

Pricing the Biological Clock: The Marriage Market Costs of Aging to Women

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Women who make time-costly career investments may face a penalty on the marriage market due to lower fecundity. Using an innovative experiment where online daters are recruited to rate profiles with randomly assigned age, incentivized with customized advice based on their ratings, I find a causal negative impact of age on women’s marriage market value. For every year a woman ages, she must earn \$7,000 more annually to remain equally attractive to potential partners. This penalty is driven entirely by men who have no children and are aware of the age–fertility trade-off, demonstrating the connection to fecundity.

JEL Codes: J12, J13, J16, C78

1 Introduction

There is a growing body of evidence that women’s loss of fecundity with age affects them in multiple ways, including impacting marriage timing and human capital investments (Low, 2019; Gershoni and Low, 2021a; Buckles, 2007; Abramowitz, 2017; Gershoni and Low, 2021b).¹ However, it is not known to what extent these effects are driven by women’s own preferences to have children versus potential partners’ preferences for younger—and more fertile—spouses. If male partners value women’s

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¹Aging affects men’s and women’s ability to have children drastically differently. Whereas men experience a reproductive decline with age that is proportional to the decline in other bodily systems, women experience a separate process—menopause—where reproductive capacity declines nonlinearly to zero before age 50 (Frank, Bianchi and Campana, 1994)

fertility, the marriage market provides a setting to quantify the economic loss of aging to women.

This paper experimentally isolates and quantifies the causal negative impact of aging on women’s marriage market attractiveness. In observational data, it would be impossible to separate age from other factors, including women’s own preferences over partners, social norms, and meeting opportunities. Earlier literature has used data from either online dating sites or speed dating to improve on observational evidence from matches by measuring one-sided preferences (Fisman et al., 2006; Hitsch, Hortagsu and Ariely, 2010; Belot and Francesconi, 2013). However, by the nature of using preferences over real individuals, these studies cannot disentangle age from correlated traits, such as attractiveness. While men having tastes for women who *look* younger may nonetheless be rooted in an evolutionary-driven desire for fertility, it would have starkly different policy implications than a true preference for age.²

Thus, I design a novel incentive-compatible experiment in which age is randomly assigned to dating profiles, holding the picture and other traits constant. By holding the photo constant, and varying age, I isolate the conscious optimization over partner age, separate from information correlated with age communicated visually. Moreover, by also randomly assigning income to the profiles, I am able to use it as a numeraire to quantify the preference for age.

The experiment’s key innovation is in creating field-experiment-like conditions and incentives without relying on deception.³ To gather relevant subjects (since presumably the dating success of women in their 30s is not determined by undergraduate students), real daters are recruited using Google ads on online dating sites and dating-related keywords. Then, subjects are incentivized to provide honest ratings of the hypothetical profiles through the experiment’s compensation: for their participation, they receive advice from a dating coach, customized to attract the type of partners they are interested in, based on their ratings in the study. This compen-

²Attractiveness has been pointed to as the driver of men’s preference for younger women in sociology, by England and McClintock (2009) and Hakim (2010).

³This type of experiment, with subjects who are contextually relevant and real stakes, has been referred to in the literature as a “framed field experiment” (Harrison and List, 2004).

sation increases in value as ratings more closely reflect the rater’s true preferences, incentivizing honest and careful responses. This method of incentivizing responses to profiles with randomly assigned traits without deception has since been modified to provide an alternative to resume audit studies, in Kessler, Low and Sullivan (2019).

I find that men, but not women, have a substantial negative preference for age. This preference is robust to multiple adjustments in sample inclusion, checks for attention, and controls. Leveraging the random assignment of income to the profiles, I calculate the marginal rate of substitution between income and age in partner’s preferences. I find that for every year a woman ages, she must earn an additional \$7,000 to receive the same rating, providing a quantitative measure of the marriage market cost of aging to women.

I then replicate my experiment using a different and larger sample and show that results are not only externally valid, but also directly connected to fertility. Subjects for this second sample were recruited by Qualtrics research from their panel of survey takers. These subjects were similarly restricted to be single men and women in the relevant age category who were actively seeking to date. Although they were also compensated with customized dating advice for participating in the survey, they were not primarily recruited using advertisement of this benefit, and thus provide a good test of external validity. It is reassuring that the point estimates for age are nearly identical between the two samples.

This larger sample allows me to test for individual heterogeneity in the response to profile age, and thus show additional support that the driving mechanism is fertility. First, I rule out that preference for age similarity between a rater and potential partner is driving men’s negative preference for age. I do find, however, that women’s apparent positive preference for age is entirely explained by a preference for the “social norm” two-year difference between men and women.

Second, I demonstrate that multiple factors that should increase men’s preference for fertility, but not other youth-related traits, strengthen the negative preference for age. Men who are more interested in marriage, want kids, have no kids currently, and have accurate knowledge of the age-fertility tradeoff all have significantly stronger

negative tastes for older partners. This heterogeneity runs counter to what one would expect to find if, for example, the preference for age was driven by a preference for carefree youth, in which case we would expect a weaker preference among those seeking to marry. Most compellingly, men who already have children or who believe that the fertility decline does not start until after age 45 (the ages presented range from 30 to 40) have no negative preference for age. Finally, I show that non-linearity in the age preference aligns with a stronger negative preference closer to the fertility decline.

By separating age itself from physical attractiveness, my experiment adds to literature suggesting fertility is an important marriage market trait (Edlund, 2006; Edlund and Korn, 2002; Grossbard-Shechtman, 1986; Arunachalam and Naidu, 2006), something taken as a given in other disciplines such as evolutionary biology (Trivers, 1972) and anthropology (Bell and Song, 1994). Thus, the decline in fertility as one ages may affect women’s economic wellbeing via their marriage market prospects, something with broad-reaching policy implications.

2 Methodology

Running this experiment required overcoming the fact that personal characteristics are naturally correlated in real people. While speed dating experiments such as Fisman et al. (2006) offer the researchers more control, they still face this challenge in isolating correlated characteristics. To truly separate age from other factors, such as attractiveness, one wants the ability to randomly assign age. But, when age is randomly assigned, potential dating partners cannot be real, and so the incentives present in a speed-dating experiment would be absent. While one could in theory simply ask real daters to evaluate hypothetical profiles, and may get accurate results, it would not have the validity of an incentive-compatible experiment. And, if the profiles were instead presented as real, it would violate the norm in experimental economics against deceptive practices (see, e.g., Hertwig and Ortmann (2001)), introducing a host of issues related to subject pool contamination, rational expectations, and experimental ethics.

To solve this problem, I employ a unique hybrid of a field and lab experiment. Real online daters were recruited to rate profiles to which age was randomly assigned. Participants were informed that the profiles themselves were hypothetical, but that their ratings would be used to customize professional dating advice on how to attract partners that fit their preferences.

