The Gender Gap Reversal in Educational Attainment and Age Differences in Marital and Non-Marital Unions Across Europe

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Background and Goals

Women's educational attainment was lower than men's for the largest part of the 20th century. This gap started to narrow in the 1970s, and today women outperform men in terms of enrollment and success in higher education (Schofer and Meyer 2005). This reversal had important consequences for family life. In the past, husbands were often more educated than their wives, but today it is women who are often more educated than their partners (De Hauw et al. 2017; Esteve et al. 2012; Grow and Van Bavel 2015; Van Bavel et al. 2018). Traditional divorce patterns have also changed. In the past, marriages in which the wife was more educated than her partner had a higher divorce risk than marriages in which she was similar or less educated. Today, at least in the USA, this difference does not exist anymore (Grow et al. 2017; Schwartz and Han 2014). In this paper, we contribute to research on the consequences of the gender gap reversal in educational attainment. We explore how the reversal has affected age differences in marital and non-marital unions.

The age of prospective spouses is a major factor in people's partnering decisions (Glick and Landau 1950). Across the developed world, spouses tend to be of similar age, with husbands being on average 2–3 years older than their wives. This pattern is so universal that it is often taken for granted (Esteve et al. 2009), but this view neglects that major changes in age homogamy that have taken place over the course of the 19th and 20th century (cf. Van de Putte et al. 2009). Homogamy has increased over time, whereas this trend has become more mixed in recent years (Kolk 2015). Age differentials within unions are a source of inequality between men and women (Van de Putte et al. 2009). Understanding the factors that determine age differences within unions, and changes therein over time, therefore is an important step towards a better understanding of gender inequality.

Van Bavel (2012) argued that changes in the relative educational attainment of men and women may be one factor that systematically affects patterns of age homogamy. The reason is that educational attainment is – next to age – an important factor in people's partnering decisions. All else equal, both men and women tend to prefer partners who are similar to them in educational attainment over partners with lower or higher educational attainment (Kalmijn 1998). Because of the gender gap reversal in education, highly educated women in recent cohorts are experiencing a shortage of similar educated men within their own age group. Thus, to the extent that they are unwilling to partner with somebody who is lower educated or to remain single, they might be inclined to look for alternatives among members of older birth cohorts, in which highly educated men are relatively abundant. This, in turn, may lead to a decrease in age homogamy and larger age differences to the disadvantage of women.

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We study the association between the gender gap reversal and age differences in two steps. In a first step, we use agent-based computational (ABC) modelling to develop hypotheses about the relation between the gender gap reversal and age differences. In a second step, we test these hypotheses empirically with data from the European Social Survey (ESS).

Our use of ABC modelling for developing hypotheses is motivated by the fact that marriage markets are complex social systems, in which the matching opportunities and preferences of men and women, as well as the resulting two-sided partnering decisions, need to be considered. Developing hypotheses about the dynamics that such systems generate based on mere verbal reasoning alone is difficult, and may lead to a situation in which non-intuitive outcomes are overlooked (Grow and Van Bavel 2018; Smaldino and Schank 2011). ABC modelling makes it possible to study complex social systems with analytical rigor, and therefore is a valuable tool for theory development in marriage market research.

Our use of the ESS for testing our hypotheses is motivated by the fact that Europe has shown considerable variation in the onset and extent of the gender gap reversal (cf. De Hauw et al. 2017). This variation provides statistical leverage for studying the association between men's and women's relative educational attainment and the level of age homogamy across countries. One complication in this context is that non-marital cohabitation is on the rise in Europe and in some countries increasingly replaces marriage (Hiekel et al. 2014). We expect that the processes that we explore apply to all committed heterosexual relationships, but we distinguish between marriage and unmarried cohabitation in our analysis.

Analytical Approach

To develop our hypotheses, we build on an existing ABC model that has been developed to study the link between the gender gap reversal and changes in marriage and divorce patterns (Grow et al. 2017; Grow and Van Bavel 2015).

