted averages of incumbents' educational attainment and income. They are highly correlated with occupational prestige scores (for details, see Ganzeboom and Treiman, 1996). SEI values for the nine major groups that comprise the 1988 International Standard Classification of Occupations (ISCO-88) range from 20 (laborers) to 70 (professionals). Scores for all nine categories are provided in Appendix 2.

Horizontal inequality is measured by distinguishing manual from non-manual occupational groups. Occupations in the major managerial, professional, associate professional, clerical, and service/sales groups are defined as non-manual (or 'white-collar'), and occupations in the major agriculture, craft, operative, and laborer groups are defined as manual (or 'blue-collar').[11] In contrast to previous analyses, horizontal segregation is thus directly measured, rather than defined as any residual distributional inequality that is not captured by fitting a vertical effect.

The explanatory models include two key covariates. 'Gender egalitarianism' is here conceptualized as the propensity for individuals in any given national or historical context to reject ascribed gender roles and to apply normative standards of 'equal opportunity' in evaluating the fairness of gender distinctions in the public and private spheres. The pervasiveness of gender-egalitarian principles is indexed using data from the 1990 World Values Survey (WVS)

on the percentage of national respondents 'dis-agreeing' with the statement that 'men have greater rights to jobs during periods of high unemployment'.[12] This survey item provides an excellent indicator of individuals' adherence to gender-egalitarian ideals because the statement's underlying assumption of male economic dominance is at odds with norms of universalism and equal opportunity.

'Postindustrial economic structure' is measured using a composite index, which was constructed by taking the mean of standardized values on two variables: service-sector size and economic rationalization. As discussed above, past research suggests that these structural features are associated with substantial changes in the sexual division of labor in the formal economy (e.g. Oppenheimer, 1973; Charles, 1992; Esping-Anderson, 1999). Service sector size is measured as percentage of the 1990 labor force working in service-industry jobs (i.e. in the commercial, banking, service, transportation, and communication industries), and economic rationalization is measured as percentage of the active labor force working as employees (as opposed to employers, own-account workers, or unpaid family workers) in the same year. Data on economic structure are taken from the ILO's *Yearbook of Labour Statistics* (1990, 1992).[13] Construct validity is high (Cronbach's alpha = 0.76). Country values and zero-order correlations for both explanatory variables are given in Appendix 3.

The analyses that follow involve application and extension of the log-linear and log-multiplicative modeling approach introduced in previous comparative work (e.g. Charles and Grusky, 1995; Grusky and Charles, 1998, 2001). This approach has a number of significant advantages over traditional index-based measurement of sex segregation. Most important for present purposes is that it allows the qualitative contours of sex segregation, in particular its horizontal and vertical components, to be preserved. Findings from pooled 10-country models are based on *unweighted* data. Unless noted, results did not differ substantially when weights were applied to produce country samples of equal size.

Describing the vertical and horizontal dimensions of sex segregation

The foregoing conceptual discussion points to the operation of distinct vertical and horizontal inequality dynamics in industrial labor markets, with the former reflected in the tendency for men to predominate in the highest-status occupational groups within the non-manual and manual sectors, and the latter reflected in men's overrepresentation in the manual sector – despite the lower average status of these occupations. The nature and causal dynamics of sex segregation is thus best appreciated with reference to *three basic components*: (1) vertical segregation within the non-manual sector, (2) vertical segregation within the manual sector, and (3) horizontal segregation (see Charles and Grusky, in press, Figure 4.1).

The descriptive analyses that follow seek to assess the extent to which prevailing patterns of occupational sex segregation can be summarized with reference to these three components (see question 1). The following sub-questions about the nature of horizontal and vertical inequalities are addressed in turn:

1a. Can the relative occupational distributions of men and women in these 10 countries be accurately described with reference to horizontal and vertical distinctions?
1b. To what extent do cross-national differences in occupational distributions of men and women reflect differences in the strength of horizontal and vertical segregation?

Question 1a is addressed by modeling vertical and horizontal segregation separately for each of 10 advanced industrial labor markets, and question 1b is addressed through a series of pooled (i.e. 10-nation) analyses.

Decomposing sex segregation: single-country models

A series of single-country descriptive models allows the strength of vertical and horizontal gender inequalities to be assessed and compared across the 10 labor markets. For each country, the different segregation dimensions are modeled by applying the appropriate (i.e. vertical or horizontal) constraints to the sex-by-occupation interaction term of a simple saturated model:

$$m_{ij} = \alpha \beta_i \gamma_j \delta_{ij}, \qquad (1)$$

where i indexes sex, j indexes occupation ($n = 64$), α is the grand mean for the respective country, β_i is the marginal effect for the ith gender (i.e. 'female labor force participation'), γ_j is the marginal effect for the jth occupation

('occupational structure'), and δ_{ij} is the interaction between occupation and sex (i.e. 'sex segregation'). The constraints, allowing for vertical or horizontal effects, can be represented with the following models:

$$m_{ij} = \alpha\beta_i\gamma_j e^{\psi Z_i V_j},$$
$$\text{and} \tag{2}$$
$$m_{ij} = \alpha\beta_i\gamma_j e^{\omega Z_i H_j},$$

where ψ and ω pertain to the strength of vertical and horizontal association respectively, Z_i is an indicator variable for gender (i.e. $Z_1 = 0$ and $Z_2 = 1$), V_j and H_j are occupational scale values, and the remaining parameters are defined as before. A model that fits *both* vertical and horizontal effects can also be fit, as follows:

$$m_{ij} = \alpha\beta_i\gamma_j e^{\psi Z_i V_j + \omega Z_i H_j}, \tag{3}$$

For each country, the percentage share of total and aggregate-level sex segregation that can be attributed to vertical and horizontal inequalities can be ascertained by contrasting fit statistics from the respective model to those from two baseline models – one of 'no sex segregation,' which allows for no association between occupation and sex, and one of 'aggregate-level sex segregation,' which allows for segregation only at the level of the major occupational categories.

