

# The Evolution of Gender Segregation over the Life Course

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## Abstract

We propose a measure of gender segregation over the life course that includes differences between women and men in occupational allocation, degree of time involvement in paid work, and their participation in different forms of economic activity and inactivity, such as paid work, homemaking, and retirement. We pool 21 Labour Force Surveys for the United Kingdom to measure, compare, and add up these various forms of segregation—occupational, time-related, and economic—from 1993 to 2013 ( $n = 1,815,482$ ). The analysis relies on the Strong Group Decomposability property of the Mutual Information index. There are four main findings. First, the marketplace is the major contributor to gender segregation. Second, over the life course, the evolution of gender segregation parallels the inverted *U*-shaped pattern of the employment rate. Third, a tradeoff between occupational and non-occupational sources of segregation defines three distinct stages in the life course: the prime childbearing years, the years when children are school age, and the retirement years. Fourth, to a large extent, women's heterogeneity drives age patterns in segregation.

## Keywords

economic activity and inactivity, gender, homemaking, life course, Mutual Information index, occupations, part-time, retirement, segregation

Gender scholars have proposed several overarching accounts of gender that portray it as an “order,” “system,” “social structure,” or “institution” (see, respectively, Connell 1987; Ridgeway and Correll 2004; Risman 1998; Martin 2004). One pillar of the “gender order” is the allocation of paid and unpaid tasks to women and men (Connell 1987), that is, gender segregation. We study this topic from a life course perspective.

At every age, women and men find themselves in different “positions” or “states” (Kohli 2007). Traditionally, society has expected a “lock-step progression” through schooling, full-time paid employment, and retirement that

many individuals, especially women, fail to fulfill (Moen 2005). Since the 1990s, women have kept pace with men through the education phase. However, as soon as schooling ends, the

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life stages of many women, but not men, are defined by both homemaking and wage-earning (Brückner and Mayer 2005). Many women engage in housework and childcare full-time or combine work at home and in the marketplace via reduced-hour employment (Bianchi, Robinson, and Milkie 2007; Cooke 2011; Gornick and Meyers 2003; Jacobs and Gerson 2004; Nitsche and Grunow 2016; Pettit and Hook 2009; Stone 2008). Turning to the process of retirement from wage labor, which occurs in significant numbers among people in their late 50s or older (Blundell and Johnson 1998), gender gaps in retirement age (Dahl, Nilsen, and Vaage 2003; Radl 2012), the incidence of poor health among older individuals, and the combination of retirement and reduced hours of paid work (Lain 2012; O’Rand and Henretta 2000) open up other channels of segregation at this stage.

Briefly, our lives are gendered from the cradle to the grave (Arber and Ginn 1991; Lorber 1994) and, at any given age, women and men are simultaneously segregated along a number of dimensions. Among the employed population, segregation arises because women and men not only tend to work in different occupations (for literature reviews on occupational segregation, see Flückiger and Silber 1999; Steinmetz 2012), but also because they confront varying time requirements in their occupations. These well-known facts have motivated some researchers to incorporate into their measure of segregation the degree of time devoted to paid work (see, e.g., Elliott 2005; Fagan and Rubery 1996; Watts and Rich 1992). In our approach, we identify these two dimensions of segregation in the marketplace, occupations and their time requirements, and integrate them into the measure of what we call “market segregation,” that is, the segregation that originates because women and men in paid work tend to work a varying number of hours in different occupations.

However, segregation between women and men does not stop at the market’s border. To be sure, much research has emphasized the connection between gender inequality and the division of labor between home and market

(Acker 1988; Chafetz 1988; Connell 1987; Cooke 2011; Crompton 2006; Damaske 2011; Glucksmann 1995; Gornick and Meyers 2003; Lorber 1994; Pettit and Hook 2009; Pfau-Effinger 2004). In this vein, Cohen (2004) and Hook and Pettit (2016) extend the domain of gender segregation beyond market activities by including an additional category—for, respectively, homemaking and all forms of economic inactivity—as if it were yet another occupation in the marketplace. We develop this approach by taking on other sources of segregation in connection with an individual’s broad relationship to the labor market: from gender differences in unemployment rates (Azmat, Güell, and Manning 2006) to non-market sources of segregation that become salient at stages in the life course that do not coincide with the core working years. For example, many members of the younger population are full-time students, whereas the proportions of the permanently sick and retirees grow in the later years. Combined with paid employment and homemaking, these are the most relevant “economic statuses,” or forms of economic activity and inactivity, that official statistics usually record. For the first time, this study measures the segregation that stems from disparities in the gender distribution over multiple economic statuses. We call this “economic segregation” for short.

Additionally, we propose a measurement framework that is capable of summing (1) economic segregation and (2) market segregation scaled down by the employment rate. We reserve the term “gender segregation” for the weighted sum of components (1) and (2) that extends the domain of segregation from the employed population to the entire population.

A gender segregation index measures how differently women and men distribute over a set of organizational units (Flückiger and Silber 1999). We show that a segregation index that satisfies the Strong Decomposability (*SD* hereafter) property allows us to compute the sum of economic and market segregation, as well as identify segregation for each year of age net of cohort and period effects. Essentially, a segregation index satisfies the *SD* property if, for any

partition of the organizational units into clusters, the overall segregation can be expressed as the sum of (1) a between-group term, capturing the uneven distribution of men and women over the clusters, and (2) a within-group term, which is the weighted sum of the segregation indices within the clusters with weights equal to their demographic importance. We use the Mutual Information index (the *M* index hereafter) because it is the only multigroup segregation index that, together with other desirable properties, satisfies the *SD* property (Frankel and Volij 2011).

From a conceptual point of view, we provide an integrated framework for the identification of gender segregation and its sources as people age and change occupations, time arrangements, and economic status. With the exception of wages, these are the major topics of study that make up the field of “gender inequality.” In addition, our approach enables quantification of the relative magnitude for each component of gender segregation at any life stage.

To illustrate our approach, we revisit the case of gender segregation in the United Kingdom, a country with a long tradition of gender segregation studies and for which large datasets are available. We analyze 21 cross-sections of data drawn from the British Labour Force Survey (LFS) from 1993 to 2013 to describe the evolution of gender segregation over the life course, and we consider ages 16 to 69 ( $n = 1,815,482$ ).

Three substantive insights result from our analysis. First, segregation sources follow opposite trends during the core working years. At younger ages, women enter the labor market at a slower pace than men, and some become homemakers whereas hardly any men do. The result is a hike in economic segregation. Simultaneously, occupational segregation falls. Later in life, some women (re)enter paid work and reverse these trends. These patterns can be interpreted as one outcome of women’s heterogeneity in labor market participation. Women’s heterogeneity is an early finding in the literature (Fagan and Rubery 1996; Hakim 1991; Heckman and Willis 1977), but the role it plays in the

unfolding of segregation over the life course is assessed for the first time herein. Similar opposite trends play out after age 65, a life stage that has received little attention in segregation studies.

Second, although differences in occupation are the major contributor to gender segregation, we find that non-occupational sources of segregation are far from negligible. They account for at least one-fifth of overall gender segregation as people pass their teens, and around half of gender segregation at critical junctures in people’s lives—up to 44.4 percent at age 35, when many people are in the midst of forming families and consolidating their careers, and 51.8 percent at age 64, when retirement takes hold at different paces across gender lines.

Third, the extension of the domain of gender segregation from the employed to the entire population has dramatic consequences for our view of the life course. Elder workers crowd into a few gender-typical occupations (Lain 2012). Had we concentrated on the marketplace, gender segregation would appear to grow with age. Instead, our unified framework weights market segregation by the employment rate. As a result, gender segregation mirrors the inverted *U*-shaped pattern of the employment rate.

## DEFINITIONAL QUESTIONS

### *Aging and the Life Course*

The concept of the life course has multiple meanings (Alwin 2012). In this article, we follow Elder’s (1992:1121) canonical and oft-quoted definition of the life course as a set of “age graded life patterns embedded in social institutions and subject to historical change.” In our empirical illustration with UK data from 1993 to 2013, our emphasis is on the first part of Elder’s statement. As we will see, the 21-year period between 1993 and 2013 saw various demographic changes, but there was no fundamental change in the “one and a half” breadwinner model that has defined gender relations in the United Kingdom since

the expansion of women's paid employment into part-time jobs in the 1980s (Lewis, Campbell, and Huerta 2008). Instead, it is reasonable to hypothesize that, as Settersten (2003) argues, the embedding of women and men within the social institutions of the educational system, the family, and the market shapes the contours of their lives as they age.

The literature to date contains two ways of measuring the evolution of segregation over the life course. One strategy consists of the age-profiling of segregation in one or multiple cross-sections of data (see Dolado and Felgueroso 2004; Jacobs 1989: Chap. 2). However, for any cross-section, a given age is coterminous with a given birth cohort. For example, people age 40 in 2015 belong to the cohort born in 1975. Therefore, at least some of the effects we attribute to being 40 years old may be caused by historical contingencies experienced by the 1975 cohort at that age.

Another approach studies segregation as one or more birth cohorts grow old (see, e.g., Blossfeld 1987; Jacobs 1989: Chap. 6). In this case, age and period are perfectly confounded: individuals in the 1975 birth cohort turned 40 in 2015. Accordingly, at least some of the effects we credit to age may instead be traceable to historical events in 2015. In conclusion, neither procedure is able to identify the effect of age, and therefore, *sensu stricto* cannot characterize the evolution of segregation over the life course.

In short, despite these and other antecedents in the burgeoning research on the disparate lives of women and men (Brückner 2004; McMunn et al. 2015), when life course research has attempted to study gender differences, age, cohort, and period effects are confounded. In the Methods section, we explain how the *M* index helps identify the level of segregation at each age net of cohort and period effects.

### Market Segregation

Many studies in the segregation literature focus on the uneven distribution of men and women over occupations. Two recent examples are Cortes and Pan (2018) and Levanon

and Grusky (2016). In this article, we broaden the analysis to take into account the fact that individuals work for pay for a number of weekly hours in a given occupation. We do this because both occupations and the time people spend in the marketplace are sources of segregation. We call their joint effect "market segregation" and measure it over "jobs" defined as the combination of an occupation and the degree of time involvement it requires.

The decomposability property of the *M* index allows us to separate the effects of occupational allocation and varying time requirements on market segregation. We refer to the effect of occupations, controlling for time, as "occupational segregation." For its part, we term "time segregation" the effect of time requirements, controlling for occupations. As we discuss in the Methods section, the *M* index can be decomposed into the part that is unambiguously attributable to each source and the part that cannot be solely attributed to either occupations or time. We refer to the latter as the "interaction term." It can be positive or negative. When the interaction term is positive, both occupation and time requirements work "in the same direction," so to speak. When the interaction is negative, these sources of segregation work "in opposite directions," such as when there is overrepresentation of women in either full-time female-typed jobs or part-time male-typed jobs (for a discussion of the interaction term in the context of occupational segregation by ethnicity and gender, see Guinea-Martin, Mora, and Ruiz-Castillo 2015). The decomposition of the *M* index in Expression 1 summarizes our strategy:

$$\begin{aligned} \text{Market segregation} &= \text{Occupational} \\ &\quad \text{segregation} \\ &\quad + \text{Time segregation} \quad (1) \\ &\quad + \text{Interaction term.} \end{aligned}$$

Research on the influence of reduced-time work on occupational segregation is plentiful, especially for Europe. However, in studies of occupational segregation, scholars have accounted for the time dimension only indirectly.<sup>1</sup> These contributions are based

on non-decomposable indexes that cannot separate the segregation fueled by occupations from that originating in different degrees of labor market involvement.

Elliott (2005)—and its sequel by Guinea-Martin and colleagues (2010)—offers the only attempt to directly weigh the salience of the time divide using the decomposition of Theil's *H* index, a normalized version of the *M* index (Mora and Ruiz-Castillo 2011). She partitions the population into men, on the one hand, and women in either full- or part-time employment, on the other. With this setup, overall occupational segregation is expressed as the sum of two terms. The first term measures the segregation that arises from women's and men's uneven distribution across occupations. The second term gauges the disparity in the distribution across occupations of women in full- and part-time employment. In this way, Elliott extends the usual approach to measuring occupational segregation. She concludes that in the early 1990s in the United Kingdom, 14 percent of the occupational segregation among people age 16 to 55 stemmed from the occupational differentiation between women in full- versus part-time work (versus 11 percent in the United States). However, this research strategy ignores time divisions among men and between women and men. It thereby precludes analysis of what we call time segregation, as well as the interaction between the two sources—occupations and time requirements—of market segregation.

