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ALTERNATIVE PATHWAYS TO RETIREMENT IN A HOUSEHOLD CONTEXT

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Research indicates significant roles for gradual transitions to full retirement and for coordination between spouses in the typical retirement experience. However, there is little research exploring the potentially important interactions between the two. This paper addresses this gap in the literature and provides a more robust understanding of retirement decisions by examining joint work-to-retirement trajectories. We analyze 12 waves of the Health and Retirement Study to develop detailed descriptions of couples' realized joint retirement trajectories. We use two strategies to classify joint work-to-retirement trajectories. First, we use simple researcher defined rules or heuristics to categorize trajectories that share common features. Second, we use an algorithmic sequence analysis method to identify trajectories that share common properties into clusters, creating a statistically derived typology of retirement pathways. A key finding of our research is the vast variation in retirement sequences followed by couples; our sample includes over 2,600 couples and over 1,400 unique retirement trajectories. We document the frequency of couples' joint work-to-retirement trajectories observed in the data and the characteristics of these joint trajectories. We also explore the extent to which couples' personal and employment characteristics correlate with their joint work-to-retirement transitions and trajectories.

1. Introduction

More and more, older individuals are transitioning to retirement through partial retirement, including phased retirement and bridge jobs. At least 48% of individuals work after retirement and 71% express the desire to do so (Maestas, 2010). At the same time, research on retirement timing has found that for many couples, retirement is a joint decision (Coile 2004, Banks et al. 2010). Yet, despite potentially important interactions, little research examining the relationship between partial retirement and joint retirement exists. To our knowledge, only Gustman and Steinmeier (2014) have looked at these problems together, however their paper takes a very different approach and only begins to address this important interaction. Our paper addresses this gap in the literature and provide a deeper understanding of retirement decisions by examining alternative work-to-retirement trajectories and joint retirement decisions of dual income couples.

Studying joint retirement decisions and work-to-retirement transitions separately, if they in fact interact, will cause us to misunderstand how individuals are retiring. For example, we may understate the importance of joint retirement decisions. When retirement is defined as the complete cessation of work, a joint transition in which one spouse stops working completely while the other only reduces the number of hours worked will be missed. Likewise, analysis using an individualistic framework omits spouses' preferences and employment opportunities, which may play an important role in shaping work-to-retirement trajectories.

In order to better design policies to help people prepare for retirement and make decisions about continuing working or retiring, it is crucial to understand their retirement decisions and the different factors that may influence the timing and the pathways to retirement. If an individual's pathway from full time work to retirement is strongly influenced by his or her spouse's decision,

then it is crucial to study these decisions in a household framework. We are still beginning to understand what motivates partial retirement, and any policies designed to encourage working longer or partial retirement need to be informed by a clear picture of the preferences and behavior of households.

While there are many papers about retirement transitions, there is little consensus on the precise definitions of various retirement pathways. We define the work-to-retirement trajectory as the path of transitions from full time work to full retirement. For some this will involve simply moving from full time work directly to full time retirement. For others this includes partial retirement, which may occur through phased retirement, where one reduces their hours at their current employer, or through a bridge job, where one takes a job at a new employer to transition to retirement. Furthermore, some re-enter after a period of retirement. A couple's work-to-retirement trajectory includes the full set of transitions for both spouses.

In this paper, we consider how work-to-retirement trajectories are jointly determined within a couple. We use the HRS to characterize and document observed patterns of joint work-to-retirement transitions allowing for partial retirement. We take two primary approaches to understand retirement trajectories. First, we consider four simple heuristics, that allow us to categorize retirement trajectories by common traits. Second, we use an algorithmic sequence analysis method to identify trajectories that share common properties into clusters, creating a statistically derived typology of retirement pathways. This cluster methods allow us to consider whether the results found with our researcher defined categories are robust to a method that classifies trajectories using a purely statistical method

In Section 2, we discuss our research in the context of the literature. Section 3 describes our data. Section 4 describes the retirement trajectories observed in our data with a focus on the

simple researcher defined heuristics that we use to classify trajectories. Section 5 uses multinomial logit models to predict the researcher defined categories. In Section 6, we use algorithmic sequence analysis to define clusters of retirement trajectories and relate those to couples' characteristics. Section 7 considers the effects of truncation of retirement trajectories. Section 8 concludes.

2. Contribution to the Literature

There is a very large literature examining the factors that influence retirement decisions. The early retirement literature was focused solely on the labor supply of older men and retirement as single event (e.g. Burtless 1986, Krueger and Pischke 1992, Stock and Wise 1990). The recent literature has extended these models, including a richer modeling of retirement itself, allowing for gradual transitions, and of how retirement decisions are made in a household setting. The research to date suggests the importance of both "nontraditional" paths to retirement and of household decision-making. However, the literatures addressing these two issues have remained largely distinct, limiting our understanding of how these factors operate together to shape retirement decisions. This paper seeks to bring together these literatures to provide a more complete understanding of work-to-retirement transitions.

2.1 Individual Work-to-retirement Transitions

There is now substantial evidence that a "traditional retirement," where an individual leaves a career job and exits the labor force completely and permanently, is not a representative experience (Cahill et al. 2006, Maestas 2010, Mutchler et al. 1997, Ruhm 1990). Maestas (2010) presents a thorough examination of individual retirement transitions. Using data from the HRS (1992-2002), Maestas finds that nearly 50 percent of older workers in the U.S follow nontraditional work-to-retirement trajectories. Twenty percent of older workers initially

transition to partial retirement and 25-40 percent of all older workers increase their labor supply following an initial reduction. The prevalence of alternative retirement paths is greater than Ruhm (1990) finds studying an earlier cohort in the RHS. Cahill et al. (2015) includes more current waves of the HRS (1992-2010) and finds that gradual retirements are increasingly prevalent, especially among women.

Given the prevalence and heterogeneity of nontraditional retirements, it is important to understand what drives work-to-retirement trajectories. Demographic variables, including age, race/ethnicity, sex, and education, as well as health and retirement plan type are correlated with partial retirement and post-retirement reentry (Giandrea et al. 2010, Ruhm 1990). Age and health are also important determinants of retirement preferences in structural models that allow for partial retirement (Gustman and Steinmeier, 1986 and 2005). Hudomiet, Parker and Rohweder (2018) consider full retirement trajectories for individuals and relate those pathways to individual characteristics. While their models control for marital status, this is not a focus of their paper. They do find that married individuals are more likely to follow complex pathways.

This literature highlights the fact that realized work-to-retirement trajectories are the product of the interaction between individual preferences for a particular trajectory, potentially competing household preferences, and labor market constraints. Despite their apparent importance, the effects of spouses and their interactions with the labor market on alternative retirement trajectories have been largely ignored. An exception is Gustman and Steinmeier (2014), discussed in more detail below.

2.2 Joint Retirement Decisions

The apparent prevalence of (near-) simultaneous retirements within households (Hurd, 1990) and the increasing labor force attachment of women, motivated research to understand how retirement decisions are made within a dual worker household. Alternative work-to-

retirement trajectories are generally not incorporated into the theoretical models or empirical analyses of household decision-making. This approach potentially masks a substantial amount of heterogeneity in the joint retirement process.

The structural literature on joint retirement largely supports the hypotheses that couples make retirement decisions together. These structural models are designed to estimate utility function parameters and simulate the overall responses to policy changes. Papers such as Hurd (1990), Maestas (2001), and Gustman Steinmeier (2004), modeled household retirement decisions of households but only considered transitions from full time work to full time retirement. Michaud and Vermeulen (2011), allows for the possibility that there are transitions to retirement that include part time work, however, their empirical results do not discuss this aspect of their model. Gustman and Steinmeier (2014) is the only paper to our knowledge that seeks to model both joint retirement and partial retirement. They use this model to simulate how couples would respond to policy changes, including the elimination of partial retirement. However, this literature does not consider the prevalence of different retirement patterns or what factors might lead couples to have stronger or weaker preferences for different trajectories.

There is a complementary reduced form literature that examines retirement timing decisions within the household context and seeks to identify the extent to which spouses coordinate. Coile (2004) estimates the probability that an individual member of a married couple retires as a function of his or her own retirement financial incentives (social security, pensions, etc.) and his or her spouse's retirement incentives. She hypothesizes that for husbands, their wives' leisure is a strong complement to their own. Banks et al. (2010), similarly examines the effect of spouses' Social Security incentives on an individual's probability of retiring, but finds

no spousal effect for men or women. Baker (2002) and Lalive and Staubli (2014) find evidence that labor supply is weakly responsive to changes in spouses' social security benefits.

2.3 Contributions of this Paper

The literature discussed above identifies both alternative work-to-retirement trajectories and household decision-making as important aspects of retirement choices. However, there has been little work examining the interaction of these two phenomena. This paper makes several contributions to the literature that has been started by Gustman and Steinmeier (2014). First, we document the prevalence of joint partial retirement. While their paper considers the prevalence of partial retirement by husbands and wives, it is unclear to what extent both spouses simultaneously partially retire, and to what extent one spouse chooses partial retirement as a compromise, allowing the other to work or retire fully. Second, our paper uses a reduced form approach to provide greater insight into heterogeneity in joint work-to-retirement trajectories. In particular, we examine how age differences and the availability of part time jobs in one's field or geographic location may lead to different retirement trajectories.