Panel A of Table 1 gives results from models that allow female occupational representation ratios to vary as a linear function of major-category SEI scores. Models allowing the gender composition of occupations to differ only between manual and non-manual occupations, and of models that fit both vertical and horizontal effects are summarized in Panels B and C, respectively. In each case, the first column of figures gives the percentage of total segregation (i.e. segregation across the 64 detailed categories) that is explained by the respective model, and the second column gives the percentage of aggregate-level segregation (i.e. segregation across the 9 major occupational categories) that is explained. Arguments pointing to the idiosyncratic, historically contingent nature of sex segregation across detailed occupations imply that vertical and horizontal dynamics operate primarily at the aggregate-group level. The remaining columns in Table 1 give the relevant vertical and horizontal interaction parameters.

Country-specific levels and patterns of vertical sex segregation can be examined in Panel A. In all 10 countries, the simple relationship between female representation and SEI is weak, with occupational status accounting for between 0 and 5 per cent of total sex segregation and between 1 and 13 per cent of sex segregation across major occupational categories. Since none of the 'sex-by-vertical' interaction terms (ψ) is negative, models in Panel A provide no evidence of female underrepresentation in high-status occupations. Findings from these models are thus consistent with results of previous American research that has found at most small overall status differences between male- and female-dominated work (Treiman and Terrell, 1975; Roos, 1985; Charles and Grusky, 1995; see also Blackburn et al., 2001). They are inconsistent, however, with pure queuing models and with the popular notion that men enjoy a status advantage in the labor market (Strober, 1984; Reskin and Roos, 1990).

Models that allow for only *horizontal* inequalities (Panel B) fit considerably better, accounting for between 18 and 60 per cent of segregation at the major-group level accounted for by this model. As expected, the uniformly negative parameter estimates for the horizontal interaction terms (ω) reveal an across-the-board tendency for female underrepresentation in manual occupations. This result is in agreement with (and no doubt reinforces) essentialist gender ideologies, which define women as naturally suited to personal service, nurturance, and interpersonal interaction and as ill-suited for strenuous, physical labor and work with machines. Levels of horizontal segregation vary across countries, however. Consistent with results from past research (e.g. Roos, 1985; Charles, 1992, 1998; Grusky and Charles, 1998), manual occupations are overall less male-dominated in Japan, Italy, and Portugal than in countries with more postindustrial economies. These cross-national differences are discussed further on.

The models displayed in Panel C allow for both vertical and horizontal segregation. Fit improves considerably relative to both sets of unidimensional models, suggesting that vertical inequalities are substantial once horizontal segregation is taken into account. Indeed, parameter estimates for the horizontal and vertical interaction terms all show stronger effects in Panel C than in either of the corresponding unidimensional models. Moreover, coefficients for the horizontal and vertical segregation terms

Table 1. *Single-country models of vertical and horizontal sex segregation*

Models[a]	Total segregation explained (%)[b]	Aggregate segregation explained (%)[c]	Effect on female representation of	
			Vertical location[d]	Horizontal location[e]
A. Vertical sex segregation only (S + O + S*V)				
Belgium	1.49	3.66	0.01	
France	1.44	2.40	0.01	
Germany	0.89	1.54	0.01	
Italy	3.56	12.78	0.01	
Portugal	0.11	0.52	0.00	
Sweden	0.59	1.02	0.01	
Switzerland	0.38	0.68	0.01	
United Kingdom	0.38	0.71	0.01	
USA	5.44	9.15	0.02	
Japan	0.25	0.61	0.00	
B. Horizontal sex segregation only (S + O + S*H)				
Belgium	17.65	43.48		−1.10
France	24.20	40.41		−1.40
Germany	24.48	42.34		−1.32
Italy	16.59	59.55		−0.83
Portugal	3.76	18.36		−0.49
Sweden	24.00	41.64		−1.53
Switzerland	23.53	42.01		−1.49
United Kingdom	21.20	39.34		−1.39
USA	32.94	55.44		−1.54
Japan	8.42	20.82		−0.65
C. Vertical and horizontal sex segregation (S + O + S*V + S*H)				
Belgium	30.48	75.08	−0.053	−2.37
France	47.70	79.64	−0.086	−3.45
Germany	48.98	84.82	−0.077	−3.14
Italy	21.10	75.73	−0.027	−1.38
Portugal	7.99	39.02	−0.034	−1.19
Sweden	46.08	79.95	−0.080	−3.40
Switzerland	46.16	82.43	−0.080	−3.23
United Kingdom	44.74	83.03	−0.084	−3.34
USA	44.57	75.02	−0.049	−2.69
Japan	31.40	77.63	−0.075	−2.16

Models[a]	Total segregation explained (%)[b]	Aggregate segregation explained (%)[c]	Vertical, nonmanual[d]	Vertical, manual[d]	Horizontal[e]
D. Vertical and horizontal sex segregation, by sector (S + O + S*V + S*H + S*V*H)					
Belgium	34.85	85.84	−0.039	−0.085	−2.89
France	52.70	87.99	−0.066	−0.110	−4.09
Germany	53.18	92.11	−0.062	−0.090	−3.61
Italy	23.36	83.84	−0.017	−0.046	−1.56
Portugal	14.74	71.93	−0.004	−0.089	−1.42
Sweden	50.62	87.84	−0.065	−0.114	−4.13
Switzerland	49.49	88.37	−0.068	−0.101	−3.86
United Kingdom	47.11	87.42	−0.071	−0.077	−3.80
USA	44.94	75.64	−0.045	−0.027	−2.86
Japan	31.52	77.94	−0.078	−0.013	−2.11

[a] O = detailed occupation; S = sex; V = vertical location (major-category SEI scores from Appendix 2); H = horizontal location (manual versus nonmanual sector). [b] Improvement in fit relative to model of 'no sex segregation' (i.e., S + O). [c] Improvement in fit relative to model of 'major-category sex segregation only' (i.e., O + S*G, where G = major occupational group). [d] Effect on female representation associated with a one-point increase in occupational SEI. [e] Effect on female representation associated with manual- (relative to nonmanual-) sector location.

are in all cases negative and in all cases larger than those for the corresponding models in Panels A and B. Values in the first row of Panel C, for instance, indicate that women's representation in Belgian occupations decreases by about 5 per cent with each point increase in SEI (exp[–0.053] = 0.948) and that Belgian women are underrepresented in manual (relative to non-manual) occupations by a factor of 0.09 (exp[–2.37] = 0.093).