### *Economic Segregation*

Moving beyond the market to include all women and men in a measure of segregation requires considering all possible forms of economic activity and inactivity or, for short, economic statuses. In practice, the exact nature, number, and definition of the alternatives depend on the statistical information available in a given country at a given moment in time. Currently, most national statistics bureaus follow the guidelines of the International Labour Organization and class as “inactive” anyone who is not in the labor force. Many bureaus further distinguish types of “economically

inactive” people. Four groups are notable. The first is people responsible for unpaid household chores and care-taking activities. We refer to tasks of this type as “homemaking.” The second is the group enrolled in education, which is classified as “studying.” A large portion of this category falls into the younger range of the population. The third and fourth are the “permanently sick” and “retired from work” categories. Most people in these categories belong to the older population.

The first two types of “economic inactivity”—studying and homemaking—concern activities that carry no pecuniary reward, whereas the last two—permanently sick and retired—do not necessarily entail any work but are often associated with pay or an allowance. This distinction highlights the purpose of official classifications of economic status, which is the individual's broad relation to the labor market or “labor force attachment.” Most of the permanently sick and retirees develop their entitlement to payment based on their past employment history. By contrast, students and homemakers typically have either less or no labor market experience.

However, the priority of modern labor force surveys lies elsewhere (Carter 2006). Serving a country's economic policy, their main goal is to record the portion of the civilian non-institutional population who, in the week prior to the survey, worked for pay for at least one hour (the employed) or were searching actively for a job and available to take one (the unemployed). “Paid work” and “unemployment” are the two possible economic statuses of people in the labor force, that is, the economically active.

The uneven distribution of women and men across these categories (“employed in jobs,” “unemployed,” “homemaking,” “studying,” “permanently sick,” and “retired”) gives rise to the sort of segregation we label “economic.”<sup>2</sup> Our study, however, does not cover a number of potential non-market sources of gender segregation. Examples are the informal economy (Snyder 2005; Vanek et al. 2014) and unpaid work in the voluntary sector (McPherson and Smith-Lovin 1986). Similarly, some population subgroups

**Table 1.** Sources of Segregation in Our Research Design

	Economic Statuses	Job Characteristics
Active population	<ul style="list-style-type: none"> <li>(1) Employed in jobs</li> <li>(2) Unemployed</li> </ul>	<ul style="list-style-type: none"> <li><i>J</i> occupations</li> <li><i>L</i> degrees of time involvement</li> </ul>
Inactive population	<ul style="list-style-type: none"> <li>(3) In homemaking</li> <li>(4) Retired</li> <li>(5) Student</li> <li>(6) Permanently sick</li> <li>(7) Other</li> </ul>	

typically excluded from labor market research, such as prison inmates (Western and Beckett 1999), are gender segregated (*Yale Law Journal* 1973). These and other dimensions can be incorporated into our framework if and when their age and gender information becomes available.

### Gender Segregation

Table 1 displays the conceptual distinction that is the mainstay of our approach: on the one hand, we have the economic statuses that classify the entire civilian non-institutional population; on the other, we have all combinations of occupations and time requirement—which for brevity we refer to as jobs—held by the subset of the population in paid employment in the formal economy. The exact categories that make up these two dimensions are the actual bricks and mortar upon which the analysis is built—the “organizational units” along which women and men distribute more or less unevenly. The nature of these units is contingent on the statistics available to the researcher. (We present ours in the Data section.) However, beyond classificatory details, we have thus far proposed to gauge the uneven distribution of women and men across economic statuses and to call this measurement “economic segregation.” Furthermore, we have proposed to weigh the uneven distribution of women and men in paid work across jobs and to call the result “market segregation.” The addition of these two measures would quantify the extent of overall gender segregation in the key

societal dimensions related to women’s and men’s labor force attachment. We call this notion of segregation “gender segregation” for short. The question, though, is how can we add the economic segregation of the entire population to the market segregation of only the employed population?

An illustration with two ages, 18 and 22, will help explain our answer. Suppose that people of either age are gender-balanced and equal in every respect except their employment rate: 70 percent of 18-year-olds are in paid work versus 80 percent of 22-year-olds. Assume they all have the same economic segregation, say *X*. Finally, among the employed, assume that women and men of both ages are equally distributed over time requirements and occupations, such that they have the same market segregation, *Y*. In so far as the employment ratio is larger for older people, it is reasonable to expect the market component of overall gender segregation is also greater for them. This is exactly what we obtain because, as we explain in the Methods section, the *M* index allows us to express gender segregation as the sum of (1) economic segregation and (2) market segregation scaled down by the employment rate:

$$\begin{aligned}
 \text{Gender segregation} &= \text{Economic} \\
 &\quad \text{segregation} \\
 &+ \text{Employment rate} \quad (2) \\
 &\times \text{Market segregation.}
 \end{aligned}$$

Because the employment rate is higher among older people, the market component of

overall gender segregation in Expression 2 is also larger for them,  $.80 \times Y > .70 \times Y$ . Moreover, it follows that overall gender segregation is higher among the 22-year-olds than among the 18-year-olds:  $X + .80 \times Y > X + .70 \times Y$ .

To our knowledge, there is only one alternative to Expression 2 in the current literature on the overall segregation of women and men. Cohen (2004) originally proposed it, and Hook and Pettit (2016) subsequently adopted it. These authors calculate the Dissimilarity index (*DI* hereafter; see Duncan and Duncan 1955) on a set of organizational units that includes either “keeping house” (Cohen 2004) or “not in the labor force” (Hook and Pettit 2016). With this framing, and using CPS data from the early 1970s, 1980s, and 1990s, Cohen (2004: Table 3) reports that the inclusion of homemaking—an activity where many women but only a few men concentrate—increases the level of gender segregation for people age 25 to 54 by 9 to 12 points, depending on the years considered. For their part, Hook and Pettit (2016: Table 2) calculate the *DI* for 11 countries on a sample drawn from the Luxembourg Income Study for women and men age 25 to 49. They report that in 2004, the level of segregation in the United States slightly decreased when people not in the labor force were included (.342), compared to the *DI* for the employed population (.346). In contrast, in the same year in the United Kingdom, the country of study in this article, the *DI* was .337 in the overall population but only .283 in the employed population.

Our approach, summarized in Expression 2, is inspired by these contributions but also expands on them substantively and methodologically. Substantively, we posit two considerations. First, there is segregation beyond paid work and homemaking, the two domains Cohen (2004) studies. The life course approach brings to the fore forms of economic activity, such as unemployment, and of inactivity, such as studying and retirement, that may alter the contours of segregation as women and men grow old. Second, as argued earlier in the section on economic segregation, there might be

segregating heterogeneity within the broad category “not in the labor force” used by Hook and Pettit (2016). Erasing distinctions in the gender gap and relative sizes of categories of inactivity such as homemaking and permanent sickness, to name only two, may cancel out their contribution to the *DI*. This fact could explain why, in Hook and Pettit’s (2016) analysis, segregation actually declines in some countries when people not in the labor force are included.

Methodologically, once we recognize there are two sources of gender segregation (economic statuses and jobs), the addition of a between term and a within term—capturing the economic segregation of the entire population and the market segregation within the employed population, respectively—makes mathematical sense only for additively decomposable segregation indices. Because the *DI* does not have this property, its use does not allow us to integrate the two types of segregation we consider.

## DATA AND METHODS

### *Data*

We analyze pooled cross-sectional data for the population of the United Kingdom age 16 to 69. The source is the British Labour Force Survey (LFS) spring quarter from 1993 until 2013 ( $n = 1,815,482$ ).<sup>3</sup> The LFS is the flagship survey for labor market outputs in the United Kingdom. It samples approximately 80,000 households each quarter. We analyze the spring quarter because it is the least influenced by seasonal variation. We study the period between 1993 and 2013 because 1993 is the first year with comparable information for all the variables of interest. With these data, our analyses produce arrays of indexes with  $69 - 16 + 1 = 54$  rows, one for each age, and  $2013 - 1993 + 1 = 21$  columns, one for each year.

Ideally, we would study segregation over the life course with longitudinal data. Unfortunately, there are no longitudinal data with a long enough observation period for our purposes.<sup>4</sup> Still, it is well known that even with

**Table 2.** Identification of the Age Effect

	Independent Cross-Sections		
	(1)	(2)	(3)
Age Groups			Young
		Young	Middle-aged
	Young	Middle-aged	Older
	Middle-aged	Older	
	Older		

longitudinal data, age, cohort, and period effects cannot be identified simultaneously. Hall, Mairesse, and Turner (2007) note the need for empirical tests or a priori information to ignore two of these dimensions and identify one. Consider the following three possibilities of introducing a priori assumptions to solve the identification problem. For illustration purposes, in Table 2, we include only three broad age groups, young, middle-aged, and older individuals, and three independent cross-sections. The first possibility consists of treating the columns in Table 2, that is, the independent cross-sections, as if they referred to the same population observed at different moments. Researchers making comparisons over time with cross-sectional data typically adopt this assumption. In the second possibility, some researchers construct “pseudo-cohorts” by taking the rows as if they referred to the same population observed over the entire life course. The middle row of Table 2 is one example of a pseudo-cohort comprising young, middle-aged, and older people drawn from cross-sections 1, 2, and 3, respectively.

We favor a third stance that serves our goal of studying gender segregation over the life course: we pool the data for each age group diagonally across cross-sections as if they referred to the same population of a given age. Each age group has its own diagonal. In Table 2, we highlight the diagonal corresponding to the middle-aged group using shaded cells. Of course, in reality, these data arise from three independent sets of middle-aged people who are sampled at different

times. In the Methods section, we explain how we aggregate the indexes calculated for each age across cross-sections in a manner that allows us to identify the impact of age net of cohort and period effects.

*Variables*

In addition to individuals’ age in years, we consider their degree of labor market involvement, occupation, and economic status. The distribution of each variable is illustrated with tables that, for simplicity, only include ages 25, 40, and 55 and cross-sections 1993, 2003, and 2013. This simplification arises from the impossibility of publishing tables with the entire dataset. Take Table 5 on economic status. Using the whole dataset, the table dimensions would be 54 ages × 8 economic statuses (including totals) by 21 years × 3 genders (including totals), resulting in 27,216 cells. Furthermore, the whole dataset is not required for illustrating the argument. Our case can be made with only two ages and two years. We chose three to show the sample distribution of ages that are representative of the “young,” “middle-aged,” and “older” groups in Table 2 every decade. We use this small subsample of our data to illustrate our methods with numerical examples in the online supplement. Next, we use this subsample to present some descriptive statistics and outline calendar time trends in the variables of our analyses.

*Labor market involvement.* Following Hakim (2004), we define labor market involvement using four categories: marginal

(10 hours or fewer per week), half-time (from 11 to 29 hours), reduced full-time (30 to 34 hours), and full-time (35 or more hours) employment. The number of hours in paid employment includes paid and unpaid overtime in the reference week.

Table 3 shows the distribution of people included in the small subsample of our data across degrees of labor market involvement. Less than one-half of all women engaged in paid employment in the 40 or 55 age groups work full-time, but approximately 80 percent of their male counterparts do so. Among 25-year-old workers, the gender gap in full-time employment is narrower but still noticeable, ranging from 10 to 20 percentage points.

Over the 21 years considered, the most noticeable changes occur among 55-year-old women. Their rates of full-time and reduced full-time employment increase by 10 and 6 percentage points, respectively. This trend suggests that time segregation among 55-year-olds decreased from 1993 to 2013.

*Occupations.* We measure the classical notion of occupational segregation using the Standard Occupational Classification (SOC) produced in 1990 and updated in 2001 and 2011 for the LFS. These versions of the SOC record 77, 81, and 90 occupational titles, respectively, at the “minor” group level. Although the SOC changes somewhat every 10 years, the classification maintains an underlying structure and coherence.