3. Data

We use the RAND HRS Enhanced Fat Files (v.O) as our main data source. This data set is a cleaned, user-friendly compilation of eleven waves (1992-2012) of the HRS biannual core surveys. The HRS is national representative of the population age 50 and older. To maintain representativeness, the survey is replenished every six years with a new cohort of households in which at least one member is 51-61 years old. Table 1 summarizes the survey cohorts.[1]

Table 1: HRS Cohorts

[1] Excluded from the table is the AHEAD (Assets and Health Dynamics) Cohort, a separate survey that began in 1993 and merged with the HRS by the 1994 wave. The AHEAD cohort is much older and the majority were retired by 1993; only a handful of AHEAD couples are in our sample, and for ease, we group them with the initial HRS.

	Birth years	Survey entry year	Years observed	Share of analytic sample
Initial HRS	1931-1941	1992	20	61.3%
War Baby	1942-1947	1998	14	16.8%
Early Baby Boomer	1948-1953	2004	8	16.5%
Mid Baby Boomer	1954-1959	2010	2	5.3%

To be included in our analytical sample, couples must both be working full time at the same time, must make a transition to retirement at some point during the HRS, and skip no more than one wave. Given that they are observed for longer periods and are older, the initial HRS cohort is more likely to have begun the retirement transition. Hence, they are a larger share of our analytic sample. Note that our sample excludes couples in which one partner is never observed working and couples in which one partner is only observed working part time. We exclude those where both are not observed working full time because we have no way to determine if a spouse who is working part time has begun their retirement transition or if they have been less attached to the labor force. Finally, we exclude couples where no transition to retirement is observed and both partners work full time for the length of their observations. This leaves us with 2,615 couples. Table 2 describes key characteristics of our sample at the time of first observation.

Husbands are, on average, a few years older than their wives (3.5 years) and the couples have been married for 25 years. However, there are long tails: wives 28 years older than husbands versus husbands 32 years older than wives, and marriages only a few months long versus 52 years. Wives report slightly better health than husbands (2.2 to 2.3). Demographic means indicate that our sample is mostly white (80%), mostly non-Hispanic (90%), roughly a

quarter college graduates (27% husbands and 23% wives), and just under half in large urban counties (46%). Husbands earn on average approximately $40,600 per year, and earn on average $14,700 more than their wives. There is again large variation, with some earning hundreds of thousands of dollars more than their spouse. We also consider employment benefits, including pensions, 401(k)s, and health insurance available from the current employer.

In all cases, we focus on characteristics at baseline so that retirement transitions are not likely to influence the covariates. However, this does not necessarily imply that our results are causal. Nevertheless, descriptive analyses of the types of trajectories followed and who follows them provides an interesting avenue of research.

Table 2: Summary Statistics

Variable	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
Husband Birthyear	2,615	1941.70	8.17	1912	1985
Wife Birthyear	2,615	1945.10	8.07	1918	1975
Age Difference (Husband-Wife)	2,615	3.37	5.81	-28	32
Length of Current Marriage	2,475	24.67	11.52	0.1	52.5
Husband's Self Rated Health (1=Excellent)	2,615	2.34	1.01	1	5
Wife's Self Rated Health (1=Excellent)	2,615	2.25	0.98	1	5
*Husband's Race**					
White	2,615	80%			
Black	2,615	13%			
Other	2,615	6%			
*Husband Hispanic**	2,615	10%			
Husband's Education					
LT High school or GED	2,615	22%			
High School	2,615	28%			
Some College	2,615	23%			
College and Above	2,615	27%			
Wife's Education					
LT High school or GED	2,615	18%			
High School	2,615	33%			
Some College	2,615	26%			
College and Above	2,615	23%			
Urbanicity					
Large Urban	2,615	46%			

Smaller Urban	2,615	25%			
Rural	2,615	29%			
Husband's earnings in $1000s	2,615	$40.6	80.6	0	3,530
Earnings Difference (Husband-Wife)	2,615	14.7	81.7	-280.6	3,500
Health coverage					
Wife covered by husband	2,615	42%			
Husband covered by self	2,615	65%			
Wife covered by self	2,615	54%			
Husband covered by wife	2,615	24%			
Retirement coverage					
Wife has pension in current job	2,615	39%			
Wife has 401k in current job	2,615	80%			
Husband has pension in current job	2,615	39%			
Husband has 401k in current job	2,615	80%			
Occupation					
Husband blue collar	2,347	24.9%			
Wife blue collar	2,347	36.2%			
Leisure complementarities					
Husband finds time together to be very or extremely enjoyable	1,584	1.77	.66	1	4
Wife finds time together to be very or extremely enjoyable	1,584	1.82	.70	1	4
Unmarried	2,615	6.0%			
Total waves observed	2,615	6.9	3.0	2	11
Missing wave	2,615	8.5%			

3.1 Definitions of retirement states

In our analysis, we focus on only three individual retirement/employment states – working full time (WFT), partially retired (PR) and fully retired (FR) and nine joint retirement states that differentiate each spouses' retirement status. Retirement states are defined by hours of work, such that each spouse is considered to be retired if they are not working at all and partially retired if working less than full time. Table 3 describes the retirement states of each spouse.

Table 3: Retirement State Definitions

	Time Worked
Working Full Time (WFT)	35 hours or more per week

Partial Retirement	Working more than zero but less than 35 hours per week
Fully Retired	Does not Work for Pay

Much of the previous literature on retirement transitions has considered both an hours-based definition of retirement and a definition based on an individual's own description of their work status. However, this introduces many additional possible states for each individual, as they may be working full time, working part time, unemployed, retired, disabled, and out of the labor force. When you then consider joint retirement states, the total number of states increases exponentially, rather than having 9 joint retirement states, a more nuanced description of retirement would lead to 36 joint retirement states.

The joint retirement states are shown in Figure 1. The wife's retirement status is indicated in the columns, and the husband's in the rows. There are nine total joint retirement states, indicated by the cell labels, when differentiated by the individual retirement states of the husband and wife. In each cell, the wife's retirement status is listed first and the husband's status is listed second; for example, PT-WFT indicates a wife who is working part time and a husband who is working full time.

Figure 1: Joint retirement states

		Wife		
		Working Full-time	Working Part-Time	Fully Retired
Husband	Working Full-time	WFT-WFT	PT-WFT	Ret-WFT
	Working Part-time	WFT-PT	PT-PT	Ret-PT
	Fully Retired	WFT-Ret	PT-Ret	Ret-Ret

3.2 Definition of work-to-retirement trajectories

A series of joint retirement states can be combined to define a joint retirement trajectory. We define a complete joint work-to-retirement trajectory as one in which both household members are observed working full time at entry into the HRS and are then observed fully retired. However, each couple's retirement trajectory is subject to possible left and right censoring. First, not all couples are observed in the joint state WFT-WFT upon entering the survey. Second, many couples in the data may have not yet completed, or even started, their joint work-to-retirement trajectories. Hence, our data include alternative, unfinished trajectories in addition to complete trajectories.

We are interested in dual-career couples, and as noted previously, restrict our analysis to couples that are observed in the state WFT-WFT who at some point transition to retirement, even if they do not reach full retirement. We acknowledge that this data limitation introduces selection bias into the sample of joint work-to-retirement trajectories, because we do not observe the trajectories of dual-career couples with early retirements not observed in the HRS. However, the objective of this research is to document the most prevalent joint work-to-retirement trajectories for dual-career couples and to understand the determinants of these trajectories. Couples enter the HRS in their 50s, so we expect to capture the majority of initial transitions to retirement for our population of interest.

4. Documenting Joint Retirement States and Trajectories

Table 4 shows the distribution of joint employment/retirement states of couples in the 2012 Health and Retirement Study (HRS).

Table 4: Density of Joint Retirement States

		Wife	
Husband	Working Full Time	Partially Retired	Fully Retired
Working Full Time	0.39	0.02	0.08
Partially Retired	0.04	0.02	0.03

Fully Retired	0.14	0.01	0.26

Notes: Couples where both spouses are ages 55-70 and respond to retirement and work questions.

While the majority of respondents are in couples where both are working full-time or both are fully retired, approximately 12% of couples have one spouse who is partially retired (phased retirement or bridge job). This is significant when you consider that it represents only one point in time, and partial retirement is typically a transitory state. These results from just one year suggest the importance of partial retirement, as has been documented elsewhere. What is unique here is that we see that among couples where one spouse is working full time and the other is at least partially retired, roughly 20% consider themselves to be partially retired; for example, 2 percent of couples have full time working husbands and *partially* retired wives, and 8% have full time working husbands and *fully* retired wives.