The model is a two-sex model that simulates partner search over the life courses of several cohorts of people (agents). Agents are born, grow older, enter school, leave education, enter the marriage market, marry, possibly divorce, reproduce, and die at some point (not necessarily in this order). The main characteristics that agents care about in their partners are their age and social status. Based on empirical research, the model assumes that women tend to prefer partners who are 2–3 years older than they are, whereas men prefer women who are in their mid-20s regardless of their own age, all else being the same (England and McClintock 2009; Skopek et al. 2011). Furthermore, the model breaks social status down into a cultural and an economic component; it assumes that men and women desire partners who possess similar cultural resources, but also prefer partners who possess high economic resources. In line with earlier sociological research (Kalmijn 1998), these resources are represented by agents' educational attainment (representing cultural resources) and earnings prospects (representing economic resources). To plausibly simulate population change over time, and in particular the reversal of the gender gap in educational attainment, the model relies on empirical input data from various sources, that are available for 12 European countries.[1]

Most importantly, the model makes assumptions about people's partner search behavior

[1] Belgium, Germany, Denmark, Spain, Finland, France, Greece, Ireland, the Netherlands, Portugal, Sweden, and the United Kingdom.

that are congruent with Van Bavel's (2012) assumptions about how men and women might react to a shortage of potential partners within the desired age range. The model assumes that individuals may lower their aspirations for the characteristics they expect in a partner, if they fail to find somebody who meets their ideals. This means that when agents fail to find a partner with similar educational attainment and high earnings prospects in the desired age range, they become increasingly willing to accept partners who are younger/older than what they desire. This aspect of the model makes it suitable for studying the link between changes in men's and women's relative educational attainment and changes in age homogamy.

As indicated above, we will test the hypotheses that our ABC model generates with data from the ESS. The ESS is a cross-national, individual-level survey that is conducted every two years and is currently available for the period 2002–2016 in a large number of countries. The simulation model described above has been calibrated to match marriages in terms of their educational characteristics, as observed in the birth cohorts (1940–1950], (1950–1960], (1960–1970], and (1970–1980] in the 2010 and 2012 rounds of the ESS in 12 countries. For the preliminary empirical analysis that we report here, we pooled data from all 28 European countries[2] and all 8 rounds of the ESS; given the longer time frame that his data covers than the data used the original model calibration, we included the additional cohort (1980–1990]. In a first explorative analysis, we compared the predictions of the simulation model with the empirical data in the following way.

In the first step, we focused on the outcomes of our simulation model, based on simulation runs that covered the period 1921–2012 in the 12 European countries for which input data was available (similar to Grow and Van Bavel 2015 and Grow, Schnor, and Van Bavel 2017). For these simulation runs, we calculated for each union that was formed the age difference between the male and the female agent (age male – age female), so that positive values indicate that the man is older than the woman, and negative values indicate that he is younger. If the value is 0, the two agents are of the same age. We refer to this variable from here on as *age disadvantage woman*. After calculating this variable, we predicted its value by means of a linear regression model, separately for male and female agents. In this analysis, we controlled for agent's *educational attainment* (low, medium, or high), whether they were in a *educationally homogamous* union (1 = yes, 0 = no), their *birth cohort* ((1940–1950], ((1950–1960], (1960–1970], (1970–1980], or (1980–1990]), whether they were *married*[3] (1 = yes, 0 = no), and whether they were *married before* (1 = yes, 2 = no) their current union. Additionally, we calculated the *f-index*, which is a standard measure of women's educational advantage in society (Esteve et al. 2012). This measure ranges from -1 to 1. A value close to 1 means that in a given population, any randomly selected woman is likely to be more educated than any randomly selected man, whereas a value close to -1 has the exact opposite meaning. A value of 0 means that men and women are on average similarly educated. We calculated this measure separately for each agent cohort, to be able to assess educational imbalances that men and women might experience among the members of their own cohort. In our analyses, we also interacted this measure with the variable *married before*, to assess whether the gender

[2] Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Slovakia, Spain, Sweden, Switzerland, and United Kingdom.

[3] As opposed to living in unmarried cohabitation.