Given men's strong overrepresentation in the (generally lower-status) manual sector, it is not surprising that the 'vertical only' models revealed no overall male status advantage. Findings in Panel C of significant vertical segregation *within* sectors suggest that some scholars' long-standing skepticism about the significance of gender parity in mean prestige scores may have been warranted (see, e.g. England, 1979; Acker, 1980). Although the data do not allow the casual direction of the relationship between occupational SEI and gender composition to be ascertained, it is most likely reciprocal, reflecting both male advantage in the competition for desirable occupations and pay 'degradation' in historically female jobs (see, e.g. England (1992) and Catanzarite (2003) on the effects of occupational composition on pay in the United States).

The foregoing results allow some sweeping conclusions about cross-national similarities in occupational sex segregation: Women are everywhere underrepresented in the manual sector; and within the manual and non-manual sectors women's occupations are of lower average status in all 10 countries. It would appear, then, that sex segregation is indeed structured by distinct vertical and horizontal dynamics in industrial labor markets.

Some pronounced cross-national *differences* in levels of vertical and horizontal segregation are evident in Table 1 as well. Taking into account vertical inequality, the highest levels of horizontal segregation are found in France and Sweden, where women are about 30 times more likely to work in the white-collar than in the blue-collar sector (exp[3.45] = 31.50; exp[3.40] = 29.96). In Portugal and Italy, by contrast, the corresponding figures are between 3 and 4 per cent (exp[1.19] = 3.29; exp[1.38] = 3.97). With respect to the vertical dimension, Portugal and Italy again show the weakest segregation; the strongest vertical segregation is found in France and the United Kingdom.

In two countries – Portugal and Italy – weak sex segregation is found on both dimensions.

The low levels of horizontal and vertical inequality in these countries support arguments linking segregation to postindustrial structural developments and their effects on the size and composition of the female labor force. In the absence of demand-side incentives for increased female employment (e.g. economic rationalization, service-sector expansion), women who are formally employed fall largely into two groups. One comprises highly motivated, academically credentialed women who are well qualified for professional and associate professional positions; the other comprises uncredentialed women who work out of economic necessity. Where non-elite white-collar options are limited, women without academic credentials must more often seek access to craft and operative positions (see also Charles, 1992; Charles and Grusky, in press, Appendix Table 3.2).

In Japan – another country for which low overall levels of sex segregation are commonly documented – a different pattern emerges: relatively little segregation on the horizontal dimension, but about average levels of vertical inequality. This result supports arguments by Brinton (1993) and others that the relative gender integration of clerical and manufacturing occupations in Japan is accompanied by significant status inequalities *within* the manual and non-manual sectors (see also Aiba and Wharton, 2001).

The final panel in Table 1 shows results of a series of models that allow levels of vertical sex segregation to vary by sector. Separate vertical segregation terms are estimated for manual and non-manual occupations by adding 'sex-by-vertical-by-horizontal' interaction terms to the models shown in Panel C.[14] Fit statistics in the second column confirm that this 3-parameter specification very well characterizes the structure of sex segregation across major occupational groups. The 3 components of sex segregation together account for between 72 and 92 per cent of aggregate-level sex segregation in these 10 countries.

Parameter estimates for both sets of vertical effects are again uniformly negative, confirming that vertical segregation occurs within both the manual and the non-manual sectors. Vertical coefficients in the first row indicate, for instance, that Belgian women's representation decreases by about 4 per cent in non-manual occupations and by about 8 per cent in manual occupations with every 1-point

increase on the occupational SEI scale ($\exp[-0.039] = 0.962$; $\exp[-0.085] = 0.919$). The corresponding horizontal coefficient indicates that women are underrepresented in manual occupations by a factor of 0.06 in Belgium ($\exp[-2.89] = 0.056$).

Comparison of the two vertical interaction terms for each country suggests that vertical inequalities are considerably stronger in manual than in non-manual occupations in all countries but the United States and Japan. The low level of vertical segregation in the Japanese manual sector can be attributed to the relative integration of craft occupations in that country (see Grusky and Charles, 2001). In the United States, vertical sex segregation is relatively low in both sectors. The causes of such cross-national differences are considered in subsequent explanatory sections. Overall, results are consistent with previous research showing that women have generally made greater inroads in securing good non-manual (e.g. professional and managerial) than manual (e.g. craft) jobs.

Decomposing cross-national variation: pooled models

The causal arguments summarized earlier imply that cross-national variability in the occupational distributions of women and men can be partly attributed to differences in the strength of vertical and horizontal inequalities across aggregate occupational categories. In a second set of descriptive models, summarized in Table 2, the validity of this claim is formally tested though a series of pooled ten-country models (see question 1b). These again depart from two baseline models (Panel A, Models 1 and 2), one which allows for no cross-national variability in level or pattern of sex segregation and one that allows for such variability but only at the level of major occupational categories. Models 3 through 5 allow for cross-national variability in vertical and/or horizontal sex segregation by applying the corresponding constraints to the sex-by-occupation-by-country term of a saturated model. The most general of these specifications, Model 5, may be represented as follows:

$$m_{ijk} = \alpha_k \beta_{ik} \gamma_{jk} \delta_{ij} e^{\psi_k Z_i V_j + \omega_k Z_i H_j}, \qquad (4)$$

with terms defined as before. The two remaining specifications, Models 3 and 4, can be secured by omitting the relevant vertical or horizontal interaction terms.

