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To cite this article: Johan Westerman, Dirk Witteveen, Erik Bihagen & Roujman Shahbazian (2024) Work life complexity no longer on the rise: trends among 1930s–1980s birth cohorts in Sweden, *European Societies*, 26:1, 1-33, DOI: [10.1080/14616696.2023.2196757](https://doi.org/10.1080/14616696.2023.2196757)

To link to this article: <https://doi.org/10.1080/14616696.2023.2196757>



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Published online: 08 May 2023.



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Work life complexity no longer on the rise: trends among 1930s–1980s birth cohorts in Sweden

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ABSTRACT

There is a conception that contemporary work lives become ever more complex. Pioneering research has indicated that work lives have indeed become more complex, yet at a modestly increasing pace. This paper uses Swedish registry data across an exceptionally long time period, including cohorts born from 1931 to 1983. The following conclusions are drawn using state-of-the-art methods of measuring sequence complexity. For early-careers, an increasing complexity trend is evident between the 1950s and 1960s birth cohorts, yet complexity fluctuates around a stable trend for the 1970s birth cohorts and onward. For mid-careers, which are considerably more stable on average, complexity has decreased among women born between the 1930s and the early-1950s. However, the opposite trend holds true for men, resulting in a gender convergence in work complexity. We observe a subsequent standstill of the mid-career complexity trend across both genders, followed by a modest decline for the last observed cohorts. Analyses point to educational expansion as an important driver of the initial increase of early-career complexity. Taken together, this study affirms an initial shift to more work life complexity in the twentieth century, yet we find no unidirectional trend toward more complexity over the last decades.



ARTICLE HISTORY Received 30 August 2022; Accepted 28 February 2023

EDITED BY Alexi Gugushvili

KEYWORDS Complexity; Swedish registers; careers; gender; work characteristics

Introduction

Social scientists have argued that work lives are more complex and less predictable than in the past. According to dominant streams in research,

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the shift toward growing complexity started in the 1970s, resulting from union decline, government deregulation, and restructuring by firms in response to global competition (e.g. Beck 2008; Hollister 2011; Kalleberg 2009; Mills *et al.* 2006), and further triggered by computerization (Kim *et al.* 2017), among other processes. This version of the 'growing complexity thesis' has considerable impact on public debate and has been informed by a wide variety of scholarly work on features of modern insecure employment situations, such as the precariat (Standing 2011), bad jobs (Kalleberg 2011), precarious work (Kalleberg 2012), and flexibility (Cappelli and Neumark 2004). The connection between insecure employment situations and rising frequencies of unemployment and inactivity spells (García-Pérez *et al.* 2019), as well as educational reentries (Goldrick-Rab and Han 2011), has also extended scholarly interests to include how growing work life complexity is related to family formation patterns (Büchman and Kriesi 2011), such as the timing of cohabitation and childbearing (Billari and Liefbroer 2010). The growing complexity thesis is thus of sociological relevance across a wide array of life domains.

Despite the theorized structural change in high-income countries and across these domains (employment, family, and education), empirical research on long-term trends in work life complexity remains rather scarce; that is, work life complexity as defined by the average duration within and transitions between states *related to* labor market participation (but overlapping with educational attainment and family formation). Recent research however suggests that work life complexity has only moderately increased in Europe ever since labor market entry of the 1930s birth cohorts and up to the birth cohorts of the late 1960s (Van Winkle and Fasang 2017, 2021). A further question regards the composition of the complexity trend, which is of crucial importance for the whole complexity debate, because rising work life complexity that is driven by, for example, unemployment spells may take on a different connotation than complexity driven by increasing educational attainment or parental leave spells.

In this paper, we define work life complexity as a holistic description of movements between several key states related to the work life. While some studies include or concentrate on transitions between (hierarchical) occupational positions for gainfully employed or on transitions between employers in the measurement of complexity (discussed in greater detail below), our assessment highlights the meaningful spells and transitions in and out of gainful employment, as well as other critical inactive states, such as unemployment, parental leave, and education. The distribution

and stability of such work life states across the life course form a crucial and comprehensive observation of individuals' socio-economic positioning. Analyses of these work life sequences do not only shed light on relevant trends and shifts in individuals' labor market trajectories, but also enhance our sociological understanding of such patterns in terms of material (in)security and other salient forms of human capital investment (i.e. education). The trends discussed in this study therefore have implications for labor market and economic stratification scholarship, as well as for social policy and education policy.

We first revisit the question of work life complexity trends and subsequently include many younger birth cohorts (1970s and 1980s), while refining the assessment of early-career complexity and mid-career complexity in separate models. Furthermore, inclusion of many more younger birth cohorts than in previous studies, in tandem with observation of distinct career phases, gives ample opportunities to accurately detect either continuing or stagnating trends in work life complexity. Following the 'growing complexity' thesis as put forward in mainstream stratification and inequality scholarship, we expect to find a progressing trend toward more complexity for both early- and mid-careers. Aside from these overall complexity trends, separate analyses of men and women in both career phases (early- and mid-careers) provide an opportunity to observe gender disparities.

We use state-of-the-art methods developed by Gabadinho *et al.* (2010) and first employed by Van Winkle and Fasang (2017, 2021) to accurately measure the complexity level of career sequences. Importantly, work life complexity is operationalized as a combination of sequence stability and entropy *at the individual level*. The sequence refers to the order and the timing of nominal 'states' that can be attained across the work life, such as different forms of employment, as well as unemployment, inactivity, or education etc. More between-state transitions, as well as more dispersion of states across the sequence (i.e. 'unpredictability'), yield higher levels of complexity. The complexity measure is therefore holistic and suitable for comparison across time. However, it simplifies some aspects of the work life. For example, a career consisting of leaving the educational system at age 20, followed by a transition into stable employment is equally non-/complex, as leaving education at the same age but ending up in permanent unemployment or inactivity. To unravel this potential ambiguity in complexity trends and inform the debate about what complexity means for individual working lives, we conduct an analysis analogous to decomposition. We show how much

of the trend that is explained by changes in the distributions of the different states over time.

Our analytical approach allows us to pinpoint three noteworthy shifts relevant to social stratification and inequality scholarship. The first being rising early-career complexity as described in previous work and the second being a stalling of the early-career complexity trend ever since the 1970s birth cohorts entered the labor force. Third, we note an evident gender convergence in mid-career complexity for the cohorts born from the 1930s and early 1950s, mostly driven by a downward complexity trend among women. Moreover, decomposition analyses reveal that education spells contributed most to the initial rise in early-career complexity. The observation lengths also allow us to descriptively link complexity patterns to fluctuations in the business cycle. Together, the analyses provide empirical evidence for a nuanced picture of work life course trends in relation to prominent social science theory on complexity.

We study Sweden, which is known to have higher work life complexity and earlier gender convergence in labor force participation compared to other European countries (Van Winkle and Fasang 2017, 2021). We use full-population registry data from Sweden, containing about one-hundred-thousand observations per birth cohort, which, in addition to yielding exact estimates of work life complexity, do not have any recall errors as occurring in data from retrospective biographies. The results of our study should be able to be replicated with data from other countries, as many high-income countries have gone through the same structural changes that potentially drive the complexity trends. Some results may be specific to the Swedish case because the timing of structural changes differs between countries.