Table 1 Results of linear regression predicting *age disadvantage woman*, separately for male and female agents, based on the simulation data

Variables	Male agents						Female agents					
	M1			M2			M3			M4		
	beta	s.e.	p	beta	s.e.	p	beta	s.e.	p	beta	s.e.	p
Constant	7.61	0.93	*	7.35	0.92	*	2.97	0.60	*	2.95	0.62	*
Educational attainment (ref.: Low)												
Medium	-0.25	0.05	*	-0.26	0.05	*	-1.20	0.08	*	-1.20	0.08	*
High	-0.52	0.09	*	-0.52	0.09	*	-2.16	0.11	*	-2.16	0.11	*
Educationally homogamous	-0.29	0.05	*	-0.29	0.05	*	-0.80	0.07	*	-0.80	0.07	*
Birth cohort (ref.: (1940,1950])												
(1950,1960])	-0.15	0.08		-0.15	0.08		0.20	0.04	*	0.20	0.04	*
(1960,1970]	-0.53	0.11	*	-0.53	0.11	*	0.33	0.07	*	0.33	0.07	*
(1970,1980]	-0.94	0.15	*	-0.94	0.15	*	0.57	0.10	*	0.57	0.10	*
(1980,1990]	-1.19	0.21	*	-1.19	0.21	*	0.61	0.13	*	0.61	0.13	*
Married	-2.35	0.06	*	-2.35	0.06	*	-0.38	0.20		-0.38	0.20	
Married before	2.10	0.08	*	4.68	0.92	*	0.13	0.08		0.31	0.31	
F-index	-6.14	1.83	*	-5.66	1.81	*	2.40	1.16		2.43	1.19	
Married before × f-index	–	–		-4.68	1.65	*	–	–		-0.33	0.59	

Note: Country-level cluster-robust standard errors; country-fixed effects have been excluded for readability; N = 3,362,477 male agents and 3,468,340 female agents

* $p < .05$, two-tailed

gap reversal might affect age differences in higher-order unions differently than in first unions.

In the second step, we prepared the ESS analogously to the simulation data and estimated the same linear regression model for all 28 countries.

First Results

Tables 1 and 2 report the results of our preliminary analysis, with Table 1 presenting our results based on the simulation data and Table 2 presenting our results based on the ESS. Focusing first on the simulation data, our results suggest that among male agents, an increase in women's relative educational attainment was associated with a decrease in the age advantage that they had over their female partners (i.e., the value of the dependent variable *age disadvantage woman* became smaller). In Table 1, this is evidenced by the negative coefficient associated with the variable *f-index* in model M1. This negative effect was even stronger among men in higher order unions, as evidenced by the negative coefficient associated with the interaction between the variables *f-index* and *married before* in model M2. For female agents, our results were in the exact opposite direction, albeit the corresponding effect estimates failed to reach statistical significance. That is, as women's relative educational attainment increased, women's age disadvantage in the unions that they formed increased (model M3), and this effect was stronger in higher order unions (model M4).

Focusing next on the empirical data presented in Table 2, our results show a striking similarity with our simulation results. In more detail, in the unions that men formed, the age

Table 2 Results of linear regression predicting *age disadvantage woman*, separately for men and women, based on the ESS data

Variables	Men						Women					
	M5			M6			M7			M8		
	beta	s.e.	p	beta	s.e.	p	beta	s.e.	p	beta	s.e.	p
Constant	4.95	0.59	*	4.84	0.59	*	2.23	0.65	*	2.34	0.65	*
Educational attainment (ref.: Low)												
Medium	-0.19	0.05	*	-0.19	0.05	*	-0.34	0.12	*	-0.34	0.12	*
High	-0.33	0.06	*	-0.33	0.06	*	-0.78	0.14	*	-0.78	0.14	*
Educational homogamy	-0.06	0.03		-0.06	0.03		-0.12	0.05	*	-0.12	0.05	*
Birth cohort (ref.: (1940,1950])												
(1950,1960]	-0.15	0.09		-0.15	0.09		0.21	0.08	*	0.21	0.08	*
(1960,1970]	-0.54	0.14	*	-0.54	0.14	*	0.28	0.12	*	0.28	0.12	*
(1970,1980]	-0.85	0.20	*	-0.85	0.20	*	0.54	0.15	*	0.54	0.15	*
(1980,1990]	-1.26	0.23	*	-1.27	0.23	*	0.72	0.23	*	0.72	0.23	*
Married	-0.28	0.06	*	-0.28	0.06	*	0.10	0.06		0.11	0.06	
Married before	1.97	0.14	*	3.33	0.60	*	-0.57	0.08	*	-1.75	0.49	*
F-index	-3.18	1.63		-2.97	1.63		1.83	1.52		1.63	1.52	
Married before × f-index	_	_		-2.71	1.13	*	_	_		2.30	0.93	*

Note: Country-level cluster-robust standard errors; design weights have been applied; country-fixed effects have been excluded for readability; N = 49,116 men and 55,768 women
* p < .05, two-tailed

disadvantage of women increased with an increase in women's relative educational attainment at the population level (model M5), whereas in the unions that women formed, their age disadvantage increased (model M7). These effects were both more pronounced (and statistically significant) in higher order unions (models M6 and M8).