Findings indicate that about 27 per cent of cross-national variability in total sex segregation and about 60 per cent of cross-national variability in segregation across major occupational categories can be attributed to the combination of vertical and horizontal effects (see line 5). As evidenced by the uniformly negative parameter estimates in Panel C of Table

Table 2. *Cross-national variability in vertical and horizontal sex segregation*

Model[a]	L^2	d.f.	Total Variability Explained (%)[b]	Aggregate Variability Explained (%)[c]
A. Baseline models				
1. No cross-national variability (universal association)				
S*N + O*N + O*S	1,763,819	567	0.0	0.0
2. Variability in major-category effects				
S*N + O*N + O*S + G*S*N	957,588	495	45.7	100.0
B. Models of cross-national variation				
3. Variability in vertical effect				
O*N + O*S + S*N*V	1,639,619	558	7.0	15.4
4. Variability in horizontal effect				
O*N + O*S + S*N*H	1,441,636	558	18.3	40.0
5. Variability in vertical and horizontal effects				
O*N + O*S + S*N*V + S*N*H	1,284,361	549	27.2	59.5

[a] O = detailed occupation; S = sex; N = country; G = major occupation; V = vertical location; H = horizontal location.
[b] The total variability in segregation is given by the L^2 value for model 1. [c] The variability in aggregate (i.e., major-category) segregation is given by the difference between the L^2 values for models 1 and 2.

1, *patterns* of vertical and horizontal segregation are cross-nationally invariant: women are everywhere underrepresented in the manual sector and everywhere overrepresented in lower-status occupations within the manual and non-manual sectors.

Results of other analyses suggest that only a small portion of the cross-national variability left unexplained by Model 5 can be attributed to simple differences in the strength of vertical or horizontal segregation measured at the detailed occupational level (see Charles and Grusky, in press). Sex segregation across detailed occupations is extreme, but it follows no clear pattern, as it is shaped by a wide array of idio-syncratic political, economic, and social forces (see also Bielby and Baron (1986) on the idio-syncratic nature of gender segregation across detailed job titles in organizations).

The foregoing analyses confirm that there is much cross-national commonality in sex-segregation profiles and that this commonality can be described with reference to three basic segregation components. Results also suggest substantial cross-national variability in the strength of these three inequality forms. The arguments advanced above treat these differences in strength as a product of international differences in gender-egalitarian cultural norms and postindustrial structural features. The remainder of this article is devoted to assessing the empirical validity of these causal arguments.

Accounting for cross-national variability

Evolutionary theories of inequality imply less sex segregation in contexts where universalistic ideals have more deeply penetrated individual identities, social institutions, and national cultures (e.g. Goode, 1963; Ramirez, 1987; Meyer, 2001). The preceding discussion suggests two qualifications to such cultural accounts. The first is that liberal principles of equality do more to undermine vertical than horizontal gender inequalities; the second is that cultural effects on vertical segregation are concentrated in the non-manual sector.

A further complication is that structural developments common to modern economies, in particular service-industry expansion and economic rationalization, may exacerbate sex segregation, first by contributing to feminization of the non-manual occupations (i.e. increased horizontal segregation), and second by promoting vertical segregation within that sector. This combination of effects, whereby postindustrialism is associated with both horizontal and (non-manual) vertical segregation, may help account for the strong positive correlation between vertical and horizontal segregation observed for these 10 countries.[15]

The models presented in the following sections are designed to assess effects of gender-egalitarianism and postindustrialism on sex segregation's three components: horizontal segregation, vertical segregation within the non-manual sector, and vertical segregation within the manual sector. The following hypotheses can be derived from the preceding discussion.

Effects on horizontal segregation

H1. Horizontal sex segregation is stronger in postindustrial economies.

H2. Horizontal sex segregation is unrelated to gender egalitarianism.

Overall effects on vertical segregation

V1. Vertical sex segregation is weaker in more gender-egalitarian contexts.

V2. Vertical sex segregation is stronger in postindustrial economies.

Sector-specific effects on vertical segregation

HV1. The negative effect of egalitarianism on vertical sex segregation is restricted to the non-manual sector.

HV2. The positive effect of postindustrialism on vertical segregation is restricted to the non-manual sector.

Serving as baseline for the first series of explanatory analyses is again a model of 'universal association', which allows for cross-national variability in occupational structure and labor-force gender composition but requires the gender composition of all occupations to be invariant across countries (Model 1, Table 3). The first 'vertical and horizontal effects' model includes, in addition, four three-way interaction terms, corresponding to the cultural and structural effects hypothesized above (i.e. under

Table 3. *Cross-national variability in vertical and horizontal sex segregation: covariate effects*

	L²	d.f.	Aggregate variability explained
1. 'Universal association' model (S*N + O*N + O*S)	1,763,819	567	0.0
2. 'Vertical and horizontal effects' model (MODEL 1) + (S*V*GENDER EGALITARIANISM) + (S*H*GENDER EGALITARIANISM) + (S*V*POST-INDUSTRIALISM) + (S*H*POST-INDUSTRIALISM)	1,397,827	563	45.4%
3. 'Vertical and horizontal effects' model + interactions (MODEL 2) + (S*V*H*GENDER EGALITARIANISM) + (S*V*H*POST-INDUSTRIALISM)	1,371,614	561	48.6%

Note: The variability in aggregate segregation is given by the difference between the L² values for Models 1 and 2 in Table 2.