Labor market trends and complexity

There are several reasons to expect that large-scale global trends would increase work life complexity in high-income countries. Influential scholarly work indirectly addresses triggers of rising complexity during work lives, using concepts such as the risk society and individualization (Beck 2008), the precariat (Standing 2011), post-Fordism (see Amin 1994), and patchwork careers (see Mills *et al.* 2006). This stream of research argues that de-standardization and greater instability of economic life started in the 1970s (Kalleberg 2011; Widmer and Ritschard 2009) and that its main drivers are structural job loss

(resulting from globalization, offshoring, and automation), fewer internal labor markets and job ladders (resulting from increased competition, downsizing, outsourcing, and de-unionization), and a rise of temporary jobs (resulting from labor market deregulation). De-industrialization also occurred simultaneously with a steady growth of the service sector and possibly with a shift in preferences and attitudes toward work life (reviewed by Hollister, [2011] and Vallas and Prener, [2012]). The implication is that *work lives* are becoming ever more unstable, more complex, and less predictable (Kalleberg 2018).

However, researchers have identified at least three trends that either counteract conditions of rising work life complexity or could explain a deviation from its existing trend. First, educational expansion, and specifically the increase of the share of time spent in schooling as part of the life course (Brückner and Mayer 2005), is ambiguously related to early-career complexity. On the one hand, assuming early-careers span between 18 and one's mid-30s, structurally prolonged schooling could lead to fewer transitions and in turn less complexity. This is because educational expansion pushes the initial school-to-work transition to an older age, leaving less 'time' for work-related transitions. On the other hand, an increasing number of transitions in and out of education (Pallas 1993), which is another component of educational expansion, could still increase early-career complexity. This pertains specifically to current-day higher education attainment, which increasingly interacts with childrearing or childbearing spells, employment spells (i.e. between college and graduate school), or other forms of so-called stop-outs (Desjardins *et al.* 2006; Goldrick-Rab and Han 2011). Today's school-to-work transitions should therefore be thought of as *trajectories*, consisting of education spells being blended into the early work life (Witteveen 2017).

Second, one dramatic change across twentieth-century birth cohorts in many European countries, and not the least in Sweden, is the rapid gender convergence in labor force participation. From the 1960s onward, and coinciding with the early-careers of the 1940s birth cohorts, women in Sweden increasingly work in full-time jobs after childbirth, albeit with temporary episodes in parental leave and part-time work. Furthermore, there is an evident trend toward gender convergence of 'typical career patterns' in several countries, including Sweden (Brückner and Mayer 2005; Härkönen and Bihagen 2011; Härkönen *et al.* 2016; McMunn *et al.* 2015). In Sweden and other Nordic countries, the increase

in women's labor force participation was paralleled with an overrepresentation of women in the public sector – generally regarded as providing relatively more stability than the private sector (Hollister 2011). On the one hand, we expect to find a trend toward less work life complexity for women as transitions in and out of inactivity states could have been reduced. This should be most pronounced for women born in the 1940s and later. On the other hand, research from other European countries indicates that women still face more work life complexity than men (Widmer and Ritschard 2009; Riekhoff *et al.* 2021), which may be explained by the number of inactivity states over the work life course remaining the same over time. In Sweden, this pattern may be amplified by the fact that, contrary to popular belief, temporary employment contracts are overrepresented in the public sector (Statistics Sweden 2015).

Third, the business cycle may have a substantive impact on work life complexity fluctuations between birth cohorts, yet these patterns remain somewhat understudied. As careers are destabilized during economic downturns because of more unemployment spells, we may assume that the work lives of some birth cohorts are more complex than others. This mechanism is 'sticky' because cohorts who experienced an economic downturn during labor market entry continue to experience more instability over the course of their careers – a form of 'scarring' (Gangl 2006; Liu *et al.* 2014; Witteveen 2017). In Sweden, unemployment rose quickly during the early-1990s recession and then stabilized at a historically high level (Gottfries 2018), yet remaining close to the OECD average. Youth unemployment also increased in the aftermath of the 2008–2011 Great Recession (Schoon and Bynner 2019). Our analysis examines whether these macroeconomic shocks are resembled in the early- and mid-career work life complexity of the early-1970s birth cohorts, who were coming of age at the time of the 1990s recession. Conversely, economic boosts may have the opposite impact on work life complexity as they could reduce both the number of transitions and disorderliness of such.

In sum, analyses of trends will clarify whether work life complexity *continues to rise*, levels off, or decreases, *after its presumed initial upward shift*. We examine early- and mid-careers separately and we split the analyses by gender. Although we are primarily concerned with accurate measurement of complexity trends in population data (a descriptive analysis), a decomposition analysis will shed light on the driving forces behind the observed trends.

Previous research on work life complexity

Trends of complexity related to the work life course have been studied in various ways. One stream of research focuses on specific work life events, such as time to the first job (e.g. Schizzerotto 2001), time to educational (re)entry, time spent in a specific job or occupation, or shifts between jobs and occupations (Rodrigues and Guest 2010; Jarvis and Song 2017). Other studies focus on selection into typical career patterns (Anders and Dorsett 2017; Brzinsky-Fay and Solga 2016) Witteveen and Westerman (2023). Importantly, these research streams measure how careers change over time by focusing on work spells *only* and using a unidimensional metric – i.e. linear measurement of work statuses, often occupations, form the dependent variable.

Recent scholarship has gained interest in the study of individual-level work life sequences using a much more comprehensive measure – a complexity indicator that combines the number of transitions and the dispersion of states. What is more, the complexity metric allows researchers to include nominal time-variant variables; sequences of both work *and non-work* spells can be analyzed, simultaneously, as ‘work lives’. One of the most critical advantages of the complexity metric include its strict comparability across cohorts and the fact, contrary to the aforementioned unidimensional metrics, it retains all available information from the entire career sequence. Because work life complexity measures are relatively novel in sociological research, we shall first discuss a number of prominent studies, while contrasting their results with those conducted with unidimensional outcomes and cluster analysis.

Van Winkle and Fasang (2017, 2021) pioneered the study of work life complexity trends and studied 30 European countries across birth cohorts from 1916 to 1966. Their studies are based on employment biographies that span 18–50 years and identify full-time employment, part-time employment, unemployment, inactivity, education, and retirement in the state alphabet. They further treat each new employer as a distinct state for the individual. The conclusions are straightforward: work life complexity is moderately increasing across birth cohorts – most evidently presented in the extended analyses by Van Winkle and Fasang (2021) – but the variation across cohorts is small compared to that between countries. Sweden and other Nordic countries, among a few others, display the highest levels of work life complexity. Van Winkle and Fasang (2021) also conducted a decomposition analysis which indicates,

first, that the increasing trend is more pronounced among women and, second, that the increase is associated with educational expansion, as well as increasing prevalence of unemployment.

Riekhoff *et al.* (2021) followed mid-careers (ages 30–45) in Finnish cohorts born between 1958 and 1972. They report stability across cohorts. Their analyses of employment sequences resemble the approach by Van Winkle and Fasang (2017, 2021). The analyses of work life complexity display a slightly decreasing trend when including employment statuses only, and a slightly increasing trend when also including job transitions. Although complexity is a function of both transitions and the dispersion of spells across the career, it could be the case that the moderate increases in complexity are driven by employer shifts rather than transitions between different labor market states. It should also be noted that the patterns described by Riekhoff *et al.* (2021) can result from using a much narrower age range for younger cohorts, thereby suppressing their ‘true level’ of full-career complexity.

Two studies of early-careers using complexity measures come from Biemann *et al.* (2011), analyzing German data, and Struffolino and Raitano (2020), analyzing Italian data, where careers are followed for respectively 7 and 8 years after first employment. Biemann *et al.*’s (2011) ‘state alphabet’ specifies the sequential order of each job state, while Struffolino and Raitano’s (2020) does not. Following careers of 1929 thru 1971 birth cohorts, Biemann *et al.* (2011) find a rise in work life complexity up to the birth cohorts of the mid-1950s and a slight downward trend among younger cohorts. Struffolino and Raitano (2020) followed careers that started between 1974 and 2001, roughly corresponding to birth cohorts of the mid-1950s to the 1980s. The careers observed in the more recent time period experienced a higher level of complexity, especially among those with lower levels of education, which the authors attribute to deregulation of the Italian labor market.

