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Matching models with and without frictions: Applications to the economics of the family

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Introduction

Economists think of families as "complex decision units in which partners with potentially different objectives make consumption, work, and fertility decisions" (Browning, Chiappori, and Weiss, 2014). In many cultures, the institutions of marriage and divorce are the two most important means of acknowledging the formation and dissolution of the interpersonal ties that bind partners together. While the rights and obligations they establish change over time and space, marriage and divorce are both among the most defining events in one's life and among the most complex economic decisions, with far-reaching implications for one's working career, health and happiness.

Whether an individual is married, divorced, cohabiting or single matters for many choices and outcomes at the microeconomic level. The economic analysis of both labor supply and demand for consumption and investment goods requires a good understanding of how families work. On top of noneconomic benefits associated with companionship and intimacy, marriage and cohabitation are associated with the sharing of public goods, such as childcare, housing, related expenses and other durables. Partners can share risk by diversifying income sources, making joint saving decisions and adjusting labor supply (Blundell, Pistaferri, and Saporta-Eksten, 2016); they can also coordinate time schedules to share the burden of time-intensive tasks (e.g., chores) or, conversely, specializing in specific tasks (e.g., one spouse works full time while the other takes care of the children). Importantly, the household decision process affects the allocation of resources across family members: in some countries, consumption inequality within the family has decreased over time; in others, householders are still able to divert most resources to meet their personal benefits.[1] In addition, when it comes to decisions that have implications for the future - such as investment in human capital and fertility - individuals are influenced not only by their current marital status but also by their expectations about their future marriage prospects Chiappori, Salanié, and Weiss (2017). Gender asymmetries in roles within marriage can be held responsible for a non-negligible share of the gender wage gap (Blundell, Costa Dias, Meghir, and Shaw, 2016).

[1] Lise and Seitz (2011) show that, in the U.K., consumption inequality between spouses has decreased in the period from 1968 to 2001, partly offsetting the rise in consumption inequality across households. Dunbar, Lewbel, and Pendakur (2013) show that, in Malawi, husbands still appropriate a large share of household resources, while many wives and children are likely to live below the poverty threshold.

At the aggregate level, systematic differences in marriage and divorce rates across population groups are an important factor of inequality between households (Greenwood, Guner, Kocharkov, and Santos, 2016). The United States are the leading example of this emerging divide across education and income strata: individuals at the bottom of the distribution are not only less likely to get married, but also more exposed to the risk of divorce and more likely to give birth out of wedlock (Carbone and Cahn, 2014); cohabitation is increasingly more common among people with low income and is associated with lower commitment with respect to legal marriage (Lundberg and Pollak, 2014). In addition, people exhibit a strong tendency to marry their likes: this typically results in the wealthy marrying the wealthy and the poor marrying the poor, with important implications for inequality between households (Fernández and Rogerson, 2001; Fernandez, Guner, and Knowles, 2005).

Ultimately, one of the main reasons why economists and policymakers are interested in marriage is that the family is the place where parents raise and invest in children. The characteristics and actions of parents have a tremendous impact on child development. We have learned that higher parental income is associated with lower borrowing constraints, better schools and a safer environment where to grow up (Acemoglu and Pischke, 2001); but parenting also has a direct influence on children's human capital endowment and helps shape cognitive and non-cognitive skills during childhood (Cunha, Heckman, and Schennach, 2010). Much of the variability in individuals' outcome, particularly lifetime earnings, is due to attributes that are determined during childhood (Heckman and Mosso, 2014). Differences in family background result in inequality of opportunities among children within the same cohort and are key determinants of intergenerational mobility (Becker and Tomes, 1979). Importantly, children raised by single parents are likely to lag behind their peers (McLanahan, 2004). Finally, the socioeconomic environment can, in its turn, influence the choice of parenting style, as in societies characterized by a higher degree of inequality parents have a stronger incentive to heavily invest in children in order to increase their odds of being successful (Doepke and Zilibotti, 2017).