Because recruitment ads promoted this compensation, and participants spend their time on the study in expectation of receiving it, it can be assumed they place value on the dating advice and therefore want to increase its quality. The best way to do so is to respond accurately regarding their preferences over the hypothetical profiles. Thus, researcher and subject incentives are aligned. This type of non-monetary incentive structure for rating hypothetical objects has been expanded to study employer preferences in Kessler, Low and Sullivan (2019), where employers rated hypothetical resumes and then received recommendations of real candidates in return, in lieu of a deceptive audit study. The model of using advice to incentivize truthful survey answers could be used to provide incentives for experiments in many other settings, ranging from investment portfolio choice to real estate tastes to job seeker valuations of firm amenities.

For the initial sample, subjects were recruited using online ads, placed on dating sites such as Match.com or OKCupid, or linked to searches of dating-related keywords. A sample Google ad is shown below:

A Better Dating Profile
*Single & 30-40? Take this survey &
get expert dating profile advice!*
www.columbiadatingstudy.com

Following the implementation of this initial experiment, I conducted a second, experiment with a larger sample in order to test for heterogeneity in men's preferences for age. In order to recruit the larger sample and test the external validity of my results, I enlisted a survey firm, Qualtrics, to recruit respondents. This second population was also incentivized with the free dating advice, but may have valued it

less due to being offered other incentives Qualtrics typically gives to survey respondents on their panels (e.g., frequent flyer miles, gift certificates, raffles). As these respondents were not exclusively interested in receiving dating advice, they may be a more general population than the initial sample.

Subjects were recruited to be single, heterosexual, between the ages of 30 and 40, and white. Overall, in the initial recruitment, which I will call the “Web Ad sample,” 151 men and 168 women participated in rating profiles. However, I restrict my main analysis to those who completed all 40 ratings and reached the post-survey, as well as those meeting the race and age eligibility requirement, leaving 36 men (1440 observations) and 45 women (1800 observations), and show robustness to other sample decisions. The Qualtrics sample contains only completed responses, comprising 202 men (8080 observations) and 101 women (4040 observations).⁴

To generate the hypothetical dating profiles, I purchased stock photos that were similar in appearance to photos on dating websites, and of ambiguous age, meaning no balding or gray hair, no obvious facial wrinkles, and no overly youthful hairstyles or clothing. I then had 120 undergraduate students rate each photo’s physical attractiveness and guess the age of the individual in the photo.⁵ The final photos 40 photos of each gender were selected to balance attractiveness and apparent age between the male and female profiles, with photos with a visually perceived age outside 30-40 removed.

A random username, height, and three interests were then assigned to the photos to create 40 male and 40 female dating profiles. The usernames were assigned by using the top 40 names for men and women from the decade of birth for 30-40-year-olds, then assigning a random three-digit number. The heights were assigned randomly from

⁴In order to test for heterogeneity in men’s preferences, male respondents in the Qualtrics sample were enrolled at a 2:1 ratio to female respondents. The extra sample was drawn from the higher end of the income distribution, with the objective of better mirroring the general population (Qualtrics respondents, in absence of this sampling concentration, tended to be lower-income). Additionally, 1 man in the Web Ad sample, 5 men in the Qualtrics sample, and 3 women in the Qualtrics sample were dropped due to using a javascript blocker, which blocked the random assignment of age and income to the profiles.

⁵This guessed age is also used to construct the “*Visual age* – *age*” variable. Students were recruited from an introductory econometrics class and given course credit for their participation.

a normal distribution using the mean and standard deviation of heights for white men and women. Gender-neutral interests were assigned from a list of top hobbies, with more popular interests being assigned more frequently. All profiles listed the person as “looking for: serious relationship,” in order to signal that the rater should consider this person as a potential long-term partner. Each of these characteristics were assigned to the profile and remain fixed throughout the experiment.

Then, as each profile was shown, age and income were randomly assigned at the rater-profile level: age between 30 and 40 (inclusive), and an income range from roughly the 25th to 95th percentile for single individuals with at least an associate’s degree in the 2010 Census. Each respondent would see the same picture and other profile details, but paired with a different income and age. The random variation in age isolates it from other factors that may be correlated with it, such as physical attractiveness. Income also being randomly assigned provides a “numeraire” by which to quantify the preference for age.

The experiment proceeded as follows: After reviewing a consent form, respondents were shown a series of dating profiles, and asked for each one, “How interested would you be in dating this person, on a scale from 1 (not interested) to 10 (very interested)?” After 10 profiles, respondents were asked to rank the previous 10 profiles in terms of who they were most interested in, both to provide a break between rating sessions, and as an attention check. The correlation between the ratings and rankings is high, providing validation of the incentives for careful rating being operative. Moreover, as a robustness check, I exclude responses with a low correlation. Following rating all 40 profiles, respondents completed a brief post-survey including demographic information, dating preferences, and, finally, their knowledge of age-fertility limits for men and women. For additional details on the experimental methodology, as well as data summary statistics and histograms of ratings, see Appendix A.

I identify the effect of randomly assigned ages on ratings for men rating women and women rating men, using the specification:

$$Rating_{ij} = \beta_0 + \beta_1 age_{ij} + \beta_2 income_{ij} + \alpha_i + \theta_j + u_{ij},$$

where $Rating_{ij}$ is the rating on a 1-10 scale that individual i gives profile j . Age and income are assigned at the rater–profile level. Because each individual rates 40 profiles, and each profile is seen by multiple individuals, both rater, α_i , and profile, θ_j , fixed effects can be accounted for.⁶

3 Men’s Preferences Over Age

Figure 1 shows men’s preferences for age by first regressing ratings on rater and profile fixed effects, to remove noise, and then plotting the average rating residual versus each age shown. Ratings are on average about a half point lower for a profile with a listed age of 40 versus one with a listed age of 30. This preference is present—and nearly identical—in both the Web Ad sample and the Qualtrics sample. I first discuss results from the Web Ad sample in more detail.