In contrast, studies analyzing unidimensional outcomes and career clusters derive fewer comprehensive conclusions. An exception is the school-to-work transition literature which mainly deals with spells in labor market and educational states. A review of this literature by Raffè (2014) concludes that first-time labor market entrants are increasingly older and that their early work life trajectories have become less linear and less predictable over time. However, in line with the complexity studies, the magnitude of these trends appears to be small in comparison to the considerable cross-country variation. Studying long-term trends, Schizzerotto (2001), using data from Italy, Great Britain, and Sweden,

concludes that there is an evident prolongation in the time between education and work for later born cohorts compared to those born up to the mid-1950s across all three countries. Analyzing English sequence data, Anders and Dorsett (2017) report a growth of the career pattern ‘potentially difficult transition’ for the school-to-work transitions of those born in the 1980s, compared to earlier periods. Brzinsky-Fay and Solga (2016) use German data with cohorts born between the 1950s and the 1970s and report heterogeneous trends as evidenced by increases in *both* ‘linear’ and ‘non-linear’ school-to-work transitions.

Thus, school-to-work trajectories have been prolonged and become more complex in recent years – a trend that is exacerbated during cyclical business upturns, such as between the recessions of the early-1990s and the Great Recession of 2008–2011. The time between full-time education and the first job has become shorter in a number of OECD-countries (Quintini *et al.* 2007, for Sweden see also Halldén and Hällsten 2008). Nevertheless, using data from individuals born in the 1970s and the 1980s, whose careers covered different recessions, Witteveen (2021) argues that the connection between macroeconomic factors and the smoothness of school-to-work-transitions is relatively weaker in Sweden compared to Germany, the United Kingdom, and the United States.

Research questions

In sum, previous research suggests that work life complexity moderately increases across several decades of the twentieth century. However, less is known about the direction of current trends, differences between early- and mid-careers, and gender disparities in work life complexity. Structural change continues to affect labor markets in high-income countries, such as the school-to-work transition becoming increasingly *complex*. We therefore examine to what extent work life complexity has risen over time and whether it is still on the rise, in Sweden – a country that has high overall levels of work life complexity. Our primary analyses, which is of descriptive statistical nature, include many more – and younger – cohorts than in previous research. Importantly, by using near full-population registry data of several millions unique career trajectories, we improve on sampling errors known to self-reported employment biographies in randomly drawn samples. As work life complexity is likely to be heterogeneous along dimensions of age and gender, we present analyses separately for the early- and the mid-career, as well as for men and women. Our second research aim pertains to the drivers

of the observed trends, asking which components of the state sequence contributes most for which we use a reweighting technique. We identify employment, self-employment, unemployment, inactivity, education, and parental leave.

Method and data

The complexity measure

Recent research on work life complexity contains more inductively oriented descriptions of typical career trajectories, i.e. sequence analysis. The method has proven highly useful to visualize and compare complex patterns and measure selection pathways into different careers. However, for research aimed at determining exact trends over time or cohorts, use of stable and comparable metrics, while still incorporating various aspects of complexity during the full career sequence (such as the duration in states and transitions between states), is prioritized (Pelletier *et al.* 2020).

A complex work life sequence is typically defined as containing frequent shifts between different labor market *states*. Moreover, shifts between states over the entire career span is generally perceived as more complex than a similar number of shifts allocated to a particular career phase, for instance in the beginning of the career. A measure of work life complexity should thus capture both the frequency of shifts between states *and* the dispersion of these shifts over the career span. The complexity measure developed by Gabadinho *et al.* (2010) combines these two traits in a single measure. Complexity, C for individual sequence x , is defined as:

$$C(x) = \sqrt{\frac{NT(x)}{(L(x) - 1)} * H(x)} \quad (1)$$

where NT is the number of transitions (i.e. number of spells – 1) and L is the total length of the sequence (a fixed number for all individuals). H is entropy (Shannon 1948), defined as:

$$H(x) = \sum_{i=1}^K \rho_{s_i} * \text{Log}(1/\rho_{s_i}) \quad (2)$$

where ρ_{s_i} is the proportion of state s_i in sequence x .

Figure 1 illustrates sequences of varying complexity when using an alphabet with only two states (employment = A, and inactivity = B),

four time points, and either one or two transitions. Evidently, the ‘simplest’ career type possible (bottom-left corner) contains only one shift, located at either edge of the career span. Complexity can then increase in two ways, either through one additional transition (top-left corner) or through more equal dispersion of labor market states across the career (bottom-right corner). Following this logic, the most complex work life sequence using this setup (top-right corner) involves shifts between states over the full career span. The average complexity is the metric which is used to compare trends in work life complexity across cohorts.

Some features of complexity can only be comprehended at the aggregated level. Referring to [Figure 1](#), given a fixed number of transitions and a fixed supply of labor market states in the economy, a movement to the right along the horizontal axis captures at the aggregated level – a tendency toward more *equal* distribution of labor market states *across* individuals. The entropy component of complexity can thus be thought of as ‘disorder’ in the allocation of states to individuals. There is ‘order’ (predictability) if states of a certain kind tend to be allocated to certain individuals, while there is ‘disorder’ (unpredictability) if, for instance, all individuals have similar propensities to experience unemployment spells.

Data

This study uses and combines total population data from several Swedish administrative population registers. Each individual in Sweden has a unique identification number, which is universal for administrative processes and is also used to link several different registers together. The first source, Total Population Register includes information on date of birth,

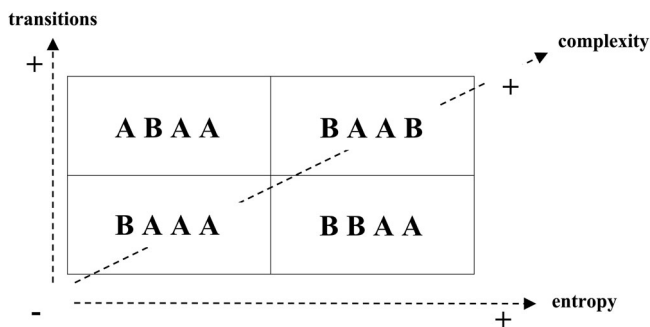


Figure 1. Examples of career types with varying levels of complexity.

date of death, biological sex, individuals' residential area (*län*) at age 18 and country of birth for all individuals who ever resided in Sweden across the observed time span. A second source is the Migration Register, which contains the dates of all emigration and immigration registrations. Thus, we can proxy for whether individuals resided in Sweden during the career phases examined.¹ A third source is the Administrative Tax Records (from 1968 onward), from which we draw income data to build some employment states for the state alphabet. A fourth source is the Educational Registry and the registry for University and Higher Education, from which we derive educational trajectories based on individuals' examination and registration dates in higher and upper-secondary education.

We construct work life sequences as early-career (ages 18–36) and mid-career (ages 37–54) phases. The study populations are defined as all individuals residing in Sweden over the course of the selected career phases, conditional on having some labor market attachment: positive earnings for at least one year during their complete career phase. This selection omits immigrants and emigrants who entered or left Sweden during the respective career phase. However, we include a robustness check varying start and end-points of the work life sequence that still includes many migrants.