H1 through V2): sex-by-horizontal-by-post-industrialism, sex-by-horizontal-by-egalitarianism, sex-by-vertical-by-egalitarianism, sex-by-vertical-by-postindustrialism (Model 2, Table 3). This model can be represented as:

$$m_{ijk} = \alpha_k \beta_{ik} \gamma_{jk} \delta_{ij} e^{\psi_k(Z_i V_j) + \omega_k(Z_i H_j)}, \text{ where}$$
$$\psi_k = a_1 + b_{11}X_{1k} + b_{21}X_{2k}, \text{ and} \qquad (5)$$
$$\omega_k = a_2 + b_{12}X_{1k} + b_{22}X_{2k},$$

with X_{1k} and X_{2k} referring to the country-level measures of gender egalitarianism and postindustrialism. Under this specification, the coefficient for vertical segregation (ψ_k) is constrained to be a function of the two country-level covariates (gender egalitarianism and postindustrialism), and the coefficient for horizontal segregation (ω_k) is likewise constrained to be a function of the two country-level covariates.

Results of Model 2 show that about 45 per cent of cross-national variability in aggregate-level sex segregation is accounted for by effects of postindustrialism and gender egalitarianism on vertical and horizontal segregation. Parameter estimates for the key horizontal and vertical interaction terms are given in Table 4. These are discussed in the following two sections.

Effects on horizontal segregation
The association between postindustrialism and horizontal segregation is strongly positive, with a one-unit increase on this scale corresponding to a two-fold increase in horizontal segregation (exp[.7074] = 2.03). This finding is consistent with hypothesis H1, and with arguments positing increasing feminization of white-collar occupations with service-sector expansion and economic rationalization.

No effect of gender egalitarianism on horizontal segregation was expected (hypothesis H2). Results suggest, though, that horizontal segregation is in fact *stronger* in more gender-egalitarian cultural contexts. This unexpected positive relationship may be attributed to greater heterogeneity of the female labor force in more egalitarian cultural contexts. On one hand, liberal norms of gender equality are associated with higher numbers of highly educated, career-committed women and thus with increased female access to elite non-manual occupations. On the other hand, growing normative acceptability of female employment encourages labor force participation even among women who regard their domestic roles as primary and who are not interested in (or qualified) for professional jobs. These 'new entrants' may view part-time clerical or associate professional work as an attractive option for balancing work and family obligations.[16] The combination of such 'elite' and 'non-elite' effects may generate increased horizontal segregation in more gender-egalitarian cultural contexts. Results thus indicate that *both* postindustrialism and gender egalitarianism are associated with higher levels of horizontal sex segregation.

Effects on vertical segregation
As expected (see hypotheses V1 and V2), parameter estimates from Model 2 show that vertical

Table 4. *'Vertical and horizontal effects' models: parameter estimates*

	Estimate	Observed effect (predicted effect)
Model 2		
Female × SEI × Egalitarianism:	0.0001[a]	↓Vertical (↓)
Female × Manual × Egalitarianism:	–0.0118[b]	↑Horizontal (0)
Female × SEI × Post-industrialism:	–0.0156[c]	↑Vertical (↑)
Female × Manual × Post-industrialism:	–0.7074[d]	↑Horizontal (↑)
Model 3		
Female × SEI × Egalitarianism (non-manual sector):	0.0003	↓Vertical (↓)
Female × SEI × Egalitarianism (manual sector):	–0.0008	↑Vertical (0)
Female × Manual × Egalitarianism:	–0.0165	↑Horizontal (0)
Female × SEI × Post-industrialism (non-manual sector):	–0.0196	↑Vertical (↑)
Female × SEI × Post-industrialism (manual sector):	0.0138	↓Vertical (0)
Female × Manual × Post-industrialism:	–0.6284	↑Horizontal (↑)

Note: Values are interaction terms from Table 3, Models 2 and 3. [a] Effect of one percentage-point increase in gender-egalitarianism on female SEI. [b] Effect of one percentage-point increase in gender-egalitarianism on female representation in manual occupations. [c] Effect of one-unit increase on the post-industrialism scale on female SEI.
[d] Effect of one-unit increase on the post-industrialism scale on female representation in manual occupations.

segregation is negatively related to gender-egalitarianism, but positively related to postindustrialism. The cultural effect, with its scale value of 0.0001, appears to be weak, however. The small overall effect may be attributed to the unevenness of egalitarian pressures, specifically their concentration in the non-manual sector. Such sector-specific effects are explored next.

Sector-specific effects
Hypotheses HV1 and HV2 hold that each covariate's effect on vertical segregation is restricted to the *non-manual sector*. To assess sector-specific effects on vertical segregation, two four-way interaction terms are added to Model 2. Effects of covariates are thereby allowed to differ between manual and non-manual occupations (Model 3, Table 3).[17] Addition of the two interaction terms modestly improves model fit, with explained aggregate-level variation increasing from 45 to 49 per cent. As can be seen in Table 4, the effects on horizontal segregation are little changed relative to Model 2, with the exception of a slight weakening of the positive postindustrialism effect. With regard to vertical segregation, clear interactions are evident, however.

As expected, both the negative impact of egalitarianism and the positive impact of postindustrialism on vertical segregation are restricted to the non-manual sector. Unexpectedly, though, the effects in the manual sector are exactly the opposite of those in the non-manual sector: vertical segregation of manual work is *positively* associated with gender egalitarianism and *negatively* associated with postindustrialism. A final set of explanatory analyses, which model segregation across major occupational groups, may help identify the occupational sources of these and other effects.

Major-category effects
Since many of the foregoing arguments posit effects at the level of aggregate occupational categories (e.g. equality norms promote increasing female representation in professional and managerial occupations; service-sector expansion effects feminization of clerical and sales occupations), modeling determinants of sex segregation across major occupational groups makes good theoretical sense. Such a specification makes empirical sense as well, given evidence of disorderly, idiosyncratic patterns of sex segregation at the detailed occupational level (see Grusky and Charles, 1998; Charles and Grusky, in press).

A strictly aggregate-level specification is not entirely unproblematic, however, because such models risk confounding cross-national differences in covariate effects with cross-national differences in the composition of major-group categories (i.e. the relative sizes of the detailed occupations comprising these categories). This problem can be addressed

through introduction of explanatory variables into the multi-level model featured in previous work (Charles and Grusky, 1995; Grusky and Charles, 1998, 2001). This specification allows covariates' effects on female representation in each of nine major occupational categories to be ascertained after the data have been purged of micro-level 'noise' (i.e. net of cross-national differences in the composition of the major categories). It thus represents a significant step forward, both conceptually and methodologically.