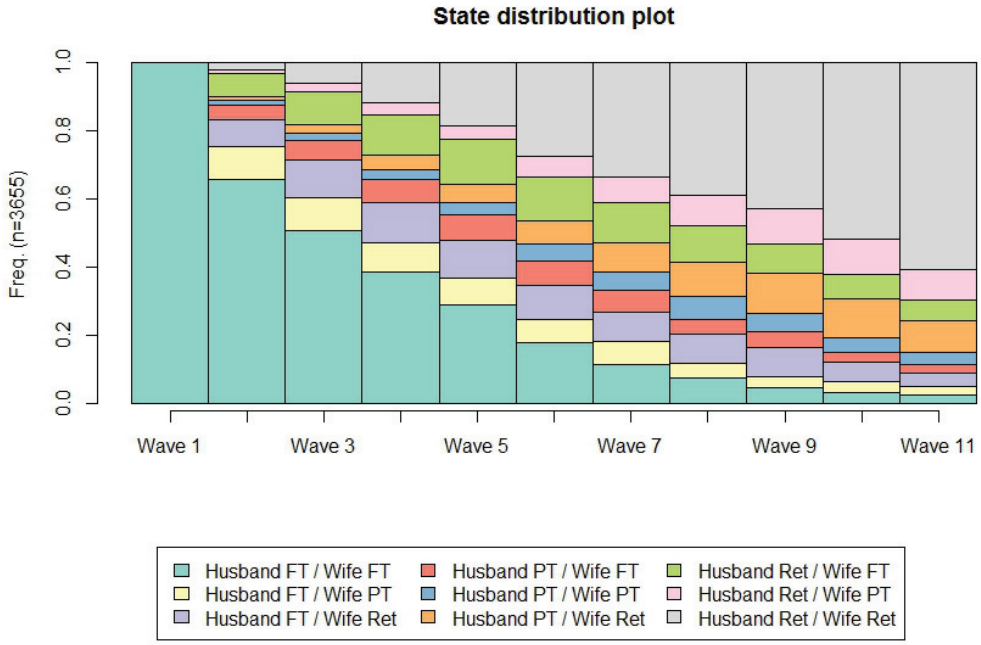
These data suggest that partial retirement plays an important role in joint work-to-retirement transitions. However, to fully understand the interaction between joint retirement decisions and work-to-retirement trajectories an empirical approach using more data are needed. This paper seeks to enrich our understanding of how the decision to transition to retirement is made in the context of a couple rather than in the independent individual context.

As a first step, we document the retirement states and transitions observed in our sample. Figure 2 illustrates the retirement states for each couple beginning in the first wave we observe them. This stacked bar chart shows what fraction of couples are in each state in each wave. The teal color (in the first bar), represents couples where both are observed working full time. By definition all couples start our sample in the FT/FT state. The blue color indicates couples where both are partially retired, and grey indicates couples where both are fully retired. These three

states represent situation where both spouses are in the same retirement state, which we refer to as concordant.

In the light green bar, the husband is fully retired and the wife is working full time. In the purple bar, the wife is fully retired and the husband is working full time. We refer to these two states as discordant, the spouses are engaging in completely different activities. The remaining bars represent states where one spouse is working part time and the other is either working full time or fully retired. We refer to these states as partially concordant because the two spouses are somewhat similar: they have shared leisure.

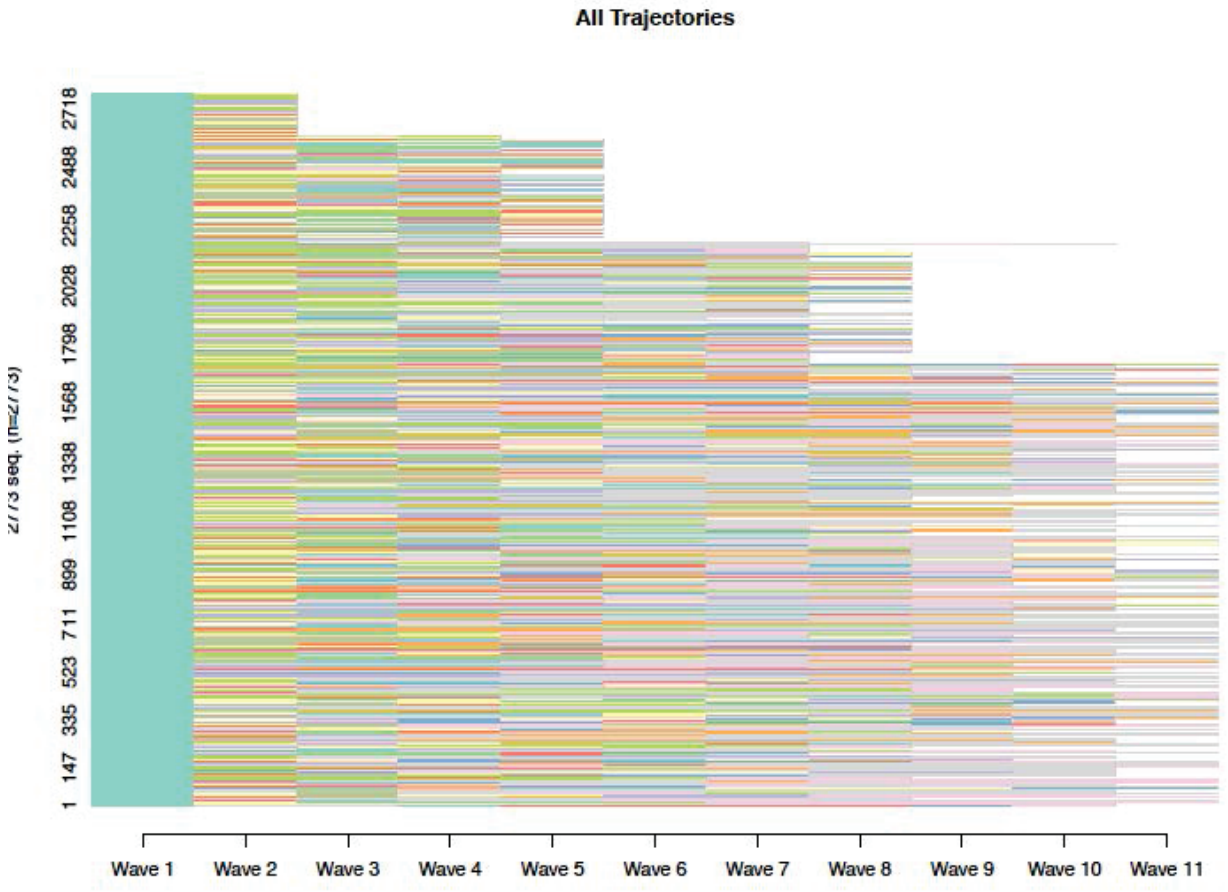
Figure 2: Wave by Wave Joint Partial Retirement States



The first thing we observe, is that much of the time that couples are observed transitioning to full retirement involves either a discordant or partially concordant state. This is somewhat contrary to the commonly held belief that couples retire simultaneously. However, this figure considers states and not transitions, thus we cannot observe what fraction of couples

over time deviate from full concordance. Figure 3 creates a single horizontal line for each couple that changes colors over time to indicate their retirement state in each wave, documenting retirement trajectories. While the details of this figure are impossible to identify, one thing is clear, there are many unique paths to joint retirement. In fact, we observe over 1,400 unique trajectories, with only 2,615 couples.

Figure 3: Wave by Wave Joint Partial Retirement Trajectories



To make the number of unique trajectories more tractable, we consider several researcher defined heuristics to classify trajectories. Our primary rule for classifying trajectories is based on the concepts of concordant, partially concordant, and discordant states described above. If a

couple is only observed in concordant states (both retired, both partially retired, or both working full time in each wave), we consider their full trajectory to be concordant. If a couple is ever observed in a discordant state (one working full time and the other fully retired in any wave), we consider their full trajectory to be discordant. In all other cases, by definition, there will be waves where one spouse is observed working part time, while the other is not. We consider these to be partially concordant trajectories. Only 7.1% of our sample is observed to have a fully concordant retirement trajectory. Contrary to common perceptions, joint transitions to retirement are not common. 31.0% of couples are observed to have partially concordant trajectories. The remaining 61.9% of couples have discordant trajectories. These discordant trajectories may include periods of partial concordance or full concordance, but the experience at least one wave where each spouse has a completely different labor force participation status.

Given that only a fraction of couples are fully concordant, and the vast majority experience periods of discordance, we consider three other heuristics to classifying retirement trajectories that provide additional insight into retirement transitions. Each method attempts to describe one feature of deviation from the expected path of WFT-WFT to Ret-Ret The first classifies trajectories based on who transitioned away from WFT first (referred to as first mover), the husband, the spouse, or if they moved together. The second classifies trajectories based on whether the first move away from WFT was to working part time (partial retirement), full retirement, or a mix. We refer to this as initial retirement status. This first transition may be made by the husband, wife or both. Nearly half of couples make an initial transition to retirement that involves at least one spouse being part time. Finally, we examine the entire joint trajectory and classify whether the husband or wife increased their labor supply at any point in the retirement trajectory, which we refer to as backtracking. Sometimes returning to the labor force

from full retirement is referred to as unretirement. However, our classification will also allow for increases from part time to full time work. It is notable that in nearly 45% of couples have one or both spouses increase their labor supply. Table 5 below indicates how many couples are observed in each type of trajectory.

Table 5: Distribution of Retirement Trajectory Categories

Concordance	Always Concordant	Partially Concordant	Ever Discordant	
	174 (6.7%)	816 (31.2%)	1,625 (62.1%)	
First Mover	Wife retires first	Both retire simultaneously	Husband retires first	
	1,211 (46.3%)	305 (11.7%)	1,099 (42.0%)	
Initial Retirement Status	One or both part time	Mix of full retirement and part time	One or both retire fully	
	1,070 (40.9%)	162 (6.2%)	1,383 (52.9%)	
Backtracking	Wife backtracks	Husband backtracks	Both backtrack	Neither backtracks
	467 (17.9%)	396 (15.1%)	281 (10.7%)	1,471 (56.3%)

Another way to think about our additional classifications is that, as noted previously, the dominant transition to retirement of dual-earning couples is often thought to be a jointly timed move into full retirement. If that is not the case, as we show here, then the question becomes whether there is an alternative descriptor of the modal pathway into retirement. Our classifications are tests of different descriptors.