Analyses make use of two state alphabets, which we labeled the 'long series' and the 'short series'. Although we present results of *both* alphabets, they trade-off inclusion of more historical cohorts and the specificity of the state alphabet. This is because more detailed information becomes available in the more recent administrative records (i.e. younger cohorts). [Figure 2](#) illustrates the observed analytical population per birth cohort for the two state alphabets: early- and mid-career. The analytical population varies between approximately 80,000–125,000 individuals per birth cohort.

Labor market statuses are derived from annual observations. This is a caveat and introduces some underestimation of complexity as some transitions (within years) are missed. Our approach to measuring sequence complexity implies that the states are mutually exclusive in any observation year. The long series contains four labor market states as observed between 1968 and 2015. First, *self-employment* is measured as any (positive) income from one's own firm or farm (and some rare forms of property from 1991 onward). We use a low threshold because some self-

¹It is worth noting that the Migration Register slightly underestimates short-term emigration because Swedish residents can briefly live in neighboring countries without have to record their emigration.

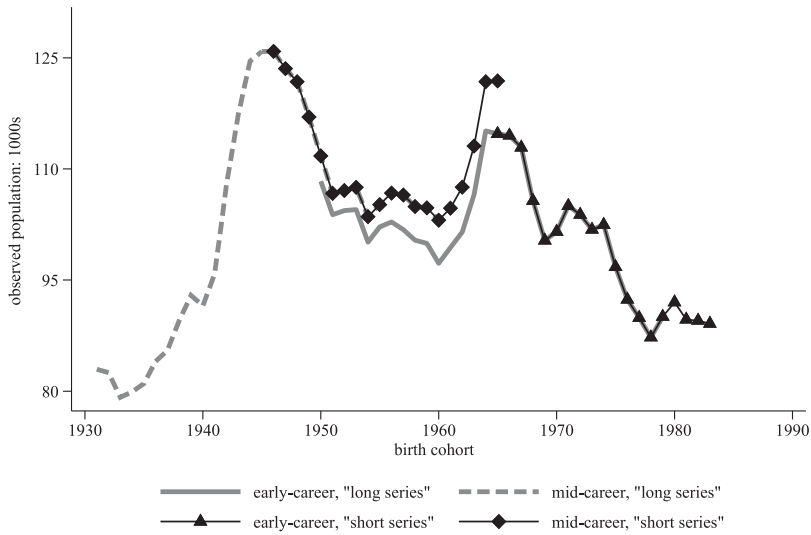


Figure 2. Population size by birth cohort.

Notes: 'long series' = simpler state alphabet, older birth cohorts included. 'short series' = more elaborate state alphabet, younger birth cohorts only. Source: Swedish Registers (1968–2018).

employed individuals may choose to not take out any salary from the own firm and instead rely on capital income. Second, *employment* is defined as earning at least 100,000 Swedish kronor (SEK) in salary (indexed to 2018), which does not contain various taxable benefits attached to employment, e.g. pensions or unemployment benefits. The salary variable comes from the Longitudinal integrated database for health insurance and labor market studies and is standardized from 1991 onward. For 1968–1991, a similar variable is derived from the Administrative Tax registers, using a standardization procedure as documented by Hjalmarsson *et al.* (2015). The threshold of 100,000 SEK to define employment is in line with previous research on Swedish register data (Antelius and Björklund 2000 see also Rooth and Ekberg 2003; Hällsten 2011). Antelius and Björklund's (2000) results suggest that annual earnings are close to a wage measure when excluding those with such low earnings, and, hence, it can be argued that individuals with earnings above this level are likely to have full-time employment. Our threshold is arbitrary and there may still exist all kinds of possible combinations of low pay, part-time work and work episodes shorter than a year below the threshold (we also test another threshold with similar results below). However, very few individuals with employment across a full calendar year would earn less than 100,000 SEK, even including those in part-time jobs. Third, *inactivity* is

the default category if no form of employment or self-employment was recorded, yet is replaced with the *education* state for ages 18–21 if the individual registered in upper-secondary school (1973–2018)² or if the individual has a registered degree from a tertiary education in the years following the period of inactivity (1968–2018).³ Complexity in the long series ranges from 0 (a single state throughout the sequence) to 1.08 for the early-career and to 1.03 for the mid-career.

The short series contains six states and ranges from 1983 to 2018. It contains an improved measure of tertiary education and other post-secondary education. Furthermore, *parental leave* is defined as having considerable income from parental leave insurance – exceeding the 20th percentile of annual salaries. The threshold was set quite low because parents often choose to have a prolonged period of leave on less than full benefits, yet not too low since it is fairly common to use excess days of parental leave several years after the main leave period. We let the parental leave state replace any other state in the alphabet. *Unemployment* is defined as any income from any non-means-tested unemployment benefit program ('A-kassa' or similar). The threshold was set low to also capture shorter unemployment spells.⁴ *Education* is defined as registration in higher education (university or högskola) during any of the semesters in a given year, or receiving non-taxable student grants (loans and benefits) from the Swedish Board of Student Finance (CSN).⁵ Complexity in the short series ranges from 0 to 1.25 for the early-career and to 1.21 for the mid-career.

State composition of complexity

One technique used to understand which states contribute most to career complexity, over time, is reweighting complexity by the duration in

²For cohorts born before 1953, upper-secondary education is underestimated in the long series due to missing registered degrees before a major school reform in 1971.

³The length of this period is set using the typical lengths of educational degrees – an approximation developed by Swedish Statistics ('Sun2000'). Degrees are usually registered in the semester following the last semester in education. Thus, if a 3-year degree is registered in the Spring term of 1999 and the individual is 'inactive' in years 1996–1998, years 1996–1998 are defined as 'in education'. In contrast, years 1996–1999 are registered as 'in education' if a 3-year degree is registered in the Fall term of 1999.

⁴A brief qualifying period during which no grants are paid out, which covers about a week for involuntary lay-offs and up to several months for voluntary quits, is excluded. Note that the measure of unemployment based on benefit receipt is different from the one used by the International Labor Organization.

⁵The inclusion of some grants used to identify labor market statuses under the CSN-umbrella varies over time. For comparability, all student grants (regardless of source) are consistently defined as 'in education'.

specific sequence states (Van Winkle 2018, 2020). The reweighted complexity (C_w) effectively normalizes the standard complexity measure (Equation 1) by the duration of one state (d_{s_i}) spent in the selected sequence:

$$C_{w_i}(x) = C(x) * \sqrt{(d_{s_i} + 1)} \quad (3)$$

Practically, this is done by calculating complexity by durations spent in each alphabet state. Hence, in an alphabet consisting of six states, we reweigh complexity by state and separately for each birth cohort. In other words, for any specific birth cohort and career phase, we plot either four or six versions of complexity, each reweighted by one of the alphabet states. This will tell us the relative contribution of each state to work life complexity. We plot the state-reweighted complexities of all selected birth cohorts to examine the extent to which inactivity, unemployment, employment, self-employment, education, and parental leave have contributed to the complexity *trend*.

Results

Descriptive statistics are included in the appendices. Appendix 1 (early career) and Appendix 2 (mid-career) display the cumulative share in each work life state per birth cohort. **Complexity trends in the early career**

Figure 3 presents the trend in work life complexity in the early career (ages 18–36) for both the long series (panel A), calculated with four states, and the short series (panel B), calculated with six states. Analysis with a simpler state alphabet (panel A) displays a steady rise in early-career complexity between the 1950 birth cohort and the 1964 birth cohort. This upward trend is the same for both genders, albeit at a consistently higher level of complexity for women. However, the gap in early-career complexity between men and women is notably larger for younger birth cohorts compared to older (pre-1965) birth cohorts. We further note a bump in the level of early-career complexity for individuals born in the early- to mid-1970s, which coincides with these cohorts entering the Swedish labor market during the severe recession of the early-1990s.