This multi-level model can be represented as follows:

$$m_{ijk} = \alpha_k \beta_{ik} \gamma_{jk} \delta_{ij} e^{Z_i V_{jk} + Z_i \varphi_{ck}}, \qquad (6)$$

with i indexing sex, j indexing occupation, k indexing country, φ_{ck} referring to the scale values for major occupational categories (indexed by c), Z_i serving as an indicator variable for gender (i.e. $Z_1 = 0$ and $Z_2 = 1$), and φ_{ck} referring to the scale values for detailed occupations nested in these major categories. In this case, however, the φ_{ck} terms are constrained to be linear functions of country-level explanatory variables:

$$\varphi_{ck} = \alpha_c + b_{1c} X_{1k} + b_{2c} X_{2k}, \qquad (7)$$

where α_c is the intercept for the cth major occupational category, b_{1c} is the slope indicating the effect of gender egalitarianism on the strength of sex segregation in the cth major occupational category, b_{2c} is the slope indicating the effect of postindustrialism on the strength of sex segregation in the cth major occupational category, and X_{1k} and X_{2k} refer to the country-level measures of these two covariates. The two slope coefficients in Equation 7 specify the relationship between the independent variables and female representation in each major occu-

pational category after cross-national differences in the micro-level composition of these categories have been purged.

Table 5 shows fit statistics from two nested models. Comparing the fit of the explanatory model (Model 2) with that from a specification that constrains the (purged) gender composition of major occupational groups to be identical in all 10 countries (Model 1) shows that nearly three-quarters (74.6 per cent) of cross-national variation in men's and women's distributions across major occupational groups can be accounted for with reference to these two covariates.

Slope coefficients for Model 2 are displayed in Table 6. These provide information on the strength and direction of the relationship between the respective covariate and female representation in each occupational group. In the first column and row, for example, the value 0.018 indicates a positive association between gender egalitarian cultural norms and women's representation in managerial occupations (net of cross-national variability in the composition of this major category). A one-point increase in the percentage of the national population expressing gender-egalitarian views is associated with a 2 per cent increase in female representation among managers ($\exp[0.018] = 1.02$).

These coefficients provide insights as to the occupation-specific mechanisms by which the cultural and structural covariates may affect vertical and horizontal segregation. Figures in the first column confirm that gender egalitarianism reduces vertical segregation of non-manual workers through its positive effect on women's professional (and to a lesser extent managerial) representation. The occupation-specific mechanisms by which gender egalitarianism generates horizontal segregation are revealed in the uniformly positive coefficients for

Table 5. *Cross-national variability in sex segregation across major occupational categories: covariate effects*

	L^2	d.f.	Aggregate variability explained
1. *'Universal association' + micro-level compositional effects*	270,266	72	0.00%
2. *Explanatory model: purged major-category effects* (MODEL 1) + ((GENDER EGALITARIANISM + POST-INDUSTRIALISM)*(MAJOR OCCUPATIONAL GROUP))	68,614	56	74.61%

Note: The variability in aggregate-level segregation is given by the L^2 value for Model 1.

Table 6. *Sex segregation across major occupations: parameter estimates for covariate effects*

	Gender egalitarianism	Post-industrialism
Managers	0.018	0.096
Professionals	0.023	−0.301
Assoc Prof	0.015	−0.062
Clerical	0.017	0.379
Service/Sales	0.007	0.296
Agriculture	−0.046	0.044
Craft	−0.030	−0.177
Operatives	0.013	−0.235
Laborers	−0.019	−0.041

Note: Values are slope coefficients (b_{1c} and b_{2c}) from Model 2, Table 5.

the five non-manual categories, and the negative coefficients found for three of four manual categories. Again, the positive cultural effects at the bottom of the non-manual hierarchy may be attributable to higher rates of labor force participation among less career-committed women in more gender-egalitarian cultural contexts. By legitimating women's equal right to engage in public-sphere activities (including market work), universalistic cultural principles decrease normative barriers to employment of even those women who regard their domestic roles as primary. Such women are likely to regard associate professional, sales, or clerical work as an attractive option for balancing work and family obligations. Those who work intermittently or part-time have relatively little to gain from questioning essentialist stereotypes that depict men as better suited for manual jobs.

Parameter estimates in the second column of Table 6 – in particular, the strong positive effects on female representation in the clerical and service/sales categories – confirm a tendency for greater horizontal segregation in contexts characterized by large service sectors and large employee classes. The strongest effects are for clerical occupations, where a one-point increase on the postindustrialism scale is associated with an increase of 46 per cent in female representation (exp[0.379] = 1.46), and for sales/service occupations. A smaller but still positive effect of postindustrialism on women's managerial representation is consistent with the notion that economic rationalization leads to increased demand for female managerial workers to help coordinate and supervise large numbers of less skilled service workers. Results thus point to an overall positive effect of postindustrialism on women's representation in non-

manual occupations (i.e. increased horizontal segregation), but with stronger positive effects at the bottom of the non-manual hierarchy (i.e. increased vertical segregation).

Readers may recall that interaction coefficients from the preceding set of models revealed some unexpected covariate effects on vertical segregation in the manual sector – specifically, a positive effect of egalitarianism and a negative effect of postindustrialism (see Model 3, Table 4). Examination of parameter estimates in Table 6 suggests that vertical segregation in the manual sector is driven predominantly by variability in the gender composition of craft and operative occupations, the two largest manual categories.[18] Gender egalitarianism is associated with increased vertical segregation in the manual sector by virtue of its negative effect on female representation in craft occupations and its positive effect on female representation in operatives occupations. Postindustrialism, on the other hand, coincides with weaker female representation in all blue-collar categories, but the negative coefficient is stronger for operatives than for crafts occupations. Results therefore show an overall negative effect of postindustrialism on vertical inequality in this sector.