5. Predicting Retirement Trajectories

We use our classifications to identify which characteristics are most associated with different trajectory types. These results address who is most likely to follow different trajectories and, in some cases, we consider whether certain characteristics of couples may cause them follow different retirement trajectories. These analyses provider a greater understanding of what may motivate couples to follow different retirement trajectories. We consider several characteristics that we assert are plausibly exogenous. We hypothesize that when there is a

larger age difference between spouses that they will be less likely to retire at the same time but may be more likely to use part time work to achieve partial concordance. The age difference between spouses is unlikely to be determined by retirement preferences, especially among the vast majority of our sample who have been married for a significant period of time before they enter our sample. Similarly, living in a rural area and occupation are likely to have been determined long before entering the panel. We hypothesize that individuals in rural areas and some occupations may have more difficulty finding part time jobs. Finally, we consider a question, studied in the previous literature, that measures leisure complementarities.[2] We hypothesize couples that have greater reported enjoyment of spending time together may be more likely to choose retirement trajectories that allow them to spend more time together.

For each method of classifying trajectories we consider 5 models. These models differ in their control variables and their samples. The first model controls for variables that can be observed for our entire sample. The second and third models limit the sample to those for whom leisure complementarities can be observed, with the third controlling for them.[3] The fourth and fifth models limit the sample to couples where we can observe the baseline occupation for each spouse, with the fifth controlling for whether the occupation is a white or blue collar job.[4] In the tables presented below we show only significant coefficients for parsimony and discuss only those that are significant in multiple models. The full set of coefficients is available in the appendix, shown in tables with corresponding table numbers; table A.6 corresponds to table 6,

[2] HRS respondents are asked "Generally speaking, would you say that the time you spend together with your wife is extremely enjoyable, very enjoyable, somewhat enjoyable, or not too enjoyable?"
[3] Leisure complementarities are defined from a question in the HRS that asks each individual how much they enjoy spending time with their partner. However, the question was only asked at most one time for each couple, and is missing for many couples.
[4] Blue collar occupations are services (cleaning, protection, or food preparation), farming, forestry, fishing, mechanics and repair, construction, extraction, manufacturing and production, machine operators, transport operators, and handler operators. White collar occupations are the remaining categories in the HRS: managerial, professional specialty, sales, clerical, health services, and personal services.

for example. All tables present the relative risk ratios from multinomial logit regressions. A number great than one indicates an increased likelihood of the given outcome relative to the baseline category. A number less than one indicates a decreased likelihood of the given outcome relative to the baseline category.

5.1 Concordance

Table 6 examines whether the first trajectory is always concordant (both spouses in the same retirement state at all times) or partially concordant (at least one spouse is part time at some point). In this table the reference category is ever discordant, representing couples who are ever observed with one working full time and the other working part time.

Table 6: Multinomial Logit Regression Predicting Concordance

Always Concordant	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*
Husband's Age minus Wife's Age if Wife Younger	0.951*	0.943	0.944	0.921**	0.920**
	0.035	0.069	0.071	0.003	0.003
Husband's birth year	0.969*	0.972	0.972	0.947**	0.949**
	0.031	0.254	0.244	0.003	0.004
Wife has college degree or more	0.719	0.684	0.691	0.586	0.569*
	0.186	0.229	0.242	0.058	0.045
Husband's earnings in $1000s	1.001	1.019*	1.019*	1.009	1.008
	0.842	0.022	0.027	0.161	0.188
Husband's earnings minus Wife's earnings in $1000s if Husband earns more	0.995	0.978*	0.978*	0.989	0.99
	0.448	0.018	0.02	0.125	0.134
Marriage length spline (0-16.7 years)	0.954	0.93	0.932	0.937*	0.936*
	0.079	0.051	0.06	0.03	0.028
Total number of waves observed	0.880***	0.918*	0.910*	0.901**	0.900**
	0	0.026	0.015	0.002	0.002
Husband finds joint leisure extremely or very enjoyable			2.576*		
			0.036		
Partially Concordant	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*

Wife's Age minus Husband's Age if Wife Older	0.962	0.923*	0.921*	0.98	0.978
	0.079	0.027	0.024	0.446	0.396
Husband's birth year	1.019*	1.018	1.017	1.014	1.016
	0.023	0.201	0.228	0.14	0.107
Husband in Excellent of Very Good Health	1.214*	1.133	1.112	1.187	1.184
	0.041	0.327	0.404	0.093	0.099
Wife in Excellent of Very Good Health	1.250*	1.047	1.041	1.263*	1.252*
	0.025	0.734	0.771	0.03	0.037
Husband has LT high school degree	0.787	0.559**	0.556***	0.811	0.845
	0.063	0.001	0.001	0.132	0.233
Husband has college degree or more	1.362**	1.550**	1.547**	1.428**	1.322*
	0.007	0.004	0.005	0.004	0.029
Wife has LT high school degree	0.732*	0.607*	0.604**	0.693*	0.720*
	0.027	0.01	0.01	0.018	0.037
Husband has DB pension	0.719**	0.817	0.816	0.732**	0.735**
	0.001	0.13	0.128	0.004	0.005
Husband has 401k	0.836	0.759*	0.755*	0.782*	0.778*
	0.067	0.035	0.033	0.02	0.018
Rural area	0.731**	0.777	0.766	0.789*	0.802*
	0.002	0.071	0.056	0.03	0.043
Marriage length spline (32 years or more)	1.049	1.107**	1.106**	1.063*	1.059*
	0.066	0.007	0.008	0.028	0.041
Total number of waves observed	0.929***	0.97	0.964	0.946**	0.946**
	0	0.184	0.116	0.005	0.005
Husband has blue collar job					0.768*
					0.021
N	2610	1584	1584	2300	2300

In Table 6, results are displayed relative to discordant trajectories. We find that when husbands are younger at baseline (i.e. they have a later birth years), couples are less likely to have concordant trajectories relative to discordant trajectories, across all 5 specifications. Being born one year later is associated with a 0.03 to 0.05 decrease in the likelihood that the couple's

retirement trajectory is concordant. Age difference is also a significant predictor of the retirement path. Larger age differences are associated with partially concordant or discordant paths. One possibility for why this happens is because the larger the gap in ages between spouses, the larger the lag between the time when the husband qualifies for social security and when the wife qualifies. However, it is interesting to that when the husband is older, concordant paths are more common, while when the wife is older partially concordant paths are more common (although this is only marginally significant and only in the limited sample where leisure complementarities are observed). We argue that age differences are plausibly exogenous to the retirement decision. The couples in our sample have been married on average 25 years and have an average age difference of approximately 3 years. At the time of marriage, it is unlikely that the majority of couples were thinking about the implications of their age difference 25 years down the road.

We also find that when the husband notes a greater enjoyment of joint leisure, concordant trajectories are more common. However, we do not find a similar effect for wives finding joint leisure extremely or very enjoyable.

In specifications limited to those with observable leisure complementarities, higher earnings by the husband are associated with an increased likelihood of a concordant trajectory, however the likelihood decreases as the husband earns more than the wife. Couples with higher earning husbands are more likely to choose fully concordant retirement paths over partially concordant paths. This may be because they can afford to have the wife quit working earlier in order to follow a concordant path. Larger earnings differences between spouses are, like age differences, associated with partially concordant retirement paths.

The more waves a couple is observed for, the more likely they are to have a concordant trajectory and the less likely to have a partially concordant trajectory. Because the number of waves observed is closely tied to the cohort in which one is recruited, this may suggest that over time concordance is becoming less common.

Partial concordance is associated with younger husbands (those born in later years) and with the health of the wife. It is less common among less educated couples (where either the husband of the wife has less than a high school education, and more common among couples where the husband has a college degree, relative to those with only a high school degree. In couples where husbands have defined benefits pensions or a 401k, partial concordance is less likely, however, this logical classification does not allow us to identify which spouse moves out of the labor force. Partial concordance is also less common in rural areas and among couples where the husband has a blue collar job. The fact that partial concordance is less common among those with less education, blue collar jobs, and living in rural areas suggests that those with fewer labor market options are less likely to be able to achieve partial concordance. Looking at the clusters created in our cluster analysis in a regression framework will allow us to consider this in more detail. We present these results below.

5.2 First Mover

Table 7 examines which spouse retires first, looking at the likelihood of the wife retiring first relative to the husband retiring first, and the likelihood of simultaneous retirement relative to the husband retiring first. We find that women are less likely to retire first when the husband is older than she is and this increases with the age difference and are more likely to retire first (in models 4 and 5) when the wife is older than the husband. These finding are not surprising given that older spouses will naturally reach retirement age earlier than younger spouses. We find that

couples with younger wives are less likely to retire at the same time as the age difference increases.