For illustrative purposes, Table 4 partitions occupations into three basic types: male, integrated, and female. (Note, however, that our analyses do not depend on this or any other partition of occupations based on the percentage of women therein.) For any given age group and year, women make up a percentage of the employed labor force. Integrated occupations are defined as those with a percentage of female workers  $\pm 5$  percentage points of the overall percentage of women in the labor market. Female occupations have a share of female workers greater than the overall percentage plus five percentage points; male occupations have a share of female workers

smaller than the overall percentage minus five percentage points. Table 4 shows that integrated occupations increase over time. This trend suggests a reduction in occupational segregation.

*Economic status.* This variable records individuals’ broad relation to the labor market. People categorized as inactive can be in one of the following five statuses: homemaking, retired, studying, permanently sick or disabled, or other. Economically active people are divided into unemployed and employed groups. Table 5 shows the distribution of people in the small subsample of our data across economic statuses. For all ages and years, there is a clear gender gap in the proportion of the population in paid work and in homemaking. The gender gap in paid work is generally over 10 percentage points in favor of men. For the gender gap in homemaking, men’s rate is at most 2 percent, whereas women’s rate oscillates between 7 and 21 percent. In general, rates in paid work increase and rates in homemaking decrease over the time period considered. This trend suggests a decline in economic segregation.

We previously mentioned that data for each age group are pooled across cross-sections as if they referred to the same population of a given age. However, Tables 3, 4, and 5 make plain that the British population has changed over the 21 years we study. In the Results section, we evaluate the effects of these demographic shifts on our results.

### *The Mutual Information Index*

In information theory, entropy is defined as the expected amount of information produced in the realization of a stochastic event (Kullback 1959), as when we learn the organizational unit of a given individual. The  $M$  index of segregation between women and men is then defined as the average increase in entropy concerning individuals’ organizational unit obtained from learning their gender (see the online supplement for details). If men and women were distributed equally

**Table 3.** Degree of Labor Market Involvement by Year and Gender

	1993			2003			2013		
	Women	Men	All	Women	Men	All	Women	Men	All
<i>Panel A. People Age 25</i>									
Marginal hours	5.5	2.1	3.7	4.7	2.5	3.6	3.5	2.5	2.9
Half-time	20.2	5.8	12.8	19.1	10.1	14.3	26.7	7.9	16.0
Reduced full-time	10.8	8.4	9.6	12.1	11.9	12.0	9.2	9.4	9.3
Full-time	63.5	83.7	73.8	64.1	75.5	70.1	60.5	80.2	71.7
Total column %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Population size	298,174	313,712	611,886	237,681	267,452	505,133	274,948	361,214	636,162
Count	801	798	1,599	494	485	979	373	384	757
<i>Panel B. People Age 40</i>									
Marginal hours	10.2	1.1	5.4	8.2	1.4	4.6	6.5	1.4	3.7
Half-time	38.2	7.5	22.0	36.8	7.8	21.3	37.4	9.4	22.3
Reduced full-time	10.7	9.3	10.0	11.2	7.4	9.1	13.7	5.6	9.3
Full-time	40.9	82.1	62.6	43.8	83.4	65.0	42.4	83.6	64.7
Total column %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Population size	272,872	303,569	576,441	352,878	406,021	758,899	312,463	367,955	680,418
Count	761	844	1,605	805	853	1,658	521	570	1,091
<i>Panel C. People Age 55</i>									
Marginal hours	8.8	1.1	4.6	10.2	2.2	5.9	5.6	2.7	4.1
Half-time	42.7	7.7	23.5	34.8	10.5	21.9	30.0	11.7	20.8
Reduced full-time	10.0	10.2	10.1	12.1	9.6	10.8	16.1	6.3	11.2
Full-time	38.5	80.9	61.9	42.9	77.7	61.4	48.4	79.3	63.8
Total column %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Population size	165,962	202,999	368,961	284,786	322,738	607,524	286,154	283,829	569,983
Count	452	546	998	651	705	1,356	506	484	990

Source: Spring quarter British Labour Force Survey (LFS) of 1993, 2003, and 2013.

Note: Working marginal hours entails 10 hours or fewer of paid work; half-time, 11 to 29 hours; reduced full-time, 30 to 34 hours; and full-time, 35 or more hours. Population size and percentages are weighted estimates. Counts are the sample sizes.

**Table 4. Sex-Typed Occupations by Year and Gender**

	1993			2003			2013		
	Women	Men	All	Women	Men	All	Women	Men	All
<i>Panel A. People Age 25</i>									
Male occupations	12.8	69.7	42.0	10.5	60.0	36.7	11.6	62.0	40.2
Integrated occupations	2.7	2.6	2.7	11.7	12.2	12.0	11.4	12.0	11.7
Female occupations	84.5	27.7	55.4	77.8	27.8	51.3	76.9	26.0	48.0
Total column %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Population size	298,174	313,712	611,886	237,681	267,452	505,133	274,948	361,214	636,162
% of population	48.7	51.3	100.0	47.1	52.9	100.0	43.2	56.8	100.0
Count	801	798	1,599	494	485	979	373	384	757
<i>Panel B. People Age 40</i>									
Male occupations	17.5	78.3	49.5	13.5	72.4	45.0	15.3	67.3	43.4
Integrated occupations	5.0	5.3	5.2	8.8	9.7	9.3	13.9	14.5	14.3
Female occupations	77.5	16.4	45.3	77.7	17.9	45.7	70.8	18.2	42.3
Total column %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Population size	272,872	303,569	576,441	352,878	406,021	758,899	312,463	367,955	680,418
% of population	47.3	52.7	100.0	46.5	53.5	100.0	45.9	54.1	100.0
Count	761	844	1,605	805	853	1,658	521	570	1,091
<i>Panel C. People Age 55</i>									
Male occupations	13.2	79.2	49.5	12.6	72.9	44.6	9.9	71.3	40.4
Integrated occupations	4.5	4.6	4.6	7.6	7.5	7.6	10.1	10.5	10.3
Female occupations	82.3	16.1	45.9	79.8	19.6	47.8	80.0	18.3	49.3
Total column %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Population size	165,962	202,999	368,961	284,786	322,738	607,524	286,154	283,829	569,983
% of population	45.0	55.0	100.0	46.9	53.1	100.0	50.2	49.8	100.0
Count	452	546	998	651	705	1,356	506	484	990

Source: Spring quarter LFS of 1993, 2003, and 2013.

Note: % of population is a row percentage representing the share of population (in this case, the population in paid work only) that is either female or male. The other percentages in the table are column percentages for the distribution of women and men across male, integrated, and female occupations. For a given age and year, women make up a share of the employed labor force. Integrated occupations have a percentage of female workers that is  $\pm 5\%$  of the percentage of women in the employed labor force. Female (male) occupations have a percentage of female workers that is more than five percentage points greater (smaller) than the percentage of women in the employed labor force. Population size and percentages are weighted estimates. Counts are the sample sizes.

**Table 5. Economic Status by Year and Gender**

	1993			2003			2013		
	Women	Men	All	Women	Men	All	Women	Men	All
<i>Panel A. People Age 25</i>									
In paid work	65.1	78.8	71.5	71.3	83.8	77.4	69.1	77.7	73.8
Unemployed	6.3	14.4	10.1	4.7	4.9	4.8	6.2	11.2	8.9
In homemaking	21.1	.8	11.7	17.1	.7	9.1	14.8	.2	6.9
Retired	.0	.0	.0	.0	.0	.0	.0	.0	.0
Student	1.9	3.3	2.5	3.4	5.7	4.5	6.3	5.3	5.8
Sick	1.9	1.1	1.5	.4	2.6	1.5	1.3	4.7	3.1
Other	3.7	1.6	2.7	3.1	2.4	2.7	2.3	.9	1.5
Total column %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Population size	458,319	398,040	856,359	333,344	319,275	652,619	397,769	464,684	862,453
% of population	53.5	46.5	100.0	51.1	48.9	100.0	46.1	53.9	100.0
Count	1,226	1,002	2,228	691	575	1,266	534	493	1,027
<i>Panel B. People Age 40</i>									
In paid work	73.7	87.1	80.2	75.6	89.3	82.3	77.0	87.6	82.3
Unemployed	4.0	7.7	5.8	2.7	3.3	3.0	3.7	3.9	3.8
In homemaking	15.2	.4	8.0	13.5	1.4	7.6	11.4	2.0	6.6
Retired	.1	.0	.1	.0	.0	.0	.0	.0	.0
Student	1.1	.4	.8	.6	.6	.6	1.2	.8	1.0
Sick	3.8	3.9	3.8	5.0	3.1	4.1	4.8	4.5	4.6
Other	2.2	.5	1.4	2.5	2.4	2.5	2.0	1.2	1.6
Total column %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Population size	370,210	348,475	718,685	467,076	454,874	921,950	405,984	420,272	826,256
% of population	51.5	48.5	100.0	50.7	49.3	100.0	49.1	50.9	100.0
Count	1,036	966	2,002	1,061	951	2,012	681	652	1,333

(continued)

**Table 5. (continued)**

	1993			2003			2013		
	Women	Men	All	Women	Men	All	Women	Men	All
<i>Panel C. People Age 55</i>									
In paid work	56.9	71.7	64.2	68.9	79.3	74.1	74.0	80.8	77.2
Unemployed	3.6	10.4	7.0	1.2	3.7	2.4	3.6	3.9	3.7
In homemaking	14.6	1.0	7.9	7.6	1.1	4.4	7.2	1.8	4.6
Retired	3.7	2.0	2.9	4.0	2.2	3.1	2.0	2.4	2.2
Student	.3	.0	.1	.2	.1	.2	.0	.0	.0
Sick	12.4	12.1	12.3	13.2	12.0	12.6	8.4	9.3	8.8
Other	8.6	2.7	5.7	4.8	1.7	3.3	4.8	1.9	3.4
Total column %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Population size	291,902	283,150	575,052	413,321	407,039	820,360	386,630	351,435	738,065
% of population	50.8	49.2	100.0	50.4	49.6	100.0	52.4	47.6	100.0
Count	793	759	1,552	943	892	1,835	681	595	1,276

Source: Spring quarter LFS of 1993, 2003, and 2013.

Note: % of population is a row percentage representing the share of the entire population of a given age that is either female or male. The other percentages in the table are column percentages for the distribution of women and men across categories of economic status. Population size and percentages are weighted estimates. Counts are the sample sizes.

among occupations—the case of complete integration—gender would provide no additional information and  $M = 0$ . In contrast,  $M$  reaches its maximum value when only one gender is present in each organizational unit and both genders are equally represented in the population.

Our main methodological proposal consists of identifying economic and market segregation as, respectively, the between- and within-group terms in a decomposition of the index of gender segregation. Additionally, we require an index that satisfies the *SD* property—defined in the online supplement—because a decomposition based on such an index provides the least ambiguous interpretation of results in a study of segregation (Mora and Ruiz-Castillo 2011). The  $M$  index satisfies the *SD* property (Mora and Ruiz-Castillo 2003) and other well-known indexes do not (Frankel and Volij 2011).

Are there alternatives to the  $M$  index? In the two-group case, Theil (1970) and Theil and Finizza (1971) introduced the entropy information, or  $H$  index, a normalization in the unit interval of the  $M$  index. The extension of the  $H$  index by Reardon and Firebaugh (2002) to the multigroup case has been used by Elliott (2005) and others. Although the  $H$  index violates the *SD* property (Frankel and Volij 2011), Reardon, Yun, and Eitle (2000) establish that it satisfies a weaker decomposability property. However, using numerical examples and actual data, Mora and Ruiz-Castillo (2011) conclude that the weights in the within-group term in the  $H$  index are not invariant to changes in the within-group distributions, leading to problems of interpretation. Therefore, when decomposability properties are desirable in empirical work, there is much to be gained by using the  $M$  index.

### Market Segregation

Traditional measures of occupational segregation are intended to capture differences in the distribution of women and men across occupations. In our approach, market segregation captures differences in the distribution of women and men across labor market

categories that are characterized by an occupation *and* a certain degree of time involvement.

Let  $A$  be the number of age groups and  $T$  the number of cross-sections or periods. In our data, individuals' age is measured in years ranging from 16 to 69, meaning  $A = 54$ . In addition, the cross-sections correspond to calendar years (i.e., periods) ranging from 1993 to 2013, such that  $T = 21$ . For any given age  $a$  and period  $t$ , we define the index of market segregation,  $MS(a,t)$ , as the  $M$  index of segregation when each combination of labor market involvement and occupation is treated as an organizational unit.