Relationships are robust to changes in sample weights and model specification. Except for modest reductions in the effect of gender egalitarianism on female managerial representation, parameter estimates did not differ substantially when data were weighted to produce equal national sample sizes. Univariate models and a model that included a control for female educational attainment also yielded similar parameter estimates.

Conclusions

The object of the foregoing analyses was to formally model the horizontal and vertical dimensions of sex segregation and to explore effects of theoretically relevant explanatory variables on these inequality dimensions.

Results confirm the fundamentally hybrid nature of occupational sex segregation. At least in these 10 industrial market economies, sex segregation reflects the interaction of vertical and horizontal inequality dynamics operating at the level of major occupational groups. Horizontal segregation is manifested in the extreme sex-typing of the manual and non-manual sectors, with men everywhere overrepresented in manual occupations, despite the lower average social status of this work. Vertical segregation is manifested in a tendency for men to predominate in the highest-status manual and non-manual occupations (e.g. crafts, elite professions/management). The ubiquitous vertical inequality revealed here provides support for claims that sex segregation results from a matching process whereby men get 'first dibs' on the most attractive jobs (e.g. Strober, 1984; Reskin and Roos, 1990), but this hierarchical inequality reveals itself only when measured *within* the manual and non-manual sectors (i.e. net of horizontal segregation).

Although cross-national variability in aggregate-level sex segregation cannot be so parsimoniously described as with a single index value, findings demonstrate that it can be very well represented with reference to three basic inequality components: horizontal segregation, vertical segregation of non-manual occupations, and vertical segregation of manual occupations.

To help account for the substantial cross-national variability in levels of vertical and horizontal segregation, new explanatory modeling methods were applied to the 10-nation data set. Findings provide further reason to question theories and analytical approaches that assume across-the-board effects of cultural or structural modernization. Rather than exerting uniform segregating or integrating pressures, cultural egalitarianism and postindustrialism influence specific *components* of segregation. Cultural egalitarianism, for instance, is associated with lower levels of vertical sex segregation in the non-manual sector, but with greater segregation of the other two varieties. Likewise, postindustrialism is positively related to two forms of segregation (horizontal and nonmanual–vertical segregation), but negatively related to the third. Findings are consistent with those from previous comparative studies of gender stratification, which have revealed uneven, localized effects of cultural and structural variables.[19]

An appreciation of the distinct vertical and horizontal dynamics of sex segregation is essential for understanding counterintuitive patterns of cross-national variability in overall levels of occupational sex segregation that have been documented by American and European researchers (e.g. Roos, 1985; Anker, 1998; Jonung, 1998). The present findings suggest, for instance, that Sweden's high segregation-index scores may be attributed, at least in part, to the segregative effects of a very large service sector and high levels of female labor force participation. Moreover, the expected benefits of cultural egalitarianism (i.e. increased female representation in the upper non-manual sector) are at least partially offset by a tendency for stronger horizontal segregation in more gender-egalitarian cultural contexts. A comparison of occupational distributions by sex in egalitarian welfare states (e.g. Sweden) with those in more traditional societies (e.g. Italy, Japan) suggests that the segregating effects of economic and cultural modernity may indeed overpower their integrating ones.

The horizontal–vertical distinction is also essential for deciphering other long-standing puzzles in the field, including the slow, uneven rate of historical change in overall levels of occupational sex segregation, and findings of relative parity in the 'average' prestige of male- and female-dominated occupations.

Norms against ascriptive discrimination in more culturally egalitarian contexts are difficult to reconcile with the sorts of blatantly discriminatory practices that have historically protected male monopolies in such key public-sphere institutions as higher education, the polity, and the labor market. The gradual elimination of *formal* legal and organizational barriers to full female participation in educational and market institutions has enabled increasing numbers of women to acquire the human and social capital necessary for accessing high-status occupations in the non-manual sector. But, while formal barriers to female occupational attainment have been significantly reduced, most men and women continue to understand their roles and aptitudes in highly gendered terms, based in large

part on deeply institutionalized, widely shared notions of 'natural' male and female qualities. Essentialist stereotypes about gender difference thus continue to influence family, educational, and occupational preferences and choices. These help account for the resilience of sex segregation in modern economies.

Acknowledgements

Notes

1. Of course, hierarchical inequality occurs both within and across occupations (see, e.g., Kalleberg and Reskin (1994) and Hultin (1998) on gender differences in workplace authority). This article focuses on the latter.
2. This approach is likely to result in underestimation of vertical inequality (relative to horizontal inequality), because the horizontal component of segregation, as measured, actually represents the sum of segregation across the manual–nonmanual divide and unmeasured vertical and horizontal inequalities. The relative importance of vertical and horizontal inequalities and the interactions between these dimensions can be much better assessed if each is measured independently.
3. These principles may well have functionalist origins. In societies characterized by high fertility, low productivity, and short life expectancy, a sexual division of labor in which women specialize in bearing and rearing children may result in large economic efficiency gains for families and communities. Likewise, in societies that rely heavily on physical strength (e.g. hunting and gathering societies), men may leverage their advantage on this trait into power over women. Whatever their origins, these gender distinctions become highly institutionalized over time, allowing them to persist even after the originating economic or social pressures disappear (see Charles and Grusky, in press).
4. On ideologies of gender difference, see Epstein (1988); Lorber (1993); Crompton (2001); Gerson (2002). Although characterizations of male and female traits are undoubtedly complex and situationally contingent (e.g. Flax, 1990; Baca Zinn and Thornton Dill, 1996), certain 'core' features can be identified.
5. Of course, sex segregation across the manual–non-manual divide is also generated by factors unrelated to gender essentialism – for example, average gender differences in upper-body strength, and gender-specific network ties within the manual sector. Moreover, the relationship between occupational task content and segregation is not unidirectional. Although the task content of new occupations was perhaps one principal determinant of their initial sex composition, historical studies suggest that occupations tend to change in ways that bring their task content into better alignment