The 1992 Nobel prize Gary Becker provides us with powerful analytical tools based on rational choice theory to study these issues and address the following fundamental questions (Becker, 1973, 1974, 1981): why do people get married, how do they choose their partner, and why do sometimes marriages end in divorce? A first key insight of Becker's approach is that, at least in many modern economies, marriage is a matching game: people are free to choose if and whom to marry, but only to the extent that they can successfully court and propose to the partner they desire. The nature of the gains from marriage can thus rationalize the aggregate marriage patterns that we observe in the data. For instance, when human capital is a valuable input for raising children, individuals compete for partners with a high level of schooling: as a result of this competition, the high educated get married with their likes, and so do the low educated. In reality, when

seeking a partner, individuals face obstacles of several kind, as search takes time and effort, while one's network of acquaintances is typically limited. However, in spite of these "frictions", Becker's key insight can be extended as long as individuals are left with some freedom to choose (Shimer and Smith, 2000).

A second key implication of Becker's theory is that one's bargaining power within the couple is proportional to how attractive she is on the marriage market: if an individual has many prospective spouses, she can afford being more demanding once engaged. Finally, Becker observes that divorce occurs when the gains from marriage fade: spouses might go through ups and downs and eventually realize that they are better off alone or with someone else (Becker, Landes, and Michael, 1977). However, unemployment and income shocks can also severely threaten the stability of the couple (Weiss and Willis, 1997): this is a major area of intervention for policymakers.

In this dissertation, I combine these key insights from Becker's theory with recent advances in the econometrics of matching models to address some of the new challenges that the economics of the family needs to face in the 21st century. The three essays aim to shed light on some key evolutions that the institution of marriage has experienced in the United States over the last 60 years. Same-sex unions have only been recently legalized in the United States and in several other Western countries, but still face important biological and legal constraints in childbearing: how do gains from marriage for same-sex couples differ with respect to different-sex couples? The American population is nowadays older, more educated and ethnically mixed than it used to be: are people also more open to the possibility of marrying someone who does not share the same ethnic or socioeconomic background? While wage inequality has increased since the 1980s, the gender wage gap has been shrinking: how has this changed the gains from marriage and the inequality patterns between households?

In the first chapter, we discuss the differences between same-sex and different-sex couples using a representative sample of Californian households for the period from 2008 to 2012. Our first contribution is to extend Becker's analytical tools to the study of same-sex marriage. Partners engaged in different-sex unions come from two separate populations (male and female) that sometimes present important asymmetries (e.g., the distribution of earnings and anthropometric characteristics). Conversely, we argue that matching among people of the same sex is a game that is known in matching theory as the "roommate problem": people are free to form pairs within the same group; namely, in this case, people are free to choose a partner of the same sex. While the identification and estimation of the gains from marriage for different-sex couples is a widely studied problem (Choo and Siow, 2006), we propose to extend these econometric tools - and in particular those developed by Dupuy and Galichon (2014) - to the analysis of the "roommate problem" in order to study same-sex marriage.

In our empirical analysis, we estimate the degree of complementarity and substitutability between observable traits for a sample of Californian same-sex couples from the 2008-2012 American Community Survey. In line with Becker's theory, our estimates are both informative about the source of the gains from marriage and useful in measuring the strength of attraction between likes on the marriage market. The identification strategy relies on the assumption that we are able to observe the stable marriage market outcome in the data and thus infer the underlying marriage payoffs. Hence, the estimation consists in recovering the structure of payoffs that can best explain the marriage patterns in the data.

We find that different-sex couples are much more strongly segregated with respect to ethnic background with respect to both male and female gay couples. Aside from ethnicity, education is the most important dimension of sorting for both male and female gay couples; age also matters, but only comparatively less. In contrast, age is the most important dimension of sorting for different-sex couples, with education being the second most important. In addition, same-sex couples seem to be characterized by a lesser degree of household specialization: partners sort positively on hourly wages and hours worked; in comparison, partners in different-sex couples exhibit weak but positive sorting on wages, but negative sorting on hours worked. Finally, our model based on matching on observable demographic traits is better at explaining marriage patterns among different-sex couples than among same-sex couples. In other words, we find that unobservable traits are comparatively more important for same-sex couples.