Using the *SD* property, we can decompose  $MS(a,t)$  in two alternative ways. First, we can partition the set of  $U$  organizational units resulting from the combination of occupational and time categories into  $C$  clusters defined by the time categories such that

$$MS(a,t) = TS(a,t) + O^W(a,t), \quad (3)$$

where  $TS(a,t)$  measures the market segregation arising from the uneven distribution of the women and men of age  $a$  in period  $t$  across degrees of labor market involvement, and  $O^W(a,t)$  is, for each age  $a$  and period  $t$ , the weighted average of occupational segregation indexes over levels of labor market involvement. Following Mora and Ruiz-Castillo (2011), the within-group term  $O^W(a,t)$  can be interpreted as the part of market segregation that exists among women and men of age  $a$  in period  $t$  that is exclusively due to their uneven distribution across occupations, controlling for the effect of labor market involvement.

Second, we can take the occupations as clusters such that

$$MS(a,t) = O(a,t) + TS^W(a,t), \quad (4)$$

where  $O(a,t)$  measures the market segregation arising from the uneven distribution of the women and men of age  $a$  in period  $t$  across occupations, that is, the usual measure of occupational segregation in the traditional literature. The within-group term  $TS^W(a,t)$  is, for each age  $a$  and period  $t$ , the weighted average of time segregation indexes over occupations.

$TS^W(a,t)$  is the portion of market segregation that exists among women and men of age  $a$  in period  $t$  that is exclusively due to their uneven distribution across time categories, controlling for the effect of occupations. As mentioned previously, occupations and time can interact. The interaction  $\Delta(a,t)$  is the part of  $MS(a,t)$  that is simultaneously due to gender differences across degrees of labor market involvement and occupations:

$$\Delta(a,t) = MS(a,t) - [O^W(a,t) + TS^W(a,t)]. \quad (5)$$

Note that we cannot attribute segregation captured by the interaction term unambiguously to either time or occupation. Thus, if we compare, for example, Equations 3 and 5, we obtain

$$TS(a,t) = TS^W(a,t) + \Delta(a,t). \quad (6)$$

That is, the term  $TS(a,t)$  includes not only time segregation controlling for occupation but also the interaction term. Similarly, using Equations 4 and 5, we observe that the traditional term  $O(a,t)$  includes not only occupational segregation controlling for time involvement but also the interaction term:

$$O(a,t) = O^W(a,t) + \Delta(a,t). \quad (7)$$

In most of this article, we express market segregation as the sum of three terms:

$$MS(a,t) = O^W(a,t) + TS^W(a,t) + \Delta(a,t). \quad (8)$$

Equation 8 is the age-period-specific version of Expression 1. This approach is essentially similar to that followed in Guinea-Martin and colleagues (2015) to study the joint impact of ethnicity and gender on occupational segregation.<sup>5</sup>

### Gender Segregation

Consider the notion of gender segregation understood as the overall segregation between women and men that exists in society, rather than exclusively in the marketplace. On the one hand, some women and men are not engaged in paid work. These people are distributed across several economic statuses. On

the other hand, people in paid employment are distributed across labor market categories. Consequently, women and men of age  $a$  in period  $t$  belong to organizational units defined by the combination of economic status and labor market category. Thus, we define  $G(a,t)$  as the  $M$  index for age  $a$  in period  $t$  that measures gender segregation across these units. We can partition the set of these organizational units into economic statuses such that labor market categories are contained within the economic status “paid work.” Because there can only logically be labor market categories within paid work, by the *SD* property, the only possible decomposition in this case is the following:

$$G(a,t) = ES(a,t) + p_w(a,t) \times MS(a,t), \quad (9)$$

where  $ES(a,t)$  is the economic segregation arising from the uneven distribution of women and men of age  $a$  in period  $t$  across economic statuses,  $MS(a,t)$  is the market segregation arising from the uneven distribution of women and men of age  $a$  in period  $t$  across labor market categories, and  $p_w(a,t)$  is the proportion of individuals of age  $a$  in period  $t$  who are employed in the labor market. Equation 9 is the age-period-specific version of Expression 2.

Combining Equations 8 and 9 yields the decomposition of gender segregation into economic and market segregation (and of market segregation into its components) for people of age  $a$  in period  $t$ :

$$G(a,t) = ES(a,t) + p_w(a,t) \times [O^W(a,t) + TS^W(a,t) + \Delta(a,t)]. \quad (10)$$

### Identification of the Age Effect

All indexes in Equation 10 are influenced by cohort and period effects. Our goal is to obtain indexes for each age net of cohort and period effects. Let  $G^W(a)$  stand for the part of segregation that, within each age, is exclusively due to differences in the distribution of women and men across economic statuses, degrees of labor market involvement, and occupations. By definition, the comparison of  $G^W(a)$  for

different values of  $a$  identifies the effect of age net of the influence of cohort and period.

Similarly, define  $ES^W(a)$  as the part of economic segregation that, within each age, is exclusively due to differences in the distribution of women and men across economic statuses. Hence, the comparison of  $ES^W(a)$  for different values of  $a$  identifies the evolution of economic segregation over the life course.

Consider the population engaged in paid employment, and let  $MS^W(a)$  stand for the part of market segregation that, within each age, is *exclusively* due to differences in the distribution of women and men across degrees of labor market involvement and occupations. Hence, the comparison of  $MS^W(a)$  for different values of  $a$  identifies the evolution of market segregation over the life course. Similarly,  $O^W(a)$ ,  $TS^W(a)$ , and  $\Delta(a)$  for different values of  $a$  identify the evolution of occupational segregation controlling for time-related effects, and of time segregation controlling for occupation-related effects, as well as the interaction between these two variables. In the online supplement, we show that by (1) multiplying both sides of Equation 9 by the proportion of individuals of age  $a$  that are observed in period  $t$  and (2) summing over all periods, we obtain a unified framework for the study of gender, economic, market, time, and occupational segregation:

$$G^W(a) = ES^W(a) + p_w(a) \times MS^W(a) \quad (11)$$

$$= ES^W(a) + p_w(a) \times [O^W(a) + TS^W(a) + \Delta(a)], \quad (12)$$

where  $p_w(a)$  is the proportion of individuals of age  $a$  who are in paid employment, that is, the employment rate, and the following equalities hold:

$$MS^W(a) = \sum_t \pi_t(a) \times [O^W(a, t) + TS^W(a, t) + \Delta(a, t)] \quad (13)$$

$$= O^W(a) + TS^W(a) + \Delta(a), \quad (14)$$

where  $\pi_t(a)$  is the proportion of employed people age  $a$  in period  $t$ . Equation 12 highlights that economic, time, and occupational

segregation are sources of gender segregation. In the Discussion section, we refer to the sum of occupational segregation and the interaction term as “occupation-related segregation,”  $O^W(a) + \Delta(a)$ .

Similarly, in the Results and Discussion sections we find it useful to refer to the sum of time segregation and the interaction term as “time-related segregation,” which we denote by  $TS(a) = TS^W(a) + \Delta(a)$ . In this simplification, there are three sources of gender segregation: economic, occupational, and time-related segregation, that is,  $ES^W(a)$ ,  $O^W(a)$ , and  $TS(a)$ , respectively. Taking into account that

$$G^W(a) = ES^W(a) + p_w(a) \times O^W(a) + p_w(a) \times TS(a), \quad (15)$$

we can interpret  $ES^W(a)$  as both a source of segregation and a contribution to overall gender segregation. In contrast, we say that the contributions of occupational and time-related segregation to overall gender segregation are  $p_w(a) \times O^W(a)$  and  $p_w(a) \times TS(a)$ , respectively.

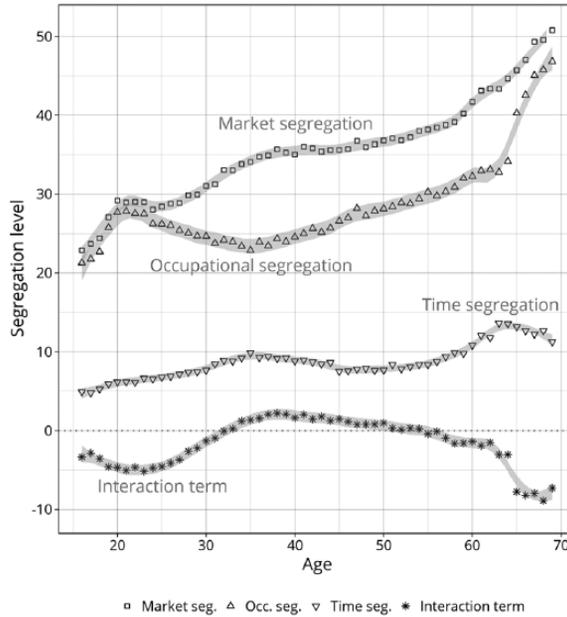
Finally, to quantify the relative role of occupations in gender segregation, consider the possibility that occupations on their own generate zero segregation, that is,  $O^W(a) = 0$  for all  $a$ . In this case, gender segregation becomes

$$G'(a) = ES^W(a) + p_w(a) \times TS(a). \quad (16)$$

In other words, in the absence of occupational segregation, gender segregation is equal to the sum of economic segregation and the contribution of time-related segregation. We refer to  $G'(a)$  as “non-occupational segregation” and to the sources of economic and time-related segregation,  $ES^W(a)$  and  $TS(a)$ , as “non-occupational sources of segregation.”

## RESULTS

The estimates for all segregation indexes and the overall employment rate over the life course, from age 16 to 69, are provided in Table D.1 in part D of the online supplement. We organize the presentation of this wealth of information into five subsections. First, we



**Figure 1.** The Evolution of Market Segregation and its Components (as Defined in Equation 14) over the Life Course

Source: Spring quarter LFS, 1993 to 2013.

Note: The shaded 99 percent confidence intervals are the result of estimating local linear regressions of the indexes on age.

provide a bird’s eye view of the findings with the help of Figures 1, 2, and 3. Second, we divide the presentation of the evolution of segregation over the life course into four stages. For each stage, we present two types of information: (1) the distribution by gender across categories of economic status, degrees of labor market involvement, and sex-typed occupational groups, and (2) the overall employment rate and index values for all types of segregation. Third, we quantify the relative role of occupations in gender segregation. Fourth, we assess the influence on our findings of the employment rate. Fifth, we conduct three robustness checks.

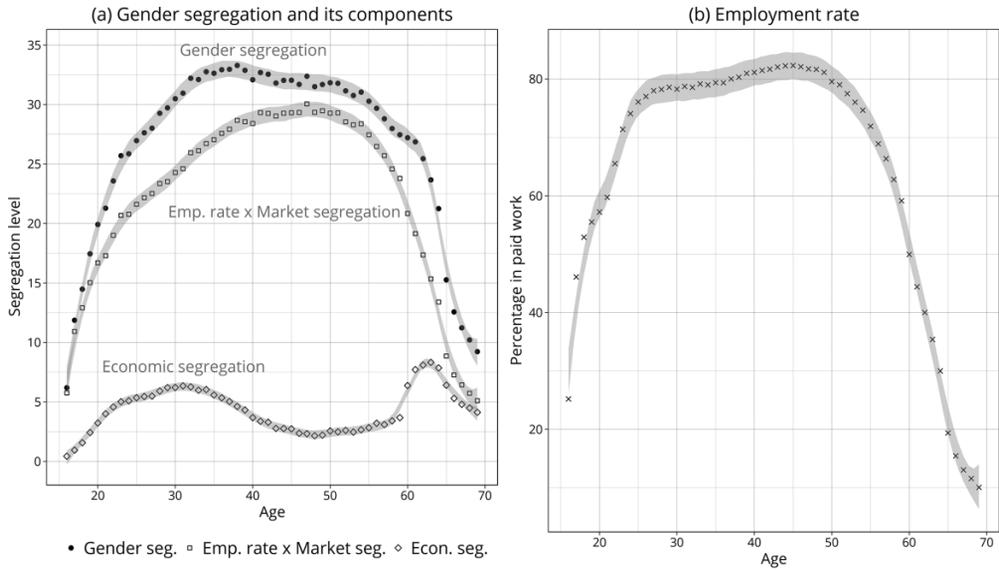
*A Bird’s Eye View*

Figures 1, 2, and 3 provide a bird’s eye view of segregation trends across the life course in the United Kingdom from 1993 to 2013. In contrast with the more common approach that pays attention to occupational segregation only, these figures make plain that these

notions of segregation cannot be properly addressed in isolation, because women and men are simultaneously segregated on various counts throughout the life course.