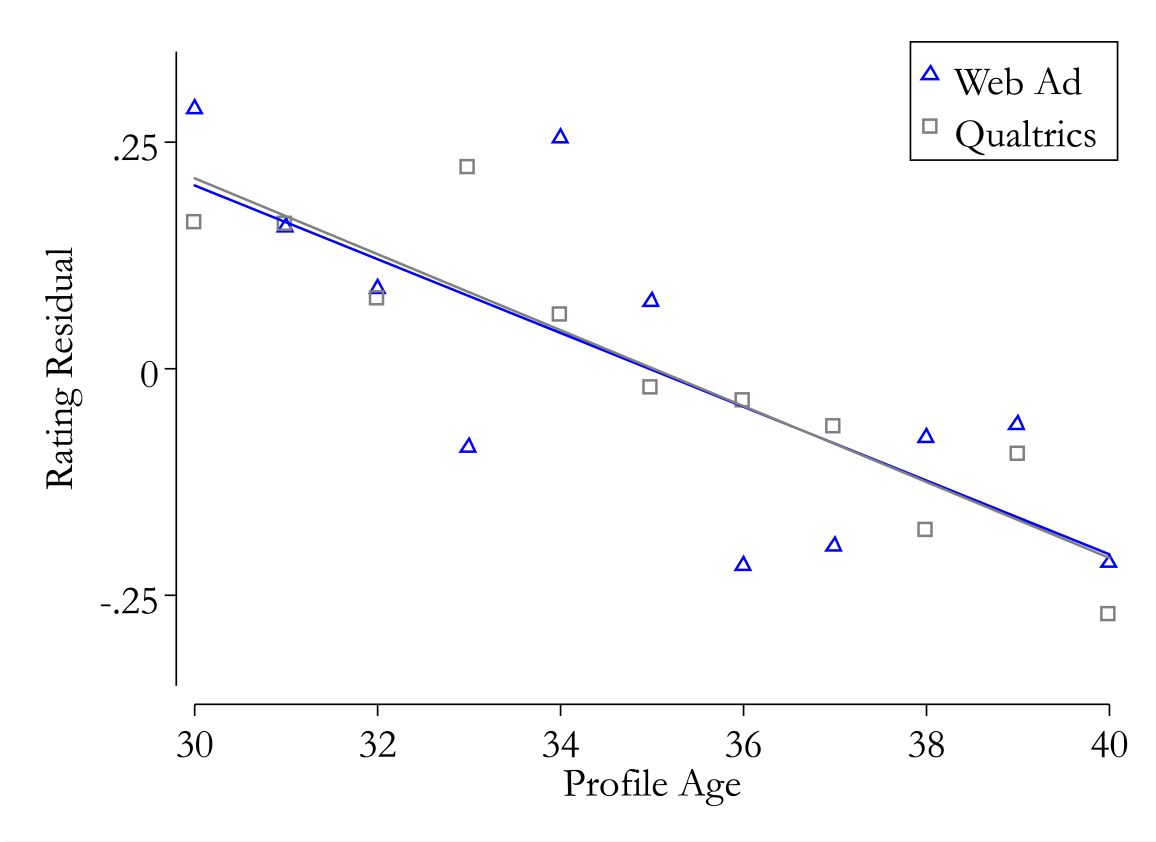
Table 1 shows a regression of ratings on randomly assigned profile age and income in the Web Ad sample. Column (1) shows that for male raters, each year of women’s age is associated with 0.044 decrease in rating, significant at the 1% level. Thus, if a woman is 10 years older, she will be rated almost a half point lower on average. A woman who is \$10,000 poorer is rated 0.06 points lower; thus to make up for each additional year of age, a woman must earn approximately \$7,000 more.

Column (2) show the sharp contrast between men’s and women’s preferences for age: while men rate women lower when the profile is presented with a higher age, women rate men more highly when a higher age is shown. The large effect size on women’s age preference may stem from their higher variance ratings. Whereas men display essentially a normal distribution in ratings with a mode of 6, women have a bi-modal distribution with peaks at 1 and 5, as shown in Appendix Figure A3.

The contrasting results for men versus women demonstrate that the negative relationship between a female profile’s listed age and the rating cannot only be a “lemons”

⁶Where no interactions are included between rater and profile characteristics, I present heteroskedasticity-robust standard errors, since “group status”—the rater—is not correlated with the x variable of interest, age, due to the random assignment. When examining heterogeneity among respondents, I present standard errors clustered at the respondent level. See: Angrist and Pischke (2008), page 311.

Figure 1: Men's Preferences for Women's Age



Notes: Web Ad data from 36 men (1440 observations) and Qualtrics data from 202 men (8080 observations). Ratings, on a 1-10 scale, are regressed on rater and profile fixed effects, with the residuals plotted against profile age.

effect, where older women still on the market are expected to be less appealing. If men's negative preference were explained by this channel, we would expect women rating men to show a similar aversion to age, although potentially less intense because men marry later.

Moreover, women's positive view of a male partner's age is consistent with a model where women know their own fertility time window is limited, and thus seek a partner who is equally ready to start a family as they are. If this is the case, we would see the preference be mostly driven by a preference for age homophily, or for a male partner who is a small amount older, consistent with the average marriage age gap, which I examine in Section 4.

Table 1: AGE-RATING RELATIONSHIP FOR MEN VS. WOMEN

Subjects:	Dependent variable: Profile rating					
	Men	Women	Men			
	(1)	(2)	(3)	(4)	(5)	(6)
Age	-0.044*** (0.015)	0.131*** (0.015)	-0.024** (0.010)	-0.049*** (0.016)	-0.048*** (0.016)	-0.087*** (0.023)
Income (\$0,000s)	0.061*** (0.016)	0.134*** (0.016)	0.023** (0.011)	0.069*** (0.018)	0.069*** (0.017)	0.061*** (0.016)
Visual age > age						-0.434*** (0.161)
Constant	6.252*** (0.662)	-0.160 (0.692)	5.811*** (0.467)	6.426*** (0.710)	6.337*** (0.711)	8.099*** (0.965)
Observations	1440	1800	3752	1280	1280	1440
R-Squared	0.471	0.394	0.487	0.460	0.446	0.474
Sample:	Eligible	Eligible	All	Opt in	High corr	Eligible

Notes: Regression of profile rating on randomly assigned age and income from Web Ad data. All columns contain rater and profile fixed effects. Columns (1) and (2) contain all respondents who rated 40 profiles, and are between 30 and 40 and white. Column (3) contains all male respondents who rated at least one profile. Column (4) restricts among the eligible sample from column (1) to those who did not opt out of having their email shared with the dating coach. Column (5) restricts among the eligible sample to those with a greater than 0.5 correlation between their ratings and rankings (this would not be expected to be perfect, since ratings can be repeated whereas rankings had to be 1-10). The sample for column (6) is the same for column (1), with “Visual age” rated by undergraduate students. Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Columns (3)-(6) display several robustness checks for the men’s results. First, I include all responses, including incomplete ones, and ones from men not meeting the age and race requirements. The coefficient on age remains negative and significant, although somewhat attenuated, possibly due to less interested or attentive responses from those who only partially completed the survey. Next, I restrict to only those who opted in to having their email address shared to receive the dating advice, at the end of the survey. This restricts to the group that is most motivated by the offered compensation. The coefficient on age is largely unaffected. Next, I use the correlation between the profile ratings and the “rankings” at the end of each section as an attention check, and restrict to only those with a correlation above 0.5. This again has little effect on the coefficient.