Preliminary conclusion

Our preliminary analyses suggest that the reversal of the gender gap in educational attainment was associated with changes in age differentials in heterosexual unions across Europe. More specifically, our simulation results suggest that the reversal of the gender gap in educational attainment might have led to a decrease the age advantage that men have in the unions that they form, but an increase in the age disadvantage that women typically experience in their unions. This pattern is also evident in our empirical analysis based on data from the European Social Survey, especially in higher-order unions. In the next step, we will refine our analyses and more closely explore the exact age differences that emerge.

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References

De Hauw, Y., Grow, A., & Van Bavel, J. (2017). The reversed gender gap in education and assortative mating in Europe. European Journal of Population, 33(4), 445–474.

England, P., & McClintock, E. A. (2009). The gendered double standard of aging in US marriage markets. Population and Development Review, 35(4), 797–816.

Esteve, A., Cortina, C., & Cabré, A. (2009). Long term trends in marital age homogamy patterns: Spain, 1922-2006. Population, 64(1), 173–202.

Esteve, A., García-Román, J., & Permanyer, I. (2012). The gender-gap reversal in education and its effect on union formation: The end of hypergamy? Population and Development Review, 38(3), 535–546.

Glick, P. C., & Landau, E. (1950). Age as a factor in marriage. American Sociological Review, 15(4), 517–529.

Grow, A., Schnor, C., & Van Bavel, J. (2017). The reversal of the gender gap in education and relative divorce risks: A matter of alternatives in partner choice? Population Studies, 71(S1), S15–S34.

Grow, A., & Van Bavel, J. (2015). Assortative mating and the reversal of gender inequality in education in Europe: An agent-based model. PLoS ONE, 10(6), e0127806.

Grow, A., & Van Bavel, J. (2018). Agent-based modeling of family formation and dissolution. In R. Schoen (Ed.), Analytical family demography (pp. 125–156). Cham: Springer.

Hiekel, N., Liefbroer, A. C., & Poortman, A.-R. (2014). Understanding diversity in the meaning of cohabitation across Europe. European Journal of Population, 30(4), 391–410.

Kalmijn, M. (1998). Intermarriage and homogamy: Causes, patterns, trends. Annual Review of Sociology, 24, 395–421.

Kolk, M. (2015). Age differences in unions: Continuity and divergence among couples between 1932 and 2007. European Journal of Population, 31(4), 365–382.

Schofer, E., & Meyer, J. W. (2005). The worldwide expansion of higher education in the twentieth century. American Sociological Review, 70(6), 898–920.

Schwartz, C. R., & Han, H. (2014). The reversal of the gender gap in education and trends in marital dissolution. American Sociological Review, 79(4), 605–629.

Skopek, J., Schmitz, A., & Blossfeld, H.-P. (2011). The gendered dynamics of age preferences – Empirical evidence from online dating. Journal of Family Research, 23(3), 267–290.

Smaldino, P. E., & Schank, J. C. (2011). Human mate choice is a complex system. Complexity, 17(5), 11–22.

Van Bavel, J. (2012). The reversal of gender inequality in education, union formation and fertility in Europe. Vienna Yearbook of Population Research, 10, 127–154.

Van Bavel, J., Schwartz, C., & Esteve, A. (2018). The reversal of the gender gap in education and its consequences for family life. Annual Review of Sociology, 44, 341–360.

Van de Putte, B., Van Poppel, F., Vanassche, S., Sanchez, M., Jidkova, S., Eeckhaut, M., et al. (2009). The rise of age homogamy in 19th century Western Europe. Journal of Marriage and Family, 71(5), 1234–1253.