Figure 1 shows the evolution of market segregation,  $MS^W(a)$ , over the life course and that of its components: occupational segregation, time segregation, and their interaction (see Equation 14). Three results stand out: (1) market segregation increases over the life course, with especially pronounced rises early and later in life; (2) occupational segregation is the major contributor to market segregation; and (3) in the early and later part of the life course, the magnitude of the interaction between time and occupations is noticeable and negative.

Figure 2, panel a, graphs the results of applying Equation 11 to our data. It reveals three main findings. First, the marketplace is the major contributor to gender segregation. Second, the evolution of gender segregation is heavily influenced by the employment rate, which exhibits a spectacular rise and fall in



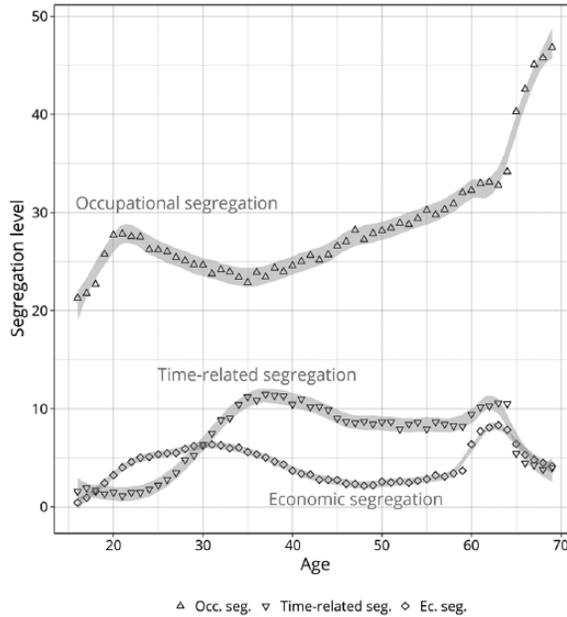
**Figure 2.** The Evolution of Gender Segregation over the Life Course and its Decomposition (as Defined in Equation 11) and of the Employment Rate  $p_w(a)$   
 Source: Spring quarter LFS, 1993 to 2013.  
 Note: The shaded 99 percent confidence intervals are the result of estimating local linear regressions of the indexes on age.

the early and later years, respectively, and is relatively stable at approximately 80 percent during the core working years, that is, from the early 20s to the late 40s (see Figure 2, panel b). The upswing in gender segregation until the 30s and its plunge after the 50s coincide, for the most part, with the rise and fall of the employment rate. Third, there are two peaks in economic segregation: one is concurrent with the career- and family-building years and the other with the retirement phase of the life course.

Figure 3 illustrates the evolution over the life course of the three sources of gender segregation in Equation 15, that is,  $ES^W(a)$ ,  $O^W(a)$ , and  $TS(a)$ . An important result stands out: occupational segregation and the non-occupational sources of segregation follow opposite trends during the core working years (ages 22 to 49) and after age 65. Occupational segregation weakens throughout most of the 20s and early 30s, but women and men deepen their divisions in participation and degree of time involvement in the market. Thereafter, occupational segregation turns upward and economic and time-related segregation ease, at least until people’s 50s.

During the core working years, gender differences in homemaking and part-time paid work draw “the time divide,” in Jacobs and Gerson’s (2004) words, between women and men in society. They are the main non-occupational sources of segregation. From ages 22 to 49, the correlation coefficient between the rate of women in homemaking and the economic segregation index is .95. Similarly, the correlation coefficient between women’s rate in part-time work and time segregation in the marketplace is .69.

The opposite trends between occupational segregation and economic and time segregation reveal at least two groups of women.<sup>6</sup> One group leaves paid employment, thereby contributing to the rise in economic segregation. A second group remains employed—in either full- or part-time work—in occupations more similar to men’s. Hence, this group helps decrease segregation in occupations. Now, if women in the first group move from full-time employment to no participation in the labor market, the women who remain in the labor market will exhibit starker differences with men in time requirements, thereby increasing time segregation.



**Figure 3.** The Evolution over the Life Course of Occupational Segregation, Time-Related Segregation, and Economic Segregation

Source: Spring quarter LFS, 1993 to 2013.

Note: The shaded 99 percent confidence intervals are the result of estimating local linear regressions of the indexes on age.

In summary, Figure 3 brings to the fore one finding of our unified framework: occupational segregation, on the one hand, and the sources behind the time divide (economic and time-related segregation), on the other, evolve in close connection with one another. In view of the patterns of their joint evolution, we distinguish four stages in segregation over the life course: coming of age (16 to 21), career-building and family-formation (22 to 35), the return to segregating occupations (36 to 49), and growing older (50 to 69).

*Coming of Age*

At age 16, women and men have yet to diverge, and all forms of segregation are at their lowest levels. Economic segregation stands at .4 index value points, reflecting the fact that the majority of this age group is still studying (see Table 6). Among the minority in paid employment, most work only marginal hours or half-time. Hence, their time segregation is also at its minimum value at 4.9 points.

The appreciable negative interaction term in Figure 1 (−3.4 index value points at age 16) reflects the “crossing” of the two factors that characterize the typical jobs of women (men): belonging to a female (male) occupation and being part-time (full-time). For example, at this age, among women, the ten most common jobs include one that is full-time and female and two that are part-time and male; among men, seven of the ten most common jobs are part-time and male. The segregating power of this “unnatural” combination of features cannot be unambiguously attributed to either occupation or time alone.

Occupational segregation is also at its lowest mark in the life course (21.3 points), because a large proportion of women and men work in the same, small subsample of occupations. For example, from 2001 to 2010, the longest period with a single occupational classification, 67.6 percent of women and 43.9 percent of men worked as sales assistants and retail cashiers or in elementary personal services occupations.<sup>7</sup>

**Table 6.** Coming of Age (Selected Ages); Key Percentages by Gender and Segregation Indexes

	Age 16		Age 21	
	Women	Men	Women	Men
<i>Panel A. Economic Status</i>				
In paid work	27.5	23.0	56.9	62.5
Unemployed	9.8	10.6	8.0	13.6
In homemaking	.5	.1	11.2	.3
Retired	.0	.0	.0	.0
Student	56.7	59.9	19.3	18.9
Sick	.5	.6	1.4	1.8
Other	5.1	5.8	3.1	3.0
Total	100.0	100.0	100.0	100.0
Count	17,128	17,972	14,594	14,086
<i>Panel B. Degree of Labor Market Involvement</i>				
Marginal hours	61.3	50.8	9.4	5.6
Half-time	27.1	26.6	26.7	18.5
Reduced full-time	3.1	4.1	10.1	10.0
Full-time	8.5	18.6	53.8	65.9
Total	100.0	100.0	100.0	100.0
<i>Panel C. Sex-Typed Occupations</i>				
Male	15.7	57.0	10.0	56.1
Integrated	2.6	2.4	7.8	8.1
Female	81.7	40.5	82.2	35.8
Total	100.0	100.0	100.0	100.0
Count	4,917	4,388	8,437	8,972
<i>Panel D. Concepts of Segregation and the Employment Rate [<math>p_w(a)</math>]</i>				
Occupational		21.3		27.8
Time		4.9		6.2
Interaction		-3.4		-5.1
Market		22.9		28.9
$p_w(a) \times 100$		25.2		59.7
$p_w(a) \times \text{Market}$		5.8		17.3
Economic		.4		4.0
Gender		6.2		21.3

Source: Spring quarter LFS, 1993 to 2013.

Note: Working marginal hours entails 10 hours or fewer of paid work; half-time, 11 to 29 hours; reduced full-time, 30 to 34 hours; and full-time, 35 or more hours. For a given age, women make up a share of the employed labor force. Integrated occupations have a percentage of female workers that is  $\pm 5\%$  of the percentage of women in the employed labor force. Female (male) occupations have a percentage of female workers that is more than five percentage points greater (smaller) than the percentage of women in the employed labor force. Panels A, B, and C list column percentages. Counts are the sample size. Panel D presents segregation indexes net of cohort and period effects for each segregation concept and age. Percentages and indexes are weighted estimates.

Only five years later, at age 21, many women and men had already sorted themselves into diverging paths. Thus, although approximately one-fifth of the population remained enrolled in full-time education,

economic segregation increases to 4 points. To a large extent, this figure reflects a gender discrepancy in the labor market activity rate— $(62.5 + 13.6) - (56.9 + 8.0) = 11.2$  percentage points in favor of men—and in the

rate of homemaking—11 percentage points in favor of women.

In the marketplace, the gender gap in the rates of half-time and full-time employment widens, boosting the time segregation index to 6.2 points. Still, compared with other phases of the life course, the rate of 21-year-old women in full-time paid employment is relatively high (53.8 percent) and strengthens the negative interaction term (−5.1 points). For example, seven of the ten most common jobs among women in this age group are full-time and female. In comparison, men of the same age have three jobs that are full-time and female among their ten most common jobs. People still cluster into the same two occupational groups they did at age 16, but less intensely: 29 percent of women and 19.9 percent of men. Nevertheless, at age 21, the occupational segregation index value soars to a local maximum of 27.8 points.

Together with the period between the ages 60 to 64, this is the only stage in which occupational and non-occupational segregating forces push in the same direction and together boost gender segregation. In total, these changes over the first six years of the life course increase gender segregation from its minimum value of 6.2 at age 16 to 21.3 points by age 21. This 15-point difference represents the greatest expansion of gender segregation over the whole life course.

### *Career-Building and Family-Formation*

Ages 22 to 49 are, for men, the core years of working in the marketplace and, for women, the core years of working in the marketplace, working at home, or both. Figures 1, 2, and 3 show that these nearly three decades in people's lives can be divided into two stages. The first stage, from age 22 to 35, is organized around the average age at childbearing—28.9 in 2004 in England and Wales (Ní Bhrolcháin and Beaujouan 2012)—and therefore includes the prime childbearing years (Hodson and Sullivan 2008). These years are also central in promoting one's position in the labor market.

Correspondingly, we follow Moen and Sweet (2004) in referring to the years from 22 to 35 as the “career-building and family-formation years.”

In young adulthood, increasing numbers of women and men diverge in the time apportioned to family and wage labor. Soon after people finish their schooling, men's employment rate surges; women's rate also expands, albeit less so because their rate of homemaking simultaneously increases. Women's rate of homemaking peaks at 20 percent when they are 30 years old. It remains at this level until after age 35, when it commences its descent (see Figure 4 and Table 7). Men's rate of homemaking, in contrast, hovers at approximately 1 percent. Together with the gender gap in the employment rate, this is the major reason why, during the core working years, the economic segregation of women and men is at a local maximum of approximately 6 index value points for a whole decade, from the mid-20s to the mid-30s (see Figure 2).