Table 7: Multinomial Logit Regression Predicting First Mover

Wife First	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*
Wife's Age minus Husband's Age if Wife Older	1.02	1.027	1.027	1.064*	1.066*
	0.342	0.379	0.373	0.023	0.019
Husband's Age minus Wife's Age if Wife Younger	0.948***	0.941***	0.941***	0.952***	0.951***
	0	0	0	0	0
Husband's birth year	1.017*	1.024	1.024	1.014	1.013
	0.045	0.073	0.069	0.154	0.171
Husband in Excellent of Very Good Health	1.253*	1.12	1.125	1.275*	1.275*
	0.016	0.348	0.33	0.014	0.014
Wife in Excellent of Very Good Health	0.694***	0.676**	0.676**	0.672***	0.675***
	0	0.003	0.003	0	0
Husband has college degree or more	1.388**	1.782***	1.783***	1.422**	1.465**
	0.006	0	0	0.005	0.004
Wife has LT high school degree	1.167	1.448*	1.453*	1.168	1.162
	0.249	0.032	0.031	0.277	0.302
Wife has college degree or more	0.984	0.707*	0.706*	1.003	1.009
	0.894	0.036	0.035	0.983	0.946
Husband's earnings in $1000s	0.990***	0.990*	0.990*	0.990**	0.990**
	0	0.039	0.039	0.003	0.003
Husband's earnings minus Wife's earnings in $1000s if Husband earns more	1.019***	1.019***	1.019***	1.018***	1.018***
	0	0	0	0	0
Husband has Health Ins through spouse's employer	1.099	1.428*	1.431*	1.151	1.156
	0.496	0.048	0.047	0.341	0.326
Wife has Health Ins through own employer	0.687**	0.721*	0.719*	0.692**	0.692**
	0.003	0.049	0.048	0.007	0.007
Husband has DB pension	0.760**	0.742*	0.743*	0.760**	0.758**
	0.005	0.019	0.019	0.008	0.008
Wife has 401k	0.815*	0.772*	0.772*	0.784*	0.782*
	0.035	0.041	0.042	0.019	0.018

Rural area	1.101	1.313*	1.321*	1.137	1.131
	0.335	0.037	0.033	0.22	0.24
Move Together	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*
Husband's Age minus Wife's Age if Wife Younger	0.942**	0.933**	0.933**	0.929***	0.929***
	0.001	0.004	0.004	0	0
Husband's birth year	0.973*	0.975	0.975	0.960**	0.961**
	0.028	0.204	0.196	0.006	0.008
Wife in Excellent of Very Good Health	0.699*	0.613**	0.607**	0.686*	0.683*
	0.015	0.009	0.008	0.016	0.015
Husband has LT high school degree	0.806	0.625*	0.629*	0.827	0.866
	0.239	0.046	0.049	0.326	0.467
Wife has LT high school degree	1.096	1.662*	1.642*	1.248	1.322
	0.641	0.037	0.042	0.28	0.183
Husband's earnings in $1000s	1	1.014*	1.013*	1.005	1.004
	0.979	0.033	0.036	0.338	0.383
Wife has Health Ins through own employer	0.673*	0.714	0.713	0.801	0.81
	0.039	0.152	0.153	0.267	0.293
Indicator if unmarried	0.488	0.523	0.532	0.401*	0.411*
	0.061	0.175	0.186	0.042	0.049
Total number of waves observed	1.042	1.068*	1.062	1.052	1.051
	0.122	0.042	0.061	0.067	0.072
N	2610	1584	1584	2300	2300

Wives are less likely to retire before their husbands when they themselves are in excellent or very good health, and more likely to retire first when their husbands are in excellent or very good health. Interestingly, these findings are in line with the likelihood of retiring simultaneously. This suggests that when women are in good health they are likely to work longer than their husbands. Similarly, wives are more likely to retire before their husbands when the wife has less than a high school degree or when the husband has a college degree or higher, relative to both retiring after and at the same time as their husbands.

5.3 Initial Retirement Status

Table 8 examines whether the first retirement transition was to part time (by either or both spouses), full retirement (by either or both spouses), or to a combination of the two (with one retiring and the other reducing hours to part time. In this table the reference category is one or both move to full time.

Table 8: Multinomial Logit Regression Predicting Initial Retirement Status

One or Both Part Time	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*
Husband's Age minus Wife's Age if Wife Younger	1.036**	1.032*	1.032*	1.042***	1.042***
	0.001	0.027	0.026	0.001	0.001
Husband's birth year	1.032***	1.035**	1.035**	1.032***	1.033***
	0	0.007	0.007	0.001	0
Husband in Excellent of Very Good Health	1.354***	1.337*	1.331*	1.422***	1.416***
	0.001	0.013	0.015	0	0
Husband has LT high school degree	0.781*	0.715*	0.716*	0.803	0.834
	0.04	0.032	0.033	0.09	0.167
Husband has college degree or more	1.342**	1.405*	1.398*	1.378**	1.302*
	0.008	0.021	0.023	0.007	0.033
Wife has LT high school degree	0.724*	0.700*	0.700*	0.733*	0.762
	0.015	0.036	0.036	0.029	0.061
Wife has college degree or more	1.465**	1.485*	1.490*	1.433**	1.403**
	0.001	0.011	0.01	0.005	0.008
Husband's earnings in $1000s	0.992**	0.989*	0.989*	0.993*	0.993*
	0.003	0.015	0.014	0.027	0.02
Husband's earnings minus Wife's earnings in $1000s if Husband earns more	1.009**	1.011*	1.011*	1.008*	1.008*
	0.002	0.024	0.023	0.014	0.011
Wife has DB pension	0.778**	0.691**	0.691**	0.786*	0.786*
	0.008	0.002	0.002	0.016	0.016
Husband has DB pension	0.660***	0.688**	0.687**	0.676***	0.677***
	0	0.002	0.002	0	0
Husband has 401k	0.815*	0.701**	0.705**	0.774*	0.774*
	0.029	0.004	0.004	0.011	0.011

Total number of waves observed	1.038*	1.051*	1.050*	1.041*	1.041*
	0.036	0.023	0.028	0.032	0.032
Mix of Full Time and Part Time	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*
Husband has college degree or more	1.893**	1.532	1.54	1.882**	1.763*
	0.005	0.143	0.138	0.008	0.021
N	2610	1584	1584	2300	2300

Again, we find that the age difference is a significant predictor. When the husband is older, a larger age difference is associated with a greater likelihood that one or both will make an initial transition to part-time, perhaps in order to straddle two preferences. We also find that couples with younger husbands (later birth year) are more likely to transition first to part time, consistent with the trend found in other work that partial retirement is becoming increasingly common. Part time work is more likely than full retirement when the husband is in good health, perhaps reflecting the ability to continue working. An initial transition to part time work is much more common among couples with higher education (either spouse has gone to college) than among couples with less education (either spouse has less than a high school degree.

Higher earnings by the husband are associated with a decreased likelihood of an initial transition to part time relative to an initial transition to fulltime, however the likelihood increases as the husband earns more than the wife. Consistent with the result above, that couples with higher earning husbands are more likely to choose fully concordant retirement paths over partially concordant paths, we find that higher earnings are associated with full retirement as an initial transition relative partial retirement. This may be because they can afford to quit working completely. Access to pensions for both spouses and 401(k)s for husbands (but not wives) are associated with a decreased likelihood that the initial transition is to part time, relative to retirement. Again, this is consistent with the possibility that initial transitions to full retirement

is a normal good, individuals who can afford it transition to full retirement rather than part time work.

Being observed for more waves is associated with a greater likelihood that the initial transition is to partial retirement. Because the number of waves observed is correlated with age cohort, and because this works in the opposite direction as husbands birth year, it is difficult to disentangle, the impact of cohort and age.

Interestingly, we find only one significant predictor for an initial transition to part time by one spouse simultaneously with an initial transition to retirement by the other spouse. However, this group is small (representing only about 6% of the sample). Thus it is not surprising that our regressions are underpowered.

5.2 Backtracking

Table 9 presents similar results for backtracking. Here we consider whether the husband only is observed to backtrack, the wife only backtracks, or both backtrack, all relative to couples who are not observed to backtrack.

Table 9: Multinomial Logit Regression Predicting Back Tracking

Husband Back Tracks	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*
Wife Black	2.443	4.955*	4.826*	2.831	2.814
	0.08	0.034	0.037	0.053	0.055
Wife's earnings minus Husband's earnings in $1000s if Wife earns more	1.007*	1.007	1.007	1.007*	1.007*
	0.024	0.059	0.059	0.021	0.021
Husband has 401k	0.855	0.714*	0.716*	0.79	0.786
	0.233	0.039	0.041	0.08	0.074
Marriage length spline (32 years or more)	0.99	0.900*	0.901*	1.01	1.01
	0.77	0.045	0.046	0.791	0.781
Total number of waves observed	1.344***	1.287***	1.289***	1.288***	1.290***
	0	0	0	0	0