Our analysis has the merit of providing a clear-cut comparison of sorting patterns across marriage markets that differ both for theoretical (two-sided matching vs "roommate problem") and empirical reasons (the demographic composition of the two populations is very different; e.g., individuals engaged in same-sex couples are on average more educated). On the other hand, we do not attempt to delve further and explain what structural differences in behavior yield this heterogeneity in the structure of complementarities. Nevertheless, we run a series of robustness checks in order to show that differences in fertility might be able to explain much of the differences we observe in marriage patterns across these markets. We hope that, in the future, improvements in the quality of the data on same-sex marriage and advances in our understanding of fertility choices will allow us to address this kind of questions.

In the second chapter, we discuss how the nature of the gains from marriage has evolved in the United States from 1964 to 2017 and the implications of such changes for cross-sectional income inequality. In light of Becker's theory, studying the evolution of marriage patterns is primarily insightful because it provides insights about changes in the institution of the family and the nature of the gains from marriage. For instance, (Becker, 1973) suggests that spouses sort negatively with respect to hourly wages if the gains from

marriage come from household specialization: in our empirical analysis, we can test whether this prediction holds in the 1970s as well as today. Moreover, the way people sort into couples on marriage markets is a determinant of economic inequality between households, particularly when wages and schooling are important sorting dimensions (Burtless, 1999; Fernandez, Guner, and Knowles, 2005): in our analysis, we test whether the strength of sorting with respect to these variables has increased over time.

Our first contribution is to draw from the literature on the estimation of matching model in order to disentangle between changes in the structure of the gains from marriage and compositional changes in the population. Differences in marriage patterns over time are the result of two main forces: the changes in the gains from marriage due to evolving household technology, gender roles, legal framework, etc.; and the changes in the demographic and socioeconomic composition of the population due to aging, increased ethnic diversity, increased college attendance, etc. For our analysis, we use the Current Population Survey data spanning from 1964 to 2017. We once again rely on the estimation technique proposed by Dupuy and Galichon (2014) and estimate the degree of complementarity and substitutability for a rich set of matching variables and for each yearly cross-section. We use our estimates of the complementarity parameters as measures of the strength of sorting and to discuss the changes in the nature of the gains from marriage.

We find that the importance of education as a sorting dimension has increased since the 1960s, while the importance of age has decreased. Racial segregation on marriage markets used to be extremely strong in the 1960s, but has much decreased in the 1970s and is nowadays slowly increasing: this recent trend seems to be driven by an increasing divide between Whites and Hispanics. While we find negative sorting with respect to hourly wages in the 1960s consistently with the predictions of Becker (1973), we observe an emerging complementarity between the spouses' earning potentials starting from the 1970s.[2]

In the second part of the paper, we run a counterfactual experiment where we hold the structure of complementarities in marriage - i.e., the "marital preferences" - fixed at its 1971 levels, while we let the demographic composition of the American population change as observed in the data. We find that, had marital preferences not changed, the 2017 Gini coefficient between married households would be lower by 6%. We conclude that about 25% of the increase in income inequality between married households is due to changes in marital preferences. We decompose this result and show that the increase in educational sorting plays a minor role in explaining the rise of inequality, while the emerging complementarity in hourly wages is one of the main driving forces.

[2]Depending on the measure of labor earnings that we use, we find weakly negative or weakly positive sorting with respect to this dimension. We use several measures of labor earnings to indirectly address the issue of endogenous labor market participation choices. For any measure, however, we observe an increasing degree of sorting on labor earnings.

In the third chapter, I study how changes in the wage distribution have reshaped marriage patterns in the United States between the 1970s and the 2000s and discuss their implications for the welfare of different population groups. Until 1970s, a vast majority of Americans got married at a young age and enjoyed stable relationships regardless of their socioeconomic status. Since then, the overall share of married adults has considerably declined, with the decrease being stronger for individuals without a college degree and with a low wage. These same individuals, once in a relationship, are also more exposed to the risk of divorce.