Finally, I check whether photographic appearance versus reported age may be influencing the results. Photos likely *look* a certain age, and so when these photos

are paired with higher ages, the person looks “good for their age,” whereas when paired with lower ages the person looks “bad for their age.” The appearance of the photograph itself is already controlled for through the profile fixed effect, but by adding a control for “Visual age > age,” I control for the interaction between the photo’s age and the reported age.⁷ Indeed, having an appearance older than reported age has a negative and significant effect, and controlling for this only strengthens the main age effect.

Table 2: AGE-RATING RELATIONSHIP FOR MEN VS. WOMEN

Subjects:	Dependent variable: Profile rating					
	Men	Women	Men			
	(1)	(2)	(3)	(4)	(5)	(6)
Age	-0.043*** (0.006)	0.028*** (0.010)	-0.062*** (0.009)	-0.046*** (0.010)	-0.053*** (0.008)	-0.047*** (0.009)
Income (\$0,000s)	0.032*** (0.007)	0.036*** (0.010)	0.007 (0.009)	0.025** (0.011)	0.035*** (0.009)	0.032*** (0.007)
Visual age > age						-0.044 (0.067)
Constant	6.250*** (0.435)	3.340*** (0.552)	7.475*** (0.426)	6.585*** (0.468)	9.999*** (0.356)	7.226*** (0.407)
Observations	8080	4040	4040	3160	4960	8080
R-Squared	0.490	0.463	0.479	0.489	0.476	0.490
Sample:	Eligible	Eligible	Natural	Opt in	High corr	Eligible

Notes: Regression of profile rating on randomly assigned age and income from Qualtrics data. All columns contain rater and profile fixed effects. Columns (1) and (2) contain all respondents who rated 40 profiles, and are between 30 and 40 and white. Column (3) restricts male respondents to those who were in the “natural” income distribution, excluding those over-sampled based on high income. Column (4) restricts among the eligible sample from column (1) to those who did not opt out of having their email shared with the dating coach. Column (5) restricts among the eligible sample to those with a greater than 0.5 correlation between their ratings and rankings (this would not be expected to be perfect, since ratings can be repeated whereas rankings had to be 1-10). The sample for column (6) is the same for column (1), with “Visual age” rated by undergraduate students. Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Next, I examine whether these same preferences hold in the second, larger sample gathered from Qualtrics, before using this larger sample to examine the drivers of men’s preferences.

Table 2 exhibits the same tradeoff between age and rating for male respondents, despite the different recruitment technique. In fact, the coefficient on age is remark-

⁷ “Visual age” was rated by undergraduate students.

ably similar between the two samples. The contrasting positive coefficient for women is also present in this sample.

Again, I conduct some robustness checks, first limiting the sample to the “natural” sample without oversampling high-income men in column (3), which slightly increases the size of the coefficient.⁸

Column (4) restricts to those who opted in to receiving the dating advice, which in the case of the Qualtrics sample drops a large number of respondents. The similarity between columns (1) and (4) confirm that even those who were not motivated by the dating advice appeared to rate profiles carefully, and share similar preferences. Dropping those with a low correlation between rating and ranking cuts the sample but does not alter the coefficient or its significance. And, controlling for “Visual age > age” does not change the significance of the main coefficient, although in this case it does not have a significant effect itself.

This robust negative preference for age by men on the marriage market shows that men also hear the ticking of women’s biological clock. As a result, aging carries not just a personal cost to women, but an economic one, impacting the quality of partner they can attract for the same level of other positive attributes, such as income. In the next section, I delve further into the drivers of men’s preferences.

4 Drivers of Preference

In this section, I rule out some potential alternative explanations for men’s negative preference for partner age, and provide additional evidence that this preference stems from fertility using the larger Qualtrics sample. To do this, I use rater characteristics to examine how different rater characteristics interact with or impact the preference for age.

I first examine how the interaction between rater age and profile age may impact

⁸Looking at this lower-income sample sheds some light on the one difference between the Qualtrics and Web Ad results: the Qualtrics sample places a lower value on income. When we restrict to the low-income portion of the Qualtrics sample, the coefficient on income reduces further, demonstrating that perhaps this lower valuation on income comes from the Qualtrics sample containing more very low-income men than the Web Ad sample (and preferences for income being of the super-modular form, where the valuation of partner income increases in own income).

preferences, and thus whether preference for age homophily or other social norms explain the apparent distaste for age for either men or women. We know that it is socially normal for husbands to be older than wives, and in fact for husbands to be approximately two years older than wives, both in observational data, and as estimated in preference decompositions (Hitsch, Hortaçsu and Ariely, 2010; Choo and Siow, 2006; Buss, Shackelford and LeBlanc, 2000). Table 3 first controls for the profile age being older than the rater’s age, for men (column 1), or younger than the rater’s age, for women (column 4). This coefficient is not significant in either case, although for women including it does halve the main effect of *Age*, demonstrating the importance of relative age in women’s preferences, and absolute age for men.

Table 3: RELATIVE AGE PREFERENCES: QUALTRICS SAMPLE

	Dependent variable: Profile rating					
	Men			Women		
	(1)	(2)	(3)	(4)	(5)	(6)
Age	-0.051*** (0.012)	-0.040*** (0.009)	-0.024** (0.010)	0.019 (0.016)	0.036** (0.015)	0.004 (0.012)
Income (\$0,000s)	0.032*** (0.009)	0.032*** (0.009)	0.032*** (0.009)	0.036** (0.014)	0.035** (0.014)	0.035** (0.014)
Age > rater age	0.084 (0.076)					
Age < rater age				-0.098 (0.134)		
(Age diff) ²		-0.004*** (0.001)			-0.008*** (0.002)	
(Age diff ± 2) ²			-0.004*** (0.001)			-0.008*** (0.002)
Observations	8080	8080	8080	4040	4040	4040
R-Squared	0.490	0.491	0.491	0.463	0.468	0.468

Notes: Regression of profile rating on randomly assigned age and income from Qualtrics data. All columns contain rater and profile fixed effects. Columns (1) and (4) controls for the random profile age being older, for men, or younger, for women, than the rater. Columns (2) and (5) control for profile age minus rater age, squared. Columns (3) and (6) control for profile age minus rater age plus two, for men, or minus two, for women, squared. Robust standard errors in parentheses, clustered at the rater level.

*** p<0.01, ** p<0.05, * p<0.1

Next, I examine whether the taste could, instead, be for similarly aged partners, rather than a secular negative preference for age. Column (2) controls for the age difference squared (i.e., a quadratic loss function in distance from equal ages), and

finds that indeed this is significantly negative for men, but controlling for it has no impact on the coefficient on age itself. The coefficient is also negative and significant for women (column 5), and twice the size.

I next perform a rescaling, where I instead control for the profile age minus the rater age plus (for men) or minus (for women) two, i.e., the distance from the “socially ideal age difference,” squared. Note that the coefficient on this variable will be identical to that measured in the previous exercise, but rescaling it in this way accounts for the impact on the main age coefficient, removing two years of age difference from the coefficient on age. Accounting for this reduces the coefficient for men, mechanically, but does not eliminate its significance. In other words, men may prefer a women two years younger than himself, but they prefer even younger women more.