A shorter birth cohort range (1965–1983) allows us to include two additional states (unemployment and parental leave), as well as younger cohorts. Results from this elaborate state alphabet are presented in the

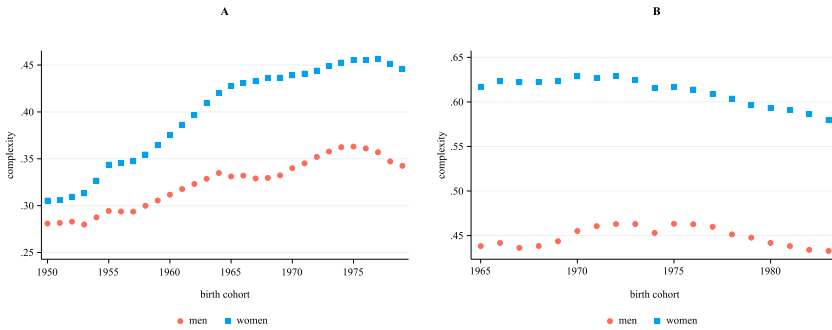


Figure 3. Early career complexity trend by gender (ages 18–36).

Notes: A = simpler state alphabet, older birth cohorts included. B = more elaborate state alphabet, younger birth cohorts only. 95-confidence intervals applied (often smaller than the marker). Controls for migration background and geographic region slightly reduce overall levels of estimated complexity, yet trends remain the same (Appendix 4). Source: Swedish Registers (1968–2018).

rightmost graph (B) of Figure 3, which resemble the trend shown panel A. The approximate flat trend lines (except for the bump for the early-1970s cohorts mentioned above) in graph B demonstrate that early-career complexity remains stable for the mid-1960s birth cohorts and onward. Inclusion of more detailed inactivity states, in graph B, does alter the complexity trend observed in graph A. It should be noted that panels A and B have different end-points, whereby the stalling work life complexity trend on right-hand side of panel A continues in panel B.

Thus, Figure 3 indicates the apparent stability of the early-career work life complexity trend since the mid-1960s cohorts. In a robustness check (Appendices 6 and 7), we find that even younger cohorts (with slightly shorter career spans), who were born around 1990, display similar or even slightly lower levels of early-career complexity as compared to mid-1960s cohorts. In other words, early-career complexity may be high, but it has not been rising for several decades.

Complexity trends in the mid-career

Figure 4 concentrates on the work life complexity trends of the mid-career (ages 37–54). As shown in the leftmost graph of Figure 4 (panel A), mid-career complexity steadily *decreases* for women between birth cohorts 1931–1949. This is followed by a brief and modest upward trend, experienced by the early-1950s birth cohorts, and by stability in mid-career complexity through the 1961 birth cohort. The same figure indicates a mirrored trend among men. That is, aside from a brief dip in mid-career complexity among the early-1930s birth cohorts, we

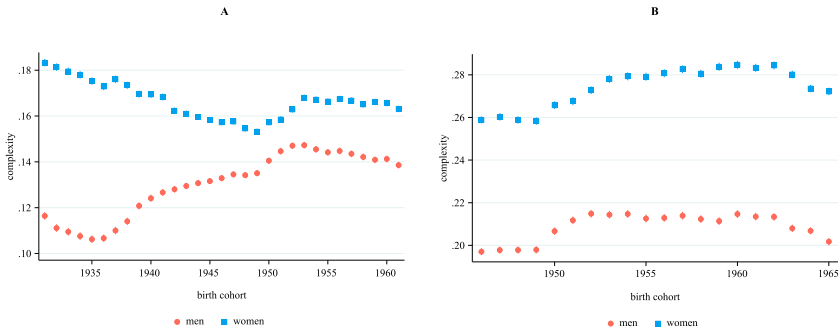


Figure 4. Mid-career complexity trend by gender (ages 37–54).

Notes: A = simpler state alphabet, older birth cohorts included. B = more elaborate state alphabet, younger birth cohorts only. 95-confidence intervals applied (often smaller than the marker). Controls for migration background and geographic region slightly reduce overall levels of estimated complexity, yet trends remain the same (Appendix 5). Source: Swedish Registers (1968–2018).

observe *increasing* complexity through the mid-1950s birth cohorts, followed by a stable level complexity. Taken together, the analysis of Figure 4's graph A suggests a convergence of mid-career work life complexity between men and women.

The rightmost graph (panel B) of Figure 4 plots the mid-career work life complexity trend using a shorter cohort time span and more elaborate state alphabet, thereby including the full-length mid-careers of the youngest cohorts available in the registry data. Similar to the same exercise conducted for the early career, the birth cohort margins 'zoom in' on the flattening mid-career complexity trend, as shown on the righthand side of the 'long series' (A). Again, it is important to note the difference in end-points between panels A and B. Thus, despite inclusion of younger cohorts and the unemployment and parental leave as work life states, Figure 4 shows that mid-career work life complexity appears to have stabilized in recent decades.

Complexity composition

We next examine the relative contribution of each state to the observed over-time changes in work life complexity – i.e. the state composition in the complexity trend. Note that given equation 3, these state specific weighted complexities do not add up to the overall unweighted complexities. The reweighted complexities can thus only be compared to one another (Van Winkle 2018, 2020). Shown in both graphs (the short and long series) of Figure 5 (men) and Figure 6 (women), we observe a steady increasing relevance of education spells for early-career complexity.

The relative impact of self-employment remains stable across all birth cohorts (1950–1983) and for both genders.

Furthermore, similar to the overall trend in early-career complexity coinciding with the business cycle, the relative weights of both employment and inactivity in early-career complexity becomes larger for birth cohorts who entered the labor market during macroeconomic downturns. These trends were also pronounced in the panel A trends ('long series') of [Figures 3 and 4](#). The more elaborate B panels in the state composition models of [Figures 5 and 6](#) suggest a connection between high unemployment for early-career work life complexity of birth cohorts who entered the labor market in the early-1990s – a recessionary period in Sweden. Specifically, we see that the weight of unemployment states on the early-career complexity reduces among birth cohorts who entered the labor market after the early

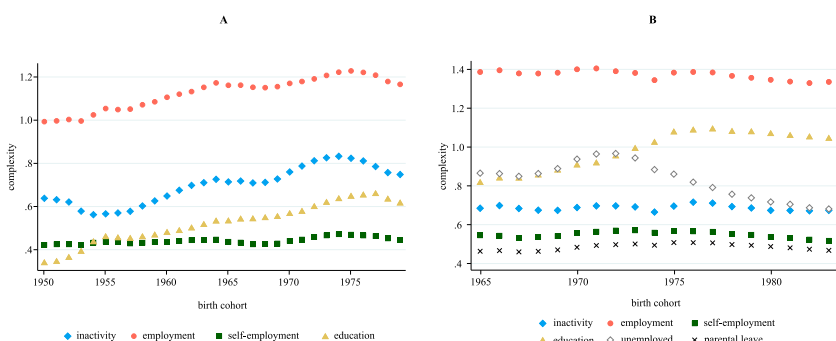


Figure 5. State composition of the early career complexity trend (ages 18–36): men. Notes: A = simpler state alphabet, older birth cohorts included. B = more elaborate state alphabet, younger birth cohorts only. Source: Swedish Registers (1968–2018).