6. with their sex composition (see, e.g., Kessler-Harris, 1982; Milkman, 1987).
7. Even within the feminist movement, the cultural intractability of gender essentialism is evident in the so-called 'equality versus difference' debates (e.g. Scott, 1988; Crompton, 1999; Epstein, 1999).
8. The term 'postindustrial' here refers to the structural characteristics of advanced industrial economies, in particular the large share of the economy that is devoted to provision of services (as opposed to production of goods) and the highly differentiated, specialized labor processes.
9. See Tilly (1998) on the intersection of 'categories' and 'hierarchies'. See also Connell (1987), Chafetz (1988), Epstein (1988), Ridgeway (1997), and Bourdieu (2001) on the relationship between gender roles and male dominance.
10. Internalized preferences may be less important to the generation of vertical inequalities, since relatively few women have intrinsic tastes for lower-status occupations per se (but see Bourdieu (2001) on male domination and the resultant female tastes for subordination).
11. Increased possibilities for outsourcing of domestic work in economies with large service sectors might arguably facilitate female employment in demanding (e.g. professional or managerial) occupations and thereby *negatively* affect vertical sex segregation. Any such 'offloading' effect is probably weak, however. Moreover, possibilities for delegating childcare and domestic work would seem no more likely to affect the labor supply of elite women (i.e. potential professionals) than to affect that of less career-committed women (i.e. potential clerks and sales workers).
12. By design, manual–non-manual distinctions figure prominently in the ILO's definition of major occupational groups. Only one group, 'laborer', includes both manual and non-manual workers. Because the overwhelming majority of 'laborers' perform tasks that require substantial physical effort (e.g. construction, manufacturing, domestic work), all occupations in this group are designated as manual.
13. Because this item was not available for Switzerland in 1990, Swiss data are taken from the 1995 WVS. Data for other countries suggest little change in these values between 1990 and 1995.
14. Japanese data are for 1991.
15. Under this interactive specification the size of the horizontal parameter depends upon the implied zero point of the SEI scale. The zero point is fixed at 37, the midpoint between the score of the lowest non-manual category (40) and that of the highest manual category (34).
16. See, e.g., Panel C of Table 1. A weaker correlation between vertical and horizontal segregation would likely obtain in samples of countries that are more homogeneous with respect to levels of post-industrial economic development.
17. Despite their relatively low pay, such positions are more prestigious than many blue-collar jobs, and they may be more easily reconciled with part-time schedules and intermittent employment. Moreover, women who work part-time or intermittently have weaker incentives to transgress traditional gender norms and to seek access to male-typed industrial and craft jobs.
18. The SEI variable is again rescaled for the interactive specification (see note 14).
19. Due to the relatively small sizes of the laborer and agricultural categories in these countries, results in Table 4 are influenced only weakly by variability in the gender composition of these occupations.
20. On occupational sex segregation, see Charles (1992, 1998) and Chang (2000); on sex segregation within higher education, see Charles and Bradley (2002).

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Appendix 1. *Sample characteristics*

Country	Census year	Sample size
Belgium	1991	3,418,512
France	1990	900,255
West Germany	1993	128,912
Italy	1991	21,071,282
Portugal	1991	4,037,130
Sweden	1990	4,059,813
Switzerland	1990	3,076,445
United Kingdom	1991	2,405,091
United States	1990	1,152,885
Japan	1990	12,220,974

Appendix 2. *Occupational classification: major and detailed occupational categories*

Manager (SEI: 55)
    Manager

Professional (SEI: 70)
    Physical science
    Architect and engineer
    Life science
    Health
    Professor
    Secondary teacher
    Other teacher
    Business professional
    Lawyer and related
    Social science and related
    Religious professional

Assoc. Professional (SEI: 54)
    Physical science
    Inspector and related
    Life science and health
    Nursing and midwife
    Primary teacher
    Other teacher
    Finance and sales
    Agent and broker
    Admin. and social work
    Customs, tax and related
    Art, entertaining and sport

Clerical (SEI: 45)
    Office clerk
    Material-recording
    Cashier and teller
    Client information

Service and Sales (SEI: 40)
    Travel attendant
    Housekeeping and related
    Personal care and related
    Other personal service
    Protective service
    Salesperson and related

Agric. and Fishery (SEI: 23)
    Farmer
    Forestry and fishery

Craft (SEI: 34)
    Miner and cutter
    Building finisher
    Painter and related
    Metal molder and related
    Blacksmith and related
    Machinery mechanic
    Electrical mechanic
    Metal precision
    Handicraft
    Printing and related
    Food processing
    Cabinet-maker
    Textile and garment
    Pelt, leather and shoe

Operative (SEI: 31)
    Wood processing
    Other stationary plant
    Metal and mineral
    Chemical and related
    Wood product operative
    Textile and related
    Food and related
    Assembler
    Locomotive
    Motor vehicle
    Mobile plant operator

Laborer (SEI: 20)
    Vendor and domestic
    Messenger and related
    Mining and construction
    Manufacturing and related

Note: See Charles and Grusky (in press) for details on occupational classification. Major-category SEI scores are from Ganzeboom and Treiman (1996).

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Appendix 3. *Descriptive statistics for explanatory variables*

	Gender-egalitarianism	Post-industrialism
Belgium	51.52	0.47
France	58.95	0.13
Germany (West)	58.46	0.11
Italy	47.66	−1.06
Portugal	54.27	−1.94
Sweden	87.93	0.87
Switzerland	54.70	0.09
United Kingdom	58.62	0.49
United States	71.06	1.04
Japan	25.71	−0.21
Mean	56.89	0.00
(Standard Deviation)	(15.89)	(0.90)
Zero-order correlation		
Gender Egalitarianism	1.00	
Postindustrialism	0.50	1.00

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