In the case of women, we see that accounting for the “ideal” two-year age difference is enough to completely eliminate the apparent preference for older partners. Thus, this apparent preference for older men can be entirely accounted for by preferences over *relative*, rather than absolute, age. This preference could itself be driven by a personal awareness of time-limited fertility, and thus the need to seek a partner on a similar timeline for starting a family. Appendix Table A2 shows that a strong preference for age similarity by female raters also explains the apparent positive preference for age by women in the Web Ad sample.

Now that I have ruled out age homophily as the driver of men’s negative age preference, I establish evidence that tastes over fecundity are, in fact, the source of this preference. The first strategy I use to do this is to interact age with rater characteristics that may make men care more or less about fertility. The characteristics examined are wanting to get married, *Want marr*, wanting kids, *Want kids*, having no children, *No kids*, and having accurate knowledge of the age–fertility tradeoff, *Knowledge*. These variables create different cuts of the data, grouping men together who are dissimilar in other ways, but each with reason to care more about fertility in a potential partner. Each of these are interacted with the main explanatory variable, *Age*, while the main effect for each rater characteristic is absorbed by the rater fixed effects.

Table 4 demonstrates that when each of these characteristics is interacted with profile age, the interaction is negative and significant, while the main effect gets smaller. First, in column (1), we see that men who want to get married dislike age *more* than men who may be looking for more casual relationships. This provides some evidence of fertility as a driver, since if the preference was for the amenity value of younger women, we may expect men who do not want to get married to value it more. Similarly, in column (2), we see that men who want children soon also demonstrate a stronger preference for younger partners.

Table 4: FERTILITY MEDIATORS: QUALTRICS SAMPLE

	Dependent variable: Profile rating (Male subjects)					
	(1)	(2)	(3)	(4)	(5)	(6)
Age	-0.028** (0.011)	-0.033*** (0.009)	0.002 (0.019)	-0.007 (0.010)		
Income (\$0,000s)	0.032*** (0.009)	0.032*** (0.009)	0.032*** (0.009)	0.032*** (0.010)	0.033*** (0.010)	0.033*** (0.010)
Want marr \times age	-0.032* (0.019)					
Want kids \times age		-0.055* (0.032)				
No kids \times age			-0.055** (0.021)			
Knowledge \times age				-0.057*** (0.017)		
Age – cutoff					-0.043*** (0.010)	-0.013 (0.013)
Age – cutoff, –10 to 0						-0.054*** (0.020)
Observations	8080	8080	8080	7800	7600	7600
R-Squared	0.490	0.491	0.491	0.488	0.479	0.480

Notes: Regression of profile rating on randomly assigned age and income from Qualtrics data. All columns contain rater and profile fixed effects. Column (1) interacts profile age with whether the rater wants to get married. Column (2) interacts age with whether the rater wants kids. Column (3) interacts age with whether the rater currently has no children currently. Column (4) interacts age with whether the rater is aware that fertility declines for women before age 45. Column (5) uses as the independent variable profile age minus the rater’s estimated age at which fertility declines for women. Column (6) allows the impact of this variable to be differential between the time period of ten to zero years before the fertility decline. Robust standard errors in parentheses, clustered at the rater level.

*** p<0.01, ** p<0.05, * p<0.1

In column (3), I look at whether men already have children, as having no children currently may be a stronger indicator of seeking the option value to have kids than

stated preferences. As expected, men with no kids have a very strong preference for younger women. In fact, with this interaction term inserted, the main effect of age becomes zero, indicating that men who already have children have *no preference* over randomly assigned age. This provides strong evidence that the preference being identified is really a preference over fertility, as other possible factors would be unlikely to diverge so strongly between men who have children and those who do not.

Column (4) interacts age with knowledge about fertility. The variable “Knowledge” represents the rater being aware that women’s fertility begins to decline before age 45, from the question, “At what age does it become biologically difficult for a woman to conceive?” in the post-survey.⁹ For men who lack such knowledge, there is again *no preference* over age—the main effect is statistically zero—whereas for the knowledgeable men the negative perception of age is much stronger. Taken together, this table shows that the age preference found by this experiment is driven by men who have reason to care about fertility and have the knowledge to connect age to fertility.

Together, these results suggest that at least some of the observed preference for younger partners stems from preferences for fertility. If the negative coefficient on age instead captured a latent preference for attractiveness or other youthful qualities, whether or not the man wants to have children or knows about the age-fertility relationship should have no bearing on the strength of his preference. These findings are consistent with a model of agents rationally maximizing utility: those with stronger preferences for children and more knowledge to act on these preferences penalize older partners more.

Columns (5) and (6) take advantage of the heterogeneity in men’s stated beliefs as to when female fecundity begins to decline to create a metric of how many year’s “past infertile” the profile is in the rater’s mind. For example, if the profile’s age is 30 and the rater believes fertility declines at 50, the age minus the cutoff is -20 . This

⁹Although fertility declines earlier than 45, the idea is to separate those who hold beliefs who are close to accurate and for whom the age range 30-40 would be relevant in terms of fertility from those who believe age in that range would not yet impact fertility.

variable has a similar coefficient as that on age, shown in column (4).

The advantage of this variable is that it has a much larger range, as the 30-40 year age range of the profiles may not have been large enough to show any non-linearity that would be associated with the fertility decline. If fertility is driving the negative age preference, we would expect aging that takes place closer to the time when a woman may begin to have difficulty conceiving to be viewed more negatively than aging that is far before or far after this threshold. Column (5) shows exactly the expected non-linearity, by allowing *Age - Cutoff* to have a different slope when between the years -10 to 0, i.e., when approaching the fertility decline.¹⁰ This coefficient is negative and significant, and larger than the main age effect—when it is included, the effect of age outside this range remains negative, but becomes insignificant.

Appendix Figure A4 graphically shows the non-linearity in the relationship between ratings and years to the fertility cutoff, using a lowess function. Interestingly, when more than ten years from the fertility cutoff, the lowess is actually upward sloping, then steeply negative from -10 to zero, and finally it levels off past zero, with further increasing in ages not further decreasing ratings.

Together, this evidence paints a strong picture that fertility plays a large role in men’s negative preference for age in female partners.

5 Conclusion

From Hollywood films to online dating site data¹¹ it seems evident that men prefer younger women. And, given that having children may be one reason that people marry, it is natural to think that fecundity might affect women’s marriage market appeal. However, since individuals’ incomes, lifestyles, and appearances also change with age, it is difficult to separate fertility from other factors. Thus, I designed an experiment specifically to measure the causal impact of age on men’s marriage market preferences, separate from other factors that change with age in observational data.