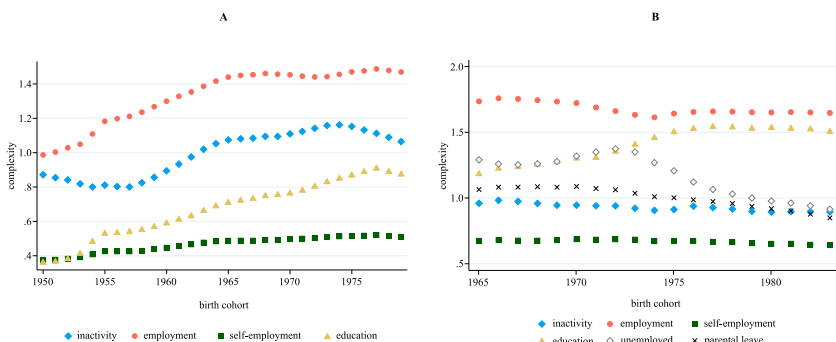


Figure 6. State composition of the early career complexity trend (ages 18–36): women. Notes: A = simpler state alphabet, older birth cohorts included. B = more elaborate state alphabet, younger birth cohorts only. Source: Swedish Registers (1968–2018).

1990s. This may be related to macroeconomic conditions temporarily increasing work lives' 'disorderliness' during the early-1990s recessionary period.

As shown in [Figure 4](#), mid-careers are subject to lower overall complexity and much less change in the over-time trends. We also ran the same state composition exercise for the mid-career phase, which is included in Appendix 3. Noteworthy, for women's mid-careers, is that the sharp decline in complexity up to the 1950s birth cohorts is explained by the rapidly reduced weight of inactivity – i.e. reflecting more stable work lives of women in the labor market.

Robustness and additional analyses

A series of additional analyses were conducted to confirm the reported trends in work life complexity. First, to control for compositional changes due to changing global and regional migration patterns, we controlled for individuals' region of birth (24 *län* or counties) and migration background (9 global regions, including one for Sweden). The combination of these control variables did not alter any of the reported over-time trends in early- and mid-career work life complexity (Appendix 4 and 5).

Second, the 100,000 SEK threshold is fairly established but some variation exists (Hällsten 2011). However, an alternative cut-off set to 125,000 SEK does not substantially change the trend reported for the long series (results available upon request).

Third, we conducted a dynamic analysis with varying start-/and end-points of the work life sequence (Pelletier *et al.* 2020), which is more inclusive of migrants and extend the analysis with cohorts born between 1984 and 1995, and between 1920 and 1929. The analyses are presented in Appendix 6 (with varying end-points and fixed start at age 18) and Appendix 7 (with varying start-points and fixed end at age 54). They point in the same direction as the main analysis: increasing early-career complexity between cohorts born between 1950 and 1964, and fluctuations around a stable trend among subsequent cohorts.

Conclusion

Our findings suggest that the long-term trend of increasing work life complexity is in line with previous research for the lion share of the historical period covered, i.e. between about 1970 to mid-1990s (Van Winkle and Fasang 2017, 2021). An additional finding is that this trend of increasing complexity is largely driven by an increase in complexity during early-

careers (cohorts born between 1950 and 1964). Analyses separated by gender revealed some increase in mid-career complexity over the same historical time period for men, yet a counteracting trend for the mid-career complexity for women; with a decreasing trend of complexity from a relatively high level. Our state decomposition analyses suggest that a growing number of episodes of education is a main factor behind the initial increase in early-career complexity, while episodes of unemployment drive a temporary increase of work life complexity for birth cohorts affected by the recession in the early 1990s. In general, the results suggest that diverging and gendered trends for the different career phases sheds light on previously unknown features in work life complexity trends. These heterogeneities in trends (by gender and career phase) may also be relevant for understanding some inconsistencies in research on trends in employment relations and occupational mobility.

Our analyses affirm a shift to more work life complexity in the twentieth century, but there are important exceptions to this trend and, thus, we are able to contribute to a more nuanced picture of this long-term shift in work lives. First, there is a counter-acting trend for women in the mid-career, and second, there is a flattening out of the trend in the last decades. Regarding the first exception, the role of the historical gender convergence in labor force participation in shaping work life patterns has been discussed in previous research. Increasing female labor market participation and public sector expansion have been suggested as explanations of stability over historical time in the duration of employment relations in the labor market taken as a whole (Hollister 2011). Notably in the present study, trends for women and men are almost parallel for the early career, although there is a widening gender gap, presumably due to young women's higher rates of participation in higher education. After an initial period of convergence with a decreasing trend for women and an increasing trend for men, trends for women and men are also parallel for mid-career work life complexity from the 1950s cohort onwards.

The expansion of the public sector, in which women are overrepresented, has thus not mitigated the work life complexity of women to the level of men. This is important in light on previous discussions about the mitigating role of public sector employment on work life complexity from a comparative perspective (Van Winkle and Fasang 2017). As noted in previous research, the public sector of Sweden is likely to be an exception to this general pattern Witteveen and Westerman (2023).

It is important to note that, regardless of the long-term trends and gender convergence, women have consistently higher rates of work life

complexity than men. In general, the higher complexity rates of women are in line with previous research, and could be explained by more and longer spells of parental leave as compared to men (Aisenbrey and Fasang 2017; Widmer and Ritschard 2009). Furthermore, the slight decline in work life complexity for women from the 1958 cohort onward is almost identical to previous research conducted with data from Finland (Riekhoff *et al.* 2021).

The second exception is more challenging to explain because it appears to go against the perception of the contemporary labor market becoming ever more insecure and precarious. So why did the initial trend of increasing complexity come to an end? Both the decomposition analysis and previous research (Van Winkle and Fasang 2021; Witteveen 2017) highlight the role of educational expansion as an important driver of the initial increase in work life complexity. Hence, it would be reasonable to investigate whether the end of increasing complexity had something to do with shifts in the nature of educational expansion. First, the last decades may have seen an increase in the proportion of young people with a ‘standardized’ higher education pathway, consisting of three years of upper-secondary school followed by a longer tertiary education program, and eventually followed by a smooth transition to employment. The 1991 educational reform in Sweden, which made all upper-secondary programs three years, compared to a division between two-year vocational programs and three-year theoretical programs, could also have contributed to a lower level of complexity for some young Swedes in almost an artificial way. Second, the pattern could also be consistent with rising dualization in school-to-work transitions (cf. Brzinsky-Fay and Solga 2016), i.e. a parallel growth in standardized transitions and growing shares of young individuals experiencing relative career ‘stability’ within the inactive state. Third, one straightforward reason for the stalled work life complexity trend is that the educational system no longer expands as rapidly as before. To gain a better understanding of this proposed relationship, future research could draw more precise comparisons to similar countries in which tertiary expansion expanded earlier or later, or still continues to increase (Thomsen *et al.* 2017).

A similar flattening complexity trend was also observed in a recent study from Finland (Riekhoff *et al.* 2021), but this trend appears to be upwards if job shifts are included in the operationalization of work life complexity. Hence, future research could also further investigate the importance of shifts between employers for the trends of work life complexity. Still, previous research does not indicate a general trend toward

higher rates of employment shifts, yet, most of this research is based on data covering the last decades of the twentieth century (Rodrigues and Guest 2010), i.e. not the later developments discussed here. We also consider it plausible that complexity in job trajectories are more impacted by business cycles than work life complexity.

Importantly, the state alphabet in our analyses, which includes parental leave, unemployment, education, and inactivity, are key components of a *comprehensive* work life cycle and worth understanding in their own right. We chose this operationalization because it can capture the extensive trajectory from education to work, which extends well into one's 20s. This life course phase previously consisted of just one transition and a couple of parental leave episodes (less often for men). However, it currently contains many more educational spells and various possible (non-)employment statuses. The degree of disorderliness of these early-career states likely contributes not only to work life complexity but also to career complexity. Analyses of work life complexity only respond to historically significant trends, but should also have implications for careers.