Furthermore, from the ages of 21 to 35, market segregation increases from 28.9 to 34.1 points, propelled by time segregation and the interaction term. The former grows from 6.2 to 9.9 points and the latter from −5.1 to 1.4. The common trend underlying these changes is the channeling of women's employment toward part-time jobs. The interaction's upward direction corroborates Gregory and Connolly's (2008:F3) finding that in the United Kingdom, “the peak age range for women switching from full to part-time work is 27–34.” By age 35, two-fifths of women in the labor market work half-time, whereas most men have full-time jobs. In this setup, the pattern responsible for the earlier negative interaction term—women's tendency to work full-time in female occupations—no longer holds.<sup>8</sup>

Occupational segregation evolves in stark contrast with the expansion of the time divide within and beyond the market. It decreases from 27.8 points at age 21 to 22.9 at age 35. This indicates that, controlling for time, women who remain in paid work during these critical years are able to build careers that approach those of men. Notably, women who

**Table 7.** The Core Working Years (Selected Ages); Key Percentages by Gender and Segregation Indexes

	Age 30		Age 35		Age 46		Age 49	
	Women	Men	Women	Men	Women	Men	Women	Men
<i>Panel A. Economic Status</i>								
In paid work	69.6	87.3	70.7	88.4	77.6	86.8	76.7	85.7
Unemployed	4.5	6.4	3.8	5.1	3.1	4.6	2.8	4.3
In homemaking	20.0	.9	18.9	1.1	9.2	1.1	8.0	1.2
Retired	.0	.0	.0	.0	.1	.0	.3	.2
Student	1.6	1.3	1.2	.7	.5	.3	.3	.2
Sick	2.1	2.7	3.2	3.1	6.6	5.8	8.0	7.0
Other	2.2	1.5	2.2	1.6	2.9	1.4	3.9	1.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Count	19,623	16,970	20,819	18,415	19,571	18,249	18,815	17,762
<i>Panel B. Degree of Labor Market Involvement</i>								
Marginal hours	6.9	1.3	9.0	1.2	7.1	1.4	7.0	1.6
Half-time	29.6	7.8	39.0	7.8	33.7	7.6	33.2	7.6
Reduced full-time	9.7	7.6	10.1	7.6	12.7	7.4	12.4	7.0
Full-time	53.8	83.3	41.9	83.4	46.5	83.5	47.4	83.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
<i>Panel C. Sex-Typed Occupations</i>								
Male	15.0	64.5	18.0	69.7	18.3	76.0	16.3	74.4
Integrated	13.0	13.9	11.7	11.9	6.3	6.3	8.0	8.3
Female	72.0	21.6	70.3	18.4	75.5	17.7	75.7	17.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Count	13,613	14,805	14,703	16,273	15,177	15,860	14,387	15,220
<i>Panel D. Concepts of Segregation and the Employment Rate <math>[p_w(a)]</math></i>								
Occupational	24.6		22.9		27.0		27.9	
Time	7.7		9.9		7.6		7.6	
Interaction	-1.3		1.4		1.1		.8	
Market	31.0		34.1		35.7		36.3	
$P_w(a) \times 100$	78.3		79.4		82.1		81.1	
$P_w(a) \times \text{Market}$	24.3		27.1		29.3		29.5	
Economic	6.2		5.6		2.4		2.2	
Gender	30.5		32.6		31.7		31.7	

Source: Spring quarter LFS, 1993 to 2013.

Note: Working marginal hours entails 10 hours or fewer of paid work; half-time, 11 to 29 hours; reduced full-time, 30 to 34 hours; and full-time, 35 or more hours. For a given age, women make up a share of the employed labor force. Integrated occupations have a percentage of female workers that is  $\pm 5\%$  of the percentage of women in the employed labor force. Female (male) occupations have a percentage of female workers that is more than five percentage points greater (smaller) than the percentage of women in the employed labor force. Panels A, B, and C list column percentages. Counts are the sample size. Panel D presents segregation indexes net of cohort and period effects for each segregation concept and age. Percentages and indexes are weighted estimates.

remain employed at this age are less concentrated in a few occupations than at other times. At age 35, 6 percent of women in paid employment work as teaching professionals, and another 6 percent are sales assistants and retail cashiers, the two most common occupations at that age. In addition, the remaining women in paid work are distributed more evenly across occupational classifications than at other life stages, as evidenced by the 18 percent share of women who work in male occupations at age 35; this share is only 10 percent at age 21.<sup>9</sup>

In spite of the reduction in occupational segregation, economic and time-related segregation expand and take gender segregation to its highest level in the life course at approximately age 35. Figures 2 and 3 show that during this stage of the life course, gender segregation climbs to the top of the inverted *U*: it intensifies by 11.3 index value points, from 21.3 at age 21 to 32.6 by age 35. Additionally, the employment rate continues to increase, gaining 19 points from ages 21 to 30 and fluctuating thereafter around the 80 percent mark.

### *Return to Segregating Occupations*

The second period of the core working years follows the nearly horizontal line at the top of the inverted *U*-shaped pattern of gender segregation in Figure 2, panel a. We define its starting point at age 36, when reversals in the trends of occupational segregation and the time divide begin; this period then persists until age 49, when people start retiring from paid work in increasing numbers.

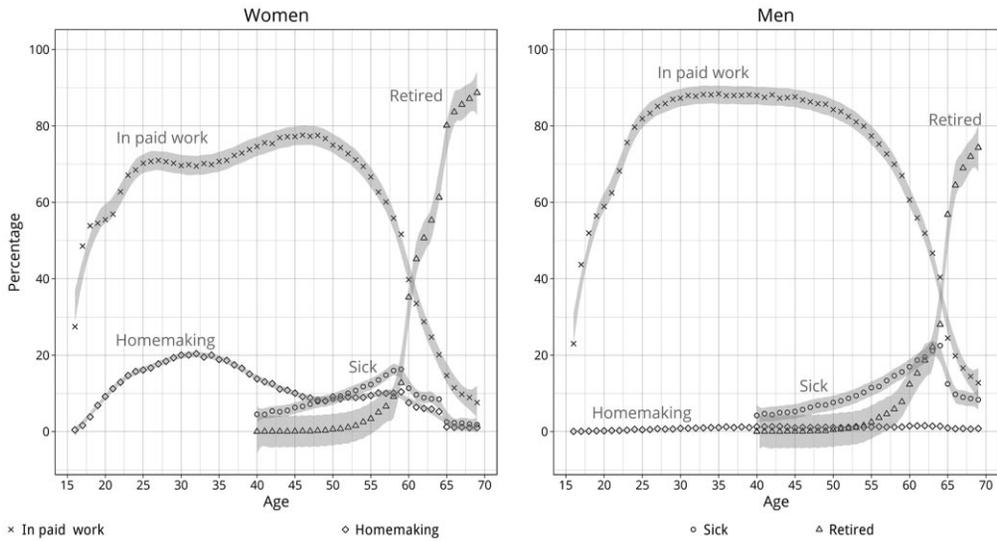
Just before this period begins, economic segregation stands at 5.6 points at age 35 and decreases monotonically to 2.2 at age 49. This equalization in women's and men's economic status is brought about by two interrelated trends: (1) the percentage of women in paid work increases, which narrows the employment gap to only 9 percentage points in favor of men at age 49; and (2) women's rate of homemaking decreases to only 8 percent (also at age 49). Similarly, time segregation in the market weakens from 9.9 to 7.6 points, and the interaction term decreases from 1.4 to .8 points (see Figure 1).

The subsiding of the time divide would soften gender segregation if occupational segregation remained at the low levels reached by age 35. However, occupational segregation rebounds from a value of 22.9 at age 35 to 27.9 points by age 49, and it props up gender segregation on its plateau. The opposing trends of occupational and non-occupational segregation suggest that when children are of school age, which begins at age 5 in the United Kingdom, women in part-time paid work or in homemaking increase their hours of involvement in the marketplace. As a result, the overrepresentation of women in a few occupations starts intensifying. For example, 8 percent of 49-year-old women in paid employment work as teaching professionals and 7 percent are in secretarial and related occupations. Overall, 76 percent of women work in female occupations.

### *Growing Older: The Midcourse Years*

Age 50 marks the start of the stage in the life course that Moen (2003) calls "late midlife" or "the midcourse years" in her analyses of U.S. data. This label can be applied to other Western countries where, as Moen argues, it is reasonable to distinguish the process of growing older from the fragility associated with being old. The midcourse years are characterized by gender differences in the retirement age, the emergence of ill health as a pathway to retirement, and the combination of retirement and paid employment through a reduction of work hours (see Figure 4).

This stage consists of three parts. The first, from ages 50 to 59, initiates a substantial rise in the rates of retirement, sickness, and disability together with a fall in the employment rate. Nevertheless, in these 10 years, occupational segregation continues its upward trend while economic and time-related segregation remain stable. Ages 60 and 65 bound the second period in the midcourse years. These are the traditional state pension ages for women and men in the United Kingdom, respectively.<sup>10</sup> This gap brings about an upsurge in all the sources of segregation—economic, time-related, and occupational. The third and final part of the



**Figure 4.** Economic Status by Age  
 Source: Spring quarter LFS, 1993 to 2013.  
 Note: The shaded 99 percent confidence intervals are the result of estimating local linear regressions of the percentages on age.

midcourse years runs from ages 66 to 69. Here, again, occupational and non-occupational segregating forces are at loggerheads.

Consider the evolution of the retirement rate. Until the early 50s, retirement is negligible, but by age 60, over one-third of women and 12.4 percent of men are retired, that is, there is a gender gap of 23 percentage points in favor of women (see Table 8). By age 65, more women and men have retired, but the gap remains steady at 23 percentage points. By age 69, the majority of women and men are retirees, and the gap narrows to 14 percentage points. In short, women quit paid work at a younger age than men. This is because heterosexual couples typically have an age gap of two to three years between an older man and a younger woman (Blundell, Meghir, and Smith 2002; Ní Bhrolcháin 2005), and partners tend to exit wage labor synchronously (Moen et al. 2006). This general tendency is reinforced in the United Kingdom by the abovementioned gender gap in the statutory retirement age for collecting social security benefits.

Sick rates are relatively gender neutral until age 59. Up to that point, there is usually only a one-percentage-point gap or less in

favor of women. The percentage of 59-year-old women who are permanently sick is 16 percent. This percentage drops to 11 percent when they are 60. As a result, the gender gap in sick rates increases to 6 percentage points in favor of men. Similarly, a full 22 percent of men are classed as permanently sick at age 64, but only 12 percent are classified as such one year later.<sup>11</sup> These patterns suggest sickness and disability are pathways to early retirement thanks to the pecuniary benefits that this economic status often entails (Dahl et al. 2003; Gruber and Wise 2004). However, many workers stop being classed as permanently sick and likely become “the retired” when they reach state pension age.

Taken together, shifts in employment, retirement, and sickness rates increase economic segregation in the 60 to 65 age range (see Figure 2) and provide the backdrop for the drastic variation in market segregation and its components illustrated by Figure 1. Two phenomena occur hand in hand: (1) the diminishing population that remains engaged in paid work, and (2) the concentration of this population in part-time employment and in a few occupations. Time segregation increases from 9.8 index value points at age 59 to 11.3

**Table 8.** Growing Older (Selected Ages); Key Percentages by Gender and Segregation Indexes

	Age 59		Age 60		Age 65		Age 69	
	Women	Men	Women	Men	Women	Men	Women	Men
<i>Panel A. Economic Status</i>								
In paid work	51.7	67.0	39.8	60.7	14.7	24.5	7.6	12.8
Unemployed	1.6	4.4	.8	3.8	.3	.9	.1	.5
In homemaking	10.4	1.2	7.6	1.5	1.2	1.0	1.1	.8
Retired	12.8	7.8	35.2	12.4	80.1	56.8	88.7	74.3
Student	.1	.0	.0	.1	.0	.1	.0	.0
Stick	16.3	15.6	11.4	17.0	2.6	12.5	1.8	8.3
Other	7.1	4.0	5.2	4.6	1.1	4.3	.7	3.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Count	15,749	14,505	15,720	14,551	14,835	13,654	13,199	11,833
<i>Panel B. Degree of Labor Market Involvement</i>								
Marginal hours	12.1	3.7	15.4	4.7	33.1	15.2	41.5	25.1
Half-time	39.5	13.3	42.6	15.0	43.0	32.3	42.6	38.8
Reduced full-time	11.7	8.9	10.9	8.2	6.4	8.7	5.3	8.3
Full-time	36.7	74.1	31.1	72.2	17.5	43.8	10.6	27.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
<i>Panel C. Sex-Typed Occupations</i>								
Male	16.7	76.7	17.2	77.3	15.8	72.3	14.9	71.8
Integrated	3.8	3.8	3.5	3.6	10.6	9.7	7.3	6.9
Female	79.4	19.5	79.2	19.1	73.7	18.0	77.8	21.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Count	8,014	9,653	6,125	8,769	2,081	3,244	978	1,473
<i>Panel D. Concepts of Segregation and the Employment Rate <math>[p_w(a)]</math></i>								
Occupational	32.0			32.3			40.3	46.8
Time	9.8			10.8			13.2	11.3
Interaction	-1.6			-1.4			-7.7	-7.3
Market	40.2			41.7			45.7	50.8
$P_w(a) \times 100$	59.1			50.0			19.4	10.0
$P_w(a) \times \text{Market}$	23.8			20.8			8.9	5.1
Economic	3.7			6.4			6.4	4.1
Gender	27.5			27.2			15.3	9.2

Source: Spring quarter LFS, 1993 to 2013.