¹⁰It should be noted that this analysis is only suggestive, as the extreme values of the *Age - Cutoff* variable are necessarily driven by those who have extreme answers to when they believe the fertility decline begins, either very high or very low.

¹¹OK Trends, “The Case for an Older Woman,” February 16th, 2010.

Through this experiment, I find that for every year a woman ages past 30, she must make an additional \$7,000 to receive equally high ratings from potential male partners. The experiment's unique design also controls for attractiveness, by randomly assigning age to dating profiles where the picture is held constant. Moreover, I show that this preference over age is only present for men who have no children of their own, and have accurate knowledge of the age-fertility tradeoff, further connecting it to fertility.

This finding indicates that the ticking of the biological clock is also relevant to men's decisions. Seeking to marry and have children, they naturally prefer more fertile partners. Women thus face a tradeoff: human capital investments increase earnings, but take up crucial time during the reproductive years, as it is difficult to co-process career investments and family formation.¹² This loss of reproductive capital may cost them real economic returns on the marriage market, despite human capital itself being a positive trait.

This suggests a tradeoff for women in pursuing time-consuming human capital investments, something that could be alleviated through policies focused on making it easier to co-process career investments and children or to make investments later in life.

¹²E.g., see Michael and Willis (1976); Goldin and Katz (2002); Bailey (2006); Bailey, Hershbein and Miller (2012); Adda, Dustmann and Stevens (2017); Kleven, Landais and Sogaard (2019).

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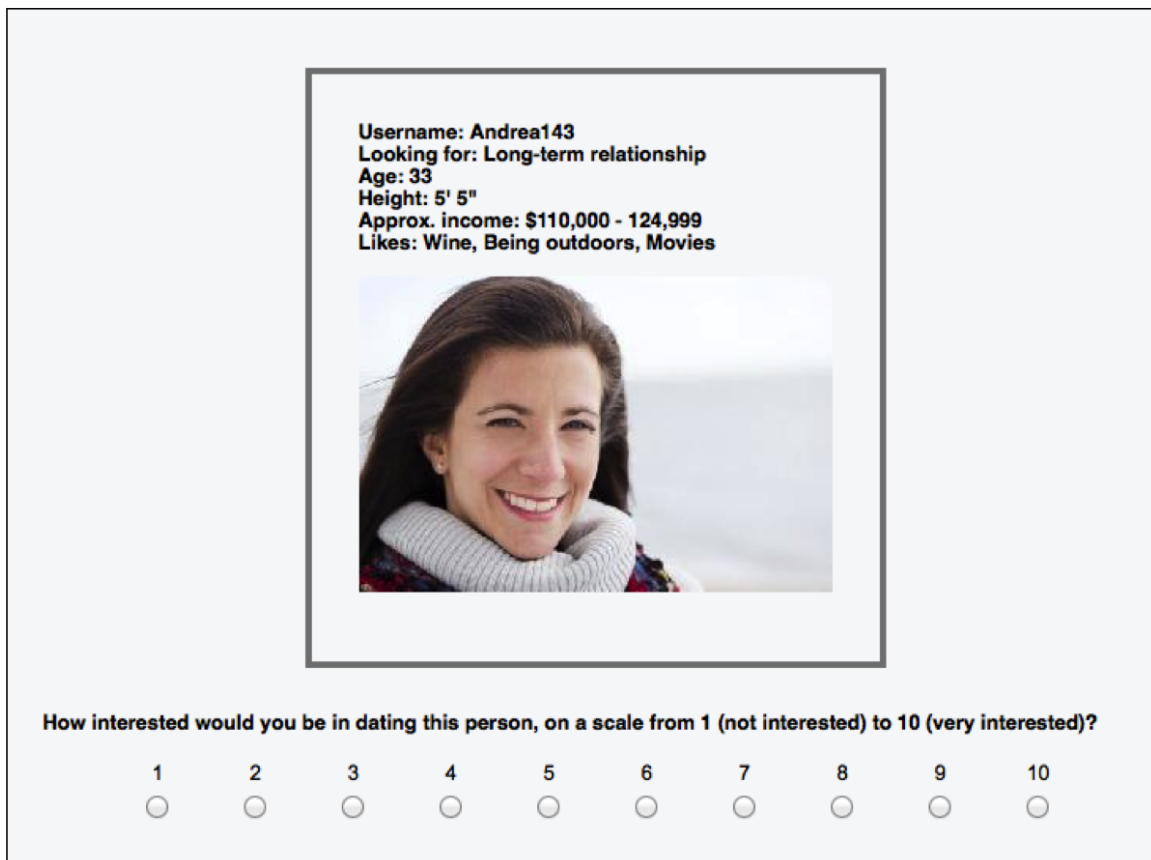
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Online Appendix

A Methodology

Figure A1 and Figure A2 shed more light on the experimental design by showing the profile and rating screen shown to participants, as well as a sample of the photos used to create the dating profiles. In addition to the rating screen, after rating 10 profiles, respondents were asked to rank them, as an attention check for their ratings. Finally, after completing rating 40 profiles, respondents were asked to complete a post-survey about their own characteristics as well as their age targets in a potential mate and expectations about fertility.

Figure A1: Sample Profile Image and Rating Screen



The image shows a sample profile and rating screen. At the top, the profile information is displayed: Username: Andrea143, Looking for: Long-term relationship, Age: 33, Height: 5' 5", Approx. income: \$110,000 - 124,999, and Likes: Wine, Being outdoors, Movies. Below this is a photo of a smiling woman with long brown hair wearing a white turtleneck. At the bottom, a rating scale is shown with the question: "How interested would you be in dating this person, on a scale from 1 (not interested) to 10 (very interested)?" The scale consists of 10 radio buttons labeled 1 through 10.

Username: Andrea143
Looking for: Long-term relationship
Age: 33
Height: 5' 5"
Approx. income: \$110,000 - 124,999
Likes: Wine, Being outdoors, Movies

How interested would you be in dating this person, on a scale from 1 (not interested) to 10 (very interested)?

1 2 3 4 5 6 7 8 9 10

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Image depicting profiles shown to study participants. Age and income are randomly assigned for each rater - profile pair, while other characteristics are initially randomly combined, and then fixed to a profile.

Table A1 presents summary statistics for all questions asked in the post-survey, for my target sample of white individuals between 30 and 40.¹³ Without these restrictions, in the initial sample 77% of male and 78% of female participants are white, and 74% fall within the targeted age range. In the Qualtrics sample all individuals are white and within the specified age range, due to pre-screening by Qualtrics.