Finally, our study contributes to a growing body of research on complexity that generally shows an initial increasing complexity trend, followed by stability. Contrary to some studies, our analysis of registry data does not suffer from recall errors, which typically is the case when using retrospective career biographies. This study also demonstrates that, sample sizes allow for separate analyses for women and men and for early- and mid-careers, one can disentangle salient heterogeneities in the complexity trends. Subsequent research on similar data, and outside of countries of Sweden and Finland, should reveal whether a flattening complexity occurred throughout high-income countries.

Acknowledgements

We have benefited greatly from comments on earlier drafts from the 2022 ECSR conference in Amsterdam; 2022 RC28 conference in London; seminars at the Swedish Institute for Social Research (SOFI), Stockholm University, in September 2021; and the Department of Sociology at the University of Munich (LMU) in November 2021. We greatly appreciate comments from and/or discussions with Amanda Almstedt, Josef Brüderl, Andreas Diemer, Carina Mood, and four anonymous reviewers.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This research was funded by the Swedish Research Council – VR [dnr: 2020:02538] and by the Swedish Research Council for Health, Working Life and Welfare – FORTE [dnr: 2016-07099].

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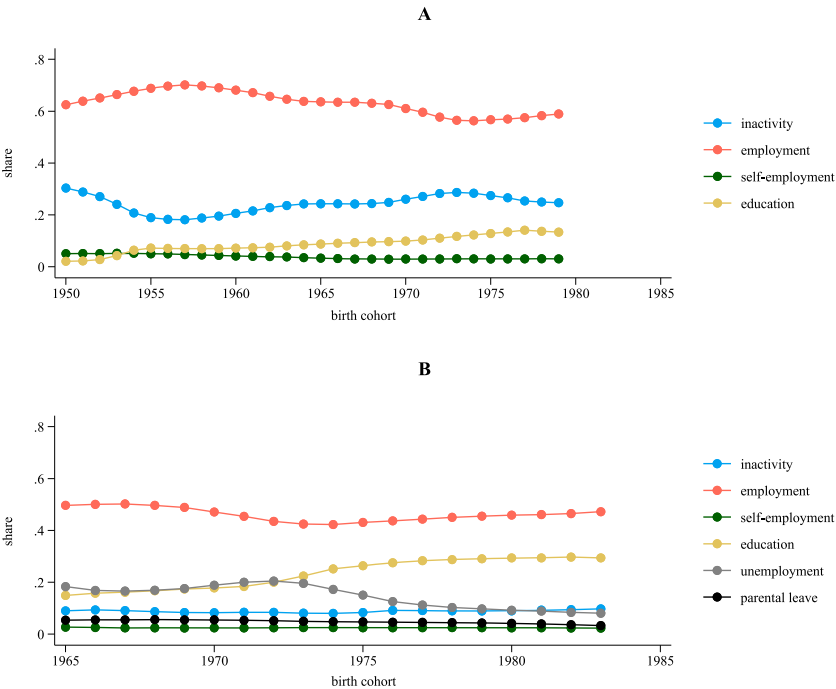
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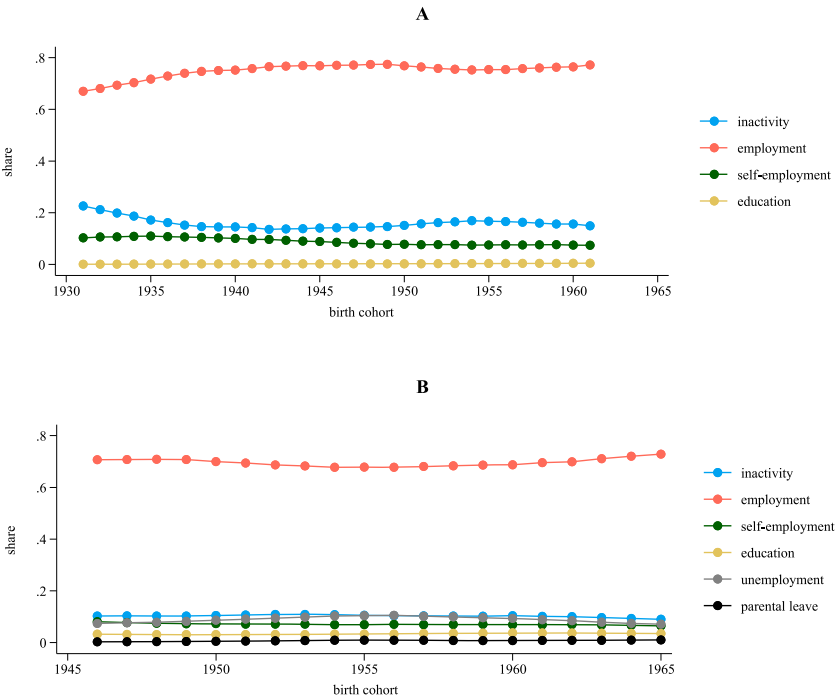
Appendices

Appendix 1. Cumulative share in states during the early-career (ages 18–36)



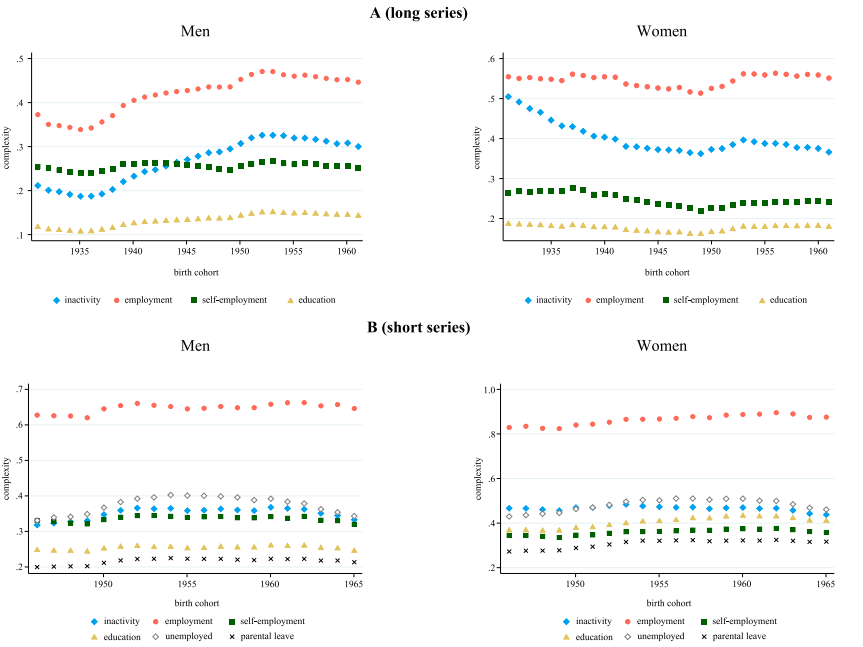
Notes: A = simpler state alphabet, older birth cohorts included. B = more elaborate state alphabet, younger birth cohorts only. Source: Swedish Registers (1968–2018).