Indicator if missing in any wave	0.609*	0.648	0.653	0.525**	0.528**
	0.033	0.119	0.127	0.006	0.007
Wife Back Tracks	Model 1	Model 2	Model 3	Model 4	Model 5
Husband's Age minus Wife's Age if Wife Younger	1.033*	1.013	1.014	1.049**	1.050**
	0.024	0.47	0.458	0.002	0.001
Husband's birth year	1.028*	1.013	1.013	1.055***	1.054***
	0.015	0.447	0.427	0	0
Wife has LT high school degree	1.083	1.550*	1.555*	1.091	1.027
	0.643	0.038	0.037	0.626	0.883
Husband's earnings minus Wife's earnings in $1000s if Husband earns more	1.007	1.014*	1.014*	1.007	1.007
	0.076	0.03	0.03	0.093	0.106
Husband has DB pension	0.731*	0.743	0.745	0.755*	0.757*
	0.014	0.062	0.065	0.031	0.032
Husband has 401k	0.809	0.734	0.735	0.752*	0.747*
	0.087	0.053	0.055	0.026	0.023
Rural area	1.342*	1.271	1.281	1.219	1.205
	0.019	0.137	0.126	0.123	0.149
Marriage length spline (32 years or more)	0.906*	0.857**	0.858**	0.920*	0.922*
	0.01	0.004	0.005	0.037	0.044
Total number of waves observed	1.324***	1.260***	1.264***	1.260***	1.262***
	0	0	0	0	0
Both Backtrack	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*
Husband Hispanic	3.253**	4.141*	4.036*	3.607**	3.627**
	0.005	0.013	0.015	0.003	0.003
Wife Hispanic	0.235**	0.192*	0.198*	0.221**	0.220**
	0.003	0.011	0.012	0.002	0.002
Husband's earnings in $1000s	0.99	0.985*	0.986*	0.989	0.989
	0.068	0.043	0.049	0.052	0.054
Wife has Health Ins through own employer	0.663*	0.564*	0.571*	0.639*	0.637*
	0.045	0.022	0.025	0.031	0.03
Husband has DB pension	0.720*	0.577**	0.577**	0.718*	0.720*
	0.042	0.004	0.004	0.041	0.043
Marriage length spline (32 years or more)	0.977	0.886*	0.887*	0.995	0.996

	0.561	0.037	0.04	0.909	0.917
Total number of waves observed	1.570***	1.544***	1.544***	1.515***	1.517***
	0	0	0	0	0
N	2610	1584	1584	2300	2300

When there is a larger difference in ages, and the husband is older, wives are more likely to backtrack. This may occur because wives make an initial transition with their husbands, but then choose to increase their labor supply after retiring at a young age.

We find that there may be racial and ethnic differences in backtracking, however, the results are surprising because they are not consistent across spouses. For example, husbands with black wives are more likely to back track. And couples where the husband is Hispanic are more likely to both back track, relative to no back tracking, but if the wife is Hispanic they are less likely to back track.

When wives earn more than their husbands at baseline, the husband is more likely to back track, but the husband's income itself is not significant. However, the coefficient on the differences in income is very small, A $1000 increase in wife's earnings only increases the relative risk by .007. We find a similar effect of higher earnings by the husband on the likelihood that the wife backtracks. The level of earnings and the relative earnings between spouses are not significant predictors of both backtracking.

Across specifications, access to pensions and 401(k)s reduces the likelihood of observing backtracking. This may occur because these households are more financially secure and thus are able to maintain reduced labor force participation. Those with less financial security may be forced back into the labor market. However, because we focus on baseline characteristics, we

cannot measure how financial assets in retirement affect labor supply decisions after an initial transition to retirement.

Women with less than a high school education and in rural areas may be more likely to backtrack. This may occur if the initial transition reflects an involuntary reduction in labor supply. However, these results are not significant across specifications. Marriage length (among the quartile married the longest) is associated with less likelihood of backtracking by the husband alone, the wife alone, and by both spouses.

Couples observed for more waves are more likely to be observed backtracking, however this results in particular may be due to the fact that couples observed for fewer waves have not been followed long enough to be observed backtracking.

One caveat to the results in table 9 is that they all are based on baseline characteristics. The decision to backtrack may be more of a function of characteristics at the time of backtracking. Each of the other characteristics of retirement trajectories that we have discussed is better understood by limiting our right hand side variables to those observed at baseline.

6. Using Cluster Analysis to define Retirement Trajectories

The four classifications that we analyzed in the previous section have a similar problem, which is that the classification itself is a function of the researcher's priors about what distinguishes one retirement path from another. We assume that concordance, or first-mover, or backtracking, is a sufficient description of trajectories, but we want to be able to judge the quality of our heuristics. Hence, as an alternative methodology, rather than defining trajectory types using heuristics, we use cluster and sequence analysis methods to group trajectories, with the twin objective of minimizing the distance between trajectories within groups and maximizing the distance across groups. The key benefit of trajectory clustering is that the distance is

measured over the entire trajectory, and not at one transition point (such as the first move) or by one transition type (such as backtracking), which our previous classifications used. Clustering methods allow small deviations from a large path to play less of a role in determining the type of trajectory than the path itself.

As an example, consider three couples each observed for 5 waves. The first couple is observed both working full time in the first wave, and then both fully retired in all future waves (WFT-WFT; Ret-Ret; Ret-Ret; Ret-Ret; Ret-Ret). The second couple is observed both working full time in the first wave, then one retired in the second wave, and then both fully retired in all future waves (WFT-WFT; WFT-Ret; Ret-Ret; Ret-Ret; Ret-Ret). The third couple is observed both working full time in the first wave, then one retired in the second through the fourth waves, and then both fully retired in the final wave (WFT-WFT; WFT-FR; WFT-Ret; WFT-Ret; Ret-Ret). The second couple spends only a brief time in a discordant state and a majority of their time in a concordant state. The third couple spends most of the time in a discordant state. By our definition, the second and third couple would both be considered discordant. Our clustering method develops a distance measure and calculates the degree of deviation from the norm, then assigns each couple across the clusters to minimize the differences within clusters. It would allow for a short period out of compliance with the group's norm.

We consider several different approaches to our analysis, as how to measure the distance between trajectories and how to group into clusters have numerous possible methods.[5] To start, there are two families of distance calculation: the optimal matching methods and the common sequence methods. The former calculates the "edit distances" between trajectories, or the costs

[5] This analysis is conducted in the R package "Traminer," which has extensive documentation on these methods and others, as well as thorough explanation of how to implement and evaluate clusters. The official documentation is here (https://cran.r-project.org/web/packages/TraMineR/vignettes/TraMineR-state-sequence.pdf) and a user guide here (http://mephisto.unige.ch/pub/TraMineR/doc/TraMineR-Users-Guide.pdf).

in terms of insertions, deletions, and substitutions of transforming one sequence into another. The latter estimate the "common attributes" among trajectories, or common identical subsequences. We use the latter approach and specify distance as a function of the longest common subsequence (LCS) between trajectories. We opt for LCS because it looks for common paths across trajectories, which aligns with the aim of this investigation to identify primary retirement pathways. In addition, the alternative approach, using optimal matching, requires many more assumptions and specifications, making it more difficult to understand, or manipulate, how distance is calculated. With no strong priors, the LCS is also the most straightforward.

Once the distance is calculated between trajectories, they are then grouped into clusters. Again, there are two main families of methods: agglomeration and partitioning around medioids (PAM). Agglomeration is akin to a nearest neighbor grouping, if there are *n* trajectories, the agglomerations starts with *n* groups, and iterates to join the two closest groups until there is only one single group, forming the equivalent of branches of a tree that starts with *n* and ends at 1. The number of clusters determines where in the agglomeration the branches are cut. PAM, on the other hand, starts with a specified number of clusters and builds the nearest neighbors into each cluster. Without a strong prior on the "correct" number of retirement pathways, we opted for the agglomerative approach, and compared clusters at multiple cut points.

Using these methods—agglomerative clustering of LCS distance sequences—we established 13 clusters, or 13 types of retirement pathways. Although there are means of evaluating clusters once formed, there is no fixed method for determining the optimal number of clusters.[6] The methods that do exist are often geared to sequences with fewer possible states. To

[6] Detailed cluster evaluation is available from the authors. Visuals of cluster typology is available in the appendix.

arrive at our cluster number, we examined each cluster in formation. Recall from the agglomeration explanation that, one the distance measure is calculated, sequences are iteratively grouped from 1 to *n,* so that any cluster number is a cut in the branch of tree of the agglomeration process. Hence, we can examine each cutpoint and the cluster that broke off at that cutpoint. So, for example, if we increase the number of clusters from 2 to 3, the third cluster will be entirely a subset of cluster 2, thus cluster 1 will remain the same and cluster 2 will break into two. We examined each cluster as they formed and looked for similarities across clusters both in terms of the sequences, and the characteristics of the trajectories that we defined above (i.e. concordance) similar to a t-test. When a new cluster was added that was not distinct from those that already existed, we determined that additional clusters would not add to our understanding. It should be noted that researchers with a different aim could have examined the same agglomerated sequences and arrived at a different cluster number for analysis. However, our aim was to find the number of clusters that describe distinct retirement typologies, and we found that 13 was an appropriate number.

Within each of the thirteen types of retirement trajectories that we identified, there is a primary (and sometime a secondary) retirement state that dominates the trajectories. To make presentation easier we have color coded these trajectories to match the figures above. Clusters are numbered by the clustering algorithm, but we have ordered them in a progression from highest to lowest labor force participation.