Table A1: SUMMARY STATISTICS

Variable	Web Ad Sample				Qualtrics Sample			
	Men		Women		Men		Women	
	N=36		N=45		N=202		N=101	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Age	35.28	3.67	35.93	3.51	34.72	3.02	34.42	3.23
High Income	0.50	0.51	0.36	0.48	0.40	0.49	0.16	0.37
College Grad	0.67	0.48	0.69	0.47	0.49	0.50	0.47	0.50
Has kids	0.36	0.49	0.43	0.50	0.19	0.40	0.43	0.50
Wants (more) kids now	0.25	0.44	0.16	0.37	0.18	0.39	0.18	0.38
Wants marriage	0.47	0.51	0.43	0.50	0.47	0.50	0.44	0.50
Date lowest age	25.86	3.62	32.95	3.93	24.89	4.36	30.09	4.13
Date highest age	40.86	5.49	46.86	6.92	41.64	6.13	44.17	7.38
Preferred low	28.58	3.74	35.30	4.32	27.06	4.73	32.62	4.38
Preferred high	37.28	4.60	44.20	6.34	37.49	5.58	41.38	6.73
Fem Fert cutoff?	1.00	0.00	1.00	0.00	0.97	0.16	0.99	0.10
Fem cutoff age	41.36	6.37	39.67	4.72	43.13	7.18	41.13	6.31
Male fert cutoff?	0.89	0.32	0.77	0.43	0.83	0.38	0.80	0.40
Male cutoff age	54.09	8.70	55.45	8.46	51.99	9.02	56.88	8.87

Notes: Summary statistics for in-sample men and women from online dating experiment. High income is classified as earning over \$60,000 annually. The fertility variables ask if there is an age at which it becomes biologically difficult for women or men to conceive, and then what that age is.

Table A1 shows that men and women taking the survey display similar characteristics, although the men are more likely to be high-income, defined as income over \$65,000 per year, in the initial sample. Where men and women differ substantially is their stated preferences for the age of their partner. In the initial sample, men state on average that the youngest they would date is a 26-year-old and the oldest is

¹³The consent form required respondents to certify that “I am between 30 and 40 years old, currently single, and seeking a partner of the opposite gender.” However, in the post survey, some initial-sample respondents listed birth years outside the 30-40-year-old range. In my main specification, I exclude these responses. Also, although the profiles feature only white men and women, I did not restrict the race of respondents, so I also exclude non-white respondents during the analysis phase, since cross-racial rankings may be driven by different factors. For the Qualtrics sample, respondents were pre-screened based on race, relationship status, and age.

Figure A2: Example Profile Photos

(a) Women

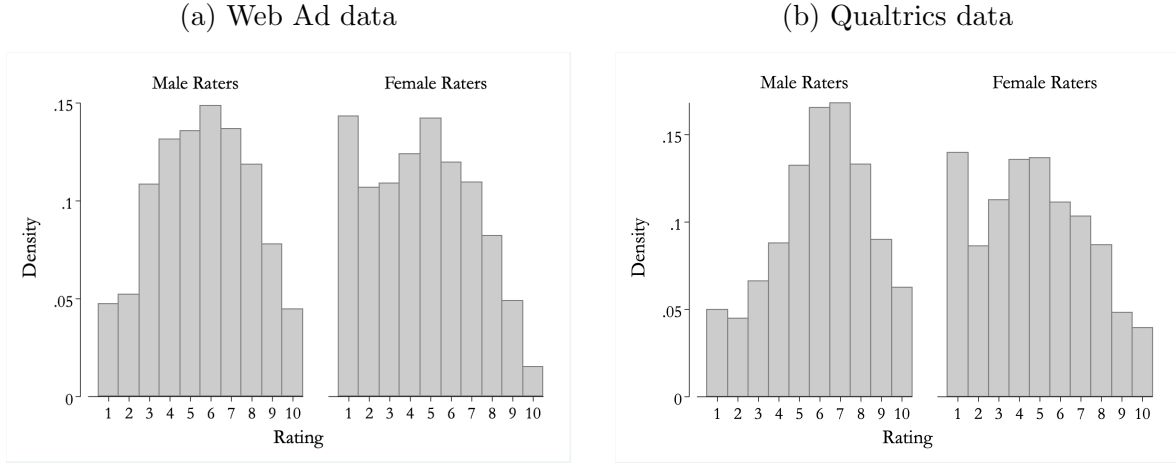


(b) Men



Notes: Samples of the stock images used to create dating profiles. Photos were chosen to be of ambiguous age in the 30-40 range, purchased from stock photo websites.

Figure A3: Rating histogram for male and female raters



Notes: Web Ad data from 36 men (1440 observations) and 45 women (1800 observations). Qualtrics data from 202 men (8080 observations) and 101 women (4040 observations).

a 41-year-old, whereas women state averages of 33 and 47. When it comes to their preferred dating range, men look for women aged 29 to 37, whereas women seek partners between the ages of 35 and 44. This pattern provides some preliminary evidence that men have differential preferences over their partner's age, compared to women.

The final questions on the survey ask men and women at what age they believe it becomes biologically difficult for members of each gender to conceive a child. 100% of initial-sample respondents believe there is a cutoff for women (97% of men and 99% of women in the Qualtrics sample), indicating that there is some knowledge of differential fertility decline, whereas 89.2% of men and 76.7% of women believe that such a cutoff exists for men. Female respondents put the start of the fertility decline for women somewhat earlier than male respondents, at 39.7 years, as compared to 41.2 for men. Both male and female respondents, conditional on thinking there *is* a cutoff, believe the cutoff to be higher for men.

Figure A3 shows histograms of men's and women's ratings in both samples. Men's ratings are roughly normally distributed while women's ratings contain some stacking at the lowest rating of "1."

B Additional Results

B.1 Drivers of preferences in the Web Ad sample

This section repeats the analysis from Section 4 with the Web Ad sample, showing consistent results. The smaller sample makes these results noisier than with the Qualtrics sample.

Table A2 shows that preference for age similarity does not explain the negative preference for age by male raters in the Web Ad sample. It does, however, explain the positive preference by female raters. Once the quadratic loss function for distance from the two-year “socially normal” age gap is accounted for, the female age preference is much smaller and no longer statistically significant. This preference would be consistent with women seeking partners similarly interested in starting a family as they are, aware of their own ticking biological clocks.

Table A2: RELATIVE AGE PREFERENCES: WEB AD SAMPLE

	Dependent variable: Profile rating					
	Men			Women		
	(1)	(2)	(3)	(4)	(5)	(6)
Age	-0.032*	-0.044**	-0.037**	0.117***	0.100***	0.033
	(0.018)	(0.018)	(0.018)	(0.040)	(0.024)	(0.026)
Income (\$0,000s)	0.060***	0.061***	0.061***	0.134***	0.136***	0.136***
	(0.021)	(0.022)	(0.022)	(0.023)	(0.023)	(0.023)
Age > rater age	-0.152					
	(0.172)					
Age < rater age				-0.169		
				(0.239)		
(Age diff) ²		-0.002			-0.017***	
		(0.002)			(0.003)	
(Age diff ± 2) ²			-0.002			-0.017***
			(0.002)			(0.003)
Observations	1440	1440	1440	1800	1800	1800
R-Squared	0.471	0.471	0.471	0.394	0.418	0.418

Notes: Regression of profile rating on randomly assigned age and income from Web Ad data. All columns contain rater and profile fixed effects. Columns (1) and (4) controls for the random profile age being older, for men, or younger, for women, than the rater. Columns (2) and (5) control for profile age minus rater age, squared. Columns (3) and (6) control for profile age minus rater age plus two, for men, or minus two, for women, squared. Robust standard errors in parentheses, clustered at the rater level.