Appendix 2. Cumulative share in states during the mid-career (ages 37–54)

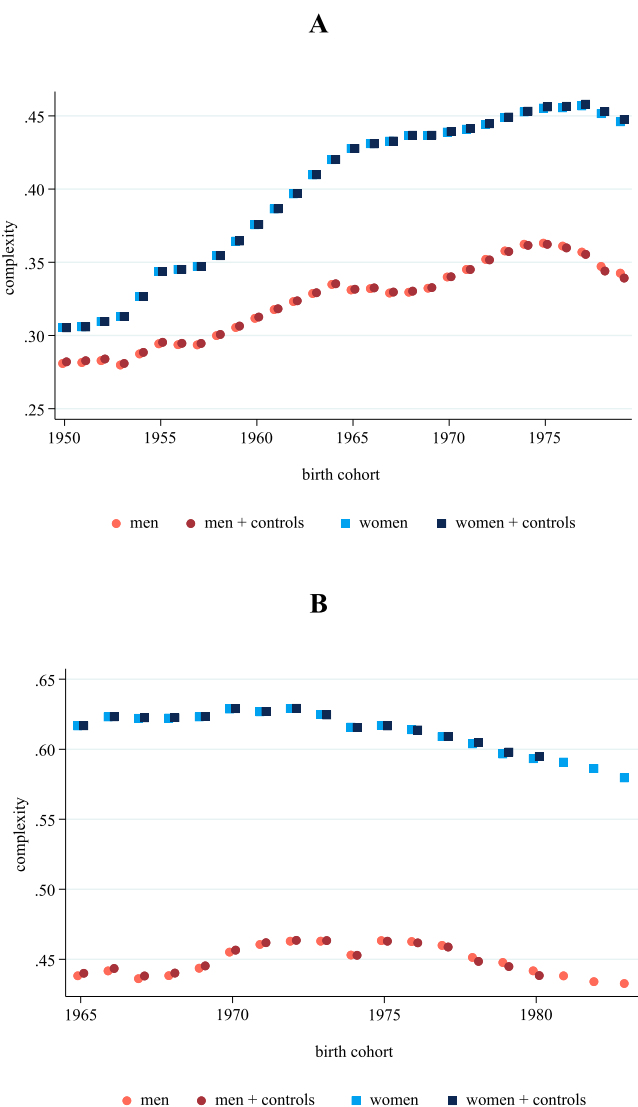


Notes: A = simpler state alphabet, older birth cohorts included. B = more elaborate state alphabet, younger birth cohorts only. Source: Swedish Registers (1968–2018).

Appendix 3. State composition of the mid-career complexity trend (ages 37–54)

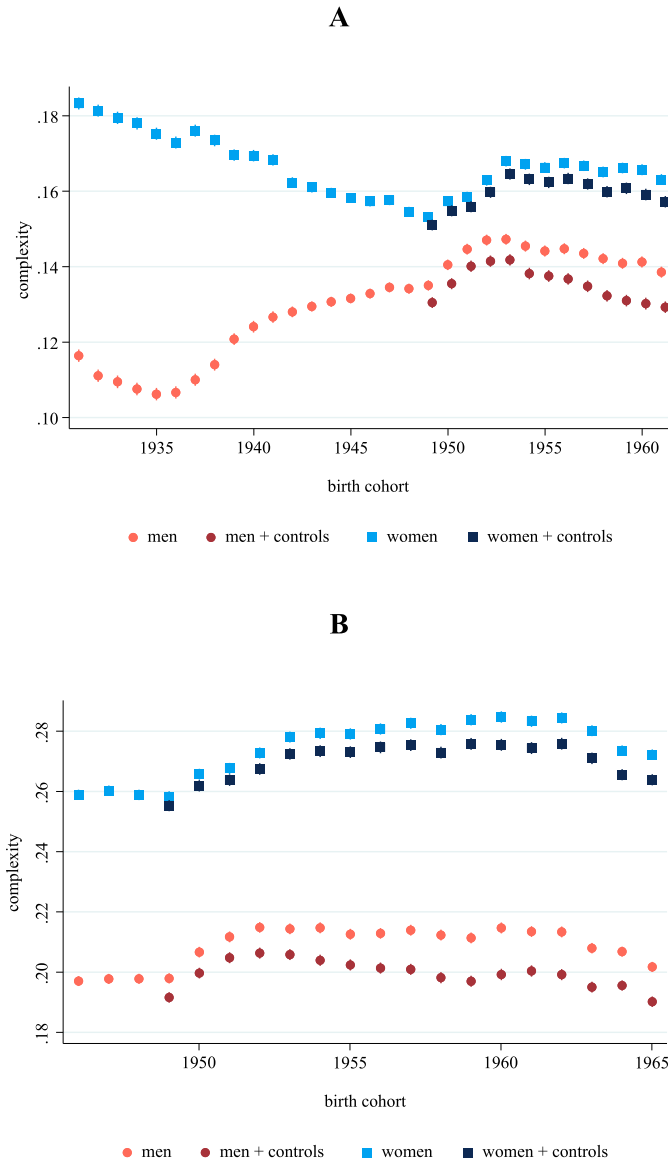


Appendix 4. Early-career complexity trend by gender + controls



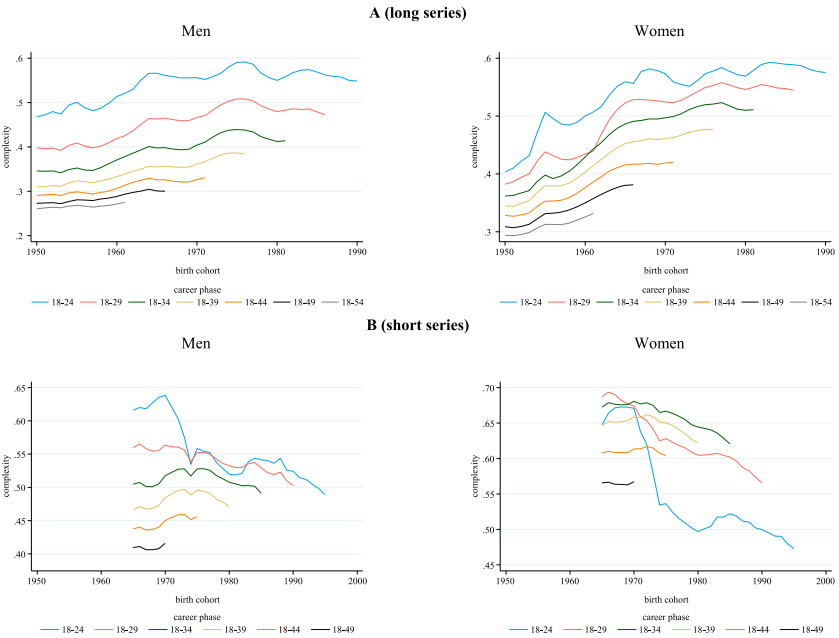
Notes: A = simpler state alphabet, older birth cohorts included. B = more elaborate state alphabet, younger birth cohorts only. 95-confidence intervals applied (often smaller than the marker). Controls include migration background (born in [1] Sweden, [2] other Nordic country, [3] Western Europe, [4] Eastern Europe, former socialist, [5] Middle East, [6] Africa, [7] Asia, [8] South America, [9] North America, other Anglo-Saxon, Israel) and geographic region (24 counties [län]). Source: Swedish Registers (1968–2018).

Appendix 5. Mid-career complexity trend by gender + controls



Notes: A = simpler state alphabet, older birth cohorts included. B = more elaborate state alphabet, younger birth cohorts only. 95-confidence intervals applied (often smaller than the marker). Controls include migration background (born in [1] Sweden, [2] other Nordic country, [3] Western Europe, [4] Eastern Europe, former socialist, [5] Middle East, [6] Africa, [7] Asia, [8] South America, [9] North America, other Anglo-Saxon, Israel) and geographic region (24 counties [län]). Source: Swedish Registers (1968–2018).

Appendix 6. Career complexity trends for different observed career lengths (end of career)



Appendix 7. Career complexity trends for different observed career lengths (start of career)