Note: Working marginal hours entails 10 hours or fewer of paid work; half-time, 11 to 29 hours; reduced full-time, 30 to 34 hours; and full-time, 35 or more hours. For a given age, women make up a share of the employed labor force. Integrated occupations have a percentage of female workers that is  $\pm 5\%$  of the percentage of women in the employed labor force. Female (male) occupations have a percentage of female workers that is more than five percentage points greater (smaller) than the percentage of women in the employed labor force. Panels A, B, and C list column percentages. Counts are the sample size. Panel D presents segregation indexes net of cohort and period effects for each segregation concept and age. Percentages and indexes are weighted estimates.

points by age 69 (see Table 8). Behind such growth is the channeling of fewer and fewer workers toward fewer and fewer hours of paid employment (Anxo et al. 2007). For example, approximately two-fifths of the few men working at age 69 are employed half-time. In addition, from ages 59 to 69, the percentage of women working marginal hours more than triples—from 12.1 to 41.5 percentage points—whereas men have a sevenfold increase—from 3.7 to 25.1 percent.

Men's reduced hours in the market create numerous examples of "contradiction" in the typical features of their employment. For example, five of their ten most common jobs at age 69 are part-time and male. Men's reduced hours in male occupations are responsible for the downward trend in the interaction term, from -1.6 points at age 59 to -7.3 points at age 69.

With regard to occupations, at age 59, 18 percent of women work in either secretarial and related occupations or as sales assistants and retail cashiers. However, by age 69, 27 percent of the few women who remain in paid employment work in either elementary cleaning occupations or as sales assistants and retail cashiers. In contrast, 15 percent of men work as either transport drivers and operatives or in construction trades at age 59. By age 69, men's concentration within a few occupations also increases, although less so: 17.1 percent of these men work as either transport drivers and operatives or in agricultural trades. The clustering of women and men around distinct occupations by the end of their working lives pushes occupational segregation to its highest value (46.8 points) at age 69 (versus, e.g., 32 points at age 59 and 27.8 points at age 21).<sup>12</sup>

Despite the increase in economic segregation and the change in the makeup of market segregation brought about by reduced work hours and clustering around a few occupations among older workers, Figure 2, panel b, shows that the employment rate is the driving force behind the decrease in gender segregation after the state pension age. Before that age, gender segregation diminishes moderately from, for example, 31.7 index value points at age 49 to 27.5 at age 59. The employment rate reaches its minimum value of 10 percent at

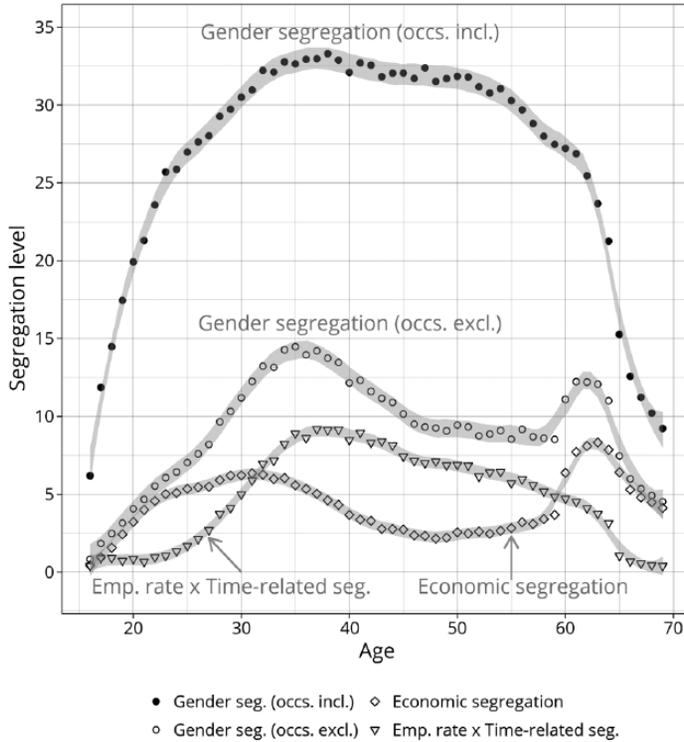
age 69, curtailing gender segregation severely to 9.2 points. The magnitude of this figure is similar at the start of the life course: 6.2 points at age 16, when only 25.2 percent of the population is engaged in paid work.

### *Gender Segregation beyond Occupation*

Figure 5 graphs gender segregation as expressed in Equations 12 and 16—that is,  $G^W(a)$  and  $G'(a)$ . These terms stand for gender segregation with occupations included and gender segregation excluding the segregating force that is exclusively attributable to occupations, respectively. We call the latter "non-occupational segregation."

To be precise, gender segregation is approximately twice as large as occupational segregation at some points of the career- and family-building stage of the life course, as well as during the retirement stage. Consider age 35 in Table 7. The employment rate stands at 79.4 percent. Thus, occupational segregation contributes  $p_w(a) \times O^W(a) = .794 \times 22.9 = 18.2$  of the 32.6 points of gender segregation,  $G^W(a)$ . In other words, in a hypothetical situation where occupations are completely integrated, 44.4 percent of gender segregation (14.5 points) would remain at this age due to the contributions of economic and time-related segregation—which amount to 17.1 and 27.3 percent of overall gender segregation, respectively (see Table 9).

Considering these calculations for every age, we conclude that gender segregation is consistently 20 percent above occupational segregation after people pass their teens. Table 9 presents this information for selected ages. (A table for all ages is available upon request.) We find three main results. (1) Gender segregation generated by non-occupational forces increases from one-fifth to one-fourth, one-third, and just under one-half of all segregation in the early 20s, mid-20s, late 20s, and mid-30s, respectively. (2) In people's 40s, non-occupational segregation recedes to approximately one-third of all segregation. (3) However, it returns with force in people's 60s, when it reaches two-fifths (age 60) and approximately one-half



**Figure 5.** The Evolution of Gender Segregation, Including and Excluding Occupations  
 Source: Spring quarter LFS, 1993 to 2013.

Note: Occupations are included as in Equation 15. In the counterfactual scenario (occupations excluded), we set the term  $O^W(a)$  to zero as in Equation 16. The shaded 99 percent confidence intervals are the result of estimating local linear regressions of the indexes on age.

(from age 63 onward) of the little overall segregation that remains.

### The Influence of the Employment Rate

The evolution over the life course of gender segregation (Figure 2, panel a) closely resembles the progression of the employment rate (Figure 2, panel b): it surges in the late teens and early 20s; it stabilizes during the prime labor market involvement years when approximately 80 percent of people are engaged in paid employment; and finally, it plunges after age 50. In short, in the United Kingdom, much of the evolution of segregation reflects the proportion of people in paid employment.

Do our economic and time segregation results hold in the face of the central role played by the employment rate? To answer this question, we consider Equation 11 with

one modification: the term for market segregation,  $MS^W(a)$ , is weighted by  $\bar{p}_w = .672$ , the average proportion of individuals age 16 to 69 who are engaged in paid employment over the 1993 to 2013 period. The results are graphed in Figure 6. Holding the employment rate constant, economic segregation in the 20s, 30s, and early 60s is non-negligible, and time-related segregation widens the gap between gender segregation and occupational segregation in the 30s, 40s, and 50s. In short, our main results are not unduly influenced by the shifting employment rate.

### Robustness Checks

To address potential confounding of age, cohort, and period effects, we proposed a method based on the *SD* property of the *M* index. We thus make cohort and period coterminous and identify segregation at each age.

**Table 9.** The Contribution of Various Notions of Segregation to Gender Segregation for Selected Ages

Age	Occupational Segregation (1)	Time-Related Segregation (2)	Economic Segregation (3)	Total
19	81.9	4.2	13.9	100.0
20	79.6	4.2	16.2	100.0
24	75.1	5.2	19.7	100.0
28	67.0	12.8	20.2	100.0
35	55.6	27.3	17.1	100.0
45	68.3	23.2	8.5	100.0
60	59.2	17.3	23.4	100.0
63	49.0	15.8	35.2	100.0

Source: Spring quarter LFS, 1993 to 2013.

Note: The row percentages in the table are calculated using the terms in Equation 12 as follows: (1) occupational segregation,  $p_w(a)[O^w(a)/G^w(a)]\times 100$ ; (2) time-related segregation,  $p_w(a)[TS^w(a)+\Delta(a)/G^w(a)]\times 100$ ; and (3) economic segregation,  $[ES^w(a)/G^w(a)]\times 100$ . Count: 258,852.

This method assumes the segregation patterns we identify over the life course are stable in the sample. However, the distributions of women and men across economic statuses, degrees of labor market involvement, and occupations vary over the 21 years spanned by the data. For this reason, we conducted a robustness check on our findings (see part C.1 of the online supplement), concluding that the main results hold for two five-year-long periods during which the assumption of stability in the segregation profile by age of the population seems acceptable.

We also assess the impact of the business cycle (part C.2 of the online supplement) and self-employment (part C.3) on the evolution of segregation over the life course. In both cases, we conclude that the patterns presented in this article are not altered.

## DISCUSSION

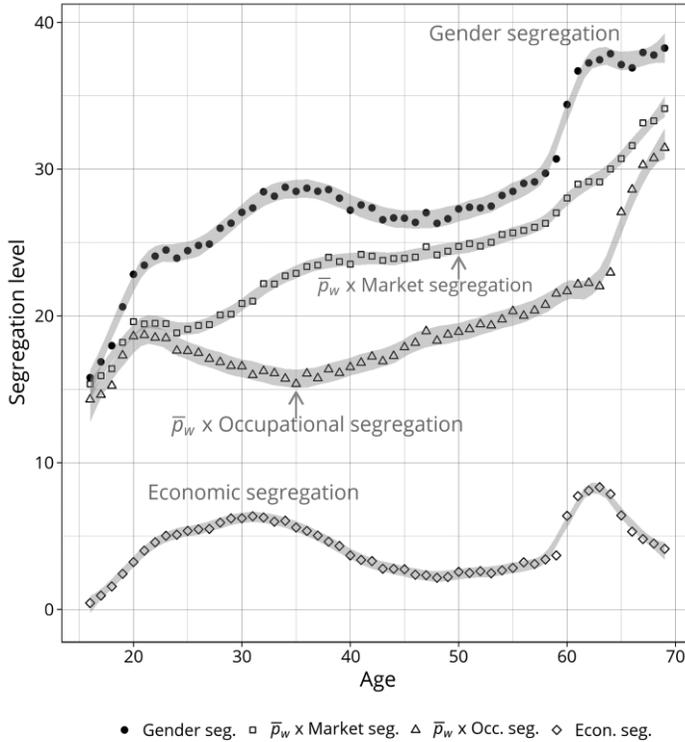
We studied British society from 1993 to 2013 and found that gender segregation follows an inverted *U*-shaped pattern over the ages 16 to 69. The methodological linchpin of the framework is the *SD* property of the *M* index, which we repeatedly applied to empirically measure the components of segregation for each age net of cohort and period effects. We

now group our findings in terms of four consequences they have for the existing literature on gender segregation.

### *Consequence 1. On the Traditional Measure of Occupational Segregation*

The traditional approach to measuring occupational segregation would lead to what we call “occupation-related segregation,” that is, the sum of the segregation that is unambiguously attributable to gender differences in occupations,  $O^w(a)$ , plus the interaction term,  $\Delta(a)$ . Failure to isolate  $O^w(a)$  leads one to overlook aspects of interest to gender relations. For example, during the career-building and family-formation years,  $O^w(a)$  and  $\Delta(a)$  follow opposite trends that cancel each other out. Hence, if we only measured occupation-related segregation, we would miss that in this life stage, controlling for time segregation, occupational segregation weakens.

Moreover, after age 35, occupational segregation expands by less than what occupation-related segregation would suggest. This is because the entry of many women into female and part-time jobs after childbearing (Blackwell 2001; Tomlinson et al. 2009) turns the interaction term positive.



**Figure 6.** The Evolution of Gender Segregation over the Life Course with the Employment Rate Set to its Mean Value in Equation 11 ( $\bar{p}_w = .672$ )

Source: Spring quarter LFS, 1993 to 2013.

Note: The shaded 99 percent confidence intervals are the result of estimating local linear regressions of the indexes on age.

*Consequence 2. On the Tradeoff between Time-Related and Occupational Segregation*

In line with many other scholars, we recognize that gender differences in hours of work affect occupational segregation (see references in note 1). Pettit and Hook (2009) describe this in terms of a “tradeoff” between part-time work and occupational segregation: institutional arrangements that encourage women’s employment in part-time jobs also result in high levels of occupational segregation.