In order to understand these changing patterns and this emerging cleavage, I build an equilibrium search-and-matching model of marriage and divorce over the life-cycle in the wake of Shimer and Smith (2000) and Chade and Ventura (2002). In the model, singles look for a partner while facing search frictions. Upon a meeting, individuals decide whether to marry or not: the motives to get married are both economic and noneconomic. Spouses enjoy the company of a partner due to both affinity by age and education and idiosyncratic reasons (e.g., love and feelings): the latter are volatile, as couples go through ups and downs. Married agents can allocate a part of their time and earnings to the production of a public good, which is a source of economies of scale. The labor supply of women is endogenous: some families will rely on two earners, others will adopt a breadwinner-caretaker scheme. In addition, by pooling resources together, spouses also have the possibility to insure each other against wage shocks. However, in lack of full commitment, both wage shocks and love shocks can cause spouses to break up. After a divorce, agents are free to look for a new spouse, although their marriage prospects change as they get older.

In the empirical analysis, I use data moments taken from the Current Population Survey and the Panel Study of Income Dynamics and estimate the model for two separate periods, the 1970s and the 2000s. The estimated model aims to replicate three main features of the data: the cross-sectional marriage patterns - who gets married, and with whom; the longitudinal marriage patterns - the odds of getting married and divorced at different stages of the life-cycle conditional on one's characteristics; and the female labor supply patterns. Following Goussé, Jacquemet, and Robin (2017), I discuss the following identification puzzle: if search frictions are present, it is hard to tell whether people match with their likes because they enjoy their company or because these are the only people they meet. Using panel data on the length of marriage and singlehood spells, it is possible to disentangle between the two alternative explanations. The key intuition behind this identification strategy is that both marriage and divorce rates contain information on the underlying value of marriage: the model allows me to establish a theoretical link between the two and to exploit their joint variation in the data.

After estimating the model for the two periods, I run a series of counterfactual experiments to provide a quantitative assessment of the role played by changes in different factors

in explaining changing marriage patterns. I find that changes in the wage distribution alone can explain about a third of the decline in the share of married adults between the 1970s and the 2000s. They can also partly explain the emerging gap between married adults between male college graduates and non-college graduates. As divorce is costly, adjustments mostly occur on the entry side: agents accept fewer proposals and search longer before getting married. In the counterfactual experiment, the shrinking gender wage gap triggers the following mechanism. After the changes in the wage distribution, high-wage men are still relatively successful on the marriage market: they can form two-earner households with high-wage women or specialized households with low-wage women. Conversely, low-wage men struggle more than they used to: they are unlikely to marry women that earn more than them as they are not fit as caretakers, while low-wage women are now earning almost as much as they do. As their comparative advantage within the household fades, low-wage men grow less likely to get married and more exposed to divorce. This is exacerbated by the fact that women have stronger incentives to look for a wealthy partner, as they gained economic independence and there is now more distance between the top and the bottom of the male wage distribution.

Finally, I build measures of intertemporal welfare for individuals at the beginning of their adult lives. These measures take into account both agents' human wealth - defined as the expected stream of labor market earnings that they are able to generate while they stand on their own - and the expected gains from marriage over the life-cycle. This second term accounts for the expectations about the number, the timing and the duration of future marriages and about the characteristics of future partners. I find that, following changes in the wage distribution, young men suffer, on average, a 10% decrease in welfare: I decompose this finding and show that the decrease is mainly due to worsened labor market prospects (8.5%), while the remaining part is due to worsened marriage prospects (1.5%). Surprisingly, women do not experience any welfare gain: while the improvements in labor market conditions they experience result, on average, in a welfare increase, the latter is offset by worsening marriage prospects.

The model proposed in the last chapter stands, jointly with the recent work of (Shephard, 2018), as one of the very first examples of empirically-tractable equilibrium models of the marriage market over the life-cycle. With improvements to the specification and to the estimation technique, it can be used in the future as a policy lab to understand how people adjust their life-cycle marriage behavior when changes in a primitive parameter kick in or when a new policy is introduced. An important instance is the case of means-tested transfers: these are often conditional on recipients' marital status and their introduction is likely to influence marriage and divorce decisions.

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