- Cluster 10 is characterized by couples who experience an initial transition and then return to full time work. (n=125, 4.8% of sample)
- Cluster 2 is characterized by couples where the husband works part time and the wife continues to work full time. (n=286, 10.9% of sample)

- Cluster 11 is characterized by couples where the husband continues to work full time and the wife initially reduces her labor supply to part time but the couple does not remain in this state for long. (n=243, 9.3% of sample)
- Cluster 9 is characterized by couples where the husband continues to work full time and the wife reduces her labor supply to part time, and in contrast to cluster the couple remains in that state for an extended period. (n=120, 4.6% of sample)
- Cluster 13 is characterized by couples who both work part time. (n=67, 2.6% of sample)
- Cluster 4 is characterized by couples where the husband retires and the wife continues to work full time, but over time the husband backtracks and increases his labor supply. (n=385, 14.7% of sample)
- Cluster 6 is characterized by couples where the husband retires and the wife continues to work full time, and in contrast to cluster 4 the couple remains in that state for an extended period. (n=205, 7.8% of sample)
- Cluster 12 is characterized by couples where the wife retires and the husband continues to work full time, the couple remains then remains in that state for an extended period. (n=162, 6.2% of sample)
- Cluster 8 is characterized by couples where the wife retires and the husband continues to work full time, however the husband quickly transitions to full retirement. (n=255, 9.8% of sample)
- Cluster 5 is characterized by couples where the husband retires and the wife continues to work full time. (n=182, 7.0% of sample)

- Cluster 3 is characterized by couples where the wife retires and the husband works part time, the couple then remains in that state for an extended period. (n=110, 4.2% of sample)
- Cluster 7 is characterized by couple where both initially retire fully but then one or both increases their labor supply, typically to part time. (n=88, 3.4% of sample)
- Cluster 1 is characterized by 1) couples where the wife retires and the husband works part time, however the husband quickly transitions to full retirement, or by 2) couples that transition to retirement directly and remain in that state. (n=387, 14.8% of sample)

It is interesting to note that there is at least one cluster corresponding to each retirement state, but for some there are multiple clusters, depending on whether that state is ongoing or transitory. It is also interesting to note that the concept of a joint transition to full retirement does not warrant its own cluster. If more clusters were allowed for, we might expect to see additional clusters within in these general constructs. However, we would need a very large number of clusters to start being able to pick up more detailed trajectory specific patterns.

As described above, a benefit of using cluster sequence analysis is that it the grouping are not a function of the researcher's priors about what distinguished trajectories, but rather are determined algorithmically. In table 10, we present results OLS regressions predicting assignment to each of the 13 clusters as a function of the trajectory types described in the previous section. For ease of presentation, we present only the sign of the significant coefficients for each right hand side variable. The clusters are color coded as above and again ordered in a progression from highest to lowest labor force participation. These regressions

merely identify the correlations between each cluster and each of our heuristically defined groups.

Table 10: Multinomial Logit Regression Relating Clusters to Trajectory Types

	Cluster size	Concordant (relative to partially concordant)	Discordant (relative to partially concordant)	Wife leader (relative to joint transition)	Husband leader (relative to joint transition)	Initial transition to part time only (relative to mixed full and part time)	Initial transition to full time only (relative to mixed full and part time)	Husband backtracks from retirement to full time	Husband backtrack from part time to full time	Husband backtrack from retirement to part time	Wife backtrack from retirement to full time	Wife backtrack from part time to full time	Wife backtrack from retirement to part time
Cluster 10: Primary State H FT W FT	125		-	+	+	+	+	+	+	-	+	+	
Cluster 2: Primary state H PT W FT	286		-		+	+	+	-	+		+	-	
Cluster 11: Primary state H FT W PT transitory	243	-	-	+	+	+	+	+	-			+	
Cluster 9: Primary state H FT W PT long term	120			+		+		+	+		-		+
Cluster 13: Primary State HPT W PT	67	-		-	-	+		-		+		-	+
Cluster 4: Primary state H Ret W FT transitory	385	-	+	-	+		+	-	-	-		+	-
Cluster 6: Primary state H Ret W FT long term	205		+	-	+				-	-	+	+	-
Cluster 12: Primary state H FT W Ret long term	162		+	+	-				+	-	-	-	
Cluster 8: Primary state H FT W Ret then HRET WRET	255	-	+	+	-				+	-	-	-	-
Cluster 5: Primary state H Ret W PT	182	-	-	-		-	-		-			+	+
Cluster 3: Primary state HPT W Ret	110	-			-	-	-		+	+	-	-	
Cluster 7: Primary state HRET WRET transitory	88	-	-	-	-		+			+		-	+
Cluster 1: HPT W Ret & HRet W Ret direct to retirement	387	+			-				+	-	-	-	-

The results in this table are encouraging. First, we note that clusters related to discordant states (clusters 4 and 6: husband retired-wife works full time and clusters 8 and 12: wife retired-husband works full time) are in fact highly correlated with being labeled discordant in our heuristic groups. Similarly, cluster 1, which includes couples who transition from both in full time work to both fully retired are more likely to be labeled concordant. When the wife made the first transition to retirement (based on the heuristic rules), the couple is likely to be assigned to clusters where the husband continues to work full time and wife is part time (clusters 11 and 9) or fully retired (clusters 12 and 8). Similarly, when the husband makes the first transition, the couple is likely to be assigned to clusters where the wife continues to work and the husband reduces his labor supply (clusters 2, 4, and, 6). The next heuristic group considers whether the initial retirement transition was to part time, full retirement, or to a combination of the two. Here we see that if the initial transition was to part time, the cluster is likely to be one that has one spouse working full time and the other working part time (clusters 2, 11, 9 and 13), but also to the cluster where couples quickly return to work (cluster 10). If this initial transition is to full retirement this is less closely related with the clusters we might expect to see. However, the excluded category (first transition is to a mix of part time and retirement) is quite small. When the initial transition is to full retirement, couples are likely to be assigned to some clusters with full time work and full retirement (cluster 4) but also to clusters where there is part time work and full time work (clusters 2 and 11).

In the last 6 columns we investigate the prevalence of backtracking in each of the clusters. We observe that each cluster is positively associated with some forms of backtracking and negatively associated with others. Typically, the cluster assigned relates to the state to which a spouse backtracks but this is not always the case.

As a next step, we examine a multinomial logit regression similar to those run for the trajectory groups based on researcher heuristics. Table 11 summarize results from a multinomial regression predicting the 13 clusters calculated by the clustering algorithm described above. Here we treat the cluster where both spouses spend most time in the full time work as the base category.[7]

[7] Full results are available from the authors.

Table 11: Multinomial Logit Regression Predicting Clusters

	Cluster size	Wife Age relative to Husband if older	Hus Age relative to Wife if older	Husbands Birth Year	Husband Black	Husband Hispanic	Wife Black	Wife Hispanic	Husband in Exc. Or VG Health	Wife in Exc. Or VG Health	Husband LT HS	Hus College Degree	Wife LT HS	Wife College	Husband earnings	Husbands earnings relative to wife	Wife earnings relative to Hus	Husband Health Insurance	Wife Health Insurance	Wife has DB Pension	Husband has DB Pension	Wife has 401k	Husband had 401K	Rural Area	Marriage Length	Unmarried	Total waves observed	Missing wave	Hus notes leisure complementarities	Wife notes leisure complementarities	Husband had Blue Collar Job	Wife has Blue Collar Job
Cluster 10: Primary State H FT W FT	125	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r
Cluster 2: Primary state H PT W FT	286					-				+																	-					
Cluster 11: Primary state H FT W PT transitory	243														-	+		+									-					
Cluster 9: Primary state H FT W PT long term	120		-															+	-						+							
Cluster 13: Primary State HPT W PT	67		-						-	+											+											
Cluster 4: Primary state H Ret W FT transitory	385			-					-	+	+	-						+		+	+						-			+		
Cluster 6: Primary state H Ret W FT long term	205			-					-			-				-		+			+						-					+
Cluster 12: Primary state H FT W Ret long term	162	+	-										+				-					-									+		
Cluster 8: Primary state H FT W Ret then HRET WRET	255		-	-					-											+	+						-					
Cluster 5: Primary state H Ret W PT	182		-	-					-	+		-	+					+			+			-								+
Cluster 3: Primary state HPT W Ret	110		-	-			-					+	+					+													+	
Cluster 7: Primary state HRet WRet transitory	88		-	-									+					+		+	+						+					+
Cluster 1: HPT W Ret & HRet W Ret direct to retirement	387		-	-					-				+			-		+		+					+		-			+		

Several key patterns emerge. First, the age difference when women are older than their husbands is associated with a greater likelihood that the wife retires and the husband continues working. The age difference when husbands are older, a later birth year for the husband, husband's access to health insurance, and total number of waves observed are associated with reduced likelihood of many states, but this may be because of the comparison group, those where both continue to work full time after an initial transition. When the husband is in worse health, the couple's retirement trajectories tend to have the husband working less than or the same as the wife, and similarly, when the wife is in good health the wife tends to work more than the husband. When husbands have a college degree they are more likely to work more than their wives, and when either spouse has less than a high school degree they are less likely to work more that their spouse. Whether either spouse has a DB pension is associated with that spouse retiring or reducing their labor supply before the other, or for both to reduce labor supply simultaneously.

We were particularly interested in 3 characteristics that are likely to have been determined long before the retirement decision. First, we hypothesized that living in a rural area might reduce the availability of part time work, but we find little evidence that this impacts retirement trajectories. We also hypothesized that occupations might be associated with retirement trajectories. Controlling for husband's occupation, women in non-professional blue collar jobs are more associated with remaining in the labor force perhaps longer than their husbands. We also hypothesized that leisure complementarities might be associated with retirement trajectories that are more concordant, but we did not find evidence of this.

The algorithmic approach has the advantage that it does not reflect researcher bias. We are most interested in whether the predictors of inclusion in our heuristic groups are also

predictors of inclusion in the sequence analysis groups. This is akin to a robustness check on the quality of our descriptive analysis. Having a large age difference predicts first mover, for example, might have us conclude that the age difference is an important characteristic in joint retirement decision making. But that is our chosen covariate relating to our chosen dependent variable. When the dependent variable is a statistical description, like in the algorithms. Is, if age difference still predictive of which typology a couple is in, we can conclude that age difference is an important factor in retirement pathways. This applies to all of our dependent variables. Hence, we can conclude that key inputs into the retirement decision making process are age differences, year of birth of the husband, health, education, access to employer benefits (such as insurance and retirement pensions or 401(k)s), and leisure complementarities.