To address this question, we define market segregation as the sum of occupational and time-related segregation. Unsurprisingly, we find that part-time employment contributes to market segregation. However, our unified framework brings to the fore that the gendered tradeoff between time-related and occupational segregation manifests in three distinct

phases throughout the life course. This is the second consequence of our findings.

The first phase includes the prime child-bearing years. At this stage, women’s rising rates of part-time work fuel time-related segregation. Simultaneously, women and men on each side of the time divide become more similar in their occupational allocation, leading to the reduction in occupational segregation discussed in Consequence 1. The second phase starts when children are school age. Part-time employment is one long-lasting consequence of childrearing that weighs on many women at this life stage (Anxo et al. 2007; Connolly and Gregory 2008). However, many women also converge with their male co-workers in hours of paid work and drive time-related segregation down. Simultaneously, occupational segregation inches up, a finding in line with women’s overrepresentation in a narrow set of occupations after

childbearing (Blackwell 2001; Tomlinson et al. 2009). Finally, the post-retirement years define the third phase. At this point, few women and men remain in paid work, and they typically work only marginal hours in heavily gender-typical occupations. Time-related segregation thus recedes, but occupational segregation surges to unprecedented levels—bearing out results from the scant research on occupational segregation at older ages (Lain 2012).

### *Consequence 3. On Segregation beyond the Marketplace*

As Cohen (2004) notes, the literature is divided between housework and occupational segregation. We agree with him that this state of affairs precludes considering the relationship between family and market labor. The divergence between overall gender segregation and the segregation that stems from occupations alone supports a holistic approach à la Cohen. Had we concentrated exclusively on the marketplace, we would have concluded that gender segregation grows monotonically (see Figure 1).

Our unified framework for the measurement of segregation across the board introduces two novelties. The first relates to the connection between the intensity of women's labor market participation and occupational segregation (Cooke 2011; Goldin 1990; Jacobs 1989; Pettit and Hook 2009; Roos 1985). In our framework, the gender gap in the employment rate, together with gender differences in five other economic statuses, identifies economic segregation. Thanks to this approach, we complete the picture of the "gendered tradeoff." We find that the ebb and flow of economic and occupational segregation mirrors that between the latter and time-related segregation described in Consequence 2.

The second novelty stems from an additional role played by the employment rate of women together with that of men. The weighted sum of the two rates equals the population's employment rate, which scales down market segregation when added to economic segregation in Equation 11. The

evolution of gender segregation over the life course follows the inverted *U* shape of this overall employment rate (see Figure 2).

### *Consequence 4. On the Life Course Perspective and the Heterogeneity of Women*

Our measurement framework yields a dynamic description of the gendered life course. Economic and time segregation become critical around the years devoted to career- and family-building. However, their influence lingers until gender disparities in retirement age and in the incidence of permanent sickness take a central role in the little gender segregation that remains at older ages. Then occupational segregation—thus far the dominant segregating force—is subject to a tradeoff with the other segregation sources. The multiple sources of segregation are interconnected synchronously and diachronically. This is because key events in the life and work domains take place simultaneously and are age graded (Brückner and Mayer 2005). Ultimately, time is yet another scarce resource in the gender system (Ridgeway 2014). You either accumulate "work time" and partake in "promotion rituals" (Ridgeway 2014) when the time comes, or you do not (Scott 2008). You either become involved in intensive parenting when your children are young, or you do not (Cha 2013; Stone 2008). You either retire from paid work together with your partner, or you do not (Radl 2012). Career-building and family-building (Moen and Sweet 2004) occur at around the same life stage in gendered, separate, and often "greedy" and competing realms of life (Blair-Loy 2003; Cha 2013). Allegiance to one dimension entails a lesser degree of adherence to, or even complete avoidance of, other spheres.

Segregation occurs because women and men specialize differently. Our results highlight that the evolution of segregation stems from heterogeneous timings of activities in the lifespan. This heterogeneity mostly pertains to women. For most men, during most of their lives, there is only one road they are walking: that of full-time employment. The

predicament around critical life and work events mainly concerns women (Gerson 1985; Myrdal and Klein 1956; Stone 2008). Different women combine labor alternatives in distinct ways. This finding is in line with ideas in the broader literature on women's heterogeneity (Hakim 1991; Heckman and Willis 1977; McMunn et al. 2015). In recent contributions, the question is often worded as the "polarization" between high- and low-educated women (Esping-Andersen 2009) or in terms of class-based differences (Cooke 2011; Crompton 2006). A critical consideration splitting women's fates is the cost of childcare (Evertsson et al. 2009). Given institutional constraints (Lewis 2008; Pedulla and Thébaud 2015) and cultural beliefs, social expectations, and norms (Benard and Correll 2010; Cech 2013; Damaske 2011; Kleven et al. 2018; Platt and Polavieja 2016), women find themselves between two extremes: opting for low-paying jobs and becoming full-time homemakers when the first child is born; or having access to higher-paying jobs, hiring childcare, and remaining in full-time employment. Our findings show, for the first time, the consequences of women's heterogeneity for the evolution of gender segregation over the life course.

### *Further Research*

We can suggest several avenues for future work. On the one hand, our framework for researching gender segregation and its components can be easily applied to conduct inter-temporal and international comparisons of gender segregation. Since the late 1960s, many studies have made inter-temporal comparisons of the level of occupational segregation (Blau, Brummund, and Liu 2013; Gross 1968). Direct measures of segregation for a given period (typically one calendar year) confound the effects of period, age, and cohort. The *SD* property satisfied by the *M* index allows the researcher to isolate the measure of segregation by period net of the influence of age and cohort in a way analogous to the identification of the effect of age net of cohort and period that we presented in this article.

In international comparisons, our research framework can contribute by addressing the following class of questions. Consider first country *A* where women and men work full-time, and country *B* where only men work in the labor market. By construction, the employment rate is lower in country *B* and weights down its level of market segregation relative to country *A*. Conversely, economic segregation in *B* is greater than in *A*. How would these two opposing factors affect the comparison of gender segregation between the two countries? Consider now country *C* where women work part-time and men full-time. By construction, both country *A* and country *C* have the same economic segregation. Given the prevalence of women in part-time jobs, would country *C* exhibit greater overall gender segregation than country *A*? Alternatively, is there a tradeoff between time and occupational segregation?

On the other hand, our existing research framework can be enriched by obtaining new information on, for example, fields of study and household chores. At younger ages, most segregation is fed by differences in fields of education (Charles and Bradley 2009). When segregation among young students is mapped, it will match, to a lesser or greater degree, the level of the ensuing economic and market segregation in later stages of the life course. Similarly, gender segregation in old age is presumably fed mostly by the gendered division of household chores. Time use data may help discern whether the "one and a half" breadwinner model turns into "one and a half pensioner," or less (Sainsbury 1996), later in the life course, as the current literature on aging suggests (Esping-Andersen 2009; Ginn, Street, and Arber 2001; Meyer and Herd 2007). In short, future research that incorporates more segregating forces at younger and older ages may hoist the tails of the inverted *U* and draw a new picture with a flatter pattern.

Two other sources of information would enrich our current framework. First, conducting the analyses by educational attainment would help assess whether the life course becomes less gendered the more human

capital people accrue. Second, Charles and Grusky (2004) argue that a sizable part of the segregation of women and men in the market can be traced to their differential distributions across manual and non-manual jobs. With the *M* index, it is easy to incorporate this and other features of jobs or workers into the research design—such as indicators of jobs' hierarchy to measure the vertical dimension of segregation. In preliminary and unpublished analyses, we found that the manual versus non-manual distinction affects gender segregation to a lesser extent than the time divide does. Thus, in this article, we focused on the latter. However, there may be periods (countries) when (where) the manual divide drives the segregative process in the market.

However, in our view, the greatest challenges for future research originate in two areas whose study would require extending the research framework proposed in this article and, possibly, complementing it with supporting tools. One area is the gender wage gap that widens around people's late 20s and early 30s (Elming, Joyce, and Costa Dias 2016), that is, the median age for mothers' first birth. To a large extent, this is a consequence of changes in mothers' economic statuses, work hours, and occupations—the “transmission mechanisms” for the effect of children (Kleven et al. 2018).

The second area is defined by the main take-home message of this article: the evolution of segregation over the life course is driven by the asymmetry between (1) the large homogeneity and constancy in men's state of full-time employment—regardless of family-formation pressures—and, in stark contrast, (2) women's heterogeneous responses to the pressures and quandaries posed by major life and work events. This finding calls for investigating the sources of women's unobserved heterogeneity that drive the evolution of gender segregation over the life course.

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### Notes

1. For example, Holden and Hansen (1987) and Sparreboom (2014) measure segregation in full- and part-time jobs separately; Hakim (2004) and Watts and Rich (1992) compare the occupational segregation of women and men in full-time employment with that of part-timers; Fagan and Rubery (1996) compare the occupational segregation of all workers with the segregation of full-timers; Blackwell (2003) and Blackwell and Guinea-Martin (2005) contrast the occupational distribution of men with that of women in full-time employment, on the one hand, and with that of women in part-time employment on the other; and Elliott (2005) and Guinea-Martin, Blackwell, and Elliott (2010) compute occupational segregation between women and men, as well as between women who are employed full- versus part-time.
2. We treat economic statuses as mutually exclusive. Hence, for example, women working for pay in the market and unpaid for their families are counted only in their role as paid workers. In other words, the “homemaking” category only records the people who look after their families full-time; the category “studying” only applies to students who did not work for pay one hour or more the week prior to the survey, and so on. Hence, as one reviewer pointed out, categories of economic status other than “in paid employment” are underreported in official statistics and in this article.
3. Downloaded on July 13, 2014, from the U.K. Data Service at <http://ukdataservice.ac.uk>. Scholars can apply to access the LFS data through the U.K. Data Service. We alone are responsible for the interpretation of the data presented herein. The LFS data are Crown Copyright and reproduced with the permission of the Controller of HMSO and Queen's Printer for Scotland.
4. The longest-running longitudinal study in the United Kingdom, the British Household Panel Study (BHPS), includes 18 years of data for 1991 to 2008. Given that individuals are followed for up to one-half of their life course, we would need to impute values for the remaining part based on

- results from other cohorts—just as we do for pooled cross-sections. Additionally, the BHPS sample size is approximately 10,000 people, which is too small to reliably estimate segregation indexes with detailed occupations, time involvement, and economic status classifications.
5. Taking genders (or ethnic groups) as supergroups and applying the *SD* property for partitions of demographic groups into supergroups, Guinea-Martin and colleagues (2015) decompose occupational segregation measured by the *M* index into three terms: the effect of gender and ethnicity, controlling for the other, plus an interaction term—an analogous decomposition to the one we introduce in Equation 8.
  6. A large and growing literature shows the heterogeneity in women's labor market behavior playing a prominent part. For recent examples, see Esping-Andersen (2009), Evertsson and colleagues (2009), Hakim (2004), Hank (2004), Kleven, Landais, and Sogaard (2018), McMunn and colleagues (2015), and Tomlinson, Olsen, and Purdam (2009).
  7. To simplify this and all the following illustrations and examples of the most common jobs, we use the 2001 to 2010 period and collapse the four degrees of labor market involvement into a full-time versus part-time work dichotomy around a threshold of 35 hours per week.
  8. Gregory and Connolly (2008:F3) further note that the number of U.K. women in part-time employment is at its highest when they are 35 to 45 years old, "the peak years for childcare."
  9. The selectivity of women of childbearing age who remain in paid employment is borne out by previous findings in the literature. Using retrospective longitudinal data, Jacobs (1995) concludes that from 1946 to 1986, British women with continuous careers were less concentrated in feminized occupations 10 to 16 years after they joined the labor market, compared to women with discontinuous careers. Furthermore, using data from the Luxembourg Income Study for the mid-1990s, Pettit and Hook (2009: Tables 5.1 and 5.2) note that British women with a child under age 6 who remained in paid work were more similar—in terms of their occupational profiles—to men than to women who quit their paid jobs.
  10. This was the case until May 2010. Since April 2010, the U.K. State Pension ages of women and men have gradually increased, with the objective of reaching a common age, 68, by the year 2046.
  11. For brevity, age 64 is not included in Table 8, but an expanded table is available upon request.
  12. On occupational segregation at older ages in the United Kingdom, see also Lain (2012).
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