*** p<0.01, ** p<0.05, * p<0.1

Table A3 shows that some of the fertility heterogeneity results also hold in the Web

Ad sample, although with the exception of knowledge over the fertility decline, the interactions are not significant (as might be expected when examining heterogeneity in a smaller sample). The interaction on “Want marr” is the wrong sign in this sample, but with a large standard error. We still see, however, that age is penalized significantly more within ten years of the rater’s subjective “cutoff age” when female fertility declines.

Table A3: FERTILITY MEDIATORS: WEB AD SAMPLE

	Dependent variable: Profile rating (Male subjects)					
	(1)	(2)	(3)	(4)	(5)	(6)
Age	-0.053*** (0.017)	-0.031 (0.021)	-0.029 (0.036)	0.015 (0.026)		
Income (\$0,000s)	0.061*** (0.021)	0.062*** (0.022)	0.062*** (0.021)	0.061*** (0.021)	0.061*** (0.022)	0.061*** (0.021)
Want marr \times age	0.019 (0.036)					
Want kids \times age		-0.048 (0.047)				
No kids \times age			-0.022 (0.041)			
Knowledge \times age				-0.079** (0.036)		
Age – cutoff					-0.044** (0.018)	0.030 (0.022)
Age – cutoff, -10 to 0						-0.108*** (0.038)
Observations	1440	1440	1440	1440	1440	1440
R-Squared	0.471	0.472	0.471	0.473	0.471	0.474

Notes: Regression of profile rating on randomly assigned age and income from Web Ad data. All columns contain rater and profile fixed effects. Column (1) interacts profile age with whether the rater wants to get married. Column (2) interacts age with whether the rater wants kids. Column (3) interacts age with whether the rater currently has no children currently. Column (4) interacts age with whether the rater is aware that fertility declines for women before age 45. Column (5) uses as the independent variable profile age minus the rater’s estimated age at which fertility declines for women. Column (6) allows the impact of this variable to be differential between the time period of ten to zero years before the fertility decline. Robust standard errors in parentheses, clustered at the rater level.

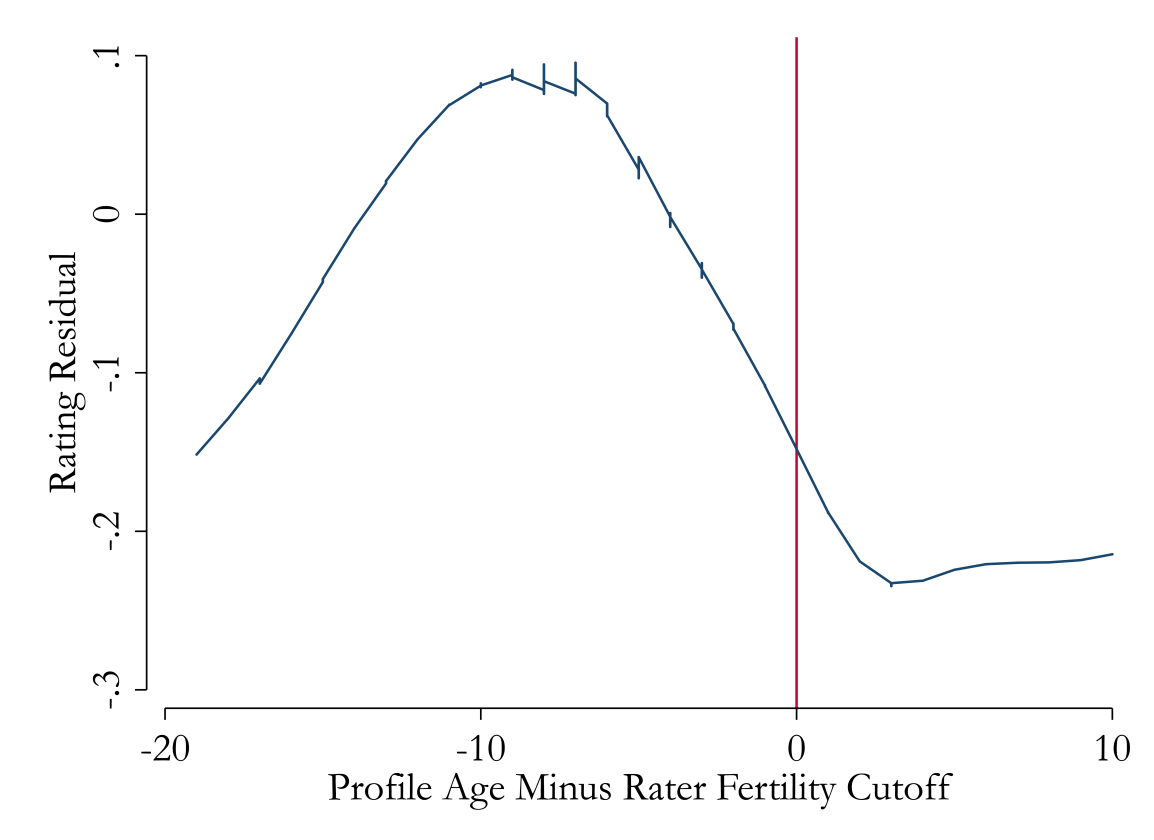
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

B.2 Non-linearity in preferences over age

Figure A4 examines non-linearity in men’s preferences over their partners’ ages, using the heterogeneity in men’s responses to the question “at what age do you think it becomes biologically difficult for a woman to conceive?” in the Qualtrics sample.

First, ratings are regressed on profile and rater fixed effects, and residuals are captured. I then lowess-smooth the plot of residuals against profile age minus the rater's expected fertility cutoff. The graph reveals that years at least ten years before the fertility cutoff have a positive relationship with ratings. There is then a steeply negative relationship from ten years before up to the fertility cutoff. A few years after the fertility cutoff, the relationship becomes flat, with additional years no longer decreasing ratings. Note, these results should be taken as suggestive only, given that very high and very low values on the x-axis can only occur when individuals have outlier views of the age of fertility decline.

Figure A4: Nonlinearity in Ratings over Time to Infertility



Notes: Qualtrics data from 202 men (8080 observations). Lowess estimation of residuals from ratings regressed on profile and rater fixed effects, over time to rater-specific infertility cutoff.