7. Sample considerations

In this paper, we present the myriad retirement pathways that we observe among dual earning couples. However, our results must be taken in context of two sample considerations. First, recall from previous sections that our sample consists of dual earning couples with at least one partner over 50 and at least one partner under 70 who begin the retirement transition in the HRS. Couples can, and do, both enter and exit our sample but remain in the HRS. On the entry side, 7% of the total sample had waves observed in the HRS in which they did not meet our requirements, because either the respondent was not partnered or one person was not working. On the exit side, 30% of the sample exited our sample though remained in the HRS, because the union dissolved through death or divorce.

Given the reasons for sample entry or exit, the couples who enter or exit the sample are not likely not random. To explore this, we perform a series of balancing regressions on the covariates used in our multivariate analysis and descriptors of sample entry and exit, in which the

covariate is the dependent variable and a dummy for sample exit is the independent variable. If the coefficient is precisely estimated, then the covariate is unbalanced across the two groups.[8] By running each covariate, we can determine if couples who enter or exit the sample vary from those who do not leave. We perform these balancing tests under numerous specifications, including a cohort fixed effect and on the full or partial samples. The coefficient estimates are not predictive, and solely show variation across the two groups, hence we do not show estimates but a summary of the findings, in Table 11. [9]

Table 11: Covariates that statistically differ among couples who enter or exit sample

	Variable
Entry – Is not in sample at first wave of HRS observation	Husband birth year Age difference (negative and positive) Earnings difference (negative) Health insurance coverage and sponsor Husband/Wife have a pension in current job Marriage length Unmarried but partnered
Exit – Ends trajectory before last wave of HRS observation	Husband birth year Husband/wife black Husband/Wife with less than a high school degree Husband/Wife with a college degree Husband/Wife in blue collar occupation Husband/Wife have a 401k in current job Husband/wife self-reported health

The majority (76%) of couples who enter the sample do so because of a new marriage. We find that in sample means, the greatest difference between those couples and those who started the HRS marriages is an almost doubling in the absolute age difference, from 4.5 years among those who start the HRS in the sample to 7.5 years for those who do not start the HRS in the sample. Table 8 shows the other statistically different characteristics across those who enter

[8] A specific example would be: $Hispanic_i = \mu_i \, Entry_i + \varepsilon_i$

[9] Available upon request from author.

and do not, many are correlated with age difference, include job characteristics (earnings, health insurance coverage, and pension coverage), and marriage length and marital status.

For those couples exiting, about half of exits are associated with the death of a partner, and the other with divorce or missing final wave. We find that in sample means, the greatest difference between those who exit and those who do not are those who exit have lower education and worse health than those who do not exit, clear correlates with divorce and death (30% of exiting respondents have less than a high school degree and 49% report good health, compared to 18% and 59% of non-exiting respondents, respectively). Again, Table 8 shows the other statistically different characteristics of those who exit and those who do not, and the characteristics in addition to education and health are correlated with less education (race, blue-collar occupation, 401k options).

Entry into and exit from our sample is not random.[10] In our multivariate analysis, we control for the characteristics that vary across the two groups. We do not, however, remove those couples from our analytical sample, for two reasons. First, our analysis is attempting to be as broad as possible so that the pathway features and modes of retirement trajectories that we identify refer to what is observed across all groups and not just stable couples. Critically, every couple in our sample comprises dual-earners whom we observe retiring; our sample gets as close as possible to describing the complete universe of that group. Second, we introduce bias, and assumptions, by removing couples who have observed events. If two couples get married, for example, one the year before they start the HRS and one the year after, creating coherence in our sample by removing the second couple assumes those two couple are not comparable. In the paper, our assumption is that couples make joint retirement decisions, and we should control for

[10] Roughly 8% of the sample has a missing interim wave. Similar balancing tests show that this is only correlated with race.

marital length, rather than the alternative: couples make joint retirement decisions if they were married by a certain date, determined by the sampling window.

Similarly for exit, if we remove for coherence any couple that we observe getting divorced, we are implicitly assuming that the remaining couples will not divorce, or that because their divorce is not observed yet, they are still eligible for the sample, or their divorce affects the earlier retirement decision differently. Again, in the paper, we assume that couples who are married make joint retirement decisions, even if they later get divorced, and control for leisure complementarities, rather than assuming couples who divorce after retirement are fully identified by the survey and make different retirement decisions and should be removed. However, the entry and exit from the sample is a consideration in interpreting the results.

The second sample consideration, aside from entry and exit due to couples' behavior, is that of generational changes. The HRS, as noted, has cohorts of respondents that are added to the survey as they age to maintain a representative, over-50 sample. Not only do we observe certain couples for differing lengths, but the birth year of the couples increases over time as the sample is replenished with younger individuals. This poses the question of how relevant our findings will be over time as couples likely change based on their year of birth. A couple born in 1930 retiring in 1995 is likely different from a couple born in 1950 retiring in 2015.

We can speak to this directly by performing balancing tests, similar to those performed for entry and exit, where the right hand side variable is a dummy for which cohort the couple entered it, with variations in controls and sample size. Table 12 summarizes which covariates are statistically different across the successive cohorts.

Table 12: Covariates that statistically differ among successive cohorts

	Variable

Consistently failed balancing tests	Husband birth year Age difference (negative and positive) Husband/Wife having a 401k in current job
Balancing test failure varies across specifications of sample and birth year	Husband/Wife black (cohort 10 only) Husband/Wife Hispanic Wife in blue collar occupation Husband/Wife with less than a high school degree Husband's earnings Earnings difference (negative and positive) Marriage length Unmarried but partnered Husband/Wife college degree holding (cohorts 1 and 4 only)

In the first row are the covariates that consistently failed the balancing tests, regardless of sample inclusion or any controls. Aside from husband birth year, which by definition of the cohorts should vary, the clearest difference across cohorts is the age difference between husband and wife. In the first cohort, husbands are on average 4 years older than their wives, but by the fourth cohort, this drops to 1.3 years older. This drop is driven not only by smaller gaps between age of husbands and wives when husbands are older, but larger gaps between wives and husbands when wives are older. In addition, later cohorts have much broader prevalence of 401ks. In the second row are the covariates that were marginally different across cohorts, but sensitive to specification and sample. We describe these characteristics as those likely changing with cohort, but too small to be consistently detected, and not consistent enough to rule out random differences identified in the balancing tests.

8. Conclusion

In this paper, we examine joint partial retirement decisions, with a focus on whole retirement trajectories, not just retirement transitions. A key finding of this paper is that retirement trajectories vary dramatically. With just over 2,600 couple we observe over 1,400 unique retirement trajectories. Our results suggest that joint retirement may be less common

than found in previous research. This may occur for several reasons. First, because we focus on trajectories, we may observe some couple whose initial transition appears to be to joint retirement later increasing labor supply. Previous research that only examined initial transition might have been classified initial transitions as joint retirement, while looking at the trajectory would not consider them as joint retirement. Second, because we account for partial retirement, some retirements that previously were counted as joint retirement may actually involve part time work amongst one or both partners in the period before retirement.

A separate explanation is that the retirement behavior of couples is changing over time, reflecting changing gender norms, changing labor market prospects, life expectancy, retirement security, and preferences. Our data is more recent than much of the previous work, and is therefore capturing evolution in retirement behavior. A counter to this explanation is that with more detailed data on couples' retirement transition, the granularity reveals complexity previously not captured.

A related explanation to changes over time is that the share of couples included in dual earners is increasing as women's labor force participation increases over time. Dual earners retiring in 1980 likely have a different composition in terms of education, geography, and occupation than dual earners in 2010, and are also a smaller share of all couples in 1980 than they are in 2010. Further analysis could examine the composition of couples over time in more detail.

These explanations aside, the major contribution of our paper is to establish that the path to retirement is complex. It cannot be succinctly described by concordance, first-time leaders, initial status, or backtracking. Even with algorithmic iterations measuring similarity, the numerous trajectories suggest a typology comprising 13 pathways. Our work that presents these

pathways and the demographic and couple characteristics that are associated with each is primarily descriptive.

We were particularly interested in understanding the impacts of 3 plausibly exogenous characteristics of couples. Most couples in this sample have been married for many years, and were unlikely to have thought about the impact of age differences on their retirement decisions. In fact, we find that retirement patterns are significantly different for couples with larger age differences. They are less likely to have concordant paths, more likely to make use of partial retirement, and more likely to backtrack, particularly when the husband is older. We found fewer impacts of labor market characteristics (living in a rural area or working in a non-professional job) on trajectory patters, although both lead to less likelihood of partial concordance. Trajectories that involve part time work and thus achieve some level of partial concordance of leisure are more common among couples where one or both spouse has greater labor market opportunities, such as those with higher education, living in urban or suburban areas, or with non-blue collar occupations. Furthermore, joint leisure complementarities influence the joint trajectories of retirement. We find that concordant joint retirement is associated with couples who have greater financial resources, either in terms of the income or having pensions and 401(k)s. This suggests that other trajectories may be the only affordable options for some couples.

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